1983

SEED PRODUCTION RESEARCH

AT OREGON STATE UNIVERSITY USDA-ARS COOPERATING

Edited by Harold W. Youngberg

Contents

Department of Crop Science Ext/CrS 50 **11/83**

Introduction

Ronald E. Welty

The Pacific Northwest produces more than two-thirds of the 594 million pounds of grass and legume seed produced each year in the United States. The farm value (to the Pacific Northwest) is estimated to be $143 million annually. Of the U.S. production, Oregon produces 57%, Idaho produces 5.4%, and Washington produces 5%. These seeds are marketed in every state; are exported to more than 60 foreign countries; provide pasture and hay to feed livestock; revegetate rangelands and road banks; and establish and maintain turf in lawns, golf courses and athletic fields. Forages are also involved in management schemes that reduce air and water pollution and reduce energy consumption.

To meet these needs, it is necessary to maintain efficient production; reduce losses caused by weeds, insects, and diseases; and insure an adequate knowledge and technological base for efficient seed harvesting and conditioning. These objectives are accomplished by federal and state agencies and private industry. The spirit of cooperation among the growers, research scientists, extension personnel, and members of the seed industry contributes to the success of the programs.

This is the second year of publishing, in this form, seed production research at Oregon State University by U.S. Department of Agriculture-Agricultural Research Service and OSU personnel. These reports summarize briefly the results of current research and the status of work in progress. The research and extension staff appreciate the support, encouragement and funding received from the many closely related agencies, including federal and state sources, Oregon Department of Environmental Quality, Field Burning fund, Seed Council Research Committee, Oregon Seed Trade Association Research Committee, Oregon Seed Growers League and the various Commissions.

It appears likely that USDA-ARS will construct and staff a National Forage Seed Production Research Center on the OSU campus. OSU was selected because it is close to grass and legume seed production areas, seed conditioning plants, and seed companies. Also, scientists and support staff are available within USDA-ARS and on the OSU campus to provide additional opportunities for cooperation. If Congress authorizes funding, support will come in two proposals. The first calls for building an office-laboratory building (12,500 sq. ft.). The estimated cost of construction is $3.2 million. The second proposal will authorize additional resources to increase the support to the present staff of USDA-ARS scientists, and to support the new programs to be housed in these facilities.

If funds for the first proposal are appropriated by Congress in this fiscal year, completion of the buildings is expected by October 1, 1986. If funds are appropriated for Phase II, research will be expanded with 10 new projects, 5 to be located at Corvallis, and 5 to be located at other locations throughout the Pacific Northwest. The addition of these projects is expected to increase the efforts presently devoted to legume seed production research.

Detection of the Endophyte in Tall Fescue Seed [1]

Ronald E. Welty, Mark D. Azevedo, and Kathy L. Cook

Endophyte fungi (*Epichloe typhina* = *Acremonium coenophialum*) in cool-season grass has been known since the early 1900's, but only recently has its association with tall fescue been linked with poor livestock gains in southeastern USA. The problem is more severe in hot weather (July, August, September) and the disorder in cattle has been called "summer syndrome." The primary mode of transmission of the fungus is by seed, and seed infection can be detected by staining the fungus and examining crushed seeds under the microscope at x 100 to x 400 magnification or by enzyme-linked immunosorbent assay (ELISA).

Planting endophyte-free seed offers an important method for controlling the disorder. We have been evaluating both detection procedures, in cooperation with the Oregon Department of Agriculture, and have examined more than 150 seed lots of tall fescue (both public and proprietary cultivars) using the seed strain method. Endophyte infection levels in these 150 seed lots ranged from 0-100%. In a survey of 64 seed lots of Fawn, Alta, and Kentucky-31 from the 1981 and 1982 harvest submitted to the Seed Laboratory Oregon State University, 49 (77%) were at or below 5% infection. Of the 15 seed lots with the seed-infection level exceeding 5%, 8 were Kentucky-31 (Table 1).

Table 1. Detection of endophyte infection in 64 seed lots of tall fescue harvested in 1981 and 1982.

Percent	Seed lot (cultivar)		
infection*	Ky-31	Alta	Fawn
0	2	11	27
1-5	1	7	1
6-10	1	6	0
11-20	3	0	0
21+	4	0	1
Total	11	24	29

* Percent infection based on staining and microscopic examination of 50 seeds per seed lot.

Evaluation of methods of rapid endophyte-detection in seed will continue. An accurate sampling procedure is being developed in cooperation with the Department of Statistics, Oregon State University, to establish how many seeds must be examined to base an accurate estimate of the endophyte content in tall fescue seed lots. This information is vital if Oregon-produced tall fescue seeds are to be used to establish or renovate the estimated 35 million acres of tall fescue pastures in the southeastern United States.

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[1] *Research done in cooperation with the Oregon Agricultural Experiment Station.*

Suggested Guide for Use of Pheromone Traps in Grass Seed Fields

James A. Kamm, USDA-ARS

Increased use of sex pheromone traps to monitor pests of grass seed fields has raised a number of important questions concerning interpretation of trap captures. The extent to which pheromone trap catches reflect population density depends on the time of capture in the seasonal cycle, weather, behavioral modes of the insect, and population density. The following is a discussion of the factors that influence trap catch and suggested guidelines for trap use. The end result will be a meaningful measure of population density.

(1) **Seasonal Flight** - Traps must be used at precise time in the seasonal flight to assess population density. For example, sod webworm (cranberry girdler) traps should be in the field during June 10-20 and sprays applied between June 15-20 in an average year. If traps are placed in the field too early, few moths will be caught and later large numbers will be caught but it will be too late to apply a spray because females have laid a large number of eggs.

(2) **Weather** - Moths do not respond well to pheromone traps during cold, windy, or rainy weather. Trap data obtained during inclement weather are of no use in assessing pest density and should be discarded.

(3) **Grass Variety** - Substantial variation exists in susceptibility of grass varieties, and the constant change in the varieties grown for seed make it difficult to evaluate susceptibility of each to insect attack. In general, varieties that are surface feeders are more susceptible to attack (for example, Merion) than deep-rooted varieties (Newport). All varieties should be considered susceptible and included in monitoring programs until the variety in question proves to be resistant or susceptible.

(4) **Trap Placement** - Field history of past infestations is helpful in deciding to use pheromone traps. For example, some fields of orchardgrass have never had an infestation of sod webworm or billbugs whereas some fields rarely escape infestation. Keeping records of infestations and the performance of any control measures used will help in making better pest management decisions. Traps should be placed in the field where damage usually first appears such as the top of well-drained ridges and well-drained soils. Low wet areas in the field usually escape damage.

(5) **Number of Traps** - Two traps will adequately monitor a 40-acre field. Traps should be moved daily to different areas in the field. When two traps are moved daily for 5 days, trap counts are obtained from 10 areas in the field and provide an adequate sample to evaluate population density, excluding periods of inclement weather.

(6) **Averaging Trap Captures** - On any given day, six traps placed at different locations in the field may result in large differences in the number of moths captured. These differences are due to variation in population density at different locations in the field. However, the same six traps may be higher or lower in the number of moths captured the following day, even during favorable weather. Favorable weather for mating results in large numbers of moths that successfully mate. The following day, even though the weather is favorable, fewer moths may be captured because males that mated the previous day require a day to recover. Therefore, it is important to average trap catches to obtain meaningful information. When these procedures are followed, it is virtually impossible for a potentially damaging infestation to escape detection with pheromone traps.

Comparison of Four New Herbicies for Control of Grass Weeds in Creeping Red, Chewings, and Hard Fescue Raised for Seed

Orvid Lee, USDA-ARS

A number of experiments were conducterd in 1982-83 to compare the effectiveness of Poast (sethoxydim), Fusilade (fluzifop-butyl), HOE 00583 (fenthiaprop-butyl), and Dowco 453 (haloxyfop-methyl) in controlling problem weeds in fescues and to evaluate their effect on fescue growth and seed production. Experiments in northeastern Oregon were aimed at downy brome control, whereas creeping velvetgrass and bentgrass were the main weed problems in western Oregon. Rates of application ranged from 0.12 to 0.5 lb/A and applications were made at several different dates during the period from November through mid-March.

In experiments conducted in northeastern Oregon, all of the herbicides gave complete control of downy brome when applied at 0.5 lb/A in November. When applied at 0.25 lb/A, Poast allowed a few plants to escape but the other herbicides showed complete control. When applications were delayed until March, Poast, Fusilade and HOE 00583 all allowed some downy brome to escape at the 0.25 lb/A rate. At 0.5 lb/A, only Poast failed to give complete control. Dowco 453 controlled all downy brome at both rates and both dates of application. Dowco 453 caused significant reduction in seed production at both rates of application when applied in March but had no effect when applied in November. The other herbicides did not affect seed production.

In an experiment designed to compare the tolerance of three creeping red, three chewings, and three hard fescue varieties to the four herbicides, applications were made in November or March to grasses that were planted in September with irrigation. In this experiment, Dowco 453 showed slight injury to the fescues when applied at 0.37 lb/A in November and moderate injury when applied at 0.5 lb/A. When applied in March, Dowco 453 caused slight injury at 0.5 lb/A. None of the other herbicide treatments caused injury to any of the fescues at any rate or date of application.

In experiments comparing the effectiveness of these herbicides for control of creeping velvetgrass and bentgrass, it was found that Dowco 453 showed excellent control of both species at all dates of application. In most experiments, control was complete at 0.5 lb/A and near complete at 0.25 lb/A. Poast gave good control at 0.5 lb/A but was somewhat less effective at 0.25 lb/A. Fusilade was consistently less effective on these species than Poast at both rates of application. HOE 00583 showed little control of either creeping velvetgrass or bentgrass. In experiments where seed yields were determined, seed yields were usually significantly higher than the untreated check on plots treated with Poast, Fusilade, or Dowco 453. This increase was due to less competition from the velvetgrass and bentgrass.

In addition to controlling downy brome, creeping velvetgrass, and bentgrass, these herbicides also control many other grasses which are a problem in fescue seed crops, such as annual ryegrass, perennial ryegrass, orchardgrass, tall fescue, and Kentucky bluegrass. None of these herbicides control rattail fescue and only Dowco 453 controls annual bluegrass. Thus, in many situations, these herbicides would have to be used in combination with another herbicide which would control rattail fescue and annual bluegrass.

An application was submitted to the Oregon State Department of Agriculture on October 11, 1983 for registration of Poast to be used in creeping red, chewings, and hard fescue seed crops. Thus, it is hoped that the herbicide will be registered in time for use this winter. Although Dowco 453 was consistently better than the other three herbicides in controlling weeds and showed adequate safety when applied in the fall or winter, it is not as far along in its commercial development as Poast or Fusilade and thus will not be registered for any use for at least another three to four years. While it is not presently available, it shows potential for use when it does become commercially available.

