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Analysis of Integrated Farming Systems in Eastern Nebraska

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ANALYSIS OF INTEGRATED FARMING SYSTEMS IN EASTERN NEBRASKA

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ANALYSIS OF INTEGRATED FARMING SYSTEMS IN EASTERN NEBRASKA

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Agroecosystems in the U.S. are beset with social, ecological and environmental problems as large industrial farming methods are edging out small family-sized farms and replacing ecological services provided by biodiversity with synthetic inputs and practices. While many of the benefits of smaller diversified or integrated farming systems are well known, farm producers need a concrete model that shows how integration is possible and with what crops. The objective of this study was to investigate some of these supplemental farm activities, and identify and evaluate whether they were compatible given the time and resource constraints of a typical eastern Nebraska farm. These activities included stalk grazing, cabbage, and herbaceous floral perennial production. Detailed enterprise budgets of the alternative cropping systems were entered into a linear programming model to determine the optimal acreage allocation given the various alternatives to maximize net returns. The compatible operations increased producer profitability while theoretically making use of synergistic relationships to decrease reliance and application of off-farm inputs, thus improving 'sustainability'.

Foreword

The purpose of this study was to identify and portray how supplemental farm activities could be integrated into an existing corn and soybean farming operation, typical to eastern Nebraska, given time and resource constraints. These compatible operations were meant to increase producer profitability, while making use of synergistic relationships to decrease reliance on off-farm inputs, thus improving sustainability.

While the model was meant to represent a typical eastern Nebraska farm, actual site conditions were based on the University of Nebraska-Lincoln Agricultural Research and Development Center's (UNL-ARDC) agroforestry farm located in Saunders County, Nebraska. Data were obtained from studies performed at this research site as well as the Nebraska Agricultural Statistics Service and Rutgers University.

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I. Introduction

Problems in U.S. Agriculture

The current U.S. farming sector is in serious trouble as it is beset with economic, social, and environmental problems. Rising costs of production and falling commodity prices in recent years have led to negative economic returns. The returns are indicative of the general trends experienced in U.S. agricultural production since the 1996 Freedom to Farm Act effectively withdrew all price stabilization and price support programs (Doering, 1999). Nearly half (48%) of all farms reported a negative cash return (net loss) in 1997 and this trend may be increasing; in 1987 43% of farms reported net losses and in 1992 it was 44% (USDA, 1999a). Critics of the new Farm Security and Rural Investment Act of 2002 expect these same conditions to continue as the new act remains essentially unchanged from the 1996 Act. Contributing to this trend is increasing pressure for international trade with U.S. producers now competing in worldwide markets that include exports from Brazil and other countries that are able to produce these same commodity goods at a lower cost. Finally, many countries have placed an embargo on U.S. products due to the use of genetically modified organisms in our crop production.

Traditional land-grant extension institutions have been encouraging farm producers to maximize their 'economies of size' to deal with this problem, encouraging farmers to purchase or rent additional land and larger machinery to offset falling prices. This has led to a trend towards larger farms, dwindling numbers of small family farming units, and the emptying of rural communities. In 1997, 3.6% of U.S. farms had sales of over $500,000, controlled 56.6% of total market values, and used 19.4% of total land in farming. At the other extreme, 73.6% of farms sold less than $50,000 worth of agricultural products, constituted only 6.8% of the total 1997 sold product, and worked 28% of the farmland (USDA, 1999a). Put another way, 9.5% of the farms and 38% of farmland account for three quarters of the market value of agricultural products sold (USDA, 1999a). Although it appears that larger farms are more efficient in the aggregate, the consequences of this centralization threaten the viability of rural communities. When control of agroecosystems and rural communities is highly concentrated, when many decisions are made by non-farm operators, when there is no clear and regular accountability, and when only a few profit from what is viewed as a common legacy, then entire agroecosystems rapidly deteriorate (Flora, 2002).

