ABSTRACT

Title of Dissertation: PRODUCTION AND ENVIRONMENTAL INFLUENCES ON SOYBEAN ISOFLAVONE TYPE AND CONCENTRATION

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Environmental conditions can have major impacts on the production of soybean [*Glycine max* (L.) Merr.] metabolites. In two studies, isoflavone type and concentration of soybean seed tissue was evaluated. Study one evaluated the effects of treatments with lactofen; weed control (WC) and white-mold suppression (WM) rates and timings of 217 g ai ha^{-1} applied at the V1 stage and 122 g ai ha^{-1} applied at the V5-R1 stages, respectively. Leaf tissue isoflavone concentration for post-lactofen treated leaf tissue was 26% higher for total soybean treated with WC than WM. Yield was unaffected by lactofen treatments, but double crop (DC) averages were ~16% higher than full season (FS). The highest concentrations of seed isoflavones for DC and FS were malonyldaidzin and malonylgenistin. The damage

caused to the leaf tissue by lactofen applications did not result in a change in the seed isoflavone concentrations, individually or quantified as total isoflavone. While the Lactofen treatments did not show an effect on isoflavone type and concentration with respect to application timing for the seed tissue, the consistency of the relative isoflavone concentrations for seed are important for cultivar selection. The second study focused on cultivar differences and interaction with elevated tropospheric ozone concentrations. Four cultivars were grown in the field in open-top chambers and fumigated with either carbon filtered (CF) or ozone (O_3) enriched air. The two β-glucosides, daidzin and genistin, and their Malonyl forms, plus one aglycone, genistein were present at detectable levels. The levels of the isoflavones daidzin, malonyldaidzin, malonylgenistin, and genistein were reduced for the seeds produced in O_3, 25, 19, 15, and 11%, respectively. Genistin levels were not significantly different, but the data did trend toward lower concentrations for the O_3 AQT. Genistein was the only aglycone detected. Williams 82 ranked consistently higher in levels of isoflavones, in some cases regardless of the AQT, than the other cultivars. Cultivar selection is important for the production of high isoflavone soybeans near urban centers. The affects of production and environmental influences on soybean seed isoflavone type and concentration are variable and should be evaluated independently. Total isoflavone concentration is the best measure of overall cultivar isoflavone production.

PRODUCTION AND ENVIRONMENTAL INFLUENCES ON SOYBEAN ISOFLAVONE TYPE AND CONCENTRATION

By

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Dissertation submitted to the Faculty of the Graduate School of the
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Dedication

To God for the love of his only son, and for all of the opportunities and gifts that he has given me in my life.

To my wife Carol Jo Osiecki Phillips and my son Camden Edward Osiecki Phillips. Thank you for all of your hard work, time, patience, and love. Without you in my life, I could never have accomplished this work. Your love and devotion both inspire and humble me. May God bless you and keep you.

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Chapter 1: Introduction

1.1 Overview

People have utilized Soybean [Glycine max (L.) Merr.] seeds in many ways. Recently, products made from soybean seed, and its constituents, are being studied in agronomic, food science, and human health research all over the world. One of the most prolific areas of ongoing research focuses on soybean seed isoflavones.

Isoflavones are secondary plant metabolites that act as phytoalexins and are often referred to as phytoestrogens. These compounds are found in many plant families but none as much as the LEGUMINOSAE family. Previous research projects have concentrated in areas such as; environmental influences on soybean isoflavone production, searching for isoflavone-rich plant sources, and the absorption, metabolism, and functions of isoflavones in the human diet, as well as the development of human nutrition supplements. The impetus behind a large portion of the research is predominantly the potential for monetary gain placed upon isoflavones by the food, nutraceutical, and pharmaceutical industries. Much of the resources in the human health fields are focused on the safety and efficacy of isoflavones. The nutriceutical, and to a much lesser extent the pharmaceutical, industries have marketed these compounds as being key to fighting diseases such as various cancers and osteoporoses or use in hormone replacement therapies for postmenopausal women. Many of the putative benefits made for isoflavones in human health have limited or no clinical research to support the purported findings. To this end, the relationship of isoflavones to human health is an ever-expanding field.

Much of the focus of the agronomic research has been limited to the amount of isoflavones produced by soybeans and the types that are produced. The primary focus of past and current research has been on isoflavone variability among cultivars, as well as the comparative response of these soybean cultivars to environmental stresses (Panizz and Bordingnon 2000). One area of potential for the alteration of isoflavone concentrations and types in soybean seed may be tied to the physiologic responses of specific cultivars to various production methodologies and crop protection chemicals and/or procedures. In many cases research conducted on soybean isoflavones has been conducted primarily within disciplines. Future research should take a multidisciplinary approach.

The objectives of the following research were to: 1. Evaluate differential cultivar responses from leaf damage, and subsequent leaf isoflavone production, resulting from applications of the herbicide lactofen and its relationship on the type and concentration of seed isoflavones. 2. Evaluate differential soybean cultivar seed responses to elevated ozone concentrations thru the analysis of isoflavone type and concentration.

1.2 Dissertation Sections

1.2.1 Chapter 2

This chapter contains a review of the research literature covering the areas of isoflavone production, soybean isoflavone genetics and physiology, as well as human health metabolism and absorption of isoflavones.

1.2.2 Chapter 3

This chapter presents the results of research conducted to evaluate the effects of the herbicide lactofen on soybean seed isoflavones. Lactofen was applied according to labeled rates and timings, as either an herbicide or as a suppressant of white mold.

1.2.3 Chapter 4

This chapter presents the results of the research conducted to evaluate the effects of chronic exposure to moderately elevated tropospheric O_3 on soybean seed isoflavones.

1.2.4 Chapter 5

This chapter presents the findings of this research as well as the contributions that this research has made to the overall body of research.

1.2.5 Appendices

In the appendices of this dissertation there are completed SAS[1] programs as well as their results, labeled “SAS Output”. The programs that are included are written in macro format. The primary file is the first to be run in SAS and is used to invoke all macros and import the data set from the database Microsoft Access 2000[2].

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[1] SAS ver 8.01, Copyrite © 1999-2000 by SAS Institute Inc., Cary, North Carolina, USA.
[2] Copyright© 1992-1999 Microsoft Corporation, One Microsoft Way, Redmond, Washington 98052-6399 U.S.A.

Chapter 2: Literature Review

2.1 Isoflavones

2.1.1 Introduction

There are more than 100 isoflavones and isoflavone glucosides known (Wong, 1975). These compounds are secondary plant metabolites that are produced as phytoalexins. Isoflavones are produced predominantly in plants of the LEGUMINOSAE family, such as soybean [Glycine max (L.) Merr.], and also in a few non-leguminous plants including the important agronomic crop sugarbeet (***Beta vulgaris***) (Jung et al., 2000). Still, other plants produce significant concentrations of isoflavones. An extract of the inedible fruit of the Osage Orange tree (***Maclura pomifera***) was found to be a significant source of the isoflavones osajin and pomiferin, containing 25.7 and 36.2%, respectively (Tsao et al., 2003). There is current research to suggest that both osajin and pomiferin may be a repellant to insects (Peterson et al. 2002).

In soybean plants, isoflavones are found primarily in the seed, but under environmental stresses they can be extracted from various parts of the plant including the leaf tissue. Three soybean cultivars, Emiliana, Elvir, and Kure were analyzed for phenolic compounds over a three-month period. With the exception of pods, all parts of the plants were found to contain isoflavones (Romani et al., 2003). However, the researchers explained that the levels and locations of flavonols within the plant gave the indication that the plants were under ultraviolet light stress. The conclusion was that this stress might have been the cause of elevated levels of isoflavones; in some cases concentrations were ten-fold the averages represented in the literature. Isoflavones have also been reported in the roots and root exudates of soybean plants without stress induction (Kosslak et al., 1987).

Isoflavones are produced as the basic molecular structure known as the aglycone. The aglycone molecule is the basic building block from which two of these molecule isoflavone conjugates are made. The aglycone can have a glucose molecule attached at the number seven carbon thus resulting in the second molecule, the β-glucoside. The addition of a malonyl group to the 6′′ carbon of the β-glucoside results in the formation of the malonyl conjugate (Figure 1.). The water-soluble β-glucosides are found in greatest abundance as compared to the aglycone (Wollenweber and Dietz, 1981).

Announced and described in 1980 the “new” isoflavone extracted from soybean was determined to be the 6″-***O***-

acetylgenistin conjugate (Ohta et al., 1980). Later it was found that this was not a new isoflavone, but a by-product of an extraction procedure that used high temperatures.

There are more than 100 isoflavones known, but only nine soybean isoflavones are thought to be of primary economic interest (Figure 1.). These isoflavones are comprised of three aglycons and three β-glucosides. Daidzein, genistein, and glycitein are the aglycones and daidzin, genistin, and glycitin are the β-glucosides. The rest of the nine forms have the malonyl prefix attached to their respective β-glucoside name: malonyldaidzin, malonylgenistin, and malonylglycitin.

2.1.2 Production

The biochemical production of isoflavones begins in the phenylalanine pathway, when triggered by specific conditions within the plant a portion of the pathway is shifted toward the production of isoflavones (Figure 2). Further down the pathway isoflavones can become precursors for other secondary metabolites. Daidzein was found to be the precursor to another phytoestrogen, coumestrol, in alfalfa (***Medicago sativa***). When soybean leaves were damaged using $CuCl_2$ and UV treatments the level of coumestrol was not affected (Dewick and Martin, 1979). However, this study has produced insight into the enzyme system to which the plants quickly shift the biochemical pathway for isoflavone production. The system elucidated by Cosio et al (1985) included the enzymes chalcone synthase, phenylalanine ammonia-lyase, and UDP-glucose:isoflavone 7-O-glucosyl transferase. This enzymatic activity leading to the production of isoflavones will be detailed in the following section.

2.2 Soybeans and Isoflavones

2.2.1 Leaf Tissue

Mature soybean leaf tissue contains no isoflavones but does contain the flavonol kaempferol-3-glucoside (K3G) (Cosio et al., 1985). Following damage to leaf tissue, cells will produce isoflavones as a means of chemical defense. This production is localized and is a shift in leaf physiology and biochemistry. While the concentration of the flavonol K3G does not change as a result of the leaf damage, isoflavones begin to develop in varying types and concentrations. Isoflavones found in the mature leaf tissue of soybean plants occur only in response to damage. Chemical, disease, insect, or mechanical damage can cause the trigger for this phytoalexin response. The localization of these reactions in the leaf tissue has been studied in a few soybean cultivars. Mature soybean leaves of the cultivar Harosoy63 contain kaempferol-3-glucosides with no other flavonoids found at detectable levels (Cosio et al., 1985). In the same study, soybean leaves that were treated with 100 mg/L of the herbicide acifluorfen[3] plus 0.01 % (v:v) Triton x-100[4] (Octylphenol ethoxylate) surfactant were found to contain

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[3] BASF AG. Carl-Bosch-Strasse 64, 67117 Limburgerhof, Germany

[4] The Dow Chemical Company, 2030 Dow Center, Midland, Michigan 48674 USA

isoflavone aglycons and β-glucosides. In a separate study, the primary isoflavones induced in soybean leaf tissue by the herbicide lactofen[5](ethyl ***O***-[5-(2-chloro-α,α,α-trifluoro-***p***-tolyloxy)-2-nitrobenzoyl]-DL-lactate), were formononetin aglycones, as well as the isoflavones diadzein and malonylgenistin (Landini et al., 2003).

Acifluorfen and lactofen are the common names of two members of the diphenylether or nitrodiphenylether, herbicide family with the trade names of Blazer and Cobra, respectively (Vencill et al., 2002). This family of herbicides is used for postemergence broadleaf weed control in soybean fields. These chemicals are not readily translocated in soybean. The mode of action of these herbicides is the inhibition of protoporphyrinogen oxidase. This inhibition begins a cascading effect where by the inhibition of this enzyme further inhibits the production of chlorophyll via the lack of oxidation of protoporphyrinogen IX to protoporphyrin IX. A subsequent buildup of protoporphyrin IX in the thylakoid lumen leads to a spill over into the chloroplast stroma where it absorbs energy from sunlight, which in turn moves the outer-most electron into a third higher valence shell. This energy is then transferred to ground-state oxygen where it forms singlet oxygen that

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[5] Valent USA Corp. P.O. Box 8025, 1333 N. California Blvd. Suite 600, Walnut Creek California 94596-8025

interacts with the plasmalemma resulting in lipid peroxidation. The result of the application of acifluorfen to soybean plants is not death but necrotic lesions on the contacted leaves (Vencill, 2002). Lactofen is the uniquely label for the prevention of white mold in soybean. White mold is caused by the fungal pathogen ***Sclerotinia sclerotiorum*** in soybeans. Lactofen prevents white mold via the induction of isoflavones in soybean leaf tissue that inhibit ***Sclerotinia sclerotiorum*** (Nelson et al., 2002).

After treatment with acifluorfen, Cosio et al (1985) evaluated enzyme induction through the accumulation and subsequent identification of chalcone synthase (24% of leaf activity), phenylalanine ammonia-lyase (12%), and UDP-glucose:isoflavone 7-O-glucosyl transferase (20%). This accumulation of enzymes was validated by an earlier study by Cosio and McClure (1984) where untreated soybean leaflets 2.5 to 3 cm long were found to have no detectable levels of phenylalanine ammonialyase activity. In addition to elucidating the enzymes in the leaf tissue, the study by Cosio et al. (1985) included a time sequence of leaf enzyme and isoflavone production. Within the first 24 to 30 hours, post spray application (PSA) of acifluorfen to the soybean plants, there were significant increases in the phenylalanine and chalcone synthase concentrations. After 48 h PSA isoflavone aglycons and pterocarpans increased, then after 72 h PSA UDP-glucose:isoflavone 7-O-glucosyl transferase also increased. After 96 h PSA, and following the availability of the UDP-glucose:isoflavone 7-O-glucosyl transferase enzyme, isoflavone aglycons were present.

Isoflavone β-glucoside production and storage were found to be within the mesophyll cells (Cosio et al. 1985). These researchers theorize that the β-glucosides were detoxification products accumulated within the vacuoles of mesophyll cells. Isoflavone β-glucoside synthesis and accumulation were found to be within the cytosol of the mesophyll cells. Isoflavone aglycones and pterocarpans accumulated in the epidermis and intercellular spaces of the mesophyll cells. Pterocarpans and aglycones were detected only in the tissue adjacent to the necrotic tissue, which resulted from the Acifluorfen treatment.

From these two influential research findings it is probable that: 1. The aglycons and pterocarpans are the important constituents in the reaction to leaf tissue damage, as they were most available in the location where the damage occurred, 2. An explanation of the lack of phenylalanine ammonialyase activity in the leaf tissue is that the flavonol intermediates may be translocated to leaf tissue where they are later used in the synthesis of secondary phenolic compounds. With respect to the later of the two findings, the evidence for this finding was the accumulation of the enzyme 4-coumarate:CoA ligase, which is an enzyme that occurs between the phenylpropanoid pathway and the flavonoid pathway. It is this enzyme that is needed to begin the production of the isoflavone phytoalexins. Further evidence is the concomitant accumulation of chalcone-flavanone isomerase, the primary enzyme required for the production of the aglycone isoflavone daidzein.

In 2003, Landini et al. found that the primary isoflavones induced by an application of lactofen were daidzein, formononetin aglycones, and malonylgenistin. The location of these induced phytoalexins were proximal the area of damage by the herbicide, thus confirming the findings of Cosio et al. (1985). Further findings from this research were that there was no movement of the isoflavones from the immediate area of damage. In this research, it was also observed that the treatment of soybean leaf tissue by several of the diphenyl ether herbicides induced a mechanism in the plant to respond to infection by ***Phytophthora sojae***. This mechanism results in the soybean tissue accumulating glyceollin, which is a pterocarpan phytoalexin. This response is induced by chemical signals from the pathogen that are designed to induce the host cells into producing glucan (Ebel et al., 1984;Ebel and A. Mithofer, 1998). A key to the successful use of lactofen over other diphenylether herbicides is that it is only one of a few of the diphenyl ethers to induce soybean leaf tissue into the production of isoflavones without a chemical signal from a pathogen (Landini et al., 2003). These researchers explain that the mode of action of the diphenyl ether herbicides, such as lactofen, result in oxygen radicals that "mimic some aspects of hypersensitive cell death" (Landini et al., 2003).

In addition to fungal pathogens, it is thought that damage caused by insects is also another stimulant by which isoflavone production is induced. While there has been no research working directly with soybean plants, there have been efforts to evaluate the role of isoflavones in insect feeding on crops such as subterranean clover (***Trifolium subterraneum*** L.). According to Beck and Knox (1971), red clover (***Trifolium pratense*** L.) was found to contain formononetin, biochanin, as well as both of their β-glucosides. The major concentration of formononetin and biochanin were in the form of malonate esters. Wang et al. (1999) also extracted isoflavones from subterranean clover. Using a methanol extraction procedure, they determined the type and concentration of the total leaf tissue (TLT) and surface leaf tissue (SLT) isoflavones. These researchers found that the primary isoflavone in the TLT extract was genistein. The next highest concentration was biochanin A, which was only one-third of the concentration of the genistein. The concentration of the TLT isoflavones was found to be a poor predictor of the level of mite resistance. However, in the TST the concentration of biochanin A was more than three times the concentration of genistein. The level of 7-0-glucoside biocchanin-A in the leaf surface was the best predictor of mite resistance (r^2 0.84), while the concentrations of the total biochanin A plus genistein were almost as good (r^2 0.78). The major problem with the analysis of this research is the comparison of the use of r^2 for the evaluation of prediction. A simple analysis comparing the collected data to the predicted data would have provided evidence of the quality of the models discussed. Perhaps a better analysis of the data would have been to use genistein as a covariate, since they seem to believe that the total biochanin A plus the genistein was a better predictor. In this study, the nonglucosilated forms of the isoflavones were found to be active deterrents of mite feeding at concentrations ten times lower than their glucosalated forms.

The ability of plant leaf tissue to produce isoflavones is a key to their protection from damage that could reduce overall plant health as well as yield. The converse to this is that the production of isoflavones requires plant products and the shifting of biochemical constituents and pathways. Thus the question yet to be evaluated involves the cost of leaf isoflavone production. Specifically, what is the cost to stored isoflavones in the seed? Are enzymes and precursors used for seed isoflavone production translocated to be used in leaf isoflavone production?

2.2.2 Root and Rhizosphere

Distribution of the isoflavones daidzein, daidzin, and the malonyated forms of daidzin and genistin were determined for seven-day-old seedlings of cultivars Williams 79 and Williams 82 (Graham, 1991). The concentrations were the same for the two thus the data were combined. Grown under lighted conditions the root had the highest concentration of daidzin and daidzein with the root tip having more than three times the concentration of daidzein than the remaining portion of the plant. The daidzin concentration in the root tip was about the same as that of the rest of the combined tissue.

Grown in dark conditions, the soybean root tip contained about the same concentration of daidzein as the remainder of the plant tissue while the cotyledons contained the same relative concentration of daidzin as the combination of all other tissue. There was a relative reduction in root isoflavones and an increase in the cotyledon isoflavones. As for the malonyl forms, the root tip and the cotyledon had the same concentration, which was well over double that of the other tissue combined; Malonyldaidzin was high for the two, but highest in the cotyledons. Overall however, the concentrations of the isoflavones in the tissue grown in the dark was about one third that of the tissue from the light.

What role the light plays in the increased production of isoflavones was not determined, however it is clear that the lack of light causes an increase in the isoflavone concentration in the cotyledons and a decrease in the roots. The majority of the malonyldaidzin and malonylgenistin were found in the root tip and the cotyledons (Graham 1991).

Exudate at the root tip was found to have a high in aglycone daidzein concentration (Graham, 1991). The research was repeated and the findings were that the majority of the root exudate was malonyldaidzin. This lead to the belief that the exudate from the root tip was the of the malonyl form. The speculation was that there were β-glucosidases in the exudate resulting in the aglycone (Graham, 1991).

In 1987 it was reported that soybean roots exude the aglycon isoflavones coumestrol, daidzein, and genistein, and that these exudates stimulate ***Bradyrhizobium japonicum*** USDA123 to begin transcription of the gene responsible for nodulation, nod gene (Kosslak et al., 1987). Many studies have demonstrated that members of the tribe Phaseolleae share a common trait of using the same isoflavone chemical triggers for transcription of the nod gene regardless of their particular species of symbiont (Dakora, 2000).

The aglycone isoflavones, daidzein and genistein were found to be the primary nod gene inducing chemicals in root exudates of soybean (Loh and Stacey, 2003; Leibovitch et al., 2001; Kosslak, 1987). The nod gene induction is a result of activation of the NodD regulator by the presence of daidzein and genistein (Loh and Stacey, 2003). In fact, Leibovitch et al. (2001) found that an increase in exposure of ***B. japonicum*** to these isoflavones plus a subsequent increase in daidzein and genistein in the rhizosphere of the soybean plants, improved nitrogen fixation and seed yield 7%. In addition, root genistein and daidzein concentrations were elevated in soybean plants inoculated with rhizobium compared to the same cultivars, which were not inoculated (Zhang et al., 2000).

Three species of rhizobium were found to metabolize the induction compounds, isoflavones, with the metabolites found in the cells of the bacteria. Two of the metabolites found, umbelliferone and phenylacetic acid, sequestered in the cells were proven to reduce the expression of the nod gene by 36% (Rao and Cooper 1995). The three rhizobia studied were ***Bradyrhizobium japonicum*** USDA 110spc4, ***Rhizobium fredii*** HH103, and ***Rhizobium*** sp. NGR234. Once the rhizobium has infected the root system the isoflavones are presumably no longer important to the system; thus the effort to reduce the isoflavone production by the bacteria (Rao and Cooper, 1995).

Medicarpin concentrations in the roots of ***Medicago truncatula*** increase during the early phase of mycorrhizal colonization (Harrison and Dixon, 1993). As a sign of the increase in flavonoids, Harrison and Dixon (1993) found that there was an increase in the concentrations of the enzymes phenylalanine ammonia-lyase (PAL) and chalcone synthase (CHS). The levels of isoflavone reductase (IFR) did not increase, but decreased for those cultivars colonized by mycorrhizae when compared to the control isolines that were negative for colonization. In addition, coumestrol was found in the colonized roots but not in the control isolines.

Volpin et al. 1995 later demonstrated that in the early stages of mycorrhizal colonization of alfalfa (***Medicago sativa***) there is a response by the plant to produce mRNA that codes for an increase in defensive secondary metabolites. Between the 14th and 18th day of colonization of roots by mycorrhizea, the levels of mRNA coding for PAL doubled, and for chalcone isomerase (CHI) increased six fold over the isoline control levels. Immediately after the 18th day, the levels of mRNA decreased rapidly as if there was some recognition by the plant of the symbiotic nature of the colonization. Levels of formononetin and formononetin plus medicarpin glucosides were also found to increase then rapidly decrease in the colonized roots. These findings complement those of earlier researchers and yet take the research a step further. Perhaps the bacterial dissolution of the isoflavone compounds is a short-term mechanism to allow for the early stages of infection, then there is some type of "feedback mechanism" that the plant utilizes to reduce the defensive isoflavone compounds. Together the two major pieces of research conclude that there is some important interaction during the early infection by rhizobia in leguminous plants. However, in a continuing effort to elucidate the details of the role of flavonoids and isoflavonoids in the symbiosis of alfalfa and ***Rhizobium meliloti***, McKhann et al. (1997) evaluated the expression of the CHS, IFR and CHI genes. CHS mRNA was located in the root hairs and epidermis of the root but almost none in nodule-forming tissue. IFR and CHI mRNA were not found to increase as a result of inoculation. The overall findings demonstrated that there was no difference found for gene expression in the comparison of the nod forming and no-nod forming alfalfa. These findings then controvert that of the earlier observations of researchers. It is perhaps important to remember that there may be some molecular recognition between the plant and its symbiont that may also control the genetic machinery. While there was an increase in isoflavones when soybean roots were infected with ***Phytophthora megasperma*** (Graham et al., 1990), there is no response from ***Rhizobium meliloti.***

In another area of this crossover of root zone ecology and root physiology research, there is the possible role of flavonoides and isoflavones in nematode resistance. Root-lesion nematode (***Pratylenchus penetrans***) resistant (RST) and susceptible (SUS) alfalfa plants were evaluated for root flavanoid and isoflavone type and content (Baldridge et al., 1998). Prior to nematode infection, the concentrations of root phenylpropanoid pathway mRNA for RST cultivars were 1.3 to 1.8 times that of the SUS.

Post nematode infection found the mRNA levels for the RST plants began to slowly decline while the concentration in the SUS root tissue increased for a short period prior to its decline. Analyses of total isoflavone concentrations were the same for the RST and SUS cultivars; however the types and ratios of isoflavones varied between the RST and the SUS. The most important of these differences was the finding that the phytoalexin medicarpin was found to be in the highest concentrations in the RST plant roots. Key to this discovery was also the fact that medicarpin was found to be a motility inhibitor of this species of nematodes ***in vitro***. Given that these phytoalexins have an effect on nematodes; it would seem that the gradual “loss of resistance” by nematode-resistant cultivars is an elementary case of selection.

2.2.3 Seed Tissue

The primary source of marketable isoflavones is the seed, or grain, of the soybean plant. Currently on the market there are diet supplements that are marketed as containing isoflavones derived directly from soybean seed. The demand for nutraceuticals, as these types of supplements are called, has begun to be an important area for soybean marketing. This marketing for the industry is becoming very important as a value-added source for soybean growers and processors. Current research on soybean-derived nutraceuticals has focused on two major areas, genotypic variation and environmental interactions with the production of nutraceuticals.

The role of isoflavones in the tissue of soybean, or any other species of plant, is first as a protectant to the developing seed and seedling. Within 24 h of seed imbibition, exudate increases in isoflavone concentrations; the largest fraction of these isoflavones has been found to be malonyldaidzin and genistin (Graham, 1991). In harvested seed, there are four predominant isoflavones, daidzin, genistin, malonyldaidzin, and malonylgenistin (Tsukamoto et al., 1995). Since the early 1970's there have been announcements of new isoflavones isolated from soybean seeds. Glycitein was announced as a newly elucidated isoflavone aglycone in 1973 by Naim et al. Later in 2003, Thoruwa et al. announced an ***in vitro*** synthesis of glycitein. In 1980, Ohta et al. announced and described a "new" isoflavone extracted from soybean as 6"-***O***-acetyl genistin. However in 1981, Murphy found that acetylated forms of isoflavone glucosides are most likely the result of β-glucosides exposed to heat during the processing of seed. The two aforementioned β-glucosides and the two malonyl forms of the isoflavones are well accepted to be the most prevalent, while the acetyl forms are considered a non-issue (Murphy, 1981).

Recent research has demonstrated that the combined genistein and daidzein derivatives accumulated in seeds range from 4.49 to 12.61 g kg^{-1} for a mix of different cultivars analyzed (Romani et al., 2003). The distribution of the recovered isoflavones from soybean seed have been found to be

80-90% in the cotyledons and 10-20% recovered from the hypocotyls, by weight (Tsukamoto et al., 1995). Isoflavone species extracted from whole seed in the same study were daidzin, genistin, malonylgenistin, and malonyldaidzin, while from the hypocotyls alone they were daidzin, genistin, glycitin, malonylgenistin, malonyldaidzin, and malonylglycitin (Figure 1.). Eldridge and Kwolck (1983) also found “trace” amounts of isoflavones in the seed coat. However, this amount of isoflavones is so small that it is regarded as insignificant.

Several studies have been published that attempted to explain the highly variable nature of isoflavones found in soybean cultivars (Duke et al., 2003; Hoeck et al., 2000; Wang et al., 2000; Tsukamoto et al., 1995; Wang and Murphy, 1994a; Graham, 1991). Initially the variability had been thought to be simply cultivar differences, most likely unintended selection of breeding lines. Early research began to focus on the role that environmental influences have on the content and concentration of isoflavones in soybean seed. Tsukamoto et al. (1995) found that the seed from soybean plants harvested from environments of high relative temperatures consistently contained higher concentration of isoflavones than the seed from plants that were harvested from areas of relatively lower season-long temperatures. This characteristic was found to be true for all seven cultivars tested in this study. This agreed with studies of Hoeck et al. (2000) where they found that the isoflavone concentrations were significantly different between environments. In addition, in this study the within environment isoflavone levels at the genotypic level were found to be different. In the Tsukamoto et al. (1995) study, all isoflavones extracted from the seed of cultivars grown in the cool temperature environments were lower in concentration when compared to the warm weather grown seed. This shift in isoflavone concentrations at high temperatures was found to be isolated to the cotyledons. When a comparison was made between growth chamber-grown soybean plants and field-grown plants, a lower overall isoflavone concentration was found for seed harvested from the growth chamber plants. Suppositional findings were related to macro- and microorganism damage. Indeed this finding would be consistent with the theory of tissue-damage induction for isoflavones. In an effort to expand on the role of environmental variability, Hoeck et al. (2000) evaluated six soybean genotypes at eight locations to determine what effect genotype by environment interactions may have on isoflavone concentration and production. The data were analyzed with year and environment (location) as fixed effects and as a result, when the year effect was determined to be significant, the data were separated and analyzed by year using F tests to determine significance. The isoflavone concentrations were significantly different between environments. Within each environment, isoflavone concentrations for genotypes were also determined to be different. Differences in mean genotype by environment interactions remained consistent for all six genotypes across the eight locations. Due to the similarity in the responses of the total and individual isoflavone concentrations, these authors contend that the results support the hypothesis that isoflavone concentration is a quantitive trait.

In another study, a total of 210 cultivars of soybeans, made up of 41, 96, and 73 cultivars of maturity groups 0, I, II, respectively, were grown in one location then evaluated for seed isoflavone concentration and types (Wang et al., 2000). Differences in isoflavones did not follow any trends based on maturity groups. In fact, maturity group differences were mixed, total isoflavones for group 0 were lower than for group II, but group I concentrations were not different from either. Genistein concentrations were higher for group 0 and I compared to group II, but daidzein was higher for group I than for groups 0 and II. In addition, findings in this study revealed that disease resistance was not linked to isoflavone type or concentration, but hilum color was linked.

Hilum color was not different for total isoflavone concentration; however seeds with a green hilum had higher concentrations of genistin when compared to black or brown hilum seeds. Daidzein was higher in yellow hilum seeds versus black, and the black hilum seeds had the lowest genistein overall. Given the research in the area of soybean seed isoflavones, it seems that if there is a qualitative trait for isoflavone type and concentrations, it may be hilum color.

While it was not the intention of this research or the data presented herein, it may be an indication of a much broader point; there is a lack of genetic diversity among modern soybean cultivars. There is a broad spectrum of cultivars used in current breeding programs and thus those that are sold to farmers. However, given data such as that from the studies discussed herein, it is easy to deduce that the cultivated soybeans of today are inbred to an extent that current progeny are descendants of only a small number of progenitors. Current annual soybean cultivars descend from the two species ***Glycine max*** and ***Glycine soja***. These two species are so readily crossed sexually that Hymowitz (2004) has referred to these two species as "effectively constituting a single species". Perhaps armed with this knowledge, researchers interested in the search for regulating isoflavone type and concentration in soybean seed may choose to begin their search at the beginning of the soybean lineage. It is clear that there remains much research to be conducted into isoflavone types and concentrations among soybean cultivar seeds, and the effects that cause a change in expression.

2.2.4 Isoflavone Genetics

The basic body of research into the genetics of isoflavone production in plants was begun first by enzyme isolation, then the bioengineering of plants to produce isoflavones. This first step began with the isolation of the enzyme responsible for the ***in vivo*** production of isoflavones in legumes. The focus of a study by Jung et al (2000) announced the finding of the soybean isoflavone synthase (IFS) gene (Genbank accession number AF195798). There were two genes IFS1 and IFS2 found in soybean that were determined to be 96.7% identical. However, the total conversion and the speed at which conversion takes place is more than double for IFS1. The existence of two IFS genes was also found in nonlegume sugarbeet (***Beta vulgaris***). These genes were found to be >95% similar to the IFS genes in soybeans (GenBank accession numbers AF195816).

Later in 2000, Yu et al. followed up with research focused on the genetic transformation of plants that do not produce isoflavones. This was accomplished by the transformation of Arabidopsis, tobacco (***Nicotiana tabacum***), and Maize Black Mexican Sweet (BMS) (***Zea mays***) plants. Transgenic arabidopsis produced the IFS enzyme that utilized the ***in vitro*** naringenin substrate to produce genistein in hydrolyzed leaf and stem tissue. In subsequent research, plants belonging to these transgenic lines were found to accumulate genistein in leaf tissue that had been damaged by UV-B.

Transgenic tobacco (***Nicotiana tabacum*** cv SR1) did not produce genistein unless there was damage to the leaf tissue, such as with UV-B light. These plants were found to produce the IFS enzyme, however there was little of the substrate naringenin due to use of its precursor in the anthocyanin pathway. The damage to the leaf tissue, however caused a shift in the use of the phenylpropanoid pathway from anthocyanins to isoflavones.

Transgenic BMS cells were used as the monocot model for the isoflavone production study. Of the 25 cell lines that were found by PCR to contain the IFS gene, none produced detectable levels of genistein. A chimeric transcription factor (CRC) was used to activate gene expression for anthocyanins in cells thus producing the substrate naringnin and subsequently genistein.

The levels of genistein were increased through stimulation by UV-B light, proving that the IFS was able to compete in the transformed monocot cell lines just as in the dicot plants.

The arabidopsis, tobacco, and BMS plants contained isoflavones in the form of genistin, while the tobacco plants contained malonyl-genistin in red flowers. Daidzein synthesis follows much the same biochemical route: the IFS gene is involved in triggering the production of the enzyme isoflavone synthase, along with chalcone reductase (CHR), the substrate liquiritigenin is produced. This process continues and results in the production of daidzein.

Transformed BMS containing the IFS, CRC, and CHR genes resulted in the production of daidzein as determined by co-chromatography using high-pressure liquid chromatography (HPLC) and gas chromatography mass spectrometry (GC-MS). This conversion is much faster than that of the naringnin to genistein. It was determined from this research that the missing part of the biochemical machinery of non-leguminous plant species is due to a lack of the production of the substrate. Jung et al. (2000) determined that the lack of genistin in the leaves of transformed tobacco is due to the lack of naringnin and not the competition for this substrate (Figure 2.). The basis of their determination was that there was a high level of IFS detected in the leaves of the tobacco plants. In the BMS cells the need of the CRC was not a result of the lack of the substrate but the over abundance of a conjugated substrate. The foundation of the research in this paper is to be able to incorporate the production of isoflavones into more popular food crops, such as wheat, to give humans the opportunity to utilize these compounds for their health benefits.

Through metabolic engineering, a decrease in the level of genistein along with a complete blockage of the anthocyanin pathway caused an increase in the production of daidzein in two independent transformed soybean lines (Yu et al., 2003). The increase in daidzein was reported to be above four fold that of “wild-type seed”. It was noted that in the two transformed lines the progeny seed exhibited differences in seed morphology. The seed coat in the transformed lines was in one case wrinkled while in the other soybean line there was a pronounced dark stripe on the seed. The researchers noted that there was a strong correlation between the transformed seed exhibiting the wrinkled seed coat with increased daidzein. There was also a strong correlation between the transformed striped seed with reduced genistein levels. The conclusion was that the phenotypic variability was related to the change in isoflavone concentrations. This finding supports the results of Wang et al (2000) who found hilum color to be closely correlated to isoflavone type and concentrations.

2.3 Human Health

The natural progression from a discussion of agronomic crops such as soybean would be to the products that are made from the seeds of these plants. Isoflavone rich foods, nutriceuticals, and pharmaceuticals have become important for their human benefits. In fact, the type and concentrations of isoflavones in end use products can be altered by the manner in which they are processed and prepared.

It is beyond the scope of this literature review to delve into the entire body of human health research with respect to isoflavones. However, it is important to understand the potential and the scope of how the production of isoflavones from soybean seed may someday impact human health. For this reason the following discussion will highlight a few of the major achievements in the current body of research.

2.3.1 Processing

The isoflavone composition of many commercial foods is varied based upon the type of soy products used in the making of these foods, as well as the process by which they are made (Wang and Murphy, 1994b). As with almost all chemical reactions, the amount of heat added to a system can result in changes and conjugated products. This includes the changes in soy foods during the cooking process (Toda et al., 2000). In the cases of the production of toasting soy flour, decarboxylation of 6′′-*O*-malonyl-β-glucoside resulted in the conjugation to 6′′-*O*-acetyl-β-glucoside caused by excessive heat. Baking and frying also caused the conversion of malonyl forms of isoflavones to β-glucosides (Coward et al., 1998).

While excessive heat can result in changes to isoflavones in food products, there are also other processing steps that have been found to alter isoflavones as well. Low-fat soy products and soymilk were found to be low in all isoflavones (Coward et al., 1998). However, isoflavone aglycon concentrations are increased when soybeans are presoaked in water as part of the processing for soymilk. The results of this increase in aglycons are the increase in a perceived acerbic and "beany" flavor. Preheating of soybeans decreased the malonyl forms of isoflavones via their conversion to β-glucosides, however no increases in the concentration of aglycons were observed. This was not perceived to impart the negative taste of soymilk made with the presoaked soybeans (Carrao-Panizzi et al., 1999).

While the processing of soybean seeds has an impact on the type of isoflavones present, as consumers it is only the choice of what we take in that can be controlled. It is for this reason that much research has focused upon the intake of different isoflavones, their absorption and ultimately the role they have in human health.

2.3.2 Human Studies

Diet and nutraceutical intake are two areas of isoflavone exposure in adults and children that are unique enough to be considered separately and then together. The unintended ingestion of foods and food products that are either directly made from, or indirectly contain isoflavones can be important with respect to human health. The addition of the intentional consumption of federally unregulated nutraceutical products for their anti-carcinogenic or hormonal effects may increase the overall considerations for human health.

Consumption of isoflavones resulting from food intake can be an issue in whole and processed foods. As previously stated, the type of isoflavones found in processed soy products can vary based upon how they are processed. Nutraceutical use by humans has increased as marketing has become more multifaceted and people become more informed and proactive with respect to their health (Kurtzweil, 1999). According to the Federal Food and Drug Administration (FDA) from the period of 1990 to 1996 the growth of the dietary supplement sales have almost doubled from

$3.3 billion to $6.5 billion dollars (Kurtzweil, 1999). Pharmaceutical research has branched into the "natural" health care market by the inclusion of "plant-based phytochemicals" into premixed treatments as well as a few stand-alone products. One of the most famous of these products is Tamoxifen Citrate[6]. Together the source of daily intake of isoflavones from the American diet has yet to become a major focus of health-care research. This may perhaps be due to the lack of available data sets for epidemiological researchers, the lack of concern or the lack of clinical knowledge in the subject area.

Research has been undertaken to evaluate the type of isoflavones absorbed via human digestion of soy products. This type of research can be used in an effort to understand the significance of isoflavones in the human diet, but it can also be exploited for the monetary value of those products sold without standardized testing.

Park et al. (2003) focused on extracting and transforming isoflavones via a method that will result in the conversion of β-glucosides to aglycones because their hypothesis was that aglycone isoflavones have greater biological activity than β-glucosides. This process resulted in the commercial yield of aglycone isoflavones from soybean seeds to be higher than that

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[6] ZENECA Pharmaceuticals, Wilmington, Delaware 19850-5437

of their initial concentration. There is no mutually agreed upon standard of human absorption of isoflavones. However, the majority of the research has demonstrated that the isoflavone aglycones are readily absorbed and that β-glucosides are hydrolyzed in the large intestine via gut micro flora prior to absorption.

Wilkinson et al. (1999) evaluated the absorption and metabolism of isoflavones ingested by humans. Ingested isoflavones were found in the blood plasma within 30 min of in take, thus the implication was that the absorption must be in the small intestine. It is currently accepted that once in the small intestine, daidzein diffusion is passive via the enterocyte. This diffusion of daidzin into the enterocyte is via “Active Sugar Transport Mechanisms”. Hydrolysis may occur in the mucosal brush border membrane forming daidzein that then diffuses as stated above. This study used ***in vitro*** rat gut as the model to test isoflavone absorption. It is thought that isoflavone β-glucosides are hydrolyzed in the large intestine via gut micro flora. This study indicated that there is no difference between aglycone or glucoside absorption, a finding that is very controversial and not widely accepted. However, in a study by Izumi et al (2000) in humans, soy isoflavone aglycones were absorbed at a faster rate and a higher percentage than their glucosides. Aglycone concentration in blood plasma was at its maximum at two h, while for the glucosides it was twice as long. When test subjects ingested the same concentration of daidzein as genistein, the blood plasma always had a higher concentration of genistein. The end result is that for perceived health reasons, food products high in isoflavone aglycones may be the ideal form. These forms may be fermented soy protein and fermented soy protein extracts. In fact in 1996 Fukutake et al. quantified the concentration of genistein and genistin in soybean and soybean products. Their findings were that the aglycon genistein is higher in fermented soybean and fermented products of soybean.

Researchers investigated the variability of intestinal metabolism of the aglycone daidzein among individual people (Rafii et al 2003). Using gut micro flora from ten individuals, it was found that those whom had changed their diets to a soy-rich diet also changed their ability to metabolize daidzein. This study supported other research, which demonstrated that a change in diet could also affect gut micro flora in such a manner as to alter the resulting metabolites.

In 2003, Setchell et al. conducted research into the pharmacokinetics of the differential absorption of aglycone isoflavone types. In this study, the concentration of genistein in blood serum was highest at 7.4 hr while daidzein concentration was highest at 5.5 hr after ingestion. Pharmacokinetics of genistein and daidzein were studied and found that genistein was more bioavailable than daidzein. In the dose response portion of the research the nonlinearity of the bioavailability of genistein and daidzein lead the researchers to the conclusion that the intake of these two isoflavones is saturable. This finding suggests that isoflavone supplements may have limited value and that a change in diet could offer the maximum pharmacological benefit that can be gained from isoflavone ingestion.

In a 2000 statement for healthcare professionals, the American Heart Association (AHA) recommended, "…the consumption of soy protein containing isoflavones…" for the population in general, but specifically for those with elevated total and LDL cholesterol (Krauss et al., 2001). This statement came just short of an acknowledgment that there is a cholesterol-lowering activity resulting from the consumption of soy protein that is due to the isoflavone content. On the other side of this debate, is the fact that while the growth parameters of infants fed soy-based formula were no different than that of breast fed babies, the American Academy of Pediatrics (AAP) has found inconsistencies in the evidence regarding soy-based formula for preterm infants (Zung et al 2001). Due to the inconsistent findings in the literature, the AAP has stated that it does not recommend soy-based infant formulas for preterm infants <1,800 g. This paper by Zung et al. (2001) stated that it was the isoflavone content of soy-based formula that resulted in reduced cholesterol and lipoprotein levels. The literature does confirm that isoflavones are found in the maternal blood, cord plasma, and amniotic fluid thus proving their passage from mother to prepartum infant. In studies using rodent models, there have been several findings that demonstrated prepartum and postpartum exposure to genistein resulting in female offspring experiencing early puberty, reduced ovary and uterus size, and a reduction in estradiol and progesterone. In the Journal of Clinical Nutrition, Setchell et al. (1998) reported on the exposure of infants to phytoestrogens from soy-based infant formula. In this study, they found that infants are exposed to isoflavone levels in soy-based infant formula at levels four times the concentration of that found in human breast milk.

Franke et al. (1998) found that human breast milk contained absorbed isoflavones in forms of glucuronide or sulfate conjugates, which were thought to increase their absorption and perhaps mobility. The metabolites of isoflavones, such as equol, were present in urine samples but not in the breast milk.

Human research subjects fed 20g of soybeans had blood plasma levels of genistein that were more than twice the concentration of daidzein. The level of genistein in urine was less than that of daidzein. Franke et al. (1998) attributed this to the higher polarity of the daidzein. Infants fed a diet high in soy-based formula had higher levels of malonyl and acetyl forms of isoflavones in their urine. This was speculated to be due to the lack of gut micro flora required to carry out β-glucosidic cleavage. Clearly there are mixed messages and a lack of information regarding infant intake of isoflavones. This is perhaps the conundrum that brought the AAP to their decision.

2.3.3 Human Indications

There are three areas in which isoflavones are thought to play an active role in human health. The first of the three areas are as antioxidants to prevent and/or aid in the treatment of some cancers. Second is the ability isoflavones have in the role of increased bone density and hormone replacement therapy (HRT) for postmenopausal women. In the third area there has been some limited success at evaluating isoflavones for their antidipsotropic properties.

There has been research conducted to evaluate the theory relating isoflavone antioxidative potential to the cellular level. Both Fleury et al. (1992) and then Yang et al. (2001) evaluated isoflavones for their antioxidative potentials. In addition to this body of work, much has been published on the role that isoflavones can play in HRT. The third area is the antidipsotropic property, which is believed to have the potential to inhibit serotonin and dopamine metabolism (Keung and Vallee, 1998). These properties have been studied with the motivation to assist in the long-term treatment of dipsomania. Current animal studies have resulted in some promising findings.

Yang et al. (2001) estimated the antioxidant activities (AA) of flavonoids from their oxidation potentials. This study was designed to develop a methodology for the estimation for the AA of several types of flavonoids. Estimation of the lipid peroxidation (LPO) inhibition of flavonoids was established. An inhibitory concentration of 50% (IC_{50}) was determined for each of the flavonoids in the study. The relationship of an IC_{50} to the LPO of the compound was that, the lower the IC_{50} the less of the compound that it takes to inhibit LPO. Compounds lacking the 2-3 double bond and the 3-hydroxyl group resulted in the electron delocalization of the molecule, thus a decrease in the LPO and an increase in the IC_{50}. To further characterize the LPO, the comparisons of the IC_{50}, $E_{1/2}/V$ (a measure of the oxidation and electron transfer on the first wave of oxidation occurring) and the log octanol/water partition coefficient (O/WPC) resulted in elucidating the AA of many compounds. As it turned out, there was a strong relationship between the $E_{1/2}$/V and the structure of the flavonoid molecule. Thus the molecular structure plus the other two measured parameters were important in the determination of the AA of flavonols, flavones, flavanones, isoflavones, flavans, and flavanonols. In this study, the flavonoid with the highest AA was the flavonol quercetin (3,5,7,3′,4′-pentahydroxyflavone). The 2-3 double bond and the 3-hydroxyl group resulted in a low IC_{50}/μM of 8.5 and a 1.15 O/WPC. The O/WPC was found to be a value that when too high or too low the lipophilicity will not allow for the correct interaction with a cellular lipid bilayer, thus resulting in a higher IC_{50} (Yang et al., 2001; Terao et al., 1994). The findings of Yang et al. (2001) provided the same conclusions as Terao et al. (1994) with respect to the AA nature of quercetin. Comparing the values of the two isoflavones included in the study with the values for quercetin demonstrated the lack of AA of these chemicals. The two isoflavones included in this study were daidzein and daidzin. There was an IC_{50} of >100/μM and >100/μM plus a 2.69 and 0.85 O/WPC for the aglycon daidzein (7,4′-dihydroxyisoflavone) and the β-glucoside daidzin (4′-hydroxyisoflavone-7--glucoside), respectively. This demonstrated a clear lack of AA properties for these chemicals. Lacking the 2-3 double bond and having the O/WPC at either extreme resulted in a very high IC_{50} for each of the two isoflavones.

As with many potential finds in pharmacognosy there are often high hopes. In the early stages of research, the potential indications for the drug tamoxifen were numerous. In fact, tamoxifen became very important for those women who have had breast cancers that are dependant upon estrogen, or those who have the potential for these types of cancers (Anonymous, 1998; Alberts and Garcia. 1995). While this turns out to be a small part of the population, to these women the early hopes did bear fruit. However, there were many for whom this research excluded them from treatment as contraindicated. In the potential role as antioxidants, isoflavones are currently being marked in the nutraceutical industry for a wide range of treatments.

The aglycone genistein has been evaluated as an inhibitor of tumor cell growth resulting from its estrogen agonistic activities ***in vitro*** (Zava and Duwe, 1997). Acting as an estrogen antagonist, genistein had properties like tamoxifen, which aid in the reduction of cellular growth in cancer cells that require estrogen to proliferate. While tamoxifen and genistein each have a different mode of action, both are considered antiestrogenic compounds. The encouraging information to come out of this research is that the concentrations of genistein required to have this effect is at levels that are consistent with acceptable *in vivo* concentrations.

A study conducted by Miltyk et al. (2003) focused on the genistein potential for prostate cancer treatment. The major problem facing this is that past findings state that genistein causes damage to genetic material of human cells *in vitro* (Miltyk et al., 2003; Record et al., 1995; Yamashita et al., 1990). The research by Miltyk et al. (2003) and Jarred et al. (2003) demonstrated that there was no genotoxic effect when genistein was administered at 300 mg d^{-1} for 28 d, then 600 mg d^{-1} for an additional 56 d. The study by Davies et al. (1998) was based upon the findings of Gallaher et al (1996) that isolated soy proteins that were proven to be cancer preventatives. However, these same anticarcinogenic compounds were said to perhaps cause colon cancer if stored for greater than two years. It was found that the rate of genistein breakdown over time was inversely related to the browning, Maillard reaction, of the stored isolated soy protein. While no further cause and effect relationship was investigated, it seems to indicate that the degradation of genistein was related to the carcinogenicity of the stored isolated soy protein.

When evaluating the effects that increased isoflavones can have on women, it is important to put into perspective the concentrations and intake reported in the literature. The average daily intake of genistein for the Japanese population is 1.5 to 4.1 mg $person^{-1}$, and 6.3 to 8.3 mg $person^{-1}$ for genistin (Fukutake et al., 1996). In evaluating the biological effects of a diet of soy protein rich in isoflavones on the menstrual cycle of premenopausal women, the daily intake of just 0.7 mg kg^{-1} is enough to have a hormonal effect on the menstrual cycle of premenopausal women (Cassidy et al., 1994).

Ishida et al. (1998) found that genistin and daidzin prevented the effects of bone loss in ovariectomized rats. Suh et al. (2003) found that when genistein and daidzein were added to cultures of osteoblastic cells in the presence of tumor necrosis factor-α, the addition of the isoflavones resulted in the reduction of apoptosis when compared to cultures without the isoflavones. Isoflavones blocked the production of interleukin-6 (IL-6) and prostaglandin E2 (PGE2). The findings of this study show isoflavones to be important in bone remolding as a result of increased osteoblastic cells. The beneficial effect on bone density is one area that isoflavone research has demonstrated promise (Piersen, 2003). This is a welcomed addition to postmenopausal women facing a potential future of suffering from the effects of osteoporosis.

The enhancement of the binding of estrogen α (ERα) and estrogen β (ERβ) to the estrogen response element (ERE) as a result of the addition of several estrogen stimulants were evaluated by Kostelac et al. (2003). The binding of the two ERs to the ERE was evaluated in the presence of 17β-estradiol, coumestrol, daidzein, genistein, and the metabolite of daidzein, equol. The response was concentration dependant and for ERα there was a two hundred-fold increase in the EC_{50} of daidzein over genistein; while for ERβ the increase was only slightly greater than 11%. This demonstrated that binding affinity was increased for ERβ by the presence of the two phytoestrogens. In the same study, the metabolites of daidzein and equol were more active for ERα at an EC_{50} of 85-fold lower then that required for daidzein, but for ERβ the two were roughly the same. When compared with 17β-estradiol; daidzein, genistein and equol required 10,000, 500, and 117 times higher concentration to reach an EC_{50}, respectively, for ERα, while for ERβ the concentrations were 35, 3, and 40 times higher. This study demonstrates the variability in the affinities that phytoestrogens, like isoflavones, have on biological effects that are activated by estrogen induction.

Another use for isoflavones was studied based upon the use of a daidzin containing plant extract in Chinese medicine for the treatment of alcoholism. A group of researchers began to evaluate the effect of daidzin on the dipsomania activity, or alcoholism, using hamster models (Keung et al., 1996). They found that a methanol extract of the plant ***Radix puerariae*** (RP) increased the "uptake" of daidzin by golden hamsters and thus had a synergistic effect. The daidzin in the extract resulted in a ten-fold increase over doses of pure daidzin. A dose of 150 and 230 mg/kg of RP extract reduced ethanol uptake in hamsters by approximately 50%. This research provides a clearer picture of the importance of daidzin as an antidipsotropic, and that some constituent in the plant extract acts in synergy to aid daidzin absorption. Keung and Vallee (1998) followed the original research and again used rodent models to evaluate the effect of pure daidzin on alcohol intake inhibition. In this study, the researchers found that ***in vitro*** daidzin inhibited the hamster mitochondrial enzymes required to metabolize dopamine and serotonin. ***In vivo*** studies with hamsters resulted in a statistical correlation between the concentration of daidzin and the level of ethanol suppression. All of the treated rodents in the study responded with a positive correlation between daidzin concentration and ethanol intake suppression.

2.4 Summation

Secondary plant metabolites such as isoflavones have found their way into the diet of humans either indirectly or directly. The indirect method of intake via the consumption of food and food products has been ongoing for centuries. However, the intentional consumption of nutraceutical and herbal supplements, along with a choice to add new food products containing isoflavones into a daily diet, is a relatively new phenomenon in the west. Regardless of the mode of consumption of isoflavones, interest sparked in this area has lead to the research that has found that soybean seed, and products from soybean seed, are the best extractable and dietary sources of isoflavones.

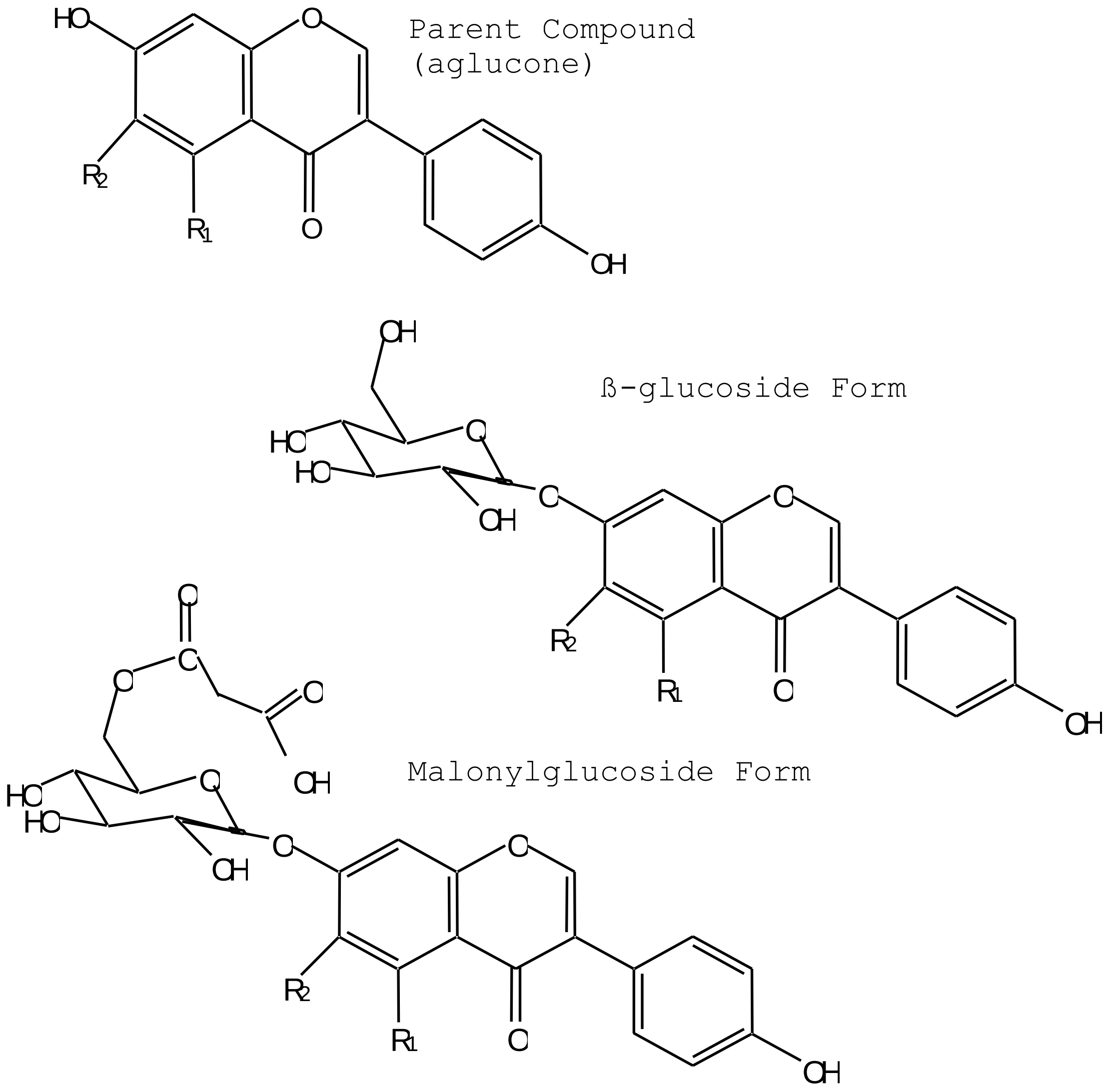
Given the almost universal acceptance of soybean as a primary source of isoflavones, it should now be the focus of researchers to understand how the production and physiology of the soybean crop function together. It will be this information that will result in the physiological manipulation and/or breeding that will ultimately benefit farmers in marketing their soybean crops based upon isoflavone content.

Attempts to date to manipulate the production of soybean isoflavones have focused on isolated parts of the plant rather than the whole. Herbicide applications to leaf tissue have induced isoflavones in that tissue, and in fact this induction has been found to be important in the role of plant disease prevention. Research has also revealed the importance of the role that the production of the three isoflavones coumestrol, daidzein, and genistein each play in the relationship between legumes and atmospheric nitrogen fixing soil bacteria. Adding to this body of research was the isolation and manipulation of the IFS genes and the substrates that are required to support isoflavone production. Finally, the research focusing on the type and concentration of isoflavones in the seed produced by soybean plants has expanded on the two fronts of environmental variability and selection of cultivars.

The entire body of research evaluating the relationship of isoflavones and soybean seeds has yet to be linked to physiological changes in other portions of the plant. Cultivar selection has been in the area of research that has not been widely undertaken. Research focusing on cultivar as well as maturity group variability has demonstrated that among cultivars there are consistent differences in isoflavones. Also, however, these studies have identified the variability within cultivars. It is this within cultivar variability in isoflavones that is not clearly understood, but is assumed to be inherent to environmental effects.

Research on the changes in isoflavones in one part of a plant, such as mature leaves, and the effects these changes have on seed isoflavones is useful for understanding the plants' reaction to environmental effects, and could provide a clearer explanation for the plant-to-plant variation observed under field conditions.

2.5 Figures



Parent Compound (aglucone)

ß-glucoside Form

Malonylglucoside Form

R_1	R_2	Compound
H	H	Daidzein
OH	H	Genistein
H	OCH_3	Glycitein

Figure 2.1. Structures of the nine primary economically important isoflavones found in soybean seeds.

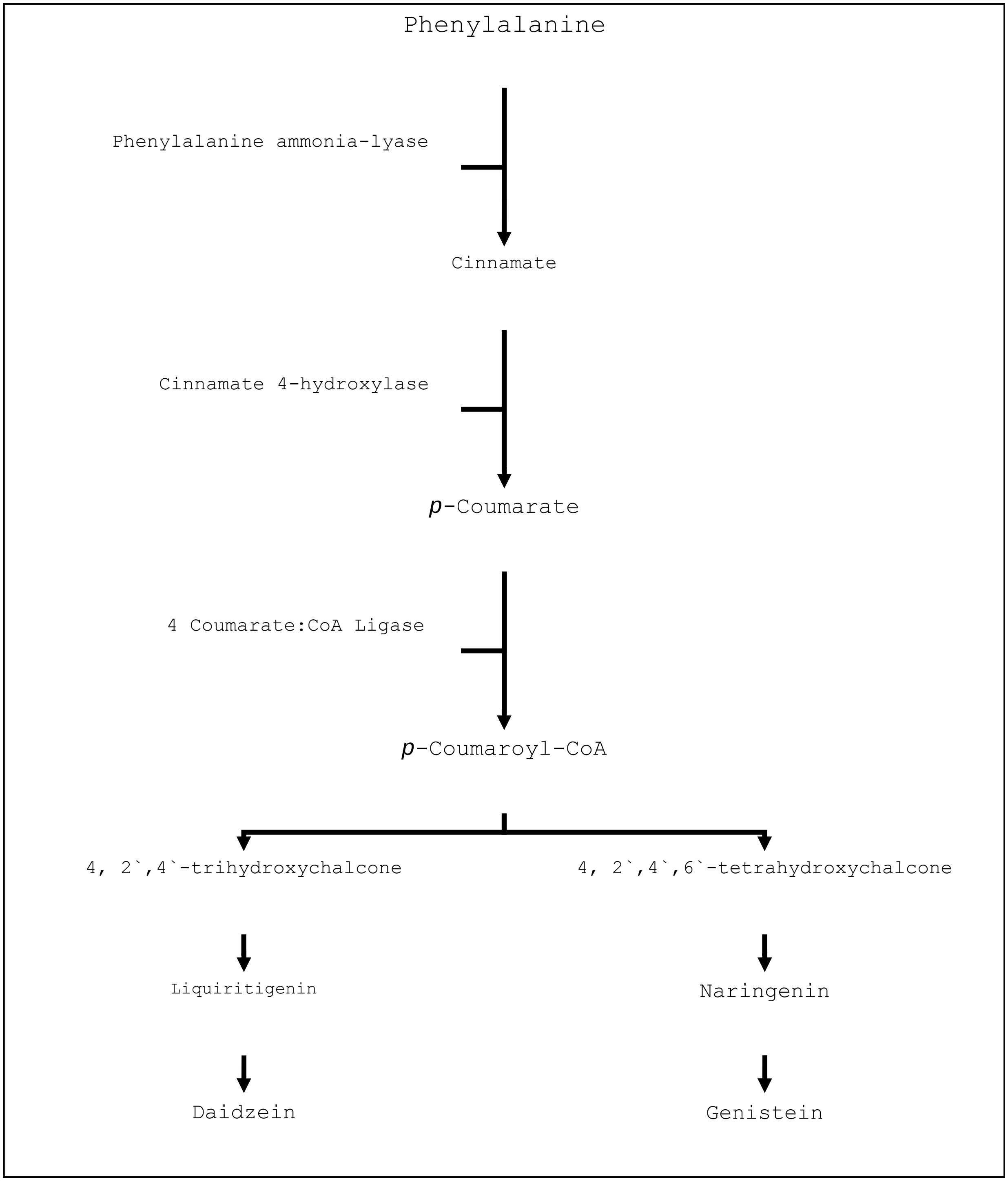


Figure 2.2. Phenylalnine pathway responsible for the production of all isoflavones found in the soybean seeds.

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Chapter 3: Soybean [***Glycine max*** (L.) Merr.] Leaf And Seed Isoflavone Response To Lactofen Applications

3.1 Abstract

Environmental conditions can have major impacts on the production of soybean [***Glycine max*** (L.) Merr.] metabolites. In this study, isoflavone type and concentration of both soybean leaf and seed tissue were evaluated under double-crop (DC) and full-season (FS) field conditions following treatment with lactofen. Lactofen was applied at weed control (WC) and white-mold suppression (WM) rates and timings of 219 g ai ha^{-1} applied at the V-1 stage and 122 g ai ha^{-1} applied at the V-5 to R-1 stages, respectively. Grain yield was obtained from the two center rows of each plot to be used for yield and laboratory analysis. Leaf tissue was obtained from plants prior to spray application. Isoflavone concentration for post-lactofen treated leaf tissue was 26% higher for total soybean treated with WC than WM. Leaf tissue concentrations of genistin were significantly higher for WC at 3.1 mg 100g $seed^{-1}$ than WM at 1.5 mg 100g $seed^{-1}$. Genistin had no response to the lactofen treatments in the FS cropping system. Yield was unaffected by

lactofen treatments in FS or DC. The DC yields averaged ~16% higher than FS. Cropping systems had no effect on average soybean seed weight. Lactofen treatment did not have an effect on soybean seed isoflavone concentrations, however, cropping systems and cultivars did. Total isoflavone concentration for DC seed was one-third higher than FS. The highest concentrations of seed isoflavones for DC and FS were malonyldaidzin and malonylgenistin. Total isoflavones within each cropping system were not different but daidzin, genistin, malonyldaidzin, malonylgenistin and genistein were, and within cropping system for cultivars, relative seed isoflavones remained consistent. The damage caused to the leaf tissue by lactofen applications did not result in a change in the seed isoflavone concentrations, individually or when quantified as total isoflavone.

3.2 Introduction

Environmental conditions can have a major impact on the production of soybean [***Glycine max*** (L.) Merr.] plant metabolites during the growing season, and thus on the composition of the harvested seed. Terrestrial and edaphic environmental factors that lead to plant stress have been shown to modify the type and concentration of soybean isoflavones found in seed. (Eldridge and Kwolck, 1983; Wang and Murphy, 1994; Tsukamoto et al., 1995; Hoeck et al. 2000; Wang et al., 2000).

Eldridge and Kwolck (1983) evaluated four soybean cultivars at one location and determined that the differences in the three aglycones, daidzein, genistein, and glycitein, and β-glucosides, daidzin, genistin, and glycitin, were significant. As part of the same study, two additional cultivars were evaluated over four years at the same location. As with the first set of cultivars, there were large differences in isoflavones across different cultivars as well as differences from year to year for each cultivar type. Although not pointed out in the research, the relative concentrations of total and individual isoflavones across years were consistent with one another. In another study, Wang and Murphy (1994) evaluated six soybean cultivars grown in eight locations over two growing seasons for the effects of interactions between environment and genotypes on the type and concentration of isoflavones. The harvested grain was analyzed for nine of the twelve known soybean isoflavones. While their findings demonstrated significant differences in the total and individual isoflavones, the relative amounts remained consistent within the cultivars across years.

The studies evaluating soybean isoflavone changes have focused on the results of many plant stresses that are often encompassed in the broad term of environment. Included within environmental stresses are many production practices that may influence the macro- and/or microenvironment. Production practices such as tillage, fertility, and residual fertility, as well as crop protection inputs all play a role in shaping, or influencing, the environment of a crop ecosystem. Some of these practices and inputs can have measurable effects.

The effects of the diphenylether herbicides, acifluorfen[7] (5-[2-chloro-4-(trifluoromethyl)phenoxy]-2-nitrobenzoic acid) and lactofen[8](ethyl *O*-[5-(2-chloro-α,α,α-trifluoro-*p*-tolyloxy)-2-nitrobenzoyl]-DL-lactate), on isoflavone induction in soybean leaf tissue have been studied (Landini et al., 2003; Hoagland, 1989; Cosio et al., 1985). In a study by Cosio et al. (1985), soybean leaves that were treated with 100 mg L^{-1} acifluorfen were

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[7] BASF AG. Carl-Bosch-Strasse 64, 67117 Limburgerhof, Germany

[8] Valent USA Corp. P.O. Box 8025, 1333 N. California Blvd. Suite 600, Walnut Creek California 94596-8025

found to contain isoflavone aglycons and β-glucosides. In a separate study, the primary isoflavones induced in soybean leaf tissue by lactofen were daidzein and daidzin, malonylgenistin, along with the aglycone flavonoid formononetin (Landini et al., 2003).

The objectives of this research were to evaluate isoflavone type and concentration in both soybean leaf and seed tissue under field conditions following treatment with the herbicide lactofen. Foliar lactofen treatments were applied at two labeled rates and timings to evaluate their effect on isoflavone type and concentration in soybean leaf and seed tissue. The relative relationships between leaf and seed tissue isoflavone types and concentrations were determined.

3.3 Materials and Methods

Field studies were established in 2002 and 2003 at the University of Maryland Wye Research and Education Center (WREC) and the Lower Eastern Shore Research and Education Center, Poplar Hill Facility (LESREC) in Queenstown and Quantico Maryland, respectively. Full-season and double-crop soybeans fields were planted at each location in each year. All field studies at WREC were treated with preemergence application of 1,120 g ai ha^{-1} metolachlor and sulfentrazone 198 g ai ha^{-1} plus 33 g ai ha^{-1} chlorimuron-ethyl. Double-crop soybean fields at WREC also received an application of glyphosate at 630 g ae ha^{-1}. Full-season field studies at LESREC were treated with the preemergence applications of 1,700 g ai ha^{-1} metolachlor, 185 g ai ha^{-1} linuron and 119 g ai ha^{-1} sulfentrazone plus 20 g ai ha^{-1} chlorimuron-ethyl. Double-crop soybean fields at LESREC were treated with 630 g ae ha^{-1} glyphosate, 1,120 g ai ha^{-1} metolachlor, and 316 g ai ha^{-1} sulfentrazone plus 53 g ai ha^{-1} chlorimuron-ethyl.

Full-season soybean seeds were planted on 23 May and 29 May 2002, and 27 June and 30 June 2003 at a density of 6.5 seeds per 30-cm of row spaced 60 cm apart. The full-season plots were planted in a split-plot arrangement with subplots of four, 6-m rows. Double-crop soybean seeds were planted following a barley (***Hordeum valgare*** L.)harvest on 19 June and 25 June 2002, and 10 July and 18 July 2003 at a density of 6.5 seeds per 30-cm of row spaced 40 cm on center and 3.5 seeds per 30-cm of row spaced 20cm on center at WREC and LESREC, respectively. The plots for double-crop soybeans were planted in a split-plot arrangement with subplots of seven, 7.5-m rows at WREC and five, 6-m rows at LESREC. Each whole plots contained one of the cultivars Bass, Corsica, Jack, or Williams 82. The herbicide treatments were randomly assigned to the subplots and were either a control, WC lactofen application or WM lactofen application. The WC rate and timing for lactofen was 219 g ha^{-1} applied at the V-1 stage of the soybean crop and the WM rate and timing for lactofen was 122 g ha^{-1} applied at the V-5 to R-1 stages of the soybean crop growth. The two center rows of each plot were harvested for yield and laboratory analysis.

3.3.1 Leaf Extraction

Isoflavones were extracted from soybean leaves harvested prior to lactofen applications then 48 h post spray application (PSA). The 48 h PSA was chosen based on the work of Cosio et al. (1985) that demonstrated that the concentrations of aglycone isoflavones reach their maximum in the leaf tissue at this point. After 96 h the maximum conversion of the aglycones to glucosides would prevent detection of the aglycones (Cosio et al., 1985). Leaf isoflavone extraction was achieved using a modification of a method that was developed for soybean seed extraction (Figallo et al., 2003; Lin and Giusti, 2003). Two whole leaves from two randomly selected plants within each plot were ground to a fine powder in liquid nitrogen using a mortar and pestle. A 2.5-g sample of the flour was transferred to a 50-ml Erlenmeyer flask. A 20-ml aliquot of 80% (v:v) methanol and a 50-ųl internal standard of 20 mM flavone were added to the flask. A Teflon stirrer bar was added to the solution then placed on a stirrer plate at medium speed for 2 h. After 2 h the supernatant was separated from the flour by vacuum separation through number one Whatmann[9] filter paper in an Erlenmeyer vacuum apparatus under 500 mm of mercury.

The supernatant was transferred from the Erlenmeyer flask to two 10-ml plastic centrifuge tubes and placed into a water bath at 40C under a constant flow of dry nitrogen until the volume reached approximately 6 ml. The samples were then centrifuged in a Beckman J2-21 at 33 g at 5 C for 10 minutes. The supernatant was then removed and transferred to 5-cm^3

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[9] Fisher Scientific, Research, 2000 Park Lane Drive, Pittsburgh, PA 15275, Part 1001-070

syringes with Tru Loc tips[10] fitted with 17-mm polypropylene syringe filters[11]. The syringes and filters were then flushed with 1.5 ml of 16% (v:v) acetonitrile. Filtered samples and acetonitrile wash were collected and the final volume was adjusted to 5 ml using the 16% (v:v) acetonitrile. The samples were then placed into a freezer at −20 C until analyzed for isoflavones.

3.3.2 Seed Extraction

Isoflavones were extracted from soybean seeds harvested in September. Total seed weight was determined for each plot. Seed size was determined on a 100-seed sample from each plot. Approximately 5 g of soybean seed was obtained from each plot and was analyzed for oil and protein using infrared analysis via an Infratec model 1255 Feed and Food Analyzer[12]. An additional 5-g sample of seeds was obtained and ground to a fine flour using a Braun Type 4041 Model KSM2 coffee grinder[13]. The grinder was pulsed for 3 sec over a 30-sec period. This flour was then used for isoflavone extraction.

Isoflavone extraction was achieved using the method outlined by Figallo et al. (2003) and Lin and Giusti (2003). A

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[10] Fisher Scientific, Research, 2000 Park Lane Drive, Pittsburgh, PA 15275, Part 14-823-35
[11] Fisher Scientific, Research, 2000 Park Lane Drive, Pittsburgh, PA 15275, Part DDP04T17NB
[12] FOSS North America, Eden Prairie, MN 55344, USA
[13] BRAUN, 1 Gillette Park, Boston, MA 02127-1096

2-g sample of the soybean seed flour was transferred to a 25-ml Erlenmeyer flask. A 10-ml aliquot of 80% (v:v) methanol and a 50-ųl internal standard of 20 mmol flavone were added to the flask. A Teflon stirrer bar was added to the solution then placed on a stirrer plate at medium speed for 2 h. After 2 h, the supernatant was separated from the flour by vacuum separation through number one Whatmann[14] filter paper in an Erlenmeyer vacuum apparatus under 500 mm of mercury.

A slight modification was made to the procedure of Figallo et al. (2003) for concentrating the samples. A steady stream of dry nitrogen gas replaced the rotary evaporator. The supernatant was transferred from the Erlenmeyer flask to a 10-ml plastic centrifuge tube and placed into a water bath at 40 C under a constant flow of dry nitrogen until the volume reached approximately 3ml. The samples were then transferred to 3-cm^3 syringes with Tru Loc tips[15] fitted with 17-mm polypropylene syringe filters[16]. The syringes and filters were then flushed with 1.5 ml of 16% (v:v) acetonitrile. Filtered samples and acetonitrile wash were collected and the final volume was adjusted to 5 ml using the 16% (v:v) acetonitrile. The samples

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[14] Fisher Scientific, Research, 2000 Park Lane Drive, Pittsburgh, PA 15275, Part 1001-070
[15] Fisher Scientific, Research, 2000 Park Lane Drive, Pittsburgh, PA 15275, Part 14-823-35
[16] Fisher Scientific, Research, 2000 Park Lane Drive, Pittsburgh, PA 15275, Part DDP04T17NB

were then placed into a freezer at -20 C until analyzed for isoflavones.

Identification and quantification of isoflavones occurred through high performance liquid chromatography (HPLC). Separation of isoflavones was on a C18 column with a linear gradient of acidified water (Solvent A: 0.1% acetic acid and 5% acetonitrile in water) and acidified acetonitrile (Solvent B was 0.1% acetic acid in acetonitrile). The flow rate of 1 ml min^{-1} and the gradient started at 10% and increasing to 14% B over 10 min, then increased to 20% over 2 min, was maintained at 20% over 8 min, continued to increase to 70% over 10 min, maintained at 70% for 3 min, and returned to 10% at the end of the 34 min run time (lin and Giusti 2005). The injection volume was 50 µl. A Waters[17] HPLC equipped with a Delta 600 pump, model 996 Photodiode Array Detector and 717plus Autosampler was used. Elution was monitored at 254 nm with spectrial data collected from 200-450 nm. Identification and quantification of isoflavones was achieved by comparing spectral data and retention times to standard references. Calibration curves were developed from pure standards of isoflavone aglycones and glucosides. Standards for the malonyl forms of the glucosides were not chromatographed due their instability; rather, molar

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[17] Waters Inc. 34 Maple Street, Milford, MA. 01757 USA

equivalents were calculated using the β-glucosides peaks (Figure 1).

3.3.3 Statistical Analysis

Statistical analysis was conducted as a split plot design with four randomized blocks. The whole plots contained one of the cultivars Bass, Corsica, Jack, or Williams 82. The herbicide treatments were randomly assigned to the subplots and were a control, WC lactofen application or WM lactofen application. In the analysis, blocks, years, and their interaction terms were treated as random effects in a mixed models analysis using SAS 8.1[18]. Residuals were examined to determine if the analysis of variance assumptions were adequately met. In all cases, normality of residuals and homogeneity of variances were assumed. The Tukey-Kramer method was used for means comparisons at a 5% significance level.

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[18] SAS/STAT, version 8.1, SAS Institute Inc., Cary North Carolina

3.4 Results and Disscussion

3.4.1 Soybean Leaf Isoflavones

Total isoflavone concentrations for untreated leaf tissue were highest for Williams 82 and Jack. Bass and Corsica were the cultivars with the two lowest isoflavone concentrations, however, Jack was not significantly different from Bass and Corsica (Table 3.1). Of the isoflavones detected in all untreated leaf samples, Williams 82 was highest for three of the four isoflavones: genistin, malonylgenistin, and genistein. The fourth isoflavone malonylglycitin was detected at very low levels and was highly variable among experimental units and as such resulted in no significant differences between cultivars.

Total isoflavone concentrations for post-lactofen treated leaf tissue was 26% higher for soybeans treated with WC applications than WM (Table 3.2). The three isoflavones genistin, malonylgenistin and genistein were found at higher concentrations for the WC treated soybeans. Leaf tissue concentrations of genistin for the WC lactofen treatments applied to DC soybeans were significantly higher at 3.1 mg 100 g seed^{-1} than WM at 1.5 mg 100 g seed^{-1}. Genistin concentrations for these same treatments applied to FS soybeans were found not to be different with levels of 1.9 and 1.3 mg 100g seed^{-1} for the

WC and WM treatments, respectively. The isoflavones daidzin, malonyldaidzin, and malonylglycitin were not different when compared between the two lactofen treatments. The three isoflavones, daidzin, malonyldaidzin, and malonylglycitin that did not show an increase were also the same isoflavones that were either at, or below, the level of detection in untreated leaf tissue (Table 3.1).

In addition to the relationship between the un-treated and post-lactofen treatment leaf tissue for the three isoflavones, daidzin, malonyldaidzin, and malonylglycitin, there was a strong relationship between isoflavone concentrations and cultivar type (Table 3.1). However, following either of the lactofen treatments, there was no relationship between isoflavone concentration and cultivar type (Table 3.3).

Overall, the isoflavones that displayed a significant post-lactofen application effect were higher for the WC treatment over the WM treatment. The one exception to this was the isoflavone genistin, which had no response to the lactofen treatments in the FS cropping system. It would be expected that a WC rate, which was over two times that used for the WM treatment, would result in higher levels of isoflavones.

As isoflavone production in leaf tissue is an acute response to physical damage, the propagation of isoflavone species would begin with aglycone production, followed by the conjugate species. In fact, genistin is the aglycone substrate from which the β-glucoside and malonylgenistin are produced, thus the level of the leaf tissue aglycone is directly related to the turnover dictated by the stimulation of the enzyme system. The ratio of total detected malonylgenistin plus genistein to the total aglycone genistin (MGG:G) for the untreated leaf was approximately 2.8:1, and the MGG:G ratio for lactofen treated leaf tissue was 4.5:1. There was no daidzin aglycone or malonyl form detected in the untreated leaf tissue. The ratio of the detected malonyldaidzin to the aglycone daidzin (MD:D) for the combined WC and WM lactofen-tissue treatments was 11.2:1.

The stimulus of leaf damage results in the production, or increased production of isoflavone aglycones, with a concomitant quick conversion of those aglycone isoflavones to their conjugate β-glucoside and malonyl forms. As discussed in Cosio et al. (1985), there is a temporal component to the different leaf tissue aglycone. From this information it can be deduced that at the 48h harvest time, both treatments of lactofen had induced aglycone isoflavone production. Further proof of this induction is the level of enzyme activity, demonstrated by the ratio of aglycones to their converted conjugate species.

3.4.2 Soybean Seed Constituents

Soybean yield was unaffected by lactofen treatments in FS or DC plantings (Table 3.4). The DC soybean yields averaged approximately 16% higher than the FS crop. This unexpected higher DC yield was driven by consistently lower yields in FS soybean at the LESREC location. DC soybean yields may have been higher since they were planted into no-tillage fields following barley. The DC no-tillage cropping systems may have allowed for increased moisture availability. While the yield difference among cropping systems did not translate to a difference in average soybean seed weight, Jack displayed an 11% decrease in weight of the full-season versus the double-crop seed (Table 3.5). This single full-season seed weight was the lowest seed weight of all cultivar weights regardless of the cropping system.

Lactofen applications did not significantly affect seed oil and protein concentrations (Table 3.6 and 3.7). The significance in the cultivar main effect for percent oil established that the four cultivars had differences of <5% between the highest and lowest concentration (Table 3.7). Tsukamoto et al. (1995) reported that soybeans seeds produced under high seasonal temperatures displayed a concomitant decrease in total fatty acid concentration and isoflavone concentration. In this study there were no differences in total percent oil when treatments were compared across cultivars with the controls. The cultivar main effect indicated that the protein variability was also low. Corsica and Williams 82 contained the highest protein concentrations of the cultivars tested (Table 3.7).

3.4.3 Soybean Seed Isoflavones

Soybean seed tissue isoflavone concentrations from untreated, WC treated, and WM treated plants were not found to be different. Significant isoflavone differences were found among cropping systems and cultivars.

Individual seed tissue isoflavones from DC soybeans were consistently higher than in tissue from the FS soybean seeds. Total isoflavone concentration for DC soybean seed (100 mg 100g^{-1}) was one-third higher than that of the FS seed tissue (62.56 mg 100g^{-1}) (Table 3.8). The isoflavone concentrations followed the pattern of higher yields for the DC soybeans than the FS soybeans. The highest concentrations of seed tissue isoflavones for both DC and FS were the malonyl forms of daidzin and genistin (Table 3.8).

Cultivar differences in total seed tissue isoflavone concentrations were highest for Williams 82, with no difference among the other three cultivars (Table 3.9). Also, the relative isoflavone concentrations for Bass, Corsica, Jack, and Williams 82 were similar over all five of the detected isoflavones. Seed isoflavone concentrations for Williams 82 were consistently among the highest of the cultivars for all isoflavones detected.

The total isoflavones within each cropping system were not different (Table 3.10). However, within cropping system, the relative concentrations of seed isoflavones at the cultivar level remained consistent. This consistency in the seed tissue isoflavones may be key to understanding the reactions of soybeans cultivars to different environments. If relative isoflavone concentrations respond consistently over varying environmental influences, quantitatively, the genetics should be based upon cultivar response and not individual isoflavone response. When Wang and Murphy (1994) evaluated seeds from six soybean cultivars over different environments, they demonstrated that regardless of environmental influences, consistency in isoflavone concentrations remained related to individual cultivars. Within this current study the importance of cultivar selection for isoflavone is clear. The consistant relative concentrations of isoflavones and the consistently high concentrations of isoflavones found over both cropping systems in the seeds of the single cultivar Williams 82, demonstrate cultivar importance. Total seed isoflavone concentration is thus the best measure for cultivar selection.

3.5 Conclusions

The results of this study demonstrate that at 48h post-lactofen treatment, there is enough daidzin and genistin in the leaf tissue that the conversion to the β–glucoside and malonyl forms are well under way. If the production of aglycone forms in the leaf tissue were to have an impact on the subsequent production in the seed, both treatments could have demonstrated this proclivity. In fact, from the seed-tissue isoflavone data it is clear that the damage caused to the leaf tissue did not translate to a change in the seed-tissue isoflavone concentrations; neither individually or quantified as total isoflavone concentration.

Future applied research should focus on establishing the isoflavone production capability of cultivars. A more basic approach to soybean isoflavone production needs to be focused on the production and storage enzymology and genetics. A better understanding of the functioning and controls of these systems could lead to the ability of farmers to produce for potential high isoflavone markets in the future.

3.6 *References*

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3.6 Tables and Figures

3.6.1 Tables

Table 3.1. Soybean untreated leaf tissue isoflavone concentration averaged over two growing seasons (2002 and 2003), two locations (Quantico and Queenstown, Maryland), and two cropping systems (full-season and double-crop).

	Cultivar			
Isoflavones	Bass	Corsica	Jack	Williams 82
	mg $100g^{-1}$			
Daidzin	nd	nd	nd	nd
Genistin	1.76ab	1.58b	1.73ab	2.05a
Glycitin	nd	nd	nd	nd
Malonyldaidzin	nd	nd	nd	nd
Malonylgenistin	3.90b	3.87b	4.70ab	5.61a
Malonylglycitin	0.07	0.07	0.15	0.31
Genistein	0.12ab	0.06b	0.12ab	0.20a
Total	5.86b	5.58b	6.72ab	8.19a

Isoflavone means across cultivars followed by the same letter are not significantly different according to Tukey-Kramer (0.05).
nd=no detection of that isoflavone for the cultivar.

Table 3.2. Soybean post-lactofen treated (48 h)leaf tissue isoflavone concentration averaged over two growing seasons (2002 and 2003), two locations (Quantico and Queenstown, Maryland), two cropping systems (full-season and double-crop), and four cultivars (Bass, Corsica, Jack, and Williams 82), for soybean plants treated with lactofen at 217 g active ingredient (ai) ha^{-1} for weed control (WC), 122 g ai ha^{-1} for white mold suppression (WM).

Isoflavones	Weed Control (WC)	White Mold Supression (WM)
	mg $100g^{-1}$	
Daidzin	0.09	0.02
Genistin	2.22a	1.70b
Glycitin	nd	nd
Malonyldaidzin	3.44	2.79
Malonylgenistin	10.20a	6.88b
Malonylglycitin	1.23	1.47
Genistein	0.31a	0.07b
Total	17.20a	12.70b

Treatment means within isoflavone and total isoflavones followed by the same letter are not significantly different according to Tukey-Kramer (0.05).

Table 3.3. Soybean post-lactofen treated (48 h)leaf tissue isoflavone concentration averaged over two growing seasons (2002 and 2003), two locations (Quantico and Queenstown, Maryland), and two cropping systems (full-season and double-crop), for soybean plants treated with lactofen at 217 g active ingredient (ai) ha^{-1} for weed control (WC), 122 g ai ha^{-1} for white mold suppression (WM).