Leaf and Head Blight of Orchardgrass[1]

Ronald E. Welty and Mark D. Azevedo

A serious disease of orchardgrass was observed in the Willamette Valley in 1981 (personal communication, P.A. Koepsell and H.W. Youngberg) and again in 1983. The cause has not been identified, but field trials with fungicides have resulted in small increases in yields. This suggests that the disease is caused by a fungus or a group of closely related fungi. Warm winter temperatures and higher-than-normal rainfall have been associated with the occurrence of the disease, but more research is needed to determine the cycle of the disease, how environment influences disease severity, and effective methods of control.

Blighted plants were collected in spring and summer from several locations in Linn and Benton Counties. Tissue was cultured and a fungus was isolated that induces crown and leaf lesions in healthy plants. Further testing is needed to determine if this fungus is the cause of the leaf and head blight disease.

Eight orchardgrass entries in the *Orchardgrass Variety Seed Yield Trial* established at Hyslop Field Laboratory were evaluated 1-5 for disease severity on 3 dates in 1983 (13 June, 29 June, 15 July). Disease severity increased in all varieties as the season progressed (Table 1).

Table 1. Leaf and head blight severity in orchardgrass, 1983.

	Disease severity (0-5) [1]		
Entries	13 June	29 June	15 July
Hay King	0 a[2]	2.0 ab	3.3 b
Mobite	0 a	1.3 a	3.0 a
Cambia	0.3 a	2.5 bc	3.3 b
Frontier	0.3 a	3.0 c	4.0 c
PSO-19	0.3 a	3.3 cd	4.0 c
Potomac	1.8 b	4.3 ef	5.0 d
PSO-18	2.5 b	4.0 de	5.0 d
Hallmark	4.3 c	5.0 f	5.0 d

[1] 0 = no disease
1 = light, (1-10%)
2 = light-moderate, (11-25%)
3 = moderate (26-75%)
4 = severe, (76-90%)
5 = very severe (91-100%)

[2] Numbers in same column with similar letters are not significantly different (P = 0.05), Duncan's new multiple range test.

The disease was most severe in Hallmark, Potmac, and entry PSO-18 and least severe in Mobite, Hay King, and Cambia.

Field plantings of orchardgrass were established in the fall of 1983 at Hyslop Field Laboratory to evaluate fungicide control and to evaluate 10 cultivars (based on 1983 acreage figures) for disease severity.

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[1] *Research done in cooperation with the Oregon Agriculture Experiment Station.*

Seed Conditioning Research [1]

A.G. Berlage, P. Krishnan, D.M. Bilsland, and T.M. Cooper (USDA-ARS)

The importance of seed for the production of food, fiber, and shelter is well known. Seed production in the U.S. is valued at more than 2 billion dollars anually. Seed crops tend to be dynamic in their annual variations thus creating new conditioning problems each year. These problems arise in crop seeds such as forage, turf, vegetable, legume, cereal, flower, tree, and petro-chemical substitutes.

There is much intuitive information within the seed conditioning industry, but there is very little quantitative information for basic physical properties including shape, resilience, density, electrostatic, ultrasonic, and reflectivity. Since these data are not available in the literature, we are doing research to develop this type of information on the currently unexplored properties. Physical property data are needed for modeling separation systems in order to predict the separation potential for a given mixture of crop seed and unwanted components.

Our present and future research includes germination improvement studies, a new separation method using a magnetic fluid, analysis of vibrating decks, study of the electrical properties of seeds, an object-recognition system using electronic vision technology, and investigating other new technologies for seed conditioning.

Germination Improvement Studies

Seeds that are precision planted (in specific intervals) to optimize productivity require high germination rates if the practice is to be successful. Seeds so planted, which are incapable of germination, waste irrigation water, fertilizer, and energy.

One of the areas of current research is to improve germination percentages within various lots of seed including vegetable, tree, legume, and flower seeds. An approach to this problem is to determine a technique to remove seed that is incapable of germinating (for any of several reasons) by some seed separation method. The cataloging of the physical properties of the seed that may contribute to nongermination is of primary concern. Physical properties such as size, shape, density, volume, electrical conductivity, and moisture content may be effectively measured and recorded using modern equipment such as a computer-aided image processing system, a stereopycnometer, and a nanocoulombmeter. Once the data are recorded, physical properties relating to low germination may be determined and appropriate equipment can be developed and tested.

Another approach to improve the germination percentage of legume and flower seeds is to develop effective scarification techniques. Many types of plants produce seeds that are excessively hard. They are living but resist germination. Scarification refers to the process of scratching or otherwise changing the seed coat so that moisture may enter to initiate germination. Current research emphasizes the controlled scarification of seeds to increase germination without damaging the seed.

Another approach would be to use the "incubation, drying, and separation" (IDS) technique for improving germination. This technique is used to identify dead seeds. Dead seeds are those seeds that are filled but do not germinate. During the incubation period, both dead and live seeds absorb moisture. When the incubated seeds are dried, the live seeds dry more slowly than the dead seeds. This brings about a difference in weight between live and dead seeds. This physical property might be used to make a separation. This technique has been used in Sweden to improve tree-seed germination and may be appropriate for improving forage, agricultural, and vegetable seed germination.

Separation Using Magnetic Fluid

We are using a magnetic fluid to remove contaminants from crop seeds and to improve the germination of the seed lots. This magnetic fluid is an aqueous colloidal suspension of submicron-sized magnetic particles in a carrier fluid (such as water) with a dispersing agent to prevent flocculation.

The seed - contaminant mixtures separated are bentgrass - soil particles, Bermudagrass - soil particles, white clover - soil particles, and onion - flower parts (white caps). The phytosanitary soil tolerances for seeds to be exported range from 0 to 0.03% by weight. Many seed lots contain greater than 0.03% soil particles after normal conditioning. Soil particles sorb the magnetic fluid more readily than seeds. When the magnetic-fluid treated seed - contaminant mixture is passed over a magnetic (permanent or electromagnetic) drum separator, two fractions, magnetized (contaminated) and nonmagnetized (clean), are obtained. The soil particles are contained in the magnetized fraction. The crop seeds are contained in the nonmagnetized fraction.

We have carried out a study using magnetic fluid to improve the germination of onion seed lots. We have been successful in removing small and shriveled onion seeds from the seed lot thereby improving the germination. This magnetic fluid also works well in removing giant-Bermudagrass and sprangletop from Bermudagrass seeds.

Analysis of Vibrating Decks

Our new approach to scaling up the vibratory separator is to study the mechanism of separation. Using waveform analysis of the deck motion to obtain better knowledge of the vibration components, we can better explain the motions of seeds and the separation process.

Our studies of the particle motion with high-speed film techniques have shown that both resilience and shape factors are important in the separation process. The film also showed that the seed receives an impulse from the oscillating deck rather than riding the deck as in the case of the lower frequency oscillating conveyors.

Electrical Properties of Seeds

Very little has been published in the literature regarding d.c. electrical properties of seeds. This information is necessary for electrostatic seed separation research. Some seeds and contaminants are good conductors while others are poor conductors. There is a need to quantify the mobile and immobile charges of the various seeds. The mobile charges together with the immobile charges comprise the total charge on the seeds. These charges are influenced by humidity and temperature. A nanocoulomb meter will be used to measure charges on the seeds. This research may lead to new methods for removing contaminants from crop seeds and also to grade seeds based on viability and germinating ability.

Object Recognition System Research

We are using a state-of-the-art machine vision system in our object recognition research program. Algorithms are being developed to allow the vision system to identify differences between difficult-to-separate crop seeds and contaminants.

Other New Technologies

By utilizing modern sensing and control technology, we will be able to develop on-line monitoring, feedback systems, and control methods for the entire conditioning system. With improved sensors, we will have research tools to better define the differences in physical properties not now being utilized.

Another proposed area of related research involves the interaction of much higher frequency ultrasound with seed. Through a technique much like the spectroscopy of chemistry, an on-line ultrasonic purity monitor may be developed that would allow a seed conditioner to dynamically adjust the conditioning process based on the contamination level of the process feed stock.

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[1] Research done in cooperation with the Oregon Agricultural Experiment Station.

Lesion Nematodes in Kentucky Bluegrass[1]

Ronald E. Welty and Gene B. Newcomb

The first lesion nematode was collected from a meadow in England in 1880. Harold Jensen identified Kentucky bluegrass as a host for the lesion nematode in 1953, and most research with nematodes and grasses has been done with turf, usually golf and bowling greens and lawns. In field plantings, damage may occur, but not be apparent because good crop management may mask symptoms. Good crop management also promotes large populations of nematodes, and symptoms may appear only in times of stress.

In June and July 1983, visits were made to stunted seed fields of Kentucky bluegrass in Union County. Assays of roots and soil revealed 16 of 18 samples contained nematode populations that exceeded the minimum threshold population needed to cause root damage (1,500 nematodes per qt. of soil), and 12 of the 18 samples contained 2,800 to 9,300 nematodes per qt. of soil.

Research is needed to assess nematode problems, identify nematodes involved, establish a relationship between population densities and seed yields, and evaluate methods for successful and economical control.

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[1] Research done in cooperation with the Oregon Agricultural Experiment Station.

Meadowfoam Crop Development

Gary Jolliff

The objective of this research program is to develop an alternative crop adapted to the poorly drained soils of the Willamette Valley that are currently growing grass seed crops. The wild meadowfoam plant *(Limnanthes alba)* has been domesticated at Oregon State University during the past 17 years. Oil extracted from the seed has some unique characteristics that give it many potential uses. Samples of oil extracted from seed grown in research plots since 1980 have been used in industrial utilization trials. Several companies have tried the oil in experimental runs of commercial processes. One Japanese firm has ordered several thousand pounds of oil for trial use in cosmetics in 1984-85.

A modest research effort has been started in 1983-84 to focus on an increased seed yield level and stability in meadowfoam. Trials are in progress to establish management systems for the plant.

This research is partially funded by the Oregon Department of Environmental Quality Field Burning Research Fund.

Grass Variety Seed Yield Evaluation

H.W. Youngberg, W.C. Young III and D.O. Chilcote

The second harvest of the pilot grass seed yield evaluation program was completed in 1983. The program objective is to obtain data on the relative seed yield of new varieties under Oregon conditions and observe any other factors that may impact their performance. This information is of value to producers, plant breeders, and others interested in optimizing the financial return from seed production. The planting provides leads to help identify plant characteristics useful in identifying productive genotypes.

One hundred forty-six entries were included in the trial, which was established in the spring of 1981. Perennial and Italian ryegrass, Chewings and red creeping fescue, hard fescue, Kentucky bluegrass, orchardgrass and tall fescue varieties were included. Results of the 1982 and 1983 harvests are presented in reports "Forage and Turfgrass Variety Seed Yield Trial - 1982", Ext/CrS 43 and "Forage and Turfgrass Variety Seed Yield Trial - 1983", Ext/CrS 49. Copies are available from County Extension Offices and the Crop Science Department, Oregon State University.