Proponents of small farming units argue that small farms can be just as profitable and more sensitive to environmental concerns. For instance, the National Commission on Small Farms (USDA, 1998b), citing a study by Dr. W.L. Peterson, suggests that there may be limits to economies of size in agriculture. "After accounting for the quality of the land and farm management, subtracting the contribution of the farmhouse to farm output, and considering the effect of opportunity costs related to off-farm employment and farm output and production costs, Peterson asserts that small family and part-time farms are at least as efficient as larger commercial operations. In fact, there is evidence of diseconomies of scale as farm size increases" (Olson, 1998). An economic study of Iowa agriculture demonstrates that farms reach full economies of size at 600 acres (Hassebrook, 1998). A basic tenet of sustainable agriculture is that sound knowledge of place is essential to efficient and sound use of the land (Jackson, 1994), and large farms make the acquisition of an intimate knowledge of the land difficult (Olson, 1998).

Coupled with this trend, further exacerbating the problem, is the industrialization of agriculture. This process has made production extremely capital-intensive leading to high costs of entry and resulting in the streamlined production of a relatively few commodity crops. This has led to bottlenecks in labor, turning the farming operation into an intense, hardly manageable enterprise during a few weeks in the spring and fall while leaving gaps where labor is underutilized throughout the rest of the year. This has encouraged farm producers to hire poorly-paid help during critical times, yet seek part-time employment themselves off of the farm during other times in the year to make ends meet. For example, farm labor has been dropping significantly over the past 50 years from 9.9 million people directly engaged in production in 1950 to 2.8 million people in 1998 (USDA, 1999b). The average wage rate for hired farm workers was $7.47 per hour (USDA, 1999b), very low compared to other private industries that involve hard labor; for example, $16.91 per hour in mining, $16.61 per hour in construction, and $13.49 per hour in manufacturing (Bureau of Statistics, 2000). As a result, the average age of farm producers is on the rise, as fewer young people are entering into the farming industry. The percentage of farmers under age 35 has dropped from 15% in 1954 to 7.8% in 1997 (ERS, 2000), and median age in the Midwest is now 58 years.

Despite the negative economic and social problems associated with the new industrialized farming sector, new and innovative research and technologies have led to tremendous gains in productivity and production. While farmers now account for less than one percent of the U.S. population, they still manage to feed and clothe the U.S. and export more than six times what they did (in real dollar value) in 1940 (Hoag, 1999).

However, the unprecedented yield increases of this era have not been gained without severe costs to environmental health.

Only 10-20 crops now provide 80-90% of the world's calories (Brown, 1981). This lack of biodiversity in agroecosystems leads to pest and disease susceptibility in the crops being produced, forcing farm producers to rely on synthetic chemical controls. Ever increasing farm size and the decoupling of agricultural crop production from base acre support payments has led to increasing reliance on herbicide use. Excessive pesticide use has caused the development of resistant strains of pests and diseases and has resulted in increased costs for their control (Pimentel and Andow, 1984). U.S. farmers now spend more than $6.2 billion annually to control weeds on crop and pasture land, including an estimated $3.6 billion for use of nearly 200 million kilograms of herbicides (Shaw, 1982). Herbicide cost per acre of harvested cropland (including cropland on which no herbicides were applied) increased from less than $0.30/acre in 1950 to more than $2.50/acre in 1985 (Ikerd, 1996). Keep in mind that the prices received for grain during the same period have increased only slightly. Not only are these costs increasing for the farm producer and being passed on to consumers as crop subsidy needs increase, society is also assuming these costs in terms of rising health care costs and through environmental degradation. Based on available data, the total estimated cost of pesticide use is $8,000 million per year, $5,000 million of which society pays in environmental and public health costs (Pimentel et al., 1992).

Farming has one of the highest work-related fatality rates of all occupations according to the U.S. Department of Labor (Runyan, 1998). Farmers also face greater health risks from pesticides than those facing the average population; high cancer mortalities have been found in areas where 2,4-D and other chlorophenoxy herbicides are commonly used in wheat producing counties in Minnesota, North Dakota, South Dakota, and Montana (Schreinmachers, 2000). Further, while pesticide use is generally viewed as profitable in terms of preventing direct crop losses, it is not necessarily successful in reducing these losses. For example, even with a 10-fold increase in insecticide use from 1945-1989, total crop losses from insect damage have nearly doubled from 7% to 13% (Pimentel, 1991).