	Cultivar			
Isoflavones	Bass	Corsica	Jack	Williams 82
	mg $100g^{-1}$			
Daidzin	0	0	0.18	0.06
Genistin	2.12	1.90	1.68	2.14
Glycitin	nd	nd	nd	nd
Malonyldaidzin	4.29	3.54	1.90	2.72
Malonylgenistin	8.87	8.39	7.99	8.86
Malonylglycitin	1.34	1.17	1.57	1.32
Genistein	0.23	0.15	0.18	0.19
Total	16.53	14.97	13.25	15.05

Isoflavone means across cultivars followed by the same letter are not significantly different according to Tukey-Kramer (0.05).
nd=no detection of the specific isoflavone for the cultivar.

Table 3.4. Soybean yields in full-season and double-crop cropping system averaged over two growing seasons (2002 and 2003), two locations (Quantico and Queenstown, Maryland), for soybeans plants treated with lactofen at 217 g active ingredient (ai) ha^{-1} for weed control (WC), 122 g ai ha^{-1} for white mold suppression (WM).

	Full-season Yields				Double-crop Yields			
Cultivar	WC	WM	Control	Mean	WC	WM	Control	Mean
	kg ha^{-1}				kg ha^{-1}			
Bass	1,901	1,787	1,806	1,831	2,185	2,049	2,642	2,292
Corsica	1,866	1,988	1,974	1,943	2,335	2,551	2,469	2,452
Jack	1,808	1,868	1,831	1,836	2,064	2,160	2,244	2,156
Williams 82	2,268	2,080	1,916	2,088	2,081	2,397	2,264	2,247
Mean	1,961	1,931	1,882	1,925b	2,166	2,289	2,405	2,287a

Cropping system main effect was tested in the anova, and means for cropping system are significantly different (0.05).

Table 3.5. Soybean seed weight in full-season and double-crop cropping system averaged over two growing seasons (2002 and 2003), two locations (Quantico and Queenstown, Maryland), for soybeans plants treated with lactofen at 217 g active ingredient (ai) ha^{-1} for weed control (WC), 122 g ai ha^{-1} for white mold suppression (WM).

	Full-season Seed Weight				Double-crop Seed Weight				
Cultivar	WC	WM	Control	Mean*	WC	WM	Control	Mean*	Cultivar*
	g 100 Seed^{-1}				g 100 Seed^{-1}				g 100 Seed^{-1}
Bass	11.8	12.2	12.1	12.0bc	14.3	14.3	14.9	14.5ab	13.3b
Corsica	12.9	13.1	13.6	13.2ab	15.2	15.9	16.3	15.8a	14.5a
Jack	11.9	11.8	11.3	11.7c	12.6	13.2	13.6	13.1b	12.4b
Williams 82	14.3	14.1	14.3	14.2a	15.0	14.9	15.2	15.0a	14.6a
Mean	12.7	12.8	12.8	12.8	14.3	14.6	15.0	14.6	

*Within column means followed by the same letter are not significantly different according to Tukey-Kramer (0.05).

Table 3.6. Soybean seed oil concentration in full-season and double-crop plantings averaged over two growing seasons (2002 and 2003), two locations (Quantico and Queenstown, Maryland), for soybeans plants treated with lactofen at 217 g active ingredient (ai) ha^{-1} for weed control (WC), 122 g ai ha^{-1} for white mold suppression (WM).

	Full-season Oil				Double-crop Oil				
Cultivar	WC	WM	Control	Mean*	WC	WM	Control	Mean*	Cultivar*
	%				%				%
Bass	21.1	21.1	20.9	21.0a	20.1	20.2	20.2	20.2ab	20.6a
Corsica	20.4	20.6	20.3	20.4b	19.6	19.5	19.7	19.6b	20.0b
Jack	20.3	20.6	19.8	20.2b	20.4	19.9	20.3	20.2a	20.2ab
Williams 82	20.6	20.7	20.5	20.6ab	20.1	19.9	19.7	19.9ab	20.2ab
Mean	20.6	20.7	20.4		20.0	19.9	20.0		

*Within column means followed by the same letter are not significantly different according to Tukey-Kramer (0.05).

Table 3.7. Soybean seed protein concentration in full-season and double-crop cropping system averaged over two growing seasons (2002 and 2003), two locations (Quantico and Queenstown, Maryland), for soybeans plants treated with lactofen at 217 g active ingredient (ai) ha^{-1} for weed control (WC), 122 g ai ha^{-1} for white mold suppression (WM).

	Full-season Protein				Double-crop Protein				
Cultivars	WC	WM	Control	Mean*	WC	WM	Control	Mean*	Cultivar*
		%				%			%
Bass	41.0	41.2	41.3	41.2b	40.8	40.7	41.0	40.8b	41.0b
Corsica	42.0	41.7	42.3	42.0a	41.8	42.0	41.8	41.8a	41.9a
Jack	41.5	41.3	42.2	41.7ab	40.0	40.1	40.0	40.0c	40.9b
Williams 82	42.0	41.9	42.6	42.2a	40.9	40.9	40.9	40.9b	41.6a
Mean	41.6	41.5	42.1	41.7	40.9	40.9	40.9	40.9	

*Within column means followed by the same letter are not significantly different according to Tukey-Kramer (0.05).

Table 3.8. Seed tissue isoflavone concentration averaged over two growing seasons (2002 and 2003), two locations (Quantico and Queenstown, Maryland), four cultivars (Bass, Corsica, Jack, and Williams 82), two lactofen treatments (217 g active ingredient [ai] ha^{-1} for weed control [WC] and 122 g ai ha^{-1} for white mold suppression [WM]), and a untreated control.

Isoflavones	Double Crop	Full Season
	mg $100g^{-1}$	
Daidzin	5.40a	3.26b
Genistin	13.75a	7.18b
Glycitin	nd	nd
Malonyldaidzin	20.27a	12.52b
Malonylgenistin	60.06a	39.51b
Malonylglycitin	nd	nd
Genistein	0.57a	0.01a
Total	100.0a	62.56b

Treatment means within isoflavone and total isoflavones followed by the same letter are not significantly different according to Tukey-Kramer (0.05).

Table 3.9. Soybean seed tissue isoflavone concentration averaged over two growing seasons (2002 and 2003), two locations (Quantico and Queenstown, Maryland), two cropping systems (full-season and double-crop), two lactofen treatments (217 g active ingredient [ai] ha^{-1} for weed control [WC] and 122 g ai ha^{-1} for white mold suppression [WM]), and a untreated control.

	Cultivar			
Isoflavones	Bass	Corsica	Jack	Williams 82
	mg 100g^{-1}			
Daidzin	4.10b	4.71ab	3.10c	5.40a
Genistin	10.13ab	10.43ab	8.87b	12.43a
Glycitin	nd	nd	nd	nd
Malonyldaidzin	14.19bc	17.70ab	11.41c	22.26a
Malonylgenistin	47.37b	46.30b	44.39b	61.07a
Malonylglycitin	nd	nd	nd	nd
Genistein	0.24b	0.25ab	0.32ab	0.36a
Total	76.05b	79.49b	68.16b	101.49a

Isoflavone means and total isoflavones across cultivars followed by the same letter are not significantly different according to Tukey-Kramer (0.05).
nd=no detection of that isoflavone for the cultivar.

Table 3.10. Soybean seed tissue isoflavone concentration averaged over two growing seasons (2002 and 2003), two locations (Quantico and Queenstown, Maryland), two lactofen treatments (217 g active ingredient [ai] ha^{-1} for weed control [WC] and 122 g ai ha^{-1} for white mold suppression [WM]), and a untreated control.

	Full Season				Double Crop			
	Cultivar				Cultivar			
Isoflavones	Bass	Corsica	Jack	Williams 82	Bass	Corsica	Jack	Williams 82
	mg 100g^{-1}				mg 100g^{-1}			
Daidzin	2.66bc	3.70ab	3.39c	4.28a	5.54a	5.72a	3.82bc	6.51a
Genistin	6.49ab	7.41ab	5.46b	9.37a	13.77ab	13.45ab	12.29b	15.49a
Glycitin	nd	nd	nd	nd	nd	nd	nd	nd
Malonyldaidzin	9.46	14.44	7.91	18.26	18.93	20.97	14.91	26.25
Malonylgenistin	35.78b	38.43b	31.82b	52.02a	58.96ab	54.18b	56.98b	70.12a
Malonylglycitin	Nd	nd	nd	nd	nd	nd	nd	nd
Genistein	0.01a	0a	0a	0.03a	0.46b	0.50b	0.63ab	0.69a
Total	54.4	64.2	47.7	84.0	97.7	94.8	88.6	119.0

Means across isoflavones type and within cropping systems (Full Season and Double Crop) followed by the same letter are not significantly different according to Tukey-Kramer (0.05).

nd=no detection of that isoflavone for the cultivar.

3.6.2 Figures

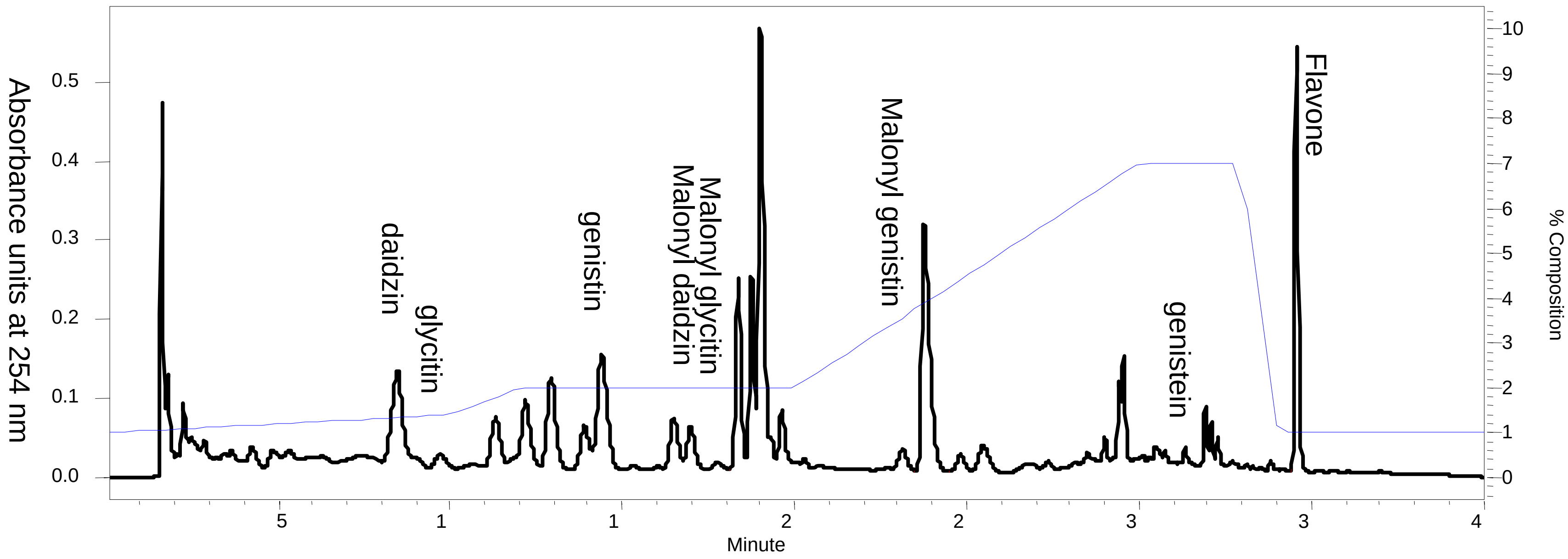

Figure 3.1. Chromatogram of the isoflavones extracted from soybean leaf tissue 48 hours after treatment with the white mold suppression application (WS) of lactofen at 122 g active ingredient (ai) ha^{-1} for weed control.

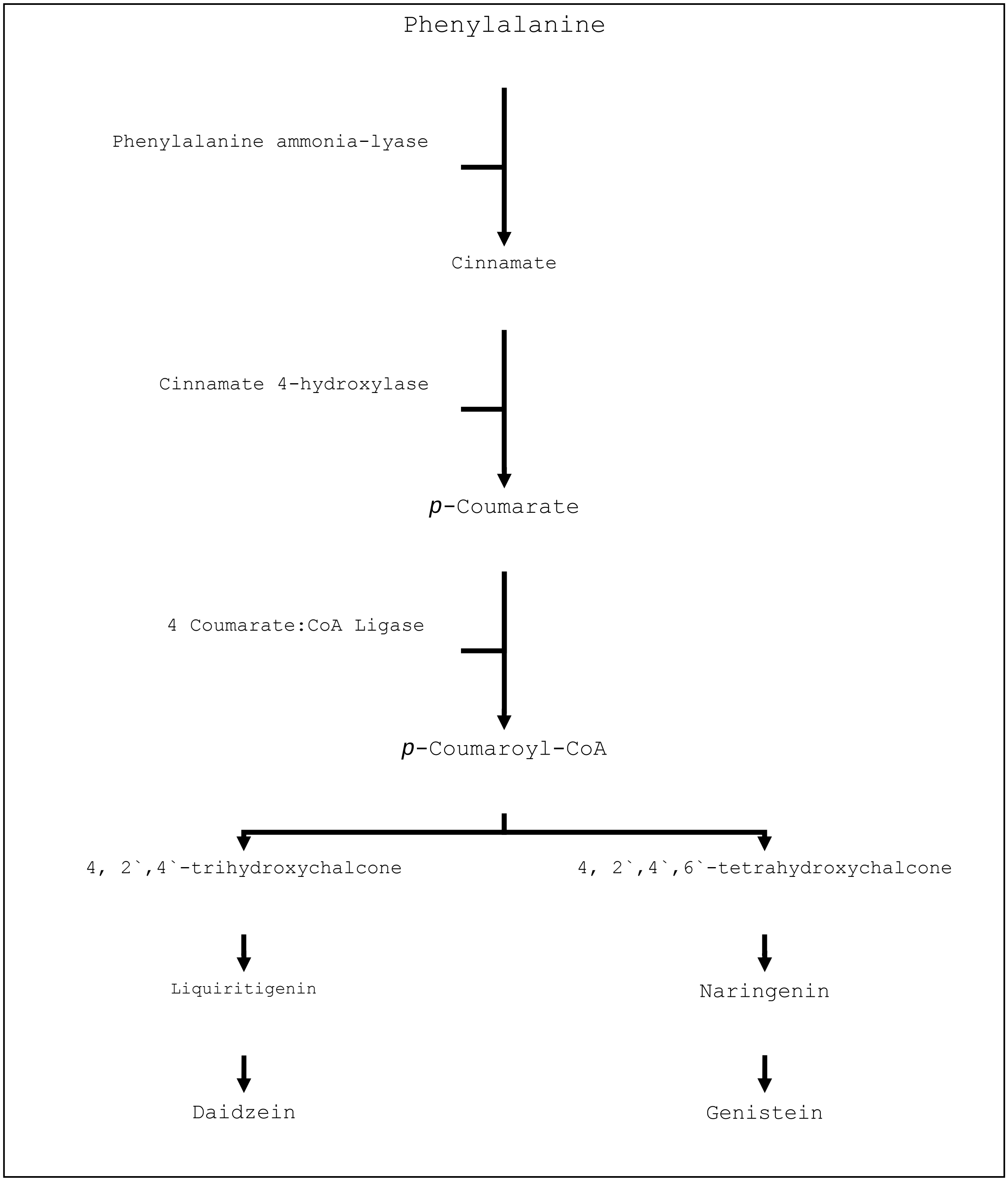

Figure 3.2. Phenylalnine pathway responsible for the production of all isoflavones found in the soybean seeds.

Chapter 4: Ozone Air Pollution Effects on the Concentration of Isoflavones in Soybean [***Glycine max*** (L.) Merr.] Seeds

4.1 Abstract

Production of isoflavones is highly variable between plants, and environmental conditions are known to increase this variability. This study focused on cultivar differences in four predominant isoflavones in soybean [***Glycine max*** (L.) Merr.] seeds: daidzin, genistin, malonyldaidzin, and malonylgenistin and the interaction with elevated tropospheric ozone concentrations. Four cultivars (Bass, Corsica, Jack, and Williams 82) were grown in the field in open-top chambers and fumigated with either carbon filtered (CF) or ozone (O_3) enriched air, 1.4 parts per billion above ambient(ppb) air. Average seasonal O_3 levels were 57.1 ppb and 31.4 ppb for O_3 and CF treatments, respectively. Soybean seed yields and average seed weight were reduced by 22% and 14%, respectively. However, the O_3 air quality treatments (AQT) had little effect on seed oil and protein concentrations. The two β-glucosides, daidzin and genistin, as well as their malonyl forms plus the only aglycone, genistein were present at detectable levels. The levels of

daidzin, malonyldaidzin, malonylgenistin and genistein were reduced for seeds from plants grown in O_3 by 25, 19, 15, and 11%, respectively compared to CF air. Although genistin levels were not significantly different, the data did trend toward lower concentrations for the plants receiving the elevated O_3 AQT. Other aglycone isoflavones were below the level of detection. Williams 82 ranked consistently higher than the other cultivars in levels of isoflavones regardless of the AQT and Jack exhibited the lowest concentration of isoflavones, except for genistein.

4.2 Introduction

Environmental conditions can have major impacts on the production of plant metabolites during the growing season, and thus may alter the composition of the harvested seed. Air pollution has become a very important consideration in the quality of agronomic-crop end products. In fact, the role of air pollutants and their effects on crop plants is an important research topic in plant sciences and has been reviewed (Hoeck et al., 2000; Heck et al., 1988; Mulchi et al., 1995). Ozone (O_3) is the primary air pollutant found to cause damage to crop plants and worldwide results in losses that and believed to be in excess of a billion dollars annually.

The background ambient level of O_3 common in the troposphere is approximately 25 parts per billion (ppb=ng g^{-1}) averaged over a 7-h mean (0900 to 1700 h EDT). However, in some regions of the United States, ambient O_3 levels above 100 ppb are not uncommon during the mid-day of summer months. Tropospheric O_3 is primarily produced by photochemical reactions among emissions from the burning of fossil fuels. Moderate to high levels of exposure to O_3 are phytotoxic to plants and result in reduced chlorophyll concentration and other traits including crop yields (Chernikova et al., 2000; Mulchi et al., 1988). An additional area of interest in O_3 air pollution is its impact on secondary plant metabolites such as isoflavones. Isoflavones extracted from the seeds of soybeans are very important in nutraceuticals and pharmaceuticals (Anonymous, 2000). These phytoestrogen compounds are currently sought for their possible health benefits of preventing some cancers and for hormone replacement therapy (Anonymous, 2000). There is also concern about the effects of these estrogen-like compounds in soy foods on the development of infants and children. Currently there is no FDA standards or requirements to monitor the concentrations of isoflavone compounds in foodstuffs or infant formulas. This remains true even in light of toxicological evidence that small disruptions in the human endocrine system can lead to health and developmental abnormalities.

Yu et al. (2000) illustrated that exposure to ultraviolet-B light increased the level of β-glucoside isoflavones of genetically transformed tobacco (***Nicotiana tabacum***) and Arabidopsis leaves. Wang et al. (1999) evaluated the concentration of the β-glucosides in subterranean clover (***Trifolium subterraneum***). They found that Reddlegged Earth Mite-resistant clover had higher levels of β-glucoside isoflavones. The levels of these forms of isoflavones, specifically daidzin and genistin, found in damaged tissue as well as insect-resistant tissues would lend support to the assertion that these metabolites were simply being routed to the strongest sink tissue. The isoflavones daidzin and genistin are highly water-soluble β-glucosides and are known to be among the most predominant in soybean seed tissue (Tsukamoto et al., 1995; Wollenweber and Dietz, 1981).

If in the future, contracts are available to farmers to produce soybean seeds for isoflavones, knowledge of how environmental factors will impact isoflavone production will be vital. If environmental conditions such as O_3 air pollution have major impacts on the production, mobility, and storage of soybean seed isoflavones, additional research is needed in order to gain a more basic understanding of such impacts. This study investigated the effect of elevated tropospheric ozone on the concentration of 12 isoflavones in the seeds of the soybean cultivars Bass, Corsica, Jack, and Williams 82. In this research the focus was on the effects of O_3 on soybean isoflavone concentrations.

4.3 Materials and Methods

4.3.1 Field

The field design of this experiment included six open-top chambers with a diameter of three meters (OTC) (Figure 4.1).

When treatments began, three of the OTC were continuously fumigated with carbon-filtered air (CF) and the remaining three OTC with ambient air plus enough O_3 to increase the ambient air O_3 concentration by 7 parts per billion (ppb).

Ozone treatments followed those described by Chernikova et al. 2000. The O_3 treatments were a mix of ambient air and artificially produced O_3, which was generated from passing O_2 through a Griffin[19] O_3 generator. The O_3 was injected into the airstream of blowers where it was mixed prior to entering the distribution ring of the chamber. Treatments were applied beginning on 13 June of 2002 for 7 h day^{-1} (1000 – 1700 h) for five days a week, over an eight-week duration (Figure 4.2). Ozone chamber air quality was sampled at canopy level hourly using a Dasibi model 1008, UV Photometric O_3 analyzer as described by Mulchi et al. (1992, 1995).

Seeds were planted in 3-cm diameter pots in the greenhouse in April for transplanting in early May. As illustrated in figure 4.3, each chamber was partitioned into six rows 1.8 m in length with rows spaced 40 cm apart. The two end rows in each chamber served as border rows. The rows were divided into three replicates 0.6 m in length with four plots per replicate. The plots within each replicate were randomly assigned to the four

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[19] Griffin Technics Corp., Lodi, New Jersey

cultivars prior to transplanting. Transplants at the V1-V2 stage were taken to the field and planted in the OTC in three 0.6-m length rows replicate with plants spaced 10 cm apart, or six plants per plot row. Each OTC contained three replicated plots for each of the four cultivars. Three chambers were equipped with charcoal filters (CF) and three were purged continuously with ambient air.

After two weeks of growth, O_3 treatment began. The O_3 levels were monitored through an automated sampling system (Chernikova et al., 2000). Supplemental O_3 was supplied to the three ambient air chambers from 0900 to 1600 h, EDT, five days week^{-1}. The activated charcoal lowered O_3 levels approximately 50% of ambient (Figure 4.1). All OTC were irrigated by hand immediately after planting and then every day for the first three days. Supplemental irrigation was made to all OTC when rainfall was insufficient for optimal plant growth. The O_3 treatments were terminated when canopy leaves were at advanced senescence.

Seed harvest yields and weights were obtained from the plants, which were hand-harvested in late September. Total seed weight was determined for each plot. Seed size (100 g^{-1} seed) was determined on a 100-seed sample from each plot.

4.3.2 Laboratory

Grain quality was obtained from approximately 5 g of soybean seed from each replicated cultivar and was analyzed for oil and protein contents using infrared analysis via an Infratec model 1255 Feed and Food Analyzer. An additional 5-g sample of seeds was obtained and ground into a fine flour using a Braun Type 4041 Model KSM2 coffee grinder. The grinder was pulsed for 3 sec over a 30-sec period. This flour was then used for isoflavone extraction.

Isoflavone extraction was achieved using the method outlined by Lin and Giusti (2005) and Figallo et al (2003). A 2-g sample of the soybean seed flour was transferred to a 25-ml Erlenmeyer flask. A 10-ml aliquot of 80% (v:v) methanol and a 50-ųl internal standard of 20 mmol flavone were added to the flask. A Teflon stirrer bar was added to the solution then placed on a stirrer plate at medium speed for 2 h. After 2 h, the supernatant was separated from the flour by vacuum separation through number one Whatmann[20] filter paper in an Erlenmeyer vacuum apparatus under 500 mm of mercury.

A slight modification was made to the procedure of Figallo et al. (2003) for concentrating the samples. A steady stream of dry nitrogen gas replaced the rotary evaporator. The

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[20] Fisher Scientific, Research, 2000 Park Lane Drive, Pittsburgh, PA 15275, Part 1001-070

supernatant was transferred from the Erlenmeyer flask to a 10-ml plastic centrifuge tube and placed into a water bath at 40C under a constant flow of dry nitrogen until the volume reached approximately 3ml. The samples were then transferred to 3-cm^3 syringes with Tru Loc tips[21] fitted with 17-mm syringe polypropylene filters[22]. The syringes and filters were then flushed with 1.5ml of 16% (v:v) acetonitrile. Filtered samples and acetonitrile wash were collected and the final volume was adjusted to 5ml using the 16% (v:v) acetonitrile. The samples were then placed into a freezer at –20 C until analyzed for isoflavones.

Identification and quantification of the isoflavones occurred through high performance liquid chromatography (HPLC) using a Waters[23] HPLC with a model 996 Photodiode Array Detector, model 600 Controller, 717plus Autosampler and Delta 600 pump. Identification and quantification of isoflavones occurred through high performance liquid chromatography (HPLC). Separation of isoflavones was on a C18 column with a linear gradient of acidified water (Solvent A: 0.1% acetic acid and 5% acetonitrile in water) and acidified acetonitrile (Solvent B was 0.1% acetic acid in acetonitrile). The flow rate of 1 ml min^{-1}

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[21] Fisher Scientific, Research, 2000 Park Lane Drive, Pittsburgh, PA 15275, Part 14-823-35
[22] Fisher Scientific, Research, 2000 Park Lane Drive, Pittsburgh, PA 15275, Part DDP04T17NB
[23] Waters Inc. 34 Maple Street, Milford, MA. 01757 USA

and the gradient started at 10% and increasing to 14% B over 10 min, then increased to 20% over 2 min, was maintained at 20% over 8 min, continued to increase to 70% over 10 min, maintained at 70% for 3 min, and returned to 10% at the end of the 34 min run time (lin and Giusti 2005). The injection volume was 50 µl. A Waters[24] HPLC with a Delta 600 pump, model 996 Photodiode Array Detector and 717plus Autosampler was used. Elution was monitored at 254 nm with spectrial data collected from 200-450 nm. Identification and quantification of isoflavones was achieved by comparing spectral data and retention times to standard references. Calibration curves were developed from pure standards of isoflavone aglycones and glucosides. Standards for the malonyl forms of the glucosides were not chromatographed due to their instability; rather, molar equivalents were calculated using the β–glucosides peaks (Figure 1).

4.3.4 Statistical Analysis

Statistical analysis was conducted as a completely randomized design with three chambers per treatment. Within each chamber there were three replicated blocks, each of which contained four soybean cultivars Bass, Corsica, Jack, or

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[24] Waters Inc. 34 Maple Street, Milford, MA. 01757 USA

Williams 82. The treatments were either Ambient air plus ozone (O_3)or carbon filtered air (CF). A mixed models analysis using SAS 8.1[25] was used. Chambers were treated as replicates and the plots within each block were treated as samples in the final analysis. Chamber and the associated interactions were designating as random variables. Residuals were examined to determine if the analysis of variance assumptions were adequately met. In all cases, normality of residuals and homogeneity of variances were assumed. The Tukey-Kramer method was used for means comparisons at a 5% significance level.

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[25] SAS/STAT, version 8.1, SAS Institute Inc., Cary North Carolina

4.4 Results and Discussion

Through daily monitoring, the average O_3 enrichment for the ambient air plus O_3 treatment was 1.4 ppb (Figure 4.2.). This change from the target of 7 ppb was the result of high seasonal ambient ozone levels and that O_3 injection was only 5 days week^{-1}, which resulted in a lower seasonal average of O_3 concentration in the treatment chambers. Average seasonal ambient O_3 level was 55.7 ppb, while O_3 and CF treatment levels were 57.1 ppb and 31.4 ppb, respectively.

Even with the modest increase in O_3 levels, average soybean seed yields were significantly reduced by 22% for plants grown in elevated O_3 AQT (90.8 g m^{-2}) when compared to those grown in CF AQT 117.0 g m^{-2}) (Table 4.1.). It has been well documented that moderate levels of O_3 exposure are phytotoxic to soybean plants and result in reduced crop yields (Chernikova et al., 2000; Mulchi et al., 1988).

In addition, individual seed weights from plants grown in elevated O_3 AQT had average weights (12.4 g g m^{-2}) that were 14% less than those from the CF AQT (14.4 g m^{-2}). All cultivars reacted similarly to the AQT. There was no significant cultivar effect, or cultivar by treatment interaction observed for seed yield or individual seed weight. The cultivars Corsica and

Williams 82 had the highest average seed weight regardless of the AQT to which they were exposed. Visual comparisons of leaf tissues between the two AQT confirmed damage from O_3 as characteristic signs of necrotic spotting on the adaxial portions of leaves. This is consistent with reported symptoms of O_3 exposure (Mulchi et al., 1995).

Likewise, the AQT did not have a significant effect on seed oil concentration (Table 4.2). However, seed oil concentrations were significantly different between cultivars. Bass and Williams 82 had the highest oil concentrations. Differences in oil concentrations were not consistent between cultivars with respect to AQT. This treatment by cultivar interaction was due to a change in ranking of the cultivars for oil concentration at each AQT. The cultivar's genotype had more influence on oil concentration than the AQT (Table 4.2).

The AQT did not have a significant effect on the seed protein concentrations (Table 4.2). Although there were significant differences between cultivars for their protein concentrations, there was no significant cultivar by treatment interaction. Averaged over all cultivars, protein concentrations were not significantly different for the comparison of the O_3 AQT and the CF AQT. Overall, the exposure to elevated O_3 had little effect on soybean seed oil and protein concentrations. The magnitude of the oil and protein changes were consistent with other studies (Mulchi et al., 1988)

Together, the reduced yield and seed weight plus the lack of effect of O_3 on oil and protein concentrations suggest that the soybean plants in the O_3-AQT were stressed, but the overall treatment effects were not severe enough to cause considerable leaf loss and necrosis.

The average levels of daidzin for soybean cultivar grown in O_3 (3.2 mg 100 g^{-1}) were 25% lower than for plants grown in CF AQT (4.2 mg 100 g^{-1}) (Table 4.3). Cultivar Williams 82 had the highest concentration of daidzin (5.1 mg 100 g^{-1}) regardless of AQT. Concentrations of the other glucoside, genistin, were not different with respect to ozone treatments; however, there were clear trends for lower concentrations with O_3-AQT as compared to the CF AQT. Cultivar differences for daidzin and genistin responded similarly. Cultivar Williams 82 was likewise found to be in the group with the highest levels of genistin (12.5 mg 100 g^{-1}). The isoflavone β-glucosides daidzin and genistin extracted from the seeds of plants grown under the two AQT did follow the same trends as found for some environmental stress such as elevated temperature, but opposite of those found for others such as ultraviolet light. (Yu et al., 2000; Tsukamoto et al., 1995)

The malonyl forms of isoflavones responded in much the same way as the β-glucosides (Table 4.4). Malonyldaidzin and malonylgenistin were both at lower concentrations in seeds from plants grown in the elevated O_3 AQT compared to the CF AQT. The average concentration of malonyldaidzin was 19% lower in the soybean seed from the O_3 AQT, while the malonylgenistin average concentration was 15% lower for the same AQT. Williams 82 exhibited the highest concentration for both of these malonyl forms of isoflavones.

Aglycone concentrations were below the level of detection with the exception of genistein. Since aglycones are produced then stored in cell vacuoles as glucosyl and malonyl forms, the rapid conversion of aglycones, ***in vivo***, to β-glucoside and malonyl forms often results in low or undetectable concentrations of these forms of isoflavones (Yu et al., 2000). In this study, the average genistein concentration was reduced in seed produced from soybean plants grown in the O_3 AQT (0.42 mg 100 g^{-1}) by 11% compared to seeds from plants exposed to the CF AQT (0.50 mg 100 g^{-1}).

Cultivar differences were significant for genistein with Williams 82 having a higher concentration (0.57 mg 100 g^{-1}) than other cultivars. Because of the interdependency of the isoflavone types (aglycone → β-glucoside → malonyl), an observed change in one form of isoflavone due to an affect of O_3 may be the result of an affect on another isoflavone type.

Speculation as to the causal factors lowering the isoflavone concentrations in soybean seeds in response to O_3 exposure, across the four cultivars, would probably be best focused on a shift in the biochemical requirements of leaf tissue and/or a reduction of photosynthate. The enzyme changes in functioning leaf tissue have been proven to favor the production of isoflavones over other essential biochemicals such as anthocyanins (Cosio et al., 1985). In addition, the phytotoxic nature of O_3 has been proven to result in a reduction of crop leaf canopy, leaf area, and thus lowering the capacity of the plant to produce the required amount of photosynthate (Chernokova et al., 2000: Mulchi et al., 1992). Together changes in biochemical and photosynthetic leaf functions may have reduced overall plant production below some threshold. As a result, the overall plant biochemistry shifted resources that would have been used for increased seed production, toward repair. This resulted in a less healthy plant that is unable to both produce seed and repair damaged tissue.

4.5 Conclusions

Overall, the O_3 AQT lowered the isoflavone concentrations in the soybean seeds. Rankings of cultivar means within isoflavone types demonstrated that Williams 82 consistently produced higher levels of isoflavones compared to other cultivars, Jack exhibited the lowest levels except for genistein.

These research findings are supported by the work of Hoeck et al. (2000). In their study, cultivar variability had a greater significance than environmental factors on isoflavone concentration. While environmental influences did result in changes in isoflavone concentrations, there remained consistency among the cultivars within the environments. The four cultivars used in this study were of two maturity groups (MG). Bass, Jack, and Williams 82 are MG III and Corsica is an early MG IV cultivar. With the exception of the β-glucoside genistin, Bass and Williams 82 were consistently different from one another with respect to isoflavone concentrations. Just as with the findings of Wang et al. (2000), this study did not demonstrate a relationship between isoflavone production and maturity group since Williams 82 and Jack, both are MG III, exhibited one higher and lower levels of isoflavones, in general.

While only four cultivars were evaluated for the impacts of O_3 AQT on isoflavones in this study, the concentrations of isoflavones were found to be significantly lower among cultivars when exposed to O_3 levels of >55 ppb. Previous research has demonstrated an increase in soybean seed isoflavones as a result of environmental stresses such as temperature. The four cultivars used in this study failed to show a similar stress response to O_3 air pollution as had been reported in the literature for temperature. The elevated air pollution resulted in a reduction in yield, which was the result of an overall reduction in physiological productivity. This lower productivity most probably resulted in the lower isoflavone concentrations observed. It would seem at this level of O_3, the response of soybean plants was to redirect resources, thus increasing the compensation point for O_3 injury, thereby lowering the overall productivity. Considering that this is the first study to examine the impact of elevated O_3 air pollution on soybean isoflavones levels in seed, follow up studies would appear to be warranted. Additional studies should be conducted to quantify and corroborate these results with elevated tropospheric O_3, and perhaps adding other environmental stresses such as drought.

4.6 References

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4.5 Tables and Figures

4.5.1 Tables

Table 4.1. Soybean yield and weight per 100 seeds for cultivars grown in open-top field chambers fumigated with either carbon-filtered or ozone-enriched air at Beltsville, MD, in 2001.

	Total Seed Yield			Weight 100 Seed^{-1}		
Cultivar	Filtered	Ozone	Mean*	Filtered	Ozone	Mean*
	g m^{-2}			g		
Bass	106.1	89.5	97.8a	13.6	11.7	12.7a
Corsica	139.3	92.8	116.0a	16.8	14.4	15.6a
Jack	86.7	84.4	85.6a	11.5	9.3	10.4a
Williams 82	135.8	96.7	116.3a	15.6	14.1	14.8a
Mean**	117.0a	90.8b		14.4a	12.4a	

*Within column means followed by the same letter are not significantly different according to Tukey-Kramer (0.05).

**Column means within total seed yield or weight 100 seed^{-1} followed by the same letter are not significantly different according to Tukey-Kramer (0.05).

Table 4.2. Soybean seed oil and protein concentrations for cultivars grown in open-top field chambers fumigated with either carbon-filtered or ozone-enriched air at Beltsville, MD, in 2001.

Cultivar	Seed Oil			Seed Protein		
	Filtered	Ozone	Mean*	Filtered	Ozone	Mean*
		%			%	
Bass	22.6	23.0	22.8a	39.8	39.4	39.6 a
Corsica	21.3	21.8	21.6b	42.3	41.4	41.9 b
Jack	21.8	20.2	21.0b	40.0	42.2	41.1bc
Williams 82	22.6	22.6	22.6a	40.1	40.0	40.1ac
Mean	22.1	21.9		40.5	40.8	

*Within column means followed by the same letter are not significantly different according to Tukey-Kramer (0.05).

Table 4.3. Soybean seed glucoside isoflavones daidzin and genistin concentrations for cultivars grown in open-top field chambers fumigated with carbon-filtered and ozone-enriched air at Beltsville, MD, in 2001.

	Daidzin			Genistin		
Cultivar	Filtered	Ozone	Mean*	Filtered	Ozone	Mean*
	mg 100g^{-1}			mg 100g^{-1}		
Bass	3.4	2.7	3.1a	10.2	8.2	9.2ab
Corsica	4.5	3.5	4.0b	9.6	7.7	8.7b
Jack	3.2	2.1	2.6a	9.5	5.5	7.5b
Williams 82	5.6	4.7	5.1c	13.6	11.4	12.5a
Mean**	4.2a	3.2b		10.7a	8.2a	

*Within column means followed by the same letter are not significantly different according to Tukey-Kramer (0.05).

**Column means within individual isoflavone and followed by the same letter are not significantly different according to Tukey-Kramer (0.05).

Table 4.4. Soybean seed malonyl and aglycone isoflavone concentrations in soybean cultivars grown in open-top field chambers fumigated with carbon-filtered or ozone-enriched air at Beltsville, MD, in 2001 and 2002.

	Malonyl						*Aglycone*		
	Daidzin			Genistin			Genistein		
Cultivar	Filtered	Ozone	Mean*	Filtered	Ozone	Mean*	Filtered	Ozone	Mean*
		mg $100g^{-1}$			mg $100g^{-1}$			mg $100g^{-1}$	
Bass	12.7	8.4	10.5ab	51.1	37.3	44.2a	0.34	0.34	0.37a
Corsica	15.5	11.3	13.4a	47.3	37.2	42.3a	0.39	0.32	0.36a
Jack	10.0	5.8	7.90b	44.1	25.9	35.0a	0.62	0.51	0.51ab
Williams 82	20.2	18.1	19.1c	61.7	58.8	60.3b	0.58	0.57	0.57b
Mean**	14.5a	10.9b		51.1a	39.8b		0.50a	0.42b	

*Within column means followed by the same letter are not significantly different according to Tukey-Kramer (0.05).

**Column means within individual isoflavone type followed by the same letter are not significantly different according to Tukey-Kramer (0.05).

4.5.2 Figures

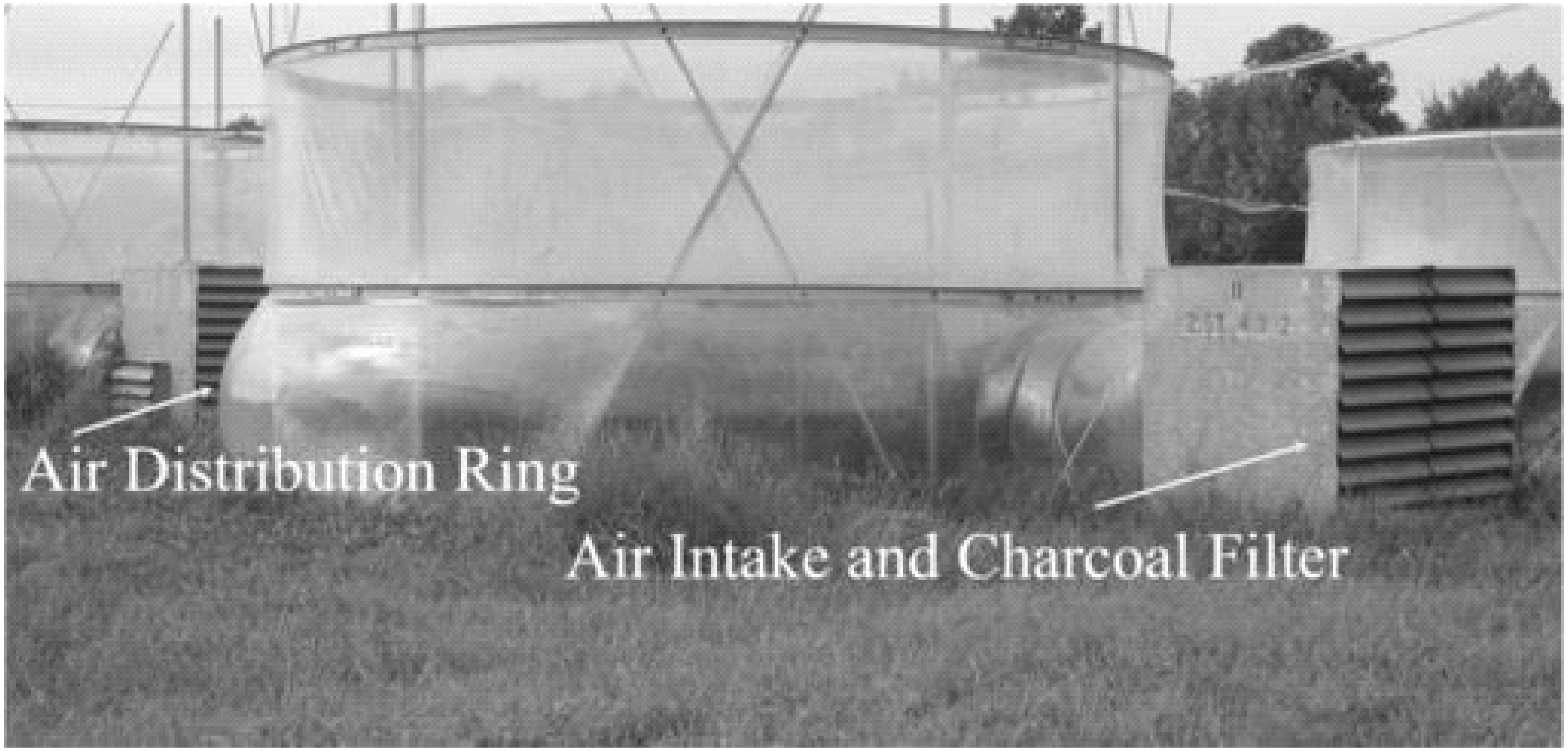

Figure 4.1. Three meter Open-Top Chamber (OTC) fitted with an air intake containing a charcoal filter system.

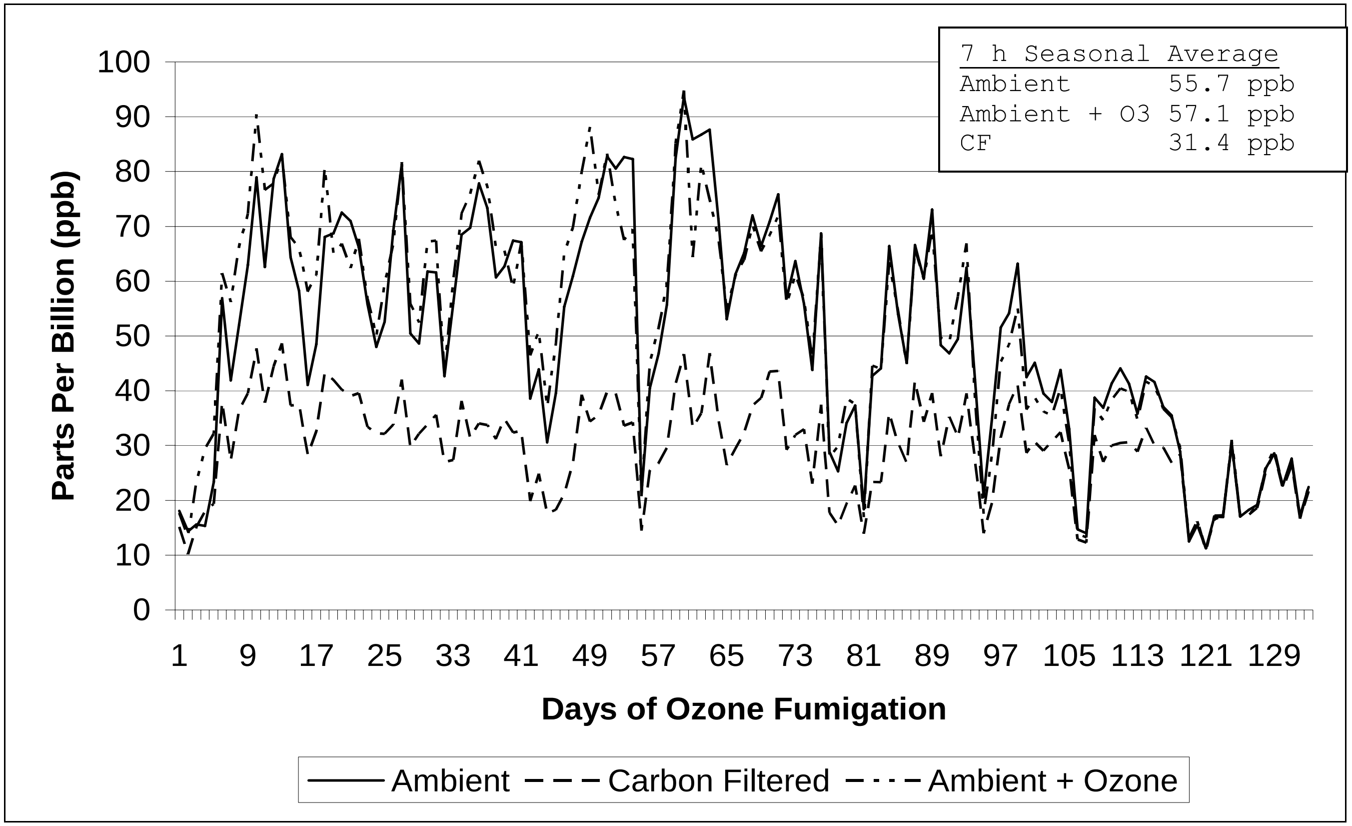

Figure 4.2. Average daily 7 h (0900 - 1600 h EDT) ozone concentration for in-field Open-Top Chambers (OTC) averaged across chamber replications.

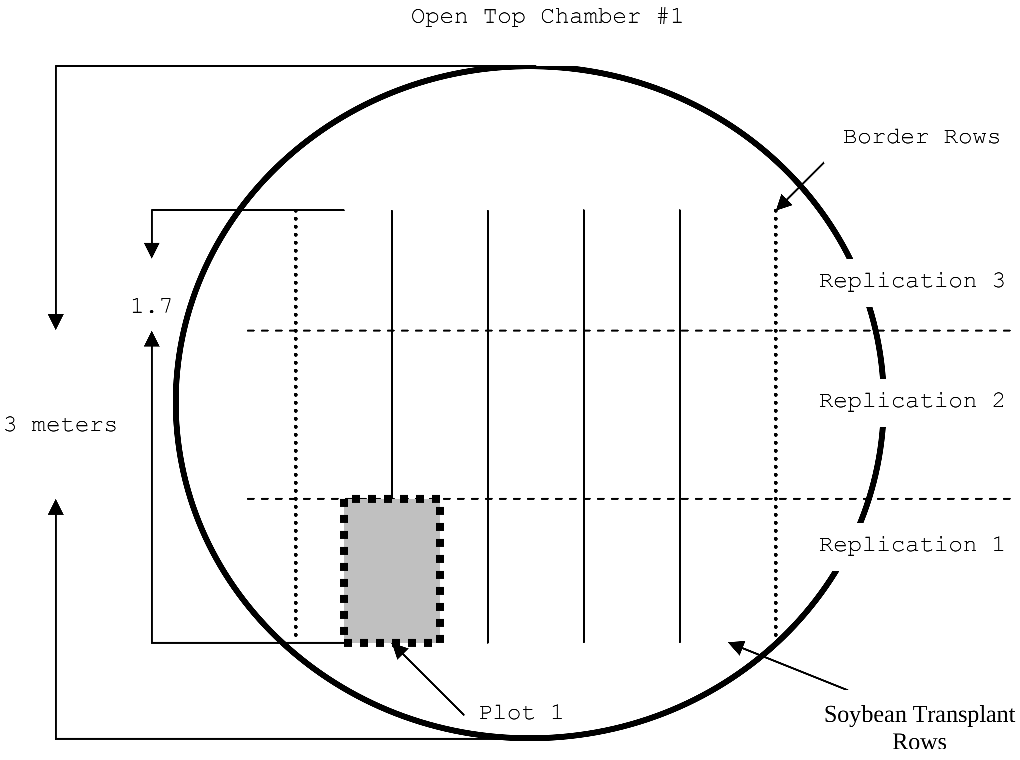

Figure 4.3. View from above an open-top chamber of a soybean plot with transplants arranged in three replications (Plot 1=Ozone Treatment + Replication 1 + Cultivar Bass).

Chapter 5: Dissertation Conclusions

Agronomic research focus has been limited to the amount of isoflavones produced by soybeans and the types that are produced. The primary focus of past and current research has been on isoflavone type and concentration with respect to the comparative response of cultivars to specific environmental stresses. The primary focus of this research was on the potential for the alteration of soybean seed isoflavone concentrations and types, in specific cultivars, to herbicide as well as ozone damage.

The findings of this research have added to the overall body of the research literature by demonstrating that: 1. Lactofen treatments did not show an effect from herbicide induced leaf injury on the isoflavone type and/or concentration in the seed tissue, 2. Cultivar selection is important for the production of high isoflavone soybeans near urban centers where air pollution is of concern. Perhaps the single most important result of this research is the determination that the effects of production and environmental influences on soybean seed isoflavone type and concentration are variable and should be evaluated independently. The dogmatic philosophy that stress will increase isoflavone concentration, and somehow alter the type of detectable isoflavone species must be rethought in light of this research. The findings of this research support the notion that total soybean plant seed isoflavone concentration is the best measure for cultivar selection.

The role of future research may best be focused on the physiological affects of three specific treatment effects. The first broad focused area would be to evaluate various cropping systems, chemical protectants, and air pollutants in combination with temperature and moisture stress. This effort could aid in focusing breeding on cultivars better suited to these extremes. In addition, it would also be of practical benefit to evaluate soybean cultivars from extreme maturity groups such as 0 and 12 to elucidate any potential temporal effects with respect to repair and isoflavone specific enzyme production. The third area of research would focus specifically on the isoflavone production and storage. A more basic approach to soybean isoflavone production needs to be focused on the production and storage enzymology and genetics. A better understanding of the functioning and controls of these systems would could lead to the ability of farmers to select high isoflavone markets.

Appendices

Statistical Analysis

SAS Programming

Chapter 3: SAS Programming for Statistical Analysis of Soybean [***Glycine max*** (L.) Merr] Seed And Leaf Isoflavone Response To Lactofen Applications

Isoflavone Analysis – Lactofen Study

```
=====================================================================
Data HPLC;
options ls=96 ps=33 pageno=1;
title1 "Bill Phillips, II";

%include 'E:\PhD Program\Biometrics\Chapter 3\Isoflavone Analysis Post
Defense\Analysis.sas';
%include 'E:\PhD Program\Biometrics\Chapter 3\Isoflavone Analysis Post
Defense\pdmix800.mac';

Proc Import Out=NewHPLC
                  Replace
                  datafile="E:\PhD Program\Biometrics\Chapter 3\Isoflavone
Analysis Post Defense\NewHPLCData.xls";
                  Quit;

/*==================================================================
Macro cantains the Mixed analysis*/
%Analysis
/*================================================================*/
Proc Print Data=NewHPLC (Obs=26);
Quit;



/* ====================================================================This
is a macro to calculate the consentration of Isoflavones from the area under
the curve.  Due to differences in dilutions between the leaf tissue(20 ml)
and   the seed (10 ml) there are two sets.*/
/*Calculations Area -> mg/L Malonyl use a ratio of mol wt [~malony]*(Malonyl
mol wt/Glucoside mol wt)
==================================================================*/

%MACRO ConsCalc;
Data HPLC;
```

```
Set HPLC;


Data HPLC;
Set HPLC;
      If Daidzin > 1 Then Daidzin=(((3.55E-6*Daidzin)+6.79)/5);
            Else If Daidzin < 1 Then Daidzin=0;

      If Malonyl_Daidzin > 1 Then  Malonyl_Daidzin=((((3.55E-
6*Malonyl_Daidzin)+6.79)*1.20666)/5);
            Else If Malonyl_Daidzin < 1 Then Malonyl_Daidzin=0;

      If Genistin > 1 Then Genistin=(((6.9E-6*Genistin)+3.19)/5);
            Else If Genistin < 1 Then Genistin=0;

      If Malonyl_Genistin > 1 Then Malonyl_Genistin=((((6.9E-
6*Malonyl_Genistin)+3.19)*1.19901)/5);
            Else If Malonyl_Genistin < 1 Then Malonyl_Genistin=0;

      If Glycitin > 1 Then Glycitin=(((3.04E-6*Glycitin)-0.55)/5);
            Else If Glycitin < 1 Then Glycitin=0;

      If Malonyl_Glycitin > 1 Then Malonyl_Glycitin=((((3.04E-
6*Malonyl_Glycitin)-0.55)*1.19276)/5);
            Else If Malonyl_Glycitin < 1 Then Malonyl_Glycitin=0;

      If Genistein > 1 Then Genistein=(((4.78E-6*Genistein)-0.03)/5);
            Else If Genistein < 1 Then Genistein=0;
Run;
*===================================================
Leaf extract was diluted double that of the seed.
====================================================;

Proc Sort Data=HPLC;
      By Sample_Type;
      Quit;


Data NewHPLC;
Set HPLC;
      If Sample_Type=LeafPre  Then Daidzin=(Daidzin/2);
      If Sample_Type=LeafPre  Then Malonyl_Daidzin=(Malonyl_Daidzin/2);
      If Sample_Type=LeafPre  Then Genistin=(Genistin/2);
      If Sample_Type=LeafPre  Then Malonyl_Genistin=(Malonyl_Genistin/2);
      If Sample_Type=LeafPre  Then Glycitin=(Glycitin/2);
      If Sample_Type=LeafPre  Then Malonyl_Glycitin=(Malonyl_Glycitin/2);
      If Sample_Type=LeafPre  Then Genistein=(Genistein/2);
      If Sample_Type=LeafPost Then Daidzin=(Daidzin/2);
      If Sample_Type=LeafPost Then Malonyl_Daidzin=(Malonyl_Daidzin/2);
      If Sample_Type=LeafPost Then Genistin=(Genistin/2);
      If Sample_Type=LeafPost Then Malonyl_Genistin=(Malonyl_Genistin/2);
      If Sample_Type=LeafPost Then Glycitin=(Glycitin/2);
      If Sample_Type=LeafPost Then Malonyl_Glycitin=(Malonyl_Glycitin/2);
      If Sample_Type=LeafPost Then Genistein=(Genistein/2);
```

```
Keep Farm Year Field_Type Block Sample_Type Timing Cultivar Plot
       Daidzin Genistin Glycitin Malonyl_Daidzin Malonyl_Genistin
Malonyl_Glycitin Genistein;


Proc Export data=NewHPLC Replace
   outfile="E:\PhD Program\Biometrics\Chapter 3\Output\NewHPLC.xls";
   Quit;

%MEND ConsCalc;


%MACRO Analysis;
/*
====================================================================
OVERALL ANALYSIS for Main Effects and Interactions
====================================================================
Dependant Variable (mg/Kg) = mgPerKg
---------------------------------------------------------
2 Years = Year
2 Locations = Farm
2 Cropping Systems at each farm (DC and FS)= Field_Type
3 Blocks within each field (12 plots - Each block has
                                          2 treatments and one
control/cultivar) = Block
4 Cultivars (Bass, Corsica, Jack, Williams82) = Cultivar
2 Herbicide Application Timings on Each Cultivar = Timing
2 Samples Harvested (Leaf and Seed) = Sample_Type
7 Isoflavone Types (1-7) = Isoflavone
====================================================================


/*******************************************************************
Daidzin
*******************************************************************/
Proc Sort Data=NewHPLC;
By Sample_Type;
Quit;

Proc Mixed Data=NewHPLC;
By Sample_Type;
Class Year Farm Field_Type Block Cultivar Timing;
Model       Daidzin=Farm
                        Field_Type
                        Field_Type*Farm
                        Cultivar
                        Cultivar*Field_Type
                        Timing
                        Timing*Field_Type
                        Timing*Cultivar
                        Timing*Field_Type*Cultivar
                        / outp=residsD;/*ddfm=kr*/
Random      Year Year*Farm
            Field_Type*Year*Farm
            Block(Year Farm Field_Type)
```

```
            Block*Year*Farm*Cultivar
            Block*Year*Farm*Cultivar*Timing
            Block*Year*Farm*Field_Type*Cultivar*Timing;

/*Repeated Isoflavone / Type=un r rcorr
      Subject=Block*Year*Farm*Field_Type*Cultivar*Timing;*/


lsmeans Field_Type Cultivar Field_Type*Cultivar/ ADJUST=TUKEY pdiff;
ods listing exclude lsmeans;
ods output lsmeans=lsmD;
ods listing exclude diffs;
ods output diffs=diffs;
Quit;
%pdmix800(diffs, lsmD, slice=Field_Type);
%pdmix800(diffs, lsmD, slice=Cultivar);
Quit;

Proc Univariate data=residsD PLOT NORMAL;
      By Sample_Type;
      var resid;
      Histogram/Normal;
      quit;

Proc Export data=residsD Replace
   outfile="E:\PhD Program\Biometrics\Chapter 3\Output\ResidsD.xls";
   Quit;
Proc Export data=lsmD Replace
   outfile="E:\PhD Program\Biometrics\Chapter 3\Output\LSMeansD.xls";
   Quit;
/*+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++*/


/*******************************************************************
MalonylDaidzin
*******************************************************************/

Proc Mixed Data=NewHPLC;
By Sample_Type;
Class Year Farm Field_Type Block Cultivar Timing;
Model       Malonyl_Daidzin=Farm
                        Field_Type
                        Field_Type*Farm
                        Cultivar
                        Cultivar*Field_Type
                        Timing
                        Timing*Field_Type
                        Timing*Cultivar
                        Timing*Field_Type*Cultivar
                        / outp=residsMD;/*ddfm=kr*/
Random      Year Year*Farm
            Field_Type*Year*Farm
            Block(Year Farm Field_Type)
            Block*Year*Farm*Cultivar
            Block*Year*Farm*Cultivar*Timing
```

```
            Block*Year*Farm*Field_Type*Cultivar*Timing;

/*Repeated Isoflavone / Type=un r rcorr
      Subject=Block*Year*Farm*Field_Type*Cultivar*Timing;*/


lsmeans Field_Type Cultivar Field_Type*Cultivar/ ADJUST=TUKEY pdiff;
ods listing exclude lsmeans;
ods output lsmeans=lsmMD;
ods listing exclude diffs;
ods output diffs=diffs;
Quit;
%pdmix800(diffs, lsmMD, slice=Field_Type);
%pdmix800(diffs, lsmMD, slice=Cultivar);
Quit;

Proc Univariate data=residsMD PLOT NORMAL;
      By Sample_Type
      var resid;
      Histogram/Normal;
      quit;

Proc Export data=residsMD Replace
   outfile="E:\PhD Program\Biometrics\Chapter 3\Output\ResidsMD.xls";
   Quit;
Proc Export data=lsmMD Replace
   outfile="E:\PhD Program\Biometrics\Chapter 3\Output\LSMeansMD.xls";
   Quit;
/*+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++*/

/*********************************************************************
Genistin
*********************************************************************/

Proc Mixed Data=NewHPLC;
By Sample_Type;
Class Year Farm Field_Type Block Cultivar Timing;
Model       Genistin=Farm
                        Field_Type
                        Field_Type*Farm
                        Cultivar
                        Cultivar*Field_Type
                        Timing
                        Timing*Field_Type
                        Timing*Cultivar
                        Timing*Field_Type*Cultivar
                        / outp=residsG;/*ddfm=kr*/
Random      Year Year*Farm
            Field_Type*Year*Farm
            Block(Year Farm Field_Type)
            Block*Year*Farm*Cultivar
            Block*Year*Farm*Cultivar*Timing
            Block*Year*Farm*Field_Type*Cultivar*Timing;

/*Repeated Isoflavone / Type=un r rcorr
```

```
      Subject=Block*Year*Farm*Field_Type*Cultivar*Timing;*/


lsmeans Field_Type Cultivar Field_Type*Timing/ ADJUST=TUKEY pdiff;
ods listing exclude lsmeans;
ods output lsmeans=lsmG;
ods listing exclude diffs;
ods output diffs=diffs;
Quit;
%pdmix800(diffs, lsmG, slice=Field_Type);
%pdmix800(diffs, lsmG, slice=Cultivar);
%pdmix800(diffs, lsmG, slice=Timing);
Quit;

Proc Univariate data=residsG PLOT NORMAL;
      By Sample_Type;
      var resid;
      Histogram/Normal;
      quit;

Proc Export data=resids Replace
   outfile="E:\PhD Program\Biometrics\Chapter 3\Output\ResidsG.xls";
   Quit;
Proc Export data=lsmG Replace
   outfile="E:\PhD Program\Biometrics\Chapter 3\Output\LSMeansG.xls";
   Quit;
/*+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++*/

/*******************************************************************
MalonylGenistin
*******************************************************************/

Proc Mixed Data=NewHPLC;
By Sample_Type;
Class Year Farm Field_Type Block Cultivar Timing;
Model       Malonyl_Genistin=Farm
                        Field_Type
                        Field_Type*Farm
                        Cultivar
                        Cultivar*Field_Type
                        Timing
                        Timing*Field_Type
                        Timing*Cultivar
                        Timing*Field_Type*Cultivar
                        / outp=residsMG;/*ddfm=kr*/
Random      Year Year*Farm
            Field_Type*Year*Farm
            Block(Year Farm Field_Type)
            Block*Year*Farm*Cultivar
            Block*Year*Farm*Cultivar*Timing
            Block*Year*Farm*Field_Type*Cultivar*Timing;

/*Repeated Isoflavone / Type=un r rcorr
      Subject=Block*Year*Farm*Field_Type*Cultivar*Timing;*/
```

```
lsmeans Field_Type Cultivar Field_Type*Cultivar Timing / ADJUST=TUKEY pdiff;
ods listing exclude lsmeans;
ods output lsmeans=lsmMG;
ods listing exclude diffs;
ods output diffs=diffs;
Quit;
%pdmix800(diffs, lsmMG, slice=Field_Type);
%pdmix800(diffs, lsmMG, slice=Cultivar);
%pdmix800(diffs, lsmMG, slice=Timing);
Quit;

Proc Univariate data=residsMG PLOT NORMAL;
      By Sample_Type;
      var resid;
      Histogram/Normal;
      quit;

Proc Export data=residsMG Replace
   outfile="E:\PhD Program\Biometrics\Chapter 3\Output\ResidsMG.xls";
   Quit;
Proc Export data=lsmMG Replace
   outfile="E:\PhD Program\Biometrics\Chapter 3\Output\LSMeansMG.xls";
   Quit;

/*++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++*/

/*****************************************************************
Glycitin
*****************************************************************/

Proc Mixed Data=NewHPLC;
By Sample_Type;
Class Year Farm Field_Type Block Cultivar Timing;
Model       Glycitin=Farm
                  Field_Type
                  Field_Type*Farm
                  Cultivar
                  Cultivar*Field_Type
                  Timing
                  Timing*Field_Type
                  Timing*Cultivar
                  Timing*Field_Type*Cultivar
                  / outp=residsGL;/*ddfm=kr*/
Random      Year Year*Farm
            Field_Type*Year*Farm
            Block(Year Farm Field_Type)
            Block*Year*Farm*Cultivar
            Block*Year*Farm*Cultivar*Timing
            Block*Year*Farm*Field_Type*Cultivar*Timing;

/*Repeated Isoflavone / Type=un r rcorr
      Subject=Block*Year*Farm*Field_Type*Cultivar*Timing;*/
```

```
lsmeans Cultivar*Timing / ADJUST=TUKEY pdiff;
ods listing exclude lsmeans;
ods output lsmeans=lsmGL;
ods listing exclude diffs;
ods output diffs=diffs;
Quit;
%pdmix800(diffs, lsmGL, slice=Cultivar);
%pdmix800(diffs, lsmGL, slice=Timing);
Quit;

Proc Univariate data=residsGL PLOT NORMAL;
      By Sample_Type;
      var resid;
      Histogram/Normal;
      quit;

Proc Export data=residsGL Replace
   outfile="E:\PhD Program\Biometrics\Chapter 3\Output\ResidsGL.xls";
   Quit;
Proc Export data=lsmGL Replace
   outfile="E:\PhD Program\Biometrics\Chapter 3\Output\LSMeansGL.xls";
   Quit;

/*+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++*/

/******************************************************************
MalonylGlycitin
******************************************************************/

Proc Mixed Data=NewHPLC;
By Sample_Type;
Class Year Farm Field_Type Block Cultivar Timing;
Model       Malonyl_Glycitin=Farm
                        Field_Type
                        Field_Type*Farm
                        Cultivar
                        Cultivar*Field_Type
                        Timing
                        Timing*Field_Type
                        Timing*Cultivar
                        Timing*Field_Type*Cultivar
                        / outp=residsML;/*ddfm=kr*/
Random      Year Year*Farm
            Field_Type*Year*Farm
            Block(Year Farm Field_Type)
            Block*Year*Farm*Cultivar
            Block*Year*Farm*Cultivar*Timing
            Block*Year*Farm*Field_Type*Cultivar*Timing;

/*Repeated Isoflavone / Type=un r rcorr
      Subject=Block*Year*Farm*Field_Type*Cultivar*Timing;


lsmeans Field_Type Cultivar Field_Type*Cultivar Farm*Field_Type*Block /
ADJUST=TUKEY pdiff;
```

```
ods listing exclude lsmeans;
ods output lsmeans=lsmML;
ods listing exclude diffs;
ods output diffs=diffs;
Quit;
%pdmix800(diffs, lsm, slice=Field_Type);
%pdmix800(diffs, lsm, slice=Cultivar);
%pdmix800(diffs, lsm, slice=Timing);
%pdmix800(diffs, lsm, slice=Sample_Type);
%pdmix800(diffs, lsm, slice=Isoflavone);*/
Quit;

Proc Univariate data=residsML PLOT NORMAL;
      By Sample_Type;
      var resid;
      Histogram/Normal;
      quit;

Proc Export data=resids Replace
   outfile="E:\PhD Program\Biometrics\Chapter 3\Output\ResidsML.xls";
   Quit;
Proc Export data=lsmML Replace
   outfile="E:\PhD Program\Biometrics\Chapter 3\Output\LSMeansML.xls";
   Quit;


/*++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++*/

/*****************************************************************
Genistein
*****************************************************************/

Proc Mixed Data=NewHPLC;
By Sample_Type;
Class Year Farm Field_Type Block Cultivar Timing;
Model       Genistein=Farm
                        Field_Type
                        Field_Type*Farm
                        Cultivar
                        Cultivar*Field_Type
                        Timing
                        Timing*Field_Type
                        Timing*Cultivar
                        Timing*Field_Type*Cultivar
                        / outp=residsGE;/*ddfm=kr*/
Random      Year Year*Farm
            Field_Type*Year*Farm
            Block(Year Farm Field_Type)
            Block*Year*Farm*Cultivar
            Block*Year*Farm*Cultivar*Timing
            Block*Year*Farm*Field_Type*Cultivar*Timing;

/*Repeated Isoflavone / Type=un r rcorr
      Subject=Block*Year*Farm*Field_Type*Cultivar*Timing;*/
```

```
lsmeans Timing Cultivar Field_Type*Cultivar Farm*Field_Type / ADJUST=TUKEY
pdiff;
ods listing exclude lsmeans;
ods output lsmeans=lsmGE;
ods listing exclude diffs;
ods output diffs=diffs;
Quit;
%pdmix800(diffs, lsmGE, slice=Field_Type);
%pdmix800(diffs, lsmGE, slice=Cultivar);
%pdmix800(diffs, lsmGE, slice=Timing);
Quit;

Proc Univariate data=residsGE PLOT NORMAL;
      By Sample_Type;
      var resid;
      Histogram/Normal;
      quit;

Proc Export data=resids Replace
   outfile="E:\PhD Program\Biometrics\Chapter 3\Output\ResidsGE.xls";
   Quit;
Proc Export data=lsmGE Replace
   outfile="E:\PhD Program\Biometrics\Chapter 3\Output\LSMeansGE.xls";
   Quit;

/*++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++*/

/*******************************************************************
Total
*******************************************************************/

Proc Mixed Data=NewHPLC;
By Sample_Type;
Class Year Farm Field_Type Block Cultivar Timing;
Model       Total_Iso=Farm
                        Field_Type
                        Field_Type*Farm
                        Cultivar
                        Cultivar*Field_Type
                        Timing
                        Timing*Field_Type
                        Timing*Cultivar
                        Timing*Field_Type*Cultivar
                        / outp=residsT;/*ddfm=kr*/
Random      Year Year*Farm
            Field_Type*Year*Farm
            Block(Year Farm Field_Type)
            Block*Year*Farm*Cultivar
            Block*Year*Farm*Cultivar*Timing
            Block*Year*Farm*Field_Type*Cultivar*Timing;

/*Repeated Isoflavone / Type=un r rcorr
      Subject=Block*Year*Farm*Field_Type*Cultivar*Timing;*/
```

```
lsmeans Timing Cultivar Field_Type/ ADJUST=TUKEY pdiff;
ods listing exclude lsmeans;
ods output lsmeans=lsmT;
ods listing exclude diffs;
ods output diffs=diffs;
Quit;
%pdmix800(diffs, lsm, slice=Field_Type);
%pdmix800(diffs, lsm, slice=Cultivar);
%pdmix800(diffs, lsm, slice=Timing);
Quit;
/**/
Proc Univariate data=residsT PLOT NORMAL;
      By Sample_Type;
      var resid;
      Histogram/Normal;
      quit;

Proc Export data=residsT Replace
   outfile="E:\PhD Program\Biometrics\Chapter 3\Output\ResidsT.xls";
   Quit;
Proc Export data=lsmT Replace
   outfile="E:\PhD Program\Biometrics\Chapter 3\Output\LSMeansT.xls";
   Quit;

%MEND;
```

Yield, Seed Weight, Protein and Oil Analysis – Lactofen Study

```
Data Seed;
options ls=96 ps=33 pageno=1;
title1 "Bill Phillips, II";

%include 'E:\PhD Program\Biometrics\Chapter 3\SeedTotalWt.sas';
%include 'E:\PhD Program\Biometrics\Chapter 3\SeedHndWt.sas';
%include 'E:\PhD Program\Biometrics\Chapter 3\SeedProNOil.sas';
%include 'E:\PhD Program\Biometrics\Chapter 3\pdmix800.mac';


proc import
     file='E:\PhD Program\Biometrics\Chapter 3\Poplar Hill and Wye Seed Data
28 April 2005.xls'
     out=Seed
     dbms=excel2000
     replace;
sheet=Sheet3;
getnames=yes;
quit;


Proc Print Data=Seed /*(Obs=50)*/;
Quit;


/*==================================================================
This is a macro to */
%SeedTotalWt
/*================================================================*/
%SeedProNOil
/*================================================================*/
%SeedHndWt
/*================================================================*/
;


%MACRO SeedTotalWt;

/*=========================================================*/
Title2'Seed Total Weight';
/*==================================================================
2 Years = Year
2 Locations = Farm
2 Cropping Systems at each farm (DC and FS)= Field_Type
3 Replications
4 Cultivars (Bass, Corsica, Jack, Williams82) = Cultivar
2 Herbicide Application Timings on Each Cultivar = Timing
================================================================*/
Proc Mixed Data=Seed;
Class Year Farm Field_Type Cultivar Timing Rep;
/*TotlWgt HndSedWt Protein Oil;*/
Model        Yield=Farm
                        Field_Type
```

```
                        Field_Type*Farm
                        Cultivar
                        Cultivar*Field_Type
                        Timing
                        Timing*Field_Type
                        Timing*Cultivar
                        Timing*Field_Type*Cultivar
                        / outp=residseed ddfm=sat;
Random      Year Year*Farm
            Field_Type*Year*Farm
            Rep(Year Farm Field_Type)
            Rep*Year*Farm*Cultivar
            Rep*Year*Farm*Cultivar*Timing;

/*Repeated Isoflavone / Type=un r rcorr
      Subject=Rep*Year*Farm*Field_Type*Cultivar*Timing;*/


lsmeans Farm Farm*Field_Type Field_Type / ADJUST=TUKEY pdiff;
ods listing exclude lsmeans;
ods output lsmeans=lsm;
ods listing exclude diffs;
ods output diffs=diffs;
Quit;
%pdmix800(diffs, lsm, slice=Farm);
%pdmix800(diffs, lsm, slice=Field_Type);
Quit;



Proc Univariate data=residseed PLOT NORMAL;
      var resid;
      Histogram/Normal;
      quit;
Proc Export data=residseed Replace
   outfile="E:\PhD Program\Biometrics\Chapter 3\Output\ResidsSeed.xls";
   Quit;
Proc Export data=lsm Replace
   outfile="E:\PhD Program\Biometrics\Chapter 3\Output\LSMeansSeed.xls";
   Quit;

/*+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++*/
%MEND;


%MACRO SeedHndWt;

Title2 'Seed Hundred Weight';
Proc Mixed Data=Seed;
Class Year Farm Field_Type Cultivar Timing  Rep;
/*TotlWgt HndSedWt Protein Oil;*/
Model       HndSedWt=Farm
                        Field_Type
                        Field_Type*Farm
                        Cultivar
```

```
                        Cultivar*Field_Type
                        Timing
                        Timing*Field_Type
                        Timing*Cultivar
                        Timing*Field_Type*Cultivar
                        / outp=residseed2; /*ddfm=kr;*/
Random      Year Year*Farm
            Field_Type*Year*Farm
            Rep(Year Farm Field_Type)
            Rep*Year*Farm*Cultivar
            Rep*Year*Farm*Cultivar*Timing;

/*Repeated Isoflavone / Type=un r rcorr
      Subject=Block*Year*Farm*Field_Type*Cultivar*Timing;*/


lsmeans Field_Type Cultivar Timing Field_Type*Timing Field_Type*Cultivar
Timing*Field_Type*Cultivar
      / ADJUST=TUKEY pdiff;
ods listing exclude lsmeans;
ods output lsmeans=lsm2;
ods listing exclude diffs;
ods output diffs=diffs;
Quit;
%pdmix800(diffs, lsm2, slice=Field_Type);
%pdmix800(diffs, lsm2, slice=Cultivar);
%pdmix800(diffs, lsm2, slice=Timing);
Quit;

Proc Univariate data=residseed2 PLOT NORMAL;
      var resid;
      Histogram/Normal;
      quit;
Proc Export data=residseed2 Replace
   outfile="E:\PhD Program\Biometrics\Chapter 3\Output\ResidsSeed2.xls";
   Quit;
Proc Export data=lsm2 Replace
   outfile="E:\PhD Program\Biometrics\Chapter 3\Output\LSMeansSeed2.xls";
   Quit;

/*+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++*/
%MEND;


%Macro SeedProNOil;

Title2 'Seed Protein';

Proc Mixed Data=Seed;
Class Year Farm Field_Type Cultivar Timing  Rep;
/*TotlWgt HndSedWt Protein Oil;*/
Model        Protein=Farm
                        Field_Type
                        Field_Type*Farm
```

```
                        Cultivar
                        Cultivar*Field_Type
                        Timing
                        Timing*Field_Type
                        Timing*Cultivar
                        Timing*Field_Type*Cultivar
                        / outp=residsP; /*ddfm=kr;*/
Random      Year Year*Farm
            Field_Type*Year*Farm
            Rep(Year Farm Field_Type)
            Rep*Year*Farm*Cultivar
            Rep*Year*Farm*Cultivar*Timing;

/*Repeated Isoflavone / Type=un r rcorr
      Subject=Block*Year*Farm*Field_Type*Cultivar*Timing;*/


lsmeans Field_Type Cultivar Timing Field_Type*Timing / ADJUST=TUKEY pdiff;
ods listing exclude lsmeans;
ods output lsmeans=lsmP;
ods listing exclude diffs;
ods output diffs=diffs;
Quit;
*%pdmix800(diffs, lsmP, slice=Field_Type);
*%pdmix800(diffs, lsmP, slice=Cultivar);
*%pdmix800(diffs, lsmP, slice=Timing);
Quit;

Proc Univariate data=residsP PLOT NORMAL;
      var resid;
      Histogram/Normal;
      quit;
Proc Export data=residsP Replace
   outfile="E:\PhD Program\Biometrics\Chapter 3\Output\ResidsP.xls";
   Quit;
Proc Export data=lsmP Replace
   outfile="E:\PhD Program\Biometrics\Chapter 3\Output\LSMeansP.xls";
   Quit;

/*===================================================================
  ===================================================================*/

Title2 'Seed Oil';

Proc Mixed Data=Seed;
Class Year Farm Field_Type Cultivar Timing  Rep;
/*TotlWgt HndSedWt Protein Oil;*/
Model           Oil=Farm
                        Field_Type
                        Field_Type*Farm
                        Cultivar
                        Cultivar*Field_Type
                        Timing
                        Timing*Field_Type
                        Timing*Cultivar
```

```
                        Timing*Field_Type*Cultivar
                        / outp=residsO; /*ddfm=kr;*/
Random      Year Year*Farm
            Field_Type*Year*Farm
            Rep(Year Farm Field_Type)
            Rep*Year*Farm*Cultivar
            Rep*Year*Farm*Cultivar*Timing;

/*Repeated Isoflavone / Type=un r rcorr
      Subject=Block*Year*Farm*Field_Type*Cultivar*Timing;*/


lsmeans Field_Type Cultivar Timing Field_Type*Timing / ADJUST=TUKEY pdiff;
ods listing exclude lsmeans;
ods output lsmeans=lsmO;
ods listing exclude diffs;
ods output diffs=diffs;
Quit;
*%pdmix800(diffs, lsmO, slice=Field_Type);
*%pdmix800(diffs, lsmO, slice=Cultivar);
*%pdmix800(diffs, lsmO, slice=Timing);
Quit;

Proc Univariate data=residsO PLOT NORMAL;
      var resid;
      Histogram/Normal;
      quit;
Proc Export data=residsO Replace
   outfile="E:\PhD Program\Biometrics\Chapter 3\Output\ResidsO.xls";
   Quit;
Proc Export data=lsmO Replace
   outfile="E:\PhD Program\Biometrics\Chapter 3\Output\LSMeansO.xls";
   Quit;
%MEND;
```

Chapter 4: SAS Programming for Statistical Analysis of Ozone Effects on the Concentration of Seed Isoflavones in Soybean [*Glycine max* (L.) Merr.] Seeds

Isoflavone Analysis – Ozone Study

```
/*==================================================================This is a
macro to calculate the consentration of Isoflavones from the area under the
curve.  Due to differences in dilutions between the leaf tissue(20 ml) and
the seed (10 ml) there are two sets.*/
/*Calculations Area -> mg/L Malonyl use a ratio of mol wt [~malony]*(Malonyl
mol wt/Glucoside mol wt)
==================================================================*/

%MACRO ISOConsCalc;
Data Ozone1;
Set Ozone1;

/*
Data Ozone debug;
Set Ozone1;
      If Daidzin > 1 Then Daidzin=(((3.55E-6*Daidzin)+6.79)/5);
            Else If Daidzin < 1 Then Daidzin=0;

      If M_Daidzin > 1 Then  M_Daidzin=((((3.55E-
6*M_Daidzin)+6.79)*1.20666)/5);
            Else If M_Daidzin < 1 Then M_Daidzin=0;

      If Genistin > 1 Then Genistin=(((6.9E-6*Genistin)+3.19)/5);
            Else If Genistin < 1 Then Genistin=0;

      If M_Genistin > 1 Then M_Genistin=((((6.9E-
6*M_Genistin)+3.19)*1.19901)/5);
            Else If M_Genistin < 1 Then M_Genistin=0;

      If Genistein > 1 Then Genistein=log(((4.78E-6*Genistein)-0.03)/5);
            Else If Genistein < 1 Then Genistein=0;
Run;
Proc Export data=Ozone Replace
   outfile="E:\PhD Program\Biometrics\Ozone\Ozone.xls";
   Quit;

/*++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
  ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++*/
Data OzoneISO1;
Set OzoneISO1;


Data OzoneISO;
Set OzoneISO1;
      If Daidzin > 1 Then Daidzin=(((3.55E-6*Daidzin)+6.79)/5);
            Else If Daidzin < 1 Then Daidzin=0;
```

```
      If M_Daidzin > 1 Then  M_Daidzin=((((3.55E-
6*M_Daidzin)+6.79)*1.20666)/5);
            Else If M_Daidzin < 1 Then M_Daidzin=0;

      If Genistin > 1 Then Genistin=(((6.9E-6*Genistin)+3.19)/5);
            Else If Genistin < 1 Then Genistin=0;

      If M_Genistin > 1 Then M_Genistin=((((6.9E-
6*M_Genistin)+3.19)*1.19901)/5);
            Else If M_Genistin < 1 Then M_Genistin=0;

      If Genistein > 1 Then Genistein=((((4.78E-6*Genistein)-
0.03)/5)*(((4.78E-6*Genistein)-0.03)/5));
            Else If Genistein < 1 Then Genistein=0;
Run;
Proc Export data=OzoneISO Replace
   outfile="E:\PhD Program\Biometrics\Ozone\OzoneISO.xls";
   Quit;

%MEND ISOConsCalc;




%MACRO OzoneAnalysis;

*=====================================================================
*=====================================================================
*====================================================================;
***********Note Chamber=Replication*************;
Title1 "Genistin";
Proc Mixed Data=OzoneISO;
Class Chamber Cultivar Treatmnt;
Model Genistin=Cultivar Treatmnt Cultivar*Treatmnt/ ddfm=kr outp=Ginresids;
Random Chamber;
lsmeans Treatmnt Cultivar Cultivar*Treatmnt / ADJUST=TUKEY pdiff;
ods listing exclude lsmeans;
ods output lsmeans=lsm;
ods listing exclude diffs;
ods output diffs=diffs;
Quit;
%pdmix800(diffs, lsm, slice=Treatmnt);
%pdmix800(diffs, lsm, slice=Cultivar);
Quit;
Proc Univariate data=Ginresids PLOT NORMAL;
      var resid;
      Histogram/Normal;
      quit;

Title1 "MalGenistin";
Proc Mixed Data=OzoneISO;
Class Chamber Cultivar Treatmnt;
Model M_Genistin=Cultivar Treatmnt Cultivar*Treatmnt/ ddfm=kr
outp=MGinresids;
Random Chamber;
```

```
lsmeans Treatmnt Cultivar Cultivar*Treatmnt / ADJUST=TUKEY pdiff;
ods listing exclude lsmeans;
ods output lsmeans=lsm;
ods listing exclude diffs;
ods output diffs=diffs;
Quit;
%pdmix800(diffs, lsm, slice=Treatmnt);
%pdmix800(diffs, lsm, slice=Cultivar);
Quit;
Proc Univariate data=MGinresids PLOT NORMAL;
      var resid;
      Histogram/Normal;
      quit;
*==================================================================;
*==================================================================;
*==================================================================;
*==================================================================;
***********Note Chamber=Replication*************;
Title1 "Daidzin";
Proc Mixed Data=OzoneISO;
Class Chamber Cultivar Treatmnt;
Model Daidzin=Cultivar Treatmnt Cultivar*Treatmnt/ ddfm=kr outp=Dinresids;
Random Chamber;
lsmeans Treatmnt Cultivar Cultivar*Treatmnt / ADJUST=TUKEY pdiff;
ods listing exclude lsmeans;
ods output lsmeans=lsm;
ods listing exclude diffs;
ods output diffs=diffs;
Quit;
%pdmix800(diffs, lsm, slice=Treatmnt);
%pdmix800(diffs, lsm, slice=Cultivar);
Quit;
Proc Univariate data=Dinresids PLOT NORMAL;
      var resid;
      Histogram/Normal;
      quit;

Title1 "MalDaidzin";
Proc Mixed Data=OzoneISO;
Class Chamber Cultivar Treatmnt;
Model M_Daidzin=Cultivar Treatmnt Cultivar*Treatmnt/ ddfm=kr outp=MDinresids;
Random Chamber;
lsmeans Treatmnt Cultivar Cultivar*Treatmnt / ADJUST=TUKEY pdiff;
ods listing exclude lsmeans;
ods output lsmeans=lsm;
ods listing exclude diffs;
ods output diffs=diffs;
Quit;
%pdmix800(diffs, lsm, slice=Treatmnt);
%pdmix800(diffs, lsm, slice=Cultivar);
Quit;
Proc Univariate data=MDinresids PLOT NORMAL;
      var resid;
      Histogram/Normal;
      quit;
```

```
*==================================================================;
*==================================================================;
*==================================================================;
***********Note Chamber=Replication**************;
Title1 "Genistein";
Proc Mixed Data=OzoneISO;
Class Chamber Cultivar Treatmnt;
Model Genistein=Cultivar Treatmnt Cultivar*Treatmnt/ ddfm=kr
outp=Geneinresids;
Random Chamber;
lsmeans Treatmnt Cultivar Cultivar*Treatmnt / ADJUST=TUKEY pdiff;
ods listing exclude lsmeans;
ods output lsmeans=lsm;
ods listing exclude diffs;
ods output diffs=diffs;
Quit;
%pdmix800(diffs, lsm, slice=Treatmnt);
%pdmix800(diffs, lsm, slice=Cultivar);
Quit;
Proc Univariate data=Geneinresids PLOT NORMAL;
      var resid;
      Histogram/Normal;
      quit;


*/*================================================================;
*==================================================================;

%MEND OzoneAnalysis;
```