A new program of variety evaluation for seed yield has been established in 1983. This program is on a self supporting basis. Information is available from the Crop Science Department.

Ryegrass Variety Identification

Janet M. Ferguson and D.F. Grabe

New ryegrass varieties are continually being developed to add to the range of genotypes already in existence. The Plant Variety Protection Act of 1970 calls for a precise description of these plant varieties, but many of the new varieties lack distinguishing morphological characteristics necessary for proper identification. The development of laboratory procedures for variety identification will be useful not only for variety protection but also for seed certification and consumer protection.

Seed lots from several varieties of annual, perennial, and intermediate ryegrass will be obtained from seed companies and from the Seed Laboratory at Oregon State University. Varieties will be grouped into categories based on their response to various morphological, chemical, and biochemical tests.

Morphological tests will include seed weight, seedling coleoptile color, growth pattern, and heading date.

Phenol and fluorescence tests will be analyzed and the varieties cataloged by frequency distribution within seed lots.

Electrophoresis banding patterns will be determined for seed and/or plant materials. Investigations will be made using general proteins and specific isoenzymes known to exist in ryegrass.

The results of all tests will be compiled into an identification key where new varieties can be tested and added as needed. The tests could also be used to determine if any changes have occurred in the original breeding material or if a field is still producing certified seed of a particular variety.

This research is partially funded by a grant from Agriculture Service Corp.

Establishing Red Fescue with Cereal Crops Using Intercropping Systems

Thomas G. Chastain and D.F. Grabe

Intercropping is the production of two or more crops, such that most, if not all, of their growth overlaps in time and space. Intercropping, when used to establish perennial grass seed crops using cereal crops, is also known as undersowing, cover cropping and companion cropping. In Europe, this system has proved to be a reliable method of perennial grass seed crop production, especially in situations where no seed crop is produced in the establishment year.

The use of this system would enable the grower to recover income lost in the establishment year by the production of a cereal crop. Previous studies have indicated depressed yields of the initial seed harvest due to the competition provided by the cereal crop in the establishment year followed by normal yields in subsequent years. The objective of this study is to investigate cultural practices that would reduce this competition to a minimum level and therefore would result in increased seed yield in the initial year with the possibility of greater long-term income than that which is attained using monocultural methods (Table 1).

Table 1. Comparison of grass seed crop establishment using intercropping and monocultural methods.

Year	Intercropping	Monoculture
1. Establishment	Cereal crop harvested	No crop harvested
2. Initial seed harvest	Seed crop harvested	Seed crop harvested
3. Second seed harvest	Seed crop harvested	Seed crop harvested

In this particular project, Pennlawn red fescue was established using two wheat varieties, Hill 81 and

Yamhill, and two barley varieties, Hesk and Scio, as cover crops. The red fescue was carbon-seeded in east-west oriented rows with a 12-inch row spacing and cereals were seeded in north-south rows with 6-, 12-, 18-, and 24-inch row spacings. This experiment was planted at Hyslop Farm in October 1982, with a duplicate experiment planted in October 1983.

The following are some preliminary results of this investigation in the establishment year. Soil moisture content in intercropped plots is equal to or, in many cases, greater than that found in monocultural plots at all except the deepest part of the profile sampled, where differences were not significant between the treatments. Cereal yields are reduced by the competition with red fescue (no data available for 12-inch plots due to mechanical difficulties) as shown in Table 2.

Table 2. 1983 Cereal Yields (lbs/a)

Variety	Row spacing (inch) 6	18	24
Hill 81	3567	4064	3368
Yamhill	4254	3515	3192
Hesk	3443	3039	2154
Scio	3668	3248	2614

Rate and Time of Spring-Applied Nitrogen on Linn and Pennfine Perennial Ryegrass

W.C. Young III, H.W. Youngberg, and D.O. Chilcote

Investigation continued in 1982 to determine how spring nitrogen management influences the total number of tillers which produce seed heads. Treatment number was expanded to include every possible combination of four nitrogen rates: 0, 55, 80, 110 lb/a, at two times of application: vegetative and spikelet initiation. Treatments were applied to both Linn and Pennfine perennial ryegrass and were replicated six times. A factorial analysis of variance was used to examine treatment effects. The primary objective was to examine how rate of nitrogen, applied in relation to distinct morphological stages of crop development, affect the yield components of perennial ryegrass. Early nitrogen treatments were timed before the onset of reproductive development (during vegetative growth) and compared with a later application date following the transition to reproductive development.

Nitrogen applied at the vegetative stage to Linn perennial ryegrass increased the total number of tillers in the stand at anthesis, but had no effect on the number of inflorescences at harvest due to a reduced percent fertile tiller survival (Table 1). Furthermore, nitrogen application at the vegetative stage had no influence on the number of florets per spikelet; however, the influence of nitrogen at spikelet initiation was found to be very important in filling all of the spikelets throughout the length of the spike, although no significant increases were observed for rates greater than 80 lb/a (Table 2). Additionally, floret site utilization (the ratio of actual seed number harvested to the number of potential seed sites) is improved by later application of nitrogen. Although no significant difference in seed yield resulted, Table 3 presents the influence of early, late, and split-spring nitrogen applications on yield components. Nitrogen applied vegetatively increased the fertile tiller number, but the number of seeds per tiller was reduced due to yield component compensation. Thus, it appears that competition between a fewer number of tillers during seed filling may result in a more efficient development of the biological yield potential of each individual tiller.

Table 1. Influence of spring nitrogen applied vegetatively to Linn perennial ryegrass. 1982.

Veg. N	Tillers/ft² Anthesis Total	Anthesis Vegetative	Maturity Fertile	Fertile tiller survival[1]
(lbs/a)				(%)
0	229	35	214	93.45
55	262	41	224	85.50
80	248	46	224	90.32
110	267	47	224	83.90
LSD .05	28	N.S.	N.S.	-

[1] Calculated using treatment means as shown:

$$\frac{\text{Fertile tillers/ft}^2\text{ at harvest}}{\text{Total tillers/ft}^2\text{ at anthesis}} \times 100$$

Table 2. Infuence of spring nitrogen applied after spikelet initiation to Linn perennial ryegrass. 1982.

N at S.I. (lbs/a)	Florets per spikelet Bottom	Middle	Top	Mean
0	6.4	7.5	5.3	6.4
55	7.3	8.3	5.8	7.1
80	8.0	8.9	6.3	7.7
110	8.1	9.0	6.2	7.8
LSD .05	0.46	0.44	0.43	0.4

Table 3. Characteristics of selected high yielding treatments in Linn perennial ryegrass. 1982.

Treatment Veg N + S.I.N.	Fertile tillers/ft² at harvest	Seeds per tiller	F.S.U.	100 seed weight	Seed yield
(lb/a)			(%)	(g)	(lb/a)
110 + 0	297	152	23.9	1.71	1600
0 + 80	201	172	33.6	1.50	1610
55 + 55	241	167	24.8	1.71	1573

In addition, when the tiller population is greater, individual tillers are frequently smaller and more likely to lodge early, which hinders the processes of pollination and seed filling.

In Pennfine perennial ryegrass, there was no significant effect on fertile tiller number at maturity due to nitrogen treatments. Although nitrogen applied during vegetative development did increase the total tiller number at anthesis, the population was comprised of more vegetative tillers. Nitrogen applied after spikelet initiation, had no significant effect on tiller number at anthesis; however, at least 55 lb/a were necessary to maintain the number of florets per spikelet. Seed yield data indicated that split application of spring nitrogen was most beneficial, as yield was decreased when all nitrogen was applied early, and also when all was applied after spikelet initiation.

In conclusion, there is no apparent benefit from spring nitrogen rates greater than 110 lb/a. Furthermore, future improvements in seed yield must be directed toward better utilization of the yield potential during seed filling through reduced or delayed lodging and improved fertile tiller survival.

Cooperative Studies in Assessing Potential in Orchardgrass Seed Production

R. Luedtke, I.T. Carlson, H.W. Youngberg, and W.C. Young, III[1]

Plant breeders in public and private programs have an interest in developing breeding lines with high seed production potential without sacrificing other desirable characteristics. The OSU project cooperates with these programs whenever possible to improve opportunities for seed production within Oregon. A project with Iowa State University is an example of this cooperation.

Clones, polycross progenies, populations, and synthetics, selected for forage characteristics in Iowa, were evaluated for seed production and related traits at locations near Ames, Iowa and Corvallis, Oregon.

Significant correlations for certain factors indicate that early maturity, high seed yield/panicle, high fertility index, and high 100 seed weight offer promise as traits that can be used to select clones in Iowa for satisfactory seed production in Oregon.

These conclusions will help plant breeders in consuming areas select for characteristics that will contribute to higher seed yields in seed producing areas.

[1] *A cooperative project with Iowa State Univ. and Oregon State Univ.*

Improving the Tetraploid Level of Ryegrass Seed Lots By Seed Conditioning

Ivan Hagen and Don Brewer

Some tetraploid annual ryegrass varieties produced in Oregon contain excessive amounts of diploid annual ryegrass. Failure to meet the high quality standard results in a loss of revenue and marketing sub-standard seed reflects unfavorably on Oregon-grown seed generally.

A study was undertaken to determine the potential for increasing the tetraploid percentage of a seed lot during seed conditioning. Stained Oregon annual ryegrass seed was added to samples of pure tetraploid annual ryegrass, then screened through a 4 X 22 wire screen. The result of this trial was favorable and a more extensive study was undertaken using tetraploid seed of several varieties. Seed samples were planted in grow-out plots in May 1983. Chromosome tests were also performed on some of the samples.

Results of the test indicate that few diploid seed were found in seed remaining on the 4 X 20 screen. Diploids were heavily concentrated in the portion which passed through the 4 X 22 screen.

Screening of seed lots to concentrate tetraploids and upgrade quality was successful in this trial. Careful screen size selection may be a very important technique for the seed conditioner to concentrate the smaller diploid seeds, thus upgrading a marginal tetraploid seed lot. Additional investigation is needed to determine the correct screen size and other adjustments to increase the efficiency of this technique in a commercial operation.

Role of Growth Regulators in Seed Production

D.O. Chilcote

Growth regulators, both promoters and inhibitors, are used effectively in many agricultural production systems. Aside from cereal crops in Europe, however, little attention has been directed toward the use of such compounds in seed crops. Certain growth regulators, and in particular growth retardants such as cycocel (CCC) and Cerone, have been studied on a limited basis for use in improving the production efficiency of seed crops including grasses and legumes.