Not only are the pesticides causing problems, but also the decoupling of agricultural systems from acreage limits accelerated the need for the use of synthetic fertilizers, which are also causing environmental problems. For example, phosphate runoff from agricultural fertilizers has contributed to accelerated eutrophication in surface water bodies, disrupting ecosystem health and functions while interfering with the health and diversity of native fish, plant and animal populations. Nitrate runoff can also have severe negative consequences to humans, livestock, and ecosystem health. High levels of nitrate, increasingly found in public drinking water supplies, can lead to methemoglobinemia, a condition commonly known as "blue baby syndrome".

The Mississippi River, and the growing hypoxia zone associated with its discharge into the Gulf of Mexico provides a glaring example of the negative environmental consequences associated with the excess use of synthetic nitrogen fertilizers. States in the upper Mississippi River Basin (Illinois, Indiana, Iowa, and Minnesota) have the highest percentage of total land in agriculture, the highest use of nitrogen fertilizer, and the highest amount of artificially drained soils in the country (Heller and Keoleian, 2002). As a result of these intensive practices, total nitrogen output to the Gulf of Mexico has increased 3 to 7 fold compared to pre-settlement outputs. This area is now the third largest hypoxia zone in the world, making it uninhabitable by most aquatic organisms, and the zone ranges in size between 12,000 and 18,000 km^2 in mid summer (Keeney and Muller, 2000).

Finally, in addition to the various problems outlined above, another consequence of this modern, industrialized system of agriculture is the increasing dependency on dwindling supplies of fossil fuels, energy captured long ago and transported from other parts of the nation and world. Pimentel et al. (1995) estimate that 10% of all energy used in U.S. agriculture today is expended just to offset the losses of soil nutrients and water caused by erosion (Blackburn and de Haan, 1999). Further, the cost of these fossil fuel energy-based agrochemicals has been increasing, and the supply is becoming unstable. For instance, due to rising natural gas costs, the cost of anhydrous fertilizer (NH_3) commonly used in Midwestern corn production skyrocketed to $400 to $500 per ton in 2000 compared to an approximate cost of only $225 per ton one year ago (Francl, 2002). This not only can cause further deficits in the net profits of producers, but also can lead to a crisis of availability, as the cost of production of nitrogen fertilizers is higher than is justified by the prices the farm products are bringing in the marketplace making it uneconomical to produce these commodities, causing fertilizer makers to cut back on production (Robinson, 2001).

<u>The Eastern Nebraska Agricultural Sector</u>

In eastern Nebraska these problems are all too real as 80% of all cropland is dedicated to the production of just corn and soybeans (NASS, 1995). Farm size is also increasing, as the rural population decreases, and more and more rural residents flock to the urban centers in Lincoln and Omaha. In 1974, there were more than 43,000 Nebraska farmers whose total annual agricultural sales fell in the range between $10,000 and $100,000, but only 453 with sales of $500,000 or more. By 1997, according to the most recently tabulated agricultural census, there were fewer than 25,000 Nebraska farmers left in the middle-income group, but the total with sales of $500,000 or more had risen to 2,500 (Hovey, 2002). Coupled with this migration and growth of large farms is the rise in the number of small non-farm acreages in eastern Nebraska and throughout the country. This trend places development pressure on agricultural lands, driving up land prices and taxes, further exacerbating the economic downturn of farm producers. For example, a study by the American Farmland Trust demonstrates that development has been occurring disproportionately on high quality farmland (Sorenson et al., 1997). This has resulted in the increased use of more marginal lands, leading to increased erosion rates and irrigation demands (Harlin, 1995). This highlights a new and upcoming problem with agriculture in general, competition over scare resources. For instance, the UNL Water Center estimates that one acre-foot of water can irrigate one half acre of corn annually, or provide for a family of five for one year (UNL Water Center, 2002).