Yield, Seed Weight, Protein and Oil Analysis - Ozone Study

```
*=====================================================================;
Title1 "Weight/Hundrd/Seed";
Proc Mixed Data=Ozone1;
Class Chamber Cultivar Treatmnt;
Model WtHundrd=Cultivar Treatmnt Cultivar*Treatmnt/ ddfm=kr outp=WtHunresids;
Random Chamber;
lsmeans Treatmnt Cultivar Cultivar*Treatmnt/ ADJUST=TUKEY pdiff;
ods listing exclude lsmeans;
ods output lsmeans=lsm;
ods listing exclude diffs;
ods output diffs=diffs;
Quit;
%pdmix800(diffs, lsm, slice=Treatmnt);
%pdmix800(diffs, lsm, slice=Cultivar);
Quit;

Proc Univariate data=WtHunresids PLOT NORMAL;
      var resid;
      Histogram/Normal;
      quit;


Title1 "Yield";
Proc Mixed Data=Ozone1;
Class Chamber Cultivar Treatmnt;
Model Wtg=Cultivar Treatmnt Cultivar*Treatmnt/ ddfm=kr outp=Yldresids;
Random Chamber;
lsmeans Treatmnt Cultivar  Cultivar*Treatmnt/ ADJUST=TUKEY pdiff;
ods listing exclude lsmeans;
ods output lsmeans=lsm;
ods listing exclude diffs;
ods output diffs=diffs;
Quit;
%pdmix800(diffs, lsm, slice=Treatmnt);
%pdmix800(diffs, lsm, slice=Cultivar);
Quit;

Proc Univariate data=Yldresids PLOT NORMAL;
      var resid;
      Histogram/Normal;
      quit;


Title1 "Oil";
Proc Mixed Data=Ozone1;
Class Chamber Cultivar Treatmnt;
Model Oil=Cultivar Treatmnt Cultivar*Treatmnt/ ddfm=kr outp=Oilresids;
Random Chamber;
lsmeans Treatmnt Cultivar Cultivar*Treatmnt/ ADJUST=TUKEY pdiff;
ods listing exclude lsmeans;
ods output lsmeans=lsm;
ods listing exclude diffs;
ods output diffs=diffs;
```

```
Quit;
%pdmix800(diffs, lsm, slice=Treatmnt);
%pdmix800(diffs, lsm, slice=Cultivar*Treatmnt);
Quit;
Proc Univariate data=Oilresids PLOT NORMAL;
      var resid;
      Histogram/Normal;
      quit;
***********Note Chamber=Replication*************;


Title1 "Protein";
Proc Mixed Data=Ozone1;
Class Chamber Cultivar Treatmnt;
Model Protein=Cultivar Treatmnt Cultivar*Treatmnt/ ddfm=kr outp=Proresids;
Random Chamber;
lsmeans Treatmnt Cultivar Cultivar*Treatmnt/ ADJUST=TUKEY pdiff;
ods listing exclude lsmeans;
ods output lsmeans=lsm;
ods listing exclude diffs;
ods output diffs=diffs;
Quit;
%pdmix800(diffs, lsm, slice=Treatmnt);
%pdmix800(diffs, lsm, slice=Cultivar*Treatmnt);
Quit;
Proc Univariate data=Proresids PLOT NORMAL;
      var resid;
      Histogram/Normal;
      quit;
***********Note Chamber=Replication*************;
```

SAS Results

Chapter 3: SAS Output for Statistical Analysis of Soybean [*Glycine max* (L.) Merr] Seed And Leaf Isoflavone Response To Lactofen Applications

Seed and Leaf Isoflavone Analysis – Lactofen Study

Daidzin Analysis

```
------------------------------------ Sample_Type=LeafPost ------------------------------------

                                      The Mixed Procedure

                                       Model Information

                     Data Set                     WORK.NEWHPLC
                     Dependent Variable           Daidzin
                     Covariance Structure         Variance Components
                     Estimation Method            REML
                     Residual Variance Method     Profile
                     Fixed Effects SE Method      Model-Based
                     Degrees of Freedom Method    Containment


                                    Class Level Information

                     Class         Levels    Values

                     Year               2    2002 2003
                     Farm               2    PHill Wye
                     Field_Type         2    DC FS
                     Block              3    1 2 3
                     Cultivar           4    Bass Corsica Jack Williams82
                     Timing             2    Early Late


                                          Dimensions

                              Covariance Parameters            8
                              Columns in X                    51
                              Columns in Z                   298
                              Subjects                         1
                              Max Obs Per Subject            158
                              Observations Used              158
                              Observations Not Used            0
                              Total Observations             158


                                       Iteration History

                  Iteration    Evaluations    -2 Res Log Like       Criterion

                          0              1       184.16631177
                          1              2       153.55454458     18.33844279
                          2              1       139.04376030      0.14050833
```

```
                 3             3       125.60418772       .
                 4             3       121.00633877      0.00536667
                 5             3       120.94172349      0.00370710
                 6             2       120.55138043      0.01067350
                 7             5       120.53362403       .
                 8             1       120.50890025      0.00000892
                 9             1       120.50827420      0.00000002


------------------------------------ Sample_Type=LeafPost ------------------------------------

                              The Mixed Procedure

                               Iteration History

          Iteration    Evaluations    -2 Res Log Like       Criterion

                 10             1       120.50827284      0.00000000


                           Convergence criteria met.


                        Covariance Parameter Estimates

                         Cov Parm                 Estimate

                         Year                     0.000488
                         Year*Farm                       0
                         Year*Farm*Field_Type            0
                         Bloc(Year*Farm*Fiel)            0
                         Year*Farm*Bloc*Culti     1.86E-20
                         Yea*Far*Blo*Cul*Timi      0.03874
                         Ye*Fa*Fi*Blo*Cul*Tim      0.09057
                         Residual                  0.01827


                                Fit Statistics

                       -2 Res Log Likelihood           120.5
                       AIC (smaller is better)         128.5
                       AICC (smaller is better)        128.8
                       BIC (smaller is better)         123.3


                         Type 3 Tests of Fixed Effects

                                Num     Den
           Effect                 DF      DF    F Value    Pr > F

           Farm                    1       1       1.30    0.4578
           Field_Type              1       2       0.94    0.4347
           Farm*Field_Type         1       2       1.20    0.3884
           Cultivar                3      26       1.29    0.2979
           Field_Type*Cultivar     3      26       0.66    0.5858
           Timing                  1      26       0.70    0.4119
           Field_Type*Timing       1      26       0.13    0.7215
           Cultivar*Timing         3      26       2.01    0.1379
           Field_*Cultiv*Timing    3      26       1.26    0.3081


------------------------------------ Sample_Type=LeafPre ------------------------------------

                              The Mixed Procedure
```

```
                   Model Information

 Data Set                    WORK.NEWHPLC
 Dependent Variable          Daidzin
 Covariance Structure        Variance Components
 Estimation Method           REML
 Residual Variance Method    Profile
 Fixed Effects SE Method     Model-Based
 Degrees of Freedom Method   Containment


                Class Level Information

 Class         Levels    Values

 Year               2    2002 2003
 Farm               2    PHill Wye
 Field_Type         2    DC FS
 Block              3    1 2 3
 Cultivar           4    Bass Corsica Jack Williams82
 Timing             2    Early Late


                      Dimensions

          Covariance Parameters            8
          Columns in X                    51
          Columns in Z                   329
          Subjects                         1
          Max Obs Per Subject            250
          Observations Used              250
          Observations Not Used            0
          Total Observations             250


                   Iteration History

Iteration    Evaluations    -2 Res Log Like       Criterion

        0              0    1.797693135E308


      WARNING: Stopped because of infinite likelihood.



------------------------------------ Sample_Type=LeafPre ------------------------------------

                  The Mixed Procedure

               Covariance Parameter Values
                    At Last Iteration

           Cov Parm                 Estimate

           Year                            0
           Year*Farm                       0
           Year*Farm*Field_Type            0
           Bloc(Year*Farm*Fiel)            0
           Year*Farm*Bloc*Culti            0
           Yea*Far*Blo*Cul*Timi            0
           Ye*Fa*Fi*Blo*Cul*Tim            0
```

```
                   Residual                        0


------------------------------------- Sample_Type=Seed -------------------------------------

                                 The Mixed Procedure

                                  Model Information

                    Data Set                    WORK.NEWHPLC
                    Dependent Variable          Daidzin
                    Covariance Structure        Variance Components
                    Estimation Method           REML
                    Residual Variance Method    Profile
                    Fixed Effects SE Method     Model-Based
                    Degrees of Freedom Method   Containment


                               Class Level Information

                    Class         Levels    Values

                    Year               2    2002 2003
                    Farm               2    PHill Wye
                    Field_Type         2    DC FS
                    Block              3    1 2 3
                    Cultivar           4    Bass Corsica Jack Williams82
                    Timing             3    Control Early Late


                                     Dimensions

                             Covariance Parameters            8
                             Columns in X                    66
                             Columns in Z                   514
                             Subjects                         1
                             Max Obs Per Subject            288
                             Observations Used              288
                             Observations Not Used            0
                             Total Observations             288


                                  Iteration History

                 Iteration    Evaluations    -2 Res Log Like       Criterion

                         0              1      1002.19658576
                         1              2       891.37705683      0.01388133
                         2              1       887.87553204      0.00332836
                         3              1       887.08723434      0.00038001
                         4              1       887.00086665      0.00002914
                         5              1       886.99434552      0.00000099
                         6              1       886.99413956      0.00000000

------------------------------------- Sample_Type=Seed -------------------------------------

                                 The Mixed Procedure

                              Convergence criteria met.


                            Covariance Parameter Estimates
```

```
                         Cov Parm                Estimate

                         Year                      0.8254
                         Year*Farm                      0
                         Year*Farm*Field_Type           0
                         Bloc(Year*Farm*Fiel)     0.06018
                         Year*Farm*Bloc*Culti      0.6042
                         Yea*Far*Blo*Cul*Timi           0
                         Ye*Fa*Fi*Blo*Cul*Tim           0
                         Residual                  1.0045


                                  Fit Statistics

                       -2 Res Log Likelihood           887.0
                       AIC (smaller is better)         895.0
                       AICC (smaller is better)        895.1
                       BIC (smaller is better)         889.8


                           Type 3 Tests of Fixed Effects

                                      Num     Den
                 Effect                DF      DF    F Value    Pr > F

                 Farm                   1       1       0.02    0.9070
                 Field_Type             1       2     189.91    0.0052
                 Farm*Field_Type        1       2       9.05    0.0950
                 Cultivar               3      33      14.70    <.0001
                 Field_Type*Cultivar    3     117       6.46    0.0004
                 Timing                 2      88       0.82    0.4419
                 Field_Type*Timing      2     117       0.02    0.9765
                 Cultivar*Timing        6      88       0.62    0.7100
                 Field_*Cultiv*Timing   6     117       0.16    0.9874

-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=0.30055 maxSD=0.30055 ---------------


Obs Sample_Type

  1 LeafPost
  2 LeafPost

    Field_                                     Standard                         Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  1   DC                             0.08929     0.05215       2       1.71    0.2290     A
  2   FS                             0.02158     0.05961       2       0.36    0.7520     A


---------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.3069 maxSD=0.31352 ----------------


Obs Sample_Type

  3 LeafPost
  4 LeafPost
  5 LeafPost
  6 LeafPost

    Field_                                   Standard                        Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp
```

```
  3         Bass                 -0.00841    0.08013     26     -0.10   0.9172    A
  4         Corsica              -0.00783    0.08139     26     -0.10   0.9241    A
  5         Jack                   0.1785    0.07912     26      2.26   0.0327    A
  6         Williams82            0.05948    0.08450     26      0.70   0.4877    A


--------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.16556 maxSD=0.16556 ----------------


Obs Sample_Type

  7 LeafPost
  8 LeafPost

    Field_                                     Standard                       Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  7                       Early      0.08902     0.06608      26       1.35    0.1896     A
  8                       Late       0.02185     0.05207      26       0.42    0.6782     A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=0.42769 maxSD=0.48026 ----------


Obs Sample_Type

  9 LeafPost
 10 LeafPost
 11 LeafPost
 12 LeafPost
 13 LeafPost
 14 LeafPost
 15 LeafPost
 16 LeafPost

    Field_                                   Standard                      Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

  9   DC     Bass                  -0.01879    0.09698     26     -0.19   0.8479    A
 10   DC     Corsica               -0.01732     0.1014     26     -0.17   0.8657    A
 11   DC     Jack                    0.2761    0.09272     26      2.98   0.0062    A
 12   DC     Williams82              0.1172    0.09586     26      1.22   0.2326    A
 13   FS     Bass                  0.001959     0.1111     26      0.02   0.9861    A
 14   FS     Corsica               0.001661     0.1120     26      0.01   0.9883    A
 15   FS     Jack                   0.08088     0.1104     26      0.73   0.4702    A
 16   FS     Williams82            0.001812     0.1228     26      0.01   0.9883    A


-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=0.6676 maxSD=0.6676 ----------------


Obs Sample_Type

 17 Seed
 18 Seed

    Field_                                     Standard                       Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 17   DC                              5.3978      0.6613       2       8.16    0.0147     A
 18   FS                              3.2596      0.6613       2       4.93    0.0388     B


-------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.97084 maxSD=0.97233 ---------------
```

```
Obs Sample_Type

 19 Seed

    Field_                                     Standard                         Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 19             Bass                  4.0999      0.6923      33       5.92    <.0001     B


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.97084 maxSD=0.97233 ----------------
                                          (continued)


Obs Sample_Type

 20 Seed
 21 Seed
 22 Seed

    Field_                                   Standard                      Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 20          Corsica                 4.7126     0.6925     33      6.81   <.0001   AB
 21          Jack                    3.1035     0.6925     33      4.48   <.0001   C
 22          Williams82              5.3989     0.6929     33      7.79   <.0001   A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.34573 maxSD=0.34654 -----------------


Obs Sample_Type

 23 Seed
 24 Seed
 25 Seed

    Field_                                      Standard                         Pr >    Let
Obs  Type     Cultivar    Timing     Estimate     Error        DF    t Value       |t|    Grp

 23                       Control      4.3855      0.6620      88       6.62    <.0001     A
 24                       Early        4.3797      0.6620      88       6.62    <.0001     A
 25                       Late         4.2210      0.6621      88       6.37    <.0001     A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=1.09763 maxSD=1.10463 ----------


Obs Sample_Type

 26 Seed
 27 Seed
 28 Seed
 29 Seed
 30 Seed

    Field_                                   Standard                      Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 26   DC     Bass                    5.5373     0.7035    117      7.87   <.0001   A
 27   DC     Corsica                 5.7236     0.7042    117      8.13   <.0001   A
 28   DC     Jack                    3.8156     0.7042    117      5.42   <.0001   B
```

```
 29   DC     Williams82             6.5148     0.7060    117      9.23   <.0001   A
 30   FS     Bass                   2.6624     0.7044    117      3.78   0.0002   BC


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=1.09763 maxSD=1.10463 ----------
                                          (continued)


Obs Sample_Type

 31 Seed
 32 Seed
 33 Seed

    Field_                                   Standard                      Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 31   FS     Corsica                3.7016     0.7042    117      5.26   <.0001   AB
 32   FS     Jack                   2.3913     0.7042    117      3.40   0.0009   C
 33   FS     Williams82             4.2830     0.7042    117      6.08   <.0001   A


-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=0.30055 maxSD=0.30055 ---------------


Obs Sample_Type

  1 LeafPost
  2 LeafPost

    Field_                                     Standard                        Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error       DF    t Value       |t|    Grp

  1   DC                             0.08929     0.05215       2       1.71    0.2290     A
  2   FS                             0.02158     0.05961       2       0.36    0.7520     A


---------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.3069 maxSD=0.31352 ----------------


Obs Sample_Type

  3 LeafPost
  4 LeafPost
  5 LeafPost
  6 LeafPost

    Field_                                   Standard                      Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

  3          Bass                 -0.00841    0.08013     26     -0.10   0.9172    A
  4          Corsica              -0.00783    0.08139     26     -0.10   0.9241    A
  5          Jack                   0.1785    0.07912     26      2.26   0.0327    A
  6          Williams82            0.05948    0.08450     26      0.70   0.4877    A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.16556 maxSD=0.16556 -----------------


Obs Sample_Type

  7 LeafPost
  8 LeafPost
```

```
    Field_                                      Standard                          Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  7                       Early      0.08902     0.06608      26       1.35    0.1896     A
  8                       Late       0.02185     0.05207      26       0.42    0.6782     A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=0.33656 maxSD=0.35139 ----------


Obs Sample_Type

  9 LeafPost
 10 LeafPost
 11 LeafPost
 12 LeafPost
 13 LeafPost
 14 LeafPost
 15 LeafPost
 16 LeafPost

    Field_                                    Standard                       Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

  9   DC     Bass                  -0.01879    0.09698     26     -0.19   0.8479    A
 10   FS     Bass                  0.001959     0.1111     26      0.02   0.9861    A
 11   DC     Corsica               -0.01732     0.1014     26     -0.17   0.8657    A
 12   FS     Corsica               0.001661     0.1120     26      0.01   0.9883    A
 13   DC     Jack                    0.2761    0.09272     26      2.98   0.0062    A
 14   FS     Jack                   0.08088     0.1104     26      0.73   0.4702    A
 15   DC     Williams82              0.1172    0.09586     26      1.22   0.2326    A
 16   FS     Williams82            0.001812     0.1228     26      0.01   0.9883    A


--------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=0.6676 maxSD=0.6676 ----------------


Obs Sample_Type

 17 Seed
 18 Seed

    Field_                                      Standard                          Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 17   DC                              5.3978      0.6613       2       8.16    0.0147     A
 18   FS                              3.2596      0.6613       2       4.93    0.0388     B


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.97084 maxSD=0.97233 ----------------


Obs Sample_Type

 19 Seed

    Field_                                      Standard                          Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 19             Bass                  4.0999      0.6923      33       5.92    <.0001     B


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.97084 maxSD=0.97233 ----------------
                                          (continued)
```

```
Obs Sample_Type

 20 Seed
 21 Seed
 22 Seed

    Field_                                   Standard                      Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 20          Corsica                 4.7126     0.6925     33      6.81   <.0001   AB
 21          Jack                    3.1035     0.6925     33      4.48   <.0001   C
 22          Williams82              5.3989     0.6929     33      7.79   <.0001   A

---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.34573 maxSD=0.34654 -----------------


Obs Sample_Type

 23 Seed
 24 Seed
 25 Seed

    Field_                                      Standard                         Pr >    Let
Obs  Type     Cultivar    Timing     Estimate     Error        DF    t Value       |t|    Grp

 23                       Control      4.3855      0.6620      88       6.62    <.0001     A
 24                       Early        4.3797      0.6620      88       6.62    <.0001     A
 25                       Late         4.2210      0.6621      88       6.37    <.0001     A

---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=0.61099 maxSD=0.62025 ----------


Obs Sample_Type

 26 Seed
 27 Seed
 28 Seed
 29 Seed
 30 Seed

    Field_                                     Standard                         Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 26   DC      Bass                    5.5373      0.7035     117       7.87    <.0001     A
 27   FS      Bass                    2.6624      0.7044     117       3.78    0.0002     B
 28   DC      Corsica                 5.7236      0.7042     117       8.13    <.0001     A
 29   FS      Corsica                 3.7016      0.7042     117       5.26    <.0001     B
 30   DC      Jack                    3.8156      0.7042     117       5.42    <.0001     A

---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=0.61099 maxSD=0.62025 ----------
                                          (continued)


Obs Sample_Type

 31 Seed
 32 Seed
 33 Seed
```

```
       Field_                                     Standard                           Pr >     Let
Obs    Type     Cultivar      Timing   Estimate     Error       DF    t Value        |t|     Grp

 31     FS      Jack                     2.3913    0.7042      117       3.40     0.0009      B
 32     DC      Williams82               6.5148    0.7060      117       9.23     <.0001      A
 33     FS      Williams82               4.2830    0.7042      117       6.08     <.0001      B
```

Genistin Analysis

```
------------------------------------ Sample_Type=LeafPost ------------------------------------

                                     The Mixed Procedure

                                      Model Information

                    Data Set                     WORK.NEWHPLC
                    Dependent Variable           Genistin
                    Covariance Structure         Variance Components
                    Estimation Method            REML
                    Residual Variance Method     Profile
                    Fixed Effects SE Method      Model-Based
                    Degrees of Freedom Method    Containment


                                  Class Level Information

                    Class         Levels    Values

                    Year               2    2002 2003
                    Farm               2    PHill Wye
                    Field_Type         2    DC FS
                    Block              3    1 2 3
                    Cultivar           4    Bass Corsica Jack Williams82
                    Timing             2    Early Late


                                        Dimensions

                             Covariance Parameters             8
                             Columns in X                     51
                             Columns in Z                    298
                             Subjects                          1
                             Max Obs Per Subject             158
                             Observations Used               158
                             Observations Not Used             0
                             Total Observations              158


                                      Iteration History

                 Iteration    Evaluations    -2 Res Log Like       Criterion

                         0              1       438.05513306
                         1              4       407.67612777      0.11383027
                         2              2       406.55449341       .
                         3              3       405.54607559      0.00010354
                         4              1       405.53790031      0.00000289
                         5              1       405.53768090      0.00000000


                                  Convergence criteria met.

------------------------------------ Sample_Type=LeafPost ------------------------------------

                                     The Mixed Procedure

                               Covariance Parameter Estimates
```

```
                 Cov Parm                Estimate

                 Year                     0.02639
                 Year*Farm                      0
                 Year*Farm*Field_Type      0.4930
                 Bloc(Year*Farm*Fiel)           0
                 Year*Farm*Bloc*Culti           0
                 Yea*Far*Blo*Cul*Timi     1.3E-18
                 Ye*Fa*Fi*Blo*Cul*Tim           0
                 Residual                  0.7446


                          Fit Statistics

               -2 Res Log Likelihood           405.5
               AIC (smaller is better)         411.5
               AICC (smaller is better)        411.7
               BIC (smaller is better)         407.6


                     Type 3 Tests of Fixed Effects

                             Num     Den
     Effect                   DF      DF    F Value    Pr > F

     Farm                      1       1       1.44    0.4425
     Field_Type                1       2       1.58    0.3352
     Farm*Field_Type           1       2       0.64    0.5070
     Cultivar                  3      26       2.00    0.1389
     Field_Type*Cultivar       3      26       0.96    0.4260
     Timing                    1      26       9.14    0.0056
     Field_Type*Timing         1      26      39.03    <.0001
     Cultivar*Timing           3      26       0.16    0.9245
     Field_*Cultiv*Timing      3      26       0.21    0.8876


------------------------------------ Sample_Type=LeafPre ------------------------------------

                          The Mixed Procedure

                           Model Information

      Data Set                     WORK.NEWHPLC
      Dependent Variable           Genistin
      Covariance Structure         Variance Components
      Estimation Method            REML
      Residual Variance Method     Profile
      Fixed Effects SE Method      Model-Based
      Degrees of Freedom Method    Containment


                        Class Level Information

      Class         Levels    Values

      Year               2    2002 2003
      Farm               2    PHill Wye
      Field_Type         2    DC FS
      Block              3    1 2 3
      Cultivar           4    Bass Corsica Jack Williams82
      Timing             2    Early Late


                              Dimensions
```

```
                 Covariance Parameters            8
                 Columns in X                    51
                 Columns in Z                   329
                 Subjects                         1
                 Max Obs Per Subject            250
                 Observations Used              250
                 Observations Not Used            0
                 Total Observations             250


                          Iteration History

      Iteration    Evaluations    -2 Res Log Like       Criterion

              0              1       558.66072540
              1              3       505.32066316      0.03250902
              2              3       502.12251581       .
              3              2       502.04965139      0.00018033
              4              1       502.04224255      0.00000398
              5              1       502.04208961      0.00000000


                      Convergence criteria met.


------------------------------------ Sample_Type=LeafPre -------------------------------------

                         The Mixed Procedure

                   Covariance Parameter Estimates

                  Cov Parm                Estimate

                  Year                      0.2102
                  Year*Farm               0.008384
                  Year*Farm*Field_Type     0.09030
                  Bloc(Year*Farm*Fiel)    0.009615
                  Year*Farm*Bloc*Culti           0
                  Yea*Far*Blo*Cul*Timi     0.05253
                  Ye*Fa*Fi*Blo*Cul*Tim     0.03043
                  Residual                  0.3233


                           Fit Statistics

                -2 Res Log Likelihood          502.0
                AIC (smaller is better)        516.0
                AICC (smaller is better)       516.5
                BIC (smaller is better)        506.9


                    Type 3 Tests of Fixed Effects

                            Num     Den
       Effect                DF      DF    F Value    Pr > F

       Farm                   1       1       0.23    0.7154
       Field_Type             1       2       7.93    0.1064
       Farm*Field_Type        1       2       0.01    0.9192
       Cultivar               3      33       3.95    0.0164
       Field_Type*Cultivar    3      36       0.73    0.5429
       Timing                 1      36       0.48    0.4917
       Field_Type*Timing      1      36       3.90    0.0559
```

```
                  Cultivar*Timing           3      36       2.60    0.0669
                  Field_*Cultiv*Timing      3      36       1.65    0.1953


---------------------------------------- Sample_Type=Seed ---------------------------------------

                                   The Mixed Procedure

                                    Model Information

                    Data Set                    WORK.NEWHPLC
                    Dependent Variable          Genistin
                    Covariance Structure        Variance Components
                    Estimation Method           REML
                    Residual Variance Method    Profile
                    Fixed Effects SE Method     Model-Based
                    Degrees of Freedom Method   Containment


                                 Class Level Information

                    Class         Levels    Values

                    Year               2    2002 2003
                    Farm               2    PHill Wye
                    Field_Type         2    DC FS
                    Block              3    1 2 3
                    Cultivar           4    Bass Corsica Jack Williams82
                    Timing             3    Control Early Late


                                        Dimensions

                             Covariance Parameters            8
                             Columns in X                    66
                             Columns in Z                   514
                             Subjects                         1
                             Max Obs Per Subject            288
                             Observations Used              288
                             Observations Not Used            0
                             Total Observations             288


                                    Iteration History

                 Iteration    Evaluations    -2 Res Log Like       Criterion

                         0              1      1553.48688370
                         1              2      1404.07347642      0.00337155
                         2              1      1402.19450685      0.00063956
                         3              1      1401.85710114      0.00005110
                         4              1      1401.83204816      0.00000060
                         5              1      1401.83177080      0.00000000


                               Convergence criteria met.


---------------------------------------- Sample_Type=Seed ---------------------------------------

                                   The Mixed Procedure

                              Covariance Parameter Estimates
```

```
                           Cov Parm                 Estimate

                           Year                       9.9110
                           Year*Farm                       0
                           Year*Farm*Field_Type       0.8394
                           Bloc(Year*Farm*Fiel)       0.8026
                           Year*Farm*Bloc*Culti       3.6654
                           Yea*Far*Blo*Cul*Timi            0
                           Ye*Fa*Fi*Blo*Cul*Tim            0
                           Residual                   7.0941


                                    Fit Statistics

                         -2 Res Log Likelihood          1401.8
                         AIC (smaller is better)        1411.8
                         AICC (smaller is better)       1412.1
                         BIC (smaller is better)        1405.3


                             Type 3 Tests of Fixed Effects

                                       Num     Den
                 Effect                 DF      DF    F Value    Pr > F

                 Farm                    1       1       0.12    0.7838
                 Field_Type              1       2      66.04    0.0148
                 Farm*Field_Type         1       2       3.60    0.1980
                 Cultivar                3      33       5.32    0.0042
                 Field_Type*Cultivar     3     117       0.88    0.4545
                 Timing                  2      88       1.32    0.2733
                 Field_Type*Timing       2     117       0.09    0.9164
                 Cultivar*Timing         6      88       0.89    0.5040
                 Field_*Cultiv*Timing    6     117       0.22    0.9680

-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=2.31723 maxSD=2.31723 ---------------


Obs Sample_Type

  1 LeafPost
  2 LeafPost

    Field_                                     Standard                         Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  1   DC                              2.2982      0.4024       2       5.71    0.0293     A
  2   FS                              1.6205      0.3932       2       4.12    0.0541     A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.61418 maxSD=0.63605 ----------------


Obs Sample_Type

  3 LeafPost
  4 LeafPost
  5 LeafPost
  6 LeafPost

    Field_                                   Standard                      Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp
```

```
  3         Bass                   2.1199     0.3212     26      6.60   <.0001    A
  4         Corsica                1.9020     0.3240     26      5.87   <.0001    A
  5         Jack                   1.6769     0.3193     26      5.25   <.0001    A
  6         Williams82             2.1387     0.3289     26      6.50   <.0001    A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.35296 maxSD=0.35296 -----------------


Obs Sample_Type

  7 LeafPost
  8 LeafPost

    Field_                                     Standard                         Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  7                       Early       2.2189      0.3122      26       7.11    <.0001     A
  8                       Late        1.6999      0.2979      26       5.71    <.0001     B


------------ Effect=Field_Type*Timing A=Tukey-Kramer(.05) avgSD=0.5956 maxSD=0.6935 ------------


Obs Sample_Type

  9 LeafPost
 10 LeafPost
 11 LeafPost
 12 LeafPost

    Field_                                     Standard                         Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  9   DC                  Early       3.0944      0.4061      26       7.62    <.0001     A
 10   DC                  Late        1.5021      0.4230      26       3.55    0.0015     B
 11   FS                  Early       1.3434      0.4455      26       3.02    0.0057     A
 12   FS                  Late        1.8976      0.3869      26       4.90    <.0001     A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=0.92172 maxSD=1.07507 ----------


Obs Sample_Type

 13 LeafPost
 14 LeafPost
 15 LeafPost
 16 LeafPost
 17 LeafPost
 18 LeafPost
 19 LeafPost
 20 LeafPost

    Field_                                   Standard                     Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 13   DC     Bass                   2.5709     0.4333     26      5.93   <.0001    A
 14   DC     Corsica                2.3941     0.4410     26      5.43   <.0001    A
 15   DC     Jack                   1.8736     0.4374     26      4.28   0.0002    A
 16   DC     Williams82             2.3543     0.4391     26      5.36   <.0001    A
 17   FS     Bass                   1.6690     0.4455     26      3.75   0.0009    A
 18   FS     Corsica                1.4098     0.4459     26      3.16   0.0040    A
 19   FS     Jack                   1.4802     0.4359     26      3.40   0.0022    A
```

```
 20   FS     Williams82              1.9231     0.4620     26      4.16   0.0003    A

-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=1.02591 maxSD=1.02591 ---------------


Obs Sample_Type

 21 LeafPre
 22 LeafPre

    Field_                                      Standard                         Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 21   DC                              2.1204      0.3711       2       5.71    0.0293     A
 22   FS                              1.4490      0.3674       2       3.94    0.0587     A

--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.37744 maxSD=0.38064 ----------------


Obs Sample_Type

 23 LeafPre
 24 LeafPre
 25 LeafPre
 26 LeafPre

    Field_                                    Standard                      Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 23          Bass                    1.7690     0.3602     33      4.91   <.0001   AB
 24          Corsica                 1.5848     0.3595     33      4.41   0.0001   B
 25          Jack                    1.7331     0.3596     33      4.82   <.0001   AB
 26          Williams82              2.0520     0.3598     33      5.70   <.0001   A

---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.21554 maxSD=0.21554 -----------------


Obs Sample_Type

 27 LeafPre
 28 LeafPre

    Field_                                      Standard                         Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 27                       Early       1.7478      0.3514      36       4.97    <.0001     A
 28                       Late        1.8217      0.3556      36       5.12    <.0001     A

----------- Effect=Field_Type*Timing A=Tukey-Kramer(.05) avgSD=0.34729 maxSD=0.3969 ------------


Obs Sample_Type

 29 LeafPre
 30 LeafPre
 31 LeafPre
 32 LeafPre

    Field_                                      Standard                         Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp
```

```
 29   DC                 Early       1.9882      0.3705      36       5.37    <.0001     A
 30   DC                 Late        2.2526      0.3890      36       5.79    <.0001     A
 31   FS                 Early       1.5074      0.3740      36       4.03    0.0003     A
 32   FS                 Late        1.3907      0.3709      36       3.75    0.0006     A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=0.52827 maxSD=0.59636 ----------


Obs Sample_Type

 33 LeafPre
 34 LeafPre
 35 LeafPre
 36 LeafPre
 37 LeafPre
 38 LeafPre
 39 LeafPre
 40 LeafPre

    Field_                                    Standard                      Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 33   DC     Bass                    2.1908     0.3933     36      5.57   <.0001    A
 34   DC     Corsica                 1.8617     0.3895     36      4.78   <.0001    A
 35   DC     Jack                    2.1054     0.3909     36      5.39   <.0001    A
 36   DC     Williams82              2.3240     0.3920     36      5.93   <.0001    A
 37   FS     Bass                    1.3472     0.3807     36      3.54   0.0011    A
 38   FS     Corsica                 1.3080     0.3817     36      3.43   0.0015    A
 39   FS     Jack                    1.3608     0.3808     36      3.57   0.0010    A
 40   FS     Williams82              1.7801     0.3808     36      4.68   <.0001    A


--------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=3.4759 maxSD=3.4759 ----------------


Obs Sample_Type

 41 Seed
 42 Seed

    Field_                                      Standard                         Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 41   DC                             13.7494      2.3148       2       5.94    0.0272     A
 42   FS                              7.1846      2.3147       2       3.10    0.0900     B


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=2.43373 maxSD=2.43791 ----------------


Obs Sample_Type

 43 Seed
 44 Seed
 45 Seed
 46 Seed

    Field_                                    Standard                      Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 43          Bass                   10.1314     2.3445     33      4.32   0.0001   AB
 44          Corsica                10.4292     2.3447     33      4.45   <.0001   AB
```

```
 45          Jack                    8.8774     2.3447     33      3.79   0.0006   B
 46          Williams82             12.4300     2.3457     33      5.30   <.0001   A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.91882 maxSD=0.92095 -----------------


Obs Sample_Type

 47 Seed
 48 Seed
 49 Seed

    Field_                                       Standard                         Pr >    Let
Obs  Type     Cultivar    Timing     Estimate     Error        DF    t Value       |t|    Grp

 47                       Control     10.5707      2.2901      88       4.62    <.0001     A
 48                       Early       10.7151      2.2900      88       4.68    <.0001     A
 49                       Late        10.1151      2.2903      88       4.42    <.0001     A


----------- Effect=Field_Type*Timing A=Tukey-Kramer(.05) avgSD=1.42059 maxSD=1.42836 -----------


Obs Sample_Type

 50 Seed
 51 Seed
 52 Seed
 53 Seed
 54 Seed
 55 Seed

    Field_                                       Standard                         Pr >    Let
Obs  Type     Cultivar    Timing     Estimate     Error        DF    t Value       |t|    Grp

 50   DC                  Control     13.8757      2.3359     117       5.94    <.0001     A
 51   DC                  Early       13.9082      2.3357     117       5.95    <.0001     A
 52   DC                  Late        13.4643      2.3369     117       5.76    <.0001     A
 53   FS                  Control      7.2658      2.3361     117       3.11    0.0023     A
 54   FS                  Early        7.5220      2.3359     117       3.22    0.0017     A
 55   FS                  Late         6.7659      2.3359     117       2.90    0.0045     A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=2.78201 maxSD=2.80164 ----------


Obs Sample_Type

 56 Seed
 57 Seed
 58 Seed
 59 Seed
 60 Seed
 61 Seed
 62 Seed
 63 Seed

    Field_                                    Standard                      Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 56   DC     Bass                   13.7658     2.3932    117      5.75   <.0001   AB
 57   DC     Corsica                13.4494     2.3947    117      5.62   <.0001   AB
 58   DC     Jack                   12.2933     2.3947    117      5.13   <.0001   B
```

```
 59   DC     Williams82             15.4890     2.3984    117      6.46   <.0001   A
 60   FS     Bass                    6.4970     2.3951    117      2.71   0.0077   AB
 61   FS     Corsica                 7.4089     2.3947    117      3.09   0.0025   AB
 62   FS     Jack                    5.4614     2.3947    117      2.28   0.0244   B
 63   FS     Williams82              9.3709     2.3947    117      3.91   0.0002   A

-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=2.31723 maxSD=2.31723 ---------------


Obs Sample_Type

  1 LeafPost
  2 LeafPost

    Field_                                      Standard                         Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  1   DC                          2.2982      0.4024       2       5.71    0.0293     A
  2   FS                          1.6205      0.3932       2       4.12    0.0541     A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.61418 maxSD=0.63605 ----------------


Obs Sample_Type

  3 LeafPost
  4 LeafPost
  5 LeafPost
  6 LeafPost

    Field_                                    Standard                      Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

  3          Bass                    2.1199     0.3212     26      6.60   <.0001    A
  4          Corsica                 1.9020     0.3240     26      5.87   <.0001    A
  5          Jack                    1.6769     0.3193     26      5.25   <.0001    A
  6          Williams82              2.1387     0.3289     26      6.50   <.0001    A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.35296 maxSD=0.35296 -----------------


Obs Sample_Type

  7 LeafPost
  8 LeafPost

    Field_                                      Standard                         Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  7                       Early       2.2189      0.3122      26       7.11    <.0001     A
  8                       Late        1.6999      0.2979      26       5.71    <.0001     B


----------- Effect=Field_Type*Timing A=Tukey-Kramer(.05) avgSD=1.25221 maxSD=1.62483 -----------


Obs Sample_Type

  9 LeafPost
 10 LeafPost
 11 LeafPost
```

```
 12 LeafPost

    Field_                                       Standard                        Pr >     Let
Obs  Type     Cultivar    Timing    Estimate      Error        DF    t Value       |t|     Grp

  9   DC                  Early       3.0944      0.4061       26       7.62    <.0001     A
 10   DC                  Late        1.5021      0.4230       26       3.55    0.0015     B
 11   FS                  Early       1.3434      0.4455       26       3.02    0.0057     B
 12   FS                  Late        1.8976      0.3869       26       4.90    <.0001     AB


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=1.50171 maxSD=1.5311 -----------


Obs Sample_Type

 13 LeafPost
 14 LeafPost
 15 LeafPost
 16 LeafPost
 17 LeafPost
 18 LeafPost
 19 LeafPost
 20 LeafPost

    Field_                                     Standard                      Pr >    Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF    t Value      |t|    Grp

 13   DC     Bass                    2.5709     0.4333     26      5.93    <.0001     A
 14   FS     Bass                    1.6690     0.4455     26      3.75    0.0009     A
 15   DC     Corsica                 2.3941     0.4410     26      5.43    <.0001     A
 16   FS     Corsica                 1.4098     0.4459     26      3.16    0.0040     A
 17   DC     Jack                    1.8736     0.4374     26      4.28    0.0002     A
 18   FS     Jack                    1.4802     0.4359     26      3.40    0.0022     A
 19   DC     Williams82              2.3543     0.4391     26      5.36    <.0001     A
 20   FS     Williams82              1.9231     0.4620     26      4.16    0.0003     A


-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=1.02591 maxSD=1.02591 ---------------


Obs Sample_Type

 21 LeafPre
 22 LeafPre

    Field_                                       Standard                        Pr >     Let
Obs  Type     Cultivar    Timing    Estimate      Error        DF    t Value       |t|     Grp

 21   DC                              2.1204      0.3711        2       5.71    0.0293      A
 22   FS                              1.4490      0.3674        2       3.94    0.0587      A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.37744 maxSD=0.38064 ----------------


Obs Sample_Type

 23 LeafPre
 24 LeafPre
 25 LeafPre
 26 LeafPre

    Field_                                     Standard                      Pr >    Let
```

```
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 23          Bass                    1.7690     0.3602     33      4.91   <.0001   AB
 24          Corsica                 1.5848     0.3595     33      4.41   0.0001   B
 25          Jack                    1.7331     0.3596     33      4.82   <.0001   AB
 26          Williams82              2.0520     0.3598     33      5.70   <.0001   A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.21554 maxSD=0.21554 -----------------


Obs Sample_Type

 27 LeafPre
 28 LeafPre

    Field_                                     Standard                        Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 27                       Early       1.7478      0.3514      36       4.97    <.0001     A
 28                       Late        1.8217      0.3556      36       5.12    <.0001     A


----------- Effect=Field_Type*Timing A=Tukey-Kramer(.05) avgSD=0.5922 maxSD=0.74205 ------------


Obs Sample_Type

 29 LeafPre
 30 LeafPre
 31 LeafPre
 32 LeafPre

    Field_                                     Standard                        Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 29   DC                  Early       1.9882      0.3705      36       5.37    <.0001    AB
 30   DC                  Late        2.2526      0.3890      36       5.79    <.0001    A
 31   FS                  Early       1.5074      0.3740      36       4.03    0.0003    B
 32   FS                  Late        1.3907      0.3709      36       3.75    0.0006    B


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=0.68708 maxSD=0.69313 ----------


Obs Sample_Type

 33 LeafPre
 34 LeafPre
 35 LeafPre
 36 LeafPre
 37 LeafPre
 38 LeafPre
 39 LeafPre
 40 LeafPre

    Field_                                   Standard                      Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 33   DC     Bass                    2.1908     0.3933     36      5.57   <.0001    A
 34   FS     Bass                    1.3472     0.3807     36      3.54   0.0011    A
 35   DC     Corsica                 1.8617     0.3895     36      4.78   <.0001    A
 36   FS     Corsica                 1.3080     0.3817     36      3.43   0.0015    A
 37   DC     Jack                    2.1054     0.3909     36      5.39   <.0001    A
```

```
 38   FS     Jack                    1.3608     0.3808     36      3.57   0.0010    A
 39   DC     Williams82              2.3240     0.3920     36      5.93   <.0001    A
 40   FS     Williams82              1.7801     0.3808     36      4.68   <.0001    A


--------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=3.4759 maxSD=3.4759 ----------------


Obs Sample_Type

 41 Seed
 42 Seed

    Field_                                      Standard                         Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 41   DC                             13.7494      2.3148       2       5.94    0.0272     A
 42   FS                              7.1846      2.3147       2       3.10    0.0900     B


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=2.43373 maxSD=2.43791 ----------------


Obs Sample_Type

 43 Seed
 44 Seed
 45 Seed
 46 Seed

    Field_                                    Standard                      Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 43          Bass                   10.1314     2.3445     33      4.32   0.0001   AB
 44          Corsica                10.4292     2.3447     33      4.45   <.0001   AB
 45          Jack                    8.8774     2.3447     33      3.79   0.0006   B
 46          Williams82             12.4300     2.3457     33      5.30   <.0001   A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.91882 maxSD=0.92095 -----------------


Obs Sample_Type

 47 Seed
 48 Seed
 49 Seed

    Field_                                         Standard                         Pr >    Let
Obs  Type     Cultivar    Timing     Estimate     Error        DF    t Value       |t|    Grp

 47                       Control     10.5707      2.2901      88       4.62    <.0001     A
 48                       Early       10.7151      2.2900      88       4.68    <.0001     A
 49                       Late        10.1151      2.2903      88       4.42    <.0001     A


----------- Effect=Field_Type*Timing A=Tukey-Kramer(.05) avgSD=2.23518 maxSD=2.67885 -----------


Obs Sample_Type

 50 Seed
 51 Seed
 52 Seed
```

```
 53 Seed
 54 Seed
 55 Seed

    Field_                                      Standard                         Pr >     Let
Obs  Type     Cultivar    Timing     Estimate     Error        DF    t Value       |t|     Grp

 50   DC                  Control     13.8757      2.3359     117       5.94    <.0001      A
 51   DC                  Early       13.9082      2.3357     117       5.95    <.0001      A
 52   DC                  Late        13.4643      2.3369     117       5.76    <.0001      A
 53   FS                  Control      7.2658      2.3361     117       3.11    0.0023      B
 54   FS                  Early        7.5220      2.3359     117       3.22    0.0017      B
 55   FS                  Late         6.7659      2.3359     117       2.90    0.0045      B

---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=2.31448 maxSD=2.33196 ----------


Obs Sample_Type

 56 Seed
 57 Seed
 58 Seed
 59 Seed
 60 Seed
 61 Seed
 62 Seed
 63 Seed

    Field_                                   Standard                      Pr >    Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|    Grp

 56   DC     Bass                   13.7658     2.3932    117      5.75   <.0001     A
 57   FS     Bass                    6.4970     2.3951    117      2.71   0.0077     B
 58   DC     Corsica                13.4494     2.3947    117      5.62   <.0001     A
 59   FS     Corsica                 7.4089     2.3947    117      3.09   0.0025     B
 60   DC     Jack                   12.2933     2.3947    117      5.13   <.0001     A
 61   FS     Jack                    5.4614     2.3947    117      2.28   0.0244     B
 62   DC     Williams82             15.4890     2.3984    117      6.46   <.0001     A
 63   FS     Williams82              9.3709     2.3947    117      3.91   0.0002     B

-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=2.31723 maxSD=2.31723 ---------------


Obs Sample_Type

  1 LeafPost
  2 LeafPost

    Field_                                     Standard                        Pr >     Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|     Grp

  1   DC                              2.2982      0.4024       2       5.71    0.0293      A
  2   FS                              1.6205      0.3932       2       4.12    0.0541      A

--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.61418 maxSD=0.63605 ----------------


Obs Sample_Type

  3 LeafPost
  4 LeafPost
```

```
  5 LeafPost
  6 LeafPost

    Field_                                  Standard                    Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

  3          Bass                    2.1199     0.3212     26      6.60   <.0001    A
  4          Corsica                 1.9020     0.3240     26      5.87   <.0001    A
  5          Jack                    1.6769     0.3193     26      5.25   <.0001    A
  6          Williams82              2.1387     0.3289     26      6.50   <.0001    A

---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.35296 maxSD=0.35296 -----------------


Obs Sample_Type

  7 LeafPost
  8 LeafPost

    Field_                                    Standard                        Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  7                       Early       2.2189      0.3122      26       7.11    <.0001     A
  8                       Late        1.6999      0.2979      26       5.71    <.0001     B


----------- Effect=Field_Type*Timing A=Tukey-Kramer(.05) avgSD=1.4042 maxSD=1.44216 ------------


Obs Sample_Type

  9 LeafPost
 10 LeafPost
 11 LeafPost
 12 LeafPost

    Field_                                    Standard                        Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  9   DC                  Early       3.0944      0.4061      26       7.62    <.0001     A
 10   FS                  Early       1.3434      0.4455      26       3.02    0.0057     B
 11   DC                  Late        1.5021      0.4230      26       3.55    0.0015     A
 12   FS                  Late        1.8976      0.3869      26       4.90    <.0001     A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=1.57967 maxSD=2.03147 ----------


Obs Sample_Type

 13 LeafPost
 14 LeafPost
 15 LeafPost
 16 LeafPost
 17 LeafPost
 18 LeafPost
 19 LeafPost
 20 LeafPost

    Field_                                  Standard                    Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 13   DC     Bass                    2.5709     0.4333     26      5.93   <.0001    A
```

```
 14   DC     Corsica                 2.3941     0.4410     26      5.43   <.0001    A
 15   DC     Jack                    1.8736     0.4374     26      4.28   0.0002    A
 16   DC     Williams82              2.3543     0.4391     26      5.36   <.0001    A
 17   FS     Bass                    1.6690     0.4455     26      3.75   0.0009    A
 18   FS     Corsica                 1.4098     0.4459     26      3.16   0.0040    A
 19   FS     Jack                    1.4802     0.4359     26      3.40   0.0022    A
 20   FS     Williams82              1.9231     0.4620     26      4.16   0.0003    A


-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=1.02591 maxSD=1.02591 ---------------


Obs Sample_Type

 21 LeafPre
 22 LeafPre

    Field_                                      Standard                         Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 21   DC                              2.1204      0.3711       2       5.71    0.0293     A
 22   FS                              1.4490      0.3674       2       3.94    0.0587     A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.37744 maxSD=0.38064 ----------------


Obs Sample_Type

 23 LeafPre
 24 LeafPre
 25 LeafPre
 26 LeafPre

    Field_                                    Standard                      Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 23          Bass                    1.7690     0.3602     33      4.91   <.0001   AB
 24          Corsica                 1.5848     0.3595     33      4.41   0.0001   B
 25          Jack                    1.7331     0.3596     33      4.82   <.0001   AB
 26          Williams82              2.0520     0.3598     33      5.70   <.0001   A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.21554 maxSD=0.21554 -----------------


Obs Sample_Type

 27 LeafPre
 28 LeafPre

    Field_                                      Standard                         Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 27                       Early       1.7478      0.3514      36       4.97    <.0001     A
 28                       Late        1.8217      0.3556      36       5.12    <.0001     A


----------- Effect=Field_Type*Timing A=Tukey-Kramer(.05) avgSD=0.62806 maxSD=0.65628 -----------


Obs Sample_Type

 29 LeafPre
```

```
 30 LeafPre
 31 LeafPre
 32 LeafPre

    Field_                                   Standard                         Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 29   DC                  Early       1.9882      0.3705      36       5.37    <.0001     A
 30   FS                  Early       1.5074      0.3740      36       4.03    0.0003     A
 31   DC                  Late        2.2526      0.3890      36       5.79    <.0001     A
 32   FS                  Late        1.3907      0.3709      36       3.75    0.0006     B


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=0.7814 maxSD=0.94169 -----------


Obs Sample_Type

 33 LeafPre
 34 LeafPre
 35 LeafPre
 36 LeafPre
 37 LeafPre
 38 LeafPre
 39 LeafPre
 40 LeafPre

    Field_                                 Standard                       Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 33   DC     Bass                    2.1908     0.3933     36      5.57   <.0001   AB
 34   DC     Corsica                 1.8617     0.3895     36      4.78   <.0001   AB
 35   DC     Jack                    2.1054     0.3909     36      5.39   <.0001   AB
 36   DC     Williams82              2.3240     0.3920     36      5.93   <.0001   A
 37   FS     Bass                    1.3472     0.3807     36      3.54   0.0011   B
 38   FS     Corsica                 1.3080     0.3817     36      3.43   0.0015   B
 39   FS     Jack                    1.3608     0.3808     36      3.57   0.0010   B
 40   FS     Williams82              1.7801     0.3808     36      4.68   <.0001   AB


--------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=3.4759 maxSD=3.4759 ----------------


Obs Sample_Type

 41 Seed
 42 Seed

    Field_                                   Standard                         Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 41   DC                             13.7494      2.3148       2       5.94    0.0272     A
 42   FS                              7.1846      2.3147       2       3.10    0.0900     B


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=2.43373 maxSD=2.43791 ----------------


Obs Sample_Type

 43 Seed
 44 Seed
 45 Seed
 46 Seed
```

```
    Field_                                  Standard                     Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 43          Bass                   10.1314     2.3445     33      4.32   0.0001   AB
 44          Corsica                10.4292     2.3447     33      4.45   <.0001   AB
 45          Jack                    8.8774     2.3447     33      3.79   0.0006   B
 46          Williams82             12.4300     2.3457     33      5.30   <.0001   A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.91882 maxSD=0.92095 -----------------


Obs Sample_Type

 47 Seed
 48 Seed
 49 Seed

    Field_                                     Standard                          Pr >    Let
Obs  Type     Cultivar    Timing     Estimate     Error        DF    t Value       |t|    Grp

 47                       Control     10.5707      2.2901      88       4.62    <.0001     A
 48                       Early       10.7151      2.2900      88       4.68    <.0001     A
 49                       Late        10.1151      2.2903      88       4.42    <.0001     A


----------- Effect=Field_Type*Timing A=Tukey-Kramer(.05) avgSD=2.18954 maxSD=2.19353 -----------


Obs Sample_Type

 50 Seed
 51 Seed
 52 Seed
 53 Seed
 54 Seed
 55 Seed

    Field_                                     Standard                          Pr >    Let
Obs  Type     Cultivar    Timing     Estimate     Error        DF    t Value       |t|    Grp

 50   DC                  Control     13.8757      2.3359     117       5.94    <.0001     A
 51   FS                  Control      7.2658      2.3361     117       3.11    0.0023     B
 52   DC                  Early       13.9082      2.3357     117       5.95    <.0001     A
 53   FS                  Early        7.5220      2.3359     117       3.22    0.0017     B
 54   DC                  Late        13.4643      2.3369     117       5.76    <.0001     A
 55   FS                  Late         6.7659      2.3359     117       2.90    0.0045     B


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=3.41098 maxSD=3.87671 ----------


Obs Sample_Type

 56 Seed
 57 Seed
 58 Seed
 59 Seed
 60 Seed
 61 Seed
 62 Seed
 63 Seed
```

```
    Field_                                        Standard                           Pr >    Let
Obs  Type     Cultivar      Timing    Estimate     Error       DF    t Value         |t|    Grp

 56   DC      Bass                     13.7658     2.3932     117       5.75      <.0001    AB
 57   DC      Corsica                  13.4494     2.3947     117       5.62      <.0001    AB
 58   DC      Jack                     12.2933     2.3947     117       5.13      <.0001    BC
 59   DC      Williams82               15.4890     2.3984     117       6.46      <.0001    A
 60   FS      Bass                      6.4970     2.3951     117       2.71      0.0077    DE
 61   FS      Corsica                   7.4089     2.3947     117       3.09      0.0025    DE
 62   FS      Jack                      5.4614     2.3947     117       2.28      0.0244    E
 63   FS      Williams82                9.3709     2.3947     117       3.91      0.0002    CD
```

Glycitin Analysis

None Detected

Malonyldaidzin Analysis

```
------------------------------------ Sample_Type=LeafPost ------------------------------------

                                  The Mixed Procedure

                                   Model Information

                   Data Set                     WORK.NEWHPLC
                   Dependent Variable           Malonyl_Daidzin
                   Covariance Structure         Variance Components
                   Estimation Method            REML
                   Residual Variance Method     Profile
                   Fixed Effects SE Method      Model-Based
                   Degrees of Freedom Method    Containment


                                Class Level Information

                   Class         Levels    Values

                   Year               2    2002 2003
                   Farm               2    PHill Wye
                   Field_Type         2    DC FS
                   Block              3    1 2 3
                   Cultivar           4    Bass Corsica Jack Williams82
                   Timing             2    Early Late


                                      Dimensions

                            Covariance Parameters            8
                            Columns in X                    51
                            Columns in Z                   298
                            Subjects                         1
                            Max Obs Per Subject            158
                            Observations Used              158
                            Observations Not Used            0
                            Total Observations             158


                                   Iteration History

                Iteration    Evaluations    -2 Res Log Like       Criterion

                        0              1       878.64062305
                        1              4       875.96300897      0.00045704
                        2              2       875.87784915      0.00000116
                        3              1       875.87750240      0.00000000


                               Convergence criteria met.


------------------------------------ Sample_Type=LeafPost ------------------------------------

                                  The Mixed Procedure

                             Covariance Parameter Estimates

                             Cov Parm                 Estimate

                             Year                       1.3251
```

```
                               Year*Farm                       0
                               Year*Farm*Field_Type       0.7049
                               Bloc(Year*Farm*Fiel)            0
                               Year*Farm*Bloc*Culti            0
                               Yea*Far*Blo*Cul*Timi     6.07E-17
                               Ye*Fa*Fi*Blo*Cul*Tim            0
                               Residual                  22.4430


                                        Fit Statistics

                             -2 Res Log Likelihood           875.9
                             AIC (smaller is better)         881.9
                             AICC (smaller is better)        882.1
                             BIC (smaller is better)         878.0


                                 Type 3 Tests of Fixed Effects

                                            Num     Den
                   Effect                    DF      DF    F Value    Pr > F

                   Farm                       1       1       4.76    0.2737
                   Field_Type                 1       2       1.96    0.2966
                   Farm*Field_Type            1       2       1.99    0.2938
                   Cultivar                   3      26       1.53    0.2312
                   Field_Type*Cultivar        3      26       0.24    0.8700
                   Timing                     1      26       0.52    0.4785
                   Field_Type*Timing          1      26       0.38    0.5427
                   Cultivar*Timing            3      26       0.03    0.9926
                   Field_*Cultiv*Timing       3      26       0.18    0.9064


------------------------------------- Sample_Type=LeafPre --------------------------------------

                                      The Mixed Procedure

                                       Model Information

                     Data Set                     WORK.NEWHPLC
                     Dependent Variable           Malonyl_Daidzin
                     Covariance Structure         Variance Components
                     Estimation Method            REML
                     Residual Variance Method     Profile
                     Fixed Effects SE Method      Model-Based
                     Degrees of Freedom Method    Containment


                                    Class Level Information

                     Class         Levels    Values

                     Year               2    2002 2003
                     Farm               2    PHill Wye
                     Field_Type         2    DC FS
                     Block              3    1 2 3
                     Cultivar           4    Bass Corsica Jack Williams82
                     Timing             2    Early Late


                                          Dimensions

                              Covariance Parameters             8
                              Columns in X                     51
```

```
              Columns in Z                    329
              Subjects                          1
              Max Obs Per Subject             250
              Observations Used               250
              Observations Not Used             0
              Total Observations              250


                         Iteration History

  Iteration    Evaluations    -2 Res Log Like       Criterion

          0              0    1.797693135E308


        WARNING: Stopped because of infinite likelihood.



------------------------------------ Sample_Type=LeafPre ------------------------------------

                        The Mixed Procedure

                    Covariance Parameter Values
                         At Last Iteration

               Cov Parm                 Estimate

               Year                            0
               Year*Farm                       0
               Year*Farm*Field_Type            0
               Bloc(Year*Farm*Fiel)            0
               Year*Farm*Bloc*Culti            0
               Yea*Far*Blo*Cul*Timi            0
               Ye*Fa*Fi*Blo*Cul*Tim            0
               Residual                        0


-------------------------------------- Sample_Type=Seed --------------------------------------

                        The Mixed Procedure

                         Model Information

     Data Set                     WORK.NEWHPLC
     Dependent Variable           Malonyl_Daidzin
     Covariance Structure         Variance Components
     Estimation Method            REML
     Residual Variance Method     Profile
     Fixed Effects SE Method      Model-Based
     Degrees of Freedom Method    Containment


                      Class Level Information

     Class         Levels    Values

     Year               2    2002 2003
     Farm               2    PHill Wye
     Field_Type         2    DC FS
     Block              3    1 2 3
     Cultivar           4    Bass Corsica Jack Williams82
     Timing             3    Control Early Late
```

```
                  Dimensions

            Covariance Parameters            8
            Columns in X                    66
            Columns in Z                   514
            Subjects                         1
            Max Obs Per Subject            288
            Observations Used              288
            Observations Not Used            0
            Total Observations             288


                     Iteration History

 Iteration    Evaluations    -2 Res Log Like       Criterion

         0              1      1940.65428871
         1              4      1614.09609805      0.02870862
         2              1      1592.87277343      0.01500097
         3              1      1582.17505068      0.00627375
         4              1      1577.87044104      0.00178570
         5              1      1576.70626385      0.00027521
         6              1      1576.53424442      0.00002810
         7              1      1576.51688404      0.00000169
         8              1      1576.51591161      0.00000001
         9              1      1576.51590559      0.00000000

-------------------------------------- Sample_Type=Seed --------------------------------------

                    The Mixed Procedure

                 Convergence criteria met.


               Covariance Parameter Estimates

             Cov Parm                 Estimate

             Year                      82.5832
             Year*Farm                  4.0961
             Year*Farm*Field_Type     3.28E-18
             Bloc(Year*Farm*Fiel)       0.6119
             Year*Farm*Bloc*Culti      14.8691
             Yea*Far*Blo*Cul*Timi            0
             Ye*Fa*Fi*Blo*Cul*Tim            0
             Residual                  12.6825


                      Fit Statistics

           -2 Res Log Likelihood          1576.5
           AIC (smaller is better)        1586.5
           AICC (smaller is better)       1586.8
           BIC (smaller is better)        1580.0


                Type 3 Tests of Fixed Effects

                           Num     Den
  Effect                    DF      DF    F Value    Pr > F
```

```
                  Farm                      1       1       0.27    0.6926
                  Field_Type                1       2     214.94    0.0046
                  Farm*Field_Type           1       2      10.41    0.0841
                  Cultivar                  3      33      15.45    <.0001
                  Field_Type*Cultivar       3     117       2.42    0.0696
                  Timing                    2      88       1.74    0.1815
                  Field_Type*Timing         2     117       0.48    0.6194
                  Cultivar*Timing           6      88       1.39    0.2273
                  Field_*Cultiv*Timing      6     117       0.32    0.9259


-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=4.86519 maxSD=4.86519 ---------------


Obs Sample_Type

  1 LeafPost
  2 LeafPost

    Field_                                     Standard                        Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  1   DC                              2.3233      1.1285       2       2.06    0.1757     A
  2   FS                              3.9057      1.1684       2       3.34    0.0790     A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=3.36574 maxSD=3.48945 ----------------


Obs Sample_Type

  3 LeafPost
  4 LeafPost
  5 LeafPost
  6 LeafPost

    Field_                                   Standard                     Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

  3          Bass                    4.2986     1.2402     26      3.47   0.0018    A
  4          Corsica                 3.5424     1.2605     26      2.81   0.0093    A
  5          Jack                    1.8961     1.2128     26      1.56   0.1301    A
  6          Williams82              2.7209     1.2884     26      2.11   0.0445    A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=1.86562 maxSD=1.86562 -----------------


Obs Sample_Type

  7 LeafPost
  8 LeafPost

    Field_                                     Standard                        Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  7                       Early       3.4408      1.1597      26       2.97    0.0064     A
  8                       Late        2.7882      1.0326      26       2.70    0.0120     A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=5.05044 maxSD=5.87722 ----------


Obs Sample_Type
```

```
  9 LeafPost
 10 LeafPost
 11 LeafPost
 12 LeafPost
 13 LeafPost
 14 LeafPost
 15 LeafPost
 16 LeafPost

    Field_                                Standard                     Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

  9   DC     Bass                    3.7571     1.4614     26      2.57   0.0162    A
 10   DC     Corsica                 2.7964     1.5157     26      1.84   0.0765    A
 11   DC     Jack                    0.5202     1.4447     26      0.36   0.7217    A
 12   DC     Williams82              2.2197     1.4616     26      1.52   0.1409    A
 13   FS     Bass                    4.8401     1.6365     26      2.96   0.0065    A
 14   FS     Corsica                 4.2885     1.6416     26      2.61   0.0147    A
 15   FS     Jack                    3.2719     1.5583     26      2.10   0.0456    A
 16   FS     Williams82              3.2222     1.7698     26      1.82   0.0802    A


-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=2.27442 maxSD=2.27442 ---------------


Obs Sample_Type

 17 Seed
 18 Seed

    Field_                                  Standard                        Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 17   DC                             20.2659      6.5395       2       3.10    0.0903     A
 18   FS                             12.5160      6.5395       2       1.91    0.1957     B


---------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=4.55313 maxSD=4.5572 ----------------


Obs Sample_Type

 19 Seed

    Field_                                  Standard                        Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 19             Bass                 14.1947      6.6147      33       2.15    0.0393    BC


---------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=4.55313 maxSD=4.5572 ----------------
                                          (continued)


Obs Sample_Type

 20 Seed
 21 Seed
 22 Seed

    Field_                                Standard                     Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp
```

```
 20         Corsica               17.7017     6.6149     33      2.68   0.0115   AB
 21         Jack                  11.4096     6.6149     33      1.72   0.0939   C
 22         Williams82            22.2578     6.6155     33      3.36   0.0020   A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=1.22871 maxSD=1.23163 -----------------


Obs Sample_Type

 23 Seed
 24 Seed
 25 Seed

    Field_                                     Standard                          Pr >    Let
Obs  Type     Cultivar    Timing     Estimate     Error        DF    t Value       |t|    Grp

 23                       Control     16.4564      6.5409      88       2.52    0.0137     A
 24                       Early       16.8359      6.5409      88       2.57    0.0117     A
 25                       Late        15.8806      6.5410      88       2.43    0.0172     A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=4.94762 maxSD=4.96782 ----------


Obs Sample_Type

 26 Seed
 27 Seed
 28 Seed
 29 Seed
 30 Seed

    Field_                                  Standard                        Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 26   DC     Bass                   18.9319     6.6291    117      2.86   0.0051   BC
 27   DC     Corsica                20.9658     6.6301    117      3.16   0.0020   AB
 28   DC     Jack                   14.9129     6.6301    117      2.25   0.0264   C
 29   DC     Williams82             26.2530     6.6325    117      3.96   0.0001   A
 30   FS     Bass                    9.4576     6.6303    117      1.43   0.1564   BC


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=4.94762 maxSD=4.96782 ----------
                                          (continued)


Obs Sample_Type

 31 Seed
 32 Seed
 33 Seed

    Field_                                  Standard                        Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 31   FS     Corsica                14.4375     6.6301    117      2.18   0.0314   AB
 32   FS     Jack                    7.9064     6.6301    117      1.19   0.2355   C
 33   FS     Williams82             18.2626     6.6301    117      2.75   0.0068   A


-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=4.86519 maxSD=4.86519 ---------------
```

```
Obs Sample_Type

  1 LeafPost
  2 LeafPost

    Field_                                      Standard                         Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  1   DC                              2.3233      1.1285       2       2.06    0.1757     A
  2   FS                              3.9057      1.1684       2       3.34    0.0790     A

--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=3.36574 maxSD=3.48945 ----------------


Obs Sample_Type

  3 LeafPost
  4 LeafPost
  5 LeafPost
  6 LeafPost

    Field_                                    Standard                      Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

  3          Bass                    4.2986     1.2402     26      3.47   0.0018    A
  4          Corsica                 3.5424     1.2605     26      2.81   0.0093    A
  5          Jack                    1.8961     1.2128     26      1.56   0.1301    A
  6          Williams82              2.7209     1.2884     26      2.11   0.0445    A

---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=1.86562 maxSD=1.86562 -----------------


Obs Sample_Type

  7 LeafPost
  8 LeafPost

    Field_                                      Standard                         Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  7                       Early       3.4408      1.1597      26       2.97    0.0064     A
  8                       Late        2.7882      1.0326      26       2.70    0.0120     A

---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=4.66975 maxSD=4.90499 ----------


Obs Sample_Type

  9 LeafPost
 10 LeafPost
 11 LeafPost
 12 LeafPost
 13 LeafPost
 14 LeafPost
 15 LeafPost
 16 LeafPost

    Field_                                    Standard                      Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

  9   DC     Bass                    3.7571     1.4614     26      2.57   0.0162    A
```

```
 10   FS     Bass                    4.8401     1.6365     26      2.96   0.0065    A
 11   DC     Corsica                 2.7964     1.5157     26      1.84   0.0765    A
 12   FS     Corsica                 4.2885     1.6416     26      2.61   0.0147    A
 13   DC     Jack                    0.5202     1.4447     26      0.36   0.7217    A
 14   FS     Jack                    3.2719     1.5583     26      2.10   0.0456    A
 15   DC     Williams82              2.2197     1.4616     26      1.52   0.1409    A
 16   FS     Williams82              3.2222     1.7698     26      1.82   0.0802    A


-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=2.27442 maxSD=2.27442 ---------------


Obs Sample_Type

 17 Seed
 18 Seed

    Field_                                      Standard                         Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 17   DC                             20.2659      6.5395       2       3.10    0.0903     A
 18   FS                             12.5160      6.5395       2       1.91    0.1957     B


---------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=4.55313 maxSD=4.5572 ----------------


Obs Sample_Type

 19 Seed

    Field_                                      Standard                         Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 19             Bass                 14.1947      6.6147      33       2.15    0.0393    BC


---------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=4.55313 maxSD=4.5572 ----------------
                                          (continued)


Obs Sample_Type

 20 Seed
 21 Seed
 22 Seed

    Field_                                    Standard                      Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 20          Corsica                17.7017     6.6149     33      2.68   0.0115   AB
 21          Jack                   11.4096     6.6149     33      1.72   0.0939   C
 22          Williams82             22.2578     6.6155     33      3.36   0.0020   A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=1.22871 maxSD=1.23163 -----------------


Obs Sample_Type

 23 Seed
 24 Seed
 25 Seed
```

```
   Field_                               Standard                      Pr >    Let
Obs  Type     Cultivar    Timing     Estimate     Error        DF    t Value       |t|    Grp

 23                       Control     16.4564      6.5409      88       2.52    0.0137     A
 24                       Early       16.8359      6.5409      88       2.57    0.0117     A
 25                       Late        15.8806      6.5410      88       2.43    0.0172     A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=2.13932 maxSD=2.17369 ----------


Obs Sample_Type

 26 Seed
 27 Seed
 28 Seed
 29 Seed
 30 Seed

   Field_                              Standard                      Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 26   DC      Bass                  18.9319      6.6291     117       2.86    0.0051     A
 27   FS      Bass                   9.4576      6.6303     117       1.43    0.1564     B
 28   DC      Corsica               20.9658      6.6301     117       3.16    0.0020     A
 29   FS      Corsica               14.4375      6.6301     117       2.18    0.0314     B
 30   DC      Jack                  14.9129      6.6301     117       2.25    0.0264     A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=2.13932 maxSD=2.17369 ----------
                                          (continued)


Obs Sample_Type

 31 Seed
 32 Seed
 33 Seed

   Field_                            Standard                    Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 31   FS     Jack                   7.9064     6.6301    117      1.19   0.2355    B
 32   DC     Williams82            26.2530     6.6325    117      3.96   0.0001    A
 33   FS     Williams82            18.2626     6.6301    117      2.75   0.0068    B
```

Malonylgenistin Analysis

```
------------------------------------ Sample_Type=LeafPost ------------------------------------

                              The Mixed Procedure

                               Model Information

                Data Set                     WORK.NEWHPLC
                Dependent Variable           Malonyl_Genistin
                Covariance Structure         Variance Components
                Estimation Method            REML
                Residual Variance Method     Profile
                Fixed Effects SE Method      Model-Based
                Degrees of Freedom Method    Containment


                            Class Level Information

                Class         Levels    Values

                Year               2    2002 2003
                Farm               2    PHill Wye
                Field_Type         2    DC FS
                Block              3    1 2 3
                Cultivar           4    Bass Corsica Jack Williams82
                Timing             2    Early Late


                                  Dimensions

                         Covariance Parameters            8
                         Columns in X                    51
                         Columns in Z                   298
                         Subjects                         1
                         Max Obs Per Subject            158
                         Observations Used              158
                         Observations Not Used            0
                         Total Observations             158


                               Iteration History

             Iteration    Evaluations    -2 Res Log Like       Criterion

                     0              1       963.99041655
                     1              4       903.66686151      0.00274108
                     2              2       903.16102053      0.00004826
                     3              2       903.14667876      0.00000059
                     4              1       903.14648823      0.00000000


                           Convergence criteria met.


------------------------------------ Sample_Type=LeafPost ------------------------------------

                              The Mixed Procedure

                         Covariance Parameter Estimates

                          Cov Parm                Estimate

                          Year                     20.5700
```

```
                               Year*Farm                       0
                               Year*Farm*Field_Type      21.6096
                               Bloc(Year*Farm*Fiel)       0.7449
                               Year*Farm*Bloc*Culti     8.26E-18
                               Yea*Far*Blo*Cul*Timi            0
                               Ye*Fa*Fi*Blo*Cul*Tim            0
                               Residual                  25.1273


                                        Fit Statistics

                             -2 Res Log Likelihood           903.1
                             AIC (smaller is better)         911.1
                             AICC (smaller is better)        911.4
                             BIC (smaller is better)         905.9


                                 Type 3 Tests of Fixed Effects

                                            Num     Den
                   Effect                    DF      DF    F Value    Pr > F

                   Farm                       1       1       0.29    0.6878
                   Field_Type                 1       2       1.72    0.3202
                   Farm*Field_Type            1       2       0.13    0.7537
                   Cultivar                   3      26       0.22    0.8796
                   Field_Type*Cultivar        3      26       0.09    0.9643
                   Timing                     1      26      10.90    0.0028
                   Field_Type*Timing          1      26       2.33    0.1392
                   Cultivar*Timing            3      26       0.14    0.9336
                   Field_*Cultiv*Timing       3      26       0.07    0.9738


------------------------------------- Sample_Type=LeafPre --------------------------------------

                                      The Mixed Procedure

                                       Model Information

                     Data Set                     WORK.NEWHPLC
                     Dependent Variable           Malonyl_Genistin
                     Covariance Structure         Variance Components
                     Estimation Method            REML
                     Residual Variance Method     Profile
                     Fixed Effects SE Method      Model-Based
                     Degrees of Freedom Method    Containment


                                    Class Level Information

                     Class         Levels    Values

                     Year               2    2002 2003
                     Farm               2    PHill Wye
                     Field_Type         2    DC FS
                     Block              3    1 2 3
                     Cultivar           4    Bass Corsica Jack Williams82
                     Timing             2    Early Late


                                          Dimensions

                              Covariance Parameters             8
                              Columns in X                     51
```

```
                              Columns in Z                   329
                              Subjects                         1
                              Max Obs Per Subject            250
                              Observations Used              250
                              Observations Not Used            0
                              Total Observations             250


                                       Iteration History

                  Iteration    Evaluations    -2 Res Log Like       Criterion

                          0              1      1101.55217395
                          1              2       994.48123576      0.04597139
                          2              3       992.45401515       .
                          3              3       991.55107681       .
                          4              3       982.12128484       .
                          5              2       981.17487119      0.00035281
                          6              3       981.14766372       .
                          7              1       981.06208571      0.00001718
                          8              1       981.05701550      0.00000019
                          9              1       981.05696244      0.00000000


------------------------------------- Sample_Type=LeafPre --------------------------------------

                                      The Mixed Procedure

                                   Convergence criteria met.


                                Covariance Parameter Estimates

                               Cov Parm                 Estimate

                               Year                       1.8412
                               Year*Farm                       0
                               Year*Farm*Field_Type       4.9304
                               Bloc(Year*Farm*Fiel)     2.28E-36
                               Year*Farm*Bloc*Culti       0.3432
                               Yea*Far*Blo*Cul*Timi     1.56E-18
                               Ye*Fa*Fi*Blo*Cul*Tim       2.3546
                               Residual                   1.4122


                                        Fit Statistics

                             -2 Res Log Likelihood          981.1
                             AIC (smaller is better)        991.1
                             AICC (smaller is better)       991.3
                             BIC (smaller is better)        984.5


                                 Type 3 Tests of Fixed Effects

                                        Num     Den
                   Effect                DF      DF    F Value    Pr > F

                   Farm                   1       1       0.09    0.8107
                   Field_Type             1       2       2.46    0.2570
                   Farm*Field_Type        1       2       0.01    0.9483
                   Cultivar               3      33       5.24    0.0046
                   Field_Type*Cultivar    3      36       2.00    0.1307
                   Timing                 1      36       1.64    0.2092
```

```
              Field_Type*Timing          1      36       0.01    0.9211
              Cultivar*Timing            3      36       0.86    0.4731
              Field_*Cultiv*Timing       3      36       0.40    0.7528


--------------------------------------- Sample_Type=Seed ---------------------------------------

                                   The Mixed Procedure

                                    Model Information

                Data Set                     WORK.NEWHPLC
                Dependent Variable           Malonyl_Genistin
                Covariance Structure         Variance Components
                Estimation Method            REML
                Residual Variance Method     Profile
                Fixed Effects SE Method      Model-Based
                Degrees of Freedom Method    Containment


                                 Class Level Information

                Class         Levels    Values

                Year               2    2002 2003
                Farm               2    PHill Wye
                Field_Type         2    DC FS
                Block              3    1 2 3
                Cultivar           4    Bass Corsica Jack Williams82
                Timing             3    Control Early Late


                                       Dimensions

                         Covariance Parameters             8
                         Columns in X                     66
                         Columns in Z                    514
                         Subjects                          1
                         Max Obs Per Subject             288
                         Observations Used               288
                         Observations Not Used             0
                         Total Observations              288


                                    Iteration History

             Iteration    Evaluations    -2 Res Log Like       Criterion

                     0              1      2482.97218141
                     1              2      2071.31099454      0.00390521
                     2              1      2067.46978069      0.00101242
                     3              1      2066.52274455      0.00014237
                     4              1      2066.39418860      0.00001351
                     5              1      2066.38233118      0.00000051
                     6              1      2066.38191118      0.00000000


--------------------------------------- Sample_Type=Seed ---------------------------------------

                                   The Mixed Procedure

                                Convergence criteria met.
```

```
                         Covariance Parameter Estimates

                        Cov Parm                 Estimate

                        Year                       779.83
                        Year*Farm                 35.9103
                        Year*Farm*Field_Type       1.5503
                        Bloc(Year*Farm*Fiel)       5.1722
                        Year*Farm*Bloc*Culti      53.5547
                        Yea*Far*Blo*Cul*Timi            0
                        Ye*Fa*Fi*Blo*Cul*Tim            0
                        Residual                  88.9296


                                Fit Statistics

                       -2 Res Log Likelihood          2066.4
                       AIC (smaller is better)        2078.4
                       AICC (smaller is better)       2078.7
                       BIC (smaller is better)        2070.5


                          Type 3 Tests of Fixed Effects

                                  Num     Den
                  Effect           DF      DF    F Value    Pr > F

                  Farm              1       1       0.31    0.6754
                  Field_Type        1       2     146.55    0.0068
                  Farm*Field_Type   1       2       9.44    0.0916
                  Cultivar          3      33      10.13    <.0001
                  Field_Type*Cultivar  3  117       3.85    0.0114
                  Timing            2      88       1.79    0.1731
                  Field_Type*Timing 2     117       0.08    0.9237
                  Cultivar*Timing   6      88       1.20    0.3160
                  Field_*Cultiv*Timing  6 117       0.68    0.6636

-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=15.1877 maxSD=15.1877 ---------------


Obs Sample_Type

  1 LeafPost
  2 LeafPost

    Field_                                  Standard                        Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  1   DC                             10.8456      4.0831       2       2.66    0.1173     A
  2   FS                              6.2181      4.0460       2       1.54    0.2641     A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=3.57648 maxSD=3.70318 ----------------


Obs Sample_Type

  3 LeafPost
  4 LeafPost
  5 LeafPost
  6 LeafPost

    Field_                                Standard                       Pr >   Let
```

```
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

  3          Bass                    8.8772     3.7403     26      2.37   0.0253    A
  4          Corsica                 8.3912     3.7491     26      2.24   0.0340    A
  5          Jack                    7.9970     3.7359     26      2.14   0.0419    A
  6          Williams82              8.8619     3.7647     26      2.35   0.0264    A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=5.3666 maxSD=6.26825 -----------


Obs Sample_Type

  7 LeafPost
  8 LeafPost
  9 LeafPost
 10 LeafPost
 11 LeafPost

    Field_                                    Standard                      Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

  7   DC     Bass                   11.4366     4.1874     26      2.73   0.0112    A
  8   DC     Corsica                10.9082     4.2156     26      2.59   0.0156    A
  9   DC     Jack                   10.2374     4.2039     26      2.44   0.0220    A
 10   DC     Williams82             10.8003     4.2102     26      2.57   0.0164    A
 11   FS     Bass                    6.3179     4.2252     26      1.50   0.1469    A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=5.3666 maxSD=6.26825 -----------
                                          (continued)


Obs Sample_Type

 12 LeafPost
 13 LeafPost
 14 LeafPost

    Field_                                    Standard                      Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 12   FS     Corsica                 5.8742     4.2270     26      1.39   0.1764    A
 13   FS     Jack                    5.7566     4.1916     26      1.37   0.1814    A
 14   FS     Williams82              6.9236     4.2871     26      1.61   0.1184    A


----------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=2.0635 maxSD=2.0635 ------------------


Obs Sample_Type

 15 LeafPost
 16 LeafPost

    Field_                                      Standard                         Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 15                       Early      10.1886      3.7161      26       2.74    0.0109     A
 16                       Late        6.8751      3.6752      26       1.87    0.0727     B


-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=6.92838 maxSD=6.92838 ---------------
```

```
Obs Sample_Type

 17 LeafPre
 18 LeafPre

    Field_                                      Standard                         Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 17   DC                              5.7863      1.4963       2       3.87    0.0608     A
 18   FS                              3.2583      1.4864       2       2.19    0.1597     A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=1.37193 maxSD=1.38291 ----------------


Obs Sample_Type

 19 LeafPre
 20 LeafPre
 21 LeafPre
 22 LeafPre

    Field_                                    Standard                      Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 19          Bass                    3.9040     1.2941     33      3.02   0.0049   B
 20          Corsica                 3.8747     1.2919     33      3.00   0.0051   B
 21          Jack                    4.7004     1.2934     33      3.63   0.0009   AB
 22          Williams82              5.6101     1.2936     33      4.34   0.0001   A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=1.94101 maxSD=2.13723 ----------


Obs Sample_Type

 23 LeafPre
 24 LeafPre
 25 LeafPre
 26 LeafPre
 27 LeafPre
 28 LeafPre
 29 LeafPre
 30 LeafPre

    Field_                                    Standard                      Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 23   DC     Bass                    4.7666     1.5659     36      3.04   0.0043   B
 24   DC     Corsica                 4.7732     1.5553     36      3.07   0.0041   B
 25   DC     Jack                    6.2423     1.5628     36      3.99   0.0003   AB
 26   DC     Williams82              7.3629     1.5635     36      4.71   <.0001   A
 27   FS     Bass                    3.0413     1.5327     36      1.98   0.0549   A
 28   FS     Corsica                 2.9761     1.5367     36      1.94   0.0607   A
 29   FS     Jack                    3.1585     1.5339     36      2.06   0.0468   A
 30   FS     Williams82              3.8573     1.5340     36      2.51   0.0165   A


----------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.7026 maxSD=0.7026 -----------------


Obs Sample_Type
```

```
 31 LeafPre
 32 LeafPre

    Field_                                      Standard                         Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 31                       Early       4.7438      1.2613      36       3.76    0.0006     A
 32                       Late        4.3008      1.2732      36       3.38    0.0018     A


-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=7.30255 maxSD=7.30255 ---------------


Obs Sample_Type

 33 Seed
 34 Seed

    Field_                                      Standard                         Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 33   DC                             60.0591     20.0362       2       3.00    0.0956     A
 34   FS                             39.5126     20.0361       2       1.97    0.1874     B


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=9.13898 maxSD=9.15298 ----------------


Obs Sample_Type

 35 Seed
 36 Seed
 37 Seed
 38 Seed

    Field_                                    Standard                      Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 35          Bass                   47.3696    20.1241     33      2.35   0.0247    B
 36          Corsica                46.3042    20.1246     33      2.30   0.0279    B
 37          Jack                   44.3992    20.1246     33      2.21   0.0344    B
 38          Williams82             61.0704    20.1259     33      3.03   0.0047    A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=10.3318 maxSD=10.3978 ----------


Obs Sample_Type

 39 Seed
 40 Seed
 41 Seed
 42 Seed
 43 Seed
 44 Seed
 45 Seed
 46 Seed

    Field_                                    Standard                      Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 39   DC     Bass                   58.9550    20.1631    117      2.92   0.0042   AB
 40   DC     Corsica                54.1772    20.1654    117      2.69   0.0083   B
 41   DC     Jack                   56.9805    20.1654    117      2.83   0.0055   B
```

```
 42   DC     Williams82            70.1237    20.1707    117      3.48   0.0007   A
 43   FS     Bass                  35.7842    20.1659    117      1.77   0.0786   B
 44   FS     Corsica               38.4311    20.1654    117      1.91   0.0591   B
 45   FS     Jack                  31.8179    20.1654    117      1.58   0.1173   B
 46   FS     Williams82            52.0171    20.1654    117      2.58   0.0111   A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=3.25311 maxSD=3.26068 -----------------


Obs Sample_Type

 47 Seed
 48 Seed
 49 Seed

    Field_                                       Standard                         Pr >    Let
Obs  Type     Cultivar    Timing     Estimate     Error        DF    t Value       |t|    Grp

 47                       Control     49.8469     20.0336      88       2.49    0.0147     A
 48                       Early       51.0453     20.0335      88       2.55    0.0126     A
 49                       Late        48.4653     20.0339      88       2.42    0.0176     A


-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=15.1877 maxSD=15.1877 ---------------


Obs Sample_Type

  1 LeafPost
  2 LeafPost

    Field_                                      Standard                         Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  1   DC                             10.8456      4.0831       2       2.66    0.1173     A
  2   FS                              6.2181      4.0460       2       1.54    0.2641     A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=3.57648 maxSD=3.70318 ----------------


Obs Sample_Type

  3 LeafPost
  4 LeafPost
  5 LeafPost
  6 LeafPost

    Field_                                    Standard                      Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

  3          Bass                    8.8772    3.7403      26      2.37   0.0253    A
  4          Corsica                 8.3912    3.7491      26      2.24   0.0340    A
  5          Jack                    7.9970    3.7359      26      2.14   0.0419    A
  6          Williams82              8.8619    3.7647      26      2.35   0.0264    A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=9.62675 maxSD=9.78866 ----------


Obs Sample_Type

  7 LeafPost
```

```
  8 LeafPost
  9 LeafPost
 10 LeafPost
 11 LeafPost

    Field_                                  Standard                       Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  7   DC      Bass                   11.4366      4.1874      26       2.73    0.0112     A
  8   FS      Bass                    6.3179      4.2252      26       1.50    0.1469     A
  9   DC      Corsica                10.9082      4.2156      26       2.59    0.0156     A
 10   FS      Corsica                 5.8742      4.2270      26       1.39    0.1764     A
 11   DC      Jack                   10.2374      4.2039      26       2.44    0.0220     A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=9.62675 maxSD=9.78866 ----------
                                          (continued)


Obs Sample_Type

 12 LeafPost
 13 LeafPost
 14 LeafPost

    Field_                                Standard                     Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 12   FS     Jack                   5.7566     4.1916     26      1.37   0.1814    A
 13   DC     Williams82            10.8003     4.2102     26      2.57   0.0164    A
 14   FS     Williams82             6.9236     4.2871     26      1.61   0.1184    A


----------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=2.0635 maxSD=2.0635 -----------------


Obs Sample_Type

 15 LeafPost
 16 LeafPost

    Field_                                  Standard                       Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 15                       Early      10.1886      3.7161      26       2.74    0.0109     A
 16                       Late        6.8751      3.6752      26       1.87    0.0727     B


-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=6.92838 maxSD=6.92838 ---------------


Obs Sample_Type

 17 LeafPre
 18 LeafPre

    Field_                                  Standard                       Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 17   DC                              5.7863      1.4963       2       3.87    0.0608     A
 18   FS                              3.2583      1.4864       2       2.19    0.1597     A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=1.37193 maxSD=1.38291 ---------------
```

```
Obs Sample_Type

 19 LeafPre
 20 LeafPre
 21 LeafPre
 22 LeafPre

    Field_                                Standard                      Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 19          Bass                    3.9040     1.2941     33      3.02   0.0049   B
 20          Corsica                 3.8747     1.2919     33      3.00   0.0051   B
 21          Jack                    4.7004     1.2934     33      3.63   0.0009   AB
 22          Williams82              5.6101     1.2936     33      4.34   0.0001   A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=4.1606 maxSD=4.16504 -----------


Obs Sample_Type

 23 LeafPre
 24 LeafPre
 25 LeafPre
 26 LeafPre
 27 LeafPre
 28 LeafPre
 29 LeafPre
 30 LeafPre

    Field_                                Standard                      Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 23   DC     Bass                    4.7666     1.5659     36      3.04   0.0043    A
 24   FS     Bass                    3.0413     1.5327     36      1.98   0.0549    A
 25   DC     Corsica                 4.7732     1.5553     36      3.07   0.0041    A
 26   FS     Corsica                 2.9761     1.5367     36      1.94   0.0607    A
 27   DC     Jack                    6.2423     1.5628     36      3.99   0.0003    A
 28   FS     Jack                    3.1585     1.5339     36      2.06   0.0468    A
 29   DC     Williams82              7.3629     1.5635     36      4.71   <.0001    A
 30   FS     Williams82              3.8573     1.5340     36      2.51   0.0165    A


----------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.7026 maxSD=0.7026 ------------------


Obs Sample_Type

 31 LeafPre
 32 LeafPre

    Field_                                  Standard                          Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 31                       Early       4.7438      1.2613      36       3.76    0.0006     A
 32                       Late        4.3008      1.2732      36       3.38    0.0018     A


-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=7.30255 maxSD=7.30255 ---------------


Obs Sample_Type
```

```
 33 Seed
 34 Seed

    Field_                                    Standard                         Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 33   DC                             60.0591     20.0362       2       3.00    0.0956     A
 34   FS                             39.5126     20.0361       2       1.97    0.1874     B


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=9.13898 maxSD=9.15298 ----------------


Obs Sample_Type

 35 Seed
 36 Seed
 37 Seed
 38 Seed

    Field_                                  Standard                       Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 35          Bass                   47.3696    20.1241     33      2.35   0.0247    B
 36          Corsica                46.3042    20.1246     33      2.30   0.0279    B
 37          Jack                   44.3992    20.1246     33      2.21   0.0344    B
 38          Williams82             61.0704    20.1259     33      3.03   0.0047    A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=6.10521 maxSD=6.18764 ----------


Obs Sample_Type

 39 Seed
 40 Seed
 41 Seed
 42 Seed
 43 Seed
 44 Seed
 45 Seed
 46 Seed

    Field_                                  Standard                       Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 39   DC     Bass                   58.9550    20.1631    117      2.92   0.0042    A
 40   FS     Bass                   35.7842    20.1659    117      1.77   0.0786    B
 41   DC     Corsica                54.1772    20.1654    117      2.69   0.0083    A
 42   FS     Corsica                38.4311    20.1654    117      1.91   0.0591    B
 43   DC     Jack                   56.9805    20.1654    117      2.83   0.0055    A
 44   FS     Jack                   31.8179    20.1654    117      1.58   0.1173    B
 45   DC     Williams82             70.1237    20.1707    117      3.48   0.0007    A
 46   FS     Williams82             52.0171    20.1654    117      2.58   0.0111    B


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=3.25311 maxSD=3.26068 -----------------


Obs Sample_Type

 47 Seed
 48 Seed
```

```
 49 Seed

    Field_                                     Standard                         Pr >    Let
Obs  Type     Cultivar    Timing     Estimate     Error        DF    t Value       |t|    Grp

 47                       Control     49.8469     20.0336      88       2.49    0.0147     A
 48                       Early       51.0453     20.0335      88       2.55    0.0126     A
 49                       Late        48.4653     20.0339      88       2.42    0.0176     A


-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=15.1877 maxSD=15.1877 ---------------


Obs Sample_Type

  1 LeafPost
  2 LeafPost

    Field_                                    Standard                         Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  1   DC                             10.8456      4.0831       2       2.66    0.1173     A
  2   FS                              6.2181      4.0460       2       1.54    0.2641     A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=3.57648 maxSD=3.70318 ----------------


Obs Sample_Type

  3 LeafPost
  4 LeafPost
  5 LeafPost
  6 LeafPost

    Field_                                  Standard                        Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

  3          Bass                    8.8772     3.7403     26      2.37   0.0253    A
  4          Corsica                 8.3912     3.7491     26      2.24   0.0340    A
  5          Jack                    7.9970     3.7359     26      2.14   0.0419    A
  6          Williams82              8.8619     3.7647     26      2.35   0.0264    A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=9.86558 maxSD=12.9776 ----------


Obs Sample_Type

  7 LeafPost
  8 LeafPost
  9 LeafPost
 10 LeafPost
 11 LeafPost

    Field_                                  Standard                        Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

  7   DC     Bass                   11.4366     4.1874     26      2.73   0.0112    A
  8   DC     Corsica                10.9082     4.2156     26      2.59   0.0156    A
  9   DC     Jack                   10.2374     4.2039     26      2.44   0.0220    A
 10   DC     Williams82             10.8003     4.2102     26      2.57   0.0164    A
 11   FS     Bass                    6.3179     4.2252     26      1.50   0.1469    A
```

```
---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=9.86558 maxSD=12.9776 ----------
                                      (continued)


Obs Sample_Type

 12 LeafPost
 13 LeafPost
 14 LeafPost

    Field_                                 Standard                      Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 12   FS     Corsica                 5.8742     4.2270     26      1.39   0.1764    A
 13   FS     Jack                    5.7566     4.1916     26      1.37   0.1814    A
 14   FS     Williams82              6.9236     4.2871     26      1.61   0.1184    A

----------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=2.0635 maxSD=2.0635 -----------------


Obs Sample_Type

 15 LeafPost
 16 LeafPost

    Field_                                   Standard                        Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 15                       Early      10.1886      3.7161      26       2.74    0.0109     A
 16                       Late        6.8751      3.6752      26       1.87    0.0727     B

-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=6.92838 maxSD=6.92838 ---------------


Obs Sample_Type

 17 LeafPre
 18 LeafPre

    Field_                                   Standard                        Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 17   DC                              5.7863      1.4963       2       3.87    0.0608     A
 18   FS                              3.2583      1.4864       2       2.19    0.1597     A

--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=1.37193 maxSD=1.38291 ----------------


Obs Sample_Type

 19 LeafPre
 20 LeafPre
 21 LeafPre
 22 LeafPre

    Field_                                 Standard                      Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 19          Bass                    3.9040     1.2941     33      3.02   0.0049   B
 20          Corsica                 3.8747     1.2919     33      3.00   0.0051   B
```

```
 21          Jack                    4.7004     1.2934     33      3.63   0.0009   AB
 22          Williams82              5.6101     1.2936     33      4.34   0.0001   A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=4.08116 maxSD=5.54312 ----------


Obs Sample_Type

 23 LeafPre
 24 LeafPre
 25 LeafPre
 26 LeafPre
 27 LeafPre
 28 LeafPre
 29 LeafPre
 30 LeafPre

    Field_                                    Standard                      Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 23   DC     Bass                    4.7666     1.5659     36      3.04   0.0043   B
 24   DC     Corsica                 4.7732     1.5553     36      3.07   0.0041   B
 25   DC     Jack                    6.2423     1.5628     36      3.99   0.0003   AB
 26   DC     Williams82              7.3629     1.5635     36      4.71   <.0001   A
 27   FS     Bass                    3.0413     1.5327     36      1.98   0.0549   AB
 28   FS     Corsica                 2.9761     1.5367     36      1.94   0.0607   AB
 29   FS     Jack                    3.1585     1.5339     36      2.06   0.0468   AB
 30   FS     Williams82              3.8573     1.5340     36      2.51   0.0165   AB


----------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.7026 maxSD=0.7026 ------------------


Obs Sample_Type

 31 LeafPre
 32 LeafPre

    Field_                                        Standard                       Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 31                       Early       4.7438      1.2613      36       3.76    0.0006     A
 32                       Late        4.3008      1.2732      36       3.38    0.0018     A


------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=7.30255 maxSD=7.30255 ---------------


Obs Sample_Type

 33 Seed
 34 Seed

    Field_                                        Standard                       Pr >    Let
Obs  Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 33   DC                             60.0591     20.0362       2       3.00    0.0956     A
 34   FS                             39.5126     20.0361       2       1.97    0.1874     B


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=9.13898 maxSD=9.15298 ----------------
```

```
Obs Sample_Type

 35 Seed
 36 Seed
 37 Seed
 38 Seed

    Field_                               Standard                     Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 35          Bass                   47.3696    20.1241     33      2.35   0.0247    B
 36          Corsica                46.3042    20.1246     33      2.30   0.0279    B
 37          Jack                   44.3992    20.1246     33      2.21   0.0344    B
 38          Williams82             61.0704    20.1259     33      3.03   0.0047    A

---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=11.281 maxSD=12.2456 -----------


Obs Sample_Type

 39 Seed
 40 Seed
 41 Seed
 42 Seed
 43 Seed
 44 Seed
 45 Seed
 46 Seed

    Field_                               Standard                     Pr >   Let
Obs  Type    Cultivar     Timing   Estimate    Error       DF   t Value      |t|   Grp

 39   DC     Bass                   58.9550    20.1631    117      2.92   0.0042   AB
 40   DC     Corsica                54.1772    20.1654    117      2.69   0.0083   B
 41   DC     Jack                   56.9805    20.1654    117      2.83   0.0055   B
 42   DC     Williams82             70.1237    20.1707    117      3.48   0.0007   A
 43   FS     Bass                   35.7842    20.1659    117      1.77   0.0786   C
 44   FS     Corsica                38.4311    20.1654    117      1.91   0.0591   C
 45   FS     Jack                   31.8179    20.1654    117      1.58   0.1173   C
 46   FS     Williams82             52.0171    20.1654    117      2.58   0.0111   B

---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=3.25311 maxSD=3.26068 -----------------


Obs Sample_Type

 47 Seed
 48 Seed
 49 Seed

    Field_                                  Standard                        Pr >     Let
Obs  Type     Cultivar    Timing     Estimate     Error        DF    t Value       |t|    Grp

 47                       Control     49.8469     20.0336      88       2.49    0.0147     A
 48                       Early       51.0453     20.0335      88       2.55    0.0126     A
 49                       Late        48.4653     20.0339      88       2.42    0.0176     A
```