Recently, a new class of growth retardant compounds which are soil active materials instead of foliar absorbed, have shown much promise for enhancing yield in grass seed crops, both in Europe and the U.S., and due to their universal dwarfing effect, may have benefit in other crops as well. These compounds, Parlay[1] (PP-333) from ICI and EL-500 from Elanco, have been tested for efficacy in grass seed and cereal crop production. Tests on other crops have also been conducted. One of these compounds, Parlay, has received more extensive testing and has shown sufficient promise to be considered for experimental use on certain grass seed crops in 1984. It was, therefore, desirable to evaluate the available growth retardant compounds for potential use in different seed crops and to develop guidelines for utilization in management systems. The following reports summarize some of the significant results from tests conducted in 1983.

[1]Parlay is a registered trade mark of ICI. The use of a trade name does not imply recommendation of the product.

The Effect of Parlay on Vegetative Growth and Development in Annual Ryegrass

J.L. Hunter, D.O. Chilcote, and H.W. Youngberg

The plant growth regulator Parlay (PP 333) has been used to enhance seed yield in perennial ryegrass. The primary effect of Parlay treatment during early reproductive development is to decrease stem length, increase stem strength, and to prevent or delay lodging. The effect of pre-reproductive treatment has not been examined since field tests have shown such treatments to be less effective in enhancing seed yield. The purpose of this study was to examine the impact of Parlay treatments upon early growth and development in ryegrass. This experiment was conducted in a growth chamber under controlled conditions using Gulf annual ryegrass.

Annual ryegrass seeds were germinated and uniform seedlings selected. These seedlings were transferred to trays filled with perlite and placed in a growth chamber where they were grown with a 10 hour daylength at a constant temperature (60° F). Nutrients were provided by watering with Long Ashton's nutrient solution. Plants were treated with Parlay at two rates (0.45 and 0.89 lb ai/a) in the granular formulation at the five tiller stage. After six weeks of continued vegetative growth the perlite was removed from plant roots and measurements were recorded.

Both treatments produced similar results which differed only in magnitude. Parlay applied at the vegetative growth stage increased tiller number with increasing rate. Leaf area was reduced by treatment with .45 lb/a but was not changed by a higher rate (Table 1).

Table 1. Effect of Parlay treatment on vegetative development in Gulf annual ryegrass.

Parlay rate	Tiller no	Leaf area	Root/ shoot	Shoot wt	Root wt	Length	
						Tiller	Root
(lb/a)		(sq cm)		(g)	(g)	(cm)	(cm)
0.00	9.3	161	.211	.422	.0864	5.50	18.9
0.45	15.5	105	.243	.328	.0799	1.64	18.3
0.89	20.4	103	.257	.344	.0850	0.85	20.3

Root growth and development did not appear to be significantly affected by Parlay treatment. Leaf area, tiller length, and shoot weight were significantly decreased. Root weight and root length were relatively unchanged. This explains the increased root/shoot ratio. Increasing rates of Parlay decreased shoot weight without effecting root weight.

Parlay treatments can affect vegetative plant growth and development in several ways when applied at early stages of the plant's development. When applied for control of lodging, therefore, consideration must be given to timing and rate of Parlay applications. The control of tillering and leaf area provided by Parlay may also prove useful in crop production as we learn more about these processes.

Acknowledgements: This research was partially funded by ICI Americas.

Effect of Parlay Growth Retardant When Combined with Varying Spring Nitrogen Management on Pennfine Perennial Ryegrass

W.C. Young, III, D.O. Chilcote, and H.W. Youngberg

Varying the time and rate of spring nitrogen application is known to alter the tillering pattern of Pennfine perennial ryegrass. Spring nitrogen stimulates the development of numerous spring-formed tillers, causing competition among developing reproductive tillers and increased lodging. Thus, we chose to study the potential of using Parlay (PP 333) growth retardant to control lodging, improve tiller survival, and increase the number of inflorescences per unit at harvest. Since seed yield in grasses is a product of the number of inflorescences, seeds per inflorescence, and weight per seed, a significant gain in efficiency should result from the combined use of spring nitrogen and Parlay growth retardant.

Treatments were a factorial arrangement of spring nitrogen before the onset of reproductive development (VEGN) and after the transition to reproductive development (SPIN), at 55, 110, and 160 lbs/a of actual nitrogen as 34-0-0, and Parlay growth regulator at 0.45 and 0.67 lb/a.

The total number of tillers at peak anthesis was significantly increased by higher rates of spring nitrogen; there was no difference due to time of nitrogen application. However, the percentage of fully emerged spikes was improved slightly by applying nitrogen during vegetative development, thus a reduced percentage of vegetative tillers occurred. Increased rate of nitrogen reduced the percentage of fully emerged spikes at anthesis due to an increased number of late developing reproductive and vegetative tillers. The influence of Parlay was to decrease the percentage of vegetative and late developing reproductive tillers in the stand. There was no significant difference between 0.45 and 0.67 lb/a of Parlay in the increased percentage of fully emerged spikes. The interaction of rate of spring nitrogen and rate of Parlay on the number of inflorescences at maturity is shown in Table 1. Furthermore, Table 1 shows that the increased number of inflorescences with 0.45 and 0.67 lb/a Parlay at higher nitrogen rates is a result of very low tiller mortality between anthesis and maturity. Additional yield component data disclosed an increase in spikelets per spike when nitrogen was applied at the vegetative stage and an increase in florets per spikelet when 0.67 lb/a Parlay was used with higher rates of spring nitrogen applied after the transition to reproductive development.

Table 1. Interaction of spring nitrogen rate and Parlay growth regulator on the number of inflorescences at maturity, and the mean percent tiller survival as influenced by rate of Parlay on Pennfine perennial ryegrass. 1983.

Parlay Rate	Inflorescences at maturity N (lbs/a) 55	110	160	Tiller survival
(lb/a)	(per ft²)			%
0.00	186	193	168	84.12
0.45	187	230	283	94.64
0.67	203	256	301	99.35
LSD .05	27	27	27	8.91

The actual number of seeds harvested per unit area were increased when nitrogrn was applied during vegetative development, and 110 lb/a of actual nitrogen was optimum as seed recovery percentage was reduced at higher nitrogen rates (Table 2). Rate of Parlay and rate of spring nitrogen were found to interact significantly as shown in Table 3. The number of potential seed sites (inflorescences at maturity x seeds per inflorescence) are significantly increased by both 0.45 and 067 lb/a Parlay rates.

Table 2. Effect of time and rate of spring nitrogen on the potential seed sites, actual number of seeds recovered, and the floret site utilization (F.S.U.) on Pennfine perennial ryegrass. 1983.

Treatment		Potential seed sites	Actual seeds recovered	F.S.U.
		(per ft²)		(%)
Time of N	VEGN	37,712	4,817	12.23
	SPIN	39,697	4,300	11.51
	LSD .05	NS	472	NS[1]
Rate of N (lb/a)	55	30,815	4,316	14.40
	110	38,573	5,205	13.65
	160	46,726	4,154	9.08
	LSD.05	4.534	431	1.60

[1] LSD .10 = 1.66

Table 3. Interation of spring nitrogen rate and Parlay growth regulator on the potential seed sites, actual number of seeds recovered, and seed yield data for Pennfine perennial ryegrass. 1983.

Treatment N	Parlay	Potential seed sites	Actual seeds recovered	Seed yield	% of Standard
(lb/a)		(per ft²)		(lb/a)	
55	0.00	27,623	2,572	481	-20
	0.45	30,381	5,148	954	+58
	0.67	34,438	5,228	972	+61
110	0.00	31,411	3,076	602[1]	---
	0.45	39,133	5,290	964	+60
	0.67	45,175	7,250	1,303	+116
160	0.00	31,769	2,416	515	-14
	0.45	52,308	4,490	819	+36
	0.67	56,101	5,556	1,009	+68
LSD .05 for intermeans		6,485	488	95	---

[1] Standard

Actual number of seed recovered and seed yield data both showed a significant gain from the 0.67 lb/a Parlay rate at 110 and 160 lb/a of spring nitrogen. Viewing the seed yield data as a percentage increase of a designated standard (110 lb/a of spring nitrogen and no growth regulator) emphasizes the positive interaction that Parlay has on nitrogen management. Seed yield was increased 116% over the standard by 0.67 lb/a of Parlay.

Furthermore, yield was increased 58 to 61% by applying 0.45 and 0.67 lb/a Parlay, respectively, where only 55 lb/a of spring nitrogen was used. Thus, seed producers can improve efficiency of spring-applied nitrogen by use of Parlay growth regulator.

Effect of Rate and Time of Application of Certain Plant Growth Retardants on Seed Production of Different Grass Species

W.C. Young, III, H.W. Youngberg, and D.O. Chilcote

More information is needed about the optimum rate and time of plant growth retardant application on grass seed crops. Several studies were conducted on several species at Hyslop Agronomy Farm, near Corvallis to further evaluate use of Parlay (PP-333) and EL-500 on grass seed crops.

Tall Fescue

Parlay was applied to a second year Fawn tall fescue stand at three rates (0.45, 0.67, and 0.89 lb/a) in the spring at four stages of development. Seed yield, resulting from a greater number of seeds per tiller was increased by applications during the vegetative growth stage at the lower rates (Table 1). An increase in both number of seeds per tiller and fertile tiller number contributed to higher yield at the two treatment rates. Rate or time of application did not affect 1000 seed weight. Lodging occurred only a few days before harvest; therefore, tiller mortality due to lodging in the untreated plot was not a factor.

Reduction in tiller length was accompanied by decreased dry weight and straw weight as Parlay rate increased. Lower straw weight and increasing seed yield improved harvest index by 60 percent over the untreated. Thus, in tall fescue, Parlay reduced early season growth, allowed better light penetration into the canopy, improved tiller development, and increased the ratio of assimilates partitioned to seed development.

Orchardgrass

A second year crop of Hallmark orchardgrass was treated with two rates (0.45 and 0.67 lb/a) of Parlay at four stages of development. Parlay significantly reduced total dry matter, seed yield, and number of seeds per tiller. No significant effects on these factors from varying the time of application were noted (Table 1).

Table 1. Seed yield, yield components and tiller length of Fawn tall fescue, Hallmark orchardgrass and Marshall annual ryegrass as influenced by rate and stage of growth at time[1] of application of Parlay. 1983.

Treatment	Seed weight	Fertile tillers	Seeds/ tiller	1000 seed wt	Tiller length
		FAWN TALL FESCUE			
Parlay growth stage	(lb/a)	(per ft^2)		(g)	(cm)
Veg.	1495	92.3	67.7	2.74	113
D.R.	1298	104.1	52.6	2.72	101
S.I.	1370	95.6	59.9	2.72	111
F.I.	1315	92.0	59.1	2.73	97
LSD .05	120	NS	10.4	NS	7
Parlay rate (lbs/a)					
0.00	1135	82.0	58.9	2.69	139
0.45	1596	97.6	69.4	2.72	102
0.67	1493	97.1	62.6	2.73	93
0.89	1255	107.3	47.3	2.77	90
LSD .05	120	14.7	10.4	NS	7
		HALLMARK ORCHARDGRASS			
Parlay rate (lbs/a)					
0.00	930	48	168	1.23	
0.45	863	52	146	1.23	
0.67	798	53	141	1.21	
LSD .05	95	NS	NS	0.02	
LSD .10			20		
		MARSHALL ANNUAL RYEGRASS			
Parlay Growth stage					
S.I.	800	56.2			
F.I.	988	58.5			
LSD .05	172	NS			
Parlay rate (lbs/a)					
0.00	718	44.4			
0.45	860	61.3			
0.75	1104	66.3			
LSD .05	210	18.1			

[1] Veg. = vegetative; D.R. = double ridge; S.I. = spikelet initiation; F.I. = floret initiation development stage.