The environmental and public health consequences of the emerging industrialized farm sector are becoming increasingly prevalent and apparent in Nebraska. For example, high ground water nitrate was first identified in the Central Platte Valley in 1961, and by 1974 large areas were found in which levels of nitrate-nitrogen (NO3-N) far exceeded the national standards for safe drinking water of 10 ppm as set by the U.S. Public Health Service and Environmental Protection Agency. This trend has continued upward (Central

Platte Natural Resources District, 1993). In addition to the health problems associated with nitrate, there are substantial economic costs as well. Rural communities must dig wells deeper, mix contaminated water with clean water to bring levels down to acceptable limits, or provide bottled water to local residents if their wells are contaminated.

Integrated Agricultural Systems

As the public is becoming aware of the multitude of problems associated with this modern industrialized method of agriculture characterized by fewer and larger farms, a push for implementation of sustainable production techniques is underway. However, reversing this trend and moving back towards smaller sustainable farming units will require the development of viable alternatives to conventional cash grain farms and other large scale farming enterprises (Olson, 1998). One method to deal with some of these problems that has been suggested by sustainability advocates is the integration of agricultural systems. Integration means to make whole or to bring parts together.

Researchers are increasingly recognizing the important role biodiversity can play in agroecosystems. Biodiversity, referring to all species of plants, animals and microorganisms existing and interacting within an ecosystem, is responsible for various ecological services essential to agriculture. These include recycling of nutrients, regulation of microclimate and local hydrological processes, suppression of undesirable organisms, and detoxification of noxious chemicals (Altieri, 1999). Unfortunately, biodiversity has suffered in the wake of the monocropping of annuals with heavy pesticide use. In natural ecosystems, the internal regulation of function is substantially a product of plant biodiversity through flow of energy and nutrients and through biological synergisms. This form of control is progressively lost under agricultural intensification and simplification, so that monocultures in order to function must be predominately subsidized by chemical inputs (Swift and Anderson, 1993). However, in general, agroecosystems that are more diverse, more permanent, isolated, and managed with low-input technologies take fuller advantage of work done by ecological processes associated with biodiversity than do simplified, input-driven and disturbed systems (Alteieri, 1995). Further, interactions among components should enhance complementarity and synergistic responses resulting in increased efficiency of production and strengthening the economic viability of integrated agricultural systems (Parker, 1989).

Integrated farming has been defined by the International Organization for Biological and Integrated Control (IOBC/WPRS Bulletin, 16(1) in El Titi et al., 1993) as a farming system which integrates natural resources and regulation of off-farm inputs; secures sustainable production of high quality food and other products through ecologically preferred technologies; sustains farm income; eliminates or reduces sources of present environmental pollution generated by agriculture; and sustains the multiple functions of agriculture (El Titi, 1993). However, while substantial research and literature exists about what is theoretically possible and advisable in reference to agricultural integration, present day producers are faced with a gap in what is actually achievable in practice. For example, while extensive literature and enterprise budgets exist on production of the major commodity crops in the area, very little exists on the production of smaller scale specialty crops, or how they could potentially fit into the current production system of a typical eastern Nebraska farm.

Systems Comparisons

To explore this integration, Olson (1998) performed a study developing economic and environmental models of alternative farming systems, as they offer a means of evaluating a wide range of systems at low cost and no risk. The study, titled "*Procedures for Evaluating Alternative Farming Systems: A Case Study for Eastern Nebraska*", provides a step-by-step guide and source of data and supporting information for readers who seek to use this approach to evaluate other systems. As will be explained in further detail in subsequent material, the conventional corn-soybean farming system, as outlined by Olson, was used as a starting point for this study's model for assessment of integrated systems. The results of Olson's study suggest that simple models, basically an accounting procedure used to quantify inputs and outputs, and a few basic rules governing the interactions among systems components, are sufficient to conduct preliminary analysis and comparisons of alternative farming systems (Olson, 1998). Further, the results suggest that by increasing crop diversity and adding high-value crops to the rotation, or by replacing row crops with pasture and cattle, farmers with smaller farms can increase net income per acre and remain competitive with larger conventional farms (Olson, 1998).