Malnoylglycitin Analysis

```
------------------------------------ Sample_Type=LeafPost ------------------------------------

                                     The Mixed Procedure

                                      Model Information

                    Data Set                     WORK.NEWHPLC
                    Dependent Variable           Malonyl_Glycitin
                    Covariance Structure         Variance Components
                    Estimation Method            REML
                    Residual Variance Method     Profile
                    Fixed Effects SE Method      Model-Based
                    Degrees of Freedom Method    Satterthwaite


                                   Class Level Information

                    Class         Levels    Values

                    Year               2    2002 2003
                    Farm               2    PHill Wye
                    Field_Type         2    DC FS
                    Block              3    1 2 3
                    Cultivar           4    Bass Corsica Jack Williams82
                    Timing             2    Early Late


                                         Dimensions

                             Covariance Parameters            8
                             Columns in X                    51
                             Columns in Z                   298
                             Subjects                         1
                             Max Obs Per Subject            158
                             Observations Used              158
                             Observations Not Used            0
                             Total Observations             158


                                      Iteration History

                 Iteration    Evaluations    -2 Res Log Like       Criterion

                         0              1       683.02389098
                         1              4       627.58546906      0.00510310
                         2              2       626.99083332      0.00087231
                         3              2       626.79986828      0.00014554
                         4              1       626.76944746      0.00000897
                         5              1       626.76769995      0.00000008
                         6              1       626.76768579      0.00000000

                                   Malnoylglycitin Analysis                                  63

------------------------------------ Sample_Type=LeafPost ------------------------------------

                                     The Mixed Procedure

                                  Convergence criteria met.


                               Covariance Parameter Estimates
```

```
                               Cov Parm                 Estimate

                               Year                       2.1534
                               Year*Farm                       0
                               Year*Farm*Field_Type       4.5554
                               Bloc(Year*Farm*Fiel)      0.09976
                               Year*Farm*Bloc*Culti            0
                               Yea*Far*Blo*Cul*Timi            0
                               Ye*Fa*Fi*Blo*Cul*Tim            0
                               Residual                   3.4650


                                        Fit Statistics

                             -2 Res Log Likelihood           626.8
                             AIC (smaller is better)         634.8
                             AICC (smaller is better)        635.1
                             BIC (smaller is better)         629.5


                                 Type 3 Tests of Fixed Effects

                                            Num     Den
                   Effect                    DF      DF    F Value    Pr > F

                   Farm                       1    2.76       0.11    0.7639
                   Field_Type                 1    2.84       2.71    0.2032
                   Farm*Field_Type            1    2.76       0.11    0.7596
                   Cultivar                   3     130       0.25    0.8620
                   Field_Type*Cultivar        3     130       0.39    0.7589
                   Timing                     1     134       0.40    0.5268
                   Field_Type*Timing          1     134       0.82    0.3664
                   Cultivar*Timing            3     130       0.64    0.5922
                   Field_*Cultiv*Timing       3     130       0.59    0.6200

------------------------------------- Sample_Type=LeafPre --------------------------------------

                                      The Mixed Procedure

                                       Model Information

                     Data Set                     WORK.NEWHPLC
                     Dependent Variable           Malonyl_Glycitin
                     Covariance Structure         Variance Components
                     Estimation Method            REML
                     Residual Variance Method     Profile
                     Fixed Effects SE Method      Model-Based
                     Degrees of Freedom Method    Satterthwaite


                                    Class Level Information

                     Class         Levels    Values

                     Year               2    2002 2003
                     Farm               2    PHill Wye
                     Field_Type         2    DC FS
                     Block              3    1 2 3
                     Cultivar           4    Bass Corsica Jack Williams82
                     Timing             2    Early Late


                                          Dimensions
```

```
                    Covariance Parameters            8
                    Columns in X                    51
                    Columns in Z                   329
                    Subjects                         1
                    Max Obs Per Subject            250
                    Observations Used              250
                    Observations Not Used            0
                    Total Observations             250


                             Iteration History

        Iteration    Evaluations    -2 Res Log Like       Criterion

                0              1       455.40175972
                1              2       409.85293277    477.75672487
                2              1       384.89335516     86.57168638
                3              1       350.78125191     22.04098081
                4              1       310.80120042      6.26256525
                5              1       267.35831615      1.86832520
                6              1       221.90694510      0.57275686
                7              1       175.47657600      0.17869141
                8              1       128.90938883      0.05639550


------------------------------------ Sample_Type=LeafPre ------------------------------------

                          The Mixed Procedure

                             Iteration History

        Iteration    Evaluations    -2 Res Log Like       Criterion

                9              1        83.03755667      0.01791314
               10              1        38.81833531      0.00569528
               11              1        -2.59216973      0.00180094
               12              3       -26.69352736       .
               13              1       -72.13255412      0.09738260
               14              1      -104.26762148      0.05356535
               15              1      -122.60817631      0.02247523
               16              3      -131.39098823      0.00342668
               17              3      -132.50400839      0.00047745
               18              2      -132.62497415       .
               19              2      -132.62778424      0.00000001


                         Convergence criteria met.


                       Covariance Parameter Estimates

                     Cov Parm                Estimate

                     Year                           0
                     Year*Farm               0.001693
                     Year*Farm*Field_Type    0.008130
                     Bloc(Year*Farm*Fiel)      0.2399
                     Year*Farm*Bloc*Culti     0.06003
                     Yea*Far*Blo*Cul*Timi           0
                     Ye*Fa*Fi*Blo*Cul*Tim      0.3476
                     Residual                0.000344
```

```
                    Fit Statistics

          -2 Res Log Likelihood          -132.6
          AIC (smaller is better)        -120.6
          AICC (smaller is better)       -120.3
          BIC (smaller is better)        -128.5


                 Type 3 Tests of Fixed Effects

                         Num     Den
Effect                    DF      DF    F Value    Pr > F

Farm                       1    2.02       1.41    0.3563
Field_Type                 1    2.05       1.41    0.3539


------------------------------------ Sample_Type=LeafPre ------------------------------------

                      The Mixed Procedure

                 Type 3 Tests of Fixed Effects

                         Num     Den
Effect                    DF      DF    F Value    Pr > F

Farm*Field_Type            1    2.03       1.43    0.3532
Cultivar                   3    18.7       0.88    0.4694
Field_Type*Cultivar        3    77.6       1.08    0.3625
Timing                     1    57.6       0.01    0.9434
Field_Type*Timing          1    57.6       0.00    0.9447
Cultivar*Timing            3    74.1       0.56    0.6412
Field_*Cultiv*Timing       3    60.8       0.91    0.4393


-------------------------------------- Sample_Type=Seed --------------------------------------

                      The Mixed Procedure

                       Model Information

  Data Set                     WORK.NEWHPLC
  Dependent Variable           Malonyl_Glycitin
  Covariance Structure         Variance Components
  Estimation Method            REML
  Residual Variance Method     Profile
  Fixed Effects SE Method      Model-Based
  Degrees of Freedom Method    Satterthwaite


                    Class Level Information

  Class         Levels    Values

  Year               2    2002 2003
  Farm               2    PHill Wye
  Field_Type         2    DC FS
  Block              3    1 2 3
  Cultivar           4    Bass Corsica Jack Williams82
  Timing             3    Control Early Late


                          Dimensions
```

```
                 Covariance Parameters            8
                 Columns in X                    66
                 Columns in Z                   514
                 Subjects                         1
                 Max Obs Per Subject            288
                 Observations Used              288
                 Observations Not Used            0
                 Total Observations             288


                          Iteration History

           Iteration    Evaluations    -2 Res Log Like       Criterion

                   0              1       190.08293174
                   1              3       122.17034830       .
                   2              2       121.82873239       .
                   3              1       121.41291987      0.00736767
                   4              1       114.94229045      0.01096299
                   5              1       112.15805525      0.01084028
                   6              1       109.38295991      0.01075114
                   7              1       106.60978547      0.01066972
                   8              1       103.83705497      0.01059094

--------------------------------------- Sample_Type=Seed ---------------------------------------

                         The Mixed Procedure

                          Iteration History

           Iteration    Evaluations    -2 Res Log Like       Criterion

                   9              1       101.06443136      0.01051364
                  10              1        98.29183398      0.01043755
                  11              1        95.51924310      0.01036257
                  12              1        92.74665384      0.01028867
                  13              1        89.97406499      0.01021582
                  14              1        87.20147623      0.01014399
                  15              1        84.42888750      0.01007316
                  16              1        81.65629877      0.01000331
                  17              1        78.88371003      0.00993443
                  18              1        76.11112134      0.00986649
                  19              1        73.33853258      0.00979947
                  20              1        70.56594400      0.00973336
                  21              1        67.79335517      0.00966813
                  22              1        65.02076655      0.00960377
                  23              1        62.24817617      0.00954027
                  24              1        59.47558936      0.00947758
                  25              1        56.70300447      0.00941572
                  26              1        53.93040520      0.00935472
                  27              1        51.15781190      0.00929445
                  28              1        48.38524702      0.00923483
                  29              1        45.61256250      0.00917659
                  30              1        42.83987096      0.00911882
                  31              1        40.06754354      0.00906012
                  32              1        37.29459900      0.00900554
                  33              1        34.52026318      0.00895689
                  34              1        31.74600828      0.00890476
                  35              1        28.96554214      0.00887847
                  36              1        26.20471062      0.00875458
                  37              1        25.30750083      0.00876323
                  38              1        25.28908621      0.00877333
                  39              1        25.27883550      0.00880167
                  40              1        25.27676361      0.00880318
```

```
                       41             6        25.27622874      0.00880368
                       42             5        25.27588525      0.00880388
                       43            15        25.27388751      0.00881056
                       44            18        25.27388179      0.00881058
                       45            19        25.27386960      0.00881064


                                 WARNING: Did not converge.



--------------------------------------- Sample_Type=Seed ---------------------------------------

                                   The Mixed Procedure

                               Covariance Parameter Values
                                    At Last Iteration

                            Cov Parm                 Estimate

                            Year                            0
                            Year*Farm                       0
                            Year*Farm*Field_Type     0.000767
                            Bloc(Year*Farm*Fiel)      0.02629
                            Year*Farm*Bloc*Culti      0.01319
                            Yea*Far*Blo*Cul*Timi            0
                            Ye*Fa*Fi*Blo*Cul*Tim      0.05545
                            Residual                 1.11E-12

                                Malnoylglycitin Analysis                                    70
                                                              15:01 Thursday, August 11, 2005

-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=5.20394 maxSD=5.20394 ---------------

         Sample_   Field_                              Standard                    Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

      1  LeafPost    DC                        2.6540    1.5350  1.79     1.73  0.2405   A
      2  LeafPost    FS                       0.04513    1.5197  1.72     0.03  0.9794   A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=1.25991 maxSD=1.30451 ----------------

        Sample_   Field_                              Standard                    Pr >  Let
   Obs  Type       Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

     3  LeafPost          Bass                  1.3415    1.3362   1.1     1.00  0.4860   A
     4  LeafPost          Corsica               1.1701    1.3396  1.11     0.87  0.5306   A
     5  LeafPost          Jack                  1.5686    1.3346   1.1     1.18  0.4352   A
     6  LeafPost          Williams82            1.3180    1.3457  1.13     0.98  0.4907   A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.73829 maxSD=0.73829 -----------------

         Sample_   Field_                              Standard                    Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

      7  LeafPost                    Early     1.2311    1.3268  1.07     0.93  0.5153   A
      8  LeafPost                    Late      1.4680    1.3113  1.02     1.12  0.4609   A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=1.88228 maxSD=2.19852 ----------
```

```
        Sample_   Field_                                Standard                   Pr >  Let
   Obs  Type       Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

     9  LeafPost    DC    Bass                  2.6507    1.5728  1.97     1.69  0.2357   A
    10  LeafPost    DC    Corsica               2.2178    1.5834  2.02     1.40  0.2949   A
    11  LeafPost    DC    Jack                  3.1263    1.5797     2     1.98  0.1862   A
    12  LeafPost    DC    Williams82            2.6210    1.5820  2.02     1.66  0.2385   A
    13  LeafPost    FS    Bass                 0.03227    1.5855  2.04     0.02  0.9856   A
    14  LeafPost    FS    Corsica               0.1223    1.5862  2.05     0.08  0.9454   A
    15  LeafPost    FS    Jack                 0.01096    1.5732  1.98     0.01  0.9951   A
    16  LeafPost    FS    Williams82           0.01497    1.6083  2.16     0.01  0.9934   A


-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=1.00422 maxSD=1.00422 ---------------

         Sample_   Field_                              Standard                   Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

     17  LeafPre     DC                         0.2921    0.1786  3.96     1.64  0.1779   A
     18  LeafPre     FS                       0.007830    0.1693  3.17     0.05  0.9659   A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.49498 maxSD=0.49906 ----------------

        Sample_   Field_                                Standard                   Pr >  Let
   Obs  Type       Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

    19  LeafPre           Bass                 0.06647    0.1666  5.67     0.40  0.7045   A
    20  LeafPre           Corsica              0.06714    0.1648  5.42     0.41  0.6992   A
    21  LeafPre           Jack                  0.1516    0.1669  5.73     0.91  0.4003   A
    22  LeafPre           Williams82            0.3147    0.1669   5.7     1.89  0.1108   A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.22465 maxSD=0.22465 -----------------

         Sample_   Field_                              Standard                   Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

     23  LeafPre                     Early     0.1460    0.1327  2.47     1.10  0.3668   A
     24  LeafPre                     Late      0.1540    0.1437  3.43     1.07  0.3534   A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=0.64355 maxSD=0.70112 ----------

        Sample_   Field_                                Standard                   Pr >  Let
   Obs  Type       Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

    25  LeafPre     DC    Bass                  0.1284    0.2352  11.5     0.55  0.5956   A
    26  LeafPre     DC    Corsica               0.1279    0.2275  10.1     0.56  0.5862   A
    27  LeafPre     DC    Jack                  0.3073    0.2352  11.5     1.31  0.2169   A
    28  LeafPre     DC    Williams82            0.6050    0.2351  11.4     2.57  0.0252   A
    29  LeafPre     FS    Bass                0.004577    0.2124  7.64     0.02  0.9834   A
    30  LeafPre     FS    Corsica             0.006374    0.2160  8.08     0.03  0.9772   A
    31  LeafPre     FS    Jack                -0.00404    0.2139  7.87    -0.02  0.9854   A
    32  LeafPre     FS    Williams82           0.02441    0.2139  7.87     0.11  0.9120   A


-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=5.20394 maxSD=5.20394 ---------------

         Sample_   Field_                              Standard                   Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

      1  LeafPost    DC                         2.6540    1.5350  1.79     1.73  0.2405   A
      2  LeafPost    FS                        0.04513    1.5197  1.72     0.03  0.9794   A
```

```
--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=1.25991 maxSD=1.30451 ----------------

        Sample_   Field_                                Standard                   Pr >  Let
   Obs  Type       Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

     3  LeafPost          Bass                  1.3415    1.3362   1.1     1.00  0.4860   A
     4  LeafPost          Corsica               1.1701    1.3396  1.11     0.87  0.5306   A
     5  LeafPost          Jack                  1.5686    1.3346   1.1     1.18  0.4352   A
     6  LeafPost          Williams82            1.3180    1.3457  1.13     0.98  0.4907   A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.73829 maxSD=0.73829 -----------------

         Sample_   Field_                              Standard                   Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

      7  LeafPost                    Early     1.2311    1.3268  1.07     0.93  0.5153   A
      8  LeafPost                    Late      1.4680    1.3113  1.02     1.12  0.4609   A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=6.12301 maxSD=6.19881 ----------

        Sample_   Field_                                Standard                   Pr >  Let
   Obs  Type       Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

     9  LeafPost    DC    Bass                  2.6507    1.5728  1.97     1.69  0.2357   A
    10  LeafPost    FS    Bass                 0.03227    1.5855  2.04     0.02  0.9856   A
    11  LeafPost    DC    Corsica               2.2178    1.5834  2.02     1.40  0.2949   A
    12  LeafPost    FS    Corsica               0.1223    1.5862  2.05     0.08  0.9454   A
    13  LeafPost    DC    Jack                  3.1263    1.5797     2     1.98  0.1862   A
    14  LeafPost    FS    Jack                 0.01096    1.5732  1.98     0.01  0.9951   A
    15  LeafPost    DC    Williams82            2.6210    1.5820  2.02     1.66  0.2385   A
    16  LeafPost    FS    Williams82           0.01497    1.6083  2.16     0.01  0.9934   A


------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=1.00422 maxSD=1.00422 --------------

         Sample_   Field_                              Standard                   Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

     17  LeafPre     DC                        0.2921    0.1786  3.96     1.64  0.1779   A
     18  LeafPre     FS                      0.007830    0.1693  3.17     0.05  0.9659   A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.49498 maxSD=0.49906 ----------------

        Sample_   Field_                                Standard                   Pr >  Let
   Obs  Type       Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

    19  LeafPre           Bass                 0.06647    0.1666  5.67     0.40  0.7045   A
    20  LeafPre           Corsica              0.06714    0.1648  5.42     0.41  0.6992   A
    21  LeafPre           Jack                  0.1516    0.1669  5.73     0.91  0.4003   A
    22  LeafPre           Williams82            0.3147    0.1669   5.7     1.89  0.1108   A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.22465 maxSD=0.22465 -----------------

         Sample_   Field_                              Standard                   Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

     23  LeafPre                     Early     0.1460    0.1327  2.47     1.10  0.3668   A
     24  LeafPre                     Late      0.1540    0.1437  3.43     1.07  0.3534   A
```

```
---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=0.96769 maxSD=0.97244 ----------

       Sample_   Field_                              Standard                  Pr >  Let
   Obs Type       Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

    25 LeafPre     DC    Bass                  0.1284    0.2352  11.5     0.55  0.5956   A
    26 LeafPre     FS    Bass                0.004577    0.2124  7.64     0.02  0.9834   A
    27 LeafPre     DC    Corsica               0.1279    0.2275  10.1     0.56  0.5862   A
    28 LeafPre     FS    Corsica             0.006374    0.2160  8.08     0.03  0.9772   A
    29 LeafPre     DC    Jack                  0.3073    0.2352  11.5     1.31  0.2169   A
    30 LeafPre     FS    Jack                -0.00404    0.2139  7.87    -0.02  0.9854   A
    31 LeafPre     DC    Williams82            0.6050    0.2351  11.4     2.57  0.0252   A
    32 LeafPre     FS    Williams82           0.02441    0.2139  7.87     0.11  0.9120   A


-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=5.20394 maxSD=5.20394 ---------------

        Sample_   Field_                              Standard                  Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

      1  LeafPost    DC                        2.6540    1.5350  1.79     1.73  0.2405   A
      2  LeafPost    FS                       0.04513    1.5197  1.72     0.03  0.9794   A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=1.25991 maxSD=1.30451 ----------------

       Sample_   Field_                              Standard                  Pr >  Let
   Obs Type       Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

     3 LeafPost          Bass                  1.3415    1.3362   1.1     1.00  0.4860   A
     4 LeafPost          Corsica               1.1701    1.3396  1.11     0.87  0.5306   A
     5 LeafPost          Jack                  1.5686    1.3346   1.1     1.18  0.4352   A
     6 LeafPost          Williams82            1.3180    1.3457  1.13     0.98  0.4907   A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.73829 maxSD=0.73829 -----------------

        Sample_   Field_                              Standard                  Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

      7  LeafPost                    Early     1.2311    1.3268  1.07     0.93  0.5153   A
      8  LeafPost                    Late      1.4680    1.3113  1.02     1.12  0.4609   A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=3.87634 maxSD=5.28021 ----------

       Sample_   Field_                              Standard                  Pr >  Let
   Obs Type       Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

     9 LeafPost    DC    Bass                  2.6507    1.5728  1.97     1.69  0.2357   A
    10 LeafPost    DC    Corsica               2.2178    1.5834  2.02     1.40  0.2949   A
    11 LeafPost    DC    Jack                  3.1263    1.5797     2     1.98  0.1862   A
    12 LeafPost    DC    Williams82            2.6210    1.5820  2.02     1.66  0.2385   A
    13 LeafPost    FS    Bass                 0.03227    1.5855  2.04     0.02  0.9856   A
    14 LeafPost    FS    Corsica               0.1223    1.5862  2.05     0.08  0.9454   A
    15 LeafPost    FS    Jack                 0.01096    1.5732  1.98     0.01  0.9951   A
    16 LeafPost    FS    Williams82           0.01497    1.6083  2.16     0.01  0.9934   A


-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=1.00422 maxSD=1.00422 ---------------

        Sample_   Field_                              Standard                  Pr >  Let
```

```
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

     17  LeafPre     DC                       0.2921    0.1786  3.96     1.64  0.1779   A
     18  LeafPre     FS                     0.007830    0.1693  3.17     0.05  0.9659   A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.49498 maxSD=0.49906 ----------------

        Sample_   Field_                                    Standard                   Pr >  Let
   Obs  Type       Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

    19  LeafPre           Bass              0.06647    0.1666  5.67     0.40  0.7045    A
    20  LeafPre           Corsica           0.06714    0.1648  5.42     0.41  0.6992    A
    21  LeafPre           Jack               0.1516    0.1669  5.73     0.91  0.4003    A
    22  LeafPre           Williams82         0.3147    0.1669   5.7     1.89  0.1108    A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.22465 maxSD=0.22465 -----------------

         Sample_   Field_                                   Standard                   Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

     23  LeafPre                    Early     0.1460    0.1327  2.47     1.10  0.3668   A
     24  LeafPre                    Late      0.1540    0.1437  3.43     1.07  0.3534   A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=0.86443 maxSD=0.99503 ----------

        Sample_   Field_                                    Standard                   Pr >  Let
   Obs  Type       Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

    25  LeafPre     DC    Bass               0.1284    0.2352  11.5     0.55  0.5956    A
    26  LeafPre     DC    Corsica            0.1279    0.2275  10.1     0.56  0.5862    A
    27  LeafPre     DC    Jack               0.3073    0.2352  11.5     1.31  0.2169    A
    28  LeafPre     DC    Williams82         0.6050    0.2351  11.4     2.57  0.0252    A
    29  LeafPre     FS    Bass             0.004577    0.2124  7.64     0.02  0.9834    A
    30  LeafPre     FS    Corsica          0.006374    0.2160  8.08     0.03  0.9772    A
    31  LeafPre     FS    Jack             -0.00404    0.2139  7.87    -0.02  0.9854    A
    32  LeafPre     FS    Williams82        0.02441    0.2139  7.87     0.11  0.9120    A


-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=5.20394 maxSD=5.20394 ---------------

         Sample_   Field_                                   Standard                   Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

      1  LeafPost    DC                       2.6540    1.5350  1.79     1.73  0.2405   A
      2  LeafPost    FS                      0.04513    1.5197  1.72     0.03  0.9794   A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=1.25991 maxSD=1.30451 ----------------

        Sample_   Field_                                    Standard                   Pr >  Let
   Obs  Type       Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

     3  LeafPost          Bass               1.3415    1.3362   1.1     1.00  0.4860    A
     4  LeafPost          Corsica            1.1701    1.3396  1.11     0.87  0.5306    A
     5  LeafPost          Jack               1.5686    1.3346   1.1     1.18  0.4352    A
     6  LeafPost          Williams82         1.3180    1.3457  1.13     0.98  0.4907    A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.73829 maxSD=0.73829 -----------------

         Sample_   Field_                                   Standard                   Pr >  Let
```

```
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

      7  LeafPost                    Early     1.2311    1.3268  1.07     0.93  0.5153   A
      8  LeafPost                    Late      1.4680    1.3113  1.02     1.12  0.4609   A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=3.87634 maxSD=5.28021 ----------

        Sample_   Field_                                Standard                  Pr >  Let
   Obs  Type       Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

     9  LeafPost    DC    Bass                  2.6507    1.5728  1.97     1.69  0.2357   A
    10  LeafPost    DC    Corsica               2.2178    1.5834  2.02     1.40  0.2949   A
    11  LeafPost    DC    Jack                  3.1263    1.5797     2     1.98  0.1862   A
    12  LeafPost    DC    Williams82            2.6210    1.5820  2.02     1.66  0.2385   A
    13  LeafPost    FS    Bass                 0.03227    1.5855  2.04     0.02  0.9856   A
    14  LeafPost    FS    Corsica               0.1223    1.5862  2.05     0.08  0.9454   A
    15  LeafPost    FS    Jack                 0.01096    1.5732  1.98     0.01  0.9951   A
    16  LeafPost    FS    Williams82           0.01497    1.6083  2.16     0.01  0.9934   A


-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=1.00422 maxSD=1.00422 ---------------

         Sample_   Field_                              Standard                  Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

     17  LeafPre     DC                        0.2921    0.1786  3.96     1.64  0.1779   A
     18  LeafPre     FS                      0.007830    0.1693  3.17     0.05  0.9659   A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.49498 maxSD=0.49906 ----------------

        Sample_   Field_                                Standard                  Pr >  Let
   Obs  Type       Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

    19  LeafPre           Bass                 0.06647    0.1666  5.67     0.40  0.7045   A
    20  LeafPre           Corsica              0.06714    0.1648  5.42     0.41  0.6992   A
    21  LeafPre           Jack                  0.1516    0.1669  5.73     0.91  0.4003   A
    22  LeafPre           Williams82            0.3147    0.1669   5.7     1.89  0.1108   A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.22465 maxSD=0.22465 -----------------

         Sample_   Field_                              Standard                  Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

     23  LeafPre                     Early     0.1460    0.1327  2.47     1.10  0.3668   A
     24  LeafPre                     Late      0.1540    0.1437  3.43     1.07  0.3534   A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=0.86443 maxSD=0.99503 ----------

        Sample_   Field_                                Standard                  Pr >  Let
   Obs  Type       Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

    25  LeafPre     DC    Bass                  0.1284    0.2352  11.5     0.55  0.5956   A
    26  LeafPre     DC    Corsica               0.1279    0.2275  10.1     0.56  0.5862   A
    27  LeafPre     DC    Jack                  0.3073    0.2352  11.5     1.31  0.2169   A
    28  LeafPre     DC    Williams82            0.6050    0.2351  11.4     2.57  0.0252   A
    29  LeafPre     FS    Bass                0.004577    0.2124  7.64     0.02  0.9834   A
    30  LeafPre     FS    Corsica             0.006374    0.2160  8.08     0.03  0.9772   A
    31  LeafPre     FS    Jack                -0.00404    0.2139  7.87    -0.02  0.9854   A
    32  LeafPre     FS    Williams82           0.02441    0.2139  7.87     0.11  0.9120   A
```

Genistein Analysis

```
------------------------------------- Sample_Type=LeafPost -------------------------------------

                                      The Mixed Procedure

                                       Model Information

                     Data Set                     WORK.NEWHPLC
                     Dependent Variable           Genistein
                     Covariance Structure         Variance Components
                     Estimation Method            REML
                     Residual Variance Method     Profile
                     Fixed Effects SE Method      Model-Based
                     Degrees of Freedom Method    Containment


                                    Class Level Information

                     Class         Levels    Values

                     Year               2    2002 2003
                     Farm               2    PHill Wye
                     Field_Type         2    DC FS
                     Block              3    1 2 3
                     Cultivar           4    Bass Corsica Jack Williams82
                     Timing             2    Early Late


                                          Dimensions

                              Covariance Parameters            8
                              Columns in X                    51
                              Columns in Z                   298
                              Subjects                         1
                              Max Obs Per Subject            158
                              Observations Used              158
                              Observations Not Used            0
                              Total Observations             158


                                       Iteration History

                  Iteration    Evaluations    -2 Res Log Like       Criterion

                          0              1        98.33895094
                          1              4        98.13867694      0.00951723
                          2              3        97.98700591      0.00152020
                          3              2        97.91210953      0.00005542
                          4              1        97.90739946      0.00000065
                          5              1        97.90734718      0.00000000


                                   Convergence criteria met.

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------------------------------------- Sample_Type=LeafPost -------------------------------------

                                      The Mixed Procedure

                                Covariance Parameter Estimates

                               Cov Parm                 Estimate
```

```
                     Year                    5.91E-20
                     Year*Farm                      0
                     Year*Farm*Field_Type    0.002435
                     Bloc(Year*Farm*Fiel)           0
                     Year*Farm*Bloc*Culti           0
                     Yea*Far*Blo*Cul*Timi           0
                     Ye*Fa*Fi*Blo*Cul*Tim           0
                     Residual                 0.08747


                              Fit Statistics

                   -2 Res Log Likelihood            97.9
                   AIC (smaller is better)         101.9
                   AICC (smaller is better)        102.0
                   BIC (smaller is better)          99.3


                       Type 3 Tests of Fixed Effects

                                  Num     Den
             Effect                DF      DF    F Value    Pr > F

             Farm                   1       1       6.58    0.2366
             Field_Type             1       2       0.26    0.6637
             Farm*Field_Type        1       2       0.04    0.8685
             Cultivar               3      26       0.35    0.7919
             Field_Type*Cultivar    3      26       0.51    0.6784
             Timing                 1      26      19.58    0.0002
             Field_Type*Timing      1      26       1.27    0.2704
             Cultivar*Timing        3      26       0.11    0.9525
             Field_*Cultiv*Timing   3      26       0.90    0.4536


------------------------------------ Sample_Type=LeafPre ------------------------------------

                           The Mixed Procedure

                            Model Information

               Data Set                     WORK.NEWHPLC
               Dependent Variable           Genistein
               Covariance Structure         Variance Components
               Estimation Method            REML
               Residual Variance Method     Profile
               Fixed Effects SE Method      Model-Based
               Degrees of Freedom Method    Containment


                         Class Level Information

               Class         Levels    Values

               Year               2    2002 2003
               Farm               2    PHill Wye
               Field_Type         2    DC FS
               Block              3    1 2 3
               Cultivar           4    Bass Corsica Jack Williams82
               Timing             2    Early Late


                                Dimensions
```

```
                 Covariance Parameters            8
                 Columns in X                    51
                 Columns in Z                   329
                 Subjects                         1
                 Max Obs Per Subject            250
                 Observations Used              250
                 Observations Not Used            0
                 Total Observations             250


                          Iteration History

     Iteration    Evaluations    -2 Res Log Like       Criterion

             0              1      -103.23537154
             1              3      -109.63260505      0.00227340
             2              3      -110.28409590      0.00024626
             3              1      -110.35360269      0.00000168
             4              1      -110.35405670      0.00000000


                      Convergence criteria met.


------------------------------------ Sample_Type=LeafPre ------------------------------------

                         The Mixed Procedure

                   Covariance Parameter Estimates

                  Cov Parm                 Estimate

                  Year                            0
                  Year*Farm                0.001385
                  Year*Farm*Field_Type            0
                  Bloc(Year*Farm*Fiel)            0
                  Year*Farm*Bloc*Culti     1.41E-20
                  Yea*Far*Blo*Cul*Timi            0
                  Ye*Fa*Fi*Blo*Cul*Tim     0.009942
                  Residual                  0.02125


                           Fit Statistics

                 -2 Res Log Likelihood          -110.4
                 AIC (smaller is better)        -104.4
                 AICC (smaller is better)       -104.2
                 BIC (smaller is better)        -108.3


                    Type 3 Tests of Fixed Effects

                             Num     Den
      Effect                  DF      DF    F Value    Pr > F

      Farm                     1       1       0.01    0.9439
      Field_Type               1       2       1.61    0.3322
      Farm*Field_Type          1       2      20.57    0.0453
      Cultivar                 3      33       4.64    0.0082
      Field_Type*Cultivar      3      36       0.52    0.6705
      Timing                   1      36       4.66    0.0376
      Field_Type*Timing        1      36       0.13    0.7199
      Cultivar*Timing          3      36       1.98    0.1349
      Field_*Cultiv*Timing     3      36       0.04    0.9901
```

```
--------------------------------------- Sample_Type=Seed ---------------------------------------

                                     The Mixed Procedure

                                      Model Information

                     Data Set                     WORK.NEWHPLC
                     Dependent Variable           Genistein
                     Covariance Structure         Variance Components
                     Estimation Method            REML
                     Residual Variance Method     Profile
                     Fixed Effects SE Method      Model-Based
                     Degrees of Freedom Method    Containment


                                   Class Level Information

                     Class         Levels    Values

                     Year               2    2002 2003
                     Farm               2    PHill Wye
                     Field_Type         2    DC FS
                     Block              3    1 2 3
                     Cultivar           4    Bass Corsica Jack Williams82
                     Timing             3    Control Early Late


                                         Dimensions

                              Covariance Parameters            8
                              Columns in X                    66
                              Columns in Z                   514
                              Subjects                         1
                              Max Obs Per Subject            288
                              Observations Used              288
                              Observations Not Used            0
                              Total Observations             288


                                      Iteration History

                  Iteration    Evaluations    -2 Res Log Like       Criterion

                          0              1       370.53513501
                          1              2        57.91741166      0.00034508
                          2              1        57.83937474      0.00000434
                          3              1        57.83844633      0.00000000


                                  Convergence criteria met.


--------------------------------------- Sample_Type=Seed ---------------------------------------

                                     The Mixed Procedure

                               Covariance Parameter Estimates

                               Cov Parm                Estimate

                               Year                     0.07428
                               Year*Farm                      0
```

```
                               Year*Farm*Field_Type       0.1688
                               Bloc(Year*Farm*Fiel)     0.002278
                               Year*Farm*Bloc*Culti     0.004029
                               Yea*Far*Blo*Cul*Timi            0
                               Ye*Fa*Fi*Blo*Cul*Tim            0
                               Residual                  0.04797


                                        Fit Statistics

                             -2 Res Log Likelihood           57.8
                             AIC (smaller is better)         67.8
                             AICC (smaller is better)        68.1
                             BIC (smaller is better)         61.3


                                 Type 3 Tests of Fixed Effects

                                            Num     Den
                   Effect                    DF      DF    F Value    Pr > F

                   Farm                       1       1       0.00    0.9876
                   Field_Type                 1       2       3.65    0.1961
                   Farm*Field_Type            1       2       0.00    0.9613
                   Cultivar                   3      33       3.27    0.0332
                   Field_Type*Cultivar        3     117       3.72    0.0135
                   Timing                     2      88       2.05    0.1349
                   Field_Type*Timing          2     117       1.63    0.2002
                   Cultivar*Timing            6      88       1.41    0.2185
                   Field_*Cultiv*Timing       6     117       1.14    0.3423


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.11509 maxSD=0.11509 -----------------

      Sample_         Field_                              Standard                   Pr >  Let
 Obs  Type      Farm   Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

   1  LeafPost                          Early     0.3135   0.04955    26     6.33  <.0001   A
   2  LeafPost                          Late     0.06578   0.03882    26     1.69  0.1021   B


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.21001 maxSD=0.21783 ----------------

     Sample_         Field_                              Standard                   Pr >  Let
Obs  Type      Farm   Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

  3  LeafPost                Bass                  0.2310   0.05772    26     4.00  0.0005   A
  4  LeafPost                Corsica               0.1534   0.05907    26     2.60  0.0153   A
  5  LeafPost                Jack                  0.1832   0.05493    26     3.34  0.0026   A
  6  LeafPost                Williams82            0.1909   0.06122    26     3.12  0.0044   A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=0.31518 maxSD=0.36645 ----------

     Sample_         Field_                              Standard                   Pr >  Let
Obs  Type      Farm   Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

  7  LeafPost          DC    Bass                  0.2709   0.07460    26     3.63  0.0012   A
  8  LeafPost          DC    Corsica               0.1125   0.07864    26     1.43  0.1644   A
  9  LeafPost          DC    Jack                  0.2121   0.07306    26     2.90  0.0074   A
 10  LeafPost          DC    Williams82            0.2329   0.07434    26     3.13  0.0043   A
 11  LeafPost          FS    Bass                  0.1910   0.08811    26     2.17  0.0395   A
 12  LeafPost          FS    Corsica               0.1943   0.08816    26     2.20  0.0366   A
 13  LeafPost          FS    Jack                  0.1544   0.08205    26     1.88  0.0712   A
```

```
 14  LeafPost          FS    Williams82           0.1490   0.09728    26     1.53  0.1378   A


------------ Effect=Farm*Field_Type A=Tukey-Kramer(.05) avgSD=0.5254 maxSD=0.54268 -------------

      Sample_          Field_                             Standard                  Pr >  Let
 Obs  Type      Farm    Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

  15  LeafPost  PHill    DC                        0.1202   0.07588     2     1.58  0.2539   A
  16  LeafPost  Wye      DC                        0.2940   0.05340     2     5.51  0.0314   A
  17  LeafPost  PHill    FS                       0.09713   0.07321     2     1.33  0.3158   A
  18  LeafPost  Wye      FS                        0.2472   0.05977     2     4.14  0.0538   A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.05882 maxSD=0.05882 -----------------

      Sample_         Field_                             Standard                  Pr >  Let
 Obs  Type      Farm   Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

  19  LeafPre                           Early     0.1562   0.02549    36     6.13  <.0001   A
  20  LeafPre                           Late     0.09361   0.03017    36     3.10  0.0037   B


---------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.1017 maxSD=0.10263 ----------------

     Sample_         Field_                               Standard                  Pr >  Let
Obs  Type      Farm   Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

 21  LeafPre                 Bass                  0.1227   0.03355    33     3.66  0.0009  AB
 22  LeafPre                 Corsica              0.06064   0.03279    33     1.85  0.0734  B
 23  LeafPre                 Jack                  0.1172   0.03304    33     3.55  0.0012  AB
 24  LeafPre                 Williams82            0.1992   0.03327    33     5.99  <.0001  A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=0.15184 maxSD=0.1704 -----------

     Sample_         Field_                               Standard                  Pr >  Let
Obs  Type      Farm   Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

 25  LeafPre           DC    Bass                  0.1636   0.04795    36     3.41  0.0016  A
 26  LeafPre           DC    Corsica              0.08541   0.04546    36     1.88  0.0684  A
 27  LeafPre           DC    Jack                  0.1316   0.04667    36     2.82  0.0078  A
 28  LeafPre           DC    Williams82            0.1939   0.04723    36     4.10  0.0002  A
 29  LeafPre           FS    Bass                 0.08184   0.03856    36     2.12  0.0408  AB
 30  LeafPre           FS    Corsica              0.03587   0.03906    36     0.92  0.3646  B
 31  LeafPre           FS    Jack                  0.1027   0.03866    36     2.66  0.0117  AB
 32  LeafPre           FS    Williams82            0.2044   0.03865    36     5.29  <.0001  A


------------ Effect=Farm*Field_Type A=Tukey-Kramer(.05) avgSD=0.32596 maxSD=0.34817 ------------

      Sample_          Field_                             Standard                  Pr >  Let
 Obs  Type      Farm    Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

  33  LeafPre   PHill    DC                       0.08060   0.04838     2     1.67  0.2376   A
  34  LeafPre   Wye      DC                        0.2066   0.03525     2     5.86  0.0279   A
  35  LeafPre   PHill    FS                        0.1734   0.03449     2     5.03  0.0373   A
  36  LeafPre   Wye      FS                       0.03901   0.03809     2     1.02  0.4135   A


----------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.0755 maxSD=0.07565 -----------------

      Sample_         Field_                             Standard                  Pr >  Let
 Obs  Type      Farm   Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp
```

```
  37  Seed                              Contr     0.2836    0.2427    88     1.17  0.2459   A
  38  Seed                              Early     0.3254    0.2427    88     1.34  0.1836   A
  39  Seed                              Late      0.2624    0.2428    88     1.08  0.2827   A


---------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.1213 maxSD=0.12183 ----------------

      Sample_         Field_                              Standard                   Pr >  Let
 Obs  Type      Farm   Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

  40  Seed                    Bass                0.2361    0.2436    33     0.97  0.3395  B
  41  Seed                    Corsica             0.2505    0.2436    33     1.03  0.3114  AB


---------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.1213 maxSD=0.12183 ----------------
                                          (continued)

     Sample_         Field_                                Standard                   Pr >  Let
Obs  Type      Farm   Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

 42  Seed                    Jack                  0.3162    0.2436    33     1.30  0.2033  AB
 43  Seed                    Williams82            0.3591    0.2437    33     1.47  0.1500  A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=0.16037 maxSD=0.16239 ----------

     Sample_         Field_                                Standard                   Pr >  Let
Obs  Type      Farm   Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

 44  Seed              DC    Bass                  0.4603    0.2849   117     1.62  0.1088  B
 45  Seed              DC    Corsica               0.5009    0.2850   117     1.76  0.0814  B
 46  Seed              DC    Jack                  0.6323    0.2850   117     2.22  0.0284  AB
 47  Seed              DC    Williams82            0.6857    0.2851   117     2.40  0.0177  A
 48  Seed              FS    Bass                 0.01182    0.2850   117     0.04  0.9670  A
 49  Seed              FS    Corsica              8.2E-15    0.2850   117     0.00  1.0000  A
 50  Seed              FS    Jack                8.27E-15    0.2850   117     0.00  1.0000  A
 51  Seed              FS    Williams82           0.03245    0.2850   117     0.11  0.9095  A


------------ Effect=Farm*Field_Type A=Tukey-Kramer(.05) avgSD=2.43779 maxSD=2.43781 ------------

      Sample_          Field_                              Standard                   Pr >  Let
 Obs  Type      Farm    Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

  52  Seed      PHill    DC                         0.5589    0.3504     2     1.60  0.2517   A
  53  Seed      Wye      DC                         0.5807    0.3504     2     1.66  0.2393   A
  54  Seed      PHill    FS                        0.01623    0.3504     2     0.05  0.9673   A
  55  Seed      Wye      FS                       0.005912    0.3504     2     0.02  0.9881   A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.11509 maxSD=0.11509 -----------------

      Sample_         Field_                              Standard                   Pr >  Let
 Obs  Type      Farm   Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

   1  LeafPost                          Early     0.3135   0.04955    26     6.33  <.0001   A
   2  LeafPost                          Late     0.06578   0.03882    26     1.69  0.1021   B


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.21001 maxSD=0.21783 ----------------

     Sample_         Field_                                Standard                   Pr >  Let
Obs  Type      Farm   Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp
```

```
  3  LeafPost                Bass                 0.2310   0.05772    26     4.00  0.0005   A
  4  LeafPost                Corsica              0.1534   0.05907    26     2.60  0.0153   A
  5  LeafPost                Jack                 0.1832   0.05493    26     3.34  0.0026   A
  6  LeafPost                Williams82           0.1909   0.06122    26     3.12  0.0044   A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=0.28941 maxSD=0.30424 ----------

     Sample_         Field_                                Standard                 Pr >  Let
Obs  Type      Farm   Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

  7  LeafPost          DC    Bass                 0.2709   0.07460    26     3.63  0.0012   A
  8  LeafPost          FS    Bass                 0.1910   0.08811    26     2.17  0.0395   A
  9  LeafPost          DC    Corsica              0.1125   0.07864    26     1.43  0.1644   A
 10  LeafPost          FS    Corsica              0.1943   0.08816    26     2.20  0.0366   A
 11  LeafPost          DC    Jack                 0.2121   0.07306    26     2.90  0.0074   A
 12  LeafPost          FS    Jack                 0.1544   0.08205    26     1.88  0.0712   A
 13  LeafPost          DC    Williams82           0.2329   0.07434    26     3.13  0.0043   A
 14  LeafPost          FS    Williams82           0.1490   0.09728    26     1.53  0.1378   A


------------ Effect=Farm*Field_Type A=Tukey-Kramer(.05) avgSD=0.63645 maxSD=0.73051 ------------

      Sample_          Field_                              Standard                 Pr >  Let
 Obs  Type      Farm    Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

  15  LeafPost  PHill    DC                       0.1202   0.07588     2     1.58  0.2539   A
  16  LeafPost  PHill    FS                      0.09713   0.07321     2     1.33  0.3158   A
  17  LeafPost  Wye      DC                       0.2940   0.05340     2     5.51  0.0314   A
  18  LeafPost  Wye      FS                       0.2472   0.05977     2     4.14  0.0538   A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.05882 maxSD=0.05882 -----------------

      Sample_         Field_                              Standard                 Pr >  Let
 Obs  Type      Farm   Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

  19  LeafPre                           Early     0.1562   0.02549    36     6.13  <.0001   A
  20  LeafPre                           Late     0.09361   0.03017    36     3.10  0.0037   B

---------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.1017 maxSD=0.10263 ----------------

     Sample_         Field_                                Standard                 Pr >  Let
Obs  Type      Farm   Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

 21  LeafPre                 Bass                 0.1227   0.03355    33     3.66  0.0009  AB
 22  LeafPre                 Corsica             0.06064   0.03279    33     1.85  0.0734  B
 23  LeafPre                 Jack                 0.1172   0.03304    33     3.55  0.0012  AB
 24  LeafPre                 Williams82           0.1992   0.03327    33     5.99  <.0001  A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=0.13362 maxSD=0.13545 ----------

     Sample_         Field_                                Standard                 Pr >  Let
Obs  Type      Farm   Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

 25  LeafPre           DC    Bass                 0.1636   0.04795    36     3.41  0.0016   A
 26  LeafPre           FS    Bass                0.08184   0.03856    36     2.12  0.0408   A
 27  LeafPre           DC    Corsica             0.08541   0.04546    36     1.88  0.0684   A
 28  LeafPre           FS    Corsica             0.03587   0.03906    36     0.92  0.3646   A
 29  LeafPre           DC    Jack                 0.1316   0.04667    36     2.82  0.0078   A
 30  LeafPre           FS    Jack                 0.1027   0.03866    36     2.66  0.0117   A
 31  LeafPre           DC    Williams82           0.1939   0.04723    36     4.10  0.0002   A
```

```
 32  LeafPre           FS    Williams82           0.2044   0.03865    36     5.29  <.0001   A


------------ Effect=Farm*Field_Type A=Tukey-Kramer(.05) avgSD=0.35021 maxSD=0.42745 ------------

      Sample_          Field_                                   Standard                  Pr >  Let
 Obs  Type      Farm    Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

  33  LeafPre   PHill    DC                       0.08060   0.04838     2     1.67  0.2376   A
  34  LeafPre   PHill    FS                        0.1734   0.03449     2     5.03  0.0373   A
  35  LeafPre   Wye      DC                        0.2066   0.03525     2     5.86  0.0279   A
  36  LeafPre   Wye      FS                       0.03901   0.03809     2     1.02  0.4135   A


----------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.0755 maxSD=0.07565 -----------------

      Sample_         Field_                                  Standard                  Pr >  Let
 Obs  Type      Farm   Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

  37  Seed                              Contr     0.2836    0.2427    88     1.17  0.2459   A
  38  Seed                              Early     0.3254    0.2427    88     1.34  0.1836   A
  39  Seed                              Late      0.2624    0.2428    88     1.08  0.2827   A


---------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.1213 maxSD=0.12183 ----------------

      Sample_         Field_                                  Standard                  Pr >  Let
 Obs  Type      Farm   Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

  40  Seed                    Bass                0.2361    0.2436    33     0.97  0.3395  B
  41  Seed                    Corsica             0.2505    0.2436    33     1.03  0.3114  AB


---------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.1213 maxSD=0.12183 ----------------
                                          (continued)

     Sample_         Field_                                     Standard                  Pr >  Let
Obs  Type      Farm   Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

 42  Seed                    Jack                  0.3162    0.2436    33     1.30  0.2033  AB
 43  Seed                    Williams82            0.3591    0.2437    33     1.47  0.1500  A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=0.7021 maxSD=0.70244 -----------

     Sample_         Field_                                     Standard                  Pr >  Let
Obs  Type      Farm   Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

 44  Seed             DC    Bass                  0.4603    0.2849   117     1.62  0.1088   A
 45  Seed             FS    Bass                 0.01182    0.2850   117     0.04  0.9670   A
 46  Seed             DC    Corsica               0.5009    0.2850   117     1.76  0.0814   A
 47  Seed             FS    Corsica              8.2E-15    0.2850   117     0.00  1.0000   A
 48  Seed             DC    Jack                  0.6323    0.2850   117     2.22  0.0284   A
 49  Seed             FS    Jack                8.27E-15    0.2850   117     0.00  1.0000   A
 50  Seed             DC    Williams82            0.6857    0.2851   117     2.40  0.0177   A
 51  Seed             FS    Williams82           0.03245    0.2850   117     0.11  0.9095   A


------------ Effect=Farm*Field_Type A=Tukey-Kramer(.05) avgSD=2.86619 maxSD=2.86716 ------------

      Sample_          Field_                                   Standard                  Pr >  Let
 Obs  Type      Farm    Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

  52  Seed      PHill    DC                        0.5589    0.3504     2     1.60  0.2517   A
```

```
  53  Seed      PHill    FS                      0.01623    0.3504     2     0.05  0.9673   A
  54  Seed      Wye      DC                       0.5807    0.3504     2     1.66  0.2393   A
  55  Seed      Wye      FS                     0.005912    0.3504     2     0.02  0.9881   A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.11509 maxSD=0.11509 -----------------

      Sample_         Field_                              Standard                  Pr >  Let
 Obs  Type      Farm   Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

   1  LeafPost                          Early     0.3135   0.04955    26     6.33  <.0001   A
   2  LeafPost                          Late     0.06578   0.03882    26     1.69  0.1021   B


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.21001 maxSD=0.21783 ----------------

     Sample_         Field_                              Standard                  Pr >  Let
Obs  Type      Farm   Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

  3  LeafPost               Bass                   0.2310   0.05772    26     4.00  0.0005   A
  4  LeafPost               Corsica                0.1534   0.05907    26     2.60  0.0153   A
  5  LeafPost               Jack                   0.1832   0.05493    26     3.34  0.0026   A
  6  LeafPost               Williams82             0.1909   0.06122    26     3.12  0.0044   A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=0.37066 maxSD=0.41162 ----------

     Sample_         Field_                              Standard                  Pr >  Let
Obs  Type      Farm   Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

  7  LeafPost          DC    Bass                  0.2709   0.07460    26     3.63  0.0012   A
  8  LeafPost          DC    Corsica               0.1125   0.07864    26     1.43  0.1644   A
  9  LeafPost          DC    Jack                  0.2121   0.07306    26     2.90  0.0074   A
 10  LeafPost          DC    Williams82            0.2329   0.07434    26     3.13  0.0043   A
 11  LeafPost          FS    Bass                  0.1910   0.08811    26     2.17  0.0395   A
 12  LeafPost          FS    Corsica               0.1943   0.08816    26     2.20  0.0366   A
 13  LeafPost          FS    Jack                  0.1544   0.08205    26     1.88  0.0712   A
 14  LeafPost          FS    Williams82            0.1490   0.09728    26     1.53  0.1378   A


------------ Effect=Farm*Field_Type A=Tukey-Kramer(.05) avgSD=0.63645 maxSD=0.73051 ------------

      Sample_          Field_                            Standard                  Pr >  Let
 Obs  Type      Farm    Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

  15  LeafPost  PHill    DC                        0.1202   0.07588     2     1.58  0.2539   A
  16  LeafPost  PHill    FS                       0.09713   0.07321     2     1.33  0.3158   A
  17  LeafPost  Wye      DC                        0.2940   0.05340     2     5.51  0.0314   A
  18  LeafPost  Wye      FS                        0.2472   0.05977     2     4.14  0.0538   A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.05882 maxSD=0.05882 -----------------

      Sample_         Field_                              Standard                  Pr >  Let
 Obs  Type      Farm   Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

  19  LeafPre                           Early     0.1562   0.02549    36     6.13  <.0001   A
  20  LeafPre                           Late     0.09361   0.03017    36     3.10  0.0037   B


---------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.1017 maxSD=0.10263 ----------------

     Sample_         Field_                              Standard                  Pr >  Let
Obs  Type      Farm   Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp
```

```
 21  LeafPre                Bass                0.1227   0.03355    33     3.66  0.0009  AB
 22  LeafPre                Corsica            0.06064   0.03279    33     1.85  0.0734  B
 23  LeafPre                Jack                0.1172   0.03304    33     3.55  0.0012  AB
 24  LeafPre                Williams82          0.1992   0.03327    33     5.99  <.0001  A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=0.17332 maxSD=0.19086 ----------

     Sample_         Field_                                Standard                 Pr >  Let
Obs  Type      Farm   Type   Cultivar    Timing  Estimate   Error      DF  t Value    |t|  Grp

 25  LeafPre           DC    Bass                0.1636   0.04795    36     3.41  0.0016  AB
 26  LeafPre           DC    Corsica            0.08541   0.04546    36     1.88  0.0684  AB
 27  LeafPre           DC    Jack                0.1316   0.04667    36     2.82  0.0078  AB
 28  LeafPre           DC    Williams82          0.1939   0.04723    36     4.10  0.0002  AB
 29  LeafPre           FS    Bass               0.08184   0.03856    36     2.12  0.0408  AB
 30  LeafPre           FS    Corsica            0.03587   0.03906    36     0.92  0.3646  B
 31  LeafPre           FS    Jack                0.1027   0.03866    36     2.66  0.0117  AB
 32  LeafPre           FS    Williams82          0.2044   0.03865    36     5.29  <.0001  A


------------ Effect=Farm*Field_Type A=Tukey-Kramer(.05) avgSD=0.35021 maxSD=0.42745 ------------

      Sample_          Field_                              Standard                 Pr >  Let
 Obs  Type      Farm     Type   Cultivar  Timing  Estimate   Error      DF  t Value    |t|  Grp

  33  LeafPre   PHill    DC                      0.08060   0.04838     2     1.67  0.2376   A
  34  LeafPre   PHill    FS                       0.1734   0.03449     2     5.03  0.0373   A
  35  LeafPre   Wye      DC                       0.2066   0.03525     2     5.86  0.0279   A
  36  LeafPre   Wye      FS                      0.03901   0.03809     2     1.02  0.4135   A


----------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.0755 maxSD=0.07565 -----------------

      Sample_         Field_                              Standard                 Pr >  Let
 Obs  Type      Farm    Type   Cultivar  Timing  Estimate   Error      DF  t Value    |t|  Grp

  37  Seed                               Contr     0.2836    0.2427    88     1.17  0.2459   A
  38  Seed                               Early     0.3254    0.2427    88     1.34  0.1836   A
  39  Seed                               Late      0.2624    0.2428    88     1.08  0.2827   A


---------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.1213 maxSD=0.12183 ----------------

      Sample_         Field_                              Standard                 Pr >  Let
 Obs  Type      Farm    Type   Cultivar  Timing  Estimate   Error      DF  t Value    |t|  Grp

  40  Seed                     Bass                0.2361    0.2436    33     0.97  0.3395  B
  41  Seed                     Corsica             0.2505    0.2436    33     1.03  0.3114  AB

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---------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.1213 maxSD=0.12183 ----------------
                                            (continued)

     Sample_         Field_                                Standard                 Pr >  Let
Obs  Type      Farm   Type   Cultivar    Timing  Estimate   Error      DF  t Value    |t|  Grp

 42  Seed                    Jack                0.3162    0.2436    33     1.30  0.2033  AB
 43  Seed                    Williams82          0.3591    0.2437    33     1.47  0.1500  A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=0.59969 maxSD=0.91682 ----------
```

```
     Sample_         Field_                                Standard                   Pr >  Let
Obs  Type      Farm   Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

 44  Seed              DC    Bass                  0.4603    0.2849   117     1.62  0.1088  B
 45  Seed              DC    Corsica               0.5009    0.2850   117     1.76  0.0814  B
 46  Seed              DC    Jack                  0.6323    0.2850   117     2.22  0.0284  AB
 47  Seed              DC    Williams82            0.6857    0.2851   117     2.40  0.0177  A
 48  Seed              FS    Bass                 0.01182    0.2850   117     0.04  0.9670  AB
 49  Seed              FS    Corsica              8.2E-15    0.2850   117     0.00  1.0000  AB
 50  Seed              FS    Jack                8.27E-15    0.2850   117     0.00  1.0000  AB
 51  Seed              FS    Williams82           0.03245    0.2850   117     0.11  0.9095  AB


------------ Effect=Farm*Field_Type A=Tukey-Kramer(.05) avgSD=2.86619 maxSD=2.86716 ------------

      Sample_          Field_                              Standard                   Pr >  Let
 Obs  Type      Farm    Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

  52  Seed      PHill    DC                        0.5589    0.3504     2     1.60  0.2517   A
  53  Seed      PHill    FS                       0.01623    0.3504     2     0.05  0.9673   A
  54  Seed      Wye      DC                        0.5807    0.3504     2     1.66  0.2393   A
  55  Seed      Wye      FS                      0.005912    0.3504     2     0.02  0.9881   A
```

Total Isoflavone Analysis

```
------------------------------------ Sample_Type=LeafPost ------------------------------------

                                    The Mixed Procedure

                                     Model Information

                    Data Set                     WORK.NEWHPLC
                    Dependent Variable           Total_Iso
                    Covariance Structure         Variance Components
                    Estimation Method            REML
                    Residual Variance Method     Profile
                    Fixed Effects SE Method      Model-Based
                    Degrees of Freedom Method    Containment


                                  Class Level Information

                    Class         Levels    Values

                    Year               2    2002 2003
                    Farm               2    PHill Wye
                    Field_Type         2    DC FS
                    Block              3    1 2 3
                    Cultivar           4    Bass Corsica Jack Williams82
                    Timing             2    Early Late


                                        Dimensions

                             Covariance Parameters            8
                             Columns in X                    51
                             Columns in Z                   298
                             Subjects                         1
                             Max Obs Per Subject            158
                             Observations Used              158
                             Observations Not Used            0
                             Total Observations             158


                                     Iteration History

                 Iteration    Evaluations    -2 Res Log Like       Criterion

                         0              1      1131.98530584
                         1              4      1085.01518006      0.03637163
                         2              2      1084.41881731      0.00205476
                         3              3      1083.92871574       .
                         4              1      1083.91484049      0.00000022
                         5              1      1083.91474817      0.00000000


------------------------------------ Sample_Type=LeafPost ------------------------------------

                                    The Mixed Procedure

                                 Convergence criteria met.


                              Covariance Parameter Estimates

                             Cov Parm                 Estimate
```

```
                 Year                      58.3395
                 Year*Farm                       0
                 Year*Farm*Field_Type      49.5690
                 Bloc(Year*Farm*Fiel)       0.4479
                 Year*Farm*Bloc*Culti            0
                 Yea*Far*Blo*Cul*Timi     2.82E-17
                 Ye*Fa*Fi*Blo*Cul*Tim            0
                 Residual                  93.9313


                          Fit Statistics

               -2 Res Log Likelihood          1083.9
               AIC (smaller is better)        1091.9
               AICC (smaller is better)       1092.2
               BIC (smaller is better)        1086.7


                   Type 3 Tests of Fixed Effects

                             Num     Den
     Effect                   DF      DF    F Value    Pr > F

     Farm                      1       1       0.86    0.5235
     Field_Type                1       2       1.14    0.3976
     Farm*Field_Type           1       2       0.37    0.6038
     Cultivar                  3      26       0.62    0.6103
     Field_Type*Cultivar       3      26       0.08    0.9680
     Timing                    1      26       5.67    0.0249
     Field_Type*Timing         1      26       0.89    0.3553
     Cultivar*Timing           3      26       0.15    0.9290
     Field_*Cultiv*Timing      3      26       0.00    0.9999


------------------------------------ Sample_Type=LeafPre ------------------------------------

                         The Mixed Procedure

                          Model Information

       Data Set                     WORK.NEWHPLC
       Dependent Variable           Total_Iso
       Covariance Structure         Variance Components
       Estimation Method            REML
       Residual Variance Method     Profile
       Fixed Effects SE Method      Model-Based
       Degrees of Freedom Method    Containment


                       Class Level Information

       Class         Levels    Values

       Year               2    2002 2003
       Farm               2    PHill Wye
       Field_Type         2    DC FS
       Block              3    1 2 3
       Cultivar           4    Bass Corsica Jack Williams82
       Timing             2    Early Late


                             Dimensions

                  Covariance Parameters            8
```

```
          Columns in X                    51
          Columns in Z                   329
          Subjects                         1
          Max Obs Per Subject            250
          Observations Used              250
          Observations Not Used            0
          Total Observations             250


                   Iteration History

Iteration    Evaluations    -2 Res Log Like       Criterion

        0              1      1256.77579809
        1              2      1157.75456467      0.03972301
        2              3      1156.54707231       .
        3              3      1142.18808955       .
        4              2      1140.31937424       .
        5              2      1139.84390098      0.00027467
        6              1      1139.72701639      0.00004032
        7              1      1139.71114530      0.00000128
        8              1      1139.71067845      0.00000000


------------------------------------ Sample_Type=LeafPre ------------------------------------

                     The Mixed Procedure

                  Convergence criteria met.


              Covariance Parameter Estimates

           Cov Parm                 Estimate

           Year                       3.8407
           Year*Farm                       0
           Year*Farm*Field_Type       7.8084
           Bloc(Year*Farm*Fiel)       0.9708
           Year*Farm*Bloc*Culti       0.5946
           Yea*Far*Blo*Cul*Timi            0
           Ye*Fa*Fi*Blo*Cul*Tim       5.3032
           Residual                   2.4367


                      Fit Statistics

         -2 Res Log Likelihood          1139.7
         AIC (smaller is better)        1151.7
         AICC (smaller is better)       1152.1
         BIC (smaller is better)        1143.9


               Type 3 Tests of Fixed Effects

                          Num     Den
 Effect                    DF      DF    F Value    Pr > F

 Farm                       1       1       0.20    0.7295
 Field_Type                 1       2       2.94    0.2287
 Farm*Field_Type            1       2       0.00    0.9905
 Cultivar                   3      33       5.36    0.0041
 Field_Type*Cultivar        3      36       1.39    0.2607
 Timing                     1      36       0.65    0.4237
```

```
                Field_Type*Timing         1      36       0.21    0.6493
                Cultivar*Timing           3      36       0.88    0.4586
                Field_*Cultiv*Timing      3      36       0.70    0.5601

                                Total Isoflavone Analysis                                  37

------------------------------------- Sample_Type=Seed -------------------------------------

                                   The Mixed Procedure

                                    Model Information

                  Data Set                     WORK.NEWHPLC
                  Dependent Variable           Total_Iso
                  Covariance Structure         Variance Components
                  Estimation Method            REML
                  Residual Variance Method     Profile
                  Fixed Effects SE Method      Model-Based
                  Degrees of Freedom Method    Containment


                                 Class Level Information

                  Class         Levels    Values

                  Year               2    2002 2003
                  Farm               2    PHill Wye
                  Field_Type         2    DC FS
                  Block              3    1 2 3
                  Cultivar           4    Bass Corsica Jack Williams82
                  Timing             3    Control Early Late


                                       Dimensions

                           Covariance Parameters            8
                           Columns in X                    66
                           Columns in Z                   514
                           Subjects                         1
                           Max Obs Per Subject            288
                           Observations Used              288
                           Observations Not Used            0
                           Total Observations             288


                                    Iteration History

               Iteration    Evaluations    -2 Res Log Like       Criterion

                       0              1      2704.75692835
                       1              2      2334.47798241      0.00458326
                       2              1      2329.14773499      0.00143209
                       3              1      2327.55637447      0.00025582
                       4              1      2327.28508141      0.00002807
                       5              1      2327.25561882      0.00000210
                       6              1      2327.25355325      0.00000003
                       7              1      2327.25352980      0.00000000


------------------------------------- Sample_Type=Seed -------------------------------------

                                   The Mixed Procedure

                                Convergence criteria met.
```

```
                                Covariance Parameter Estimates

                               Cov Parm                 Estimate

                               Year                      1724.80
                               Year*Farm                 56.3131
                               Year*Farm*Field_Type       8.2692
                               Bloc(Year*Farm*Fiel)       8.8683
                               Year*Farm*Bloc*Culti       162.65
                               Yea*Far*Blo*Cul*Timi            0
                               Ye*Fa*Fi*Blo*Cul*Tim            0
                               Residual                   238.91


                                        Fit Statistics

                             -2 Res Log Likelihood          2327.3
                             AIC (smaller is better)        2339.3
                             AICC (smaller is better)       2339.6
                             BIC (smaller is better)        2331.4


                                 Type 3 Tests of Fixed Effects

                                            Num     Den
                   Effect                    DF      DF    F Value    Pr > F

                   Farm                       1       1       0.37    0.6522
                   Field_Type                 1       2     156.83    0.0063
                   Farm*Field_Type            1       2       9.00    0.0955
                   Cultivar                   3      33      12.00    <.0001
                   Field_Type*Cultivar        3     117       2.46    0.0661
                   Timing                     2      88       1.92    0.1530
                   Field_Type*Timing          2     117       0.07    0.9336
                   Cultivar*Timing            6      88       1.18    0.3255
                   Field_*Cultiv*Timing       6     117       0.48    0.8252


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=3.96493 maxSD=3.96493 -----------------

         Sample_   Field_                              Standard                   Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

      1  LeafPost                    Early    17.2497    6.1869    26     2.79  0.0098   A
      2  LeafPost                    Late     12.6574    6.0938    26     2.08  0.0478   B


---------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=6.90134 maxSD=7.1467 ----------------

        Sample_   Field_                                Standard                   Pr >  Let
   Obs  Type       Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

     3  LeafPost          Bass                 16.5346    6.2421    26     2.65  0.0135   A
     4  LeafPost          Corsica              14.9727    6.2612    26     2.39  0.0243   A
     5  LeafPost          Jack                 13.2539    6.2308    26     2.13  0.0431   A
     6  LeafPost          Williams82           15.0530    6.2939    26     2.39  0.0243   A


-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=23.6802 maxSD=23.6802 ---------------

         Sample_   Field_                              Standard                   Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp
```

```
      7  LeafPost    DC                      17.8904    6.6932     2     2.67  0.1161   A
      8  LeafPost    FS                      12.0167    6.6255     2     1.81  0.2114   A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=10.3561 maxSD=12.0822 ----------

        Sample_   Field_                             Standard                  Pr >  Let
   Obs  Type       Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

     9  LeafPost    DC    Bass                 20.1814    6.9332    26     2.91  0.0073   A
    10  LeafPost    DC    Corsica              17.9201    6.9941    26     2.56  0.0165   A
    11  LeafPost    DC    Jack                 15.7492    6.9640    26     2.26  0.0323   A
    12  LeafPost    DC    Williams82           17.7108    6.9776    26     2.54  0.0175   A
    13  LeafPost    FS    Bass                 12.8878    7.0303    26     1.83  0.0783   A
    14  LeafPost    FS    Corsica              12.0252    7.0340    26     1.71  0.0993   A
    15  LeafPost    FS    Jack                 10.7586    6.9549    26     1.55  0.1340   A
    16  LeafPost    FS    Williams82           12.3953    7.1648    26     1.73  0.0955   A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=1.02007 maxSD=1.02007 -----------------

         Sample_   Field_                             Standard                  Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

     17  LeafPre                     Early     6.7914    1.7458    36     3.89  0.0004   A
     18  LeafPre                     Late      6.3843    1.7639    36     3.62  0.0009   A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=1.94968 maxSD=1.96691 ----------------

        Sample_   Field_                             Standard                  Pr >  Let
   Obs  Type       Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

    19  LeafPre           Bass                  5.8598    1.7931    33     3.27  0.0025  B
    20  LeafPre           Corsica               5.5757    1.7898    33     3.12  0.0038  B
    21  LeafPre           Jack                  6.7220    1.7924    33     3.75  0.0007  AB
    22  LeafPre           Williams82            8.1939    1.7926    33     4.57  <.0001  A


-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=8.95777 maxSD=8.95777 ---------------

         Sample_   Field_                             Standard                  Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

     23  LeafPre     DC                        8.3721    2.0326     2     4.12  0.0542   A
     24  LeafPre     FS                        4.8036    2.0171     2     2.38  0.1402   A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=2.78206 maxSD=3.06882 ----------

        Sample_   Field_                             Standard                  Pr >  Let
   Obs  Type       Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

    25  LeafPre     DC    Bass                  7.2428    2.1374    36     3.39  0.0017  AB
    26  LeafPre     DC    Corsica               6.8400    2.1207    36     3.23  0.0027  B
    27  LeafPre     DC    Jack                  8.8435    2.1336    36     4.14  0.0002  AB
    28  LeafPre     DC    Williams82           10.5622    2.1342    36     4.95  <.0001  A
    29  LeafPre     FS    Bass                  4.4768    2.0867    36     2.15  0.0387  A
    30  LeafPre     FS    Corsica               4.3114    2.0931    36     2.06  0.0467  A
    31  LeafPre     FS    Jack                  4.6004    2.0889    36     2.20  0.0341  A
    32  LeafPre     FS    Williams82            5.8257    2.0890    36     2.79  0.0084  A
```

```
---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=5.33208 maxSD=5.34452 -----------------

         Sample_   Field_                              Standard                   Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

     33  Seed                        Contr    81.5628   29.7282    88     2.74  0.0074   A
     34  Seed                        Early    83.3463   29.7280    88     2.80  0.0062   A
     35  Seed                        Late     78.9871   29.7288    88     2.66  0.0094   A


---------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=15.725 maxSD=15.747 -----------------

         Sample_   Field_                              Standard                   Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

     36  Seed              Bass               76.0548   29.9117    33     2.54  0.0159   B
     37  Seed              Corsica            79.4908   29.9125    33     2.66  0.0120   B
     38  Seed              Jack               68.1615   29.9125    33     2.28  0.0293   B


---------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=15.725 maxSD=15.747 -----------------
                                          (continued)

        Sample_   Field_                                Standard                   Pr >  Let
   Obs  Type       Type    Cultivar   Timing  Estimate   Error      DF  t Value     |t|  Grp

    39  Seed              Williams82            101.49   29.9149    33     3.39  0.0018   A


-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=12.8745 maxSD=12.8745 ---------------

         Sample_   Field_                              Standard                   Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

     40  Seed        DC                        100.03   29.7381     2     3.36  0.0782   A
     41  Seed        FS                       62.5627   29.7378     2     2.10  0.1701   B


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=17.6294 maxSD=17.7335 ----------

        Sample_   Field_                                Standard                   Pr >  Let
   Obs  Type       Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

    42  Seed        DC    Bass                 97.6779   29.9872   117     3.26  0.0015   B
    43  Seed        DC    Corsica              94.8169   29.9913   117     3.16  0.0020   B
    44  Seed        DC    Jack                 88.6347   29.9913   117     2.96  0.0038   B
    45  Seed        DC    Williams82            119.01   30.0010   117     3.97  0.0001   A
    46  Seed        FS    Bass                 54.4317   29.9922   117     1.81  0.0721   B
    47  Seed        FS    Corsica              64.1647   29.9913   117     2.14  0.0345   B
    48  Seed        FS    Jack                 47.6883   29.9913   117     1.59  0.1145   B
    49  Seed        FS    Williams82           83.9661   29.9913   117     2.80  0.0060   A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=3.96493 maxSD=3.96493 -----------------

         Sample_   Field_                              Standard                   Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

      1  LeafPost                    Early    17.2497    6.1869    26     2.79  0.0098   A
      2  LeafPost                    Late     12.6574    6.0938    26     2.08  0.0478   B


---------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=6.90134 maxSD=7.1467 ----------------
```

```
        Sample_   Field_                                Standard                   Pr >  Let
   Obs  Type       Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

     3  LeafPost          Bass                 16.5346    6.2421    26     2.65  0.0135   A
     4  LeafPost          Corsica              14.9727    6.2612    26     2.39  0.0243   A
     5  LeafPost          Jack                 13.2539    6.2308    26     2.13  0.0431   A
     6  LeafPost          Williams82           15.0530    6.2939    26     2.39  0.0243   A


-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=23.6802 maxSD=23.6802 ---------------

         Sample_   Field_                              Standard                   Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

      7  LeafPost    DC                       17.8904    6.6932     2     2.67  0.1161   A
      8  LeafPost    FS                       12.0167    6.6255     2     1.81  0.2114   A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=15.6721 maxSD=16.0247 ----------

        Sample_   Field_                                Standard                   Pr >  Let
   Obs  Type       Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

     9  LeafPost    DC    Bass                 20.1814    6.9332    26     2.91  0.0073   A
    10  LeafPost    FS    Bass                 12.8878    7.0303    26     1.83  0.0783   A
    11  LeafPost    DC    Corsica              17.9201    6.9941    26     2.56  0.0165   A
    12  LeafPost    FS    Corsica              12.0252    7.0340    26     1.71  0.0993   A
    13  LeafPost    DC    Jack                 15.7492    6.9640    26     2.26  0.0323   A
    14  LeafPost    FS    Jack                 10.7586    6.9549    26     1.55  0.1340   A
    15  LeafPost    DC    Williams82           17.7108    6.9776    26     2.54  0.0175   A
    16  LeafPost    FS    Williams82           12.3953    7.1648    26     1.73  0.0955   A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=1.02007 maxSD=1.02007 -----------------

         Sample_   Field_                              Standard                   Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

     17  LeafPre                     Early     6.7914    1.7458    36     3.89  0.0004   A
     18  LeafPre                     Late      6.3843    1.7639    36     3.62  0.0009   A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=1.94968 maxSD=1.96691 ----------------

        Sample_   Field_                                Standard                   Pr >  Let
   Obs  Type       Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

    19  LeafPre           Bass                  5.8598    1.7931    33     3.27  0.0025  B
    20  LeafPre           Corsica               5.5757    1.7898    33     3.12  0.0038  B
    21  LeafPre           Jack                  6.7220    1.7924    33     3.75  0.0007  AB
    22  LeafPre           Williams82            8.1939    1.7926    33     4.57  <.0001  A


-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=8.95777 maxSD=8.95777 ---------------

         Sample_   Field_                              Standard                   Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

     23  LeafPre     DC                        8.3721    2.0326     2     4.12  0.0542   A
     24  LeafPre     FS                        4.8036    2.0171     2     2.38  0.1402   A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=5.45098 maxSD=5.45719 ----------
```

```
        Sample_   Field_                               Standard                  Pr >  Let
   Obs  Type       Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

    25  LeafPre     DC    Bass                  7.2428    2.1374    36     3.39  0.0017   A
    26  LeafPre     FS    Bass                  4.4768    2.0867    36     2.15  0.0387   A
    27  LeafPre     DC    Corsica               6.8400    2.1207    36     3.23  0.0027   A
    28  LeafPre     FS    Corsica               4.3114    2.0931    36     2.06  0.0467   A
    29  LeafPre     DC    Jack                  8.8435    2.1336    36     4.14  0.0002   A
    30  LeafPre     FS    Jack                  4.6004    2.0889    36     2.20  0.0341   A
    31  LeafPre     DC    Williams82           10.5622    2.1342    36     4.95  <.0001   A
    32  LeafPre     FS    Williams82            5.8257    2.0890    36     2.79  0.0084   A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=5.33208 maxSD=5.34452 -----------------

         Sample_   Field_                              Standard                  Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

     33  Seed                        Contr    81.5628   29.7282    88     2.74  0.0074   A
     34  Seed                        Early    83.3463   29.7280    88     2.80  0.0062   A
     35  Seed                        Late     78.9871   29.7288    88     2.66  0.0094   A


---------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=15.725 maxSD=15.747 -----------------

         Sample_   Field_                              Standard                  Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

     36  Seed              Bass               76.0548   29.9117    33     2.54  0.0159   B
     37  Seed              Corsica            79.4908   29.9125    33     2.66  0.0120   B
     38  Seed              Jack               68.1615   29.9125    33     2.28  0.0293   B


---------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=15.725 maxSD=15.747 -----------------
                                          (continued)

        Sample_   Field_                               Standard                  Pr >  Let
   Obs  Type       Type    Cultivar   Timing  Estimate   Error      DF  t Value     |t|  Grp

    39  Seed              Williams82             101.49   29.9149    33     3.39  0.0018   A


-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=12.8745 maxSD=12.8745 ---------------

         Sample_   Field_                              Standard                  Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

     40  Seed        DC                        100.03   29.7381     2     3.36  0.0782   A
     41  Seed        FS                       62.5627   29.7378     2     2.10  0.1701   B


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=10.3431 maxSD=10.474 -----------

        Sample_   Field_                               Standard                  Pr >  Let
   Obs  Type       Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

    42  Seed        DC    Bass                 97.6779   29.9872   117     3.26  0.0015   A
    43  Seed        FS    Bass                 54.4317   29.9922   117     1.81  0.0721   B
    44  Seed        DC    Corsica              94.8169   29.9913   117     3.16  0.0020   A
    45  Seed        FS    Corsica              64.1647   29.9913   117     2.14  0.0345   B
    46  Seed        DC    Jack                 88.6347   29.9913   117     2.96  0.0038   A
    47  Seed        FS    Jack                 47.6883   29.9913   117     1.59  0.1145   B
    48  Seed        DC    Williams82            119.01   30.0010   117     3.97  0.0001   A
    49  Seed        FS    Williams82           83.9661   29.9913   117     2.80  0.0060   B
```

```
---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=3.96493 maxSD=3.96493 -----------------

        Sample_   Field_                              Standard                  Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

      1  LeafPost                    Early    17.2497    6.1869    26     2.79  0.0098   A
      2  LeafPost                    Late     12.6574    6.0938    26     2.08  0.0478   B


---------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=6.90134 maxSD=7.1467 ----------------

       Sample_   Field_                              Standard                  Pr >  Let
   Obs  Type       Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

     3  LeafPost          Bass                 16.5346    6.2421    26     2.65  0.0135   A
     4  LeafPost          Corsica              14.9727    6.2612    26     2.39  0.0243   A
     5  LeafPost          Jack                 13.2539    6.2308    26     2.13  0.0431   A
     6  LeafPost          Williams82           15.0530    6.2939    26     2.39  0.0243   A


-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=23.6802 maxSD=23.6802 ---------------

        Sample_   Field_                              Standard                  Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

      7  LeafPost    DC                       17.8904    6.6932     2     2.67  0.1161   A
      8  LeafPost    FS                       12.0167    6.6255     2     1.81  0.2114   A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=16.8407 maxSD=21.2745 ----------

       Sample_   Field_                              Standard                  Pr >  Let
   Obs  Type       Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

     9  LeafPost    DC    Bass                 20.1814    6.9332    26     2.91  0.0073   A
    10  LeafPost    DC    Corsica              17.9201    6.9941    26     2.56  0.0165   A
    11  LeafPost    DC    Jack                 15.7492    6.9640    26     2.26  0.0323   A
    12  LeafPost    DC    Williams82           17.7108    6.9776    26     2.54  0.0175   A
    13  LeafPost    FS    Bass                 12.8878    7.0303    26     1.83  0.0783   A
    14  LeafPost    FS    Corsica              12.0252    7.0340    26     1.71  0.0993   A
    15  LeafPost    FS    Jack                 10.7586    6.9549    26     1.55  0.1340   A
    16  LeafPost    FS    Williams82           12.3953    7.1648    26     1.73  0.0955   A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=1.02007 maxSD=1.02007 -----------------

        Sample_   Field_                              Standard                  Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

     17  LeafPre                     Early     6.7914    1.7458    36     3.89  0.0004   A
     18  LeafPre                     Late      6.3843    1.7639    36     3.62  0.0009   A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=1.94968 maxSD=1.96691 ----------------

       Sample_   Field_                              Standard                  Pr >  Let
   Obs  Type       Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

    19  LeafPre           Bass                  5.8598    1.7931    33     3.27  0.0025  B
    20  LeafPre           Corsica               5.5757    1.7898    33     3.12  0.0038  B
    21  LeafPre           Jack                  6.7220    1.7924    33     3.75  0.0007  AB
    22  LeafPre           Williams82            8.1939    1.7926    33     4.57  <.0001  A
```

```
-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=8.95777 maxSD=8.95777 ---------------

         Sample_   Field_                             Standard                   Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

     23  LeafPre     DC                        8.3721    2.0326     2     4.12  0.0542   A
     24  LeafPre     FS                        4.8036    2.0171     2     2.38  0.1402   A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=5.46178 maxSD=7.26754 ----------

        Sample_   Field_                               Standard                   Pr >  Let
   Obs  Type       Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

    25  LeafPre     DC    Bass                  7.2428    2.1374    36     3.39  0.0017  AB
    26  LeafPre     DC    Corsica               6.8400    2.1207    36     3.23  0.0027  B
    27  LeafPre     DC    Jack                  8.8435    2.1336    36     4.14  0.0002  AB
    28  LeafPre     DC    Williams82           10.5622    2.1342    36     4.95  <.0001  A
    29  LeafPre     FS    Bass                  4.4768    2.0867    36     2.15  0.0387  AB
    30  LeafPre     FS    Corsica               4.3114    2.0931    36     2.06  0.0467  AB
    31  LeafPre     FS    Jack                  4.6004    2.0889    36     2.20  0.0341  AB
    32  LeafPre     FS    Williams82            5.8257    2.0890    36     2.79  0.0084  AB


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=5.33208 maxSD=5.34452 -----------------

         Sample_   Field_                             Standard                   Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

     33  Seed                        Contr    81.5628   29.7282    88     2.74  0.0074   A
     34  Seed                        Early    83.3463   29.7280    88     2.80  0.0062   A
     35  Seed                        Late     78.9871   29.7288    88     2.66  0.0094   A


---------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=15.725 maxSD=15.747 -----------------

         Sample_   Field_                             Standard                   Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

     36  Seed              Bass               76.0548   29.9117    33     2.54  0.0159   B
     37  Seed              Corsica            79.4908   29.9125    33     2.66  0.0120   B
     38  Seed              Jack               68.1615   29.9125    33     2.28  0.0293   B


---------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=15.725 maxSD=15.747 -----------------
                                          (continued)

        Sample_   Field_                               Standard                   Pr >  Let
   Obs  Type       Type    Cultivar   Timing  Estimate   Error      DF  t Value     |t|  Grp

    39  Seed              Williams82             101.49   29.9149    33     3.39  0.0018   A


-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=12.8745 maxSD=12.8745 ---------------

         Sample_   Field_                             Standard                   Pr >  Let
    Obs  Type       Type   Cultivar  Timing  Estimate   Error      DF  t Value     |t|  Grp

     40  Seed        DC                        100.03   29.7381     2     3.36  0.0782   A
     41  Seed        FS                       62.5627   29.7378     2     2.10  0.1701   B
```

```
---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=19.3182 maxSD=21.0769 ----------

       Sample_   Field_                                Standard                  Pr >  Let
  Obs  Type       Type   Cultivar    Timing  Estimate   Error      DF  t Value     |t|  Grp

   42  Seed        DC    Bass                 97.6779   29.9872   117     3.26  0.0015   B
   43  Seed        DC    Corsica              94.8169   29.9913   117     3.16  0.0020   B
   44  Seed        DC    Jack                 88.6347   29.9913   117     2.96  0.0038   B
   45  Seed        DC    Williams82            119.01   30.0010   117     3.97  0.0001   A
   46  Seed        FS    Bass                 54.4317   29.9922   117     1.81  0.0721   C
   47  Seed        FS    Corsica              64.1647   29.9913   117     2.14  0.0345   C
   48  Seed        FS    Jack                 47.6883   29.9913   117     1.59  0.1145   C
   49  Seed        FS    Williams82           83.9661   29.9913   117     2.80  0.0060   B
```