Fertile tiller number was not affected by the rate or date of treatment due to the fact that lodging did not occur until one week prior to harvest, thus minimizing tiller mortality.

Delayed panicle emergence in treated plots was noted. This may have contributed to lower 1000 seed weight in the high treatment rate. Maturity was delayed 3-5 days at the higher treatment rate.

Annual Ryegrass

Annual ryegrass seed crops often produce excessive vegetative growth, particularly at high nitrogen rates. Parlay was applied to Marshall annual ryegrass at two rates (0.45 and 0.67 lbs/a) at two plant development stages.

Parlay treatment significantly delayed onset of lodging in annual ryegrass. Seed yield was increased 20 and 54 percent by Parlay treatment (Table 1) due to an increase in fertile tiller number and greater number of seed harvested per unit area.

Some yield compensation did occur due to the increase in tiller number (fewer spikelets per spike and florets per spikelet); however, the seed harvest potential did not change. Thus, the improvement in seed recovery rate (floret site utilization) is an example of significant improvement in efficiency during seed production from the use of a growth retardant. Parlay application increased the number of fully emerged spikes at anthesis and provided better conditions for seed filling by delaying and reducing the severity of lodging.

Perennial Ryegrass

EL-500 (Eli Lilly and Company) has reduced or delayed lodging in perennial ryegrass. This study was conducted to further evaluate the effects of this growth retardant on perennial ryegrass. Caravelle perennial ryegrass was treated with two rates of EL-500 (0.22 and 0.45 lbs/a) at two growth development stages.

Total dry weight was increased at the 0.45 lb/a application rate (Table 2). There was no difference in seed yield.

Table 2. Seed yield and total dry matter distribution of Caravelle perennial ryegrass in response to EL-500 treatment, 1982.

EL-500 rate	Total dry wt	Straw wt	Seed yield
(lb/a)	(ton/a)		(lb/a)
0.00	3.12	2.47	771
0.22	3.03	2.65	752
0.45	3.63	3.20	851
LSD .05	0.47	0.41	NS

Trends in the data suggest that dry weight, straw weight, seed yield, and seeds per tiller are increased by use of EL-500 at the spikelet initiation stage. Potential for seed yield increase from increased number of seeds per tiller should be studied further.

Summary

The opportunity for improving seed yield by controlling lodging in several species has been shown. In spite of the fact that lodging did not occur until just prior to harvest in tall fescue, increases in seed yield were observed. Parlay application in some species has been shown to delay inflorescence emergence, anthesis, and maturity. This was evident in orchardgrass. The implication of these effects of growth retardants on these species need further study.

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Effects of Parlay on Seed Yield and Crop Residue Characteristics in Willamette Valley Grass Seed Production

W.C. Young, III, D.O. Chilcote, and H.W. Youngberg

Field studies located in growers' fields investigating the use of a growth retardant, Parlay (PP-333, Imperial Chemical Industries), to enhance the seed yield of perennial grasses while reducing that portion of the plant partitioned to straw, were started in the spring of 1983. Growth regulator application at optimum and super optimum rates were applied to plots in commercial seed fields of Manhattan perennial ryegrass, Banner fine fescue, and Parade bluegrass and allowed to interact with all other cultural practices used by the grower. Standard swathing and combining operations were used in determining seed yield. Residue samples collected at several dates following harvest were used to measure straw and stubble.

Seed yield data (Table 1) support previous reports of improved efficiency in seed production resulting from properly timed application of Parlay. Yield component data suggest an increase in number of fertile tillers per unit area where significant seed yield increases occurred.

Table 1. Effect of Parlay on seed yield of three perennial grasses shown as both lb/a and percent change as compared with untreated plots. 1983.

Treatment[1]	Perennial ryegrass		Fine fescue		Bluegrass	
	(lb/a)	(%)	(lb/a)	(%)	(lb/a)	(%)
0	636	-	406	-	445	-
1	883	+39	687	+69	496	+11
2	944	+48	739	+82	495	+11
LSD .05	201	-	192	-	NS	-

[1]Treatments 0, 1, and 2 correspond to Parlay rates of 0, 0.45, and 0.67 lb/a for perennial ryegrass and fine fescue and for bluegrass 0, 0.13, and 0.27 lb/a respectively.

Crop residue samples were collected at three dates over a period of 3 to 6 weeks following harvest. Straw and stubble dry weight was reduced by Parlay application (Table 2). Treatment of seed crops may provide significant benefits in post-harvest residue management. Generally, earlier collection dates have drier straw and less stubble; however, stubble weights increase at later data due to regrowth.

Table 2. Mean percent change in straw and stubble residue from three perennial grasses over three sample dates as influenced by rate of Parlay. 1983.

	Perennial ryegrass		Fine fescue		Bluegrass	
Treatment[1]	Straw[2]	Stubble[3]	Straw	Stubble	Straw	Stubble
0	-	-	-	-	-	-
1	-34	-20	-54	-32	-18	+5
2	-15	-19	-41	-26	-35	-3

[1]Treatments 0, 1, and 2 correspond to rates of 0, 0.45, and 0.67 lb/a Parlay for perennial ryegrass and fine fescue, and to rates of 0, 0.13, and 0.27 lb/a for bluegrass.

[2] Straw residue dry weights were determined by raking, weighing, and adjusting for moisture content all loose material from a 120 ft^2 area.

[3] Stubble residue dry weights were determined as above, following a close clipping of the same 120 ft^2 area.

No significant treatment differences for straw or stubble moisture content were found at any sample date. Thus, the influence of Parlay was on quantity of residue, while climatic conditions determined the moisture content.

Continuing observations will follow the treatment response to open field burning, i.e., burning effectiveness, stand injury, and rate of regrowth. A second year study of treatment effects will examine soil samples taken periodically to determine differences in soil moisture depletion under treated and untreated crop canopies.

This research was supported by a grant from the Oregon Department of Environmental Quality, Field Burning Research Fund.

Effect of Reduced Rate and Delayed Application Date of Parlay Growth Regulator on Caravelle Perennial Ryegrass Grown for Seed Production

W.C. Young, III, D.O. Chilcote, and H.W. Youngberg

This study was developed to investigate the use of reduced rates of Parlay in perennial ryegrass seed production and to examine the effect of application after floret initiation. The experiment was conducted in the spring of 1983 at the OSU Crop Science farm. Treatments were designed in a factorial arrangement of application at floret initiation (FI) stage and 10 days after floret initiation (FI + 10) at 0.00, 0.22, and 0.45 lb/a of Parlay (PPP-333) growth regulator. The experiment was replicated six times on Caravelle perennial ryegrass. The objective of this study was to determine if results previously shown from Parlay (i.e., increased seed yield due to reduced or delayed lodging, reduced tiller mortality, increased seed recovery, and greater harvest index) at rates of 0.45 to 0.67 lb/a applied between spikelet and floret initiation, could be achieved at a lower rate and later date of application. Quadrat samples at anthesis and at maturity allowed comparison of changes in yield components due to treatments. Plots were harvested, dried and threshed for seed yield and dry matter distribution data.

Total dry weight was lower following the floret initiation date of application (Table 1). Delaying application by 10 days, when stem elongation and rapid growth was occurring, reduced the effectiveness of Parlay, resulting in the greater total harvested dry matter and straw weights following the FI + 10 treatment. Furthermore, it is not until at least 0.45 lb/a of Parlay was applied that a significant reduction in dry matter was observed. Thus, improved harvest index resulted when 0.45 lb/a was applied at floret initiation.

Table 1. Dry matter distribution and harvest index of Caravelle perennial ryegrass as influenced by time and rate of Parlay application. 1983.

Treatment	Total dry wt.	Straw wt.	Harvest index
	--- (tons/a) ---		(%)
Parlay application stage			
FI	2.55	2.14	16.40
FI + 10	2.89	2.49	14.38
LSD .05	NS[1]	NS[2]	1.58
Parlay rate (lbs/a)			
0.00	2.84	2.46	13.58
0.22	3.02	2.60	14.29
0.45	2.29	1.89	18.30
LSD .05	0.46	0.43	1.94

[1] LSD .10 = 0.31

[2] LSD .10 = 0.29

There was a significant interaction between date and rate of application for seed yield (Table 2). The 0.22 lb/a rate at floret initiation resulted in a 27% increase in yield; whereas, the same treatment 10 days later resulted in less than a 1% increase. However, the 0.45 lb/a rate applied 10 days after floret initiation resulted in a 13% increase which suggests that higher rates may be required at later dates to increase seed yield. Advanced plant growth may increase the canopy resulting in greater leaf interception of the chemical, reducing the amount of chemical reaching the soil, and decreasing uptake through the soil. Later application times may also result in reduced exposure of internode cells because of delayed uptake. That 0.45 lb/a applied at floret initiation resulted in only a 4% increase in seed yield suggests that this rate may be above the optimum for this variety. In a subsequent study on the growth and development, Caravelle perennial ryegrass yielded 807 and 718 lb/a following 0.45 and 0.67 lb/a Parlay, respectively, at floret initiation compared to an untreated plot which yielded 701 lb/a. This supports the conclusion that 0.67 lb/a is a super-optimum rate. Furthermore, the data showing the actual number of seeds recovered (Table 2) supports the seed yield data.

Table 2. Seed yield and seed recovery in Caravelle perennial ryegrass showing the interaction of time and rate of Parlay application. 1983.

Treatment time and Parlay rate	Seed yield	Increase	Harvested seed
(lb/a)	(lb/a)	(%)	(per ft²)
FI [1]			
0.00	735	--	4178
0.22	933	27	5401
0.45	762	4	4388
FI + 10 [2]			
0.00	771	--	4408
0.22	775	1	4417
0.45	874	13	4978
LSD .05	137	--	802

[1] FI = floret initiation development stage.

[2] FI + 1 = 10 days after floret initiation development stage

Yield component data identified that an increase in seeds per tiller contributed to the yield increase. There was no difference in fertile tiller number at maturity or 1000 seed weight. Thus, to benefit seed production in Caravelle perennial ryegrass, Parlay application should be timed to coincide with early reproductive development. Rates of 0.22 lb/a may be near optimum for this variety.

This research was partially supported by funds from ICI Americas.