Two other national studies also provided supporting information to help formulate the procedures used in the current study to examine the feasibility of integrating supplemental crops into an existing enterprise. "*Supplemental Vegetable Enterprises for a Cow-Calf and Grain Farmer in Southeastern Oklahoma*" by Schatzer et al. (1986) investigated the economics of supplementing income on beef cow and grain farms, typical of southeastern Oklahoma, by adding vegetable enterprises. This was the only study found that specifically focused on the labor requirements of the supplemental crops and the labor availability of the producer to determine the feasibility of integration. It used enterprise budgets with weekly intervals of resource requirements, and the hypothetical labor availability of one full-time farm operator, and also was dependant on the climatic conditions of the area. This general assessment of labor varied from twenty hours per week in the winter to seventy hours per week in the summer. The assessment focused on having the operator's labor fixed to the original operation, as would be expected given their current skills, knowledge and equipment, and held the labor as variable for the alternative enterprises. It utilized a linear programming model to determine the optimal cropping mix given the set labor and resource constraints. Results of the study indicated that many vegetable enterprises could be profitable alternatives that could fit into the current labor pattern of the beef cow and grain operation.

The other study, "*A Multiperiod Linear Programming Model of Diversification into fruit on Long Island Potato Farms*" (Warner, 1985) developed a multiperiod linear programming model to analyze the transition, year by year, from an annual potato crop to perennial peach and grape crops. The area was noted to be under increasing development pressure and was experiencing rising drinking water contamination. Special consideration was given to labor, marketing, cash flow, and pesticide contamination. A seemingly unlimited amount of labor was used in this model, representing the skilled labor of the producer and hired workers, as well as additional unskilled labor during critical time periods. Because of the high population density of the area, the hiring of additional labor was not constraining as it may be in rural areas of Nebraska. Results of the study indicated that transition to these perennial crops is an economically viable alternative over the entire transition period and beyond, while also resulting in lower pesticide and nitrogen loading rates, thus making it more ecologically beneficial as well. However, sufficient marketing outlets for these alternative crops were indicated to be major constraints to expansion.

Based on the hypothetical and proven benefits of integration found in agroecological research, and the perceived economic benefits alluded to in the previous studies, this current research was undertaken to determine the feasibility, and evaluate the potential success or failure, of integrating various supplemental enterprises that have been researched and proven adaptable in eastern Nebraska. These included: the integration of cattle into the farming system through the grazing of stalk residues; the integration of both fall and spring cabbage production with wheat and sunflower, respectively, to represent the benefits of increasing temporal biodiversity into the farming operation by additional annuals crops; and the integration of herbaceous windbreaks and associated woody floral crops to represent the benefits of increasing both the temporal and the spatial biodiversity of the operation through an intercrop system. Relative to monocultures, intercrop systems can display more efficient use of land, labor or resources, increase yield, and reduced loss to insects, diseases and weeds (Francis, 1986).

The integration analysis was initially focused on optimizing the economic profitability of one full-time farm operator, on an average-sized eastern Nebraska farm by making use of the time available during 'off-times' for corn and soybean production, but also attempts to examine other potential benefits of integration in relation to other resource constraints. This study was not designed to evaluate a system where all farm producers in eastern Nebraska diversify with these particular supplemental activities, as markets would become saturated, yet the research sought to study whether integration of small-scale specialty crops is feasible and beneficial, and provide a model of how this analysis can be done for any combination of enterprises.

Study Objectives

The following objectives guided the research and associated analyses of this study.

1) To determine a realistic base model of a typical eastern Nebraska family farm with one full-time operator, focusing on labor availability among other resource constraints.
2) To analyze and evaluate the feasibility of integrating a number of alternative supplemental cropping enterprises, domestic animals, a specialty annual cropping enterprise such as vegetable production, and a perennial cropping system such as woody floral perennial crops.
3) To provide a working model for future researchers and farm producers to use to determine the feasibility of integrating various supplemental cropping enterprises.
4) To evaluate the synergies present when integration of various crops occurs, assessing whether a gain in sustainability can be achieved through this integration.
5) To examine the effect of the addition of various resources, such as additional labor, rental land, and markets into the model through sensitivity analyses to determine which of those factors most inhibit the added benefits of integration.