Output Yield, Seed Weight, Protein, and Oil Analysis – Lactofen Study

Yield

```
                   The Mixed Procedure

                    Model Information

     Data Set                     WORK.SEED
     Dependent Variable           Yield
     Covariance Structure         Variance Components
     Estimation Method            REML
     Residual Variance Method     Profile
     Fixed Effects SE Method      Model-Based
     Degrees of Freedom Method    Satterthwaite


                 Class Level Information

     Class         Levels    Values

     Year               2    2002 2003
     Farm               2    P W
     Field_Type         2    D F
     Cultivar           4    BASS CORC JACK WM82
     Timing             3    c e l
     Rep                3    1 2 3


                       Dimensions

              Covariance Parameters            7
              Columns in X                    66
              Columns in Z                   230
              Subjects                         1
              Max Obs Per Subject            288
              Observations Used              211
              Observations Not Used           77
              Total Observations             288


                    Iteration History

  Iteration    Evaluations    -2 Res Log Like       Criterion

          0              1      2921.44318929
          1              2      2891.22230764      0.00014496
          2              1      2891.01824823      0.00000457
          3              1      2891.01229461      0.00000001


                 Convergence criteria met.



                   The Mixed Procedure

              Covariance Parameter Estimates

               Cov Parm                Estimate
```

```
                               Year                        25122
                               Year*Farm                       0
                               Year*Farm*Field_Type            0
                               Rep(Year*Farm*Field)        39081
                               Year*Farm*Cultiv*Rep        90667
                               Yea*Far*Cul*Timi*Rep            0
                               Residual                   191355


                                        Fit Statistics

                             -2 Res Log Likelihood          2891.0
                             AIC (smaller is better)        2899.0
                             AICC (smaller is better)       2899.2
                             BIC (smaller is better)        2893.8


                                 Type 3 Tests of Fixed Effects

                                            Num     Den
                   Effect                    DF      DF    F Value    Pr > F

                   Farm                       1    16.6       2.18    0.1583
                   Field_Type                 1    8.68       7.46    0.0240
                   Farm*Field_Type            1    9.04       4.82    0.0556
                   Cultivar                   3    29.4       0.76    0.5253
                   Field_Type*Cultivar        3     171       1.29    0.2791
                   Timing                     2     133       0.57    0.5661
                   Field_Type*Timing          2     133       2.20    0.1146
                   Cultivar*Timing            6     134       0.91    0.4917
                   Field_*Cultiv*Timing       6     133       0.77    0.5935

---------------------- Effect=Cultivar A=' ' avgSD=412.899 maxSD=414.306 -----------------------

       Field_                                      Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  1                BASS                 2061.79      164.08    1.96      12.57    0.0068
  2                CORC                 2197.05      163.89    1.95      13.41    0.0061
  3                JACK                 1995.79      163.71    1.94      12.19    0.0074
  4                WM82                 2167.52      164.24    1.97      13.20    0.0061


----------------- Effect=Field_*Cultiv*Timing A=' ' avgSD=948.936 maxSD=1133.7 -----------------

       Field_                                      Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  5      D         BASS        c        2642.09      220.41    6.16      11.99    <.0001
  6      D         BASS        e        2184.80      220.41    6.16       9.91    <.0001
  7      D         BASS        l        2049.26      236.58    8.03       8.66    <.0001
  8      D         CORC        c        2469.07      220.38    6.15      11.20    <.0001
  9      D         CORC        e        2334.66      220.38    6.15      10.59    <.0001
 10      D         CORC        l        2551.46      228.26    7.06      11.18    <.0001
 11      D         JACK        c        2243.94      220.40    6.16      10.18    <.0001
 12      D         JACK        e        2063.68      220.40    6.16       9.36    <.0001
 13      D         JACK        l        2159.77      220.40    6.16       9.80    <.0001
 14      D         WM82        c        2263.53      220.58    6.17      10.26    <.0001
 15      D         WM82        e        2080.65      220.58    6.17       9.43    <.0001
 16      D         WM82        l        2397.04      220.58    6.17      10.87    <.0001
 17      F         BASS        c        1806.06      236.43    8.01       7.64    <.0001
 18      F         BASS        e        1901.45      220.47    6.16       8.62    0.0001
 19      F         BASS        l        1787.06      212.48    5.36       8.41    0.0003
 20      F         CORC        c        1973.72      220.37    6.16       8.96    <.0001
```

```
 21      F         CORC        e        1865.62      220.37    6.16       8.47    0.0001
 22      F         CORC        l        1987.74      220.37    6.16       9.02    <.0001
 23      F         JACK        c        1831.45      236.16    7.99       7.76    <.0001
 24      F         JACK        e        1808.06      216.11    5.72       8.37    0.0002
 25      F         JACK        l        1867.85      216.15    5.72       8.64    0.0002
 26      F         WM82        c        1916.44      248.24    9.58       7.72    <.0001
 27      F         WM82        e        2267.65      212.39    5.35      10.68    <.0001
 28      F         WM82        l        2079.78      227.79    6.96       9.13    <.0001


--------------------- Effect=Field_Type A=' ' avgSD=301.791 maxSD=301.791 ----------------------

       Field_                                      Standard                         Pr >     Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|     Grp

 29      D                              2286.66      150.49    1.35      15.19    0.0178
 30      F                              1924.41      150.49    1.35      12.79    0.0225


----------------------- Effect=Timing A=' ' avgSD=178.536 maxSD=182.538 ------------------------

       Field_                                      Standard                         Pr >     Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|     Grp

 31                            c        2143.29      142.57    1.13      15.03    0.0308
 32                            e        2063.32      141.27    1.09      14.61    0.0351
 33                            l        2109.99      141.90    1.11      14.87    0.0328


-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=301.791 maxSD=301.791 ---------------

       Field_                                      Standard                         Pr >     Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|     Grp

  1      D                              2286.66      150.49    1.35      15.19    0.0178      A
  2      F                              1924.41      150.49    1.35      12.79    0.0225      B


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=178.536 maxSD=182.538 -----------------

       Field_                                      Standard                         Pr >     Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|     Grp

  3                            c        2143.29      142.57    1.13      15.03    0.0308      A
  4                            e        2063.32      141.27    1.09      14.61    0.0351      A
  5                            l        2109.99      141.90    1.11      14.87    0.0328      A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=412.899 maxSD=414.306 ----------------

       Field_                                      Standard                         Pr >     Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|     Grp

  6                BASS                 2061.79      164.08    1.96      12.57    0.0068      A
  7                CORC                 2197.05      163.89    1.95      13.41    0.0061      A
  8                JACK                 1995.79      163.71    1.94      12.19    0.0074      A
  9                WM82                 2167.52      164.24    1.97      13.20    0.0061      A


--------- Effect=Field_*Cultiv*Timing A=Tukey-Kramer(.05) avgSD=855.293 maxSD=995.393 ----------

       Field_                                      Standard                         Pr >     Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|     Grp
```

```
 10      D         BASS        c        2642.09      220.41    6.16      11.99    <.0001     A
 11      D         BASS        e        2184.80      220.41    6.16       9.91    <.0001     A
 12      D         BASS        l        2049.26      236.58    8.03       8.66    <.0001     A
 13      D         CORC        c        2469.07      220.38    6.15      11.20    <.0001     A
 14      D         CORC        e        2334.66      220.38    6.15      10.59    <.0001     A
 15      D         CORC        l        2551.46      228.26    7.06      11.18    <.0001     A
 16      D         JACK        c        2243.94      220.40    6.16      10.18    <.0001     A
 17      D         JACK        e        2063.68      220.40    6.16       9.36    <.0001     A
 18      D         JACK        l        2159.77      220.40    6.16       9.80    <.0001     A
 19      D         WM82        c        2263.53      220.58    6.17      10.26    <.0001     A
 20      D         WM82        e        2080.65      220.58    6.17       9.43    <.0001     A
 21      D         WM82        l        2397.04      220.58    6.17      10.87    <.0001     A
 22      F         BASS        c        1806.06      236.43    8.01       7.64    <.0001     A
 23      F         BASS        e        1901.45      220.47    6.16       8.62    0.0001     A
 24      F         BASS        l        1787.06      212.48    5.36       8.41    0.0003     A
 25      F         CORC        c        1973.72      220.37    6.16       8.96    <.0001     A
 26      F         CORC        e        1865.62      220.37    6.16       8.47    0.0001     A
 27      F         CORC        l        1987.74      220.37    6.16       9.02    <.0001     A
 28      F         JACK        c        1831.45      236.16    7.99       7.76    <.0001     A


--------- Effect=Field_*Cultiv*Timing A=Tukey-Kramer(.05) avgSD=855.293 maxSD=995.393 ----------
                                           (continued)

       Field_                                        Standard                           Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 29      F         JACK        e        1808.06      216.11    5.72       8.37    0.0002     A
 30      F         JACK        l        1867.85      216.15    5.72       8.64    0.0002     A
 31      F         WM82        c        1916.44      248.24    9.58       7.72    <.0001     A
 32      F         WM82        e        2267.65      212.39    5.35      10.68    <.0001     A
 33      F         WM82        l        2079.78      227.79    6.96       9.13    <.0001     A




-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=301.791 maxSD=301.791 ---------------

       Field_                                        Standard                           Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  1      D                              2286.66      150.49    1.35      15.19    0.0178     A
  2      F                              1924.41      150.49    1.35      12.79    0.0225     B


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=178.536 maxSD=182.538 -----------------

       Field_                                        Standard                           Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  3                             c       2143.29      142.57    1.13      15.03    0.0308     A
  4                             e       2063.32      141.27    1.09      14.61    0.0351     A
  5                             l       2109.99      141.90    1.11      14.87    0.0328     A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=412.899 maxSD=414.306 ----------------

       Field_                                        Standard                           Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  6                BASS                 2061.79      164.08    1.96      12.57    0.0068     A
  7                CORC                 2197.05      163.89    1.95      13.41    0.0061     A
  8                JACK                 1995.79      163.71    1.94      12.19    0.0074     A
  9                WM82                 2167.52      164.24    1.97      13.20    0.0061     A
```

```
---------- Effect=Field_*Cultiv*Timing A=Tukey-Kramer(.05) avgSD=875.906 maxSD=988.85 ----------

       Field_                                     Standard                        Pr >     Let
Obs     Type     Cultivar    Timing    Estimate      Error        DF    t Value       |t|     Grp

 10       D         BASS        c       2642.09      220.41     6.16      11.99    <.0001      A
 11       D         CORC        c       2469.07      220.38     6.15      11.20    <.0001      A
 12       D         JACK        c       2243.94      220.40     6.16      10.18    <.0001      A
 13       D         WM82        c       2263.53      220.58     6.17      10.26    <.0001      A
 14       F         BASS        c       1806.06      236.43     8.01       7.64    <.0001      A
 15       F         CORC        c       1973.72      220.37     6.16       8.96    <.0001      A
 16       F         JACK        c       1831.45      236.16     7.99       7.76    <.0001      A
 17       F         WM82        c       1916.44      248.24     9.58       7.72    <.0001      A
 18       D         BASS        e       2184.80      220.41     6.16       9.91    <.0001      A
 19       D         CORC        e       2334.66      220.38     6.15      10.59    <.0001      A
 20       D         JACK        e       2063.68      220.40     6.16       9.36    <.0001      A
 21       D         WM82        e       2080.65      220.58     6.17       9.43    <.0001      A
 22       F         BASS        e       1901.45      220.47     6.16       8.62    0.0001      A
 23       F         CORC        e       1865.62      220.37     6.16       8.47    0.0001      A
 24       F         JACK        e       1808.06      216.11     5.72       8.37    0.0002      A
 25       F         WM82        e       2267.65      212.39     5.35      10.68    <.0001      A
 26       D         BASS        l       2049.26      236.58     8.03       8.66    <.0001      A
 27       D         CORC        l       2551.46      228.26     7.06      11.18    <.0001      A
 28       D         JACK        l       2159.77      220.40     6.16       9.80    <.0001      A


---------- Effect=Field_*Cultiv*Timing A=Tukey-Kramer(.05) avgSD=875.906 maxSD=988.85 ----------
                                             (continued)

       Field_                                     Standard                        Pr >     Let
Obs     Type     Cultivar    Timing    Estimate      Error        DF    t Value       |t|     Grp

 29       D         WM82        l       2397.04      220.58     6.17      10.87    <.0001      A
 30       F         BASS        l       1787.06      212.48     5.36       8.41    0.0003      A
 31       F         CORC        l       1987.74      220.37     6.16       9.02    <.0001      A
 32       F         JACK        l       1867.85      216.15     5.72       8.64    0.0002      A
 33       F         WM82        l       2079.78      227.79     6.96       9.13    <.0001      A
```

Seed Weight / 100

```
                     Model Information

   Data Set                     WORK.SEED
   Dependent Variable           HndSedWt
   Covariance Structure         Variance Components
   Estimation Method            REML
   Residual Variance Method     Profile
   Fixed Effects SE Method      Model-Based
   Degrees of Freedom Method    Containment


                  Class Level Information

   Class         Levels    Values

   Year               2    2002 2003
   Farm               2    P W
   Field_Type         2    D F
   Cultivar           4    BASS CORC JACK WM82
   Timing             3    c e l
   Rep                3    1 2 3


                        Dimensions

            Covariance Parameters            7
            Columns in X                    66
            Columns in Z                   230
            Subjects                         1
            Max Obs Per Subject            288
            Observations Used              288
            Observations Not Used            0
            Total Observations             288


                     Iteration History

Iteration    Evaluations    -2 Res Log Like       Criterion

        0              1      1209.99618216
        1              3      1068.25997628      0.00000272
        2              1      1068.25917037      0.00000000


                 Convergence criteria met.


                    Seed Hundred Weight

                    The Mixed Procedure

              Covariance Parameter Estimates

             Cov Parm                 Estimate

             Year                            0
             Year*Farm                       0
             Year*Farm*Field_Type       3.6038
             Rep(Year*Farm*Field)            0
             Year*Farm*Cultiv*Rep       0.5006
             Yea*Far*Cul*Timi*Rep            0
```

```
                         Residual                  2.2015


                                  Fit Statistics

                        -2 Res Log Likelihood          1068.3
                        AIC (smaller is better)        1074.3
                        AICC (smaller is better)       1074.4
                        BIC (smaller is better)        1070.3


                            Type 3 Tests of Fixed Effects

                                    Num     Den
              Effect                 DF      DF    F Value    Pr > F

              Farm                    1       1       1.07    0.4899
              Field_Type              1       2       1.86    0.3060
              Farm*Field_Type         1       2       0.34    0.6198
              Cultivar                3      33      15.14    <.0001
              Field_Type*Cultivar     3     121       5.89    0.0009
              Timing                  2      88       1.59    0.2096
              Field_Type*Timing       2     121       0.98    0.3799
              Cultivar*Timing         6      88       0.52    0.7939
              Field_*Cultiv*Timing    6     121       0.34    0.9147

                               Seed Hundred Weight

-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=5.82594 maxSD=5.82594 ---------------

       Field_                                     Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  1      D                              14.6111      0.9626       2      15.18    0.0043     A
  2      F                              12.7653      0.9631       2      13.25    0.0056     A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=1.03495 maxSD=1.03992 ----------------

       Field_                                     Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  3                BASS                 13.2589      0.7232      33      18.33    <.0001     B
  4                CORC                 14.4891      0.7231      33      20.04    <.0001     A
  5                JACK                 12.3955      0.7244      33      17.11    <.0001     B
  6                WM82                 14.6093      0.7239      33      20.18    <.0001     A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.52307 maxSD=0.53565 -----------------

       Field_                                     Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  7                            c        13.8986      0.6993      88      19.87    <.0001     A
  8                            e        13.4980      0.6948      88      19.43    <.0001     A
  9                            l        13.6681      0.6948      88      19.67    <.0001     A


----------- Effect=Field_Type*Timing A=Tukey-Kramer(.05) avgSD=0.80768 maxSD=0.8648 ------------

       Field_                                     Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 10      D                     c        14.9937      0.9784     121      15.32    <.0001     A
```

```
 11      D                     e        14.2812      0.9784     121      14.60    <.0001     A
 12      D                     l        14.5583      0.9784     121      14.88    <.0001     A
 13      F                     c        12.8034      0.9890     121      12.95    <.0001     A
 14      F                     e        12.7147      0.9762     121      13.03    <.0001     A
 15      F                     l        12.7778      0.9762     121      13.09    <.0001     A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=1.26704 maxSD=1.29476 ----------

       Field_                                      Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 16      D         BASS                 14.5000      1.0019     121      14.47    <.0001    AB
 17      D         CORC                 15.8000      1.0019     121      15.77    <.0001    A
 18      D         JACK                 13.1278      1.0019     121      13.10    <.0001    B
 19      D         WM82                 15.0167      1.0019     121      14.99    <.0001    A
 20      F         BASS                 12.0179      1.0025     121      11.99    <.0001    BC

                                      Seed Hundred Weight

---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=1.26704 maxSD=1.29476 ----------
                                          (continued)

       Field_                                      Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 21      F         CORC                 13.1781      1.0021     121      13.15    <.0001    AB
 22      F         JACK                 11.6633      1.0060     121      11.59    <.0001    C
 23      F         WM82                 14.2020      1.0043     121      14.14    <.0001    A


---------- Effect=Field_*Cultiv*Timing A=Tukey-Kramer(.05) avgSD=2.36522 maxSD=2.9562 ----------

       Field_                                      Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 24      D         BASS        c        14.9250      1.0612     121      14.06    <.0001    ABCD
 25      D         BASS        e        14.3083      1.0612     121      13.48    <.0001    ABCD
 26      D         BASS        l        14.2667      1.0612     121      13.44    <.0001    ABCD
 27      D         CORC        c        16.3333      1.0612     121      15.39    <.0001    A
 28      D         CORC        e        15.1667      1.0612     121      14.29    <.0001    ABC
 29      D         CORC        l        15.9000      1.0612     121      14.98    <.0001    AB
 30      D         JACK        c        13.5667      1.0612     121      12.78    <.0001    BCD
 31      D         JACK        e        12.6083      1.0612     121      11.88    <.0001    D
 32      D         JACK        l        13.2083      1.0612     121      12.45    <.0001    CD
 33      D         WM82        c        15.1500      1.0612     121      14.28    <.0001    ABC
 34      D         WM82        e        15.0417      1.0612     121      14.17    <.0001    ABCD
 35      D         WM82        l        14.8583      1.0612     121      14.00    <.0001    ABCD
 36      F         BASS        c        12.0753      1.0807     121      11.17    <.0001    AB
 37      F         BASS        e        11.8250      1.0612     121      11.14    <.0001    B
 38      F         BASS        l        12.1534      1.0500     121      11.57    <.0001    AB
 39      F         CORC        c        13.5862      1.0699     121      12.70    <.0001    AB
 40      F         CORC        e        12.8732      1.0552     121      12.20    <.0001    AB
 41      F         CORC        l        13.0750      1.0612     121      12.32    <.0001    AB
 42      F         JACK        c        11.2978      1.1301     121      10.00    <.0001    B
 43      F         JACK        e        11.8641      1.0498     121      11.30    <.0001    B
 44      F         JACK        l        11.8278      1.0451     121      11.32    <.0001    B
 45      F         WM82        c        14.2544      1.1098     121      12.84    <.0001    AB
 46      F         WM82        e        14.2965      1.0451     121      13.68    <.0001    A
 47      F         WM82        l        14.0552      1.0552     121      13.32    <.0001    AB
```

```
                                 Seed Hundred Weight

-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=5.82594 maxSD=5.82594 ---------------

       Field_                                    Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  1      D                              14.6111      0.9626       2      15.18    0.0043     A
  2      F                              12.7653      0.9631       2      13.25    0.0056     A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=1.03495 maxSD=1.03992 ----------------

       Field_                                    Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  3                BASS                 13.2589      0.7232      33      18.33    <.0001     B
  4                CORC                 14.4891      0.7231      33      20.04    <.0001     A
  5                JACK                 12.3955      0.7244      33      17.11    <.0001     B
  6                WM82                 14.6093      0.7239      33      20.18    <.0001     A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.52307 maxSD=0.53565 -----------------

       Field_                                    Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  7                            c        13.8986      0.6993      88      19.87    <.0001     A
  8                            e        13.4980      0.6948      88      19.43    <.0001     A
  9                            l        13.6681      0.6948      88      19.67    <.0001     A


----------- Effect=Field_Type*Timing A=Tukey-Kramer(.05) avgSD=2.7527 maxSD=4.00685 ------------

       Field_                                    Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 10      D                     c        14.9937      0.9784     121      15.32    <.0001     A
 11      D                     e        14.2812      0.9784     121      14.60    <.0001     A
 12      D                     l        14.5583      0.9784     121      14.88    <.0001     A
 13      F                     c        12.8034      0.9890     121      12.95    <.0001     A
 14      F                     e        12.7147      0.9762     121      13.03    <.0001     A
 15      F                     l        12.7778      0.9762     121      13.09    <.0001     A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=3.29474 maxSD=3.29862 ----------

       Field_                                    Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 16      D         BASS                 14.5000      1.0019     121      14.47    <.0001     A
 17      F         BASS                 12.0179      1.0025     121      11.99    <.0001     A
 18      D         CORC                 15.8000      1.0019     121      15.77    <.0001     A
 19      F         CORC                 13.1781      1.0021     121      13.15    <.0001     A
 20      D         JACK                 13.1278      1.0019     121      13.10    <.0001     A

                                 Seed Hundred Weight

---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=3.29474 maxSD=3.29862 ----------
                                     (continued)
```

```
       Field_                                       Standard                           Pr >    Let
Obs     Type     Cultivar    Timing    Estimate      Error        DF    t Value       |t|    Grp

 21      F         JACK                 11.6633      1.0060      121      11.59    <.0001     A
 22      D         WM82                 15.0167      1.0019      121      14.99    <.0001     A
 23      F         WM82                 14.2020      1.0043      121      14.14    <.0001     A


--------- Effect=Field_*Cultiv*Timing A=Tukey-Kramer(.05) avgSD=3.72017 maxSD=4.99767 ----------

       Field_                                       Standard                           Pr >    Let
Obs     Type     Cultivar    Timing    Estimate      Error        DF    t Value       |t|    Grp

 24      D         BASS        c        14.9250      1.0612      121      14.06    <.0001     A
 25      D         BASS        e        14.3083      1.0612      121      13.48    <.0001     A
 26      D         BASS        l        14.2667      1.0612      121      13.44    <.0001     A
 27      F         BASS        c        12.0753      1.0807      121      11.17    <.0001     A
 28      F         BASS        e        11.8250      1.0612      121      11.14    <.0001     A
 29      F         BASS        l        12.1534      1.0500      121      11.57    <.0001     A
 30      D         CORC        c        16.3333      1.0612      121      15.39    <.0001     A
 31      D         CORC        e        15.1667      1.0612      121      14.29    <.0001     A
 32      D         CORC        l        15.9000      1.0612      121      14.98    <.0001     A
 33      F         CORC        c        13.5862      1.0699      121      12.70    <.0001     A
 34      F         CORC        e        12.8732      1.0552      121      12.20    <.0001     A
 35      F         CORC        l        13.0750      1.0612      121      12.32    <.0001     A
 36      D         JACK        c        13.5667      1.0612      121      12.78    <.0001     A
 37      D         JACK        e        12.6083      1.0612      121      11.88    <.0001     A
 38      D         JACK        l        13.2083      1.0612      121      12.45    <.0001     A
 39      F         JACK        c        11.2978      1.1301      121      10.00    <.0001     A
 40      F         JACK        e        11.8641      1.0498      121      11.30    <.0001     A
 41      F         JACK        l        11.8278      1.0451      121      11.32    <.0001     A
 42      D         WM82        c        15.1500      1.0612      121      14.28    <.0001     A
 43      D         WM82        e        15.0417      1.0612      121      14.17    <.0001     A
 44      D         WM82        l        14.8583      1.0612      121      14.00    <.0001     A
 45      F         WM82        c        14.2544      1.1098      121      12.84    <.0001     A
 46      F         WM82        e        14.2965      1.0451      121      13.68    <.0001     A
 47      F         WM82        l        14.0552      1.0552      121      13.32    <.0001     A

                                      Seed Hundred Weight

-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=5.82594 maxSD=5.82594 ---------------

       Field_                                       Standard                           Pr >    Let
Obs     Type     Cultivar    Timing    Estimate      Error        DF    t Value       |t|    Grp

  1      D                              14.6111      0.9626        2      15.18    0.0043     A
  2      F                              12.7653      0.9631        2      13.25    0.0056     A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=1.03495 maxSD=1.03992 ----------------

       Field_                                       Standard                           Pr >    Let
Obs     Type     Cultivar    Timing    Estimate      Error        DF    t Value       |t|    Grp

  3                BASS                 13.2589      0.7232       33      18.33    <.0001     B
  4                CORC                 14.4891      0.7231       33      20.04    <.0001     A
  5                JACK                 12.3955      0.7244       33      17.11    <.0001     B
  6                WM82                 14.6093      0.7239       33      20.18    <.0001     A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.52307 maxSD=0.53565 -----------------

       Field_                                       Standard                           Pr >    Let
Obs     Type     Cultivar    Timing    Estimate      Error        DF    t Value       |t|    Grp
```

```
  7                            c        13.8986       0.6993     88      19.87    <.0001    A
  8                            e        13.4980       0.6948     88      19.43    <.0001    A
  9                            l        13.6681       0.6948     88      19.67    <.0001    A


----------- Effect=Field_Type*Timing A=Tukey-Kramer(.05) avgSD=3.26884 maxSD=3.28325 -----------

       Field_                                      Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 10      D                     c        14.9937       0.9784    121      15.32    <.0001    A
 11      F                     c        12.8034       0.9890    121      12.95    <.0001    A
 12      D                     e        14.2812       0.9784    121      14.60    <.0001    A
 13      F                     e        12.7147       0.9762    121      13.03    <.0001    A
 14      D                     l        14.5583       0.9784    121      14.88    <.0001    A
 15      F                     l        12.7778       0.9762    121      13.09    <.0001    A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=3.09155 maxSD=4.37961 ----------

       Field_                                      Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 16      D         BASS                 14.5000       1.0019    121      14.47    <.0001    ABCD
 17      D         CORC                 15.8000       1.0019    121      15.77    <.0001    ABC
 18      D         JACK                 13.1278       1.0019    121      13.10    <.0001    DE
 19      D         WM82                 15.0167       1.0019    121      14.99    <.0001    ABC
 20      F         BASS                 12.0179       1.0025    121      11.99    <.0001    BCE

                                      Seed Hundred Weight

---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=3.09155 maxSD=4.37961 ----------
                                          (continued)

       Field_                                      Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 21      F         CORC                 13.1781       1.0021    121      13.15    <.0001    ABD
 22      F         JACK                 11.6633       1.0060    121      11.59    <.0001    CE
 23      F         WM82                 14.2020       1.0043    121      14.14    <.0001    AD


--------- Effect=Field_*Cultiv*Timing A=Tukey-Kramer(.05) avgSD=3.87916 maxSD=5.24001 ----------

       Field_                                      Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 24      D         BASS        c        14.9250       1.0612    121      14.06    <.0001    AB
 25      D         CORC        c        16.3333       1.0612    121      15.39    <.0001    A
 26      D         JACK        c        13.5667       1.0612    121      12.78    <.0001    B
 27      D         WM82        c        15.1500       1.0612    121      14.28    <.0001    AB
 28      F         BASS        c        12.0753       1.0807    121      11.17    <.0001    AB
 29      F         CORC        c        13.5862       1.0699    121      12.70    <.0001    AB
 30      F         JACK        c        11.2978       1.1301    121      10.00    <.0001    AB
 31      F         WM82        c        14.2544       1.1098    121      12.84    <.0001    AB
 32      D         BASS        e        14.3083       1.0612    121      13.48    <.0001    ABC
 33      D         CORC        e        15.1667       1.0612    121      14.29    <.0001    AB
 34      D         JACK        e        12.6083       1.0612    121      11.88    <.0001    CD
 35      D         WM82        e        15.0417       1.0612    121      14.17    <.0001    ABC
 36      F         BASS        e        11.8250       1.0612    121      11.14    <.0001    BD
 37      F         CORC        e        12.8732       1.0552    121      12.20    <.0001    ABC
 38      F         JACK        e        11.8641       1.0498    121      11.30    <.0001    BD
```

```
39      F         WM82       e       14.2965      1.0451     121       13.68     <.0001    AC
40      D         BASS       l       14.2667      1.0612     121       13.44     <.0001    AB
41      D         CORC       l       15.9000      1.0612     121       14.98     <.0001    A
42      D         JACK       l       13.2083      1.0612     121       12.45     <.0001    B
43      D         WM82       l       14.8583      1.0612     121       14.00     <.0001    AB
44      F         BASS       l       12.1534      1.0500     121       11.57     <.0001    AB
45      F         CORC       l       13.0750      1.0612     121       12.32     <.0001    AB
46      F         JACK       l       11.8278      1.0451     121       11.32     <.0001    AB
47      F         WM82       l       14.0552      1.0552     121       13.32     <.0001    AB
```

Seed Protein

```
                    The Mixed Procedure

                     Model Information

   Data Set                     WORK.SEED
   Dependent Variable           Protein
   Covariance Structure         Variance Components
   Estimation Method            REML
   Residual Variance Method     Profile
   Fixed Effects SE Method      Model-Based
   Degrees of Freedom Method    Containment


                  Class Level Information

   Class         Levels    Values

   Year               2    2002 2003
   Farm               2    P W
   Field_Type         2    D F
   Cultivar           4    BASS CORC JACK WM82
   Timing             3    c e l
   Rep                3    1 2 3


                        Dimensions

            Covariance Parameters            7
            Columns in X                    66
            Columns in Z                   230
            Subjects                         1
            Max Obs Per Subject            288
            Observations Used              288
            Observations Not Used            0
            Total Observations             288


                     Iteration History

Iteration    Evaluations    -2 Res Log Like       Criterion

        0              1       979.47619376
        1              3       817.74631779      0.00052721
        2              1       817.65102636      0.00000868
        3              1       817.64954724      0.00000000


                 Convergence criteria met.


                        Seed Protein

                    The Mixed Procedure

              Covariance Parameter Estimates

             Cov Parm                 Estimate

             Year                       0.3924
             Year*Farm                       0
             Year*Farm*Field_Type       1.1132
             Rep(Year*Farm*Field)       0.1852
```

```
                               Year*Farm*Cultiv*Rep      0.07319
                               Yea*Far*Cul*Timi*Rep            0
                               Residual                   0.8445


                                        Fit Statistics

                             -2 Res Log Likelihood           817.6
                             AIC (smaller is better)         827.6
                             AICC (smaller is better)        827.9
                             BIC (smaller is better)         821.1


                                 Type 3 Tests of Fixed Effects

                                            Num     Den
                   Effect                    DF      DF    F Value    Pr > F

                   Farm                       1       1       0.39    0.6430
                   Field_Type                 1       2       1.22    0.3850
                   Farm*Field_Type            1       2       0.01    0.9231
                   Cultivar                   3      33      13.52    <.0001
                   Field_Type*Cultivar        3     121      10.85    <.0001
                   Timing                     2      88       2.54    0.0844
                   Field_Type*Timing          2     121       1.82    0.1669
                   Cultivar*Timing            6      88       0.12    0.9931
                   Field_*Cultiv*Timing       6     121       0.60    0.7277

                                          Seed Protein

-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=3.33148 maxSD=3.33148 ---------------

       Field_                                      Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  1      D                              40.8937      0.7052       2      57.99    0.0003     A
  2      F                              41.7478      0.7055       2      59.18    0.0003     A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.51564 maxSD=0.51941 ----------------

       Field_                                      Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  3                BASS                 40.9948      0.6008      33      68.23    <.0001     B
  4                CORC                 41.9201      0.6008      33      69.78    <.0001     A
  5                JACK                 40.8437      0.6014      33      67.92    <.0001     B
  6                WM82                 41.5245      0.6011      33      69.08    <.0001     A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.32379 maxSD=0.33144 -----------------

       Field_                                      Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  7                            c        41.5056      0.5961      88      69.63    <.0001     A
  8                            e        41.2317      0.5941      88      69.40    <.0001     A
  9                            l        41.2250      0.5941      88      69.39    <.0001     A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=0.68101 maxSD=0.7005 -----------

       Field_                                      Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp
```

```
 10      D         BASS                 40.8306      0.7207     121      56.65    <.0001    B
 11      D         CORC                 41.8361      0.7207     121      58.05    <.0001    A
 12      D         JACK                 40.0028      0.7207     121      55.50    <.0001    C
 13      D         WM82                 40.9056      0.7207     121      56.75    <.0001    B
 14      F         BASS                 41.1590      0.7211     121      57.08    <.0001    B
 15      F         CORC                 42.0041      0.7208     121      58.27    <.0001    A
 16      F         JACK                 41.6846      0.7229     121      57.66    <.0001    AB
 17      F         WM82                 42.1434      0.7220     121      58.37    <.0001    A


--------- Effect=Field_*Cultiv*Timing A=Tukey-Kramer(.05) avgSD=1.39385 maxSD=1.75376 ----------

       Field_                                Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 18      D         BASS        c        41.0167      0.7526     121      54.50    <.0001    AB
 19      D         BASS        e        40.7833      0.7526     121      54.19    <.0001    AB
 20      D         BASS        l        40.6917      0.7526     121      54.07    <.0001    AB

                                          Seed Protein

--------- Effect=Field_*Cultiv*Timing A=Tukey-Kramer(.05) avgSD=1.39385 maxSD=1.75376 ----------
                                          (continued)

       Field_                                Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 21      D         CORC        c        41.7917      0.7526     121      55.53    <.0001    A
 22      D         CORC        e        41.7583      0.7526     121      55.49    <.0001    A
 23      D         CORC        l        41.9583      0.7526     121      55.75    <.0001    A
 24      D         JACK        c        39.9917      0.7526     121      53.14    <.0001    B
 25      D         JACK        e        39.9667      0.7526     121      53.11    <.0001    B
 26      D         JACK        l        40.0500      0.7526     121      53.22    <.0001    B
 27      D         WM82        c        40.9083      0.7526     121      54.36    <.0001    AB
 28      D         WM82        e        40.8917      0.7526     121      54.33    <.0001    AB
 29      D         WM82        l        40.9167      0.7526     121      54.37    <.0001    AB
 30      F         BASS        c        41.2530      0.7630     121      54.07    <.0001    AB
 31      F         BASS        e        40.9833      0.7526     121      54.46    <.0001    B
 32      F         BASS        l        41.2407      0.7465     121      55.25    <.0001    AB
 33      F         CORC        c        42.2640      0.7573     121      55.81    <.0001    AB
 34      F         CORC        e        42.0151      0.7493     121      56.07    <.0001    AB
 35      F         CORC        l        41.7333      0.7526     121      55.45    <.0001    AB
 36      F         JACK        c        42.2002      0.7894     121      53.46    <.0001    AB
 37      F         JACK        e        41.5042      0.7464     121      55.60    <.0001    AB
 38      F         JACK        l        41.3493      0.7439     121      55.59    <.0001    AB
 39      F         WM82        c        42.6193      0.7785     121      54.74    <.0001    A
 40      F         WM82        e        41.9510      0.7439     121      56.40    <.0001    AB
 41      F         WM82        l        41.8601      0.7493     121      55.86    <.0001    AB

                                          Seed Protein

-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=3.33148 maxSD=3.33148 ---------------

       Field_                                Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  1      D                              40.8937      0.7052       2      57.99    0.0003     A
  2      F                              41.7478      0.7055       2      59.18    0.0003     A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.51564 maxSD=0.51941 ----------------

       Field_                                Standard                         Pr >    Let
```

```
Obs     Type     Cultivar    Timing    Estimate       Error      DF    t Value      |t|    Grp

  3                BASS                 40.9948       0.6008      33      68.23    <.0001     B
  4                CORC                 41.9201       0.6008      33      69.78    <.0001     A
  5                JACK                 40.8437       0.6014      33      67.92    <.0001     B
  6                WM82                 41.5245       0.6011      33      69.08    <.0001     A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.32379 maxSD=0.33144 -----------------

       Field_                                       Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate       Error      DF    t Value      |t|    Grp

  7                             c       41.5056       0.5961      88      69.63    <.0001     A
  8                             e       41.2317       0.5941      88      69.40    <.0001     A
  9                             l       41.2250       0.5941      88      69.39    <.0001     A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=1.89201 maxSD=1.89456 ----------

       Field_                                       Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate       Error      DF    t Value      |t|    Grp

 10      D         BASS                 40.8306       0.7207     121      56.65    <.0001     A
 11      F         BASS                 41.1590       0.7211     121      57.08    <.0001     A
 12      D         CORC                 41.8361       0.7207     121      58.05    <.0001     A
 13      F         CORC                 42.0041       0.7208     121      58.27    <.0001     A
 14      D         JACK                 40.0028       0.7207     121      55.50    <.0001     A
 15      F         JACK                 41.6846       0.7229     121      57.66    <.0001     A
 16      D         WM82                 40.9056       0.7207     121      56.75    <.0001     A
 17      F         WM82                 42.1434       0.7220     121      58.37    <.0001     A


--------- Effect=Field_*Cultiv*Timing A=Tukey-Kramer(.05) avgSD=2.18809 maxSD=2.90706 ----------

       Field_                                       Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate       Error      DF    t Value      |t|    Grp

 18      D         BASS         c       41.0167       0.7526     121      54.50    <.0001     A
 19      D         BASS         e       40.7833       0.7526     121      54.19    <.0001     A
 20      D         BASS         l       40.6917       0.7526     121      54.07    <.0001     A

                                          Seed Protein

--------- Effect=Field_*Cultiv*Timing A=Tukey-Kramer(.05) avgSD=2.18809 maxSD=2.90706 ----------
                                          (continued)

       Field_                                       Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate       Error      DF    t Value      |t|    Grp

 21      F         BASS         c       41.2530       0.7630     121      54.07    <.0001     A
 22      F         BASS         e       40.9833       0.7526     121      54.46    <.0001     A
 23      F         BASS         l       41.2407       0.7465     121      55.25    <.0001     A
 24      D         CORC         c       41.7917       0.7526     121      55.53    <.0001     A
 25      D         CORC         e       41.7583       0.7526     121      55.49    <.0001     A
 26      D         CORC         l       41.9583       0.7526     121      55.75    <.0001     A
 27      F         CORC         c       42.2640       0.7573     121      55.81    <.0001     A
 28      F         CORC         e       42.0151       0.7493     121      56.07    <.0001     A
 29      F         CORC         l       41.7333       0.7526     121      55.45    <.0001     A
 30      D         JACK         c       39.9917       0.7526     121      53.14    <.0001     A
 31      D         JACK         e       39.9667       0.7526     121      53.11    <.0001     A
 32      D         JACK         l       40.0500       0.7526     121      53.22    <.0001     A
 33      F         JACK         c       42.2002       0.7894     121      53.46    <.0001     A
 34      F         JACK         e       41.5042       0.7464     121      55.60    <.0001     A
```

```
 35      F         JACK        l        41.3493      0.7439     121      55.59    <.0001     A
 36      D         WM82        c        40.9083      0.7526     121      54.36    <.0001     A
 37      D         WM82        e        40.8917      0.7526     121      54.33    <.0001     A
 38      D         WM82        l        40.9167      0.7526     121      54.37    <.0001     A
 39      F         WM82        c        42.6193      0.7785     121      54.74    <.0001     A
 40      F         WM82        e        41.9510      0.7439     121      56.40    <.0001     A
 41      F         WM82        l        41.8601      0.7493     121      55.86    <.0001     A

                                          Seed Protein

-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=3.33148 maxSD=3.33148 ---------------

       Field_                                    Standard                          Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  1      D                              40.8937      0.7052       2      57.99    0.0003     A
  2      F                              41.7478      0.7055       2      59.18    0.0003     A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.51564 maxSD=0.51941 ----------------

       Field_                                    Standard                          Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  3                BASS                 40.9948      0.6008      33      68.23    <.0001     B
  4                CORC                 41.9201      0.6008      33      69.78    <.0001     A
  5                JACK                 40.8437      0.6014      33      67.92    <.0001     B
  6                WM82                 41.5245      0.6011      33      69.08    <.0001     A


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.32379 maxSD=0.33144 -----------------

       Field_                                    Standard                          Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  7                            c        41.5056      0.5961      88      69.63    <.0001     A
  8                            e        41.2317      0.5941      88      69.40    <.0001     A
  9                            l        41.2250      0.5941      88      69.39    <.0001     A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=1.74058 maxSD=2.48627 ----------

       Field_                                    Standard                          Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 10      D         BASS                 40.8306      0.7207     121      56.65    <.0001    BE
 11      D         CORC                 41.8361      0.7207     121      58.05    <.0001    AD
 12      D         JACK                 40.0028      0.7207     121      55.50    <.0001    CF
 13      D         WM82                 40.9056      0.7207     121      56.75    <.0001    BE
 14      F         BASS                 41.1590      0.7211     121      57.08    <.0001    DEF
 15      F         CORC                 42.0041      0.7208     121      58.27    <.0001    ABC
 16      F         JACK                 41.6846      0.7229     121      57.66    <.0001    ABCD
 17      F         WM82                 42.1434      0.7220     121      58.37    <.0001    ABC


--------- Effect=Field_*Cultiv*Timing A=Tukey-Kramer(.05) avgSD=2.23873 maxSD=3.01782 ----------

       Field_                                    Standard                          Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 18      D         BASS        c        41.0167      0.7526     121      54.50    <.0001    AB
 19      D         CORC        c        41.7917      0.7526     121      55.53    <.0001    A
 20      D         JACK        c        39.9917      0.7526     121      53.14    <.0001    B
```

```
                                         Seed Protein

--------- Effect=Field_*Cultiv*Timing A=Tukey-Kramer(.05) avgSD=2.23873 maxSD=3.01782 ----------
                                          (continued)

       Field_                                      Standard                            Pr >    Let
Obs     Type     Cultivar    Timing    Estimate       Error        DF    t Value        |t|    Grp

 21       D        WM82         c       40.9083      0.7526       121      54.36     <.0001    AB
 22       F        BASS         c       41.2530      0.7630       121      54.07     <.0001    AB
 23       F        CORC         c       42.2640      0.7573       121      55.81     <.0001    AB
 24       F        JACK         c       42.2002      0.7894       121      53.46     <.0001    AB
 25       F        WM82         c       42.6193      0.7785       121      54.74     <.0001    AB
 26       D        BASS         e       40.7833      0.7526       121      54.19     <.0001    AB
 27       D        CORC         e       41.7583      0.7526       121      55.49     <.0001    A
 28       D        JACK         e       39.9667      0.7526       121      53.11     <.0001    B
 29       D        WM82         e       40.8917      0.7526       121      54.33     <.0001    AB
 30       F        BASS         e       40.9833      0.7526       121      54.46     <.0001    AB
 31       F        CORC         e       42.0151      0.7493       121      56.07     <.0001    AB
 32       F        JACK         e       41.5042      0.7464       121      55.60     <.0001    AB
 33       F        WM82         e       41.9510      0.7439       121      56.40     <.0001    AB
 34       D        BASS         l       40.6917      0.7526       121      54.07     <.0001    AB
 35       D        CORC         l       41.9583      0.7526       121      55.75     <.0001    A
 36       D        JACK         l       40.0500      0.7526       121      53.22     <.0001    B
 37       D        WM82         l       40.9167      0.7526       121      54.37     <.0001    AB
 38       F        BASS         l       41.2407      0.7465       121      55.25     <.0001    AB
 39       F        CORC         l       41.7333      0.7526       121      55.45     <.0001    AB
 40       F        JACK         l       41.3493      0.7439       121      55.59     <.0001    AB
 41       F        WM82         l       41.8601      0.7493       121      55.86     <.0001    AB
```

Seed Oil

```
                    The Mixed Procedure

                     Model Information

   Data Set                     WORK.SEED
   Dependent Variable           Oil
   Covariance Structure         Variance Components
   Estimation Method            REML
   Residual Variance Method     Profile
   Fixed Effects SE Method      Model-Based
   Degrees of Freedom Method    Containment


                  Class Level Information

   Class         Levels    Values

   Year               2    2002 2003
   Farm               2    P W
   Field_Type         2    D F
   Cultivar           4    BASS CORC JACK WM82
   Timing             3    c e l
   Rep                3    1 2 3


                        Dimensions

            Covariance Parameters            7
            Columns in X                    66
            Columns in Z                   230
            Subjects                         1
            Max Obs Per Subject            288
            Observations Used              288
            Observations Not Used            0
            Total Observations             288


                     Iteration History

Iteration    Evaluations    -2 Res Log Like       Criterion

        0              1       717.82538339
        1              4       686.59349386      0.00576743
        2              2       686.04883414      0.00114227
        3              1       685.91704019      0.00006706
        4              1       685.90982038      0.00000056
        5              1       685.90976293      0.00000000


                 Convergence criteria met.
```

```
                             The Mixed Procedure

                      Covariance Parameter Estimates

                     Cov Parm                 Estimate

                     Year                            0
                     Year*Farm                       0
                     Year*Farm*Field_Type       0.1582
                     Rep(Year*Farm*Field)      0.04101
                     Year*Farm*Cultiv*Rep      0.05398
                     Yea*Far*Cul*Timi*Rep            0
                     Residual                   0.5384


                              Fit Statistics

                    -2 Res Log Likelihood           685.9
                    AIC (smaller is better)         693.9
                    AICC (smaller is better)        694.1
                    BIC (smaller is better)         688.7


                       Type 3 Tests of Fixed Effects

                                  Num     Den
          Effect                   DF      DF    F Value    Pr > F

          Farm                      1       1       6.18    0.2435
          Field_Type                1       2       3.77    0.1916
          Farm*Field_Type           1       2       0.02    0.8916
          Cultivar                  3      33       5.08    0.0053
          Field_Type*Cultivar       3     121       5.32    0.0018
          Timing                    2      88       0.87    0.4237
          Field_Type*Timing         2     121       2.60    0.0786
          Cultivar*Timing           6      88       0.19    0.9776
          Field_*Cultiv*Timing      6     121       0.89    0.5070

                                  Seed Oil

-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=1.31652 maxSD=1.31652 ---------------

       Field_                                  Standard                       Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value      |t|    Grp

  1      D                              19.9639      0.2187       2      91.29    0.0001     A
  2      F                              20.5581      0.2192       2      93.79    0.0001     A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.42241 maxSD=0.42534 ----------------

       Field_                                  Standard                       Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value      |t|    Grp

  3               BASS                  20.5935      0.1831      33     112.46    <.0001    A
  4               CORC                  19.9953      0.1830      33     109.29    <.0001    B
  5               JACK                  20.2228      0.1843      33     109.76    <.0001    AB
  6               WM82                  20.2324      0.1837      33     110.13    <.0001    AB


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.25835 maxSD=0.26442 -----------------

       Field_                                  Standard                       Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value      |t|    Grp
```

```
  7                            c        20.1769      0.1716      88     117.57    <.0001     A
  8                            e        20.3177      0.1672      88     121.54    <.0001     A
  9                            l        20.2884      0.1672      88     121.36    <.0001     A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=0.55227 maxSD=0.56759 ----------

       Field_                                      Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 10       D         BASS                    20.1583      0.2498     121      80.69    <.0001    AB
 11       D         CORC                    19.5889      0.2498     121      78.41    <.0001    B
 12       D         JACK                    20.2278      0.2498     121      80.97    <.0001    A
 13       D         WM82                    19.8806      0.2498     121      79.58    <.0001    AB
 14       F         BASS                    21.0287      0.2504     121      83.97    <.0001    A
 15       F         CORC                    20.4017      0.2500     121      81.62    <.0001    B
 16       F         JACK                    20.2179      0.2537     121      79.68    <.0001    B
 17       F         WM82                    20.5842      0.2522     121      81.63    <.0001    AB


---------- Effect=Field_*Cultiv*Timing A=Tukey-Kramer(.05) avgSD=1.1182 maxSD=1.40567 ----------

       Field_                                      Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 18       D         BASS        c        20.2333      0.3038     121      66.59    <.0001     A
 19       D         BASS        e        20.0833      0.3038     121      66.10    <.0001     A
 20       D         BASS        l        20.1583      0.3038     121      66.34    <.0001     A

                                            Seed Oil

---------- Effect=Field_*Cultiv*Timing A=Tukey-Kramer(.05) avgSD=1.1182 maxSD=1.40567 ----------
                                          (continued)

       Field_                                      Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 21       D         CORC        c        19.6833      0.3038     121      64.78    <.0001     A
 22       D         CORC        e        19.5667      0.3038     121      64.40    <.0001     A
 23       D         CORC        l        19.5167      0.3038     121      64.23    <.0001     A
 24       D         JACK        c        20.3417      0.3038     121      66.95    <.0001     A
 25       D         JACK        e        20.4000      0.3038     121      67.14    <.0001     A
 26       D         JACK        l        19.9417      0.3038     121      65.63    <.0001     A
 27       D         WM82        c        19.7167      0.3038     121      64.89    <.0001     A
 28       D         WM82        e        20.1083      0.3038     121      66.18    <.0001     A
 29       D         WM82        l        19.8167      0.3038     121      65.22    <.0001     A
 30       F         BASS        c        20.8884      0.3199     121      65.29    <.0001     A
 31       F         BASS        e        21.1250      0.3038     121      69.53    <.0001     A
 32       F         BASS        l        21.0726      0.2940     121      71.67    <.0001     A
 33       F         CORC        c        20.2534      0.3112     121      65.09    <.0001     A
 34       F         CORC        e        20.3933      0.2986     121      68.29    <.0001     A
 35       F         CORC        l        20.5583      0.3038     121      67.66    <.0001     A
 36       F         JACK        c        19.7756      0.3583     121      55.20    <.0001     A
 37       F         JACK        e        20.2995      0.2939     121      69.07    <.0001     A
 38       F         JACK        l        20.5785      0.2897     121      71.03    <.0001     A
 39       F         WM82        c        20.5227      0.3428     121      59.86    <.0001     A
 40       F         WM82        e        20.5652      0.2897     121      70.98    <.0001     A
 41       F         WM82        l        20.6646      0.2986     121      69.20    <.0001     A

                                            Seed Oil

-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=1.31652 maxSD=1.31652 ---------------
```

```
       Field_                                      Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  1      D                              19.9639      0.2187       2      91.29    0.0001     A
  2      F                              20.5581      0.2192       2      93.79    0.0001     A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.42241 maxSD=0.42534 ----------------

       Field_                                      Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  3                BASS                 20.5935      0.1831      33     112.46    <.0001    A
  4                CORC                 19.9953      0.1830      33     109.29    <.0001    B
  5                JACK                 20.2228      0.1843      33     109.76    <.0001    AB
  6                WM82                 20.2324      0.1837      33     110.13    <.0001    AB


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.25835 maxSD=0.26442 -----------------

       Field_                                      Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  7                            c        20.1769      0.1716      88     117.57    <.0001     A
  8                            e        20.3177      0.1672      88     121.54    <.0001     A
  9                            l        20.2884      0.1672      88     121.36    <.0001     A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=0.81065 maxSD=0.81445 ----------

       Field_                                      Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 10      D         BASS                 20.1583      0.2498     121      80.69    <.0001     A
 11      F         BASS                 21.0287      0.2504     121      83.97    <.0001     A
 12      D         CORC                 19.5889      0.2498     121      78.41    <.0001     A
 13      F         CORC                 20.4017      0.2500     121      81.62    <.0001     A
 14      D         JACK                 20.2278      0.2498     121      80.97    <.0001     A
 15      F         JACK                 20.2179      0.2537     121      79.68    <.0001     A
 16      D         WM82                 19.8806      0.2498     121      79.58    <.0001     A
 17      F         WM82                 20.5842      0.2522     121      81.63    <.0001     A


--------- Effect=Field_*Cultiv*Timing A=Tukey-Kramer(.05) avgSD=1.23322 maxSD=1.50969 ----------

       Field_                                      Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 18      D         BASS        c        20.2333      0.3038     121      66.59    <.0001     A
 19      D         BASS        e        20.0833      0.3038     121      66.10    <.0001     A
 20      D         BASS        l        20.1583      0.3038     121      66.34    <.0001     A

                                            Seed Oil

--------- Effect=Field_*Cultiv*Timing A=Tukey-Kramer(.05) avgSD=1.23322 maxSD=1.50969 ----------
                                          (continued)

       Field_                                      Standard                         Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 21      F         BASS        c        20.8884      0.3199     121      65.29    <.0001     A
 22      F         BASS        e        21.1250      0.3038     121      69.53    <.0001     A
 23      F         BASS        l        21.0726      0.2940     121      71.67    <.0001     A
 24      D         CORC        c        19.6833      0.3038     121      64.78    <.0001     A
```

```
 25      D         CORC        e        19.5667      0.3038     121      64.40    <.0001     A
 26      D         CORC        l        19.5167      0.3038     121      64.23    <.0001     A
 27      F         CORC        c        20.2534      0.3112     121      65.09    <.0001     A
 28      F         CORC        e        20.3933      0.2986     121      68.29    <.0001     A
 29      F         CORC        l        20.5583      0.3038     121      67.66    <.0001     A
 30      D         JACK        c        20.3417      0.3038     121      66.95    <.0001     A
 31      D         JACK        e        20.4000      0.3038     121      67.14    <.0001     A
 32      D         JACK        l        19.9417      0.3038     121      65.63    <.0001     A
 33      F         JACK        c        19.7756      0.3583     121      55.20    <.0001     A
 34      F         JACK        e        20.2995      0.2939     121      69.07    <.0001     A
 35      F         JACK        l        20.5785      0.2897     121      71.03    <.0001     A
 36      D         WM82        c        19.7167      0.3038     121      64.89    <.0001     A
 37      D         WM82        e        20.1083      0.3038     121      66.18    <.0001     A
 38      D         WM82        l        19.8167      0.3038     121      65.22    <.0001     A
 39      F         WM82        c        20.5227      0.3428     121      59.86    <.0001     A
 40      F         WM82        e        20.5652      0.2897     121      70.98    <.0001     A
 41      F         WM82        l        20.6646      0.2986     121      69.20    <.0001     A

                                          Seed Oil

-------------- Effect=Field_Type A=Tukey-Kramer(.05) avgSD=1.31652 maxSD=1.31652 ---------------

       Field_                                      Standard                          Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  1      D                              19.9639      0.2187       2      91.29    0.0001     A
  2      F                              20.5581      0.2192       2      93.79    0.0001     A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.42241 maxSD=0.42534 ----------------

       Field_                                      Standard                          Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  3                BASS                 20.5935      0.1831      33     112.46    <.0001    A
  4                CORC                 19.9953      0.1830      33     109.29    <.0001    B
  5                JACK                 20.2228      0.1843      33     109.76    <.0001    AB
  6                WM82                 20.2324      0.1837      33     110.13    <.0001    AB


---------------- Effect=Timing A=Tukey-Kramer(.05) avgSD=0.25835 maxSD=0.26442 -----------------

       Field_                                      Standard                          Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

  7                             c       20.1769      0.1716      88     117.57    <.0001     A
  8                             e       20.3177      0.1672      88     121.54    <.0001     A
  9                             l       20.2884      0.1672      88     121.36    <.0001     A


---------- Effect=Field_Type*Cultivar A=Tukey-Kramer(.05) avgSD=0.88289 maxSD=1.09842 ----------

       Field_                                      Standard                          Pr >    Let
Obs     Type     Cultivar    Timing    Estimate     Error        DF    t Value       |t|    Grp

 10      D         BASS                 20.1583      0.2498     121      80.69    <.0001    ABC
 11      D         CORC                 19.5889      0.2498     121      78.41    <.0001    C
 12      D         JACK                 20.2278      0.2498     121      80.97    <.0001    AB
 13      D         WM82                 19.8806      0.2498     121      79.58    <.0001    BC
 14      F         BASS                 21.0287      0.2504     121      83.97    <.0001    A
 15      F         CORC                 20.4017      0.2500     121      81.62    <.0001    BC
 16      F         JACK                 20.2179      0.2537     121      79.68    <.0001    BC
 17      F         WM82                 20.5842      0.2522     121      81.63    <.0001    ABC
```

```
--------- Effect=Field_*Cultiv*Timing A=Tukey-Kramer(.05) avgSD=1.29328 maxSD=1.58788 ----------

      Field_                                         Standard                          Pr >    Let
Obs    Type     Cultivar    Timing    Estimate      Error        DF    t Value       |t|    Grp

 18      D        BASS         c        20.2333      0.3038      121      66.59    <.0001     A
 19      D        CORC         c        19.6833      0.3038      121      64.78    <.0001     A
 20      D        JACK         c        20.3417      0.3038      121      66.95    <.0001     A

                                                 Seed Oil

--------- Effect=Field_*Cultiv*Timing A=Tukey-Kramer(.05) avgSD=1.29328 maxSD=1.58788 ----------
                                               (continued)

      Field_                                         Standard                          Pr >    Let
Obs    Type     Cultivar    Timing    Estimate      Error        DF    t Value       |t|    Grp

 21      D        WM82         c        19.7167      0.3038      121      64.89    <.0001     A
 22      F        BASS         c        20.8884      0.3199      121      65.29    <.0001     A
 23      F        CORC         c        20.2534      0.3112      121      65.09    <.0001     A
 24      F        JACK         c        19.7756      0.3583      121      55.20    <.0001     A
 25      F        WM82         c        20.5227      0.3428      121      59.86    <.0001     A
 26      D        BASS         e        20.0833      0.3038      121      66.10    <.0001     A
 27      D        CORC         e        19.5667      0.3038      121      64.40    <.0001     A
 28      D        JACK         e        20.4000      0.3038      121      67.14    <.0001     A
 29      D        WM82         e        20.1083      0.3038      121      66.18    <.0001     A
 30      F        BASS         e        21.1250      0.3038      121      69.53    <.0001     A
 31      F        CORC         e        20.3933      0.2986      121      68.29    <.0001     A
 32      F        JACK         e        20.2995      0.2939      121      69.07    <.0001     A
 33      F        WM82         e        20.5652      0.2897      121      70.98    <.0001     A
 34      D        BASS         l        20.1583      0.3038      121      66.34    <.0001     A
 35      D        CORC         l        19.5167      0.3038      121      64.23    <.0001     A
 36      D        JACK         l        19.9417      0.3038      121      65.63    <.0001     A
 37      D        WM82         l        19.8167      0.3038      121      65.22    <.0001     A
 38      F        BASS         l        21.0726      0.2940      121      71.67    <.0001     A
 39      F        CORC         l        20.5583      0.3038      121      67.66    <.0001     A
 40      F        JACK         l        20.5785      0.2897      121      71.03    <.0001     A
 41      F        WM82         l        20.6646      0.2986      121      69.20    <.0001     A
```

Chapter 4: SAS Output for Statistical Analysis of Ozone Effects on the Concentration of Seed Isoflavones in Soybean [*Glycine max* (L.) Merr.] Seeds

Isoflavone Analysis – Ozone Study

```
                             Genistin
                    The Mixed Procedure

                      Model Information

          Data Set                     WORK.OZONEISO
          Dependent Variable           Genistin
          Covariance Structure         Variance Components
          Estimation Method            REML
          Residual Variance Method     Profile
          Fixed Effects SE Method      Prasad-Rao-Jeske-
                                       Kackar-Harville
          Degrees of Freedom Method    Kenward-Roger


                    Class Level Information

           Class       Levels    Values

           Chamber          6    1 2 3 4 5 6
           Cultivar         4    Bass Corsica Jack Williams
           Treatmnt         2    F O


                         Dimensions

               Covariance Parameters            2
               Columns in X                    15
               Columns in Z                     6
               Subjects                         1
               Max Obs Per Subject             24
               Observations Used               24
               Observations Not Used            0
               Total Observations              24


                      Iteration History

       Iteration    Evaluations    -2 Res Log Like       Criterion

               0              1        77.66568411
               1              1        77.22756996      0.00000000


                   Convergence criteria met.


                    Covariance Parameter
                          Estimates

                    Cov Parm     Estimate

                    Chamber        0.6309
```

```
                                     Residual       3.7049


                                      The Mixed Procedure

                                        Fit Statistics

                             -2 Res Log Likelihood            77.2
                             AIC (smaller is better)          81.2
                             AICC (smaller is better)         82.2
                             BIC (smaller is better)          80.8


                                 Type 3 Tests of Fixed Effects

                                           Num     Den
                     Effect                 DF      DF    F Value    Pr > F

                     Cultivar                3      12       7.31    0.0048
                     Treatmnt                1       4       6.08    0.0693
                     Cultivar*Treatmnt       3      12       0.43    0.7357


------------------- Effect=Treatmnt A=Tukey(.05) avgSD=2.82887 maxSD=2.82887 -------------------

                                               Standard                         Pr >    Let
    Obs    Cultivar    Treatmnt    Estimate     Error        DF    t Value       |t|    Grp

      1                   F         10.7287      0.7205       4      14.89    0.0001     A
      2                   O          8.2173      0.7205       4      11.41    0.0003     A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=3.29922 maxSD=3.29922 ----------------

                                               Standard                         Pr >    Let
    Obs    Cultivar    Treatmnt    Estimate     Error        DF    t Value       |t|    Grp

      3    Bass                      9.1971      0.8501      15      10.82    <.0001    AB
      4    Corsica                   8.6906      0.8501      15      10.22    <.0001    B
      5    Jack                      7.5229      0.8501      15       8.85    <.0001    B
      6    Williams                 12.4812      0.8501      15      14.68    <.0001    A


----------- Effect=Cultivar*Treatmnt A=Tukey-Kramer(.05) avgSD=5.00928 maxSD=5.00928 -----------

                                               Standard                         Pr >    Let
    Obs    Cultivar    Treatmnt    Estimate     Error        DF    t Value       |t|    Grp

      7    Bass           F         10.1516      1.2022      15       8.44    <.0001    A
      8    Corsica        F          9.6496      1.2022      15       8.03    <.0001    A
      9    Jack           F          9.5456      1.2022      15       7.94    <.0001    A
     10    Williams       F         13.5678      1.2022      15      11.29    <.0001    A
     11    Bass           O          8.2426      1.2022      15       6.86    <.0001    AB
     12    Corsica        O          7.7316      1.2022      15       6.43    <.0001    AB
     13    Jack           O          5.5003      1.2022      15       4.58    0.0004    B
     14    Williams       O         11.3945      1.2022      15       9.48    <.0001    A
```

```
------------------- Effect=Treatmnt A=Tukey(.05) avgSD=2.82887 maxSD=2.82887 -------------------

                                              Standard                        Pr >    Let
   Obs    Cultivar    Treatmnt    Estimate     Error        DF    t Value       |t|    Grp

     1                   F         10.7287      0.7205       4      14.89    0.0001     A
     2                   O          8.2173      0.7205       4      11.41    0.0003     A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=3.29922 maxSD=3.29922 ----------------

                                              Standard                        Pr >    Let
   Obs    Cultivar    Treatmnt    Estimate     Error        DF    t Value       |t|    Grp

     3    Bass                      9.1971      0.8501      15      10.82    <.0001    AB
     4    Corsica                   8.6906      0.8501      15      10.22    <.0001    B
     5    Jack                      7.5229      0.8501      15       8.85    <.0001    B
     6    Williams                 12.4812      0.8501      15      14.68    <.0001    A


----------- Effect=Cultivar*Treatmnt A=Tukey-Kramer(.05) avgSD=4.41476 maxSD=4.41476 -----------

                                              Standard                        Pr >    Let
   Obs    Cultivar    Treatmnt    Estimate     Error        DF    t Value       |t|    Grp

     7    Bass           F         10.1516      1.2022      15       8.44    <.0001     A
     8    Bass           O          8.2426      1.2022      15       6.86    <.0001     A
     9    Corsica        F          9.6496      1.2022      15       8.03    <.0001     A
    10    Corsica        O          7.7316      1.2022      15       6.43    <.0001     A
    11    Jack           F          9.5456      1.2022      15       7.94    <.0001     A
    12    Jack           O          5.5003      1.2022      15       4.58    0.0004     A
    13    Williams       F         13.5678      1.2022      15      11.29    <.0001     A
    14    Williams       O         11.3945      1.2022      15       9.48    <.0001     A
```

MalonylGenistin

```
                 The Mixed Procedure

                    Model Information

Data Set                     WORK.OZONEISO
Dependent Variable           M_Genistin
Covariance Structure         Variance Components
Estimation Method            REML
Residual Variance Method     Profile
Fixed Effects SE Method      Prasad-Rao-Jeske-
                             Kackar-Harville
Degrees of Freedom Method    Kenward-Roger


                 Class Level Information

 Class       Levels    Values

 Chamber          6    1 2 3 4 5 6
 Cultivar         4    Bass Corsica Jack Williams
 Treatmnt         2    F O


                       Dimensions

         Covariance Parameters            2
         Columns in X                    15
         Columns in Z                     6
         Subjects                         1
         Max Obs Per Subject             24
         Observations Used               24
         Observations Not Used            0
         Total Observations              24


                    Iteration History

Iteration    Evaluations    -2 Res Log Like       Criterion

        0              1       116.56352009
        1              1       116.34754855      0.00000000


                Convergence criteria met.


                  Covariance Parameter
                        Estimates

                  Cov Parm     Estimate

                  Chamber        4.9438
                  Residual      44.3618


                   The Mixed Procedure

                     Fit Statistics

        -2 Res Log Likelihood           116.3
        AIC (smaller is better)         120.3
        AICC (smaller is better)        121.3
```

```
                             BIC (smaller is better)         119.9


                                 Type 3 Tests of Fixed Effects

                                           Num     Den
                     Effect                 DF      DF    F Value    Pr > F

                     Cultivar                3      12      15.35    0.0002
                     Treatmnt                1       4      11.84    0.0263
                     Cultivar*Treatmnt       3      12       1.40    0.2903

------------------- Effect=Treatmnt A=Tukey(.05) avgSD=9.07757 maxSD=9.07757 -------------------

                                               Standard                         Pr >    Let
    Obs    Cultivar    Treatmnt    Estimate     Error        DF    t Value       |t|    Grp

      1                   F         51.0553      2.3119       4      22.08    <.0001     A
      2                   O         39.8067      2.3119       4      17.22    <.0001     B


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=11.4163 maxSD=11.4163 ----------------

                                               Standard                         Pr >    Let
    Obs    Cultivar    Treatmnt    Estimate     Error        DF    t Value       |t|    Grp

      3    Bass                     44.1722      2.8666    15.5      15.41    <.0001     B
      4    Corsica                  42.2632      2.8666    15.5      14.74    <.0001     B
      5    Jack                     35.0143      2.8666    15.5      12.21    <.0001     B
      6    Williams                 60.2743      2.8666    15.5      21.03    <.0001     A


----------- Effect=Cultivar*Treatmnt A=Tukey-Kramer(.05) avgSD=17.3336 maxSD=17.3336 -----------

                                               Standard                         Pr >    Let
    Obs    Cultivar    Treatmnt    Estimate     Error        DF    t Value       |t|    Grp

      7    Bass           F         51.0748      4.0540    15.5      12.60    <.0001     A
      8    Corsica        F         47.3203      4.0540    15.5      11.67    <.0001     A
      9    Jack           F         44.0826      4.0540    15.5      10.87    <.0001     A
     10    Williams       F         61.7433      4.0540    15.5      15.23    <.0001     A
     11    Bass           O         37.2697      4.0540    15.5       9.19    <.0001     B
     12    Corsica        O         37.2061      4.0540    15.5       9.18    <.0001     B
     13    Jack           O         25.9459      4.0540    15.5       6.40    <.0001     B
     14    Williams       O         58.8052      4.0540    15.5      14.51    <.0001     A


------------------- Effect=Treatmnt A=Tukey(.05) avgSD=9.07757 maxSD=9.07757 -------------------

                                               Standard                         Pr >    Let
    Obs    Cultivar    Treatmnt    Estimate     Error        DF    t Value       |t|    Grp

      1                   F         51.0553      2.3119       4      22.08    <.0001     A
      2                   O         39.8067      2.3119       4      17.22    <.0001     B


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=11.4163 maxSD=11.4163 ----------------

                                               Standard                         Pr >    Let
    Obs    Cultivar    Treatmnt    Estimate     Error        DF    t Value       |t|    Grp

      3    Bass                     44.1722      2.8666    15.5      15.41    <.0001     B
      4    Corsica                  42.2632      2.8666    15.5      14.74    <.0001     B
      5    Jack                     35.0143      2.8666    15.5      12.21    <.0001     B
```

```
      6    Williams                60.2743      2.8666    15.5      21.03    <.0001     A


----------- Effect=Cultivar*Treatmnt A=Tukey-Kramer(.05) avgSD=14.8381 maxSD=14.8381 -----------

                                                 Standard                            Pr >     Let
    Obs    Cultivar    Treatmnt    Estimate      Error        DF     t Value         |t|     Grp

      7    Bass           F         51.0748      4.0540    15.5      12.60    <.0001     A
      8    Bass           O         37.2697      4.0540    15.5       9.19    <.0001     A
      9    Corsica        F         47.3203      4.0540    15.5      11.67    <.0001     A
     10    Corsica        O         37.2061      4.0540    15.5       9.18    <.0001     A
     11    Jack           F         44.0826      4.0540    15.5      10.87    <.0001     A
     12    Jack           O         25.9459      4.0540    15.5       6.40    <.0001     A
     13    Williams       F         61.7433      4.0540    15.5      15.23    <.0001     A
     14    Williams       O         58.8052      4.0540    15.5      14.51    <.0001     A
```

Daidzin

```
                  The Mixed Procedure

                   Model Information

  Data Set                    WORK.OZONEISO
  Dependent Variable          Daidzin
  Covariance Structure        Variance Components
  Estimation Method           REML
  Residual Variance Method    Profile
  Fixed Effects SE Method     Prasad-Rao-Jeske-
                              Kackar-Harville
  Degrees of Freedom Method   Kenward-Roger


                Class Level Information

   Class       Levels    Values

   Chamber          6    1 2 3 4 5 6
   Cultivar         4    Bass Corsica Jack Williams
   Treatmnt         2    F O


                      Dimensions

           Covariance Parameters            2
           Columns in X                    15
           Columns in Z                     6
           Subjects                         1
           Max Obs Per Subject             24
           Observations Used               24
           Observations Not Used            0
           Total Observations              24


                   Iteration History

Iteration    Evaluations    -2 Res Log Like       Criterion

        0              1        37.46166550
        1              1        36.62931177      0.00000000


               Convergence criteria met.


                 Covariance Parameter
                       Estimates

                 Cov Parm     Estimate

                 Chamber       0.07189
                 Residual       0.2795


                  The Mixed Procedure

                    Fit Statistics

          -2 Res Log Likelihood           36.6
          AIC (smaller is better)         40.6
          AICC (smaller is better)        41.6
```

```
                     BIC (smaller is better)          40.2


                         Type 3 Tests of Fixed Effects

                              Num     Den
                 Effect        DF      DF    F Value    Pr > F

                 Cultivar             3      12      26.61    <.0001
                 Treatmnt             1       4       9.01    0.0399
                 Cultivar*Treatmnt    3      12       0.10    0.9564


------------------- Effect=Treatmnt A=Tukey(.05) avgSD=0.85355 maxSD=0.85355 -------------------

                                        Standard                            Pr >    Let
    Obs    Cultivar    Treatmnt    Estimate     Error        DF    t Value       |t|    Grp

      1                   F         4.1668      0.2174       4      19.17    <.0001     A
      2                   O         3.2440      0.2174       4      14.92    0.0001     B


---------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.9062 maxSD=0.9062 -----------------

                                        Standard                            Pr >    Let
    Obs    Cultivar    Treatmnt    Estimate     Error        DF    t Value       |t|    Grp

      3    Bass                     3.0518      0.2420    14.2      12.61    <.0001     C
      4    Corsica                  3.9843      0.2420    14.2      16.46    <.0001     B
      5    Jack                     2.6389      0.2420    14.2      10.90    <.0001     C
      6    Williams                 5.1465      0.2420    14.2      21.27    <.0001     A


----------- Effect=Cultivar*Treatmnt A=Tukey-Kramer(.05) avgSD=1.3759 maxSD=1.3759 -----------

                                        Standard                            Pr >    Let
    Obs    Cultivar    Treatmnt    Estimate     Error        DF    t Value       |t|    Grp

      7    Bass           F         3.4345      0.3422    14.2      10.04    <.0001    B
      8    Corsica        F         4.4800      0.3422    14.2      13.09    <.0001    AB
      9    Jack           F         3.1778      0.3422    14.2       9.29    <.0001    B
     10    Williams       F         5.5747      0.3422    14.2      16.29    <.0001    A
     11    Bass           O         2.6690      0.3422    14.2       7.80    <.0001    B
     12    Corsica        O         3.4886      0.3422    14.2      10.19    <.0001    AB
     13    Jack           O         2.0999      0.3422    14.2       6.14    <.0001    B
     14    Williams       O         4.7182      0.3422    14.2      13.79    <.0001    A


------------------- Effect=Treatmnt A=Tukey(.05) avgSD=0.85355 maxSD=0.85355 -------------------

                                        Standard                            Pr >    Let
    Obs    Cultivar    Treatmnt    Estimate     Error        DF    t Value       |t|    Grp

      1                   F         4.1668      0.2174       4      19.17    <.0001     A
      2                   O         3.2440      0.2174       4      14.92    0.0001     B


---------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.9062 maxSD=0.9062 -----------------

                                        Standard                            Pr >    Let
    Obs    Cultivar    Treatmnt    Estimate     Error        DF    t Value       |t|    Grp

      3    Bass                     3.0518      0.2420    14.2      12.61    <.0001     C
      4    Corsica                  3.9843      0.2420    14.2      16.46    <.0001     B
```

```
       5    Jack                   2.6389      0.2420    14.2      10.90    <.0001     C
       6    Williams               5.1465      0.2420    14.2      21.27    <.0001     A


----------- Effect=Cultivar*Treatmnt A=Tukey-Kramer(.05) avgSD=1.26461 maxSD=1.26461 -----------

                                              Standard                        Pr >    Let
     Obs    Cultivar    Treatmnt    Estimate     Error        DF    t Value       |t|    Grp

       7    Bass           F          3.4345      0.3422    14.2      10.04    <.0001     A
       8    Bass           O          2.6690      0.3422    14.2       7.80    <.0001     A
       9    Corsica        F          4.4800      0.3422    14.2      13.09    <.0001     A
      10    Corsica        O          3.4886      0.3422    14.2      10.19    <.0001     A
      11    Jack           F          3.1778      0.3422    14.2       9.29    <.0001     A
      12    Jack           O          2.0999      0.3422    14.2       6.14    <.0001     A
      13    Williams       F          5.5747      0.3422    14.2      16.29    <.0001     A
      14    Williams       O          4.7182      0.3422    14.2      13.79    <.0001     A
```

MalonlyDaidzin

```
                    The Mixed Procedure

                     Model Information

   Data Set                    WORK.OZONEISO
   Dependent Variable          M_Daidzin
   Covariance Structure        Variance Components
   Estimation Method           REML
   Residual Variance Method    Profile
   Fixed Effects SE Method     Prasad-Rao-Jeske-
                               Kackar-Harville
   Degrees of Freedom Method   Kenward-Roger


                  Class Level Information

    Class       Levels    Values

    Chamber          6    1 2 3 4 5 6
    Cultivar         4    Bass Corsica Jack Williams
    Treatmnt         2    F O


                        Dimensions

            Covariance Parameters            2
            Columns in X                    15
            Columns in Z                     6
            Subjects                         1
            Max Obs Per Subject             24
            Observations Used               24
            Observations Not Used            0
            Total Observations              24


                     Iteration History

Iteration    Evaluations    -2 Res Log Like       Criterion

        0              1        80.39951076
        1              1        78.78122363      0.00000000


                 Convergence criteria met.


                   Covariance Parameter
                         Estimates

                   Cov Parm     Estimate

                   Chamber        1.4976
                   Residual       3.6461
```

```
                                 The Mixed Procedure

                                   Fit Statistics

                        -2 Res Log Likelihood            78.8
                        AIC (smaller is better)          82.8
                        AICC (smaller is better)         83.7
                        BIC (smaller is better)          82.4


                             Type 3 Tests of Fixed Effects

                                      Num     Den
                Effect                 DF      DF    F Value    Pr > F

                Cultivar                3      12      38.13    <.0001
                Treatmnt                1       4       8.53    0.0432
                Cultivar*Treatmnt       3      12       0.44    0.7310

------------------- Effect=Treatmnt A=Tukey(.05) avgSD=3.51868 maxSD=3.51868 -------------------

                                                  Standard                         Pr >    Let
    Obs    Cultivar    Treatmnt    Estimate     Error        DF     t Value       |t|    Grp

      1                   F         14.5976      0.8961       4      16.29    <.0001     A
      2                   O         10.8955      0.8961       4      12.16    0.0003     B


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=3.27293 maxSD=3.27293 ----------------

                                                  Standard                         Pr >    Let
    Obs    Cultivar    Treatmnt    Estimate     Error        DF     t Value       |t|    Grp

      3    Bass                     10.5450      0.9259    12.8      11.39    <.0001    BC
      4    Corsica                  13.3857      0.9259    12.8      14.46    <.0001    B
      5    Jack                      7.9140      0.9259    12.8       8.55    <.0001    C
      6    Williams                 19.1415      0.9259    12.8      20.67    <.0001    A


----------- Effect=Cultivar*Treatmnt A=Tukey-Kramer(.05) avgSD=4.96936 maxSD=4.96936 -----------

                                                  Standard                         Pr >    Let
    Obs    Cultivar    Treatmnt    Estimate     Error        DF     t Value       |t|    Grp

      7    Bass           F         12.7165      1.3094    12.8       9.71    <.0001    B
      8    Corsica        F         15.4538      1.3094    12.8      11.80    <.0001    AB
      9    Jack           F          9.9969      1.3094    12.8       7.63    <.0001    B
     10    Williams       F         20.2232      1.3094    12.8      15.44    <.0001    A
     11    Bass           O          8.3736      1.3094    12.8       6.39    <.0001    B
     12    Corsica        O         11.3175      1.3094    12.8       8.64    <.0001    B
     13    Jack           O          5.8310      1.3094    12.8       4.45    0.0007    B
     14    Williams       O         18.0598      1.3094    12.8      13.79    <.0001    A
```

```
------------------- Effect=Treatmnt A=Tukey(.05) avgSD=3.51868 maxSD=3.51868 -------------------

                                          Standard                           Pr >    Let
   Obs    Cultivar    Treatmnt    Estimate     Error        DF    t Value       |t|    Grp

     1                   F         14.5976      0.8961       4      16.29    <.0001     A
     2                   O         10.8955      0.8961       4      12.16    0.0003     B


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=3.27293 maxSD=3.27293 ----------------

                                          Standard                           Pr >    Let
   Obs    Cultivar    Treatmnt    Estimate     Error        DF    t Value       |t|    Grp

     3    Bass                     10.5450      0.9259    12.8      11.39    <.0001    BC
     4    Corsica                  13.3857      0.9259    12.8      14.46    <.0001    B
     5    Jack                      7.9140      0.9259    12.8       8.55    <.0001    C
     6    Williams                 19.1415      0.9259    12.8      20.67    <.0001    A


----------- Effect=Cultivar*Treatmnt A=Tukey-Kramer(.05) avgSD=4.90116 maxSD=4.90116 -----------

                                          Standard                           Pr >    Let
   Obs    Cultivar    Treatmnt    Estimate     Error        DF    t Value       |t|    Grp

     7    Bass           F         12.7165      1.3094    12.8       9.71    <.0001     A
     8    Bass           O          8.3736      1.3094    12.8       6.39    <.0001     A
     9    Corsica        F         15.4538      1.3094    12.8      11.80    <.0001     A
    10    Corsica        O         11.3175      1.3094    12.8       8.64    <.0001     A
    11    Jack           F          9.9969      1.3094    12.8       7.63    <.0001     A
    12    Jack           O          5.8310      1.3094    12.8       4.45    0.0007     A
    13    Williams       F         20.2232      1.3094    12.8      15.44    <.0001     A
    14    Williams       O         18.0598      1.3094    12.8      13.79    <.0001     A
```