Response of Bluegrass Varieties to Growth Retardant Rate and Date of Application Under Different Fall Nitrogen Levels

D.O. Chilcote, D.T. Ehrensing, W.C. Young, III, and H.W. Youngberg

Good turfgrass varieties may not possess high seed yield potential. Touchdown and Bristol are two bluegrass varieties with good turfgrass characteristics but with some problems in seed production. The use of growth retardants may offer a means for inceasing seed yield in such cases.

Earlier tests on bluegrass with spring applications of Parlay did not produce significant, positive yield effects. This was due, in part, to apparent excessive rates, and possibly improper (too early), dates of application. This investigation was undertaken to determine if lower rates, applied in the spring (floral initiation), or the fall (September 24), or split between spring and fall in conjunction with different fall nitrogen levels, could benefit yield of Touchdown and Bristol bluegrass varieties.

Seed yield was increased by an additional 45 lb/a of nitrogen in the fall (total of 25 vs. 70 lbs) for both varieties. Although Parlay application caused visible height reduction, it did not change seed yield, plant dry weight, 1000 seed weight, fertile tiller number, straw weight, or harvest index.

The varieties did differ in response to Parlay. Although the yield increase was not statistically significant, Touchdown showed a trend for increased seed yield with Parlay application, but only when 70 lbs of fall nitrogen was applied. Floret initiation application of Parlay at 0.13 lb/a was the most effective treatment, yielding 747 lb/a. The control yielded 500 lb/a. Rates above 0.13 lb/a caused yield reductions in Touchdown. Fall applications showed the least yield response with split applications being somewhat intermediate.

A fall infestation of rust in Touchdown was controlled by the higher rates of fall-applied Parlay. There was also a serious spring rust infestation in Touchdown, and although Tilt was applied, incomplete control was obtained in these tests. High rates of Parlay (0.27-0.54 lbs/a) in the spring provided visible rust control, but these rates did not increase yield.

In contrast, Bristol showed reduced yield at all rates of Parlay at both levels of nitrogen. Rust infestation in Bristol was much less severe and yields of untreated plots were 800-900 lbs.

No lodging was observed in either variety and these results suggest that in the absence of severe lodging, significant increases in yield of bluegrass with Parlay application cannot be expected. Varietal differences in response to Parlay should be expected. The small increases in yield observed in this and other bluegrass tests are likely a result of the energy not used for stem growth being partitioned to seed.

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Effect of Parlay on Bargena Fine Fescue in the Grande Ronde Valley

D.T. Ehrensing, D.O. Chilcote, and H.W. Youngberg

Previous research has shown the potential of Parlay to increase grass seed yield; however, field testing for each species under a wide range of conditions is needed. An experiment was conducted in a production field of Bargena fine fescue near Alicel, Oregon. The purpose of this trial was to determine the effect of Parlay application rates on fine fescue under conditions in the Grande Ronde Valley.

All Parlay applications were made on March 18 when the plants had reached the floret initiation stage of development as determined by growing point dissection. Parlay was applied at 2 rates (0.45 and 0.67 lb/a).

Marked reductions in plant height were observed at both rates of Parlay. Retardation effects were so great that most growers felt the untreated plots would definitely produce a higher seed yield. Treatment delayed lodging until near maturity, and was less severe at harvest at the higher rate of Parlay, while the untreated checks lodged early in the seed filling period. All plots were harvested shortly after swathing of the surrounding field with no noticeable delay of maturity due to treatment.

Table 1. Yield, thousand seed weight, straw weight, and harvest index response from Parlay treated Bargena fine fescue. 1983.

Parlay Rate	Seed Yield	Thousand Seed Wt.	Straw Weight	Harvest Index
(lb/a)	(lb/a)	(g)	(tons/a)	(%)
0.00	1265	1.06	4.07	13.5
0.45	1531	1.13	3.30	18.8
0.67	1491	1.13	2.94	20.2
LSD .05	169	0.05	0.37	1.7

Seed yield, thousand seed weight and harvest index were significantly increased over the untreated check at both rates of Parlay (Table 1), however, no significant differences in any of these factors were detected between the high and low rates. Straw weight was significantly decreased by both rates of Parlay.

These results indicate that while a yield increase of 21% could be realized through use of Parlay on fine fescue, no yield or quality advantage was gained by application in excess of 0.45 lb/a. Further studies using rates below this level should be undertaken to determine optimum application rate.

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Response of Different Varieties of Fine Fescue and Perennial Ryegrass to Parlay Growth Retardant Treatment

W.C. Young, III, D.O. Chilcote, and H.W. Youngberg

Plant growth retardants may induce different growth and yield response due to varietal characteristics. Differences in morphology or maturity may be involved in this differential reaction. Therefore, a study was planned to determine the effectiveness of Parlay (PP-333, Imperial Chemical Industries plant growth regulator) on several varieties of fine fescue and perennial ryegrass. Pennlawn, Cascade, and Koket varieties of fine leaf fescue, and Pennfine, Manhattan, and Acclaim perennial ryegrass were treated with Parlay in the spring of 1983 at either spikelet initiation or floret initiation growth stage at rates of 0.0, 0.45, or 0.67 lb/a. This was a three-factor experiment using a split split-plot design, replicated four times, where all combinations of varieties, dates of application, and rates of Parlay were present. Samples were taken at maturity to quantify fertile tiller number. Plots were harvested and samples were threshed for seed yield and dry matter determination.

Fine Fescue

The effects of Parlay were very consistent across the three varieties of fine fescue studied; there were no significant interactions between varieties, date of application or rate of Parlay. Dry matter distribution patterns differed among the varieties studied (Table 1). Pennlawn had the highest total harvested dry mat-

Table 1. Seed, straw, total harvested dry matter, and harvest index for variety, stage of application, and rate of Parlay in fine fescue. 1983.

Treatment	Total harvested dry wt.	Straw wt.	Seed yield	Harvest index
	------ (tons/a) ------		(lb/a)	(%)
Variety				
Pennlawn	2.09	1.72	750	17.97
Cascade	1.47	1.25	439	15.99
Koket	1.51	1.12	781	27.16
LSD .05	0.30	0.28	107	3.23
Growth stage [1]				
SI	1.75	1.41	681	20.11
FI	1.64	1.32	633	20.63
LSD .05	NS	NS	48	NS
Parlay rate (lb/a)				
0.00	1.93	1.61	639	16.87
0.45	1.61	1.28	674	21.67
0.67	1.53	1.20	656	22.58
LSD .05	0.20	0.18	NS	2.00

[1] SI = Spikelet initiation
FI = Floret initiation

ter production; however, its yield did not differ significantly from Koket because of higher harvest index for Koket. Cascade seed yield was lowest.

Application at the spikelet initiation stage resulted in a significantly greater seed yield across all varieties (Table 1). Both rates, 0.45 and 0.67 lb/a, of Parlay resulted in significant decreases in total harvested dry weight due to a related reduction in straw weight. However, seed yield was not decreased by the growth retardant treatments, and as a result, harvest index was significantly increased for both rates.

Table 2 shows differences in yield components within each factor. Varieties studied were significantly different in fertile tillers at maturity and thousand seed weight. Spikelet initiation stage treatment of Parlay increased seeds per tiller compared to floral initiation stage application. Fertile tiller number at maturity was increased by both 0.45 and 0.67 lb/a application, probably due to improved light penetration into the treated canopies during early reproductive growth which allowed more tillers to mature. The reduced number of seeds per tiller and 1000 seed weight is probably due to yield component compensation with the increased number of fertile tillers.

Table 2. Yield component data for variety, stage of application, and rate of Parlay in fine fescue. 1983.

Treatment	Fertile tillers at maturity	Seeds per tiller	1000 seed wt.
			(g)
Variety			
Pennlawn	104	60.3	1.36
Cascade	67	71.8	1.29
Koket	139	44.9	1.37
LSD .05	22	NS[1]	0.02
Development Stage [4]			
SI	104	65.1	1.34
FI	103	52.9	1.34
LSD .05	NS	NS[2]	NS
Parlay rate lbs/a			
0.00	86	73.1	1.39
0.45	111	50.2	1.32
0.67	113	53.7	1.30
LSD .05	21	NS[3]	0.04

[1] $P < .11$
[2] LSD .10 = 11.5
[3] LSD .10 = 18.7
[4] SI = Spikelet initiation
FI = Floret initiation

Perennial Ryegrass

Table 3 summarizes both variety and date of application effects on total dry matter distribution and harvest index. Manhattan, a later maturing variety, produced more total dry weight and straw, but less seed. This may have been the result of prolonged vegetative growth with the subsequent initiation of fewer inflorescences in relation to the total tiller number. Furthermore, Table 3 also shows Parlay treatment of the floret initiation stage increased dry matter across all varieties; however, harvest index is reduced slightly. Parlay rate interacted with varieties.

Table 3. Seed, straw, total harvested dry matter, and harvest index for variety and date of application in perennial ryegrass treated with Parlay. 1983.

Treatment	Total harvested dry wt.	Straw wt.	Seed yield	Harvest index
	------ (tons/a) ------		(lb/a)	(%)
Variety				
Pennfine	2.11	1.76	692	16.20
Manhattan	3.03	2.87	325	5.33
Acclaim	2.52	2.15	734	15.21
LSD .05	0.44	0.40	101	0.03
Development stage				
Spikelet Init.	2.37	2.10	551	12.68
Floret Init.	2.73	2.42	616	11.81
LSD .05	0.20	0.18	64	NS

Table 4 shows that both Pennfine and Acclaim benefited from Parlay treatment at 0.45 and 0.67 lb/a, improving seed yield and harvest index an average of 98% and 46%, respectively. Manhattan was not significantly affected by the use of Parlay in this experiment. A significant interaction between rate of Parlay and date of application for both seed yield and 1000 seed weight shows the benefit of the higher rate only at the floret initiation stage of development (Table 5).

Table 4. Seed, straw, total harvested dry matter, and harvest index for variety and rate of Parlay in perennial ryegrass. 1983.

Variety and Treatment	Total harvested dry wt.	Straw wt.	Seed yield	Harvest index
(Parlay rate: lb/a)	------ (tons/a) ------		(lb/a)	(%)
Pennfine				
0.00	1.57	1.37	404	12.29
0.45	2.55	2.16	791	16.59
0.67	2.19	1.75	880	19.70
Manhattan				
0.00	3.03	2.86	351	5.69
0.45	3.20	3.03	334	5.27
0.67	2.86	2.72	291	5.04
Acclaim				
0.00	1.93	1.70	460	11.79
0.45	2.63	2.22	817	18.44
0.67	2.99	2.53	924	15.39
LSD .05[1]	0.41	0.39	85	4.09

[1] LSD .05 is to compare Parlay rate within each variety.

Table 5. Seed yield and 1000 seed weight for date of application and rate of Parlay in perennial ryegrass from Parlay treatment at spikelet (SI) and floret (FI) initiation stages. 1983.