Research Methods and Characteristics of a Typical Eastern Nebraska Farm

Research Methods

Enterprise budgets were established for each of four scenarios: 1) base corn-soybean model, 2) winter wheat/cabbage integration with corn-soybean, 3) spring cabbage/sunflower integration with corn-soybean, and 4) agroforestry integration with corn-soybean. Budgets for these farms went beyond typical enterprise budgets to include detailed accounting of the labor needed to perform each individual activity and when it needed to take place. A detailed assessment was performed to determine the maximum field labor available for a typical eastern Nebraska farm as well as the time available for other tasks associated with the farming enterprises that are not critical to field time availability.

A linear programming model was established to evaluate the various alternatives, and determine the optimal acreage allocation given labor constraints. The model utilized a six-year average of the alternative scenarios, so that the costs and returns of the transitions over time for the supplemental enterprises could be included in the evaluation. The initial analysis focused on the optimal strategy for one full-time farm operator. Additional sensitivity analyses were performed to evaluate the outcomes given additional resources, such as additional labor and markets.

Typical Farm

The initial focus of this study was to establish a definition of the size of a typical farming unit in eastern Nebraska, its cropping system, and its typical equipment compliment. This information was used to develop a model that could provide an example of what could be feasible in regard to the integration of supplemental activities to make the farming unit more sustainable given mainly economic and environmental objectives. A study was performed by Bernhardt et al. (1994) to determine the characteristics of typical Nebraska farms. It employed a survey to characterize 381 Nebraska farms statewide in terms of production and non-production variables grouping farms by their common characteristics. Olson (1998) reduced the data set to include only dryland farming in eastern Nebraska.

This typical farm grows both corn and soybeans for grain in rotation, with half of the farm planted to each of these crops in any given year. This average farm turned out to be approximately 650 acres in size with the producer owning about 45% of the land in production; the average debt owed on this owned farmland is 20%; 100% of the cropland is in production; most of the equipment is owned; and chemical applications are based on standard recommendations (Olsen, 1998, Johnson, 1995, and Bernhardt et al., 1994).

Land Costs

The average cost of dryland cropland in eastern Nebraska is $1807/acre (Selley et al., 2001). It is assumed that the producer will have 288 acres owned with a 30-year loan at an 8% interest rate. The remainder of the farmed acreage (352 acres) is rented at a cost of $86/acre, the average for dryland cropland in eastern Nebraska (Selley et al., 2001). Taxes are assumed to be $12/acre, obtained from Selley (1996) in Olson (1998), and adjusted upward by 2.5% per year to account for inflation. See Table 1 for a breakdown of these costs and the total associated land costs for the typical eastern Nebraska farm being illustrated in this study. The actual site conditions in this study were based on the

UNL-ARDC Agroforestry Farm, so its farm size of 640 acres, or one section of land, was used for analysis.

Table 1 – Land Costs of a Typical Eastern Nebraska Conventional Farm

640 Acres X 0 .45 = 288 acres owned & 352 acres rented

Land Ownership Costs

Farmland Debt/acre - $1807 X 0.20 = $361.40
Ammortization Factor - [1-(1/(1+.08)^30)]/.08 = 11.258
Principal Payment + Interest - $361.40/11.258 = $32.10
Total Cost Per Acre - $32.10 + $14.10 = $46.20
Total Owned Land Cost - 46.20 X 288 = **$13,305.60**

Land Rental Costs

Total Rental Land Cost - $86 X 352 = **$30,272**

Total Annual Land Cost - $13,305.60 + $30,272 = **$43,577.60 or $68.09/acre**

Equipment

The typical set of machinery for an average eastern Nebraska conventional farm was taken from Bernhardt et al. (1994). Equipment includes: 120 hp and 100 hp tractors, tandem disc, row and field cultivators, sprayer, combine with corn and bean heads, planter and a pick-up truck. Typical equipment and tasks used on a rental basis include: spreader, anhydrous applicator, roguing crew, tractor to haul corn and soybeans, and the drying of corn. See Table 2 for descriptions of the equipment, as well as the cost of use per hour and per acre, and the ownership costs as outlined by Selley (1996) in Olson (1998) adjusted upward by 2.5% per year to account for inflation to 2001. The machinery costs were averaged among the alternative tasks within the budget to account for flexibility in the operation as a whole.