Genistein

```
                    The Mixed Procedure

                     Model Information

   Data Set                    WORK.OZONEISO
   Dependent Variable          Genistein
   Covariance Structure        Variance Components
   Estimation Method           REML
   Residual Variance Method    Profile
   Fixed Effects SE Method     Prasad-Rao-Jeske-
                               Kackar-Harville
   Degrees of Freedom Method   Kenward-Roger


                  Class Level Information

    Class       Levels    Values

    Chamber          6    1 2 3 4 5 6
    Cultivar         4    Bass Corsica Jack Williams
    Treatmnt         2    F O


                        Dimensions

            Covariance Parameters             2
            Columns in X                     15
            Columns in Z                      6
            Subjects                          1
            Max Obs Per Subject              24
            Observations Used                24
            Observations Not Used             0
            Total Observations               24


                     Iteration History

Iteration    Evaluations    -2 Res Log Like       Criterion

        0              1       -23.13121316
        1              1       -24.01139657      0.00000000


                 Convergence criteria met.


                   Covariance Parameter
                         Estimates

                   Cov Parm     Estimate

                   Chamber      0.001678
                   Residual     0.006285
```

```
                                           Genistein          17:11 Sunday, August 14, 2005  38

                                      The Mixed Procedure

                                        Fit Statistics

                             -2 Res Log Likelihood           -24.0
                             AIC (smaller is better)         -20.0
                             AICC (smaller is better)        -19.1
                             BIC (smaller is better)         -20.4


                                 Type 3 Tests of Fixed Effects

                                           Num     Den
                     Effect                 DF      DF    F Value    Pr > F

                     Cultivar                3      12       8.61    0.0025
                     Treatmnt                1       4       2.32    0.2023
                     Cultivar*Treatmnt       3      12       3.72    0.0423


------------------- Effect=Treatmnt A=Tukey(.05) avgSD=0.12923 maxSD=0.12923 -------------------

                                               Standard                         Pr >    Let
    Obs    Cultivar    Treatmnt    Estimate     Error        DF    t Value       |t|    Grp

      1                   F          0.2487     0.03291       4       7.56    0.0016     A
      2                   O          0.1777     0.03291       4       5.40    0.0057     A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.13589 maxSD=0.13589 ----------------

                                               Standard                         Pr >    Let
    Obs    Cultivar    Treatmnt    Estimate     Error        DF    t Value       |t|    Grp

      3    Bass                      0.1405     0.03643    14.1       3.86    0.0017    BC
      4    Corsica                   0.1268     0.03643    14.1       3.48    0.0036    C
      5    Jack                      0.2640     0.03643    14.1       7.25    <.0001    AB
      6    Williams                  0.3215     0.03643    14.1       8.82    <.0001    A


----------- Effect=Cultivar*Treatmnt A=Tukey-Kramer(.05) avgSD=0.20632 maxSD=0.20632 -----------

                                               Standard                         Pr >    Let
    Obs    Cultivar    Treatmnt    Estimate     Error        DF    t Value       |t|    Grp

      7    Bass           F          0.1182     0.05152    14.1       2.29    0.0376    B
      8    Corsica        F          0.1487     0.05152    14.1       2.89    0.0119    B
      9    Jack           F          0.3881     0.05152    14.1       7.53    <.0001    A
     10    Williams       F          0.3396     0.05152    14.1       6.59    <.0001    AB
     11    Bass           O          0.1628     0.05152    14.1       3.16    0.0069    A
     12    Corsica        O          0.1049     0.05152    14.1       2.04    0.0609    A
     13    Jack           O          0.1399     0.05152    14.1       2.72    0.0166    A
     14    Williams       O          0.3034     0.05152    14.1       5.89    <.0001    A
```

```
------------------- Effect=Treatmnt A=Tukey(.05) avgSD=0.12923 maxSD=0.12923 -------------------

                                             Standard                              Pr >    Let
   Obs    Cultivar    Treatmnt    Estimate     Error        DF    t Value       |t|    Grp

     1                    F         0.2487     0.03291       4       7.56    0.0016     A
     2                    O         0.1777     0.03291       4       5.40    0.0057     A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.13589 maxSD=0.13589 ----------------

                                             Standard                              Pr >    Let
   Obs    Cultivar    Treatmnt    Estimate     Error        DF    t Value       |t|    Grp

     3    Bass                      0.1405     0.03643    14.1       3.86    0.0017    BC
     4    Corsica                   0.1268     0.03643    14.1       3.48    0.0036    C
     5    Jack                      0.2640     0.03643    14.1       7.25    <.0001    AB
     6    Williams                  0.3215     0.03643    14.1       8.82    <.0001    A


----------- Effect=Cultivar*Treatmnt A=Tukey-Kramer(.05) avgSD=0.19052 maxSD=0.19052 -----------

                                             Standard                              Pr >    Let
   Obs    Cultivar    Treatmnt    Estimate     Error        DF    t Value       |t|    Grp

     7    Bass            F         0.1182     0.05152    14.1       2.29    0.0376     A
     8    Bass            O         0.1628     0.05152    14.1       3.16    0.0069     A
     9    Corsica         F         0.1487     0.05152    14.1       2.89    0.0119     A
    10    Corsica         O         0.1049     0.05152    14.1       2.04    0.0609     A
    11    Jack            F         0.3881     0.05152    14.1       7.53    <.0001     A
    12    Jack            O         0.1399     0.05152    14.1       2.72    0.0166     A
    13    Williams        F         0.3396     0.05152    14.1       6.59    <.0001     A
    14    Williams        O         0.3034     0.05152    14.1       5.89    <.0001     A
```

```
Yield, Seed Weight, Protein, and Oil - Ozone Study

                              WtHundrd
                          The Mixed Procedure

                           Model Information

         Data Set                      WORK.OZONE
         Dependent Variable            Wtg
         Covariance Structure          Variance Components
         Estimation Method             REML
         Residual Variance Method      Profile
         Fixed Effects SE Method       Prasad-Rao-Jeske-
                                       Kackar-Harville
         Degrees of Freedom Method     Kenward-Roger


                        Class Level Information

          Class       Levels    Values

          Chamber          6    1 2 3 4 5 6
          Cultivar         4    Bass Corsica Jack Willms82
          Treatmnt         2    CF O3


                              Dimensions

                  Covariance Parameters            2
                  Columns in X                    15
                  Columns in Z                     6
                  Subjects                         1
                  Max Obs Per Subject             24
                  Observations Used               24
                  Observations Not Used            0
                  Total Observations              24


                           Iteration History

      Iteration    Evaluations    -2 Res Log Like       Criterion

              0              1       159.11309228
              1              1       159.11309228      0.00000000


                       Convergence criteria met.


                         Covariance Parameter
                               Estimates

                         Cov Parm     Estimate

                         Chamber             0
                         Residual       709.63


                          The Mixed Procedure

                            Fit Statistics

                 -2 Res Log Likelihood          159.1
```

```
                             AIC (smaller is better)         161.1
                             AICC (smaller is better)        161.4
                             BIC (smaller is better)         160.9


                                 Type 3 Tests of Fixed Effects

                                           Num     Den
                     Effect                 DF      DF    F Value    Pr > F

                     Cultivar                3      16       1.29    0.3130
                     Treatmnt                1      16       4.39    0.0525
                     Cultivar*Treatmnt       3      16       0.47    0.7061


                                      Least Squares Means

                                                         Standard
Effect               Cultivar    Treatmnt    Estimate       Error      DF    t Value    Pr > |t|

Treatmnt                         CF            113.97      7.9267      16      14.38      <.0001
Treatmnt                         O3           90.8417      7.6900      16      11.81      <.0001
Cultivar             Bass                     97.8167     10.8753      16       8.99      <.0001
Cultivar             Corsica                   108.93     10.1729      16      10.71      <.0001
Cultivar             Jack                     86.6250     12.1589      16       7.12      <.0001
Cultivar             Willms82                  116.25     10.8753      16      10.69      <.0001
Cultivar*Treatmnt    Bass        CF            106.10     15.3800      16       6.90      <.0001
Cultivar*Treatmnt    Bass        O3           89.5333     15.3800      16       5.82      <.0001
Cultivar*Treatmnt    Corsica     CF            125.10     13.3195      16       9.39      <.0001
Cultivar*Treatmnt    Corsica     O3           92.7667     15.3800      16       6.03      <.0001
Cultivar*Treatmnt    Jack        CF           88.8500     18.8366      16       4.72      0.0002
Cultivar*Treatmnt    Jack        O3           84.4000     15.3800      16       5.49      <.0001
Cultivar*Treatmnt    Willms82    CF            135.83     15.3800      16       8.83      <.0001
Cultivar*Treatmnt    Willms82    O3           96.6667     15.3800      16       6.29      <.0001


                               Differences of Least Squares Means

                                                                       Standard
  Effect             Cultivar  Treatmnt  Cultivar  Treatmnt  Estimate     Error    DF  t Value

  Treatmnt                     CF                  O3         23.1292   11.0439    16     2.09
  Cultivar           Bass                Corsica             -11.1167   14.8916    16    -0.75
  Cultivar           Bass                Jack                 11.1917   16.3129    16     0.69
  Cultivar           Bass                Willms82            -18.4333   15.3800    16    -1.20
  Cultivar           Corsica             Jack                 22.3083   15.8533    16     1.41
  Cultivar           Corsica             Willms82             -7.3167   14.8916    16    -0.49
  Cultivar           Jack                Willms82            -29.6250   16.3129    16    -1.82
```

```
                               The Mixed Procedure

                         Differences of Least Squares Means

                                                                     Standard
Effect             Cultivar  Treatmnt  Cultivar  Treatmnt  Estimate     Error    DF  t Value

Cultivar*Treatmnt  Bass      CF        Bass      O3         16.5667   21.7506    16     0.76
Cultivar*Treatmnt  Bass      CF        Corsica   CF        -19.0000   20.3458    16    -0.93
Cultivar*Treatmnt  Bass      CF        Corsica   O3         13.3333   21.7506    16     0.61
Cultivar*Treatmnt  Bass      CF        Jack      CF         17.2500   24.3179    16     0.71
Cultivar*Treatmnt  Bass      CF        Jack      O3         21.7000   21.7506    16     1.00
Cultivar*Treatmnt  Bass      CF        Willms82  CF        -29.7333   21.7506    16    -1.37
Cultivar*Treatmnt  Bass      CF        Willms82  O3          9.4333   21.7506    16     0.43
Cultivar*Treatmnt  Bass      O3        Corsica   CF        -35.5667   20.3458    16    -1.75
Cultivar*Treatmnt  Bass      O3        Corsica   O3         -3.2333   21.7506    16    -0.15
Cultivar*Treatmnt  Bass      O3        Jack      CF          0.6833   24.3179    16     0.03
Cultivar*Treatmnt  Bass      O3        Jack      O3          5.1333   21.7506    16     0.24
Cultivar*Treatmnt  Bass      O3        Willms82  CF        -46.3000   21.7506    16    -2.13
Cultivar*Treatmnt  Bass      O3        Willms82  O3         -7.1333   21.7506    16    -0.33
Cultivar*Treatmnt  Corsica   CF        Corsica   O3         32.3333   20.3458    16     1.59
Cultivar*Treatmnt  Corsica   CF        Jack      CF         36.2500   23.0700    16     1.57
Cultivar*Treatmnt  Corsica   CF        Jack      O3         40.7000   20.3458    16     2.00
Cultivar*Treatmnt  Corsica   CF        Willms82  CF        -10.7333   20.3458    16    -0.53
Cultivar*Treatmnt  Corsica   CF        Willms82  O3         28.4333   20.3458    16     1.40
Cultivar*Treatmnt  Corsica   O3        Jack      CF          3.9167   24.3179    16     0.16
Cultivar*Treatmnt  Corsica   O3        Jack      O3          8.3667   21.7506    16     0.38
Cultivar*Treatmnt  Corsica   O3        Willms82  CF        -43.0667   21.7506    16    -1.98
Cultivar*Treatmnt  Corsica   O3        Willms82  O3         -3.9000   21.7506    16    -0.18
Cultivar*Treatmnt  Jack      CF        Jack      O3          4.4500   24.3179    16     0.18
Cultivar*Treatmnt  Jack      CF        Willms82  CF        -46.9833   24.3179    16    -1.93
Cultivar*Treatmnt  Jack      CF        Willms82  O3         -7.8167   24.3179    16    -0.32
Cultivar*Treatmnt  Jack      O3        Willms82  CF        -51.4333   21.7506    16    -2.36
Cultivar*Treatmnt  Jack      O3        Willms82  O3        -12.2667   21.7506    16    -0.56
Cultivar*Treatmnt  Willms82  CF        Willms82  O3         39.1667   21.7506    16     1.80

                        Differences of Least Squares Means

Effect             Cultivar  Treatmnt  Cultivar  Treatmnt  Pr > |t|   Adjustment      Adj P

Treatmnt                     CF                  O3          0.0525   Tukey-Kramer   0.0525
Cultivar           Bass                Corsica               0.4662   Tukey-Kramer   0.8768
Cultivar           Bass                Jack                  0.5025   Tukey-Kramer   0.9009
Cultivar           Bass                Willms82              0.2482   Tukey-Kramer   0.6365
Cultivar           Corsica             Jack                  0.1785   Tukey-Kramer   0.5130
Cultivar           Corsica             Willms82              0.6299   Tukey-Kramer   0.9599
Cultivar           Jack                Willms82              0.0881   Tukey-Kramer   0.3021
Cultivar*Treatmnt  Bass      CF        Bass      O3          0.4573   Tukey-Kramer   0.9930
Cultivar*Treatmnt  Bass      CF        Corsica   CF          0.3643   Tukey-Kramer   0.9777
Cultivar*Treatmnt  Bass      CF        Corsica   O3          0.5485   Tukey-Kramer   0.9981
Cultivar*Treatmnt  Bass      CF        Jack      CF          0.4883   Tukey-Kramer   0.9954
Cultivar*Treatmnt  Bass      CF        Jack      O3          0.3333   Tukey-Kramer   0.9682
Cultivar*Treatmnt  Bass      CF        Willms82  CF          0.1905   Tukey-Kramer   0.8591


                               The Mixed Procedure

                        Differences of Least Squares Means

Effect             Cultivar  Treatmnt  Cultivar  Treatmnt  Pr > |t|   Adjustment      Adj P

Cultivar*Treatmnt  Bass      CF        Willms82  O3          0.6703   Tukey-Kramer   0.9998
Cultivar*Treatmnt  Bass      O3        Corsica   CF          0.0996   Tukey-Kramer   0.6594
```

```
 Cultivar*Treatmnt  Bass      O3       Corsica   O3          0.8837   Tukey-Kramer   1.0000
 Cultivar*Treatmnt  Bass      O3       Jack      CF          0.9779   Tukey-Kramer   1.0000
 Cultivar*Treatmnt  Bass      O3       Jack      O3          0.8164   Tukey-Kramer   1.0000
 Cultivar*Treatmnt  Bass      O3       Willms82  CF          0.0492   Tukey-Kramer   0.4383
 Cultivar*Treatmnt  Bass      O3       Willms82  O3          0.7472   Tukey-Kramer   1.0000
 Cultivar*Treatmnt  Corsica   CF       Corsica   O3          0.1316   Tukey-Kramer   0.7500
 Cultivar*Treatmnt  Corsica   CF       Jack      CF          0.1357   Tukey-Kramer   0.7597
 Cultivar*Treatmnt  Corsica   CF       Jack      O3          0.0627   Tukey-Kramer   0.5105
 Cultivar*Treatmnt  Corsica   CF       Willms82  CF          0.6051   Tukey-Kramer   0.9993
 Cultivar*Treatmnt  Corsica   CF       Willms82  O3          0.1813   Tukey-Kramer   0.8458
 Cultivar*Treatmnt  Corsica   O3       Jack      CF          0.8741   Tukey-Kramer   1.0000
 Cultivar*Treatmnt  Corsica   O3       Jack      O3          0.7056   Tukey-Kramer   0.9999
 Cultivar*Treatmnt  Corsica   O3       Willms82  CF          0.0652   Tukey-Kramer   0.5223
 Cultivar*Treatmnt  Corsica   O3       Willms82  O3          0.8599   Tukey-Kramer   1.0000
 Cultivar*Treatmnt  Jack      CF       Jack      O3          0.8571   Tukey-Kramer   1.0000
 Cultivar*Treatmnt  Jack      CF       Willms82  CF          0.0713   Tukey-Kramer   0.5504
 Cultivar*Treatmnt  Jack      CF       Willms82  O3          0.7520   Tukey-Kramer   1.0000
 Cultivar*Treatmnt  Jack      O3       Willms82  CF          0.0310   Tukey-Kramer   0.3199
 Cultivar*Treatmnt  Jack      O3       Willms82  O3          0.5806   Tukey-Kramer   0.9989
 Cultivar*Treatmnt  Willms82  CF       Willms82  O3          0.0906   Tukey-Kramer   0.6283


---------------- Effect=Treatmnt A=Tukey-Kramer(.05) avgSD=23.412 maxSD=23.412 -----------------

                                                 Standard                              Pr >    Let
   Obs    Cultivar    Treatmnt    Estimate     Error        DF     t Value       |t|    Grp

     1                   CF         113.97      7.9267      16      14.38    <.0001     A
     2                   O3        90.8417      7.6900      16      11.81    <.0001     A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=44.6521 maxSD=46.6716 ----------------

                                                 Standard                              Pr >    Let
   Obs    Cultivar    Treatmnt    Estimate     Error        DF     t Value       |t|    Grp

     3    Bass                     97.8167     10.8753      16       8.99    <.0001     A
     4    Corsica                   108.93     10.1729      16      10.71    <.0001     A
     5    Jack                     86.6250     12.1589      16       7.12    <.0001     A
     6    Willms82                  116.25     10.8753      16      10.69    <.0001     A


---------- Effect=Cultivar*Treatmnt A=Tukey-Kramer(.05) avgSD=67.5671 maxSD=74.5021 -----------

                                                 Standard                              Pr >    Let
   Obs    Cultivar    Treatmnt    Estimate     Error        DF     t Value       |t|    Grp

     7    Bass           CF         106.10     15.3800      16       6.90    <.0001     A
     8    Corsica        CF         125.10     13.3195      16       9.39    <.0001     A
     9    Jack           CF        88.8500     18.8366      16       4.72    0.0002     A
    10    Willms82       CF         135.83     15.3800      16       8.83    <.0001     A
    11    Bass           O3        89.5333     15.3800      16       5.82    <.0001     A
    12    Corsica        O3        92.7667     15.3800      16       6.03    <.0001     A
    13    Jack           O3        84.4000     15.3800      16       5.49    <.0001     A
    14    Willms82       O3        96.6667     15.3800      16       6.29    <.0001     A
```

```
---------------- Effect=Treatmnt A=Tukey-Kramer(.05) avgSD=23.412 maxSD=23.412 -----------------

                                                   Standard                            Pr >     Let
   Obs     Cultivar     Treatmnt     Estimate        Error        DF     t Value        |t|     Grp

     1                     CF          113.97       7.9267        16       14.38     <.0001      A
     2                     O3         90.8417       7.6900        16       11.81     <.0001      A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=44.6521 maxSD=46.6716 ----------------

                                                   Standard                            Pr >     Let
   Obs     Cultivar     Treatmnt     Estimate        Error        DF     t Value        |t|     Grp

     3     Bass                       97.8167      10.8753        16        8.99     <.0001      A
     4     Corsica                     108.93      10.1729        16       10.71     <.0001      A
     5     Jack                       86.6250      12.1589        16        7.12     <.0001      A
     6     Willms82                    116.25      10.8753        16       10.69     <.0001      A


----------- Effect=Cultivar*Treatmnt A=Tukey-Kramer(.05) avgSD=56.8736 maxSD=62.7482 -----------

                                                   Standard                            Pr >     Let
   Obs     Cultivar     Treatmnt     Estimate        Error        DF     t Value        |t|     Grp

     7     Bass            CF          106.10      15.3800        16        6.90     <.0001      A
     8     Bass            O3         89.5333      15.3800        16        5.82     <.0001      A
     9     Corsica         CF          125.10      13.3195        16        9.39     <.0001      A
    10     Corsica         O3         92.7667      15.3800        16        6.03     <.0001      A
    11     Jack            CF         88.8500      18.8366        16        4.72     0.0002      A
    12     Jack            O3         84.4000      15.3800        16        5.49     <.0001      A
    13     Willms82        CF          135.83      15.3800        16        8.83     <.0001      A
    14     Willms82        O3         96.6667      15.3800        16        6.29     <.0001      A
```

Yield

```
                  The Mixed Procedure

                   Model Information

   Data Set                    WORK.OZONE
   Dependent Variable          Wtg
   Covariance Structure        Variance Components
   Estimation Method           REML
   Residual Variance Method    Profile
   Fixed Effects SE Method     Prasad-Rao-Jeske-
                               Kackar-Harville
   Degrees of Freedom Method   Kenward-Roger


                Class Level Information

    Class       Levels    Values

    Chamber          6    1 2 3 4 5 6
    Cultivar         4    Bass Corsica Jack Willms82
    Treatmnt         2    CF O3


                      Dimensions

            Covariance Parameters            2
            Columns in X                    15
            Columns in Z                     6
            Subjects                         1
            Max Obs Per Subject             24
            Observations Used               24
            Observations Not Used            0
            Total Observations              24


                   Iteration History

Iteration    Evaluations    -2 Res Log Like       Criterion

        0              1       159.11309228
        1              1       159.11309228      0.00000000


               Convergence criteria met.


                 Covariance Parameter
                       Estimates

                 Cov Parm     Estimate

                 Chamber             0
                 Residual       709.63
```

```
                          The Mixed Procedure

                             Fit Statistics

                 -2 Res Log Likelihood           159.1
                 AIC (smaller is better)         161.1
                 AICC (smaller is better)        161.4
                 BIC (smaller is better)         160.9


                     Type 3 Tests of Fixed Effects

                              Num     Den
             Effect            DF      DF    F Value    Pr > F

             Cultivar           3      16       1.29    0.3130
             Treatmnt           1      16       4.39    0.0525
             Cultivar*Treatmnt  3      16       0.47    0.7061


                          Least Squares Means

                                                 Standard
Effect             Cultivar    Treatmnt    Estimate       Error      DF    t Value    Pr > |t|

Treatmnt                       CF            113.97      7.9267      16      14.38      <.0001
Treatmnt                       O3           90.8417      7.6900      16      11.81      <.0001
Cultivar           Bass                     97.8167     10.8753      16       8.99      <.0001
Cultivar           Corsica                   108.93     10.1729      16      10.71      <.0001
Cultivar           Jack                     86.6250     12.1589      16       7.12      <.0001
Cultivar           Willms82                  116.25     10.8753      16      10.69      <.0001
Cultivar*Treatmnt  Bass        CF            106.10     15.3800      16       6.90      <.0001
Cultivar*Treatmnt  Bass        O3           89.5333     15.3800      16       5.82      <.0001
Cultivar*Treatmnt  Corsica     CF            125.10     13.3195      16       9.39      <.0001
Cultivar*Treatmnt  Corsica     O3           92.7667     15.3800      16       6.03      <.0001
Cultivar*Treatmnt  Jack        CF           88.8500     18.8366      16       4.72      0.0002
Cultivar*Treatmnt  Jack        O3           84.4000     15.3800      16       5.49      <.0001
Cultivar*Treatmnt  Willms82    CF            135.83     15.3800      16       8.83      <.0001
Cultivar*Treatmnt  Willms82    O3           96.6667     15.3800      16       6.29      <.0001


                       Differences of Least Squares Means

                                                                  Standard
 Effect            Cultivar  Treatmnt  Cultivar  Treatmnt  Estimate     Error    DF  t Value

 Treatmnt                    CF                  O3         23.1292   11.0439    16     2.09
 Cultivar          Bass                Corsica             -11.1167   14.8916    16    -0.75
 Cultivar          Bass                Jack                 11.1917   16.3129    16     0.69
 Cultivar          Bass                Willms82            -18.4333   15.3800    16    -1.20
 Cultivar          Corsica             Jack                 22.3083   15.8533    16     1.41
 Cultivar          Corsica             Willms82             -7.3167   14.8916    16    -0.49
 Cultivar          Jack                Willms82            -29.6250   16.3129    16    -1.82
```

```
                                The Mixed Procedure

                          Differences of Least Squares Means

                                                                       Standard
Effect             Cultivar  Treatmnt  Cultivar  Treatmnt  Estimate     Error    DF  t Value

Cultivar*Treatmnt  Bass      CF        Bass      O3         16.5667   21.7506    16     0.76
Cultivar*Treatmnt  Bass      CF        Corsica   CF        -19.0000   20.3458    16    -0.93
Cultivar*Treatmnt  Bass      CF        Corsica   O3         13.3333   21.7506    16     0.61
Cultivar*Treatmnt  Bass      CF        Jack      CF         17.2500   24.3179    16     0.71
Cultivar*Treatmnt  Bass      CF        Jack      O3         21.7000   21.7506    16     1.00
Cultivar*Treatmnt  Bass      CF        Willms82  CF        -29.7333   21.7506    16    -1.37
Cultivar*Treatmnt  Bass      CF        Willms82  O3          9.4333   21.7506    16     0.43
Cultivar*Treatmnt  Bass      O3        Corsica   CF        -35.5667   20.3458    16    -1.75
Cultivar*Treatmnt  Bass      O3        Corsica   O3         -3.2333   21.7506    16    -0.15
Cultivar*Treatmnt  Bass      O3        Jack      CF          0.6833   24.3179    16     0.03
Cultivar*Treatmnt  Bass      O3        Jack      O3          5.1333   21.7506    16     0.24
Cultivar*Treatmnt  Bass      O3        Willms82  CF        -46.3000   21.7506    16    -2.13
Cultivar*Treatmnt  Bass      O3        Willms82  O3         -7.1333   21.7506    16    -0.33
Cultivar*Treatmnt  Corsica   CF        Corsica   O3         32.3333   20.3458    16     1.59
Cultivar*Treatmnt  Corsica   CF        Jack      CF         36.2500   23.0700    16     1.57
Cultivar*Treatmnt  Corsica   CF        Jack      O3         40.7000   20.3458    16     2.00
Cultivar*Treatmnt  Corsica   CF        Willms82  CF        -10.7333   20.3458    16    -0.53
Cultivar*Treatmnt  Corsica   CF        Willms82  O3         28.4333   20.3458    16     1.40
Cultivar*Treatmnt  Corsica   O3        Jack      CF          3.9167   24.3179    16     0.16
Cultivar*Treatmnt  Corsica   O3        Jack      O3          8.3667   21.7506    16     0.38
Cultivar*Treatmnt  Corsica   O3        Willms82  CF        -43.0667   21.7506    16    -1.98
Cultivar*Treatmnt  Corsica   O3        Willms82  O3         -3.9000   21.7506    16    -0.18
Cultivar*Treatmnt  Jack      CF        Jack      O3          4.4500   24.3179    16     0.18
Cultivar*Treatmnt  Jack      CF        Willms82  CF        -46.9833   24.3179    16    -1.93
Cultivar*Treatmnt  Jack      CF        Willms82  O3         -7.8167   24.3179    16    -0.32
Cultivar*Treatmnt  Jack      O3        Willms82  CF        -51.4333   21.7506    16    -2.36
Cultivar*Treatmnt  Jack      O3        Willms82  O3        -12.2667   21.7506    16    -0.56
Cultivar*Treatmnt  Willms82  CF        Willms82  O3         39.1667   21.7506    16     1.80

                         Differences of Least Squares Means

Effect             Cultivar  Treatmnt  Cultivar  Treatmnt  Pr > |t|   Adjustment      Adj P

Treatmnt                     CF                  O3          0.0525   Tukey-Kramer   0.0525
Cultivar           Bass                Corsica               0.4662   Tukey-Kramer   0.8768
Cultivar           Bass                Jack                  0.5025   Tukey-Kramer   0.9009
Cultivar           Bass                Willms82              0.2482   Tukey-Kramer   0.6365
Cultivar           Corsica             Jack                  0.1785   Tukey-Kramer   0.5130
Cultivar           Corsica             Willms82              0.6299   Tukey-Kramer   0.9599
Cultivar           Jack                Willms82              0.0881   Tukey-Kramer   0.3021
Cultivar*Treatmnt  Bass      CF        Bass      O3          0.4573   Tukey-Kramer   0.9930
Cultivar*Treatmnt  Bass      CF        Corsica   CF          0.3643   Tukey-Kramer   0.9777
Cultivar*Treatmnt  Bass      CF        Corsica   O3          0.5485   Tukey-Kramer   0.9981
Cultivar*Treatmnt  Bass      CF        Jack      CF          0.4883   Tukey-Kramer   0.9954
Cultivar*Treatmnt  Bass      CF        Jack      O3          0.3333   Tukey-Kramer   0.9682
Cultivar*Treatmnt  Bass      CF        Willms82  CF          0.1905   Tukey-Kramer   0.8591
```

```
                                        The Mixed Procedure

                                 Differences of Least Squares Means

 Effect             Cultivar  Treatmnt  Cultivar  Treatmnt  Pr > |t|   Adjustment      Adj P

 Cultivar*Treatmnt  Bass      CF        Willms82  O3          0.6703   Tukey-Kramer   0.9998
 Cultivar*Treatmnt  Bass      O3        Corsica   CF          0.0996   Tukey-Kramer   0.6594
 Cultivar*Treatmnt  Bass      O3        Corsica   O3          0.8837   Tukey-Kramer   1.0000
 Cultivar*Treatmnt  Bass      O3        Jack      CF          0.9779   Tukey-Kramer   1.0000
 Cultivar*Treatmnt  Bass      O3        Jack      O3          0.8164   Tukey-Kramer   1.0000
 Cultivar*Treatmnt  Bass      O3        Willms82  CF          0.0492   Tukey-Kramer   0.4383
 Cultivar*Treatmnt  Bass      O3        Willms82  O3          0.7472   Tukey-Kramer   1.0000
 Cultivar*Treatmnt  Corsica   CF        Corsica   O3          0.1316   Tukey-Kramer   0.7500
 Cultivar*Treatmnt  Corsica   CF        Jack      CF          0.1357   Tukey-Kramer   0.7597
 Cultivar*Treatmnt  Corsica   CF        Jack      O3          0.0627   Tukey-Kramer   0.5105
 Cultivar*Treatmnt  Corsica   CF        Willms82  CF          0.6051   Tukey-Kramer   0.9993
 Cultivar*Treatmnt  Corsica   CF        Willms82  O3          0.1813   Tukey-Kramer   0.8458
 Cultivar*Treatmnt  Corsica   O3        Jack      CF          0.8741   Tukey-Kramer   1.0000
 Cultivar*Treatmnt  Corsica   O3        Jack      O3          0.7056   Tukey-Kramer   0.9999
 Cultivar*Treatmnt  Corsica   O3        Willms82  CF          0.0652   Tukey-Kramer   0.5223
 Cultivar*Treatmnt  Corsica   O3        Willms82  O3          0.8599   Tukey-Kramer   1.0000
 Cultivar*Treatmnt  Jack      CF        Jack      O3          0.8571   Tukey-Kramer   1.0000
 Cultivar*Treatmnt  Jack      CF        Willms82  CF          0.0713   Tukey-Kramer   0.5504
 Cultivar*Treatmnt  Jack      CF        Willms82  O3          0.7520   Tukey-Kramer   1.0000
 Cultivar*Treatmnt  Jack      O3        Willms82  CF          0.0310   Tukey-Kramer   0.3199
 Cultivar*Treatmnt  Jack      O3        Willms82  O3          0.5806   Tukey-Kramer   0.9989
 Cultivar*Treatmnt  Willms82  CF        Willms82  O3          0.0906   Tukey-Kramer   0.6283


---------------- Effect=Treatmnt A=Tukey-Kramer(.05) avgSD=23.412 maxSD=23.412 -----------------

                                              Standard                             Pr >    Let
   Obs    Cultivar    Treatmnt    Estimate     Error        DF     t Value          |t|    Grp

     1                   CF         113.97      7.9267      16       14.38       <.0001     A
     2                   O3        90.8417      7.6900      16       11.81       <.0001     A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=44.6521 maxSD=46.6716 ----------------

                                              Standard                             Pr >    Let
   Obs    Cultivar    Treatmnt    Estimate     Error        DF     t Value          |t|    Grp

     3    Bass                     97.8167     10.8753      16        8.99       <.0001     A
     4    Corsica                   108.93     10.1729      16       10.71       <.0001     A
     5    Jack                     86.6250     12.1589      16        7.12       <.0001     A
     6    Willms82                  116.25     10.8753      16       10.69       <.0001     A


----------- Effect=Cultivar*Treatmnt A=Tukey-Kramer(.05) avgSD=67.5671 maxSD=74.5021 -----------

                                              Standard                             Pr >    Let
   Obs    Cultivar    Treatmnt    Estimate     Error        DF     t Value          |t|    Grp

     7    Bass           CF         106.10     15.3800      16        6.90       <.0001     A
     8    Corsica        CF         125.10     13.3195      16        9.39       <.0001     A
     9    Jack           CF        88.8500     18.8366      16        4.72       0.0002     A
    10    Willms82       CF         135.83     15.3800      16        8.83       <.0001     A
    11    Bass           O3        89.5333     15.3800      16        5.82       <.0001     A
    12    Corsica        O3        92.7667     15.3800      16        6.03       <.0001     A
    13    Jack           O3        84.4000     15.3800      16        5.49       <.0001     A
```

```
14    Willms82       O3        96.6667     15.3800       16       6.29    <.0001      A
```

```
---------------- Effect=Treatmnt A=Tukey-Kramer(.05) avgSD=23.412 maxSD=23.412 -----------------

                                                Standard                           Pr >    Let
    Obs    Cultivar    Treatmnt    Estimate     Error        DF    t Value       |t|    Grp

      1                   CF         113.97      7.9267      16      14.38    <.0001     A
      2                   O3        90.8417      7.6900      16      11.81    <.0001     A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=44.6521 maxSD=46.6716 ----------------

                                                Standard                           Pr >    Let
    Obs    Cultivar    Treatmnt    Estimate     Error        DF    t Value       |t|    Grp

      3    Bass                     97.8167     10.8753      16       8.99    <.0001     A
      4    Corsica                   108.93     10.1729      16      10.71    <.0001     A
      5    Jack                     86.6250     12.1589      16       7.12    <.0001     A
      6    Willms82                  116.25     10.8753      16      10.69    <.0001     A


----------- Effect=Cultivar*Treatmnt A=Tukey-Kramer(.05) avgSD=56.8736 maxSD=62.7482 -----------

                                                Standard                           Pr >    Let
    Obs    Cultivar    Treatmnt    Estimate     Error        DF    t Value       |t|    Grp

      7    Bass           CF         106.10     15.3800      16       6.90    <.0001     A
      8    Bass           O3        89.5333     15.3800      16       5.82    <.0001     A
      9    Corsica        CF         125.10     13.3195      16       9.39    <.0001     A
     10    Corsica        O3        92.7667     15.3800      16       6.03    <.0001     A
     11    Jack           CF        88.8500     18.8366      16       4.72    0.0002     A
     12    Jack           O3        84.4000     15.3800      16       5.49    <.0001     A
     13    Willms82       CF         135.83     15.3800      16       8.83    <.0001     A
     14    Willms82       O3        96.6667     15.3800      16       6.29    <.0001     A
```

Oil

```
                    The Mixed Procedure

                     Model Information

   Data Set                    WORK.OZONE
   Dependent Variable          Oil
   Covariance Structure        Variance Components
   Estimation Method           REML
   Residual Variance Method    Profile
   Fixed Effects SE Method     Prasad-Rao-Jeske-
                               Kackar-Harville
   Degrees of Freedom Method   Kenward-Roger


                  Class Level Information

    Class       Levels    Values

    Chamber          6    1 2 3 4 5 6
    Cultivar         4    Bass Corsica Jack Willms82
    Treatmnt         2    CF O3


                        Dimensions

            Covariance Parameters            2
            Columns in X                    15
            Columns in Z                     6
            Subjects                         1
            Max Obs Per Subject             24
            Observations Used               24
            Observations Not Used            0
            Total Observations              24


                     Iteration History

Iteration    Evaluations    -2 Res Log Like       Criterion

        0              1        31.71204678
        1              1        31.71204678      0.00000000


                 Convergence criteria met.


                   Covariance Parameter
                         Estimates

                   Cov Parm     Estimate

                   Chamber             0
                   Residual       0.2471
```

```
                              The Mixed Procedure

                                Fit Statistics

                     -2 Res Log Likelihood            31.7
                     AIC (smaller is better)          33.7
                     AICC (smaller is better)         34.0
                     BIC (smaller is better)          33.5


                         Type 3 Tests of Fixed Effects

                                Num     Den
                 Effect          DF      DF    F Value    Pr > F

                 Cultivar         3      16      15.88    <.0001
                 Treatmnt         1      16       0.85    0.3713
                 Cultivar*Treatmnt 3     16       4.83    0.0140


--------------- Effect=Treatmnt A=Tukey-Kramer(.05) avgSD=0.43691 maxSD=0.43691 ----------------

                                             Standard                        Pr >    Let
    Obs    Cultivar    Treatmnt    Estimate     Error       DF    t Value      |t|    Grp

     1                    CF        22.1063      0.1479      16     149.44    <.0001     A
     2                    O3        21.9167      0.1435      16     152.72    <.0001     A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.83328 maxSD=0.87097 ----------------

                                             Standard                        Pr >    Let
    Obs    Cultivar    Treatmnt    Estimate     Error       DF    t Value      |t|    Grp

     3     Bass                     22.7833      0.2030      16     112.26    <.0001     A
     4     Corsica                  21.6292      0.1898      16     113.93    <.0001     B
     5     Jack                     21.0000      0.2269      16      92.55    <.0001     B
     6     Willms82                 22.6333      0.2030      16     111.52    <.0001     A
```

```
--------------- Effect=Treatmnt A=Tukey-Kramer(.05) avgSD=0.43691 maxSD=0.43691 ----------------

                                             Standard                        Pr >    Let
    Obs    Cultivar    Treatmnt    Estimate     Error       DF    t Value      |t|    Grp

     1                    CF        22.1063      0.1479      16     149.44    <.0001     A
     2                    O3        21.9167      0.1435      16     152.72    <.0001     A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=0.83328 maxSD=0.87097 ----------------

                                             Standard                        Pr >    Let
    Obs    Cultivar    Treatmnt    Estimate     Error       DF    t Value      |t|    Grp

     3     Bass                     22.7833      0.2030      16     112.26    <.0001     A
     4     Corsica                  21.6292      0.1898      16     113.93    <.0001     B
     5     Jack                     21.0000      0.2269      16      92.55    <.0001     B
     6     Willms82                 22.6333      0.2030      16     111.52    <.0001     A
```

Protein

```
                         The Mixed Procedure

                    Model Information

   Data Set                     WORK.OZONE
   Dependent Variable           Protein
   Covariance Structure         Variance Components
   Estimation Method            REML
   Residual Variance Method     Profile
   Fixed Effects SE Method      Prasad-Rao-Jeske-
                                Kackar-Harville
   Degrees of Freedom Method    Kenward-Roger


                 Class Level Information

    Class       Levels    Values

    Chamber          6    1 2 3 4 5 6
    Cultivar         4    Bass Corsica Jack Willms82
    Treatmnt         2    CF O3


                       Dimensions

            Covariance Parameters            2
            Columns in X                    15
            Columns in Z                     6
            Subjects                         1
            Max Obs Per Subject             24
            Observations Used               24
            Observations Not Used            0
            Total Observations              24


                    Iteration History

Iteration    Evaluations    -2 Res Log Like       Criterion

        0              1        55.31006813
        1              1        55.31006813      0.00000000


                Convergence criteria met.


                  Covariance Parameter
                        Estimates

                  Cov Parm     Estimate

                  Chamber             0
                  Residual       1.0801
```

```
                         The Mixed Procedure

                           Fit Statistics

                  -2 Res Log Likelihood            55.3
                  AIC (smaller is better)          57.3
                  AICC (smaller is better)         57.6
                  BIC (smaller is better)          57.1


                     Type 3 Tests of Fixed Effects

                          Num     Den
          Effect           DF      DF    F Value    Pr > F

          Cultivar          3      16       4.61    0.0165
          Treatmnt          1      16       0.54    0.4730
          Cultivar*Treatmnt 3      16       1.25    0.3248


--------------- Effect=Treatmnt A=Tukey-Kramer(.05) avgSD=0.91339 maxSD=0.91339 ----------------

                                             Standard                          Pr >    Let
    Obs    Cultivar    Treatmnt    Estimate     Error       DF    t Value       |t|    Grp

     1                    CF        40.4417      0.3092      16     130.77    <.0001     A
     2                    O3        40.7583      0.3000      16     135.85    <.0001     A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=1.74204 maxSD=1.82083 ----------------

                                             Standard                          Pr >    Let
    Obs    Cultivar    Treatmnt    Estimate     Error       DF    t Value       |t|    Grp

     3     Bass                     39.6000      0.4243      16      93.33    <.0001    B
     4     Corsica                  41.4583      0.3969      16     104.46    <.0001    A
     5     Jack                     41.2750      0.4744      16      87.01    <.0001    AB
     6     Willms82                 40.0667      0.4243      16      94.43    <.0001    AB
```

```
--------------- Effect=Treatmnt A=Tukey-Kramer(.05) avgSD=0.91339 maxSD=0.91339 ----------------

                                             Standard                          Pr >    Let
    Obs    Cultivar    Treatmnt    Estimate     Error       DF    t Value       |t|    Grp

     1                    CF        40.4417      0.3092      16     130.77    <.0001     A
     2                    O3        40.7583      0.3000      16     135.85    <.0001     A


--------------- Effect=Cultivar A=Tukey-Kramer(.05) avgSD=1.74204 maxSD=1.82083 ----------------

                                             Standard                          Pr >    Let
    Obs    Cultivar    Treatmnt    Estimate     Error       DF    t Value       |t|    Grp

     3     Bass                     39.6000      0.4243      16      93.33    <.0001    B
     4     Corsica                  41.4583      0.3969      16     104.46    <.0001    A
     5     Jack                     41.2750      0.4744      16      87.01    <.0001    AB
     6     Willms82                 40.0667      0.4243      16      94.43    <.0001    AB
```

Data Sets

Seed and Leaf Tissue Isoflavone Analysis Data

Farm	Year	Field_Type	Block	Sample_Type	Timing	Cultivar	Plot	Isoflavone	Isof.Concen.
PHill	2002	DC	1	LeafPost	Late	Bass	2	1	0
PHill	2002	DC	1	LeafPost	Late	Bass	2	2	0
PHill	2002	DC	1	LeafPost	Late	Bass	2	3	0
PHill	2002	DC	1	LeafPost	Late	Bass	2	4	0
PHill	2002	DC	1	LeafPost	Late	Bass	2	5	2.709462584
PHill	2002	DC	1	LeafPost	Late	Bass	2	6	0
PHill	2002	DC	1	LeafPost	Late	Bass	2	7	0
PHill	2002	DC	1	Seed	Late	Bass	2	1	8.23800508
PHill	2002	DC	1	Seed	Late	Bass	2	2	16.56165854
PHill	2002	DC	1	Seed	Late	Bass	2	3	0
PHill	2002	DC	1	Seed	Late	Bass	2	4	27.2837303
PHill	2002	DC	1	Seed	Late	Bass	2	5	68.10513895
PHill	2002	DC	1	Seed	Late	Bass	2	6	0
PHill	2002	DC	1	Seed	Late	Bass	2	7	0
PHill	2002	DC	1	LeafPost	Early	Bass	3	1	0
PHill	2002	DC	1	LeafPost	Early	Bass	3	2	2.06752268
PHill	2002	DC	1	LeafPost	Early	Bass	3	3	0
PHill	2002	DC	1	LeafPost	Early	Bass	3	4	0
PHill	2002	DC	1	LeafPost	Early	Bass	3	5	4.321613661
PHill	2002	DC	1	LeafPost	Early	Bass	3	6	0
PHill	2002	DC	1	LeafPost	Early	Bass	3	7	0.345680852
PHill	2002	DC	1	Seed	Early	Bass	3	1	7.76169661
PHill	2002	DC	1	Seed	Early	Bass	3	2	15.67024064
PHill	2002	DC	1	Seed	Early	Bass	3	3	0
PHill	2002	DC	1	Seed	Early	Bass	3	4	26.4922947
PHill	2002	DC	1	Seed	Early	Bass	3	5	67.24208527
PHill	2002	DC	1	Seed	Early	Bass	3	6	0
PHill	2002	DC	1	Seed	Early	Bass	3	7	0
PHill	2002	DC	1	LeafPost	Late	Corsica	5	1	0
PHill	2002	DC	1	LeafPost	Late	Corsica	5	2	0
PHill	2002	DC	1	LeafPost	Late	Corsica	5	3	0
PHill	2002	DC	1	LeafPost	Late	Corsica	5	4	0
PHill	2002	DC	1	LeafPost	Late	Corsica	5	5	0
PHill	2002	DC	1	LeafPost	Late	Corsica	5	6	0
PHill	2002	DC	1	LeafPost	Late	Corsica	5	7	0
PHill	2002	DC	1	Seed	Late	Corsica	5	1	3.7964453
PHill	2002	DC	1	Seed	Late	Corsica	5	2	9.67890578
PHill	2002	DC	1	Seed	Late	Corsica	5	3	0
PHill	2002	DC	1	Seed	Late	Corsica	5	4	12.86048928
PHill	2002	DC	1	Seed	Late	Corsica	5	5	43.03097719
PHill	2002	DC	1	Seed	Late	Corsica	5	6	0
PHill	2002	DC	1	Seed	Late	Corsica	5	7	0.503561384
PHill	2002	DC	1	LeafPost	Early	Corsica	6	1	0
PHill	2002	DC	1	LeafPost	Early	Corsica	6	2	1.95297854
PHill	2002	DC	1	LeafPost	Early	Corsica	6	3	0
PHill	2002	DC	1	LeafPost	Early	Corsica	6	4	0
PHill	2002	DC	1	LeafPost	Early	Corsica	6	5	5.030946898
PHill	2002	DC	1	LeafPost	Early	Corsica	6	6	0
PHill	2002	DC	1	LeafPost	Early	Corsica	6	7	0.289918328
PHill	2002	DC	1	Seed	Early	Corsica	6	1	4.23662755
PHill	2002	DC	1	Seed	Early	Corsica	6	2	10.97030564
PHill	2002	DC	1	Seed	Early	Corsica	6	3	0
PHill	2002	DC	1	Seed	Early	Corsica	6	4	14.01009398
PHill	2002	DC	1	Seed	Early	Corsica	6	5	48.15582813
PHill	2002	DC	1	Seed	Early	Corsica	6	6	0
PHill	2002	DC	1	Seed	Early	Corsica	6	7	0
PHill	2002	DC	1	LeafPost	Early	Jack	7	1	0
PHill	2002	DC	1	LeafPost	Early	Jack	7	2	1.75884152
PHill	2002	DC	1	LeafPost	Early	Jack	7	3	0
PHill	2002	DC	1	LeafPost	Early	Jack	7	4	0
PHill	2002	DC	1	LeafPost	Early	Jack	7	5	3.852071609
PHill	2002	DC	1	LeafPost	Early	Jack	7	6	0
PHill	2002	DC	1	LeafPost	Early	Jack	7	7	0.2252564
PHill	2002	DC	1	Seed	Early	Jack	7	1	2.58180357
PHill	2002	DC	1	Seed	Early	Jack	7	2	9.60473216
PHill	2002	DC	1	Seed	Early	Jack	7	3	0
PHill	2002	DC	1	Seed	Early	Jack	7	4	13.32600048

PHill	2002	DC	1	Seed	Early	Jack	7	5	0
PHill	2002	DC	1	Seed	Early	Jack	7	6	0
PHill	2002	DC	1	Seed	Early	Jack	7	7	0
PHill	2002	DC	1	LeafPost	Late	Jack	8	1	0
PHill	2002	DC	1	LeafPost	Late	Jack	8	2	0.998387
PHill	2002	DC	1	LeafPost	Late	Jack	8	3	0
PHill	2002	DC	1	LeafPost	Late	Jack	8	4	0
PHill	2002	DC	1	LeafPost	Late	Jack	8	5	0
PHill	2002	DC	1	LeafPost	Late	Jack	8	6	0
PHill	2002	DC	1	LeafPost	Late	Jack	8	7	0
PHill	2002	DC	1	Seed	Late	Jack	8	1	2.91356172
PHill	2002	DC	1	Seed	Late	Jack	8	2	6.14800742
PHill	2002	DC	1	Seed	Late	Jack	8	3	0
PHill	2002	DC	1	Seed	Late	Jack	8	4	8.462290531
PHill	2002	DC	1	Seed	Late	Jack	8	5	27.9493657
PHill	2002	DC	1	Seed	Late	Jack	8	6	0
PHill	2002	DC	1	Seed	Late	Jack	8	7	0
PHill	2002	DC	1	LeafPost	Late	Williams82	10	1	0
PHill	2002	DC	1	LeafPost	Late	Williams82	10	2	1.1645597
PHill	2002	DC	1	LeafPost	Late	Williams82	10	3	0
PHill	2002	DC	1	LeafPost	Late	Williams82	10	4	0
PHill	2002	DC	1	LeafPost	Late	Williams82	10	5	2.22897182
PHill	2002	DC	1	LeafPost	Late	Williams82	10	6	0
PHill	2002	DC	1	LeafPost	Late	Williams82	10	7	0
PHill	2002	DC	1	Seed	Late	Williams82	10	1	4.61363684
PHill	2002	DC	1	Seed	Late	Williams82	10	2	8.37069338
PHill	2002	DC	1	Seed	Late	Williams82	10	3	0
PHill	2002	DC	1	Seed	Late	Williams82	10	4	15.57137476
PHill	2002	DC	1	Seed	Late	Williams82	10	5	38.03821732
PHill	2002	DC	1	Seed	Late	Williams82	10	6	0
PHill	2002	DC	1	Seed	Late	Williams82	10	7	0
PHill	2002	DC	1	LeafPost	Early	Williams82	11	1	0
PHill	2002	DC	1	LeafPost	Early	Williams82	11	2	2.03037722
PHill	2002	DC	1	LeafPost	Early	Williams82	11	3	0
PHill	2002	DC	1	LeafPost	Early	Williams82	11	4	0
PHill	2002	DC	1	LeafPost	Early	Williams82	11	5	6.348693947
PHill	2002	DC	1	LeafPost	Early	Williams82	11	6	0
PHill	2002	DC	1	LeafPost	Early	Williams82	11	7	0.15822168
PHill	2002	DC	1	Seed	Early	Williams82	11	1	5.15188997
PHill	2002	DC	1	Seed	Early	Williams82	11	2	9.87640586
PHill	2002	DC	1	Seed	Early	Williams82	11	3	0
PHill	2002	DC	1	Seed	Early	Williams82	11	4	16.91492226
PHill	2002	DC	1	Seed	Early	Williams82	11	5	42.01903294
PHill	2002	DC	1	Seed	Early	Williams82	11	6	0
PHill	2002	DC	1	Seed	Early	Williams82	11	7	0.812031992
PHill	2002	DC	2	LeafPost	Early	Williams82	12	1	0
PHill	2002	DC	2	LeafPost	Early	Williams82	12	2	1.2178829
PHill	2002	DC	2	LeafPost	Early	Williams82	12	3	0
PHill	2002	DC	2	LeafPost	Early	Williams82	12	4	0
PHill	2002	DC	2	LeafPost	Early	Williams82	12	5	2.120090297
PHill	2002	DC	2	LeafPost	Early	Williams82	12	6	0
PHill	2002	DC	2	LeafPost	Early	Williams82	12	7	0
PHill	2002	DC	2	LeafPost	Late	Corsica	13	1	0
PHill	2002	DC	2	LeafPost	Late	Corsica	13	2	0
PHill	2002	DC	2	LeafPost	Late	Corsica	13	3	0
PHill	2002	DC	2	LeafPost	Late	Corsica	13	4	0
PHill	2002	DC	2	LeafPost	Late	Corsica	13	5	2.33725602
PHill	2002	DC	2	LeafPost	Late	Corsica	13	6	0
PHill	2002	DC	2	LeafPost	Late	Corsica	13	7	0
PHill	2002	DC	2	Seed	Late	Corsica	13	1	4.95136822
PHill	2002	DC	2	Seed	Late	Corsica	13	2	9.5738588
PHill	2002	DC	2	Seed	Late	Corsica	13	3	0
PHill	2002	DC	2	Seed	Late	Corsica	13	4	15.72095358
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PHill	2002	DC	2	Seed	Late	Corsica	13	6	0
PHill	2002	DC	2	Seed	Late	Corsica	13	7	0.50308912
PHill	2002	DC	2	LeafPost	Early	Corsica	14	1	0
PHill	2002	DC	2	LeafPost	Early	Corsica	14	2	1.50173648
PHill	2002	DC	2	LeafPost	Early	Corsica	14	3	0
PHill	2002	DC	2	LeafPost	Early	Corsica	14	4	0
PHill	2002	DC	2	LeafPost	Early	Corsica	14	5	3.567151942
PHill	2002	DC	2	LeafPost	Early	Corsica	14	6	0
PHill	2002	DC	2	LeafPost	Early	Corsica	14	7	0.124146016
PHill	2002	DC	2	Seed	Early	Corsica	14	1	5.80554295
PHill	2002	DC	2	Seed	Early	Corsica	14	2	10.82317694
PHill	2002	DC	2	Seed	Early	Corsica	14	3	0
PHill	2002	DC	2	Seed	Early	Corsica	14	4	19.29248548
PHill	2002	DC	2	Seed	Early	Corsica	14	5	45.10382464
PHill	2002	DC	2	Seed	Early	Corsica	14	6	0

PHill	2002	DC	2	Seed	Early	Corsica	14	7	0.509001024
PHill	2002	DC	2	LeafPost	Late	Jack	16	1	0
PHill	2002	DC	2	LeafPost	Late	Jack	16	2	0
PHill	2002	DC	2	LeafPost	Late	Jack	16	3	0
PHill	2002	DC	2	LeafPost	Late	Jack	16	4	0
PHill	2002	DC	2	LeafPost	Late	Jack	16	5	3.001642784
PHill	2002	DC	2	LeafPost	Late	Jack	16	6	0
PHill	2002	DC	2	LeafPost	Late	Jack	16	7	0
PHill	2002	DC	2	Seed	Late	Jack	16	1	25.57925595
PHill	2002	DC	2	Seed	Late	Jack	16	2	9.74209874
PHill	2002	DC	2	Seed	Late	Jack	16	3	0
PHill	2002	DC	2	Seed	Late	Jack	16	4	11.54112381
PHill	2002	DC	2	Seed	Late	Jack	16	5	38.00553168
PHill	2002	DC	2	Seed	Late	Jack	16	6	0
PHill	2002	DC	2	Seed	Late	Jack	16	7	0.774223148
PHill	2002	DC	2	LeafPost	Early	Jack	17	1	0
PHill	2002	DC	2	LeafPost	Early	Jack	17	2	2.00694206
PHill	2002	DC	2	LeafPost	Early	Jack	17	3	0
PHill	2002	DC	2	LeafPost	Early	Jack	17	4	0
PHill	2002	DC	2	LeafPost	Early	Jack	17	5	5.595038034
PHill	2002	DC	2	LeafPost	Early	Jack	17	6	0
PHill	2002	DC	2	LeafPost	Early	Jack	17	7	0.295115144
PHill	2002	DC	2	Seed	Early	Jack	17	1	4.03350649
PHill	2002	DC	2	Seed	Early	Jack	17	2	10.64507
PHill	2002	DC	2	Seed	Early	Jack	17	3	0
PHill	2002	DC	2	Seed	Early	Jack	17	4	12.38611009
PHill	2002	DC	2	Seed	Early	Jack	17	5	44.08462317
PHill	2002	DC	2	Seed	Early	Jack	17	6	0
PHill	2002	DC	2	Seed	Early	Jack	17	7	0
PHill	2002	DC	2	LeafPost	Late	Bass	20	1	0
PHill	2002	DC	2	LeafPost	Late	Bass	20	2	1.40295056
PHill	2002	DC	2	LeafPost	Late	Bass	20	3	0
PHill	2002	DC	2	LeafPost	Late	Bass	20	4	0
PHill	2002	DC	2	LeafPost	Late	Bass	20	5	0
PHill	2002	DC	2	LeafPost	Late	Bass	20	6	0
PHill	2002	DC	2	LeafPost	Late	Bass	20	7	0
PHill	2002	DC	2	Seed	Late	Bass	20	1	5.61533679
PHill	2002	DC	2	Seed	Late	Bass	20	2	11.04181862
PHill	2002	DC	2	Seed	Late	Bass	20	3	0
PHill	2002	DC	2	Seed	Late	Bass	20	4	17.66023673
PHill	2002	DC	2	Seed	Late	Bass	20	5	43.91786752
PHill	2002	DC	2	Seed	Late	Bass	20	6	0
PHill	2002	DC	2	Seed	Late	Bass	20	7	0
PHill	2002	DC	2	LeafPost	Early	Bass	21	1	0
PHill	2002	DC	2	LeafPost	Early	Bass	21	2	2.18450114
PHill	2002	DC	2	LeafPost	Early	Bass	21	3	0
PHill	2002	DC	2	LeafPost	Early	Bass	21	4	0
PHill	2002	DC	2	LeafPost	Early	Bass	21	5	4.558712757
PHill	2002	DC	2	LeafPost	Early	Bass	21	6	0
PHill	2002	DC	2	LeafPost	Early	Bass	21	7	0.231402524
PHill	2002	DC	2	Seed	Early	Bass	21	1	7.46888338
PHill	2002	DC	2	Seed	Early	Bass	21	2	15.58044404
PHill	2002	DC	2	Seed	Early	Bass	21	3	0
PHill	2002	DC	2	Seed	Early	Bass	21	4	20.4651516
PHill	2002	DC	2	Seed	Early	Bass	21	5	52.62578494
PHill	2002	DC	2	Seed	Early	Bass	21	6	0
PHill	2002	DC	2	Seed	Early	Bass	21	7	0
PHill	2002	DC	2	LeafPost	Late	Williams82	22	1	0
PHill	2002	DC	2	LeafPost	Late	Williams82	22	2	0.87121724
PHill	2002	DC	2	LeafPost	Late	Williams82	22	3	0
PHill	2002	DC	2	LeafPost	Late	Williams82	22	4	0
PHill	2002	DC	2	LeafPost	Late	Williams82	22	5	0
PHill	2002	DC	2	LeafPost	Late	Williams82	22	6	0
PHill	2002	DC	2	LeafPost	Late	Williams82	22	7	0
PHill	2002	DC	2	Seed	Late	Williams82	22	1	3.73719438
PHill	2002	DC	2	Seed	Late	Williams82	22	2	9.45471236
PHill	2002	DC	2	Seed	Late	Williams82	22	3	0
PHill	2002	DC	2	Seed	Late	Williams82	22	4	10.18533624
PHill	2002	DC	2	Seed	Late	Williams82	22	5	33.75621036
PHill	2002	DC	2	Seed	Late	Williams82	22	6	0
PHill	2002	DC	2	Seed	Late	Williams82	22	7	0
PHill	2002	DC	2	LeafPost	Early	Williams82	23	1	0
PHill	2002	DC	2	LeafPost	Early	Williams82	23	2	1.5116711
PHill	2002	DC	2	LeafPost	Early	Williams82	23	3	0
PHill	2002	DC	2	LeafPost	Early	Williams82	23	4	0
PHill	2002	DC	2	LeafPost	Early	Williams82	23	5	3.069515862
PHill	2002	DC	2	LeafPost	Early	Williams82	23	6	0
PHill	2002	DC	2	LeafPost	Early	Williams82	23	7	0.153691196
PHill	2002	DC	2	Seed	Early	Williams82	23	1	3.30422218

PHill	2002	DC	2	Seed	Early	Williams82	23	2	8.98336094
PHill	2002	DC	2	Seed	Early	Williams82	23	3	0
PHill	2002	DC	2	Seed	Early	Williams82	23	4	9.102546089
PHill	2002	DC	2	Seed	Early	Williams82	23	5	33.08811722
PHill	2002	DC	2	Seed	Early	Williams82	23	6	0
PHill	2002	DC	2	Seed	Early	Williams82	23	7	0
PHill	2002	DC	3	Seed	Late	Williams82	26	1	7.19646277
PHill	2002	DC	3	Seed	Late	Williams82	26	2	14.72673464
PHill	2002	DC	3	Seed	Late	Williams82	26	3	0
PHill	2002	DC	3	Seed	Late	Williams82	26	4	21.55464908
PHill	2002	DC	3	Seed	Late	Williams82	26	5	54.70631651
PHill	2002	DC	3	Seed	Late	Williams82	26	6	0
PHill	2002	DC	3	Seed	Late	Williams82	26	7	0
PHill	2002	DC	3	LeafPost	Early	Williams82	27	1	0
PHill	2002	DC	3	LeafPost	Early	Williams82	27	2	1.94327576
PHill	2002	DC	3	LeafPost	Early	Williams82	27	3	0
PHill	2002	DC	3	LeafPost	Early	Williams82	27	4	0
PHill	2002	DC	3	LeafPost	Early	Williams82	27	5	3.901172867
PHill	2002	DC	3	LeafPost	Early	Williams82	27	6	0
PHill	2002	DC	3	LeafPost	Early	Williams82	27	7	0.301036608
PHill	2002	DC	3	Seed	Early	Williams82	27	1	8.0194969
PHill	2002	DC	3	Seed	Early	Williams82	27	2	16.8720164
PHill	2002	DC	3	Seed	Early	Williams82	27	3	0
PHill	2002	DC	3	Seed	Early	Williams82	27	4	23.49073663
PHill	2002	DC	3	Seed	Early	Williams82	27	5	59.47378641
PHill	2002	DC	3	Seed	Early	Williams82	27	6	0
PHill	2002	DC	3	Seed	Early	Williams82	27	7	0
PHill	2002	DC	3	Seed	Late	Corsica	28	1	4.87132779
PHill	2002	DC	3	Seed	Late	Corsica	28	2	9.73555202
PHill	2002	DC	3	Seed	Late	Corsica	28	3	0
PHill	2002	DC	3	Seed	Late	Corsica	28	4	13.58746634
PHill	2002	DC	3	Seed	Late	Corsica	28	5	34.27030674
PHill	2002	DC	3	Seed	Late	Corsica	28	6	0
PHill	2002	DC	3	Seed	Late	Corsica	28	7	0
PHill	2002	DC	3	LeafPost	Early	Corsica	29	1	0
PHill	2002	DC	3	LeafPost	Early	Corsica	29	2	1.64626802
PHill	2002	DC	3	LeafPost	Early	Corsica	29	3	0
PHill	2002	DC	3	LeafPost	Early	Corsica	29	4	0
PHill	2002	DC	3	LeafPost	Early	Corsica	29	5	3.69783161
PHill	2002	DC	3	LeafPost	Early	Corsica	29	6	0
PHill	2002	DC	3	LeafPost	Early	Corsica	29	7	0.10957562
PHill	2002	DC	3	Seed	Early	Corsica	29	1	4.77886804
PHill	2002	DC	3	Seed	Early	Corsica	29	2	9.8617475
PHill	2002	DC	3	Seed	Early	Corsica	29	3	0
PHill	2002	DC	3	Seed	Early	Corsica	29	4	13.27447768
PHill	2002	DC	3	Seed	Early	Corsica	29	5	34.23405702
PHill	2002	DC	3	Seed	Early	Corsica	29	6	0
PHill	2002	DC	3	Seed	Early	Corsica	29	7	0
PHill	2002	DC	3	LeafPost	Late	Jack	31	1	0
PHill	2002	DC	3	LeafPost	Late	Jack	31	2	0.93126794
PHill	2002	DC	3	LeafPost	Late	Jack	31	3	0
PHill	2002	DC	3	LeafPost	Late	Jack	31	4	0
PHill	2002	DC	3	LeafPost	Late	Jack	31	5	2.228207379
PHill	2002	DC	3	LeafPost	Late	Jack	31	6	0
PHill	2002	DC	3	LeafPost	Late	Jack	31	7	0
PHill	2002	DC	3	Seed	Late	Jack	31	1	3.75167199
PHill	2002	DC	3	Seed	Late	Jack	31	2	10.9670861
PHill	2002	DC	3	Seed	Late	Jack	31	3	0
PHill	2002	DC	3	Seed	Late	Jack	31	4	11.35762882
PHill	2002	DC	3	Seed	Late	Jack	31	5	44.41434536
PHill	2002	DC	3	Seed	Late	Jack	31	6	0
PHill	2002	DC	3	Seed	Late	Jack	31	7	0
PHill	2002	DC	3	LeafPost	Early	Jack	33	1	0
PHill	2002	DC	3	LeafPost	Early	Jack	33	2	1.19288972
PHill	2002	DC	3	LeafPost	Early	Jack	33	3	0
PHill	2002	DC	3	LeafPost	Early	Jack	33	4	0
PHill	2002	DC	3	LeafPost	Early	Jack	33	5	1.614468955
PHill	2002	DC	3	LeafPost	Early	Jack	33	6	0
PHill	2002	DC	3	LeafPost	Early	Jack	33	7	0
PHill	2002	DC	3	Seed	Early	Jack	33	1	3.38312022
PHill	2002	DC	3	Seed	Early	Jack	33	2	9.40995482
PHill	2002	DC	3	Seed	Early	Jack	33	3	0
PHill	2002	DC	3	Seed	Early	Jack	33	4	9.408112909
PHill	2002	DC	3	Seed	Early	Jack	33	5	37.43851681
PHill	2002	DC	3	Seed	Early	Jack	33	6	0
PHill	2002	DC	3	Seed	Early	Jack	33	7	0
PHill	2002	DC	3	Seed	Late	Bass	34	1	4.382032
PHill	2002	DC	3	Seed	Late	Bass	34	2	11.61037448
PHill	2002	DC	3	Seed	Late	Bass	34	3	0

PHill	2002	DC	3	Seed	Late	Bass	34	4	11.58999247
PHill	2002	DC	3	Seed	Late	Bass	34	5	41.884953
PHill	2002	DC	3	Seed	Late	Bass	34	6	0
PHill	2002	DC	3	Seed	Late	Bass	34	7	0
PHill	2002	DC	3	LeafPost	Early	Bass	36	1	0
PHill	2002	DC	3	LeafPost	Early	Bass	36	2	2.47215524
PHill	2002	DC	3	LeafPost	Early	Bass	36	3	0
PHill	2002	DC	3	LeafPost	Early	Bass	36	4	0
PHill	2002	DC	3	LeafPost	Early	Bass	36	5	6.803614
PHill	2002	DC	3	LeafPost	Early	Bass	36	6	2.718217864
PHill	2002	DC	3	LeafPost	Early	Bass	36	7	0.25831488
PHill	2002	DC	3	Seed	Early	Bass	36	1	4.14726979
PHill	2002	DC	3	Seed	Early	Bass	36	2	10.36679714
PHill	2002	DC	3	Seed	Early	Bass	36	3	0
PHill	2002	DC	3	Seed	Early	Bass	36	4	11.94088366
PHill	2002	DC	3	Seed	Early	Bass	36	5	40.82956468
PHill	2002	DC	3	Seed	Early	Bass	36	6	0
PHill	2002	DC	3	Seed	Early	Bass	36	7	0
PHill	2002	FS	1	LeafPost	Late	Williams82	1	1	0
PHill	2002	FS	1	LeafPost	Late	Williams82	1	2	1.28578856
PHill	2002	FS	1	LeafPost	Late	Williams82	1	3	0
PHill	2002	FS	1	LeafPost	Late	Williams82	1	4	0
PHill	2002	FS	1	LeafPost	Late	Williams82	1	5	2.231010329
PHill	2002	FS	1	LeafPost	Late	Williams82	1	6	0
PHill	2002	FS	1	LeafPost	Late	Williams82	1	7	0
PHill	2002	FS	1	Seed	Late	Williams82	1	1	2.54415156
PHill	2002	FS	1	Seed	Late	Williams82	1	2	4.79366438
PHill	2002	FS	1	Seed	Late	Williams82	1	3	0
PHill	2002	FS	1	Seed	Late	Williams82	1	4	7.588876285
PHill	2002	FS	1	Seed	Late	Williams82	1	5	24.68907692
PHill	2002	FS	1	Seed	Late	Williams82	1	6	0
PHill	2002	FS	1	Seed	Late	Williams82	1	7	0
PHill	2002	FS	1	Seed	Early	Williams82	2	1	3.13566037
PHill	2002	FS	1	Seed	Early	Williams82	2	2	7.33009886
PHill	2002	FS	1	Seed	Early	Williams82	2	3	0
PHill	2002	FS	1	Seed	Early	Williams82	2	4	9.125025791
PHill	2002	FS	1	Seed	Early	Williams82	2	5	34.66589659
PHill	2002	FS	1	Seed	Early	Williams82	2	6	0
PHill	2002	FS	1	Seed	Early	Williams82	2	7	0.737129392
PHill	2002	FS	1	LeafPost	Early	Williams82	3	1	0
PHill	2002	FS	1	LeafPost	Early	Williams82	3	2	1.59777482
PHill	2002	FS	1	LeafPost	Early	Williams82	3	3	0
PHill	2002	FS	1	LeafPost	Early	Williams82	3	4	4.666079841
PHill	2002	FS	1	LeafPost	Early	Williams82	3	5	5.577027345
PHill	2002	FS	1	LeafPost	Early	Williams82	3	6	0
PHill	2002	FS	1	LeafPost	Early	Williams82	3	7	0
PHill	2002	FS	1	LeafPost	Late	Bass	4	1	0
PHill	2002	FS	1	LeafPost	Late	Bass	4	2	1.46045654
PHill	2002	FS	1	LeafPost	Late	Bass	4	3	0
PHill	2002	FS	1	LeafPost	Late	Bass	4	4	0
PHill	2002	FS	1	LeafPost	Late	Bass	4	5	4.915005053
PHill	2002	FS	1	LeafPost	Late	Bass	4	6	0
PHill	2002	FS	1	LeafPost	Late	Bass	4	7	0.357497968
PHill	2002	FS	1	Seed	Late	Bass	4	1	2.5282717
PHill	2002	FS	1	Seed	Late	Bass	4	2	5.0074526
PHill	2002	FS	1	Seed	Late	Bass	4	3	0
PHill	2002	FS	1	Seed	Late	Bass	4	4	6.275648418
PHill	2002	FS	1	Seed	Late	Bass	4	5	20.73619152
PHill	2002	FS	1	Seed	Late	Bass	4	6	0
PHill	2002	FS	1	Seed	Late	Bass	4	7	0
PHill	2002	FS	1	Seed	Early	Bass	5	1	1.83334003
PHill	2002	FS	1	Seed	Early	Bass	5	2	3.78065606
PHill	2002	FS	1	Seed	Early	Bass	5	3	0
PHill	2002	FS	1	Seed	Early	Bass	5	4	3.678850057
PHill	2002	FS	1	Seed	Early	Bass	5	5	16.5465942
PHill	2002	FS	1	Seed	Early	Bass	5	6	0
PHill	2002	FS	1	Seed	Early	Bass	5	7	0
PHill	2002	FS	1	Seed	Early	Jack	7	1	1.70140783
PHill	2002	FS	1	Seed	Early	Jack	7	2	1.90286936
PHill	2002	FS	1	Seed	Early	Jack	7	3	0
PHill	2002	FS	1	Seed	Early	Jack	7	4	4.303662225
PHill	2002	FS	1	Seed	Early	Jack	7	5	8.622766384
PHill	2002	FS	1	Seed	Early	Jack	7	6	0
PHill	2002	FS	1	Seed	Early	Jack	7	7	0
PHill	2002	FS	1	LeafPost	Late	Jack	9	1	0
PHill	2002	FS	1	LeafPost	Late	Jack	9	2	1.47458912
PHill	2002	FS	1	LeafPost	Late	Jack	9	3	0
PHill	2002	FS	1	LeafPost	Late	Jack	9	4	0
PHill	2002	FS	1	LeafPost	Late	Jack	9	5	4.515933854

PHill	2002	FS	1	LeafPost	Late	Jack	9	6	0
PHill	2002	FS	1	LeafPost	Late	Jack	9	7	0
PHill	2002	FS	1	Seed	Late	Jack	9	1	1.98823363
PHill	2002	FS	1	Seed	Late	Jack	9	2	2.91603776
PHill	2002	FS	1	Seed	Late	Jack	9	3	0
PHill	2002	FS	1	Seed	Late	Jack	9	4	5.113769369
PHill	2002	FS	1	Seed	Late	Jack	9	5	14.58531043
PHill	2002	FS	1	Seed	Late	Jack	9	6	0
PHill	2002	FS	1	Seed	Late	Jack	9	7	0
PHill	2002	FS	1	LeafPost	Early	Corsica	10	1	0
PHill	2002	FS	1	LeafPost	Early	Corsica	10	2	1.1730536
PHill	2002	FS	1	LeafPost	Early	Corsica	10	3	0
PHill	2002	FS	1	LeafPost	Early	Corsica	10	4	3.985854468
PHill	2002	FS	1	LeafPost	Early	Corsica	10	5	4.846670331
PHill	2002	FS	1	LeafPost	Early	Corsica	10	6	0
PHill	2002	FS	1	LeafPost	Early	Corsica	10	7	0
PHill	2002	FS	1	Seed	Early	Corsica	10	1	3.14909002
PHill	2002	FS	1	Seed	Early	Corsica	10	2	8.25782318
PHill	2002	FS	1	Seed	Early	Corsica	10	3	0
PHill	2002	FS	1	Seed	Early	Corsica	10	4	9.321835198
PHill	2002	FS	1	Seed	Early	Corsica	10	5	33.29799594
PHill	2002	FS	1	Seed	Early	Corsica	10	6	0
PHill	2002	FS	1	Seed	Early	Corsica	10	7	0
PHill	2002	FS	1	LeafPost	Late	Corsica	12	1	0
PHill	2002	FS	1	LeafPost	Late	Corsica	12	2	1.34956802
PHill	2002	FS	1	LeafPost	Late	Corsica	12	3	0
PHill	2002	FS	1	LeafPost	Late	Corsica	12	4	0
PHill	2002	FS	1	LeafPost	Late	Corsica	12	5	3.884140067
PHill	2002	FS	1	LeafPost	Late	Corsica	12	6	0
PHill	2002	FS	1	LeafPost	Late	Corsica	12	7	0
PHill	2002	FS	1	Seed	Late	Corsica	12	1	3.40772598
PHill	2002	FS	1	Seed	Late	Corsica	12	2	8.26193006
PHill	2002	FS	1	Seed	Late	Corsica	12	3	0
PHill	2002	FS	1	Seed	Late	Corsica	12	4	9.475536593
PHill	2002	FS	1	Seed	Late	Corsica	12	5	36.38301102
PHill	2002	FS	1	Seed	Late	Corsica	12	6	0
PHill	2002	FS	1	Seed	Late	Corsica	12	7	0
PHill	2002	FS	2	Seed	Early	Corsica	14	1	3.28825641
PHill	2002	FS	2	Seed	Early	Corsica	14	2	8.22603212
PHill	2002	FS	2	Seed	Early	Corsica	14	3	0
PHill	2002	FS	2	Seed	Early	Corsica	14	4	9.904867283
PHill	2002	FS	2	Seed	Early	Corsica	14	5	35.30929763
PHill	2002	FS	2	Seed	Early	Corsica	14	6	0
PHill	2002	FS	2	Seed	Early	Corsica	14	7	0
PHill	2002	FS	2	LeafPost	Late	Corsica	15	1	0
PHill	2002	FS	2	LeafPost	Late	Corsica	15	2	1.12175486
PHill	2002	FS	2	LeafPost	Late	Corsica	15	3	0
PHill	2002	FS	2	LeafPost	Late	Corsica	15	4	0
PHill	2002	FS	2	LeafPost	Late	Corsica	15	5	2.910146499
PHill	2002	FS	2	LeafPost	Late	Corsica	15	6	0
PHill	2002	FS	2	LeafPost	Late	Corsica	15	7	0
PHill	2002	FS	2	Seed	Late	Corsica	15	1	3.21895899
PHill	2002	FS	2	Seed	Late	Corsica	15	2	7.86463634
PHill	2002	FS	2	Seed	Late	Corsica	15	3	0
PHill	2002	FS	2	Seed	Late	Corsica	15	4	8.614245056
PHill	2002	FS	2	Seed	Late	Corsica	15	5	33.60337184
PHill	2002	FS	2	Seed	Late	Corsica	15	6	0
PHill	2002	FS	2	Seed	Late	Corsica	15	7	0
PHill	2002	FS	2	Seed	Early	Bass	16	1	1.83650166
PHill	2002	FS	2	Seed	Early	Bass	16	2	3.86591522
PHill	2002	FS	2	Seed	Early	Bass	16	3	0
PHill	2002	FS	2	Seed	Early	Bass	16	4	3.890454311
PHill	2002	FS	2	Seed	Early	Bass	16	5	16.68449635
PHill	2002	FS	2	Seed	Early	Bass	16	6	0
PHill	2002	FS	2	Seed	Early	Bass	16	7	0
PHill	2002	FS	2	LeafPost	Late	Bass	17	1	0
PHill	2002	FS	2	LeafPost	Late	Bass	17	2	2.01766328
PHill	2002	FS	2	LeafPost	Late	Bass	17	3	0
PHill	2002	FS	2	LeafPost	Late	Bass	17	4	0
PHill	2002	FS	2	LeafPost	Late	Bass	17	5	4.09111159
PHill	2002	FS	2	LeafPost	Late	Bass	17	6	0
PHill	2002	FS	2	LeafPost	Late	Bass	17	7	0
PHill	2002	FS	2	Seed	Late	Bass	17	1	1.62890618
PHill	2002	FS	2	Seed	Late	Bass	17	2	1.94712044
PHill	2002	FS	2	Seed	Late	Bass	17	3	0
PHill	2002	FS	2	Seed	Late	Bass	17	4	2.892839263
PHill	2002	FS	2	Seed	Late	Bass	17	5	7.198603217
PHill	2002	FS	2	Seed	Late	Bass	17	6	0
PHill	2002	FS	2	Seed	Late	Bass	17	7	0

PHill	2002	FS	2	Seed	Early	Williams82	19	1	2.46360064
PHill	2002	FS	2	Seed	Early	Williams82	19	2	6.04607234
PHill	2002	FS	2	Seed	Early	Williams82	19	3	0
PHill	2002	FS	2	Seed	Early	Williams82	19	4	6.706114273
PHill	2002	FS	2	Seed	Early	Williams82	19	5	25.50805612
PHill	2002	FS	2	Seed	Early	Williams82	19	6	0
PHill	2002	FS	2	Seed	Early	Williams82	19	7	0
PHill	2002	FS	2	LeafPost	Late	Williams82	21	1	0
PHill	2002	FS	2	LeafPost	Late	Williams82	21	2	2.17387238
PHill	2002	FS	2	LeafPost	Late	Williams82	21	3	0
PHill	2002	FS	2	LeafPost	Late	Williams82	21	4	0
PHill	2002	FS	2	LeafPost	Late	Williams82	21	5	3.06234468
PHill	2002	FS	2	LeafPost	Late	Williams82	21	6	0
PHill	2002	FS	2	LeafPost	Late	Williams82	21	7	0
PHill	2002	FS	2	Seed	Late	Williams82	21	1	3.02721213
PHill	2002	FS	2	Seed	Late	Williams82	21	2	7.1469977
PHill	2002	FS	2	Seed	Late	Williams82	21	3	0
PHill	2002	FS	2	Seed	Late	Williams82	21	4	7.604141475
PHill	2002	FS	2	Seed	Late	Williams82	21	5	29.20507722
PHill	2002	FS	2	Seed	Late	Williams82	21	6	0
PHill	2002	FS	2	Seed	Late	Williams82	21	7	0
PHill	2002	FS	2	Seed	Early	Jack	22	1	1.72435361
PHill	2002	FS	2	Seed	Early	Jack	22	2	1.34732966
PHill	2002	FS	2	Seed	Early	Jack	22	3	0
PHill	2002	FS	2	Seed	Early	Jack	22	4	2.885769539
PHill	2002	FS	2	Seed	Early	Jack	22	5	4.406845503
PHill	2002	FS	2	Seed	Early	Jack	22	6	0
PHill	2002	FS	2	Seed	Early	Jack	22	7	0
PHill	2002	FS	2	LeafPost	Early	Jack	23	1	0
PHill	2002	FS	2	LeafPost	Early	Jack	23	2	1.38829634
PHill	2002	FS	2	LeafPost	Early	Jack	23	3	0
PHill	2002	FS	2	LeafPost	Early	Jack	23	4	4.197340493
PHill	2002	FS	2	LeafPost	Early	Jack	23	5	4.852531044
PHill	2002	FS	2	LeafPost	Early	Jack	23	6	0
PHill	2002	FS	2	LeafPost	Early	Jack	23	7	0
PHill	2002	FS	2	LeafPost	Late	Jack	23	1	0
PHill	2002	FS	2	LeafPost	Late	Jack	23	2	1.369331
PHill	2002	FS	2	LeafPost	Late	Jack	23	3	0
PHill	2002	FS	2	LeafPost	Late	Jack	23	4	0
PHill	2002	FS	2	LeafPost	Late	Jack	23	5	2.461979006
PHill	2002	FS	2	LeafPost	Late	Jack	23	6	0
PHill	2002	FS	2	LeafPost	Late	Jack	23	7	0
PHill	2002	FS	2	Seed	Late	Jack	23	1	1.55548366
PHill	2002	FS	2	Seed	Late	Jack	23	2	1.53948638
PHill	2002	FS	2	Seed	Late	Jack	23	3	0
PHill	2002	FS	2	Seed	Late	Jack	23	4	2.925699088
PHill	2002	FS	2	Seed	Late	Jack	23	5	5.780328891
PHill	2002	FS	2	Seed	Late	Jack	23	6	0
PHill	2002	FS	2	Seed	Late	Jack	23	7	0
PHill	2002	FS	3	Seed	Early	Williams82	26	1	2.92386879
PHill	2002	FS	3	Seed	Early	Williams82	26	2	7.82726042
PHill	2002	FS	3	Seed	Early	Williams82	26	3	0
PHill	2002	FS	3	Seed	Early	Williams82	26	4	7.743734263
PHill	2002	FS	3	Seed	Early	Williams82	26	5	32.29151198
PHill	2002	FS	3	Seed	Early	Williams82	26	6	0
PHill	2002	FS	3	Seed	Early	Williams82	26	7	0
PHill	2002	FS	3	LeafPost	Late	Williams82	27	1	0
PHill	2002	FS	3	LeafPost	Late	Williams82	27	2	3.15040592
PHill	2002	FS	3	LeafPost	Late	Williams82	27	3	0
PHill	2002	FS	3	LeafPost	Late	Williams82	27	4	0
PHill	2002	FS	3	LeafPost	Late	Williams82	27	5	2.498557996
PHill	2002	FS	3	LeafPost	Late	Williams82	27	6	0
PHill	2002	FS	3	LeafPost	Late	Williams82	27	7	0
PHill	2002	FS	3	Seed	Late	Williams82	27	1	2.26185343
PHill	2002	FS	3	Seed	Late	Williams82	27	2	4.75060838
PHill	2002	FS	3	Seed	Late	Williams82	27	3	0
PHill	2002	FS	3	Seed	Late	Williams82	27	4	4.985140993
PHill	2002	FS	3	Seed	Late	Williams82	27	5	19.46259341
PHill	2002	FS	3	Seed	Late	Williams82	27	6	0
PHill	2002	FS	3	Seed	Late	Williams82	27	7	0
PHill	2002	FS	3	Seed	Early	Corsica	28	1	3.18603416
PHill	2002	FS	3	Seed	Early	Corsica	28	2	7.42444118
PHill	2002	FS	3	Seed	Early	Corsica	28	3	0
PHill	2002	FS	3	Seed	Early	Corsica	28	4	7.805072604
PHill	2002	FS	3	Seed	Early	Corsica	28	5	28.34362192
PHill	2002	FS	3	Seed	Early	Corsica	28	6	0
PHill	2002	FS	3	Seed	Early	Corsica	28	7	0
PHill	2002	FS	3	LeafPost	Late	Corsica	30	1	0
PHill	2002	FS	3	LeafPost	Late	Corsica	30	2	0.98168072