Treatment	Seed yield (lb/a)		1000 seed wt. (g)	
	SI	FI	SI	FI
Parlay rate (lbs/a)				
0.00	386	424	1.86	1.84
0.45	651	644	1.79	1.80
0.67	618	778	1.76	1.83
LSD .05	85	85	0.03	0.03

These data indicate that not all varieties of perennial ryegrass respond in the same way to Parlay application, and that maturity differences among varieties may influence the effectiveness of applied growth retardant treatments. In contrast, all of the fine fescue varieties responded to growth retardant treatment. Further study of varietal response is needed.

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Parlay and Its Effect On Lodging and Seed Yield in Perennial Ryegrass

J.L. Hunter, D.O. Chilcote, W.C. Young, III, and H.W. Youngberg

The purpose of this study was to identify the effects of Parlay treatment on perennial ryegrass lodging when grown for seed production and to develop a greater understanding of correct application rates and stage of development.

Second year stands of Pennfine and Caravelle perennial ryegrass were teated at the 0.45 and 0.67 lb/a at the spikelet and floret initiation stages of development. Lodging was delayed in both varieties at the 0.45 and 0.67 lb/a rate and at both growth stages (table 1). There were large differences in the degree and time of lodging between the two varieties. In both Pennfine and Caravelle the 0.67 treatment lodged less than the 0.45 lb/a treatment. This is attributed to a greater reduction in stem length at the higher rate with an associated increase in stem strength for the middle two internode segments.

In general, the seed yield from the floret initiation stage treatment was not significantly better than the spikelet initiation treatment. Parlay induced seed yield increases in perennial ryegrass have been attributed to increased fertile tiller survival in treated and unlodged stands. This is supported by the 20 - 25% increase in fertile tiller number when treated with Parlay (table 1). Yield differences between the 0.45 and 0.67 lb/a treatments vary with variety. This is attributed to varietal variation in plant height, stem stiffness, and lodging. The yield of Pennfine and Caravelle at the different rates and dates of application are shown in table 1.

Table 1. The effect of different Parlay treatments on date of lodging, fertile tiller number and seed yield. 1983.

Treatment Stage & Rate	Lodging Date	Fertile Tillers	Seed Yield
(lb/a)			(lb/a)
PENNFINE			
S.I. 0.00	5/10	192	677
0.45	6/22	252	1293
0.67	6/22	253	1436
F.I. 0.00	5/10	189	657
0.45	6/22	253	1201
0.67	6/22	222	1414
CARAVELLE			
S.I. 0.00	6/23	265	679
0.45	7/06	309	839
0.67	7/18	301	770
F.I. 0.00	6/23	265	679
0.45	7/06	316	807
0.67	7/18	275	718

S.I. = Spikelet Initiation F.I. = Floret Initiation

Differences in response to Parlay indicate that additional work is needed to identify varieties which would have the greatest benefit from the use of this plant growth retardant. Continued research and field trials with Parlay will allow development of recommendations to cover other types of ryegrass varieties grown for seed production in Oregon.

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Interaction of Tilt Fungicide and Parlay Plant Growth Retardant in Pennfine Perennial Ryegrass Seed Production

W.C. Young, III, D.O. Chilcote and H.W. Youngberg

Tilt is a broad spectrum fungicide commonly used for the control of rusts (*Puccinia* spp.) and powdery mildew in grasses grown for seed in Oregon. The objective of this study was to evaluate the use of Parlay (PP-333) both with and without supplementary disease control via Tilt. A factorial arrangement of two rates of Parlay (0.45 and 0.67 lb/a) applied as WP at floret initiation and two levels of disease control (0.0 and 4.0 oz/a Tilt) was initiated in the spring of 1983 on Pennfine perennial ryegrass. Earlier work with Parlay had shown some reduction in rust buildup in treated plots (Chilcote, unpublished).

Analysis of the data found no significant interaction between growth retardant or fungicide treatments for the dry matter distribution or harvest index measurements shown in Table 1. However, significant differences for both Parlay and Tilt treatments were observed for several characteristics shown. Parlay at 0.45 and 0.67 lb/a significantly reduced total harvested dry matter and straw weight, while seed weight and harvest index were dramatically increased. Tilt, however, had no effect on total dry weight or straw weight but did maintain seed yield and harvest index.

Table 1. Total dry matter distribution and harvest index of Pennfine perennial ryegrass as influenced by Parlay growth regulator and Tilt fungicide. 1983.

Treatment	Total dry weight	Straw weight	Seed weight	Harvest index
	--- (tons/A) ---		(lb/A)	(%)
Parlay rate				
0.00 lb/a	3.63	3.28	708	9.50
0.45 lb/a	3.27	2.67	1207	18.56
0.67 lb/a	3.35	2.66	1382	20.78
LSD .05	NS	0.27	152	1.62
Tilt rate (oz/a)				
0 oz/a	3.32	2.85	958	14.42
4 oz/a [2]	3.51	2.89	1241	18.15
LSD .05	NS	NS	124	1.32

[1] LSD .10 = 0.26
[2] Tilt was applied on 5/17/83 and again on 6/2/83.

Table 2 presents a table of means for seed yield which shows that although Parlay and Tilt do not significantly interact (i.e. 4 oz/a Tilt increased yield at each level of Parlay and vice versa), there is a benefit that results from using both products. Thus, yield increase due to Parlay may be a result of increased tiller number, reduced lodging, and some reduction in disease incidence from improved microclimate; however, maximum seed yield cannot be achieved without late season fungicide use. Furthermore, improved fungicide efficacy may be expected with plant response to growth regulator application. The more upright canopies allow greater penetration of the fungicide and improved coverage. However, even without fungicide application, Parlay treatments at 0.45 and 0.67 lb/a yielded 22% and 38% higher, respectively, than plots with disease control, but no growth regulator treatment. In summary, seed production management directed toward maximum yield per unit area will benefit from the combined use of growth regulator and fungicide application.

Table 2. Means for seed yield of Pennfine perennial ryegrass as influenced by Parlay growth regulator and Tilt fungicide. 1983.

Tilt	Parlay (lb/a)			
(oz/a)	0.00	0.45	0.67	Mean
0	505	1111	1256	958
4	911	1303	1508	1241
Mean	708	1207	1382	

This research was partially funded by a grant from the Department of Environmental Quality, Field Burning Research Fund. The use of a trade name does not imply recommendation of the product.

Cereal Crop Response to Plant Growth Retardants

D.O. Chilcote, D.T. Ehrensing, H.W. Younberg, W.C. Young, III, L.A. Morrison, and W.E. Kronstad

Studies on several plant growth retardants for lodging control and yield enhancement were continued in 1983 on different cultivars of wheat and barley in locations in the Willamette Valley and eastern Oregon. This work was conducted as a follow-up to research done in 1982, where promising yield responses were observed in Yamhill wheat. The compounds tested were Parlay (PP-333), EL-500, Cerone, and formulations of Cycocel (CCC). Not all compounds were compared at each of the experimental sites; but different rates and dates of application were investigated and analyses made of seed yield, components of seed yield, fertile tiller number, tiller length, internode length and strength, harvest index, and seed recovery. The winter wheat varieties examined in these tests were Hill, Yamhill, Stephens, and Paha club wheat. Tests on wheat were located in the Willamette Valley, at Hermiston, and in Moro, Oregon. The Moro location, a dryland site, was selected to observe possible effects of retardant treatment on the moisture-supplying capacity of plants during later stages of crop development. Tests with barley were on Scio winter barley in the Willamette Valley and Steptoe spring barley near La Grande, Oregon.

Some stem shortening was observed in all of the treated plots with average height reduction ranging from 5-15%. The greatest reduction in height was for Paha wheat, a tall club variety. Little lodging occurred in any of the plots with the exception of a high nitrogen Yamhill wheat test which lodged quite late in the seed-filling stage. Tests on stem strength showed no effect of growth retardant treatments in either wheat or barley.

Analysis of the yield results showed that none of the growth retardant treatments significantly increased yield (although there were some trends for increased yield) and some reductions in seed yield occurred at the higher growth retardant rates. Response depended upon variety, location, and the chemical used. Some of the more significant results are summarized by species and location.

Wheat

Moro Location (Experiment Station)

Although yields of Stephens and Hill were not positively affected at this site, significant stem shortening was observed. Measurements of internode length showed that the reduction in height was due primarily to shortening of the two internodes closest to the soil surface. Stephens seemed to be somewhat more sensitive to Parlay growth retardant than Hill. At the 0.13 lb a.i./a rate of application, Parlay increased spikelets per spike in Stephens when applications of the compound were made in the fall (September 24). Hill did not show this response. Because of the rather wet season, no moisture stress effects were observed. Average yields at this location in 1983 were in the 70-80 bu/a range.

Corvallis Location (Hyslop Experimental Farm)

Two tests were conducted at this location in 1983. One investigated the effect of Cerone, CCC, Parlay, and EL-500 on Yamhill wheat. The other test involved different rates and dates of Parlay on Hill and Paha wheat.

Although there was no significant increase in yield for Yamhill wheat from any of the growth retardant treatments, there was a reduced yield from Cerone applications at rates above 0.5 lb/a. These treatments reduced seed number and also slightly increased the individual seed weight. CCC treatment showed a reduction in individual seed weight when the rate of chemical exceeded 1.4 lb/a. The average yield of Yamhill wheat in these tests was 75 bu/a. A severe stripe rust infestation may have influenced the yield potential.

In tests on Hill and Paha wheat with EL-500 and Parlay, plant height was reduced by both compounds, but no significant yield differences were found. For Hill, it was noted that EL-500 was not as effective pound for pound as Parlay. The highest yield for Hill in these tests, 129 bu/a, however, was the result of application of EL-500 at 0.13 lb/a yield for the untreated wheat was 116 bu/a.

Results with Paha club wheat showed no effect on yield and no differences between compounds. The yield of Paha at this location, however, was quite low (36 bu/a).

Hermiston Location (Experiment Station)

Stephens and Hill wheat were treated with different rates of Parlay at two stages of growth. Height reduction was observed with higher rates giving greater reductions. Although none of the Parlay treatments increased yield significantly, the 0.07 lb/a rate was the highest yielding. At rates above this level, decreasing yield was observed in both varieties. For rates below .13 lb/a, earlier applications (Spikelet initiation) were superior in yield to applications made later (Floret initiation). The yield for both varieties at this location was in the 80 bu/a range.

Barley

Corvallis Location (Hyslop Experimental Farm)

Scio winter barley was treated with Parlay, EL-500, CCC, and Cerone to compare response to these various growth retardant treatments. Although stem shortening was noted with all treatments, none of the treated plots yielded better than the control; and at the higher rates of growth retardant application, reductions in yield were observed. On barley, EL-500 seemed to be more effective pound for pound in reducing height, but negative yield responses at higher rates were more pronounced than with Parlay. The average yield at this location for Scio barley was 73 bu/a.