PHill	2002	FS	3	LeafPost	Late	Corsica	30	3	0
PHill	2002	FS	3	LeafPost	Late	Corsica	30	4	0
PHill	2002	FS	3	LeafPost	Late	Corsica	30	5	2.611539701
PHill	2002	FS	3	LeafPost	Late	Corsica	30	6	0
PHill	2002	FS	3	LeafPost	Late	Corsica	30	7	0
PHill	2002	FS	3	Seed	Late	Corsica	30	1	2.74341448
PHill	2002	FS	3	Seed	Late	Corsica	30	2	7.07384666
PHill	2002	FS	3	Seed	Late	Corsica	30	3	0
PHill	2002	FS	3	Seed	Late	Corsica	30	4	6.899868587
PHill	2002	FS	3	Seed	Late	Corsica	30	5	25.2354734
PHill	2002	FS	3	Seed	Late	Corsica	30	6	0
PHill	2002	FS	3	Seed	Late	Corsica	30	7	0
PHill	2002	FS	3	Seed	Early	Jack	31	1	1.54840709
PHill	2002	FS	3	Seed	Early	Jack	31	2	1.43124884
PHill	2002	FS	3	Seed	Early	Jack	31	3	0
PHill	2002	FS	3	Seed	Early	Jack	31	4	2.558182224
PHill	2002	FS	3	Seed	Early	Jack	31	5	3.97639252
PHill	2002	FS	3	Seed	Early	Jack	31	6	0
PHill	2002	FS	3	Seed	Early	Jack	31	7	0
PHill	2002	FS	3	LeafPost	Late	Jack	32	1	0
PHill	2002	FS	3	LeafPost	Late	Jack	32	2	1.57088828
PHill	2002	FS	3	LeafPost	Late	Jack	32	3	0
PHill	2002	FS	3	LeafPost	Late	Jack	32	4	0
PHill	2002	FS	3	LeafPost	Late	Jack	32	5	3.260339815
PHill	2002	FS	3	LeafPost	Late	Jack	32	6	0
PHill	2002	FS	3	LeafPost	Late	Jack	32	7	0
PHill	2002	FS	3	Seed	Late	Jack	32	1	1.6422556
PHill	2002	FS	3	Seed	Late	Jack	32	2	1.6706747
PHill	2002	FS	3	Seed	Late	Jack	32	3	0
PHill	2002	FS	3	Seed	Late	Jack	32	4	2.979009882
PHill	2002	FS	3	Seed	Late	Jack	32	5	4.764301006
PHill	2002	FS	3	Seed	Late	Jack	32	6	0
PHill	2002	FS	3	Seed	Late	Jack	32	7	0
PHill	2002	FS	3	Seed	Early	Bass	34	1	2.12345597
PHill	2002	FS	3	Seed	Early	Bass	34	2	6.7998725
PHill	2002	FS	3	Seed	Early	Bass	34	3	0
PHill	2002	FS	3	Seed	Early	Bass	34	4	4.184469002
PHill	2002	FS	3	Seed	Early	Bass	34	5	21.95143897
PHill	2002	FS	3	Seed	Early	Bass	34	6	0
PHill	2002	FS	3	Seed	Early	Bass	34	7	0
PHill	2002	FS	3	LeafPost	Late	Bass	35	1	0
PHill	2002	FS	3	LeafPost	Late	Bass	35	2	1.99681148
PHill	2002	FS	3	LeafPost	Late	Bass	35	3	0
PHill	2002	FS	3	LeafPost	Late	Bass	35	4	0
PHill	2002	FS	3	LeafPost	Late	Bass	35	5	5.648409902
PHill	2002	FS	3	LeafPost	Late	Bass	35	6	0
PHill	2002	FS	3	LeafPost	Late	Bass	35	7	0
PHill	2002	FS	3	Seed	Late	Bass	35	1	1.80033923
PHill	2002	FS	3	Seed	Late	Bass	35	2	3.477626
PHill	2002	FS	3	Seed	Late	Bass	35	3	0
PHill	2002	FS	3	Seed	Late	Bass	35	4	3.35072386
PHill	2002	FS	3	Seed	Late	Bass	35	5	12.11335703
PHill	2002	FS	3	Seed	Late	Bass	35	6	0
PHill	2002	FS	3	Seed	Late	Bass	35	7	0
Wye	2002	DC	1	LeafPost	Early	Corsica	1	1	0
Wye	2002	DC	1	LeafPost	Early	Corsica	1	2	1.7054024
Wye	2002	DC	1	LeafPost	Early	Corsica	1	3	0
Wye	2002	DC	1	LeafPost	Early	Corsica	1	4	0
Wye	2002	DC	1	LeafPost	Early	Corsica	1	5	5.311433801
Wye	2002	DC	1	LeafPost	Early	Corsica	1	6	0
Wye	2002	DC	1	LeafPost	Early	Corsica	1	7	0
Wye	2002	DC	1	Seed	Early	Corsica	1	1	5.69385995
Wye	2002	DC	1	Seed	Early	Corsica	1	2	13.32913412
Wye	2002	DC	1	Seed	Early	Corsica	1	3	0
Wye	2002	DC	1	Seed	Early	Corsica	1	4	20.45112353
Wye	2002	DC	1	Seed	Early	Corsica	1	5	52.88037186
Wye	2002	DC	1	Seed	Early	Corsica	1	6	0
Wye	2002	DC	1	Seed	Early	Corsica	1	7	0
Wye	2002	DC	1	LeafPost	Early	Corsica	3	1	0
Wye	2002	DC	1	LeafPost	Early	Corsica	3	2	2.69438078
Wye	2002	DC	1	LeafPost	Early	Corsica	3	3	0
Wye	2002	DC	1	LeafPost	Early	Corsica	3	4	0
Wye	2002	DC	1	LeafPost	Early	Corsica	3	5	7.717835576
Wye	2002	DC	1	LeafPost	Early	Corsica	3	6	0
Wye	2002	DC	1	LeafPost	Early	Corsica	3	7	0.363831468
Wye	2002	DC	1	Seed	Late	Corsica	3	1	3.81978584
Wye	2002	DC	1	Seed	Late	Corsica	3	2	6.13686392
Wye	2002	DC	1	Seed	Late	Corsica	3	3	0
Wye	2002	DC	1	Seed	Late	Corsica	3	4	13.44088436

Wye	2002	DC	1	Seed	Late	Corsica	3	5	30.90287545
Wye	2002	DC	1	Seed	Late	Corsica	3	6	0
Wye	2002	DC	1	Seed	Late	Corsica	3	7	0
Wye	2002	DC	1	LeafPost	Late	Williams82	4	1	2.37089807
Wye	2002	DC	1	LeafPost	Late	Williams82	4	2	1.74255476
Wye	2002	DC	1	LeafPost	Late	Williams82	4	3	0
Wye	2002	DC	1	LeafPost	Late	Williams82	4	4	6.92398721
Wye	2002	DC	1	LeafPost	Late	Williams82	4	5	6.077357169
Wye	2002	DC	1	LeafPost	Late	Williams82	4	6	0
Wye	2002	DC	1	LeafPost	Late	Williams82	4	7	0.072380528
Wye	2002	DC	1	Seed	Late	Williams82	4	1	2.69010129
Wye	2002	DC	1	Seed	Late	Williams82	4	2	5.43729086
Wye	2002	DC	1	Seed	Late	Williams82	4	3	0
Wye	2002	DC	1	Seed	Late	Williams82	4	4	7.671210474
Wye	2002	DC	1	Seed	Late	Williams82	4	5	25.70771912
Wye	2002	DC	1	Seed	Late	Williams82	4	6	0
Wye	2002	DC	1	Seed	Late	Williams82	4	7	0
Wye	2002	DC	1	LeafPost	Early	Williams82	5	1	0
Wye	2002	DC	1	LeafPost	Early	Williams82	5	2	1.93318796
Wye	2002	DC	1	LeafPost	Early	Williams82	5	3	0
Wye	2002	DC	1	LeafPost	Early	Williams82	5	4	0
Wye	2002	DC	1	LeafPost	Early	Williams82	5	5	4.501196031
Wye	2002	DC	1	LeafPost	Early	Williams82	5	6	0
Wye	2002	DC	1	LeafPost	Early	Williams82	5	7	0
Wye	2002	DC	1	Seed	Early	Williams82	5	1	3.16773959
Wye	2002	DC	1	Seed	Early	Williams82	5	2	6.80932688
Wye	2002	DC	1	Seed	Early	Williams82	5	3	0
Wye	2002	DC	1	Seed	Early	Williams82	5	4	10.01685113
Wye	2002	DC	1	Seed	Early	Williams82	5	5	33.29532039
Wye	2002	DC	1	Seed	Early	Williams82	5	6	0
Wye	2002	DC	1	Seed	Early	Williams82	5	7	0
Wye	2002	DC	1	LeafPost	Early	Jack	7	1	0
Wye	2002	DC	1	LeafPost	Early	Jack	7	2	3.50392466
Wye	2002	DC	1	LeafPost	Early	Jack	7	3	0
Wye	2002	DC	1	LeafPost	Early	Jack	7	4	0
Wye	2002	DC	1	LeafPost	Early	Jack	7	5	7.517388274
Wye	2002	DC	1	LeafPost	Early	Jack	7	6	0
Wye	2002	DC	1	LeafPost	Early	Jack	7	7	0
Wye	2002	DC	1	Seed	Early	Jack	7	1	3.33483667
Wye	2002	DC	1	Seed	Early	Jack	7	2	8.87331008
Wye	2002	DC	1	Seed	Early	Jack	7	3	0
Wye	2002	DC	1	Seed	Early	Jack	7	4	10.21005971
Wye	2002	DC	1	Seed	Early	Jack	7	5	38.05213941
Wye	2002	DC	1	Seed	Early	Jack	7	6	0
Wye	2002	DC	1	Seed	Early	Jack	7	7	0
Wye	2002	DC	1	LeafPost	Late	Jack	8	1	0
Wye	2002	DC	1	LeafPost	Late	Jack	8	2	0
Wye	2002	DC	1	LeafPost	Late	Jack	8	3	0
Wye	2002	DC	1	LeafPost	Late	Jack	8	4	0
Wye	2002	DC	1	LeafPost	Late	Jack	8	5	0
Wye	2002	DC	1	LeafPost	Late	Jack	8	6	0
Wye	2002	DC	1	LeafPost	Late	Jack	8	7	0
Wye	2002	DC	1	Seed	Late	Jack	8	1	3.76076709
Wye	2002	DC	1	Seed	Late	Jack	8	2	10.02293564
Wye	2002	DC	1	Seed	Late	Jack	8	3	0
Wye	2002	DC	1	Seed	Late	Jack	8	4	12.91567032
Wye	2002	DC	1	Seed	Late	Jack	8	5	47.44162696
Wye	2002	DC	1	Seed	Late	Jack	8	6	0
Wye	2002	DC	1	Seed	Late	Jack	8	7	0
Wye	2002	DC	1	LeafPost	Early	Bass	11	1	0
Wye	2002	DC	1	LeafPost	Early	Bass	11	2	3.16046198
Wye	2002	DC	1	LeafPost	Early	Bass	11	3	0
Wye	2002	DC	1	LeafPost	Early	Bass	11	4	0
Wye	2002	DC	1	LeafPost	Early	Bass	11	5	8.145106699
Wye	2002	DC	1	LeafPost	Early	Bass	11	6	0
Wye	2002	DC	1	LeafPost	Early	Bass	11	7	0.780097768
Wye	2002	DC	1	Seed	Early	Bass	11	1	4.58692025
Wye	2002	DC	1	Seed	Early	Bass	11	2	10.19627606
Wye	2002	DC	1	Seed	Early	Bass	11	3	0
Wye	2002	DC	1	Seed	Early	Bass	11	4	14.27529689
Wye	2002	DC	1	Seed	Early	Bass	11	5	43.11480921
Wye	2002	DC	1	Seed	Early	Bass	11	6	0
Wye	2002	DC	1	Seed	Early	Bass	11	7	0
Wye	2002	DC	1	LeafPost	Late	Bass	12	1	0
Wye	2002	DC	1	LeafPost	Late	Bass	12	2	2.11240028
Wye	2002	DC	1	LeafPost	Late	Bass	12	3	0
Wye	2002	DC	1	LeafPost	Late	Bass	12	4	11.35490271
Wye	2002	DC	1	LeafPost	Late	Bass	12	5	8.092221293
Wye	2002	DC	1	LeafPost	Late	Bass	12	6	0

Wye	2002	DC	1	LeafPost	Late	Bass	12	7	0
Wye	2002	DC	1	Seed	Late	Bass	12	1	5.79822782
Wye	2002	DC	1	Seed	Late	Bass	12	2	13.42468808
Wye	2002	DC	1	Seed	Late	Bass	12	3	0
Wye	2002	DC	1	Seed	Late	Bass	12	4	18.14183557
Wye	2002	DC	1	Seed	Late	Bass	12	5	51.18707257
Wye	2002	DC	1	Seed	Late	Bass	12	6	0
Wye	2002	DC	1	Seed	Late	Bass	12	7	0
Wye	2002	DC	2	LeafPost	Early	Williams82	14	1	0
Wye	2002	DC	2	LeafPost	Early	Williams82	14	2	1.84686206
Wye	2002	DC	2	LeafPost	Early	Williams82	14	3	0
Wye	2002	DC	2	LeafPost	Early	Williams82	14	4	0
Wye	2002	DC	2	LeafPost	Early	Williams82	14	5	4.937097723
Wye	2002	DC	2	LeafPost	Early	Williams82	14	6	0
Wye	2002	DC	2	LeafPost	Early	Williams82	14	7	0.49879668
Wye	2002	DC	2	Seed	Early	Williams82	14	1	2.96154139
Wye	2002	DC	2	Seed	Early	Williams82	14	2	6.94469522
Wye	2002	DC	2	Seed	Early	Williams82	14	3	0
Wye	2002	DC	2	Seed	Early	Williams82	14	4	8.690526457
Wye	2002	DC	2	Seed	Early	Williams82	14	5	30.13333671
Wye	2002	DC	2	Seed	Early	Williams82	14	6	0
Wye	2002	DC	2	Seed	Early	Williams82	14	7	0
Wye	2002	DC	2	LeafPost	Late	Williams82	15	1	0
Wye	2002	DC	2	LeafPost	Late	Williams82	15	2	1.53783728
Wye	2002	DC	2	LeafPost	Late	Williams82	15	3	0
Wye	2002	DC	2	LeafPost	Late	Williams82	15	4	6.959014559
Wye	2002	DC	2	LeafPost	Late	Williams82	15	5	7.21641204
Wye	2002	DC	2	LeafPost	Late	Williams82	15	6	0
Wye	2002	DC	2	LeafPost	Late	Williams82	15	7	0.130973768
Wye	2002	DC	2	Seed	Late	Williams82	15	1	2.77341056
Wye	2002	DC	2	Seed	Late	Williams82	15	2	6.32396708
Wye	2002	DC	2	Seed	Late	Williams82	15	3	0
Wye	2002	DC	2	Seed	Late	Williams82	15	4	7.903000967
Wye	2002	DC	2	Seed	Late	Williams82	15	5	26.23687763
Wye	2002	DC	2	Seed	Late	Williams82	15	6	0
Wye	2002	DC	2	Seed	Late	Williams82	15	7	0
Wye	2002	DC	2	LeafPost	Early	Jack	16	1	0
Wye	2002	DC	2	LeafPost	Early	Jack	16	2	1.3817096
Wye	2002	DC	2	LeafPost	Early	Jack	16	3	0
Wye	2002	DC	2	LeafPost	Early	Jack	16	4	0
Wye	2002	DC	2	LeafPost	Early	Jack	16	5	2.003200347
Wye	2002	DC	2	LeafPost	Early	Jack	16	6	0
Wye	2002	DC	2	LeafPost	Early	Jack	16	7	0
Wye	2002	DC	2	Seed	Early	Jack	16	1	2.48637815
Wye	2002	DC	2	Seed	Early	Jack	16	2	5.62203836
Wye	2002	DC	2	Seed	Early	Jack	16	3	0
Wye	2002	DC	2	Seed	Early	Jack	16	4	7.239608596
Wye	2002	DC	2	Seed	Early	Jack	16	5	25.85959796
Wye	2002	DC	2	Seed	Early	Jack	16	6	0
Wye	2002	DC	2	Seed	Early	Jack	16	7	0
Wye	2002	DC	2	LeafPost	Late	Jack	17	1	0
Wye	2002	DC	2	LeafPost	Late	Jack	17	2	1.52534
Wye	2002	DC	2	LeafPost	Late	Jack	17	3	0
Wye	2002	DC	2	LeafPost	Late	Jack	17	4	5.651790646
Wye	2002	DC	2	LeafPost	Late	Jack	17	5	5.032651171
Wye	2002	DC	2	LeafPost	Late	Jack	17	6	0
Wye	2002	DC	2	LeafPost	Late	Jack	17	7	0.175774796
Wye	2002	DC	2	Seed	Late	Jack	17	1	3.97440751
Wye	2002	DC	2	Seed	Late	Jack	17	2	10.40262194
Wye	2002	DC	2	Seed	Late	Jack	17	3	0
Wye	2002	DC	2	Seed	Late	Jack	17	4	13.87586003
Wye	2002	DC	2	Seed	Late	Jack	17	5	48.35232251
Wye	2002	DC	2	Seed	Late	Jack	17	6	0
Wye	2002	DC	2	Seed	Late	Jack	17	7	0
Wye	2002	DC	2	Seed	Early	Corsica	20	1	7.17967908
Wye	2002	DC	2	Seed	Early	Corsica	20	2	19.22172446
Wye	2002	DC	2	Seed	Early	Corsica	20	3	0
Wye	2002	DC	2	Seed	Early	Corsica	20	4	13.38450305
Wye	2002	DC	2	Seed	Early	Corsica	20	5	40.7024855
Wye	2002	DC	2	Seed	Early	Corsica	20	6	0
Wye	2002	DC	2	Seed	Early	Corsica	20	7	0
Wye	2002	DC	2	LeafPost	Late	Corsica	21	1	0
Wye	2002	DC	2	LeafPost	Late	Corsica	21	2	1.94356556
Wye	2002	DC	2	LeafPost	Late	Corsica	21	3	0
Wye	2002	DC	2	LeafPost	Late	Corsica	21	4	6.878279026
Wye	2002	DC	2	LeafPost	Late	Corsica	21	5	7.279989689
Wye	2002	DC	2	LeafPost	Late	Corsica	21	6	0
Wye	2002	DC	2	LeafPost	Late	Corsica	21	7	0
Wye	2002	DC	2	Seed	Late	Corsica	21	1	6.73886067

Wye	2002	DC	2	Seed	Late	Corsica	21	2	17.62509068
Wye	2002	DC	2	Seed	Late	Corsica	21	3	0
Wye	2002	DC	2	Seed	Late	Corsica	21	4	13.47289602
Wye	2002	DC	2	Seed	Late	Corsica	21	5	39.99644167
Wye	2002	DC	2	Seed	Late	Corsica	21	6	0
Wye	2002	DC	2	Seed	Late	Corsica	21	7	0
Wye	2002	DC	2	Seed	Early	Bass	22	1	7.31075644
Wye	2002	DC	2	Seed	Early	Bass	22	2	15.73094546
Wye	2002	DC	2	Seed	Early	Bass	22	3	0
Wye	2002	DC	2	Seed	Early	Bass	22	4	11.9738857
Wye	2002	DC	2	Seed	Early	Bass	22	5	27.97845582
Wye	2002	DC	2	Seed	Early	Bass	22	6	0
Wye	2002	DC	2	Seed	Early	Bass	22	7	0.094299696
Wye	2002	DC	2	LeafPost	Late	Bass	24	1	0
Wye	2002	DC	2	LeafPost	Late	Bass	24	2	1.34550806
Wye	2002	DC	2	LeafPost	Late	Bass	24	3	0
Wye	2002	DC	2	LeafPost	Late	Bass	24	4	3.911916219
Wye	2002	DC	2	LeafPost	Late	Bass	24	5	4.066525386
Wye	2002	DC	2	LeafPost	Late	Bass	24	6	0
Wye	2002	DC	2	LeafPost	Late	Bass	24	7	0.065401728
Wye	2002	DC	2	Seed	Late	Bass	24	1	10.03143455
Wye	2002	DC	2	Seed	Late	Bass	24	2	22.43895986
Wye	2002	DC	2	Seed	Late	Bass	24	3	0
Wye	2002	DC	2	Seed	Late	Bass	24	4	15.88788029
Wye	2002	DC	2	Seed	Late	Bass	24	5	36.81531057
Wye	2002	DC	2	Seed	Late	Bass	24	6	0
Wye	2002	DC	2	Seed	Late	Bass	24	7	0.437202556
Wye	2002	DC	3	LeafPost	Early	Corsica	20	1	0
Wye	2002	DC	3	LeafPost	Early	Corsica	20	2	3.40411616
Wye	2002	DC	3	LeafPost	Early	Corsica	20	3	0
Wye	2002	DC	3	LeafPost	Early	Corsica	20	4	0
Wye	2002	DC	3	LeafPost	Early	Corsica	20	5	5.812049876
Wye	2002	DC	3	LeafPost	Early	Corsica	20	6	0
Wye	2002	DC	3	LeafPost	Early	Corsica	20	7	0
Wye	2002	DC	3	LeafPost	Early	Bass	22	1	0
Wye	2002	DC	3	LeafPost	Early	Bass	22	2	2.1227075
Wye	2002	DC	3	LeafPost	Early	Bass	22	3	0
Wye	2002	DC	3	LeafPost	Early	Bass	22	4	0
Wye	2002	DC	3	LeafPost	Early	Bass	22	5	7.283537224
Wye	2002	DC	3	LeafPost	Early	Bass	22	6	0
Wye	2002	DC	3	LeafPost	Early	Bass	22	7	0
Wye	2002	DC	3	LeafPost	Early	Corsica	25	1	0
Wye	2002	DC	3	LeafPost	Early	Corsica	25	2	3.22638182
Wye	2002	DC	3	LeafPost	Early	Corsica	25	3	0
Wye	2002	DC	3	LeafPost	Early	Corsica	25	4	0
Wye	2002	DC	3	LeafPost	Early	Corsica	25	5	10.51248725
Wye	2002	DC	3	LeafPost	Early	Corsica	25	6	0
Wye	2002	DC	3	LeafPost	Early	Corsica	25	7	0.739424748
Wye	2002	DC	3	Seed	Early	Corsica	25	1	2.87705778
Wye	2002	DC	3	Seed	Early	Corsica	25	2	7.13289824
Wye	2002	DC	3	Seed	Early	Corsica	25	3	0
Wye	2002	DC	3	Seed	Early	Corsica	25	4	3.34214201
Wye	2002	DC	3	Seed	Early	Corsica	25	5	8.448045328
Wye	2002	DC	3	Seed	Early	Corsica	25	6	0
Wye	2002	DC	3	Seed	Early	Corsica	25	7	0
Wye	2002	DC	3	LeafPost	Late	Corsica	26	1	0
Wye	2002	DC	3	LeafPost	Late	Corsica	26	2	3.69480764
Wye	2002	DC	3	LeafPost	Late	Corsica	26	3	0
Wye	2002	DC	3	LeafPost	Late	Corsica	26	4	13.88636095
Wye	2002	DC	3	LeafPost	Late	Corsica	26	5	13.2649259
Wye	2002	DC	3	LeafPost	Late	Corsica	26	6	0
Wye	2002	DC	3	LeafPost	Late	Corsica	26	7	0.280426204
Wye	2002	DC	3	Seed	Late	Corsica	26	1	6.09309863
Wye	2002	DC	3	Seed	Late	Corsica	26	2	18.51183728
Wye	2002	DC	3	Seed	Late	Corsica	26	3	0
Wye	2002	DC	3	Seed	Late	Corsica	26	4	12.91101914
Wye	2002	DC	3	Seed	Late	Corsica	26	5	47.33868722
Wye	2002	DC	3	Seed	Late	Corsica	26	6	0
Wye	2002	DC	3	Seed	Late	Corsica	26	7	0
Wye	2002	DC	3	LeafPost	Early	Bass	28	1	0
Wye	2002	DC	3	LeafPost	Early	Bass	28	2	3.09764024
Wye	2002	DC	3	LeafPost	Early	Bass	28	3	0
Wye	2002	DC	3	LeafPost	Early	Bass	28	4	0
Wye	2002	DC	3	LeafPost	Early	Bass	28	5	8.227027618
Wye	2002	DC	3	LeafPost	Early	Bass	28	6	0
Wye	2002	DC	3	LeafPost	Early	Bass	28	7	0.66156046
Wye	2002	DC	3	Seed	Early	Bass	28	1	7.23417442
Wye	2002	DC	3	Seed	Early	Bass	28	2	17.97514976
Wye	2002	DC	3	Seed	Early	Bass	28	3	0

Wye	2002	DC	3	Seed	Early	Bass	28	4	15.54561979
Wye	2002	DC	3	Seed	Early	Bass	28	5	46.65585626
Wye	2002	DC	3	Seed	Early	Bass	28	6	0
Wye	2002	DC	3	Seed	Early	Bass	28	7	0
Wye	2002	DC	3	LeafPost	Late	Bass	30	1	0
Wye	2002	DC	3	LeafPost	Late	Bass	30	2	2.05365782
Wye	2002	DC	3	LeafPost	Late	Bass	30	3	0
Wye	2002	DC	3	LeafPost	Late	Bass	30	4	7.763439878
Wye	2002	DC	3	LeafPost	Late	Bass	30	5	7.78342526
Wye	2002	DC	3	LeafPost	Late	Bass	30	6	0
Wye	2002	DC	3	LeafPost	Late	Bass	30	7	0.074295396
Wye	2002	DC	3	Seed	Late	Bass	30	1	4.96221986
Wye	2002	DC	3	Seed	Late	Bass	30	2	11.84088002
Wye	2002	DC	3	Seed	Late	Bass	30	3	0
Wye	2002	DC	3	Seed	Late	Bass	30	4	17.6337364
Wye	2002	DC	3	Seed	Late	Bass	30	5	53.27495072
Wye	2002	DC	3	Seed	Late	Bass	30	6	0
Wye	2002	DC	3	Seed	Late	Bass	30	7	0
Wye	2002	DC	3	LeafPost	Late	Jack	31	1	0
Wye	2002	DC	3	LeafPost	Late	Jack	31	2	1.53216686
Wye	2002	DC	3	LeafPost	Late	Jack	31	3	0
Wye	2002	DC	3	LeafPost	Late	Jack	31	4	5.50231121
Wye	2002	DC	3	LeafPost	Late	Jack	31	5	7.587015264
Wye	2002	DC	3	LeafPost	Late	Jack	31	6	0
Wye	2002	DC	3	LeafPost	Late	Jack	31	7	0.330209904
Wye	2002	DC	3	Seed	Late	Jack	31	1	2.73707986
Wye	2002	DC	3	Seed	Late	Jack	31	2	6.65699558
Wye	2002	DC	3	Seed	Late	Jack	31	3	0
Wye	2002	DC	3	Seed	Late	Jack	31	4	9.227212951
Wye	2002	DC	3	Seed	Late	Jack	31	5	3.771388356
Wye	2002	DC	3	Seed	Late	Jack	31	6	0
Wye	2002	DC	3	Seed	Late	Jack	31	7	0
Wye	2002	DC	3	LeafPost	Early	Jack	32	1	0
Wye	2002	DC	3	LeafPost	Early	Jack	32	2	1.91841644
Wye	2002	DC	3	LeafPost	Early	Jack	32	3	0
Wye	2002	DC	3	LeafPost	Early	Jack	32	4	0
Wye	2002	DC	3	LeafPost	Early	Jack	32	5	7.286416287
Wye	2002	DC	3	LeafPost	Early	Jack	32	6	0
Wye	2002	DC	3	LeafPost	Early	Jack	32	7	0.67238238
Wye	2002	DC	3	Seed	Early	Jack	32	1	1.980954
Wye	2002	DC	3	Seed	Early	Jack	32	2	2.77400678
Wye	2002	DC	3	Seed	Early	Jack	32	3	0
Wye	2002	DC	3	Seed	Early	Jack	32	4	4.980502665
Wye	2002	DC	3	Seed	Early	Jack	32	5	12.07840124
Wye	2002	DC	3	Seed	Early	Jack	32	6	0
Wye	2002	DC	3	Seed	Early	Jack	32	7	0
Wye	2002	DC	3	LeafPost	Early	Williams82	34	1	0
Wye	2002	DC	3	LeafPost	Early	Williams82	34	2	2.37946478
Wye	2002	DC	3	LeafPost	Early	Williams82	34	3	0
Wye	2002	DC	3	LeafPost	Early	Williams82	34	4	0
Wye	2002	DC	3	LeafPost	Early	Williams82	34	5	5.918133413
Wye	2002	DC	3	LeafPost	Early	Williams82	34	6	0
Wye	2002	DC	3	LeafPost	Early	Williams82	34	7	0
Wye	2002	DC	3	Seed	Early	Williams82	34	1	4.26959072
Wye	2002	DC	3	Seed	Early	Williams82	34	2	7.93401446
Wye	2002	DC	3	Seed	Early	Williams82	34	3	0
Wye	2002	DC	3	Seed	Early	Williams82	34	4	15.01450717
Wye	2002	DC	3	Seed	Early	Williams82	34	5	35.97212077
Wye	2002	DC	3	Seed	Early	Williams82	34	6	0
Wye	2002	DC	3	Seed	Early	Williams82	34	7	0
Wye	2002	DC	3	LeafPost	Late	Williams82	36	1	0
Wye	2002	DC	3	LeafPost	Late	Williams82	36	2	1.45379528
Wye	2002	DC	3	LeafPost	Late	Williams82	36	3	0
Wye	2002	DC	3	LeafPost	Late	Williams82	36	4	3.962356116
Wye	2002	DC	3	LeafPost	Late	Williams82	36	5	4.339778231
Wye	2002	DC	3	LeafPost	Late	Williams82	36	6	0
Wye	2002	DC	3	LeafPost	Late	Williams82	36	7	0.601774132
Wye	2002	DC	3	Seed	Late	Williams82	36	1	4.72028381
Wye	2002	DC	3	Seed	Late	Williams82	36	2	8.80342826
Wye	2002	DC	3	Seed	Late	Williams82	36	3	0
Wye	2002	DC	3	Seed	Late	Williams82	36	4	19.06076438
Wye	2002	DC	3	Seed	Late	Williams82	36	5	44.65054102
Wye	2002	DC	3	Seed	Late	Williams82	36	6	0
Wye	2002	DC	3	Seed	Late	Williams82	36	7	0
Wye	2002	FS	1	LeafPost	Late	Corsica	1	1	0
Wye	2002	FS	1	LeafPost	Late	Corsica	1	2	2.34808772
Wye	2002	FS	1	LeafPost	Late	Corsica	1	3	0
Wye	2002	FS	1	LeafPost	Late	Corsica	1	4	4.565053548
Wye	2002	FS	1	LeafPost	Late	Corsica	1	5	6.416858241

Wye	2002	FS	1	LeafPost	Late	Corsica	1	6	0
Wye	2002	FS	1	LeafPost	Late	Corsica	1	7	0
Wye	2002	FS	1	Seed	Late	Corsica	1	1	2.98576304
Wye	2002	FS	1	Seed	Late	Corsica	1	2	4.95586958
Wye	2002	FS	1	Seed	Late	Corsica	1	3	0
Wye	2002	FS	1	Seed	Late	Corsica	1	4	7.906591516
Wye	2002	FS	1	Seed	Late	Corsica	1	5	19.31801481
Wye	2002	FS	1	Seed	Late	Corsica	1	6	0
Wye	2002	FS	1	Seed	Late	Corsica	1	7	0
Wye	2002	FS	1	LeafPost	Early	Corsica	3	1	0
Wye	2002	FS	1	LeafPost	Early	Corsica	3	2	1.18760846
Wye	2002	FS	1	LeafPost	Early	Corsica	3	3	0
Wye	2002	FS	1	LeafPost	Early	Corsica	3	4	3.807274531
Wye	2002	FS	1	LeafPost	Early	Corsica	3	5	5.18849451
Wye	2002	FS	1	LeafPost	Early	Corsica	3	6	0.187162708
Wye	2002	FS	1	LeafPost	Early	Corsica	3	7	0.542164664
Wye	2002	FS	1	Seed	Early	Corsica	3	1	3.73722917
Wye	2002	FS	1	Seed	Early	Corsica	3	2	7.5344465
Wye	2002	FS	1	Seed	Early	Corsica	3	3	0
Wye	2002	FS	1	Seed	Early	Corsica	3	4	9.144972146
Wye	2002	FS	1	Seed	Early	Corsica	3	5	19.91475353
Wye	2002	FS	1	Seed	Early	Corsica	3	6	0
Wye	2002	FS	1	Seed	Early	Corsica	3	7	0
Wye	2002	FS	1	LeafPost	Early	Jack	5	1	0
Wye	2002	FS	1	LeafPost	Early	Jack	5	2	1.25395058
Wye	2002	FS	1	LeafPost	Early	Jack	5	3	0
Wye	2002	FS	1	LeafPost	Early	Jack	5	4	3.044768086
Wye	2002	FS	1	LeafPost	Early	Jack	5	5	5.107832767
Wye	2002	FS	1	LeafPost	Early	Jack	5	6	0
Wye	2002	FS	1	LeafPost	Early	Jack	5	7	0
Wye	2002	FS	1	Seed	Early	Jack	5	1	1.79637601
Wye	2002	FS	1	Seed	Early	Jack	5	2	2.56794242
Wye	2002	FS	1	Seed	Early	Jack	5	3	0
Wye	2002	FS	1	Seed	Early	Jack	5	4	4.050390976
Wye	2002	FS	1	Seed	Early	Jack	5	5	10.58209438
Wye	2002	FS	1	Seed	Early	Jack	5	6	0
Wye	2002	FS	1	Seed	Early	Jack	5	7	0
Wye	2002	FS	1	LeafPost	Late	Jack	6	1	0
Wye	2002	FS	1	LeafPost	Late	Jack	6	2	1.85151956
Wye	2002	FS	1	LeafPost	Late	Jack	6	3	0
Wye	2002	FS	1	LeafPost	Late	Jack	6	4	3.89989032
Wye	2002	FS	1	LeafPost	Late	Jack	6	5	5.061196913
Wye	2002	FS	1	LeafPost	Late	Jack	6	6	0
Wye	2002	FS	1	LeafPost	Late	Jack	6	7	0.408995776
Wye	2002	FS	1	Seed	Late	Jack	6	1	2.11102955
Wye	2002	FS	1	Seed	Late	Jack	6	2	4.06419914
Wye	2002	FS	1	Seed	Late	Jack	6	3	0
Wye	2002	FS	1	Seed	Late	Jack	6	4	5.167120429
Wye	2002	FS	1	Seed	Late	Jack	6	5	15.54001097
Wye	2002	FS	1	Seed	Late	Jack	6	6	0
Wye	2002	FS	1	Seed	Late	Jack	6	7	0
Wye	2002	FS	1	LeafPost	Early	Bass	7	1	0
Wye	2002	FS	1	LeafPost	Early	Bass	7	2	1.65988172
Wye	2002	FS	1	LeafPost	Early	Bass	7	3	0
Wye	2002	FS	1	LeafPost	Early	Bass	7	4	4.797801864
Wye	2002	FS	1	LeafPost	Early	Bass	7	5	7.395767726
Wye	2002	FS	1	LeafPost	Early	Bass	7	6	0.08959891
Wye	2002	FS	1	LeafPost	Early	Bass	7	7	0.548069876
Wye	2002	FS	1	Seed	Early	Bass	7	1	3.39959364
Wye	2002	FS	1	Seed	Early	Bass	7	2	9.57990458
Wye	2002	FS	1	Seed	Early	Bass	7	3	0
Wye	2002	FS	1	Seed	Early	Bass	7	4	8.330689308
Wye	2002	FS	1	Seed	Early	Bass	7	5	33.9851455
Wye	2002	FS	1	Seed	Early	Bass	7	6	0
Wye	2002	FS	1	Seed	Early	Bass	7	7	0
Wye	2002	FS	1	Seed	Late	Bass	8	1	2.64223735
Wye	2002	FS	1	Seed	Late	Bass	8	2	6.83945918
Wye	2002	FS	1	Seed	Late	Bass	8	3	0
Wye	2002	FS	1	Seed	Late	Bass	8	4	5.479931745
Wye	2002	FS	1	Seed	Late	Bass	8	5	20.75746183
Wye	2002	FS	1	Seed	Late	Bass	8	6	0
Wye	2002	FS	1	Seed	Late	Bass	8	7	0
Wye	2002	FS	1	LeafPost	Late	Bass	9	1	0
Wye	2002	FS	1	LeafPost	Late	Bass	9	2	2.95779932
Wye	2002	FS	1	LeafPost	Late	Bass	9	3	0
Wye	2002	FS	1	LeafPost	Late	Bass	9	4	4.501532263
Wye	2002	FS	1	LeafPost	Late	Bass	9	5	6.237145155
Wye	2002	FS	1	LeafPost	Late	Bass	9	6	0
Wye	2002	FS	1	LeafPost	Late	Bass	9	7	0.276577348

Wye	2002	FS	1	LeafPost	Late	Williams82	10	1	0
Wye	2002	FS	1	LeafPost	Late	Williams82	10	2	2.97321254
Wye	2002	FS	1	LeafPost	Late	Williams82	10	3	0
Wye	2002	FS	1	LeafPost	Late	Williams82	10	4	6.954317973
Wye	2002	FS	1	LeafPost	Late	Williams82	10	5	6.854656143
Wye	2002	FS	1	LeafPost	Late	Williams82	10	6	0
Wye	2002	FS	1	LeafPost	Late	Williams82	10	7	0
Wye	2002	FS	1	Seed	Late	Williams82	10	1	3.57956728
Wye	2002	FS	1	Seed	Late	Williams82	10	2	7.6509599
Wye	2002	FS	1	Seed	Late	Williams82	10	3	0
Wye	2002	FS	1	Seed	Late	Williams82	10	4	6.956412674
Wye	2002	FS	1	Seed	Late	Williams82	10	5	19.47152347
Wye	2002	FS	1	Seed	Late	Williams82	10	6	0
Wye	2002	FS	1	Seed	Late	Williams82	10	7	0
Wye	2002	FS	1	LeafPost	Early	Williams82	12	1	0
Wye	2002	FS	1	LeafPost	Early	Williams82	12	2	1.91803142
Wye	2002	FS	1	LeafPost	Early	Williams82	12	3	0
Wye	2002	FS	1	LeafPost	Early	Williams82	12	4	4.169489959
Wye	2002	FS	1	LeafPost	Early	Williams82	12	5	8.312654917
Wye	2002	FS	1	LeafPost	Early	Williams82	12	6	0
Wye	2002	FS	1	LeafPost	Early	Williams82	12	7	0.609727096
Wye	2002	FS	1	Seed	Early	Williams82	12	1	3.87989444
Wye	2002	FS	1	Seed	Early	Williams82	12	2	8.00352092
Wye	2002	FS	1	Seed	Early	Williams82	12	3	0
Wye	2002	FS	1	Seed	Early	Williams82	12	4	10.80379919
Wye	2002	FS	1	Seed	Early	Williams82	12	5	31.0659512
Wye	2002	FS	1	Seed	Early	Williams82	12	6	0
Wye	2002	FS	1	Seed	Early	Williams82	12	7	0
Wye	2002	FS	1	LeafPost	Early	Jack	20	1	0
Wye	2002	FS	1	LeafPost	Early	Jack	20	2	1.5481445
Wye	2002	FS	1	LeafPost	Early	Jack	20	3	0
Wye	2002	FS	1	LeafPost	Early	Jack	20	4	3.684226029
Wye	2002	FS	1	LeafPost	Early	Jack	20	5	5.836483853
Wye	2002	FS	1	LeafPost	Early	Jack	20	6	0
Wye	2002	FS	1	LeafPost	Early	Jack	20	7	0.420774652
Wye	2002	FS	2	LeafPost	Early	Jack	13	1	0
Wye	2002	FS	2	LeafPost	Early	Jack	13	2	2.13207356
Wye	2002	FS	2	LeafPost	Early	Jack	13	3	0
Wye	2002	FS	2	LeafPost	Early	Jack	13	4	4.590082874
Wye	2002	FS	2	LeafPost	Early	Jack	13	5	9.984526692
Wye	2002	FS	2	LeafPost	Early	Jack	13	6	0
Wye	2002	FS	2	LeafPost	Early	Jack	13	7	1.024270684
Wye	2002	FS	2	Seed	Early	Jack	13	1	2.46986497
Wye	2002	FS	2	Seed	Early	Jack	13	2	6.10079348
Wye	2002	FS	2	Seed	Early	Jack	13	3	0
Wye	2002	FS	2	Seed	Early	Jack	13	4	7.249634035
Wye	2002	FS	2	Seed	Early	Jack	13	5	24.88084236
Wye	2002	FS	2	Seed	Early	Jack	13	6	0
Wye	2002	FS	2	Seed	Early	Jack	13	7	0
Wye	2002	FS	2	LeafPost	Late	Jack	14	1	0
Wye	2002	FS	2	LeafPost	Late	Jack	14	2	1.75391216
Wye	2002	FS	2	LeafPost	Late	Jack	14	3	0
Wye	2002	FS	2	LeafPost	Late	Jack	14	4	6.188764144
Wye	2002	FS	2	LeafPost	Late	Jack	14	5	6.530836036
Wye	2002	FS	2	LeafPost	Late	Jack	14	6	0
Wye	2002	FS	2	LeafPost	Late	Jack	14	7	0.382688568
Wye	2002	FS	2	Seed	Late	Jack	14	1	2.62614449
Wye	2002	FS	2	Seed	Late	Jack	14	2	6.76606802
Wye	2002	FS	2	Seed	Late	Jack	14	3	0
Wye	2002	FS	2	Seed	Late	Jack	14	4	8.292238472
Wye	2002	FS	2	Seed	Late	Jack	14	5	28.46153774
Wye	2002	FS	2	Seed	Late	Jack	14	6	0
Wye	2002	FS	2	Seed	Late	Jack	14	7	0
Wye	2002	FS	2	LeafPost	Early	Bass	16	1	0
Wye	2002	FS	2	LeafPost	Early	Bass	16	2	1.81447346
Wye	2002	FS	2	LeafPost	Early	Bass	16	3	0
Wye	2002	FS	2	LeafPost	Early	Bass	16	4	5.371890558
Wye	2002	FS	2	LeafPost	Early	Bass	16	5	7.197564107
Wye	2002	FS	2	LeafPost	Early	Bass	16	6	0.034734774
Wye	2002	FS	2	LeafPost	Early	Bass	16	7	0.47810406
Wye	2002	FS	2	Seed	Early	Bass	16	1	3.32741859
Wye	2002	FS	2	Seed	Early	Bass	16	2	9.61261058
Wye	2002	FS	2	Seed	Early	Bass	16	3	0
Wye	2002	FS	2	Seed	Early	Bass	16	4	8.620077665
Wye	2002	FS	2	Seed	Early	Bass	16	5	32.56149527
Wye	2002	FS	2	Seed	Early	Bass	16	6	0
Wye	2002	FS	2	Seed	Early	Bass	16	7	0
Wye	2002	FS	2	LeafPost	Late	Bass	17	1	0
Wye	2002	FS	2	LeafPost	Late	Bass	17	2	2.64218642

Wye	2002	FS	2	LeafPost	Late	Bass	17	3	0
Wye	2002	FS	2	LeafPost	Late	Bass	17	4	6.243713003
Wye	2002	FS	2	LeafPost	Late	Bass	17	5	5.373535517
Wye	2002	FS	2	LeafPost	Late	Bass	17	6	0
Wye	2002	FS	2	LeafPost	Late	Bass	17	7	0
Wye	2002	FS	2	Seed	Late	Bass	17	1	3.00525609
Wye	2002	FS	2	Seed	Late	Bass	17	2	7.88367482
Wye	2002	FS	2	Seed	Late	Bass	17	3	0
Wye	2002	FS	2	Seed	Late	Bass	17	4	7.448963081
Wye	2002	FS	2	Seed	Late	Bass	17	5	27.65027906
Wye	2002	FS	2	Seed	Late	Bass	17	6	0
Wye	2002	FS	2	Seed	Late	Bass	17	7	0
Wye	2002	FS	2	LeafPost	Late	Williams82	19	1	0
Wye	2002	FS	2	LeafPost	Late	Williams82	19	2	2.20979378
Wye	2002	FS	2	LeafPost	Late	Williams82	19	3	0
Wye	2002	FS	2	LeafPost	Late	Williams82	19	4	0
Wye	2002	FS	2	LeafPost	Late	Williams82	19	5	1.784810196
Wye	2002	FS	2	LeafPost	Late	Williams82	19	6	0
Wye	2002	FS	2	LeafPost	Late	Williams82	19	7	0
Wye	2002	FS	2	Seed	Late	Williams82	19	1	4.15918856
Wye	2002	FS	2	Seed	Late	Williams82	19	2	9.30590006
Wye	2002	FS	2	Seed	Late	Williams82	19	3	0
Wye	2002	FS	2	Seed	Late	Williams82	19	4	11.17125351
Wye	2002	FS	2	Seed	Late	Williams82	19	5	34.31135655
Wye	2002	FS	2	Seed	Late	Williams82	19	6	0
Wye	2002	FS	2	Seed	Late	Williams82	19	7	0
Wye	2002	FS	2	Seed	Early	Williams82	20	1	5.40035234
Wye	2002	FS	2	Seed	Early	Williams82	20	2	11.93257964
Wye	2002	FS	2	Seed	Early	Williams82	20	3	0
Wye	2002	FS	2	Seed	Early	Williams82	20	4	13.80995361
Wye	2002	FS	2	Seed	Early	Williams82	20	5	39.60059039
Wye	2002	FS	2	Seed	Early	Williams82	20	6	0
Wye	2002	FS	2	Seed	Early	Williams82	20	7	0
Wye	2002	FS	2	LeafPost	Early	Corsica	23	1	0
Wye	2002	FS	2	LeafPost	Early	Corsica	23	2	1.56617282
Wye	2002	FS	2	LeafPost	Early	Corsica	23	3	0
Wye	2002	FS	2	LeafPost	Early	Corsica	23	4	5.885697258
Wye	2002	FS	2	LeafPost	Early	Corsica	23	5	8.477029548
Wye	2002	FS	2	LeafPost	Early	Corsica	23	6	0.438110977
Wye	2002	FS	2	LeafPost	Early	Corsica	23	7	0.770188828
Wye	2002	FS	2	Seed	Early	Corsica	23	1	2.39822739
Wye	2002	FS	2	Seed	Early	Corsica	23	2	4.5707516
Wye	2002	FS	2	Seed	Early	Corsica	23	3	0
Wye	2002	FS	2	Seed	Early	Corsica	23	4	6.016453747
Wye	2002	FS	2	Seed	Early	Corsica	23	5	18.38036693
Wye	2002	FS	2	Seed	Early	Corsica	23	6	0
Wye	2002	FS	2	Seed	Early	Corsica	23	7	0
Wye	2002	FS	2	LeafPost	Late	Corsica	24	1	0
Wye	2002	FS	2	LeafPost	Late	Corsica	24	1	0
Wye	2002	FS	2	LeafPost	Late	Corsica	24	2	2.58797726
Wye	2002	FS	2	LeafPost	Late	Corsica	24	2	2.74993406
Wye	2002	FS	2	LeafPost	Late	Corsica	24	3	0
Wye	2002	FS	2	LeafPost	Late	Corsica	24	3	0
Wye	2002	FS	2	LeafPost	Late	Corsica	24	4	4.949190948
Wye	2002	FS	2	LeafPost	Late	Corsica	24	4	7.094391385
Wye	2002	FS	2	LeafPost	Late	Corsica	24	5	5.8368578
Wye	2002	FS	2	LeafPost	Late	Corsica	24	5	8.591614593
Wye	2002	FS	2	LeafPost	Late	Corsica	24	6	0
Wye	2002	FS	2	LeafPost	Late	Corsica	24	6	0
Wye	2002	FS	2	LeafPost	Late	Corsica	24	7	0.262168516
Wye	2002	FS	2	LeafPost	Late	Corsica	24	7	0
Wye	2002	FS	2	Seed	Late	Corsica	24	1	3.41571064
Wye	2002	FS	2	Seed	Late	Corsica	24	2	5.55885506
Wye	2002	FS	2	Seed	Late	Corsica	24	3	0
Wye	2002	FS	2	Seed	Late	Corsica	24	4	8.61706455
Wye	2002	FS	2	Seed	Late	Corsica	24	5	19.72987137
Wye	2002	FS	2	Seed	Late	Corsica	24	6	0
Wye	2002	FS	2	Seed	Late	Corsica	24	7	0
Wye	2002	FS	3	LeafPost	Late	Bass	26	1	0
Wye	2002	FS	3	LeafPost	Late	Bass	26	2	3.0659582
Wye	2002	FS	3	LeafPost	Late	Bass	26	3	0
Wye	2002	FS	3	LeafPost	Late	Bass	26	4	4.810579971
Wye	2002	FS	3	LeafPost	Late	Bass	26	5	7.229450555
Wye	2002	FS	3	LeafPost	Late	Bass	26	6	0
Wye	2002	FS	3	LeafPost	Late	Bass	26	7	0.367541704
Wye	2002	FS	3	Seed	Late	Bass	26	1	2.07334062
Wye	2002	FS	3	Seed	Late	Bass	26	2	5.00126606
Wye	2002	FS	3	Seed	Late	Bass	26	3	0
Wye	2002	FS	3	Seed	Late	Bass	26	4	3.813402711

Wye	2002	FS	3	Seed	Late	Bass	26	5	14.31549757
Wye	2002	FS	3	Seed	Late	Bass	26	6	0
Wye	2002	FS	3	Seed	Late	Bass	26	7	0
Wye	2002	FS	3	LeafPost	Early	Bass	27	1	0
Wye	2002	FS	3	LeafPost	Early	Bass	27	2	2.20159106
Wye	2002	FS	3	LeafPost	Early	Bass	27	3	0
Wye	2002	FS	3	LeafPost	Early	Bass	27	4	7.016788052
Wye	2002	FS	3	LeafPost	Early	Bass	27	5	9.587525441
Wye	2002	FS	3	LeafPost	Early	Bass	27	6	0.138388786
Wye	2002	FS	3	LeafPost	Early	Bass	27	7	0.317766608
Wye	2002	FS	3	Seed	Early	Bass	27	1	2.09544434
Wye	2002	FS	3	Seed	Early	Bass	27	2	5.34679046
Wye	2002	FS	3	Seed	Early	Bass	27	3	0
Wye	2002	FS	3	Seed	Early	Bass	27	4	4.065069307
Wye	2002	FS	3	Seed	Early	Bass	27	5	15.38950713
Wye	2002	FS	3	Seed	Early	Bass	27	6	0
Wye	2002	FS	3	Seed	Early	Bass	27	7	0
Wye	2002	FS	3	LeafPost	Late	Williams82	28	1	0
Wye	2002	FS	3	LeafPost	Late	Williams82	28	2	2.66843678
Wye	2002	FS	3	LeafPost	Late	Williams82	28	3	0
Wye	2002	FS	3	LeafPost	Late	Williams82	28	4	0
Wye	2002	FS	3	LeafPost	Late	Williams82	28	5	3.429306055
Wye	2002	FS	3	LeafPost	Late	Williams82	28	6	0
Wye	2002	FS	3	LeafPost	Late	Williams82	28	7	0.186783136
Wye	2002	FS	3	LeafPost	Early	Williams82	29	1	0
Wye	2002	FS	3	LeafPost	Early	Williams82	29	2	1.852124
Wye	2002	FS	3	LeafPost	Early	Williams82	29	3	0
Wye	2002	FS	3	LeafPost	Early	Williams82	29	4	0
Wye	2002	FS	3	LeafPost	Early	Williams82	29	5	9.422338384
Wye	2002	FS	3	LeafPost	Early	Williams82	29	6	0
Wye	2002	FS	3	LeafPost	Early	Williams82	29	7	0
Wye	2002	FS	3	Seed	Early	Williams82	29	1	2.93197344
Wye	2002	FS	3	Seed	Early	Williams82	29	2	6.4258028
Wye	2002	FS	3	Seed	Early	Williams82	29	3	0
Wye	2002	FS	3	Seed	Early	Williams82	29	4	8.317921482
Wye	2002	FS	3	Seed	Early	Williams82	29	5	26.90258314
Wye	2002	FS	3	Seed	Early	Williams82	29	6	0
Wye	2002	FS	3	Seed	Early	Williams82	29	7	0
Wye	2002	FS	3	LeafPost	Late	Williams82	30	1	0
Wye	2002	FS	3	LeafPost	Late	Williams82	30	2	1.51391222
Wye	2002	FS	3	LeafPost	Late	Williams82	30	3	0
Wye	2002	FS	3	LeafPost	Late	Williams82	30	4	3.920140814
Wye	2002	FS	3	LeafPost	Late	Williams82	30	5	4.761061233
Wye	2002	FS	3	LeafPost	Late	Williams82	30	6	0
Wye	2002	FS	3	LeafPost	Late	Williams82	30	7	0.248551252
Wye	2002	FS	3	Seed	Late	Williams82	30	1	2.66781155
Wye	2002	FS	3	Seed	Late	Williams82	30	2	5.00882846
Wye	2002	FS	3	Seed	Late	Williams82	30	3	0
Wye	2002	FS	3	Seed	Late	Williams82	30	4	6.2874747
Wye	2002	FS	3	Seed	Late	Williams82	30	5	18.57734778
Wye	2002	FS	3	Seed	Late	Williams82	30	6	0
Wye	2002	FS	3	Seed	Late	Williams82	30	7	0
Wye	2002	FS	3	LeafPost	Early	Jack	32	1	0
Wye	2002	FS	3	LeafPost	Early	Jack	32	2	1.80249368
Wye	2002	FS	3	LeafPost	Early	Jack	32	3	0
Wye	2002	FS	3	LeafPost	Early	Jack	32	4	3.982922742
Wye	2002	FS	3	LeafPost	Early	Jack	32	5	8.051255869
Wye	2002	FS	3	LeafPost	Early	Jack	32	6	0
Wye	2002	FS	3	LeafPost	Early	Jack	32	7	0
Wye	2002	FS	3	Seed	Early	Jack	32	1	1.61594513
Wye	2002	FS	3	Seed	Early	Jack	32	2	2.4191315
Wye	2002	FS	3	Seed	Early	Jack	32	3	0
Wye	2002	FS	3	Seed	Early	Jack	32	4	0
Wye	2002	FS	3	Seed	Early	Jack	32	5	6.614504248
Wye	2002	FS	3	Seed	Early	Jack	32	6	1.446043483
Wye	2002	FS	3	Seed	Early	Jack	32	7	0
Wye	2002	FS	3	LeafPost	Late	Jack	33	1	0
Wye	2002	FS	3	LeafPost	Late	Jack	33	2	2.03611664
Wye	2002	FS	3	LeafPost	Late	Jack	33	3	0
Wye	2002	FS	3	LeafPost	Late	Jack	33	4	0
Wye	2002	FS	3	LeafPost	Late	Jack	33	5	2.374663981
Wye	2002	FS	3	LeafPost	Late	Jack	33	6	0
Wye	2002	FS	3	LeafPost	Late	Jack	33	7	0
Wye	2002	FS	3	Seed	Late	Jack	33	1	1.7300826
Wye	2002	FS	3	Seed	Late	Jack	33	2	3.54447596
Wye	2002	FS	3	Seed	Late	Jack	33	3	0
Wye	2002	FS	3	Seed	Late	Jack	33	4	0
Wye	2002	FS	3	Seed	Late	Jack	33	5	11.74331142
Wye	2002	FS	3	Seed	Late	Jack	33	6	1.332365783

Wye	2002	FS	3	Seed	Late	Jack	33	7	0
Wye	2002	FS	3	Seed	Late	Corsica	34	1	2.71897486
Wye	2002	FS	3	Seed	Late	Corsica	34	2	5.34850166
Wye	2002	FS	3	Seed	Late	Corsica	34	3	0
Wye	2002	FS	3	Seed	Late	Corsica	34	4	0
Wye	2002	FS	3	Seed	Late	Corsica	34	5	15.9433081
Wye	2002	FS	3	Seed	Late	Corsica	34	6	3.297631549
Wye	2002	FS	3	Seed	Late	Corsica	34	7	0
Wye	2002	FS	3	LeafPost	Early	Corsica	35	1	0
Wye	2002	FS	3	LeafPost	Early	Corsica	35	2	1.29368216
Wye	2002	FS	3	LeafPost	Early	Corsica	35	3	0
Wye	2002	FS	3	LeafPost	Early	Corsica	35	4	3.996535303
Wye	2002	FS	3	LeafPost	Early	Corsica	35	5	4.765264003
Wye	2002	FS	3	LeafPost	Early	Corsica	35	6	0.257107338
Wye	2002	FS	3	LeafPost	Early	Corsica	35	7	0.374962176
Wye	2002	FS	3	Seed	Early	Corsica	35	1	2.31109761
Wye	2002	FS	3	Seed	Early	Corsica	35	2	4.29483854
Wye	2002	FS	3	Seed	Early	Corsica	35	3	0
Wye	2002	FS	3	Seed	Early	Corsica	35	4	0
Wye	2002	FS	3	Seed	Early	Corsica	35	5	16.14320938
Wye	2002	FS	3	Seed	Early	Corsica	35	6	3.378259797
Wye	2002	FS	3	Seed	Early	Corsica	35	7	0
PHill	2003	DC	1	Seed	Late	Corsica	1	1	5.50705895
PHill	2003	DC	1	Seed	Late	Corsica	1	2	11.99283458
PHill	2003	DC	1	Seed	Late	Corsica	1	3	0
PHill	2003	DC	1	Seed	Late	Corsica	1	4	26.08340556
PHill	2003	DC	1	Seed	Late	Corsica	1	5	64.29434522
PHill	2003	DC	1	Seed	Late	Corsica	1	6	0
PHill	2003	DC	1	Seed	Late	Corsica	1	7	0.444731056
PHill	2003	DC	1	LeafPost	Early	Corsica	2	1	0
PHill	2003	DC	1	LeafPost	Early	Corsica	2	2	2.24502794
PHill	2003	DC	1	LeafPost	Early	Corsica	2	3	0
PHill	2003	DC	1	LeafPost	Early	Corsica	2	4	0
PHill	2003	DC	1	LeafPost	Early	Corsica	2	5	8.634932906
PHill	2003	DC	1	LeafPost	Early	Corsica	2	6	3.94942798
PHill	2003	DC	1	LeafPost	Early	Corsica	2	7	0
PHill	2003	DC	1	Seed	Early	Corsica	2	1	5.56526901
PHill	2003	DC	1	Seed	Early	Corsica	2	2	12.2099831
PHill	2003	DC	1	Seed	Early	Corsica	2	3	0
PHill	2003	DC	1	Seed	Early	Corsica	2	4	25.25866292
PHill	2003	DC	1	Seed	Early	Corsica	2	5	62.10449365
PHill	2003	DC	1	Seed	Early	Corsica	2	6	0
PHill	2003	DC	1	Seed	Early	Corsica	2	7	0.664205712
PHill	2003	DC	1	Seed	Late	Williams82	5	1	8.20255123
PHill	2003	DC	1	Seed	Late	Williams82	5	2	20.09638778
PHill	2003	DC	1	Seed	Late	Williams82	5	3	0
PHill	2003	DC	1	Seed	Late	Williams82	5	4	37.0539772
PHill	2003	DC	1	Seed	Late	Williams82	5	5	97.09068293
PHill	2003	DC	1	Seed	Late	Williams82	5	6	0
PHill	2003	DC	1	Seed	Late	Williams82	5	7	1.284395416
PHill	2003	DC	1	Seed	Early	Williams82	6	1	8.04411331
PHill	2003	DC	1	Seed	Early	Williams82	6	2	19.89576338
PHill	2003	DC	1	Seed	Early	Williams82	6	3	0
PHill	2003	DC	1	Seed	Early	Williams82	6	4	35.85463598
PHill	2003	DC	1	Seed	Early	Williams82	6	5	94.79103978
PHill	2003	DC	1	Seed	Early	Williams82	6	6	0
PHill	2003	DC	1	Seed	Early	Williams82	6	7	1.33934056
PHill	2003	DC	1	Seed	Early	Jack	7	1	4.64426624
PHill	2003	DC	1	Seed	Early	Jack	7	2	16.9458395
PHill	2003	DC	1	Seed	Early	Jack	7	3	0
PHill	2003	DC	1	Seed	Early	Jack	7	4	18.23403928
PHill	2003	DC	1	Seed	Early	Jack	7	5	79.61833905
PHill	2003	DC	1	Seed	Early	Jack	7	6	0
PHill	2003	DC	1	Seed	Early	Jack	7	7	1.383600492
PHill	2003	DC	1	Seed	Late	Jack	9	1	1.65267272
PHill	2003	DC	1	Seed	Late	Jack	9	2	15.7120712
PHill	2003	DC	1	Seed	Late	Jack	9	3	0
PHill	2003	DC	1	Seed	Late	Jack	9	4	17.24780073
PHill	2003	DC	1	Seed	Late	Jack	9	5	76.84433721
PHill	2003	DC	1	Seed	Late	Jack	9	6	0
PHill	2003	DC	1	Seed	Late	Jack	9	7	1.227695056
PHill	2003	DC	1	Seed	Early	Bass	10	1	4.21009911
PHill	2003	DC	1	Seed	Early	Bass	10	2	11.78059058
PHill	2003	DC	1	Seed	Early	Bass	10	3	0
PHill	2003	DC	1	Seed	Early	Bass	10	4	17.85522901
PHill	2003	DC	1	Seed	Early	Bass	10	5	63.5438811
PHill	2003	DC	1	Seed	Early	Bass	10	6	0
PHill	2003	DC	1	Seed	Early	Bass	10	7	0.862126392
PHill	2003	DC	1	Seed	Late	Bass	12	1	3.70744538

PHill	2003	DC	1	Seed	Late	Bass	12	2	9.89334536
PHill	2003	DC	1	Seed	Late	Bass	12	3	0
PHill	2003	DC	1	Seed	Late	Bass	12	4	16.40033765
PHill	2003	DC	1	Seed	Late	Bass	12	5	57.72655599
PHill	2003	DC	1	Seed	Late	Bass	12	6	0
PHill	2003	DC	1	Seed	Late	Bass	12	7	0.694785284
PHill	2003	DC	2	Seed	Early	Bass	14	1	9.2014126
PHill	2003	DC	2	Seed	Early	Bass	14	2	23.25677132
PHill	2003	DC	2	Seed	Early	Bass	14	3	0
PHill	2003	DC	2	Seed	Early	Bass	14	4	38.20402911
PHill	2003	DC	2	Seed	Early	Bass	14	5	103.0633434
PHill	2003	DC	2	Seed	Early	Bass	14	6	0
PHill	2003	DC	2	Seed	Early	Bass	14	7	1.4501075
PHill	2003	DC	2	Seed	Late	Bass	15	1	9.87921836
PHill	2003	DC	2	Seed	Late	Bass	15	2	24.22250774
PHill	2003	DC	2	Seed	Late	Bass	15	3	0
PHill	2003	DC	2	Seed	Late	Bass	15	4	40.03307785
PHill	2003	DC	2	Seed	Late	Bass	15	5	103.1121088
PHill	2003	DC	2	Seed	Late	Bass	15	6	0
PHill	2003	DC	2	Seed	Late	Bass	15	7	1.359731084
PHill	2003	DC	2	Seed	Early	Jack	16	1	4.70199847
PHill	2003	DC	2	Seed	Early	Jack	16	2	16.36251626
PHill	2003	DC	2	Seed	Early	Jack	16	3	0
PHill	2003	DC	2	Seed	Early	Jack	16	4	18.14398682
PHill	2003	DC	2	Seed	Early	Jack	16	5	76.37910052
PHill	2003	DC	2	Seed	Early	Jack	16	6	0
PHill	2003	DC	2	Seed	Early	Jack	16	7	1.212769984
PHill	2003	DC	2	Seed	Late	Jack	17	1	5.20655713
PHill	2003	DC	2	Seed	Late	Jack	17	2	18.9720728
PHill	2003	DC	2	Seed	Late	Jack	17	3	0
PHill	2003	DC	2	Seed	Late	Jack	17	4	18.24336562
PHill	2003	DC	2	Seed	Late	Jack	17	5	77.36086756
PHill	2003	DC	2	Seed	Late	Jack	17	6	0
PHill	2003	DC	2	Seed	Late	Jack	17	7	1.541288868
PHill	2003	DC	2	Seed	Late	Corsica	20	1	7.21336148
PHill	2003	DC	2	Seed	Late	Corsica	20	2	17.34313046
PHill	2003	DC	2	Seed	Late	Corsica	20	3	0
PHill	2003	DC	2	Seed	Late	Corsica	20	4	27.52037845
PHill	2003	DC	2	Seed	Late	Corsica	20	5	70.24653292
PHill	2003	DC	2	Seed	Late	Corsica	20	6	0
PHill	2003	DC	2	Seed	Late	Corsica	20	7	1.012998488
PHill	2003	DC	2	Seed	Early	Corsica	21	1	7.53842859
PHill	2003	DC	2	Seed	Early	Corsica	21	2	17.5647074
PHill	2003	DC	2	Seed	Early	Corsica	21	3	0
PHill	2003	DC	2	Seed	Early	Corsica	21	4	27.39493625
PHill	2003	DC	2	Seed	Early	Corsica	21	5	70.0217443
PHill	2003	DC	2	Seed	Early	Corsica	21	6	0
PHill	2003	DC	2	Seed	Early	Corsica	21	7	1.036781856
PHill	2003	DC	2	Seed	Early	Bass	23	1	4.84516145
PHill	2003	DC	2	Seed	Early	Bass	23	2	14.62632584
PHill	2003	DC	2	Seed	Early	Bass	23	3	0
PHill	2003	DC	2	Seed	Early	Bass	23	4	18.30657677
PHill	2003	DC	2	Seed	Early	Bass	23	5	68.51182312
PHill	2003	DC	2	Seed	Early	Bass	23	6	0
PHill	2003	DC	2	Seed	Early	Bass	23	7	0.409098068
PHill	2003	DC	2	Seed	Late	Bass	24	1	4.9883223
PHill	2003	DC	2	Seed	Late	Bass	24	2	15.0904019
PHill	2003	DC	2	Seed	Late	Bass	24	3	0
PHill	2003	DC	2	Seed	Late	Bass	24	4	18.5021148
PHill	2003	DC	2	Seed	Late	Bass	24	5	66.7346521
PHill	2003	DC	2	Seed	Late	Bass	24	6	0
PHill	2003	DC	2	Seed	Late	Bass	24	7	0.836622224
PHill	2003	DC	3	Seed	Early	Corsica	25	1	6.80042619
PHill	2003	DC	3	Seed	Early	Corsica	25	2	15.8911607
PHill	2003	DC	3	Seed	Early	Corsica	25	3	0
PHill	2003	DC	3	Seed	Early	Corsica	25	4	26.58884887
PHill	2003	DC	3	Seed	Early	Corsica	25	5	67.92459193
PHill	2003	DC	3	Seed	Early	Corsica	25	6	0
PHill	2003	DC	3	Seed	Early	Corsica	25	7	0.932601756
PHill	2003	DC	3	Seed	Late	Corsica	27	1	6.92019964
PHill	2003	DC	3	Seed	Late	Corsica	27	2	15.37429274
PHill	2003	DC	3	Seed	Late	Corsica	27	3	0
PHill	2003	DC	3	Seed	Late	Corsica	27	4	26.17574377
PHill	2003	DC	3	Seed	Late	Corsica	27	5	63.98155987
PHill	2003	DC	3	Seed	Late	Corsica	27	6	0
PHill	2003	DC	3	Seed	Late	Corsica	27	7	0.723655528
PHill	2003	DC	3	Seed	Early	Bass	28	1	4.55401317
PHill	2003	DC	3	Seed	Early	Bass	28	2	13.79029976
PHill	2003	DC	3	Seed	Early	Bass	28	3	0

PHill	2003	DC	3	Seed	Early	Bass	28	4	17.38560724
PHill	2003	DC	3	Seed	Early	Bass	28	5	63.99649956
PHill	2003	DC	3	Seed	Early	Bass	28	6	0
PHill	2003	DC	3	Seed	Early	Bass	28	7	0.790385284
PHill	2003	DC	3	Seed	Late	Bass	30	1	4.85263633
PHill	2003	DC	3	Seed	Late	Bass	30	2	14.963987
PHill	2003	DC	3	Seed	Late	Bass	30	3	0
PHill	2003	DC	3	Seed	Late	Bass	30	4	17.08340736
PHill	2003	DC	3	Seed	Late	Bass	30	5	63.17862731
PHill	2003	DC	3	Seed	Late	Bass	30	6	0
PHill	2003	DC	3	Seed	Late	Bass	30	7	0.880059996
PHill	2003	DC	3	Seed	Early	Jack	32	1	5.59764572
PHill	2003	DC	3	Seed	Early	Jack	32	2	21.71734406
PHill	2003	DC	3	Seed	Early	Jack	32	3	0
PHill	2003	DC	3	Seed	Early	Jack	32	4	18.10827409
PHill	2003	DC	3	Seed	Early	Jack	32	5	79.32755371
PHill	2003	DC	3	Seed	Early	Jack	32	6	0
PHill	2003	DC	3	Seed	Early	Jack	32	7	1.4807234
PHill	2003	DC	3	Seed	Late	Jack	33	1	5.28529116
PHill	2003	DC	3	Seed	Late	Jack	33	2	20.63268476
PHill	2003	DC	3	Seed	Late	Jack	33	3	0
PHill	2003	DC	3	Seed	Late	Jack	33	4	18.13454481
PHill	2003	DC	3	Seed	Late	Jack	33	5	81.87275278
PHill	2003	DC	3	Seed	Late	Jack	33	6	0
PHill	2003	DC	3	Seed	Late	Jack	33	7	0
PHill	2003	DC	3	Seed	Late	Williams82	35	1	9.47112101
PHill	2003	DC	3	Seed	Late	Williams82	35	2	23.65974788
PHill	2003	DC	3	Seed	Late	Williams82	35	3	0
PHill	2003	DC	3	Seed	Late	Williams82	35	4	35.88541224
PHill	2003	DC	3	Seed	Late	Williams82	35	5	96.55974073
PHill	2003	DC	3	Seed	Late	Williams82	35	6	0
PHill	2003	DC	3	Seed	Late	Williams82	35	7	0
PHill	2003	DC	3	LeafPost	Early	Bass	36	1	0
PHill	2003	DC	3	LeafPost	Early	Bass	36	2	5.20409432
PHill	2003	DC	3	LeafPost	Early	Bass	36	3	0
PHill	2003	DC	3	LeafPost	Early	Bass	36	4	0
PHill	2003	DC	3	LeafPost	Early	Bass	36	5	32.35907564
PHill	2003	DC	3	LeafPost	Early	Bass	36	6	8.552150689
PHill	2003	DC	3	LeafPost	Early	Bass	36	7	1.0007875
PHill	2003	DC	3	Seed	Early	Williams82	36	1	8.69775067
PHill	2003	DC	3	Seed	Early	Williams82	36	2	22.12906154
PHill	2003	DC	3	Seed	Early	Williams82	36	3	0
PHill	2003	DC	3	Seed	Early	Williams82	36	4	46.36445898
PHill	2003	DC	3	Seed	Early	Williams82	36	5	126.6248257
PHill	2003	DC	3	Seed	Early	Williams82	36	6	0
PHill	2003	DC	3	Seed	Early	Williams82	36	7	2.102750536
PHill	2003	FS	1	LeafPost	Late	Corsica	2	1	0
PHill	2003	FS	1	LeafPost	Late	Corsica	2	2	1.73975888
PHill	2003	FS	1	LeafPost	Late	Corsica	2	3	0
PHill	2003	FS	1	LeafPost	Late	Corsica	2	4	6.521549231
PHill	2003	FS	1	LeafPost	Late	Corsica	2	5	8.376786869
PHill	2003	FS	1	LeafPost	Late	Corsica	2	6	0
PHill	2003	FS	1	LeafPost	Late	Corsica	2	7	0
PHill	2003	FS	1	Seed	Late	Corsica	2	1	4.0140106
PHill	2003	FS	1	Seed	Late	Corsica	2	2	7.55640506
PHill	2003	FS	1	Seed	Late	Corsica	2	3	0
PHill	2003	FS	1	Seed	Late	Corsica	2	4	16.63706204
PHill	2003	FS	1	Seed	Late	Corsica	2	5	45.26061112
PHill	2003	FS	1	Seed	Late	Corsica	2	6	0
PHill	2003	FS	1	Seed	Late	Corsica	2	7	0
PHill	2003	FS	1	Seed	Early	Corsica	3	1	4.87031391
PHill	2003	FS	1	Seed	Early	Corsica	3	2	8.80450052
PHill	2003	FS	1	Seed	Early	Corsica	3	3	0
PHill	2003	FS	1	Seed	Early	Corsica	3	4	24.10191396
PHill	2003	FS	1	Seed	Early	Corsica	3	5	59.94947211
PHill	2003	FS	1	Seed	Early	Corsica	3	6	0
PHill	2003	FS	1	Seed	Early	Corsica	3	7	0
PHill	2003	FS	1	Seed	Early	Jack	4	1	3.01710386
PHill	2003	FS	1	Seed	Early	Jack	4	2	9.06290966
PHill	2003	FS	1	Seed	Early	Jack	4	3	0
PHill	2003	FS	1	Seed	Early	Jack	4	4	10.77103875
PHill	2003	FS	1	Seed	Early	Jack	4	5	49.15780321
PHill	2003	FS	1	Seed	Early	Jack	4	6	0
PHill	2003	FS	1	Seed	Early	Jack	4	7	0
PHill	2003	FS	1	LeafPost	Late	Jack	5	1	0
PHill	2003	FS	1	LeafPost	Late	Jack	5	2	1.72420904
PHill	2003	FS	1	LeafPost	Late	Jack	5	3	0
PHill	2003	FS	1	LeafPost	Late	Jack	5	4	4.290348663
PHill	2003	FS	1	LeafPost	Late	Jack	5	5	5.957333342

PHill	2003	FS	1	LeafPost	Late	Jack	5	6	0
PHill	2003	FS	1	LeafPost	Late	Jack	5	7	0
PHill	2003	FS	1	Seed	Late	Jack	5	1	2.66091532
PHill	2003	FS	1	Seed	Late	Jack	5	2	7.6367804
PHill	2003	FS	1	Seed	Late	Jack	5	3	0
PHill	2003	FS	1	Seed	Late	Jack	5	4	9.12916122
PHill	2003	FS	1	Seed	Late	Jack	5	5	40.79710408
PHill	2003	FS	1	Seed	Late	Jack	5	6	0
PHill	2003	FS	1	Seed	Late	Jack	5	7	0
PHill	2003	FS	1	LeafPost	Late	Bass	7	1	0
PHill	2003	FS	1	LeafPost	Late	Bass	7	2	1.8071291
PHill	2003	FS	1	LeafPost	Late	Bass	7	3	0
PHill	2003	FS	1	LeafPost	Late	Bass	7	4	6.940852769
PHill	2003	FS	1	LeafPost	Late	Bass	7	5	5.687232575
PHill	2003	FS	1	LeafPost	Late	Bass	7	6	0
PHill	2003	FS	1	LeafPost	Late	Bass	7	7	0
PHill	2003	FS	1	Seed	Late	Bass	7	1	3.26139711
PHill	2003	FS	1	Seed	Late	Bass	7	2	7.92662042
PHill	2003	FS	1	Seed	Late	Bass	7	3	0
PHill	2003	FS	1	Seed	Late	Bass	7	4	14.9278465
PHill	2003	FS	1	Seed	Late	Bass	7	5	57.30839032
PHill	2003	FS	1	Seed	Late	Bass	7	6	0
PHill	2003	FS	1	Seed	Late	Bass	7	7	0
PHill	2003	FS	1	Seed	Early	Bass	8	1	3.06058213
PHill	2003	FS	1	Seed	Early	Bass	8	2	7.8422486
PHill	2003	FS	1	Seed	Early	Bass	8	3	0
PHill	2003	FS	1	Seed	Early	Bass	8	4	11.61579542
PHill	2003	FS	1	Seed	Early	Bass	8	5	47.72131136
PHill	2003	FS	1	Seed	Early	Bass	8	6	0
PHill	2003	FS	1	Seed	Early	Bass	8	7	0
PHill	2003	FS	1	Seed	Early	Williams82	10	1	7.17723881
PHill	2003	FS	1	Seed	Early	Williams82	10	2	14.74129088
PHill	2003	FS	1	Seed	Early	Williams82	10	3	0
PHill	2003	FS	1	Seed	Early	Williams82	10	4	34.49435144
PHill	2003	FS	1	Seed	Early	Williams82	10	5	86.61194168
PHill	2003	FS	1	Seed	Early	Williams82	10	6	0
PHill	2003	FS	1	Seed	Early	Williams82	10	7	0
PHill	2003	FS	1	LeafPost	Late	Williams82	12	1	0
PHill	2003	FS	1	LeafPost	Late	Williams82	12	2	1.9575146
PHill	2003	FS	1	LeafPost	Late	Williams82	12	3	0
PHill	2003	FS	1	LeafPost	Late	Williams82	12	4	4.454002674
PHill	2003	FS	1	LeafPost	Late	Williams82	12	5	7.621294313
PHill	2003	FS	1	LeafPost	Late	Williams82	12	6	0
PHill	2003	FS	1	LeafPost	Late	Williams82	12	7	0
PHill	2003	FS	1	Seed	Late	Williams82	12	1	3.76915432
PHill	2003	FS	1	Seed	Late	Williams82	12	2	6.64468322
PHill	2003	FS	1	Seed	Late	Williams82	12	3	0
PHill	2003	FS	1	Seed	Late	Williams82	12	4	16.73566293
PHill	2003	FS	1	Seed	Late	Williams82	12	5	45.16630196
PHill	2003	FS	1	Seed	Late	Williams82	12	6	0
PHill	2003	FS	1	Seed	Late	Williams82	12	7	0
PHill	2003	FS	2	Seed	Early	Jack	13	1	2.4309307
PHill	2003	FS	2	Seed	Early	Jack	13	2	5.84947202
PHill	2003	FS	2	Seed	Early	Jack	13	3	0
PHill	2003	FS	2	Seed	Early	Jack	13	4	9.626816016
PHill	2003	FS	2	Seed	Early	Jack	13	5	41.14595218
PHill	2003	FS	2	Seed	Early	Jack	13	6	0
PHill	2003	FS	2	Seed	Early	Jack	13	7	0
PHill	2003	FS	2	LeafPost	Late	Jack	15	1	0
PHill	2003	FS	2	LeafPost	Late	Jack	15	2	1.30742006
PHill	2003	FS	2	LeafPost	Late	Jack	15	3	0
PHill	2003	FS	2	LeafPost	Late	Jack	15	4	3.949697094
PHill	2003	FS	2	LeafPost	Late	Jack	15	5	5.114138576
PHill	2003	FS	2	LeafPost	Late	Jack	15	6	0
PHill	2003	FS	2	LeafPost	Late	Jack	15	7	0
PHill	2003	FS	2	Seed	Late	Jack	15	1	2.30276789
PHill	2003	FS	2	Seed	Late	Jack	15	2	5.658992
PHill	2003	FS	2	Seed	Late	Jack	15	3	0
PHill	2003	FS	2	Seed	Late	Jack	15	4	8.045582881
PHill	2003	FS	2	Seed	Late	Jack	15	5	33.97162548
PHill	2003	FS	2	Seed	Late	Jack	15	6	0
PHill	2003	FS	2	Seed	Late	Jack	15	7	0
PHill	2003	FS	2	Seed	Early	Bass	16	1	2.42222255
PHill	2003	FS	2	Seed	Early	Bass	16	2	5.44141844
PHill	2003	FS	2	Seed	Early	Bass	16	3	0
PHill	2003	FS	2	Seed	Early	Bass	16	4	8.564647324
PHill	2003	FS	2	Seed	Early	Bass	16	5	34.18225871
PHill	2003	FS	2	Seed	Early	Bass	16	6	0
PHill	2003	FS	2	Seed	Early	Bass	16	7	0

PHill	2003	FS	2	LeafPost	Late	Bass	17	1	0
PHill	2003	FS	2	LeafPost	Late	Bass	17	2	1.87418054
PHill	2003	FS	2	LeafPost	Late	Bass	17	3	0
PHill	2003	FS	2	LeafPost	Late	Bass	17	4	5.342875731
PHill	2003	FS	2	LeafPost	Late	Bass	17	5	5.510934653
PHill	2003	FS	2	LeafPost	Late	Bass	17	6	0
PHill	2003	FS	2	LeafPost	Late	Bass	17	7	0
PHill	2003	FS	2	Seed	Late	Bass	17	1	2.8425461
PHill	2003	FS	2	Seed	Late	Bass	17	2	6.7102691
PHill	2003	FS	2	Seed	Late	Bass	17	3	0
PHill	2003	FS	2	Seed	Late	Bass	17	4	11.28836917
PHill	2003	FS	2	Seed	Late	Bass	17	5	42.56564949
PHill	2003	FS	2	Seed	Late	Bass	17	6	0
PHill	2003	FS	2	Seed	Late	Bass	17	7	0
PHill	2003	FS	2	Seed	Early	Williams82	19	1	4.30869184
PHill	2003	FS	2	Seed	Early	Williams82	19	2	7.74305972
PHill	2003	FS	2	Seed	Early	Williams82	19	3	0
PHill	2003	FS	2	Seed	Early	Williams82	19	4	24.07995001
PHill	2003	FS	2	Seed	Early	Williams82	19	5	63.84511711
PHill	2003	FS	2	Seed	Early	Williams82	19	6	0
PHill	2003	FS	2	Seed	Early	Williams82	19	7	0
PHill	2003	FS	2	LeafPost	Late	Williams82	21	1	0
PHill	2003	FS	2	LeafPost	Late	Williams82	21	2	2.64186764
PHill	2003	FS	2	LeafPost	Late	Williams82	21	3	0
PHill	2003	FS	2	LeafPost	Late	Williams82	21	4	5.919880729
PHill	2003	FS	2	LeafPost	Late	Williams82	21	5	7.922374788
PHill	2003	FS	2	LeafPost	Late	Williams82	21	6	0
PHill	2003	FS	2	LeafPost	Late	Williams82	21	7	0
PHill	2003	FS	2	Seed	Late	Williams82	21	1	5.09121976
PHill	2003	FS	2	Seed	Late	Williams82	21	2	9.97721348
PHill	2003	FS	2	Seed	Late	Williams82	21	3	0
PHill	2003	FS	2	Seed	Late	Williams82	21	4	23.26315439
PHill	2003	FS	2	Seed	Late	Williams82	21	5	61.00841789
PHill	2003	FS	2	Seed	Late	Williams82	21	6	0
PHill	2003	FS	2	Seed	Late	Williams82	21	7	0.431177844
PHill	2003	FS	2	Seed	Early	Corsica	23	1	4.14246948
PHill	2003	FS	2	Seed	Early	Corsica	23	2	7.41899156
PHill	2003	FS	2	Seed	Early	Corsica	23	3	0
PHill	2003	FS	2	Seed	Early	Corsica	23	4	16.32693143
PHill	2003	FS	2	Seed	Early	Corsica	23	5	40.55688931
PHill	2003	FS	2	Seed	Early	Corsica	23	6	0
PHill	2003	FS	2	Seed	Early	Corsica	23	7	0
PHill	2003	FS	2	LeafPost	Late	Corsica	24	1	0
PHill	2003	FS	2	LeafPost	Late	Corsica	24	2	2.22173906
PHill	2003	FS	2	LeafPost	Late	Corsica	24	3	0
PHill	2003	FS	2	LeafPost	Late	Corsica	24	4	5.709237725
PHill	2003	FS	2	LeafPost	Late	Corsica	24	5	7.705794806
PHill	2003	FS	2	LeafPost	Late	Corsica	24	6	0
PHill	2003	FS	2	LeafPost	Late	Corsica	24	7	0
PHill	2003	FS	2	Seed	Late	Corsica	24	1	3.09169433
PHill	2003	FS	2	Seed	Late	Corsica	24	2	7.87813274
PHill	2003	FS	2	Seed	Late	Corsica	24	3	0
PHill	2003	FS	2	Seed	Late	Corsica	24	4	15.24495774
PHill	2003	FS	2	Seed	Late	Corsica	24	5	56.62808432
PHill	2003	FS	2	Seed	Late	Corsica	24	6	0
PHill	2003	FS	2	Seed	Late	Corsica	24	7	0
PHill	2003	FS	3	LeafPost	Late	Bass	26	1	0
PHill	2003	FS	3	LeafPost	Late	Bass	26	2	2.04616994
PHill	2003	FS	3	LeafPost	Late	Bass	26	3	0
PHill	2003	FS	3	LeafPost	Late	Bass	26	4	7.550772424
PHill	2003	FS	3	LeafPost	Late	Bass	26	5	9.735128703
PHill	2003	FS	3	LeafPost	Late	Bass	26	6	0
PHill	2003	FS	3	LeafPost	Late	Bass	26	7	0
PHill	2003	FS	3	Seed	Late	Bass	26	1	2.26061945
PHill	2003	FS	3	Seed	Late	Bass	26	2	4.45630544
PHill	2003	FS	3	Seed	Late	Bass	26	3	0
PHill	2003	FS	3	Seed	Late	Bass	26	4	9.230306598
PHill	2003	FS	3	Seed	Late	Bass	26	5	37.8833287
PHill	2003	FS	3	Seed	Late	Bass	26	6	0
PHill	2003	FS	3	Seed	Late	Bass	26	7	0
PHill	2003	FS	3	LeafPost	Early	Bass	27	1	0
PHill	2003	FS	3	LeafPost	Early	Bass	27	2	1.1777732
PHill	2003	FS	3	LeafPost	Early	Bass	27	3	0
PHill	2003	FS	3	LeafPost	Early	Bass	27	4	5.300585037
PHill	2003	FS	3	LeafPost	Early	Bass	27	5	4.732780232
PHill	2003	FS	3	LeafPost	Early	Bass	27	6	0
PHill	2003	FS	3	LeafPost	Early	Bass	27	7	0
PHill	2003	FS	3	Seed	Early	Bass	27	1	2.50348134
PHill	2003	FS	3	Seed	Early	Bass	27	2	5.42650754

PHill	2003	FS	3	Seed	Early	Bass	27	3	0
PHill	2003	FS	3	Seed	Early	Bass	27	4	11.82530669
PHill	2003	FS	3	Seed	Early	Bass	27	5	45.56294416
PHill	2003	FS	3	Seed	Early	Bass	27	6	0
PHill	2003	FS	3	Seed	Early	Bass	27	7	0
PHill	2003	FS	3	LeafPost	Late	Williams82	28	1	0
PHill	2003	FS	3	LeafPost	Late	Williams82	28	2	2.2929443
PHill	2003	FS	3	LeafPost	Late	Williams82	28	3	0
PHill	2003	FS	3	LeafPost	Late	Williams82	28	4	4.546480529
PHill	2003	FS	3	LeafPost	Late	Williams82	28	5	6.805980126
PHill	2003	FS	3	LeafPost	Late	Williams82	28	6	0
PHill	2003	FS	3	LeafPost	Late	Williams82	28	7	0.505855784
PHill	2003	FS	3	Seed	Late	Williams82	28	1	4.51041207
PHill	2003	FS	3	Seed	Late	Williams82	28	2	8.37784454
PHill	2003	FS	3	Seed	Late	Williams82	28	3	0
PHill	2003	FS	3	Seed	Late	Williams82	28	4	26.2529213
PHill	2003	FS	3	Seed	Late	Williams82	28	5	68.72689076
PHill	2003	FS	3	Seed	Late	Williams82	28	6	0
PHill	2003	FS	3	Seed	Late	Williams82	28	7	0
PHill	2003	FS	3	Seed	Early	Williams82	30	1	4.70146029
PHill	2003	FS	3	Seed	Early	Williams82	30	2	8.60429564
PHill	2003	FS	3	Seed	Early	Williams82	30	3	0
PHill	2003	FS	3	Seed	Early	Williams82	30	4	26.70918583
PHill	2003	FS	3	Seed	Early	Williams82	30	5	68.09423326
PHill	2003	FS	3	Seed	Early	Williams82	30	6	0
PHill	2003	FS	3	Seed	Early	Williams82	30	7	0
PHill	2003	FS	3	Seed	Early	Jack	32	1	2.64777109
PHill	2003	FS	3	Seed	Early	Jack	32	2	6.12086144
PHill	2003	FS	3	Seed	Early	Jack	32	3	0
PHill	2003	FS	3	Seed	Early	Jack	32	4	12.08692761
PHill	2003	FS	3	Seed	Early	Jack	32	5	47.25591582
PHill	2003	FS	3	Seed	Early	Jack	32	6	0
PHill	2003	FS	3	Seed	Early	Jack	32	7	0
PHill	2003	FS	3	LeafPost	Late	Jack	33	1	0
PHill	2003	FS	3	LeafPost	Late	Jack	33	2	1.35799016
PHill	2003	FS	3	LeafPost	Late	Jack	33	3	0
PHill	2003	FS	3	LeafPost	Late	Jack	33	4	5.183334017
PHill	2003	FS	3	LeafPost	Late	Jack	33	5	6.931757115
PHill	2003	FS	3	LeafPost	Late	Jack	33	6	0
PHill	2003	FS	3	LeafPost	Late	Jack	33	7	0
PHill	2003	FS	3	Seed	Late	Jack	33	1	2.17783984
PHill	2003	FS	3	Seed	Late	Jack	33	2	5.0308574
PHill	2003	FS	3	Seed	Late	Jack	33	3	0
PHill	2003	FS	3	Seed	Late	Jack	33	4	8.771929382
PHill	2003	FS	3	Seed	Late	Jack	33	5	36.45718659
PHill	2003	FS	3	Seed	Late	Jack	33	6	0
PHill	2003	FS	3	Seed	Late	Jack	33	7	0
PHill	2003	FS	3	Seed	Early	Corsica	34	1	3.50314217
PHill	2003	FS	3	Seed	Early	Corsica	34	2	5.50783922
PHill	2003	FS	3	Seed	Early	Corsica	34	3	0
PHill	2003	FS	3	Seed	Early	Corsica	34	4	16.91624162
PHill	2003	FS	3	Seed	Early	Corsica	34	5	43.33805406
PHill	2003	FS	3	Seed	Early	Corsica	34	6	0
PHill	2003	FS	3	Seed	Early	Corsica	34	7	0
PHill	2003	FS	3	LeafPost	Late	Corsica	35	1	0
PHill	2003	FS	3	LeafPost	Late	Corsica	35	2	1.56533378
PHill	2003	FS	3	LeafPost	Late	Corsica	35	3	0
PHill	2003	FS	3	LeafPost	Late	Corsica	35	4	4.710799361
PHill	2003	FS	3	LeafPost	Late	Corsica	35	5	4.980100001
PHill	2003	FS	3	LeafPost	Late	Corsica	35	6	0
PHill	2003	FS	3	LeafPost	Late	Corsica	35	7	0
PHill	2003	FS	3	Seed	Late	Corsica	35	1	3.71452053
PHill	2003	FS	3	Seed	Late	Corsica	35	2	6.2956136
PHill	2003	FS	3	Seed	Late	Corsica	35	3	0
PHill	2003	FS	3	Seed	Late	Corsica	35	4	17.95435508
PHill	2003	FS	3	Seed	Late	Corsica	35	5	46.74566316
PHill	2003	FS	3	Seed	Late	Corsica	35	6	0
PHill	2003	FS	3	Seed	Late	Corsica	35	7	0
Wye	2003	DC	1	LeafPost	Early	Bass	2	1	0
Wye	2003	DC	1	LeafPost	Early	Bass	2	2	7.10892212
Wye	2003	DC	1	LeafPost	Early	Bass	2	3	0
Wye	2003	DC	1	LeafPost	Early	Bass	2	4	22.54139481
Wye	2003	DC	1	LeafPost	Early	Bass	2	5	30.40169349
Wye	2003	DC	1	LeafPost	Early	Bass	2	6	0
Wye	2003	DC	1	LeafPost	Early	Bass	2	7	0
Wye	2003	DC	1	Seed	Early	Bass	2	1	4.54158533
Wye	2003	DC	1	Seed	Early	Bass	2	2	11.99264414
Wye	2003	DC	1	Seed	Early	Bass	2	3	0
Wye	2003	DC	1	Seed	Early	Bass	2	4	24.84333717

Wye	2003	DC	1	Seed	Early	Bass	2	5	81.54799946
Wye	2003	DC	1	Seed	Early	Bass	2	6	0
Wye	2003	DC	1	Seed	Early	Bass	2	7	0.693144788
Wye	2003	DC	1	Seed	Early	Bass	3	1	4.18194903
Wye	2003	DC	1	Seed	Early	Bass	3	2	12.02637134
Wye	2003	DC	1	Seed	Early	Bass	3	3	0
Wye	2003	DC	1	Seed	Early	Bass	3	4	20.4579765
Wye	2003	DC	1	Seed	Early	Bass	3	5	72.74712803
Wye	2003	DC	1	Seed	Early	Bass	3	6	0
Wye	2003	DC	1	Seed	Early	Bass	3	7	1.272805828
Wye	2003	DC	1	LeafPost	Late	Bass	3	1	0
Wye	2003	DC	1	LeafPost	Late	Bass	3	2	1.77382004
Wye	2003	DC	1	LeafPost	Late	Bass	3	3	0
Wye	2003	DC	1	LeafPost	Late	Bass	3	4	0
Wye	2003	DC	1	LeafPost	Late	Bass	3	5	11.54202356
Wye	2003	DC	1	LeafPost	Late	Bass	3	6	6.293091952
Wye	2003	DC	1	LeafPost	Late	Bass	3	7	0
Wye	2003	DC	1	Seed	Late	Corsica	4	1	5.40436029
Wye	2003	DC	1	Seed	Late	Corsica	4	2	11.89666928
Wye	2003	DC	1	Seed	Late	Corsica	4	3	0
Wye	2003	DC	1	Seed	Late	Corsica	4	4	28.31792166
Wye	2003	DC	1	Seed	Late	Corsica	4	5	68.8641294
Wye	2003	DC	1	Seed	Late	Corsica	4	6	0
Wye	2003	DC	1	Seed	Late	Corsica	4	7	0.78013792
Wye	2003	DC	1	LeafPost	Early	Corsica	6	1	0
Wye	2003	DC	1	LeafPost	Early	Corsica	6	1	0
Wye	2003	DC	1	LeafPost	Early	Corsica	6	2	5.09572568
Wye	2003	DC	1	LeafPost	Early	Corsica	6	2	2.10322328
Wye	2003	DC	1	LeafPost	Early	Corsica	6	3	0
Wye	2003	DC	1	LeafPost	Early	Corsica	6	3	0
Wye	2003	DC	1	LeafPost	Early	Corsica	6	4	13.52264882
Wye	2003	DC	1	LeafPost	Early	Corsica	6	4	0
Wye	2003	DC	1	LeafPost	Early	Corsica	6	5	23.33019733
Wye	2003	DC	1	LeafPost	Early	Corsica	6	5	7.210678734
Wye	2003	DC	1	LeafPost	Early	Corsica	6	6	0
Wye	2003	DC	1	LeafPost	Early	Corsica	6	6	0
Wye	2003	DC	1	LeafPost	Early	Corsica	6	7	0
Wye	2003	DC	1	LeafPost	Early	Corsica	6	7	0
Wye	2003	DC	1	Seed	Early	Corsica	6	1	5.84426422
Wye	2003	DC	1	Seed	Early	Corsica	6	2	13.35493046
Wye	2003	DC	1	Seed	Early	Corsica	6	3	0
Wye	2003	DC	1	Seed	Early	Corsica	6	4	30.33197237
Wye	2003	DC	1	Seed	Early	Corsica	6	5	74.58749613
Wye	2003	DC	1	Seed	Early	Corsica	6	6	0
Wye	2003	DC	1	Seed	Early	Corsica	6	7	0.883838108
Wye	2003	DC	1	LeafPost	Early	Jack	7	1	0
Wye	2003	DC	1	LeafPost	Early	Jack	7	2	4.51492508
Wye	2003	DC	1	LeafPost	Early	Jack	7	3	0
Wye	2003	DC	1	LeafPost	Early	Jack	7	4	0
Wye	2003	DC	1	LeafPost	Early	Jack	7	5	28.69320302
Wye	2003	DC	1	LeafPost	Early	Jack	7	6	8.924942388
Wye	2003	DC	1	LeafPost	Early	Jack	7	7	1.02360244
Wye	2003	DC	1	LeafPost	Late	Jack	7	1	0
Wye	2003	DC	1	LeafPost	Late	Jack	7	2	1.30245344
Wye	2003	DC	1	LeafPost	Late	Jack	7	3	0
Wye	2003	DC	1	LeafPost	Late	Jack	7	4	0
Wye	2003	DC	1	LeafPost	Late	Jack	7	5	8.80295435
Wye	2003	DC	1	LeafPost	Late	Jack	7	6	4.500089738
Wye	2003	DC	1	LeafPost	Late	Jack	7	7	0
Wye	2003	DC	1	Seed	Late	Jack	7	1	4.02477065
Wye	2003	DC	1	Seed	Late	Jack	7	2	12.43099562
Wye	2003	DC	1	Seed	Late	Jack	7	3	0
Wye	2003	DC	1	Seed	Late	Jack	7	4	21.29826533
Wye	2003	DC	1	Seed	Late	Jack	7	5	82.81538442
Wye	2003	DC	1	Seed	Late	Jack	7	6	0
Wye	2003	DC	1	Seed	Late	Jack	7	7	1.187925456
Wye	2003	DC	1	LeafPost	Early	Jack	9	1	0
Wye	2003	DC	1	LeafPost	Early	Jack	9	2	1.19346932
Wye	2003	DC	1	LeafPost	Early	Jack	9	3	0
Wye	2003	DC	1	LeafPost	Early	Jack	9	4	0
Wye	2003	DC	1	LeafPost	Early	Jack	9	5	0
Wye	2003	DC	1	LeafPost	Early	Jack	9	6	1.617323666
Wye	2003	DC	1	LeafPost	Early	Jack	9	7	0
Wye	2003	DC	1	Seed	Early	Jack	9	1	4.48544421
Wye	2003	DC	1	Seed	Early	Jack	9	2	15.30586268
Wye	2003	DC	1	Seed	Early	Jack	9	3	0
Wye	2003	DC	1	Seed	Early	Jack	9	4	20.51244902
Wye	2003	DC	1	Seed	Early	Jack	9	5	88.86597319
Wye	2003	DC	1	Seed	Early	Jack	9	6	0

Wye	2003	DC	1	Seed	Early	Jack	9	7	1.42351158
Wye	2003	DC	1	LeafPost	Early	Williams82	10	1	0
Wye	2003	DC	1	LeafPost	Early	Williams82	10	2	5.66535794
Wye	2003	DC	1	LeafPost	Early	Williams82	10	3	0
Wye	2003	DC	1	LeafPost	Early	Williams82	10	4	0
Wye	2003	DC	1	LeafPost	Early	Williams82	10	5	23.499104
Wye	2003	DC	1	LeafPost	Early	Williams82	10	6	8.13716479
Wye	2003	DC	1	LeafPost	Early	Williams82	10	7	0.991806836
Wye	2003	DC	1	LeafPost	Late	Williams82	11	1	0
Wye	2003	DC	1	LeafPost	Late	Williams82	11	2	2.18096972
Wye	2003	DC	1	LeafPost	Late	Williams82	11	3	0
Wye	2003	DC	1	LeafPost	Late	Williams82	11	4	0
Wye	2003	DC	1	LeafPost	Late	Williams82	11	5	13.32326332
Wye	2003	DC	1	LeafPost	Late	Williams82	11	6	5.710260408
Wye	2003	DC	1	LeafPost	Late	Williams82	11	7	0
Wye	2003	DC	1	Seed	Late	Williams82	11	1	7.04115808
Wye	2003	DC	1	Seed	Late	Williams82	11	2	17.21117624
Wye	2003	DC	1	Seed	Late	Williams82	11	3	0
Wye	2003	DC	1	Seed	Late	Williams82	11	4	33.55186859
Wye	2003	DC	1	Seed	Late	Williams82	11	5	85.83615504
Wye	2003	DC	1	Seed	Late	Williams82	11	6	0
Wye	2003	DC	1	Seed	Late	Williams82	11	7	1.172450684
Wye	2003	DC	1	LeafPost	Early	Williams82	12	1	0
Wye	2003	DC	1	LeafPost	Early	Williams82	12	2	4.17217034
Wye	2003	DC	1	LeafPost	Early	Williams82	12	3	0
Wye	2003	DC	1	LeafPost	Early	Williams82	12	4	10.85830084
Wye	2003	DC	1	LeafPost	Early	Williams82	12	5	18.30484779
Wye	2003	DC	1	LeafPost	Early	Williams82	12	6	0
Wye	2003	DC	1	LeafPost	Early	Williams82	12	7	0.876883208
Wye	2003	DC	1	Seed	Early	Williams82	12	1	8.25738595
Wye	2003	DC	1	Seed	Early	Williams82	12	2	21.54889298
Wye	2003	DC	1	Seed	Early	Williams82	12	3	0
Wye	2003	DC	1	Seed	Early	Williams82	12	4	40.58828425
Wye	2003	DC	1	Seed	Early	Williams82	12	5	105.1548535
Wye	2003	DC	1	Seed	Early	Williams82	12	6	0
Wye	2003	DC	1	Seed	Early	Williams82	12	7	1.38778108
Wye	2003	DC	2	LeafPost	Early	Corsica	13	1	0
Wye	2003	DC	2	LeafPost	Early	Corsica	13	2	4.27134956
Wye	2003	DC	2	LeafPost	Early	Corsica	13	3	0
Wye	2003	DC	2	LeafPost	Early	Corsica	13	4	12.25054907
Wye	2003	DC	2	LeafPost	Early	Corsica	13	5	19.84613587
Wye	2003	DC	2	LeafPost	Early	Corsica	13	6	0
Wye	2003	DC	2	LeafPost	Early	Corsica	13	7	0
Wye	2003	DC	2	Seed	Early	Corsica	13	1	5.76820618
Wye	2003	DC	2	Seed	Early	Corsica	13	2	13.66622948
Wye	2003	DC	2	Seed	Early	Corsica	13	3	0
Wye	2003	DC	2	Seed	Early	Corsica	13	4	31.54411912
Wye	2003	DC	2	Seed	Early	Corsica	13	5	67.78780004
Wye	2003	DC	2	Seed	Early	Corsica	13	6	0
Wye	2003	DC	2	Seed	Early	Corsica	13	7	1.180028896
Wye	2003	DC	2	LeafPost	Early	Corsica	14	1	0
Wye	2003	DC	2	LeafPost	Early	Corsica	14	2	4.81579406
Wye	2003	DC	2	LeafPost	Early	Corsica	14	3	0
Wye	2003	DC	2	LeafPost	Early	Corsica	14	4	0
Wye	2003	DC	2	LeafPost	Early	Corsica	14	5	28.60963077
Wye	2003	DC	2	LeafPost	Early	Corsica	14	6	9.603716913
Wye	2003	DC	2	LeafPost	Early	Corsica	14	7	0.367092384
Wye	2003	DC	2	LeafPost	Late	Corsica	14	1	0
Wye	2003	DC	2	LeafPost	Late	Corsica	14	2	1.96490864
Wye	2003	DC	2	LeafPost	Late	Corsica	14	3	0
Wye	2003	DC	2	LeafPost	Late	Corsica	14	4	0
Wye	2003	DC	2	LeafPost	Late	Corsica	14	5	7.681041485
Wye	2003	DC	2	LeafPost	Late	Corsica	14	6	2.16337824
Wye	2003	DC	2	LeafPost	Late	Corsica	14	7	0
Wye	2003	DC	2	Seed	Late	Corsica	14	1	6.17520374
Wye	2003	DC	2	Seed	Late	Corsica	14	2	15.71979368
Wye	2003	DC	2	Seed	Late	Corsica	14	3	0
Wye	2003	DC	2	Seed	Late	Corsica	14	4	31.32083937
Wye	2003	DC	2	Seed	Late	Corsica	14	5	79.64721076
Wye	2003	DC	2	Seed	Late	Corsica	14	6	0
Wye	2003	DC	2	Seed	Late	Corsica	14	7	1.005765392
Wye	2003	DC	2	LeafPost	Early	Jack	16	1	3.21071944
Wye	2003	DC	2	LeafPost	Early	Jack	16	1	2.17548974
Wye	2003	DC	2	LeafPost	Early	Jack	16	2	5.2462685
Wye	2003	DC	2	LeafPost	Early	Jack	16	2	3.83322854
Wye	2003	DC	2	LeafPost	Early	Jack	16	3	0
Wye	2003	DC	2	LeafPost	Early	Jack	16	3	0
Wye	2003	DC	2	LeafPost	Early	Jack	16	4	15.18971331
Wye	2003	DC	2	LeafPost	Early	Jack	16	4	0

Wye	2003	DC	2	LeafPost	Early	Jack	16	5	27.34014608
Wye	2003	DC	2	LeafPost	Early	Jack	16	5	26.3160469
Wye	2003	DC	2	LeafPost	Early	Jack	16	6	0
Wye	2003	DC	2	LeafPost	Early	Jack	16	6	6.736983521
Wye	2003	DC	2	LeafPost	Early	Jack	16	7	0.80426736
Wye	2003	DC	2	LeafPost	Early	Jack	16	7	0.812016696
Wye	2003	DC	2	Seed	Early	Jack	16	1	4.12105446
Wye	2003	DC	2	Seed	Early	Jack	16	2	13.78505576
Wye	2003	DC	2	Seed	Early	Jack	16	3	0
Wye	2003	DC	2	Seed	Early	Jack	16	4	19.6337933
Wye	2003	DC	2	Seed	Early	Jack	16	5	79.06887819
Wye	2003	DC	2	Seed	Early	Jack	16	6	0
Wye	2003	DC	2	Seed	Early	Jack	16	7	1.462524984
Wye	2003	DC	2	LeafPost	Late	Jack	17	1	0
Wye	2003	DC	2	LeafPost	Late	Jack	17	2	2.52936176
Wye	2003	DC	2	LeafPost	Late	Jack	17	3	0
Wye	2003	DC	2	LeafPost	Late	Jack	17	4	0
Wye	2003	DC	2	LeafPost	Late	Jack	17	5	16.98161398
Wye	2003	DC	2	LeafPost	Late	Jack	17	6	6.829628301
Wye	2003	DC	2	LeafPost	Late	Jack	17	7	0
Wye	2003	DC	2	Seed	Late	Jack	17	1	3.395345
Wye	2003	DC	2	Seed	Late	Jack	17	2	9.9219707
Wye	2003	DC	2	Seed	Late	Jack	17	3	0
Wye	2003	DC	2	Seed	Late	Jack	17	4	14.01042811
Wye	2003	DC	2	Seed	Late	Jack	17	5	52.42668285
Wye	2003	DC	2	Seed	Late	Jack	17	6	0
Wye	2003	DC	2	Seed	Late	Jack	17	7	1.04891254
Wye	2003	DC	2	LeafPost	Late	Bass	19	1	0
Wye	2003	DC	2	LeafPost	Late	Bass	19	2	2.25791024
Wye	2003	DC	2	LeafPost	Late	Bass	19	3	0
Wye	2003	DC	2	LeafPost	Late	Bass	19	4	0
Wye	2003	DC	2	LeafPost	Late	Bass	19	5	14.14911256
Wye	2003	DC	2	LeafPost	Late	Bass	19	6	9.188614257
Wye	2003	DC	2	LeafPost	Late	Bass	19	7	0
Wye	2003	DC	2	Seed	Late	Bass	19	1	4.32202777
Wye	2003	DC	2	Seed	Late	Bass	19	2	12.6199052
Wye	2003	DC	2	Seed	Late	Bass	19	3	0
Wye	2003	DC	2	Seed	Late	Bass	19	4	19.95657866
Wye	2003	DC	2	Seed	Late	Bass	19	5	72.07386085
Wye	2003	DC	2	Seed	Late	Bass	19	6	0
Wye	2003	DC	2	Seed	Late	Bass	19	7	1.004275944
Wye	2003	DC	2	LeafPost	Early	Bass	20	1	0
Wye	2003	DC	2	LeafPost	Early	Bass	20	2	4.03060994
Wye	2003	DC	2	LeafPost	Early	Bass	20	3	0
Wye	2003	DC	2	LeafPost	Early	Bass	20	4	16.49706573
Wye	2003	DC	2	LeafPost	Early	Bass	20	5	21.12592396
Wye	2003	DC	2	LeafPost	Early	Bass	20	6	0
Wye	2003	DC	2	LeafPost	Early	Bass	20	7	1.366642008
Wye	2003	DC	2	Seed	Early	Bass	20	1	4.28393414
Wye	2003	DC	2	Seed	Early	Bass	20	2	11.99358392
Wye	2003	DC	2	Seed	Early	Bass	20	3	0
Wye	2003	DC	2	Seed	Early	Bass	20	4	20.50303186
Wye	2003	DC	2	Seed	Early	Bass	20	5	70.16166344
Wye	2003	DC	2	Seed	Early	Bass	20	6	0
Wye	2003	DC	2	Seed	Early	Bass	20	7	1.032338368
Wye	2003	DC	2	LeafPost	Early	Bass	21	1	0
Wye	2003	DC	2	LeafPost	Early	Bass	21	2	3.40362488
Wye	2003	DC	2	LeafPost	Early	Bass	21	3	0
Wye	2003	DC	2	LeafPost	Early	Bass	21	4	0
Wye	2003	DC	2	LeafPost	Early	Bass	21	5	4.278818212
Wye	2003	DC	2	LeafPost	Early	Bass	21	6	0
Wye	2003	DC	2	LeafPost	Early	Bass	21	7	0
Wye	2003	DC	2	LeafPost	Early	Williams82	22	1	0
Wye	2003	DC	2	LeafPost	Early	Williams82	22	2	6.73117334
Wye	2003	DC	2	LeafPost	Early	Williams82	22	3	0
Wye	2003	DC	2	LeafPost	Early	Williams82	22	4	19.2483888
Wye	2003	DC	2	LeafPost	Early	Williams82	22	5	33.0852696
Wye	2003	DC	2	LeafPost	Early	Williams82	22	6	0
Wye	2003	DC	2	LeafPost	Early	Williams82	22	7	1.309587928
Wye	2003	DC	2	Seed	Early	Williams82	22	1	8.82187784
Wye	2003	DC	2	Seed	Early	Williams82	22	2	21.99401198
Wye	2003	DC	2	Seed	Early	Williams82	22	3	0
Wye	2003	DC	2	Seed	Early	Williams82	22	4	37.76224416
Wye	2003	DC	2	Seed	Early	Williams82	22	5	98.11789283
Wye	2003	DC	2	Seed	Early	Williams82	22	6	0
Wye	2003	DC	2	Seed	Early	Williams82	22	7	1.797963396
Wye	2003	DC	2	LeafPost	Early	Williams82	23	1	0
Wye	2003	DC	2	LeafPost	Early	Williams82	23	2	3.2134319
Wye	2003	DC	2	LeafPost	Early	Williams82	23	3	0

Wye	2003	DC	2	LeafPost	Early	Williams82	23	4	0
Wye	2003	DC	2	LeafPost	Early	Williams82	23	5	8.670375162
Wye	2003	DC	2	LeafPost	Early	Williams82	23	6	0
Wye	2003	DC	2	LeafPost	Early	Williams82	23	7	0
Wye	2003	DC	2	LeafPost	Late	Williams82	23	1	0
Wye	2003	DC	2	LeafPost	Late	Williams82	23	2	2.0524586
Wye	2003	DC	2	LeafPost	Late	Williams82	23	3	0
Wye	2003	DC	2	LeafPost	Late	Williams82	23	4	0
Wye	2003	DC	2	LeafPost	Late	Williams82	23	5	10.81199747
Wye	2003	DC	2	LeafPost	Late	Williams82	23	6	5.192510315
Wye	2003	DC	2	LeafPost	Late	Williams82	23	7	0
Wye	2003	DC	2	Seed	Late	Williams82	23	1	8.93949715
Wye	2003	DC	2	Seed	Late	Williams82	23	2	21.78939248
Wye	2003	DC	2	Seed	Late	Williams82	23	3	0
Wye	2003	DC	2	Seed	Late	Williams82	23	4	38.97333884
Wye	2003	DC	2	Seed	Late	Williams82	23	5	102.4662307
Wye	2003	DC	2	Seed	Late	Williams82	23	6	0
Wye	2003	DC	2	Seed	Late	Williams82	23	7	1.69886348
Wye	2003	DC	3	LeafPost	Early	Williams82	25	1	0
Wye	2003	DC	3	LeafPost	Early	Williams82	25	1	0
Wye	2003	DC	3	LeafPost	Early	Williams82	25	2	7.34450744
Wye	2003	DC	3	LeafPost	Early	Williams82	25	2	3.39028718
Wye	2003	DC	3	LeafPost	Early	Williams82	25	3	0
Wye	2003	DC	3	LeafPost	Early	Williams82	25	3	0
Wye	2003	DC	3	LeafPost	Early	Williams82	25	4	18.87504447
Wye	2003	DC	3	LeafPost	Early	Williams82	25	4	0
Wye	2003	DC	3	LeafPost	Early	Williams82	25	5	38.37353217
Wye	2003	DC	3	LeafPost	Early	Williams82	25	5	17.36850045
Wye	2003	DC	3	LeafPost	Early	Williams82	25	6	4.098043548
Wye	2003	DC	3	LeafPost	Early	Williams82	25	6	5.30494285
Wye	2003	DC	3	LeafPost	Early	Williams82	25	7	1.445817928
Wye	2003	DC	3	LeafPost	Early	Williams82	25	7	0
Wye	2003	DC	3	Seed	Early	Williams82	25	1	11.90595312
Wye	2003	DC	3	Seed	Early	Williams82	25	2	31.23866372
Wye	2003	DC	3	Seed	Early	Williams82	25	3	0
Wye	2003	DC	3	Seed	Early	Williams82	25	4	54.39238635
Wye	2003	DC	3	Seed	Early	Williams82	25	5	149.5823882
Wye	2003	DC	3	Seed	Early	Williams82	25	6	0
Wye	2003	DC	3	Seed	Early	Williams82	25	7	1.948362272
Wye	2003	DC	3	LeafPost	Late	Williams82	27	1	0
Wye	2003	DC	3	LeafPost	Late	Williams82	27	2	2.58485846
Wye	2003	DC	3	LeafPost	Late	Williams82	27	3	0
Wye	2003	DC	3	LeafPost	Late	Williams82	27	4	0
Wye	2003	DC	3	LeafPost	Late	Williams82	27	5	17.43741264
Wye	2003	DC	3	LeafPost	Late	Williams82	27	6	7.358380374
Wye	2003	DC	3	LeafPost	Late	Williams82	27	7	0
Wye	2003	DC	3	Seed	Late	Williams82	27	1	7.68650903
Wye	2003	DC	3	Seed	Late	Williams82	27	2	19.0819277
Wye	2003	DC	3	Seed	Late	Williams82	27	3	0
Wye	2003	DC	3	Seed	Late	Williams82	27	4	38.40851909
Wye	2003	DC	3	Seed	Late	Williams82	27	5	99.70857007
Wye	2003	DC	3	Seed	Late	Williams82	27	6	0
Wye	2003	DC	3	Seed	Late	Williams82	27	7	1.10654022
Wye	2003	DC	3	LeafPost	Early	Corsica	28	1	0
Wye	2003	DC	3	LeafPost	Early	Corsica	28	1	0
Wye	2003	DC	3	LeafPost	Early	Corsica	28	2	7.30826726
Wye	2003	DC	3	LeafPost	Early	Corsica	28	2	5.70446852
Wye	2003	DC	3	LeafPost	Early	Corsica	28	3	0
Wye	2003	DC	3	LeafPost	Early	Corsica	28	3	0
Wye	2003	DC	3	LeafPost	Early	Corsica	28	4	22.21326519
Wye	2003	DC	3	LeafPost	Early	Corsica	28	4	0
Wye	2003	DC	3	LeafPost	Early	Corsica	28	5	34.14527103
Wye	2003	DC	3	LeafPost	Early	Corsica	28	5	29.91759563
Wye	2003	DC	3	LeafPost	Early	Corsica	28	6	0
Wye	2003	DC	3	LeafPost	Early	Corsica	28	6	12.67432742
Wye	2003	DC	3	LeafPost	Early	Corsica	28	7	0
Wye	2003	DC	3	LeafPost	Early	Corsica	28	7	1.396285656
Wye	2003	DC	3	Seed	Early	Corsica	28	1	5.79689515
Wye	2003	DC	3	Seed	Early	Corsica	28	2	13.5709598
Wye	2003	DC	3	Seed	Early	Corsica	28	3	0
Wye	2003	DC	3	Seed	Early	Corsica	28	4	28.18339129
Wye	2003	DC	3	Seed	Early	Corsica	28	5	70.86330263
Wye	2003	DC	3	Seed	Early	Corsica	28	6	0
Wye	2003	DC	3	Seed	Early	Corsica	28	7	0.754661476
Wye	2003	DC	3	LeafPost	Late	Corsica	29	1	0
Wye	2003	DC	3	LeafPost	Late	Corsica	29	2	2.15669966
Wye	2003	DC	3	LeafPost	Late	Corsica	29	3	0
Wye	2003	DC	3	LeafPost	Late	Corsica	29	4	0
Wye	2003	DC	3	LeafPost	Late	Corsica	29	5	12.07512837

Wye	2003	DC	3	LeafPost	Late	Corsica	29	6	4.408474739
Wye	2003	DC	3	LeafPost	Late	Corsica	29	7	0
Wye	2003	DC	3	Seed	Late	Corsica	29	1	5.64882394
Wye	2003	DC	3	Seed	Late	Corsica	29	2	13.24699514
Wye	2003	DC	3	Seed	Late	Corsica	29	3	0
Wye	2003	DC	3	Seed	Late	Corsica	29	4	27.10021989
Wye	2003	DC	3	Seed	Late	Corsica	29	5	67.31591503
Wye	2003	DC	3	Seed	Late	Corsica	29	6	0
Wye	2003	DC	3	Seed	Late	Corsica	29	7	0.67427048
Wye	2003	DC	3	LeafPost	Early	Jack	32	1	2.34104967
Wye	2003	DC	3	LeafPost	Early	Jack	32	2	4.55099414
Wye	2003	DC	3	LeafPost	Early	Jack	32	3	0
Wye	2003	DC	3	LeafPost	Early	Jack	32	4	0
Wye	2003	DC	3	LeafPost	Early	Jack	32	5	30.19257756
Wye	2003	DC	3	LeafPost	Early	Jack	32	6	7.992291245
Wye	2003	DC	3	LeafPost	Early	Jack	32	7	0.568190808
Wye	2003	DC	3	LeafPost	Late	Jack	32	1	0
Wye	2003	DC	3	LeafPost	Late	Jack	32	2	1.48416218
Wye	2003	DC	3	LeafPost	Late	Jack	32	3	0
Wye	2003	DC	3	LeafPost	Late	Jack	32	4	0
Wye	2003	DC	3	LeafPost	Late	Jack	32	5	9.233372586
Wye	2003	DC	3	LeafPost	Late	Jack	32	6	3.811147936
Wye	2003	DC	3	LeafPost	Late	Jack	32	7	0
Wye	2003	DC	3	Seed	Late	Jack	32	1	4.21780829
Wye	2003	DC	3	Seed	Late	Jack	32	2	13.54917236
Wye	2003	DC	3	Seed	Late	Jack	32	3	0
Wye	2003	DC	3	Seed	Late	Jack	32	4	20.45283698
Wye	2003	DC	3	Seed	Late	Jack	32	5	81.51357315
Wye	2003	DC	3	Seed	Late	Jack	32	6	0
Wye	2003	DC	3	Seed	Late	Jack	32	7	0.951523864
Wye	2003	DC	3	LeafPost	Early	Jack	33	1	2.6569663
Wye	2003	DC	3	LeafPost	Early	Jack	33	2	3.7166006
Wye	2003	DC	3	LeafPost	Early	Jack	33	3	0.260762656
Wye	2003	DC	3	LeafPost	Early	Jack	33	4	0
Wye	2003	DC	3	LeafPost	Early	Jack	33	5	23.20432602
Wye	2003	DC	3	LeafPost	Early	Jack	33	6	10.29837835
Wye	2003	DC	3	LeafPost	Early	Jack	33	7	0.876876516
Wye	2003	DC	3	Seed	Early	Jack	33	1	4.54269293
Wye	2003	DC	3	Seed	Early	Jack	33	2	16.62733826
Wye	2003	DC	3	Seed	Early	Jack	33	3	0
Wye	2003	DC	3	Seed	Early	Jack	33	4	22.74712619
Wye	2003	DC	3	Seed	Early	Jack	33	5	99.53461842
Wye	2003	DC	3	Seed	Early	Jack	33	6	0
Wye	2003	DC	3	Seed	Early	Jack	33	7	1.222903584
Wye	2003	DC	3	LeafPost	Late	Bass	34	1	0
Wye	2003	DC	3	LeafPost	Late	Bass	34	2	2.04583736
Wye	2003	DC	3	LeafPost	Late	Bass	34	3	0
Wye	2003	DC	3	LeafPost	Late	Bass	34	4	0
Wye	2003	DC	3	LeafPost	Late	Bass	34	5	13.39955518
Wye	2003	DC	3	LeafPost	Late	Bass	34	6	9.480488355
Wye	2003	DC	3	LeafPost	Late	Bass	34	7	0
Wye	2003	DC	3	Seed	Late	Bass	34	1	3.87868176
Wye	2003	DC	3	Seed	Late	Bass	34	2	11.28779534
Wye	2003	DC	3	Seed	Late	Bass	34	3	0
Wye	2003	DC	3	Seed	Late	Bass	34	4	18.16383122
Wye	2003	DC	3	Seed	Late	Bass	34	5	66.16933157
Wye	2003	DC	3	Seed	Late	Bass	34	6	0
Wye	2003	DC	3	Seed	Late	Bass	34	7	0.777479284
Wye	2003	DC	3	Seed	Early	Bass	35	1	4.59177026
Wye	2003	DC	3	Seed	Early	Bass	35	2	13.80880418
Wye	2003	DC	3	Seed	Early	Bass	35	3	0
Wye	2003	DC	3	Seed	Early	Bass	35	4	20.68893168
Wye	2003	DC	3	Seed	Early	Bass	35	5	72.75868234
Wye	2003	DC	3	Seed	Early	Bass	35	6	0
Wye	2003	DC	3	Seed	Early	Bass	35	7	0.884631588
Wye	2003	DC	3	LeafPost	Late	Bass	35	1	0
Wye	2003	DC	3	LeafPost	Late	Bass	35	2	4.14588272
Wye	2003	DC	3	LeafPost	Late	Bass	35	3	0
Wye	2003	DC	3	LeafPost	Late	Bass	35	4	21.03900641
Wye	2003	DC	3	LeafPost	Late	Bass	35	5	21.87427015
Wye	2003	DC	3	LeafPost	Late	Bass	35	6	0
Wye	2003	DC	3	LeafPost	Late	Bass	35	7	1.125181264
Wye	2003	FS	1	LeafPost	Late	Williams82	1	1	0
Wye	2003	FS	1	LeafPost	Late	Williams82	1	2	2.21507642
Wye	2003	FS	1	LeafPost	Late	Williams82	1	3	0
Wye	2003	FS	1	LeafPost	Late	Williams82	1	4	7.66571456
Wye	2003	FS	1	LeafPost	Late	Williams82	1	5	9.854255718
Wye	2003	FS	1	LeafPost	Late	Williams82	1	6	0
Wye	2003	FS	1	LeafPost	Late	Williams82	1	7	0.266820412

Wye	2003	FS	1	Seed	Late	Williams82	1	1	4.95983497
Wye	2003	FS	1	Seed	Late	Williams82	1	2	6.86185658
Wye	2003	FS	1	Seed	Late	Williams82	1	3	0
Wye	2003	FS	1	Seed	Late	Williams82	1	4	28.72626936
Wye	2003	FS	1	Seed	Late	Williams82	1	5	87.20686691
Wye	2003	FS	1	Seed	Late	Williams82	1	6	0
Wye	2003	FS	1	Seed	Late	Williams82	1	7	0
Wye	2003	FS	1	LeafPost	Late	Williams82	2	1	0
Wye	2003	FS	1	LeafPost	Late	Williams82	2	2	1.75066364
Wye	2003	FS	1	LeafPost	Late	Williams82	2	3	0
Wye	2003	FS	1	LeafPost	Late	Williams82	2	4	0
Wye	2003	FS	1	LeafPost	Late	Williams82	2	5	2.667444813
Wye	2003	FS	1	LeafPost	Late	Williams82	2	6	0
Wye	2003	FS	1	LeafPost	Late	Williams82	2	7	0.121919492
Wye	2003	FS	1	Seed	Early	Williams82	3	1	5.15685216
Wye	2003	FS	1	Seed	Early	Williams82	3	2	13.7711771
Wye	2003	FS	1	Seed	Early	Williams82	3	3	0
Wye	2003	FS	1	Seed	Early	Williams82	3	4	28.0848358
Wye	2003	FS	1	Seed	Early	Williams82	3	5	87.38263535
Wye	2003	FS	1	Seed	Early	Williams82	3	6	0
Wye	2003	FS	1	Seed	Early	Williams82	3	7	0
Wye	2003	FS	1	LeafPost	Late	Bass	4	1	0
Wye	2003	FS	1	LeafPost	Late	Bass	4	2	1.8693326
Wye	2003	FS	1	LeafPost	Late	Bass	4	3	0
Wye	2003	FS	1	LeafPost	Late	Bass	4	4	9.608991777
Wye	2003	FS	1	LeafPost	Late	Bass	4	5	8.875624212
Wye	2003	FS	1	LeafPost	Late	Bass	4	6	0
Wye	2003	FS	1	LeafPost	Late	Bass	4	7	0.251166868
Wye	2003	FS	1	Seed	Late	Bass	4	1	3.23183058
Wye	2003	FS	1	Seed	Late	Bass	4	2	8.96560034
Wye	2003	FS	1	Seed	Late	Bass	4	3	0
Wye	2003	FS	1	Seed	Late	Bass	4	4	16.16605065
Wye	2003	FS	1	Seed	Late	Bass	4	5	61.59384884
Wye	2003	FS	1	Seed	Late	Bass	4	6	0
Wye	2003	FS	1	Seed	Late	Bass	4	7	0
Wye	2003	FS	1	Seed	Early	Bass	5	1	2.78787965
Wye	2003	FS	1	Seed	Early	Bass	5	2	6.91040498
Wye	2003	FS	1	Seed	Early	Bass	5	3	0
Wye	2003	FS	1	Seed	Early	Bass	5	4	14.55589007
Wye	2003	FS	1	Seed	Early	Bass	5	5	54.61597185
Wye	2003	FS	1	Seed	Early	Bass	5	6	0
Wye	2003	FS	1	Seed	Early	Bass	5	7	0
Wye	2003	FS	1	LeafPost	Late	Bass	6	1	0
Wye	2003	FS	1	LeafPost	Late	Bass	6	2	0
Wye	2003	FS	1	LeafPost	Late	Bass	6	3	0
Wye	2003	FS	1	LeafPost	Late	Bass	6	4	0
Wye	2003	FS	1	LeafPost	Late	Bass	6	5	1.800881654
Wye	2003	FS	1	LeafPost	Late	Bass	6	6	0
Wye	2003	FS	1	LeafPost	Late	Bass	6	7	0
Wye	2003	FS	1	Seed	Early	Jack	7	1	3.33250716
Wye	2003	FS	1	Seed	Early	Jack	7	2	11.20707776
Wye	2003	FS	1	Seed	Early	Jack	7	3	0
Wye	2003	FS	1	Seed	Early	Jack	7	4	16.15656323
Wye	2003	FS	1	Seed	Early	Jack	7	5	74.59046785
Wye	2003	FS	1	Seed	Early	Jack	7	6	0
Wye	2003	FS	1	Seed	Early	Jack	7	7	0
Wye	2003	FS	1	LeafPost	Late	Jack	8	1	0
Wye	2003	FS	1	LeafPost	Late	Jack	8	2	1.17149834
Wye	2003	FS	1	LeafPost	Late	Jack	8	3	0
Wye	2003	FS	1	LeafPost	Late	Jack	8	4	0
Wye	2003	FS	1	LeafPost	Late	Jack	8	5	2.212241818
Wye	2003	FS	1	LeafPost	Late	Jack	8	6	0
Wye	2003	FS	1	LeafPost	Late	Jack	8	7	0
Wye	2003	FS	1	Seed	Late	Jack	8	1	3.0869281
Wye	2003	FS	1	Seed	Late	Jack	8	2	9.59939156
Wye	2003	FS	1	Seed	Late	Jack	8	3	0
Wye	2003	FS	1	Seed	Late	Jack	8	4	15.15203353
Wye	2003	FS	1	Seed	Late	Jack	8	5	66.77337881
Wye	2003	FS	1	Seed	Late	Jack	8	6	0
Wye	2003	FS	1	Seed	Late	Jack	8	7	0
Wye	2003	FS	1	LeafPost	Late	Jack	9	1	0
Wye	2003	FS	1	LeafPost	Late	Jack	9	2	1.37976656
Wye	2003	FS	1	LeafPost	Late	Jack	9	3	0
Wye	2003	FS	1	LeafPost	Late	Jack	9	4	0
Wye	2003	FS	1	LeafPost	Late	Jack	9	5	1.964697019
Wye	2003	FS	1	LeafPost	Late	Jack	9	6	0
Wye	2003	FS	1	LeafPost	Late	Jack	9	7	0
Wye	2003	FS	1	Seed	Early	Corsica	10	1	3.91222145
Wye	2003	FS	1	Seed	Early	Corsica	10	2	7.12206524

Wye	2003	FS	1	Seed	Early	Corsica	10	3	0
Wye	2003	FS	1	Seed	Early	Corsica	10	4	20.12847097
Wye	2003	FS	1	Seed	Early	Corsica	10	5	47.86047434
Wye	2003	FS	1	Seed	Early	Corsica	10	6	0
Wye	2003	FS	1	Seed	Early	Corsica	10	7	0
Wye	2003	FS	1	Seed	Late	Corsica	11	1	4.74908212
Wye	2003	FS	1	Seed	Late	Corsica	11	2	9.26358926
Wye	2003	FS	1	Seed	Late	Corsica	11	3	0
Wye	2003	FS	1	Seed	Late	Corsica	11	4	24.39595778
Wye	2003	FS	1	Seed	Late	Corsica	11	5	57.90074922
Wye	2003	FS	1	Seed	Late	Corsica	11	6	0
Wye	2003	FS	1	Seed	Late	Corsica	11	7	0
Wye	2003	FS	1	LeafPost	Late	Corsica	12	1	0
Wye	2003	FS	1	LeafPost	Late	Corsica	12	2	1.13310674
Wye	2003	FS	1	LeafPost	Late	Corsica	12	3	0
Wye	2003	FS	1	LeafPost	Late	Corsica	12	4	0
Wye	2003	FS	1	LeafPost	Late	Corsica	12	5	2.265092476
Wye	2003	FS	1	LeafPost	Late	Corsica	12	6	0
Wye	2003	FS	1	LeafPost	Late	Corsica	12	7	0
Wye	2003	FS	2	LeafPost	Late	Corsica	11	1	0
Wye	2003	FS	2	LeafPost	Late	Corsica	11	2	1.81779374
Wye	2003	FS	2	LeafPost	Late	Corsica	11	3	0
Wye	2003	FS	2	LeafPost	Late	Corsica	11	4	7.248465457
Wye	2003	FS	2	LeafPost	Late	Corsica	11	5	9.396315959
Wye	2003	FS	2	LeafPost	Late	Corsica	11	6	0
Wye	2003	FS	2	LeafPost	Late	Corsica	11	7	0.146449496
Wye	2003	FS	2	LeafPost	Late	Corsica	13	1	0
Wye	2003	FS	2	LeafPost	Late	Corsica	13	2	2.43049442
Wye	2003	FS	2	LeafPost	Late	Corsica	13	3	0
Wye	2003	FS	2	LeafPost	Late	Corsica	13	4	8.708936698
Wye	2003	FS	2	LeafPost	Late	Corsica	13	5	9.687830996
Wye	2003	FS	2	LeafPost	Late	Corsica	13	6	0
Wye	2003	FS	2	LeafPost	Late	Corsica	13	7	0
Wye	2003	FS	2	Seed	Late	Corsica	13	1	4.61723015
Wye	2003	FS	2	Seed	Late	Corsica	13	2	8.71104416
Wye	2003	FS	2	Seed	Late	Corsica	13	3	0
Wye	2003	FS	2	Seed	Late	Corsica	13	4	24.1304713
Wye	2003	FS	2	Seed	Late	Corsica	13	5	56.88777082
Wye	2003	FS	2	Seed	Late	Corsica	13	6	0
Wye	2003	FS	2	Seed	Late	Corsica	13	7	0
Wye	2003	FS	2	LeafPost	Late	Corsica	14	1	0
Wye	2003	FS	2	LeafPost	Late	Corsica	14	2	1.20205154
Wye	2003	FS	2	LeafPost	Late	Corsica	14	3	0
Wye	2003	FS	2	LeafPost	Late	Corsica	14	4	0
Wye	2003	FS	2	LeafPost	Late	Corsica	14	5	2.160251569
Wye	2003	FS	2	LeafPost	Late	Corsica	14	6	0
Wye	2003	FS	2	LeafPost	Late	Corsica	14	7	0
Wye	2003	FS	2	Seed	Early	Corsica	15	1	4.93193268
Wye	2003	FS	2	Seed	Early	Corsica	15	2	10.21982162
Wye	2003	FS	2	Seed	Early	Corsica	15	3	0
Wye	2003	FS	2	Seed	Early	Corsica	15	4	27.13142966
Wye	2003	FS	2	Seed	Early	Corsica	15	5	66.67120351
Wye	2003	FS	2	Seed	Early	Corsica	15	6	0
Wye	2003	FS	2	Seed	Early	Corsica	15	7	0
Wye	2003	FS	2	LeafPost	Late	Bass	16	1	0
Wye	2003	FS	2	LeafPost	Late	Bass	16	2	1.91429576
Wye	2003	FS	2	LeafPost	Late	Bass	16	3	0
Wye	2003	FS	2	LeafPost	Late	Bass	16	4	9.978236663
Wye	2003	FS	2	LeafPost	Late	Bass	16	5	8.905622723
Wye	2003	FS	2	LeafPost	Late	Bass	16	6	0
Wye	2003	FS	2	LeafPost	Late	Bass	16	7	0.21776614
Wye	2003	FS	2	Seed	Late	Bass	16	1	2.74740326
Wye	2003	FS	2	Seed	Late	Bass	16	2	6.47846222
Wye	2003	FS	2	Seed	Late	Bass	16	3	0
Wye	2003	FS	2	Seed	Late	Bass	16	4	11.98464792
Wye	2003	FS	2	Seed	Late	Bass	16	5	44.2579957
Wye	2003	FS	2	Seed	Late	Bass	16	6	0
Wye	2003	FS	2	Seed	Late	Bass	16	7	0
Wye	2003	FS	2	Seed	Early	Bass	17	1	3.26369325
Wye	2003	FS	2	Seed	Early	Bass	17	2	8.57281508
Wye	2003	FS	2	Seed	Early	Bass	17	3	0
Wye	2003	FS	2	Seed	Early	Bass	17	4	17.43326362
Wye	2003	FS	2	Seed	Early	Bass	17	5	65.34253092
Wye	2003	FS	2	Seed	Early	Bass	17	6	0
Wye	2003	FS	2	Seed	Early	Bass	17	7	0
Wye	2003	FS	2	LeafPost	Late	Bass	18	1	0
Wye	2003	FS	2	LeafPost	Late	Bass	18	2	1.24561952
Wye	2003	FS	2	LeafPost	Late	Bass	18	3	0
Wye	2003	FS	2	LeafPost	Late	Bass	18	4	0

Wye	2003	FS	2	LeafPost	Late	Bass	18	5	2.190787836
Wye	2003	FS	2	LeafPost	Late	Bass	18	6	0
Wye	2003	FS	2	LeafPost	Late	Bass	18	7	0
Wye	2003	FS	2	LeafPost	Late	Williams82	19	1	0
Wye	2003	FS	2	LeafPost	Late	Williams82	19	2	2.02368698
Wye	2003	FS	2	LeafPost	Late	Williams82	19	3	0
Wye	2003	FS	2	LeafPost	Late	Williams82	19	4	0
Wye	2003	FS	2	LeafPost	Late	Williams82	19	5	3.937579774
Wye	2003	FS	2	LeafPost	Late	Williams82	19	6	0
Wye	2003	FS	2	LeafPost	Late	Williams82	19	7	0.19702094
Wye	2003	FS	2	LeafPost	Late	Williams82	20	1	0
Wye	2003	FS	2	LeafPost	Late	Williams82	20	2	3.35962496
Wye	2003	FS	2	LeafPost	Late	Williams82	20	3	0
Wye	2003	FS	2	LeafPost	Late	Williams82	20	4	8.642178692
Wye	2003	FS	2	LeafPost	Late	Williams82	20	5	13.25417574
Wye	2003	FS	2	LeafPost	Late	Williams82	20	6	0
Wye	2003	FS	2	LeafPost	Late	Williams82	20	7	0.317258972
Wye	2003	FS	2	Seed	Late	Williams82	20	1	5.74663567
Wye	2003	FS	2	Seed	Late	Williams82	20	2	13.17360674
Wye	2003	FS	2	Seed	Late	Williams82	20	3	0
Wye	2003	FS	2	Seed	Late	Williams82	20	4	33.03912852
Wye	2003	FS	2	Seed	Late	Williams82	20	5	94.07884403
Wye	2003	FS	2	Seed	Late	Williams82	20	6	0
Wye	2003	FS	2	Seed	Late	Williams82	20	7	0
Wye	2003	FS	2	Seed	Early	Williams82	21	1	5.93752769
Wye	2003	FS	2	Seed	Early	Williams82	21	2	14.63031542
Wye	2003	FS	2	Seed	Early	Williams82	21	3	0
Wye	2003	FS	2	Seed	Early	Williams82	21	4	30.62596222
Wye	2003	FS	2	Seed	Early	Williams82	21	5	89.14886924
Wye	2003	FS	2	Seed	Early	Williams82	21	6	0
Wye	2003	FS	2	Seed	Early	Williams82	21	7	0
Wye	2003	FS	2	LeafPost	Late	Jack	22	1	0
Wye	2003	FS	2	LeafPost	Late	Jack	22	2	1.47255086
Wye	2003	FS	2	LeafPost	Late	Jack	22	3	0
Wye	2003	FS	2	LeafPost	Late	Jack	22	4	0
Wye	2003	FS	2	LeafPost	Late	Jack	22	5	2.492477216
Wye	2003	FS	2	LeafPost	Late	Jack	22	6	0
Wye	2003	FS	2	LeafPost	Late	Jack	22	7	0
Wye	2003	FS	2	Seed	Early	Jack	23	1	3.07044616
Wye	2003	FS	2	Seed	Early	Jack	23	2	9.3428399
Wye	2003	FS	2	Seed	Early	Jack	23	3	0
Wye	2003	FS	2	Seed	Early	Jack	23	4	16.01701842
Wye	2003	FS	2	Seed	Early	Jack	23	5	70.02661554
Wye	2003	FS	2	Seed	Early	Jack	23	6	0
Wye	2003	FS	2	Seed	Early	Jack	23	7	0
Wye	2003	FS	2	LeafPost	Late	Jack	24	1	0
Wye	2003	FS	2	LeafPost	Late	Jack	24	2	1.9387604
Wye	2003	FS	2	LeafPost	Late	Jack	24	3	0
Wye	2003	FS	2	LeafPost	Late	Jack	24	4	6.085132539
Wye	2003	FS	2	LeafPost	Late	Jack	24	5	8.366701876
Wye	2003	FS	2	LeafPost	Late	Jack	24	6	0
Wye	2003	FS	2	LeafPost	Late	Jack	24	7	0.227019264
Wye	2003	FS	2	Seed	Late	Jack	24	1	2.50361624
Wye	2003	FS	2	Seed	Late	Jack	24	2	6.63334238
Wye	2003	FS	2	Seed	Late	Jack	24	3	0
Wye	2003	FS	2	Seed	Late	Jack	24	4	12.01814687
Wye	2003	FS	2	Seed	Late	Jack	24	5	54.8116869
Wye	2003	FS	2	Seed	Late	Jack	24	6	0
Wye	2003	FS	2	Seed	Late	Jack	24	7	0
Wye	2003	FS	3	LeafPost	Late	Williams82	25	1	0
Wye	2003	FS	3	LeafPost	Late	Williams82	25	2	2.13043826
Wye	2003	FS	3	LeafPost	Late	Williams82	25	3	0
Wye	2003	FS	3	LeafPost	Late	Williams82	25	4	7.560416618
Wye	2003	FS	3	LeafPost	Late	Williams82	25	5	9.013109389
Wye	2003	FS	3	LeafPost	Late	Williams82	25	6	0
Wye	2003	FS	3	LeafPost	Late	Williams82	25	7	0.293353236
Wye	2003	FS	3	Seed	Late	Williams82	25	1	5.80647234
Wye	2003	FS	3	Seed	Late	Williams82	25	2	14.30808956
Wye	2003	FS	3	Seed	Late	Williams82	25	3	0
Wye	2003	FS	3	Seed	Late	Williams82	25	4	27.20573287
Wye	2003	FS	3	Seed	Late	Williams82	25	5	79.80889992
Wye	2003	FS	3	Seed	Late	Williams82	25	6	0
Wye	2003	FS	3	Seed	Late	Williams82	25	7	0
Wye	2003	FS	3	LeafPost	Late	Williams82	26	1	0
Wye	2003	FS	3	LeafPost	Late	Williams82	26	2	1.7955785
Wye	2003	FS	3	LeafPost	Late	Williams82	26	3	0
Wye	2003	FS	3	LeafPost	Late	Williams82	26	4	0
Wye	2003	FS	3	LeafPost	Late	Williams82	26	5	3.561766109
Wye	2003	FS	3	LeafPost	Late	Williams82	26	6	0

Wye	2003	FS	3	LeafPost	Late	Williams82	26	7	0.196317324
Wye	2003	FS	3	Seed	Early	Williams82	27	1	5.31488822
Wye	2003	FS	3	Seed	Early	Williams82	27	2	12.39685994
Wye	2003	FS	3	Seed	Early	Williams82	27	3	0
Wye	2003	FS	3	Seed	Early	Williams82	27	4	41.39752095
Wye	2003	FS	3	Seed	Early	Williams82	27	5	77.55285802
Wye	2003	FS	3	Seed	Early	Williams82	27	6	0
Wye	2003	FS	3	Seed	Early	Williams82	27	7	0
Wye	2003	FS	3	Seed	Early	Corsica	28	1	4.52755076
Wye	2003	FS	3	Seed	Early	Corsica	28	2	9.01431158
Wye	2003	FS	3	Seed	Early	Corsica	28	3	0
Wye	2003	FS	3	Seed	Early	Corsica	28	4	19.88098349
Wye	2003	FS	3	Seed	Early	Corsica	28	5	48.0045069
Wye	2003	FS	3	Seed	Early	Corsica	28	6	0
Wye	2003	FS	3	Seed	Early	Corsica	28	7	0
Wye	2003	FS	3	LeafPost	Late	Corsica	29	1	0
Wye	2003	FS	3	LeafPost	Late	Corsica	29	2	1.1678855
Wye	2003	FS	3	LeafPost	Late	Corsica	29	3	0
Wye	2003	FS	3	LeafPost	Late	Corsica	29	4	0
Wye	2003	FS	3	LeafPost	Late	Corsica	29	5	2.574844887
Wye	2003	FS	3	LeafPost	Late	Corsica	29	6	0
Wye	2003	FS	3	LeafPost	Late	Corsica	29	7	0
Wye	2003	FS	3	LeafPost	Late	Corsica	30	1	0
Wye	2003	FS	3	LeafPost	Late	Corsica	30	2	1.63754642
Wye	2003	FS	3	LeafPost	Late	Corsica	30	3	0
Wye	2003	FS	3	LeafPost	Late	Corsica	30	4	9.061038445
Wye	2003	FS	3	LeafPost	Late	Corsica	30	5	7.850803603
Wye	2003	FS	3	LeafPost	Late	Corsica	30	6	0
Wye	2003	FS	3	LeafPost	Late	Corsica	30	7	0
Wye	2003	FS	3	Seed	Late	Corsica	30	1	4.97130289
Wye	2003	FS	3	Seed	Late	Corsica	30	2	9.8426
Wye	2003	FS	3	Seed	Late	Corsica	30	3	0
Wye	2003	FS	3	Seed	Late	Corsica	30	4	25.33075063
Wye	2003	FS	3	Seed	Late	Corsica	30	5	61.68172975
Wye	2003	FS	3	Seed	Late	Corsica	30	6	0
Wye	2003	FS	3	Seed	Late	Corsica	30	7	0
Wye	2003	FS	3	LeafPost	Late	Jack	31	1	0
Wye	2003	FS	3	LeafPost	Late	Jack	31	2	1.47781832
Wye	2003	FS	3	LeafPost	Late	Jack	31	3	0
Wye	2003	FS	3	LeafPost	Late	Jack	31	4	0
Wye	2003	FS	3	LeafPost	Late	Jack	31	5	2.453508936
Wye	2003	FS	3	LeafPost	Late	Jack	31	6	0
Wye	2003	FS	3	LeafPost	Late	Jack	31	7	0
Wye	2003	FS	3	LeafPost	Late	Jack	32	1	0
Wye	2003	FS	3	LeafPost	Late	Jack	32	2	1.9134029
Wye	2003	FS	3	LeafPost	Late	Jack	32	3	0
Wye	2003	FS	3	LeafPost	Late	Jack	32	4	7.412221418
Wye	2003	FS	3	LeafPost	Late	Jack	32	5	8.333013531
Wye	2003	FS	3	LeafPost	Late	Jack	32	6	0
Wye	2003	FS	3	LeafPost	Late	Jack	32	7	0.313244728
Wye	2003	FS	3	Seed	Late	Jack	32	1	2.9832397
Wye	2003	FS	3	Seed	Late	Jack	32	2	8.62840424
Wye	2003	FS	3	Seed	Late	Jack	32	3	0
Wye	2003	FS	3	Seed	Late	Jack	32	4	12.13531564
Wye	2003	FS	3	Seed	Late	Jack	32	5	49.49266634
Wye	2003	FS	3	Seed	Late	Jack	32	6	0
Wye	2003	FS	3	Seed	Late	Jack	32	7	0
Wye	2003	FS	3	Seed	Early	Jack	33	1	3.49944378
Wye	2003	FS	3	Seed	Early	Jack	33	2	11.93756282
Wye	2003	FS	3	Seed	Early	Jack	33	3	0
Wye	2003	FS	3	Seed	Early	Jack	33	4	15.06999663
Wye	2003	FS	3	Seed	Early	Jack	33	5	65.98897152
Wye	2003	FS	3	Seed	Early	Jack	33	6	0
Wye	2003	FS	3	Seed	Early	Jack	33	7	0
Wye	2003	FS	3	LeafPost	Late	Bass	34	1	0
Wye	2003	FS	3	LeafPost	Late	Bass	34	2	2.06469368
Wye	2003	FS	3	LeafPost	Late	Bass	34	3	0
Wye	2003	FS	3	LeafPost	Late	Bass	34	4	10.85593113
Wye	2003	FS	3	LeafPost	Late	Bass	34	5	9.866665472
Wye	2003	FS	3	LeafPost	Late	Bass	34	6	0
Wye	2003	FS	3	LeafPost	Late	Bass	34	7	0.165044652
Wye	2003	FS	3	Seed	Late	Bass	34	1	3.55851365
Wye	2003	FS	3	Seed	Late	Bass	34	2	9.76967666
Wye	2003	FS	3	Seed	Late	Bass	34	3	0
Wye	2003	FS	3	Seed	Late	Bass	34	4	16.2649197
Wye	2003	FS	3	Seed	Late	Bass	34	5	60.02014483
Wye	2003	FS	3	Seed	Late	Bass	34	6	0
Wye	2003	FS	3	Seed	Late	Bass	34	7	0
Wye	2003	FS	3	Seed	Early	Bass	35	1	3.81643251

Wye	2003	FS	3	Seed	Early	Bass	35	2	10.73824208
Wye	2003	FS	3	Seed	Early	Bass	35	3	0
Wye	2003	FS	3	Seed	Early	Bass	35	4	16.49115773
Wye	2003	FS	3	Seed	Early	Bass	35	5	59.82608938
Wye	2003	FS	3	Seed	Early	Bass	35	6	0
Wye	2003	FS	3	Seed	Early	Bass	35	7	0
Wye	2003	FS	3	LeafPost	Late	Bass	36	1	0
Wye	2003	FS	3	LeafPost	Late	Bass	36	2	1.24061702
Wye	2003	FS	3	LeafPost	Late	Bass	36	3	0
Wye	2003	FS	3	LeafPost	Late	Bass	36	4	0
Wye	2003	FS	3	LeafPost	Late	Bass	36	5	2.974222193
Wye	2003	FS	3	LeafPost	Late	Bass	36	6	0
Wye	2003	FS	3	LeafPost	Late	Bass	36	7	0

Seed Constituent Analysis Data

Year	Farm	Field_Type	Cultivar	Timing	FieldID	Rep	TotlWgt	Yield	HndSedWt	Protein	Oil
2002	P	D	BASS	c	1	1	839.0	44.8	17.1	41.4	20.8
2002	P	D	CORC	c	4	1	1596.6	42.6	17.7	42.6	20.4
2002	P	D	JACK	c	9	1	1079.5	28.8	15.0	41.9	20.0
2002	P	D	WM82	c	12	1	1374.4	36.7	19.6	43.4	20.0
2002	P	D	CORC	c	15	2	1421.1	37.9	20.0	44.1	19.6
2002	P	D	JACK	c	18	2	1560.4	41.7	18.6	42.1	21.2
2002	P	D	BASS	c	19	2	1560.4	41.7	19.2	42.2	20.3
2002	P	D	WM82	c	24	2	1156.7	30.9	14.3	41.1	20.8
2002	P	D	WM82	c	25	3	1496.9	40.0	18.2	41.7	20.4
2002	P	D	CORC	c	30	3	1691.9	45.2	19.9	43.4	20.0
2002	P	D	JACK	c	32	3	1174.8	31.4	15.1	40.8	21.2
2002	P	D	BASS	c	35	3	1805.3	48.2	17.6	41.5	21.2
2002	P	D	BASS	e	3	1	1660.1	44.3	17.4	41.0	21.4
2002	P	D	CORC	e	6	1	1623.9	43.4	17.9	42.0	21.0
2002	P	D	JACK	e	7	1	807.4	43.1	15.2	41.5	20.1
2002	P	D	WM82	e	11	1	1687.4	45.1	19.1	43.3	20.2
2002	P	D	CORC	e	14	2	1746.4	46.6	19.1	42.8	20.1
2002	P	D	JACK	e	17	2	1623.9	43.4	17.5	42.1	21.1
2002	P	D	BASS	e	21	2	1651.1	44.1	17.7	41.4	20.6
2002	P	D	WM82	e	23	2	1056.9	28.2	15.2	41.3	21.0
2002	P	D	WM82	e	27	3	1161.2	31.0	18.0	41.1	20.8
2002	P	D	CORC	e	29	3	1646.5	44.0	19.5	43.9	19.7
2002	P	D	JACK	e	33	3	1220.2	32.6	15.2	40.8	21.4
2002	P	D	BASS	e	36	3	1723.7	46.0	17.2	42.0	20.6
2002	P	D	BASS	l	2	1	.	.	18.2	41.4	21.5
2002	P	D	CORC	l	5	1	1642.0	43.8	17.7	42.2	20.5
2002	P	D	JACK	l	8	1	1165.7	31.1	15.1	41.7	19.9
2002	P	D	WM82	l	10	1	1741.8	46.5	19.3	44.1	19.2
2002	P	D	CORC	l	13	2	1664.7	44.4	19.1	44.0	19.6
2002	P	D	JACK	l	16	2	1655.6	44.2	17.4	41.8	20.8
2002	P	D	BASS	l	20	2	1374.4	36.7	17.7	41.8	20.6
2002	P	D	WM82	l	22	2	1270.1	33.9	15.4	41.9	20.4
2002	P	D	WM82	l	26	3	1755.4	46.9	17.8	41.3	21.4
2002	P	D	CORC	l	28	3	1782.6	47.6	18.4	43.9	19.7
2002	P	D	JACK	l	31	3	1297.3	34.6	15.5	40.5	21.0
2002	P	D	BASS	l	34	3	.	.	17.8	41.7	21.5
2002	P	F	WM82	e	2	1	643.3	32.2	14.3	41.3	20.4
2002	P	F	BASS	e	5	1	358.3	17.9	9.3	40.7	20.3
2002	P	F	JACK	e	7	1	525.1	26.3	8.5	41.1	19.4
2002	P	F	CORC	e	10	1	714.5	35.7	14.1	42.2	20.0
2002	P	F	CORC	e	14	2	809.1	40.5	13.3	41.3	21.0
2002	P	F	BASS	e	16	2	386.4	19.3	9.9	40.1	21.3
2002	P	F	WM82	e	19	2	535.9	26.8	14.6	41.3	21.1
2002	P	F	JACK	e	22	2	690.4	34.5	8.6	40.4	19.3
2002	P	F	WM82	e	26	3	654.8	32.7	13.5	40.8	21.2
2002	P	F	CORC	e	28	3	718.0	35.9	13.6	41.7	20.9
2002	P	F	JACK	e	31	3	601.5	30.1	9.1	41.0	19.5
2002	P	F	BASS	e	34	3	751.6	37.6	10.2	39.0	22.3
2002	P	F	WM82	l	1	1	504.0	25.2	12.7	41.3	20.7
2002	P	F	BASS	l	4	1	390.0	19.5	10.2	40.9	20.8
2002	P	F	JACK	l	9	1	561.0	28.1	10.9	40.9	20.4
2002	P	F	CORC	l	12	1	713.7	35.7	13.4	41.4	20.7
2002	P	F	CORC	l	15	2	777.2	38.9	15.1	41.1	21.1
2002	P	F	BASS	l	17	2	349.0	17.5	8.5	40.9	20.3
2002	P	F	WM82	l	21	2	508.0	25.4	15.1	41.3	21.2
2002	P	F	JACK	l	23	2	708.9	35.4	9.4	40.6	19.6
2002	P	F	WM82	l	27	3	618.2	30.9	12.8	41.4	20.9
2002	P	F	CORC	l	30	3	666.3	33.3	13.4	41.6	20.5
2002	P	F	JACK	l	32	3	703.8	35.2	8.9	41.0	19.8
2002	P	F	BASS	l	35	3	586.5	29.3	10.3	40.1	21.5
2002	P	F	WM82	c	3	1	416.0	20.8	13.0	41.9	20.3
2002	P	F	BASS	c	6	1	356.2	17.8	9.7	41.7	19.3
2002	P	F	JACK	c	8	1	533.5	26.7	10.1	40.8	19.7
2002	P	F	CORC	c	11	1	718.0	35.9	14.6	42.2	20.3
2002	P	F	CORC	c	13	2	798.9	39.9	14.0	40.9	20.7
2002	P	F	BASS	c	18	2	396.0	19.8	10.1	40.2	21.2
2002	P	F	WM82	c	20	2	389.0	19.5	11.3	41.7	20.5
2002	P	F	JACK	c	24	2	685.3	34.3	10.2	40.1	20.5
2002	P	F	WM82	c	25	3	590.1	29.5	13.3	40.8	21.7
2002	P	F	CORC	c	29	3	568.6	28.4	13.2	41.6	20.6
2002	P	F	JACK	c	33	3	674.4	33.7	9.1	41.6	19.8
2002	P	F	BASS	c	36	3	557.1	27.9	9.5	40.7	20.6
2002	W	D	CORC	c	2	1	.	.	16.3	42.5	19.6

2002	W	D	WM82	c	6	1	.	.	10.5	40.7	19.2
2002	W	D	JACK	c	9	1	.	.	13.2	42.8	19.5
2002	W	D	BASS	c	10	1	.	.	13.9	42.4	19.8
2002	W	D	WM82	c	13	2	.	.	8.0	41.1	20.1
2002	W	D	JACK	c	18	2	.	.	12.4	41.5	20.3
2002	W	D	CORC	c	19	2	.	.	14.1	42.0	20.1
2002	W	D	BASS	c	23	2	.	.	14.9	42.9	19.0
2002	W	D	CORC	c	27	3	.	.	12.9	42.2	19.9
2002	W	D	BASS	c	29	3	.	.	14.5	42.7	19.3
2002	W	D	JACK	c	33	3	.	.	10.3	40.9	20.2
2002	W	D	WM82	c	35	3	.	.	14.7	42.4	19.9
2002	W	D	CORC	e	1	1	.	.	14.7	41.9	19.1
2002	W	D	WM82	e	5	1	.	.	10.7	40.4	19.8
2002	W	D	JACK	e	7	1	.	.	12.3	41.4	19.5
2002	W	D	BASS	e	11	1	.	.	12.9	42.0	20.0
2002	W	D	WM82	e	14	2	.	.	10.7	41.0	20.3
2002	W	D	JACK	e	16	2	.	.	12.2	42.1	19.4
2002	W	D	CORC	e	20	2	.	.	13.4	42.2	20.0
2002	W	D	BASS	e	22	2	.	.	14.8	43.6	18.6
2002	W	D	CORC	e	25	3	.	.	5.5	42.3	21.5
2002	W	D	BASS	e	28	3	.	.	14.1	42.1	21.1
2002	W	D	JACK	e	32	3	.	.	5.6	41.2	22.0
2002	W	D	WM82	e	34	3	.	.	14.7	43.2	18.9
2002	W	D	CORC	l	3	1	.	.	13.1	43.1	19.1
2002	W	D	WM82	l	4	1	.	.	10.0	41.8	19.6
2002	W	D	JACK	l	8	1	.	.	11.5	40.6	20.0
2002	W	D	BASS	l	12	1	.	.	12.7	43.8	19.1
2002	W	D	WM82	l	15	2	.	.	10.8	41.8	19.5
2002	W	D	JACK	l	17	2	.	.	11.6	41.6	19.7
2002	W	D	CORC	l	21	2	.	.	12.6	41.9	19.5
2002	W	D	BASS	l	24	2	.	.	14.9	41.8	19.1
2002	W	D	CORC	l	26	3	.	.	13.5	42.3	19.1
2002	W	D	BASS	l	30	3	.	.	12.5	41.2	19.5
2002	W	D	JACK	l	31	3	.	.	10.3	41.5	19.1
2002	W	D	WM82	l	36	3	.	.	14.0	42.6	20.1
2002	W	F	CORC	e	3	1	490.8	24.5	13.4	43.1	20.2
2002	W	F	JACK	e	5	1	723.8	36.2	7.2	41.1	16.9
2002	W	F	BASS	e	7	1	1183.8	59.2	10.9	38.2	22.5
2002	W	F	WM82	e	12	1	1075.9	53.8	14.8	42.5	20.4
2002	W	F	JACK	e	13	2	330.3	16.5	9.7	38.5	20.8
2002	W	F	BASS	e	16	2	897.6	44.9	12.2	39.9	22.1
2002	W	F	WM82	e	20	2	1214.3	60.7	15.5	42.4	20.4
2002	W	F	CORC	e	23	2	784.5	39.2	13.4	43.9	20.5
2002	W	F	BASS	e	27	3	485.9	24.3	10.2	44.0	19.5
2002	W	F	WM82	e	29	3	764.2	38.2	13.6	44.6	19.3
2002	W	F	CORC	e	32	3	334.2	16.7	7.1	44.0	16.0
2002	W	F	JACK	e	35	3	767.8	38.4	14.1	45.1	19.6
2002	W	F	CORC	l	1	1	1007.3	50.4	13.6	43.5	20.2
2002	W	F	JACK	l	6	1	843.8	42.2	8.4	40.3	19.0
2002	W	F	BASS	l	9	1	844.8	42.2	11.3	39.9	21.9
2002	W	F	WM82	l	10	1	946.7	47.3	13.7	42.8	20.6
2002	W	F	JACK	l	14	2	717.1	35.9	9.5	40.6	19.5
2002	W	F	BASS	l	17	2	703.6	35.2	9.6	40.1	21.5
2002	W	F	WM82	l	19	2	1040.9	52.0	14.3	42.5	20.0
2002	W	F	CORC	l	24	2	1029.4	51.5	13.9	43.9	20.2
2002	W	F	BASS	l	26	3	684.2	34.2	11.7	42.6	20.3
2002	W	F	WM82	l	30	3	948.4	47.4	13.2	44.1	20.2
2002	W	F	CORC	l	33	3	479.6	24.0	7.9	41.2	17.9
2002	W	F	JACK	l	34	3	692.0	34.6	12.6	45.4	19.9
2002	W	F	CORC	c	2	1	1050.5	52.5	14.1	43.6	20.5
2002	W	F	JACK	c	4	1	694.0	34.7	7.5	42.5	17.5
2002	W	F	BASS	c	8	1	760.8	38.0	9.7	40.6	21.0
2002	W	F	WM82	c	11	1	1051.6	52.6	14.8	43.2	20.3
2002	W	F	JACK	c	15	2	232.6	11.6	7.0	42.1	17.2
2002	W	F	BASS	c	18	2	1095.0	54.8	10.4	38.5	22.3
2002	W	F	WM82	c	21	2	968.7	48.4	14.3	44.4	19.3
2002	W	F	CORC	c	22	2	357.7	17.9	12.9	45.2	18.9
2002	W	F	BASS	c	25	3	753.1	37.7	12.6	43.3	20.3
2002	W	F	WM82	c	28	3	748.5	37.4	12.7	45.5	19.0
2002	W	F	CORC	c	31	3	489.4	24.5	8.0	42.5	17.2
2002	W	F	JACK	c	36	3	910.7	45.5	15.7	44.7	19.9
2003	P	D	CORC	c	3	1	671.3	35.8	15.8	41.6	19.3
2003	P	D	WM82	c	4	1	997.9	26.6	15.1	40.0	19.4
2003	P	D	JACK	c	8	1	1451.5	38.8	12.6	38.1	21.2
2003	P	D	BASS	c	11	1	1619.3	43.2	13.5	40.0	21.3
2003	P	D	WM82	c	13	2	1102.2	29.4	15.3	39.9	20.1
2003	P	D	JACK	c	18	2	1551.3	41.4	12.4	36.0	20.7
2003	P	D	CORC	c	19	2	1823.4	48.7	15.6	39.8	19.6
2003	P	D	BASS	c	22	2	1324.5	35.4	13.2	38.5	20.4

2003	P	D	CORC	c	26	3	1905.1	50.9	15.4	40.6	19.5
2003	P	D	BASS	c	29	3	1655.6	44.2	13.2	40.5	21.6
2003	P	D	JACK	c	31	3	1392.5	37.2	11.7	37.7	21.1
2003	P	D	WM82	c	34	3	1437.9	38.4	15.2	39.8	19.7
2003	P	D	CORC	e	2	1	1214.3	32.4	15.6	41.9	18.9
2003	P	D	WM82	e	6	1	1124.9	30.0	14.6	41.0	19.6
2003	P	D	JACK	e	7	1	1238.3	33.1	11.4	36.0	21.1
2003	P	D	BASS	e	10	1	775.6	20.7	13.0	39.9	20.0
2003	P	D	WM82	e	14	2	1419.7	37.9	14.4	39.5	19.6
2003	P	D	JACK	e	16	2	1115.8	29.8	12.0	37.8	20.4
2003	P	D	CORC	e	21	2	1669.2	44.6	14.7	40.5	19.6
2003	P	D	BASS	e	23	2	1020.6	27.3	13.3	39.6	20.5
2003	P	D	CORC	e	25	3	1292.7	34.5	14.3	40.4	19.0
2003	P	D	BASS	e	28	3	1233.7	32.9	12.5	38.9	19.9
2003	P	D	JACK	e	32	3	1542.2	41.2	12.0	38.6	20.1
2003	P	D	WM82	e	36	3	1115.8	29.8	14.9	39.6	20.0
2003	P	D	CORC	l	1	1	1311.5	35.0	15.9	40.9	20.0
2003	P	D	WM82	l	5	1	1061.4	28.3	14.6	39.6	20.0
2003	P	D	JACK	l	9	1	1528.6	40.8	12.3	38.2	20.7
2003	P	D	BASS	l	12	1	807.4	21.6	13.9	39.7	19.9
2003	P	D	WM82	l	15	2	1292.7	34.5	15.1	38.5	20.2
2003	P	D	JACK	l	17	2	1487.8	39.7	12.7	37.1	21.3
2003	P	D	CORC	l	20	2	1841.6	49.2	15.4	40.3	21.0
2003	P	D	BASS	l	24	2	743.9	19.9	12.7	39.2	20.5
2003	P	D	CORC	l	27	3	1714.6	45.8	15.3	40.5	20.1
2003	P	D	BASS	l	30	3	1601.2	42.8	12.5	39.0	19.8
2003	P	D	JACK	l	33	3	1759.9	47.0	13.0	36.9	20.9
2003	P	D	WM82	l	35	3	1841.6	49.2	15.4	38.0	20.1
2003	P	F	WM82	e	2	1	50.5	.	15.1	42.7	20.7
2003	P	F	BASS	e	5	1	49.1	.	13.1	41.1	22.3
2003	P	F	JACK	e	7	1	49.1	.	14.9	41.8	22.0
2003	P	F	CORC	e	10	1	51.0	.	15.4	41.7	21.7
2003	P	F	CORC	e	14	2	51.0	.	13.7	41.0	22.2
2003	P	F	BASS	e	16	2	50.7	.	13.2	41.8	21.7
2003	P	F	WM82	e	19	2	49.2	.	14.1	41.6	21.1
2003	P	F	JACK	e	22	2	50.3	.	16.6	43.2	20.7
2003	P	F	WM82	e	26	3	49.4	.	12.5	41.8	20.8
2003	P	F	CORC	e	28	3	51.1	.	14.3	41.5	21.0
2003	P	F	JACK	e	31	3	49.4	.	13.6	41.4	22.0
2003	P	F	BASS	e	34	3	.	.	14.8	42.1	20.7
2003	P	F	WM82	l	1	1	50.0	.	17.1	41.1	20.9
2003	P	F	BASS	l	4	1	50.4	.	14.5	41.8	21.8
2003	P	F	JACK	l	9	1	51.0	.	14.4	41.1	21.8
2003	P	F	CORC	l	12	1	49.6	.	14.7	41.8	21.1
2003	P	F	CORC	l	15	2	50.5	.	13.2	41.7	22.0
2003	P	F	BASS	l	17	2	50.7	.	14.3	41.9	21.0
2003	P	F	WM82	l	21	2	49.5	.	15.0	41.5	21.4
2003	P	F	JACK	l	23	2	50.6	.	15.5	42.1	20.6
2003	P	F	WM82	l	27	3	49.8	.	13.0	41.3	21.5
2003	P	F	CORC	l	30	3	49.7	.	15.0	41.6	21.4
2003	P	F	JACK	l	32	3	50.9	.	14.5	41.2	22.1
2003	P	F	BASS	l	35	3	.	.	14.7	42.3	21.0
2003	P	F	WM82	e	3	1	50.3	.	16.7	42.5	20.8
2003	P	F	BASS	c	6	1	50.1	.	13.8	41.5	21.7
2003	P	F	JACK	e	8	1	50.6	.	13.1	41.2	21.7
2003	P	F	CORC	c	11	1	50.4	.	15.0	41.7	21.0
2003	P	F	CORC	e	13	2	51.0	.	13.6	41.3	21.9
2003	P	F	BASS	c	18	2	49.8	.	14.8	42.6	20.7
2003	P	F	WM82	c	20	2	50.1	.	15.9	41.6	21.2
2003	P	F	JACK	l	24	2	50.5	.	15.3	42.3	21.5
2003	P	F	WM82	c	25	3	50.9	.	14.8	42.3	21.3
2003	P	F	CORC	c	29	3	51.1	.	15.2	41.9	21.3
2003	P	F	JACK	l	33	3	49.6	.	12.8	42.3	21.6
2003	P	F	BASS	c	36	3	.	.	16.6	42.0	21.2
2003	W	D	BASS	c	1	1	1564.9	41.8	14.4	40.4	20.5
2003	W	D	CORC	c	5	1	1737.3	46.4	16.7	41.6	19.4
2003	W	D	JACK	c	8	1	1437.1	38.4	13.8	39.5	20.0
2003	W	D	WM82	c	10	1	1378.9	36.8	17.0	39.9	19.0
2003	W	D	CORC	c	15	2	1496.9	40.0	15.2	39.6	20.0
2003	W	D	JACK	c	18	2	1596.6	42.6	13.7	37.8	20.0
2003	W	D	BASS	c	21	2	1601.2	42.8	13.5	40.1	19.0
2003	W	D	WM82	c	24	2	1564.9	41.8	16.5	40.5	19.0
2003	W	D	WM82	c	26	3	1546.7	41.3	17.4	40.4	19.0
2003	W	D	CORC	c	30	3	1036.6	27.7	16.4	41.5	18.8
2003	W	D	JACK	c	31	3	1469.6	39.2	14.0	40.8	18.7
2003	W	D	BASS	c	36	3	1583.0	42.3	14.1	39.6	19.6
2003	W	D	BASS	e	2	1	1310.0	35.0	13.3	40.3	19.2
2003	W	D	CORC	e	6	1	1297.3	34.6	15.6	40.9	18.5
2003	W	D	JACK	e	9	1	1043.3	27.9	12.3	39.1	19.7

2003	W	D	WM82	e	12	1	1016.0	27.1	16.4	40.5	21.6
2003	W	D	CORC	e	13	2	1451.5	38.8	15.8	40.3	19.5
2003	W	D	JACK	e	16	2	1070.5	28.6	12.9	38.6	19.8
2003	W	D	BASS	e	20	2	1174.8	31.4	12.5	39.2	19.6
2003	W	D	WM82	e	22	2	1342.6	35.8	15.8	39.6	20.1
2003	W	D	WM82	e	25	3	1106.8	29.6	16.0	40.2	19.4
2003	W	D	CORC	e	28	3	1356.2	36.2	15.9	42.0	17.9
2003	W	D	JACK	e	33	3	1233.8	32.9	12.7	40.4	20.2
2003	W	D	BASS	e	35	3	1279.1	34.2	13.0	39.4	19.5
2003	W	D	BASS	l	3	1	1283.7	34.3	13.6	40.3	21.3
2003	W	D	CORC	l	4	1	.	.	16.8	41.1	18.3
2003	W	D	JACK	l	7	1	1024.1	27.3	12.9	40.4	18.0
2003	W	D	WM82	l	11	1	1251.9	33.4	15.6	40.5	19.1
2003	W	D	CORC	l	14	2	1846.1	49.3	17.2	41.4	18.5
2003	W	D	JACK	l	17	2	1088.7	29.1	13.0	39.6	19.4
2003	W	D	BASS	l	19	2	1233.8	32.9	12.1	38.6	19.9
2003	W	D	WM82	l	23	2	1134.0	30.3	15.1	39.7	19.5
2003	W	D	WM82	l	27	3	1456.0	38.9	15.2	41.2	18.7
2003	W	D	CORC	l	29	3	1288.2	34.4	15.8	41.9	18.8
2003	W	D	JACK	l	32	3	1233.8	32.9	13.2	40.7	18.5
2003	W	D	BASS	l	34	3	1324.5	35.4	12.6	39.8	19.2
2003	W	F	CORC	e	3	1	846.2	22.6	14.0	41.3	20.7
2003	W	F	JACK	e	5	1	367.7	9.8	13.3	40.6	21.3
2003	W	F	BASS	e	7	1	1434.2	38.3	12.7	41.6	20.7
2003	W	F	WM82	e	12	1	941.7	25.1	14.7	42.3	19.8
2003	W	F	JACK	e	13	2	1271.4	33.9	12.7	41.7	20.1
2003	W	F	BASS	e	16	2	1083.6	28.9	11.3	40.2	20.7
2003	W	F	WM82	e	20	2	1258.8	33.6	14.0	40.6	20.7
2003	W	F	CORC	e	23	2	1661.9	44.4	12.0	42.1	20.1
2003	W	F	BASS	e	27	3	1491.2	39.8	14.1	43.1	19.4
2003	W	F	WM82	e	29	3	1885.1	50.3	14.2	41.9	20.6
2003	W	F	CORC	e	32	3	1220.9	32.6	10.9	41.2	19.8
2003	W	F	JACK	e	35	3	1624.4	43.4	12.4	42.0	20.9
2003	W	F	CORC	l	1	1	565.6	15.1	13.4	40.4	20.8
2003	W	F	JACK	l	6	1	423.8	11.3	12.5	41.0	20.6
2003	W	F	BASS	l	9	1	1563.7	41.8	13.7	40.7	21.5
2003	W	F	WM82	l	10	1	.	.	15.9	43.1	19.6
2003	W	F	JACK	l	14	2	1718.2	45.9	14.0	41.8	20.8
2003	W	F	BASS	l	17	2	1559.7	41.6	12.3	41.4	21.1
2003	W	F	WM82	l	19	2	1528.8	40.8	15.2	41.8	20.6
2003	W	F	CORC	l	24	2	558.4	14.9	10.8	40.9	20.1
2003	W	F	BASS	l	26	3	1677.9	44.8	15.1	42.3	21.0
2003	W	F	WM82	l	30	3	1326.7	35.4	12.4	40.8	20.7
2003	W	F	CORC	l	33	3	1749.5	46.7	12.5	41.7	20.7
2003	W	F	JACK	l	34	3	1161.8	31.0	10.9	39.6	21.2
2003	W	F	CORC	c	2	1	768.2	20.5	15.9	40.8	21.1
2003	W	F	JACK	l	4	1	366.4	9.8	12.4	39.8	21.9
2003	W	F	BASS	l	8	1	1440.2	38.5	11.9	41.4	20.3
2003	W	F	WM82	l	11	1	.	.	13.1	40.9	20.3
2003	W	F	JACK	e	15	2	1799.0	48.0	15.0	41.6	21.0
2003	W	F	BASS	c	18	2	1258.1	33.6	12.8	41.7	20.6
2003	W	F	WM82	e	21	2	1539.5	41.1	15.8	41.1	20.5
2003	W	F	CORC	c	22	2	1633.4	43.6	12.5	42.0	20.4
2003	W	F	BASS	l	25	3	537.6	14.4	12.8	40.8	21.0
2003	W	F	WM82	e	28	3	1955.5	52.2	14.2	41.7	21.3
2003	W	F	CORC	c	31	3	1686.2	45.0	12.6	42.4	19.9
2003	W	F	JACK	c	36	3	1521.5	40.6	12.2	44.2	21.2

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