La Grande Location (Farmer Field)

Steptoe spring barley in the La Grande area showed no effect of Parlay treatment on yield. This was true, even though additional nitrogen and higher seeding rates were evaluated. Some slight height reductions could be observed at the higher rates of Parlay, but apparently rates greater than 0.4 lb/a will be required to achieve significant stem height reduction. Further tests with growth retardants need to be conducted on spring barley.

Conclusions

The results obtained in 1983 suggest that significant yield enhancement from growth retardant applications cannot be expected in the absence of lodging problems. Greatest response would likely occur in situations where lodging occurs early in the seed-filling period.

Barley appears to be somewhat less sensitive to the soil-active growth retardant compounds, and higher rates will be needed to accomplish significant height reduction.

Future tests with growth retardants in cereals should focus on taller growing varieties, and conditions of high nitrogen fertility and increased stand density. In Europe, for example, seeding cereals in 4-inch rows is a common practice. Higher plant density, along with higher nitrogen levels, could intensify lodging problems and under these conditions, growth retardants may play an important role.

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Cooperative Parlay Field Evaluation on Grass Seed Crops in the Willamette Valley

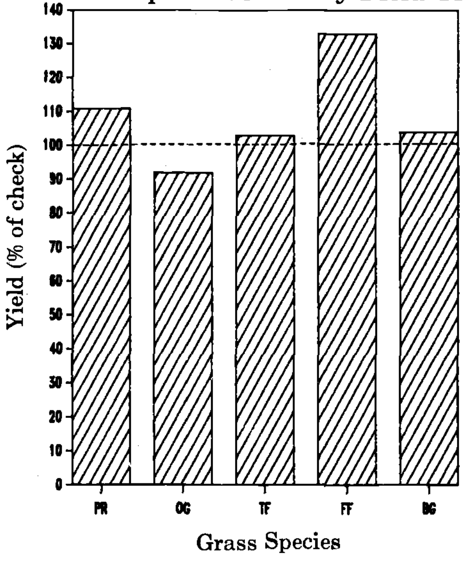
J.L. Hunter, H.W. Youngberg, and D.O. Chilcote

In 1983 a series of cooperative field trials were initiated to determine the value of Parlay treatments on several grass seed crops under field conditions. Trials were located at more than 100 locations representing a range of soil types, management conditions, grass species, and varieties. Seed was harvested using standard grower practices and equipment.

Field trial results were highly variable. Harvest operations in 1983 were complicated by abnormal rain during swathing and harvest. These conditions contributed to the wide variation in yield obtained between fields of the same variety. A summary of yield responses by species is presented in Figure 1. Perennial ryegrass and fine fescue benefited most from the Parlay treatment. These trials also indicate that there is a potential for benefit from the use of Parlay on selected tall fescue varieties, but additional research is required to identify the optimum time and rate of application. Bluegrass and orchardgrass showed no benefit from Parlay application in these trials.

Figure 1.

1983 Cooperative Parlay Field Trials



Additional research is required to more precisely determine the actual benefit a grower may expect from the use of this or other growth retardants. Research results at Oregon State University have shown yield increases of 100% for some ryegrass varieties. With further field research more reliable yield data will allow a realistic assessment of the costs and benefits of Parlay use.

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Post-Harvest Management Alternatives for Grass Seed Production

W.C. Young, III, D.O. Chilcote, and H.W. Youngberg

Long-term Effects of Crew-Cutting

The benefits of open field burning have been documented; however, continued concern over the contribution to air pollution from this practice has encouraged alternative research programs. The primary objective of this study was to investigate the long-term effectiveness of close-cutting and removal of crop residues (crew-cutting) from grass species grown for seed production.

Table 1 presents seed yield data for three species averaged across 3-4 years as a percent of burn treatment. Continuous burning is the only treatment capable of maintaining high quality seed yields over several years in perennial ryegrass. The average yield reduction for all non-thermal treatments was 15% after four years. No advantage has been demonstrated for crew-cutting over the other non-thermal residue removal treatments.

Table 1. Cumulative effect of several treatments on seed yield shown as an average of four years in perennial ryegrass, and three years in fine fescue and bluegrass.

Treatment	Perennial Ryegrass	Fine Fescue	Blue-Grass
Burn	100	100	100
Crew-cut	84	98	104
Flail-chop	82	85	87
Late crew-cut	83	107	110
Late flail-chop	84	91	89

In fine fescue, the alternate-year treatments investigated through three years have not resulted in a reduction of either seed yield or seed quality. Additionally, no superiority has been found for alternating the crew-cutter with burning when compared to using the flail-chopper on alternate years.

Bluegrass plots crew-cut for two consecutive years developed a significant thatch layer which increases the incidence of burn-out when burned in the third year. However, no significant effect on seed yield has been observed.

In annual ryegrass production, control over plant density is necessary in order to achieve efficient seed production. Burning provides the greatest control upon stand density, and sod-seeding lessens the volunteer stand more than tillage and seeding. It is difficult to preserve the integrity of each treatment, however, because of accumulating amounts of shattered seed at this location. In 1982, only those plots tilled prior to seeding responded with significant yield increase.

In fine fescue, the crew-cut equipment has been successful in maintaining seed yield through three years of study, regardless if used early in the post-harvest period or later. However, these treatments profoundly alter stand density via a more prostrate growth habit and the establishment of volunteer seedlings. Furthermore, the establishment of seedling plants would not be acceptable in certified seed production as these seedlings represent a good generation of the crop and would be a cause for rejection.

In bluegrass, crew-cutting has maintained seed yields equal to burning when averaged over three years, and is superior to flail-chop removal of residue. However, seed yield and fertile tiller number both declined in the third year, suggesting that the crew-cutter should not be used as an alternative to burning for more than two years.

Non-yearly Burning

The objective of this research was to evaluate the feasibility of alternating either burning, crew-cutting or flail-chopping in an effort to reduce the acreage of perennial grasses burned annually. Also, non-yearly burning alternatives for annual ryegrass seed production were studied.

The non-yearly burning study for perennial ryegrass continues to support the practice of open field burning annually in order to maintain vigorous stands of high yielding, high quality seed. The cumulative effect on seed yield averaged over four years was 90-96% of annual burning when crew-cut two years out of four in the alternating system with burning. Additionally, crew-cutting three years out of four reduced seed yields 85-86% of annual burning.

Nitrogen Fertilizer Effects on Straw Decomposition and Grass Seed Yields

T.L. Jackson

Experiments were established in August and September 1982 to evaluate effects of treating straw with different N fertilizers on seed yields where the straw was not burned or burned on alternate years. Linn perennial ryegrass, fawn fescue, annual ryegrass, and orchardgrass were included in thee experiments. Our first objective was to evaluate possible effects of urea-sulfuric acid and ammonium chloride in modifying yield reductions where straw was not burned. Urea sulfuric acid affects the rate at which cellulose (most of the straw is cellulose) decomposes; it might also have a sanitization effect on some fungus diseases. Ammonium chloride was included as a treatment since the application of chloride has had an effect on wheat diseases.

The many and varied effects of the June and July rains on the 1983 grass seed crop are legend by now. Suffice it to say that our plots were swathed and "in the windrow" for three to six weeks with an excessive amount of rain on the windrows. Our worst case was the annual ryegrass experiment, swathed on June 28 and run through the grower's combine August 6.

Plots with the heaviest vegetative growth (and possibly higher seed yields) held more moisture and took longer to dry. Shattering was more of a problem on treatments with heavy hay yield and any wet spots remaining at harvest were more evident. Therefore, we probably lost more seed from our highest yielding plots. Obviously the harvest conditions limit a good evaluation of the data. Seed samples were saved and light seed separated with an air blast by the Seed Laboratory. The seed that was harvested with th combine was good quality with a low percentage of light seed. The percent light seed was relatively constant for all treatments in a given location.

The following observations were made during the growing season:

1. August applications at 10 or 20 lb N/A as urea sulfuric acid had little visual effect on stubble.
2. Later applications (Sept. 20-30) seemed to have a greater effect on straw.
3. Removing the straw with a flail mower (feather duster) did not result in better yields when comparable N treatments were applied.
4. Adding 20 or 40 lbs of fall applied N to the grower's base treatment of 40 lbs N as 16-20-0 in October increased yields of perennial ryegrass from 1300 to 1450 lbs seed/A (this response was from increasing fall N to 60 or 80 lbs.A). All plots had 80 lb N/A spring applied.
5. Applying spring N as urea-sulfuric acid about April 1 burned back spring foliage growth on Linn perennial ryegrass and reduced straw yields at harvest 10% while maintaining seed yield.

Yields of annual ryegrass and fawn fescue were reduced with a spring application (about April 1) of urea sulfuric acid. Possible effects of spring applications of urea sulfuric acid need further evaluation--application time is probably critical.

Experiments for 1984 have mid-September and early November application times on perennial ryegrass. Treatments include different N sources (urea-sulfuric acid, ammonium sulfate, ammonium chloride) where the straw had been burned and left to compose. Urea sulfuric acid treatments have also been included where fine leaf fescue grass seed fields had a "poor burn" in September.

Research Faculty and Staff

Agricultural Engineering
- A.G. Berlage
  - Agricultural Engineer - USDA-ARS
- D.M. Bilsland
  - Research Assistant - OSU
- T.M. Cooper
  - Research Assistant - OSU
- P. Krishnan
  - Assistant Professor - OSU

Botany and Plant Pathology
- M.D. Azevedo
  - Research Assistant - OSU
- K.L. Cook
  - Research Assistant - OSU
- G.B. Newcomb
  - Research Associate - OSU
- R.E. Welty
  - Research Plant Pathologist - USDA-ARS

Crop Science
- D.H. Brewer
  - Certification Specialist - OSU
- T.G. Chastain
  - Graduate Research Assistant - OSU
- D.O. Chilcote
  - Professor of Crop Physiology - OSU
- D.T. Ehrensing
  - Research Assistant - OSU
- J.M. Ferguson
  - Graduate Research Assistant - OSU
- D.F. Grabe
  - Professor of Agronomy - OSU
- I. Hagen
  - Certification Assistant - OSU
- J.L. Hunter
  - Graduate Research Assistant - OSU
- G.D. Jolliff
  - Associate Professor of Crop Science - OSU
- W.E. Kronstad
  - Professor of Plant Breeding - OSU
- O. Lee
  - Professor of Agronomy (Weed Science) - USDA-ARS
- L.A. Morrison
  - Graduate Research Assistant - OSU
- C. Moon
  - Biological Technician - OSU
- W.C. Young, III
  - Research Assistant - OSU
- H.W. Youngberg
  - Professor and Extension Agronomist - OSU

Entomology
- J.A. Kamm
  - Research Entomologist - USDA—ARS

Soil Science
- H. Gardner
  - Extension Soils Specialist - OSU
- T.L. Jackson
  - Professor of Soil Science - OSU