Table 2 – Average Equipment Costs for Eastern Nebraska Corn-Soybean Farm (2001)

Equipment	Age at Trade	Description	Costs/hr	Costs/acre	Ownership Costs/ac
Tractor #1	15	120 hp diesel cab	8.67		28.65
Tractor #2	20	100 hp diesel cab	8.04		22.11
disc	15	tandem disc harrow 20'		3.11	0.5
row cultivator	15	8 row X 30"		0.38	1.28
field cultivator	10	24'		0.19	2.48
sprayer	15	300 gallon, 20', 3-point mount		0.1	0.44
combine	15	185 hp	24.89		130.48
corn head	15	8 row		0.47	10.71
grain head	15	20'		0.05	3.58
planter	10	8 row X 30"		1.91	4.86
pick up			1609.88 (total)		1105.88 (total)
RENTAL					
Spreader Rental	1.69/hr				
Anhy. Appl. Ren.	9.35/hr				
Hired rogue crew	5.63/hr				
truck corn	.14/bu				
dry corn	.11/bu				
truck soybeans	.14/bu				

Site Conditions

As mentioned earlier, while this farm was meant to be an example of a typical eastern Nebraska farm, actual site conditions were based on the UNL-ARDC Agroforestry Farm to establish a more realistic model. However, these conditions are similar to those that are typically experienced in most of eastern Nebraska.

Eastern Nebraska lies within the western portion of the Western Cornbelt ecoregion (Omernik, 1987). Terrain is flat to rolling glaciated soils of loess parent material. It has a continental climate with approximately 25 to 32 inches annual precipitation, highly variable from year to year and shows a spring and early summer maximum (Olson, 1998). The farm is in dryland production. Nitrogen is usually the most limiting soil nutrient needed to produce grain crops and the application of anhydrous ammonia is the common fertilization practice for the area. Crops are generally sold directly to the elevator at the time of harvest for the going market price.

Base Model

Benefits of Rotation

It has been commonly accepted that crops grown in rotation have benefits over those grown in continuous production. For instance, where crop species are significantly niche differentiated and are suited to the particular environment, growing them in rotation is known to produce higher yields of each component crop (Hall, 1993). Nutrient management, erosion control, and suppression of pests, diseases and weeds are highly dependant on crop diversification, both in time and space (Hall, 1993). For example, the use of crop rotation establishes the framework for sustainable weed management by limiting build-up of weed populations, since crops tend to be affected by particular weed species that possess similar growth habits and thrive under the same cultural conditions as the crop. By growing sequences of crops that differ in planting and maturation dates, competitive characteristics, and soil management requirements, growth and reproduction of a given weed species can be disrupted (Leibman and Janke, 1990)

Further, rotation of a non-legume crop with a legume crop can have additional benefits. For example, legumes have the ability to combine symbiotically with soil bacteria genera, including *Rhizobium* species, to fix atmospheric nitrogen and convert it into forms available to other organisms, a process vital to the biosphere. This is an important part of the nitrogen cycle (Hall, 1993). Soybeans are known to produce more nitrogen by fixation when in a nutrient-limited environment, for example after corn (Hall, 1993).

Finally, Helmers et al. (2001) found that rotations of corn and soybeans not only result in higher crop yields and net returns, but they also provide a significant reduction in risk compared to continuous corn. Data from a study at the UNL-ARDC over a period of 1985-1998 had an average net return of $319.59 per acre on continuous corn, compared to an average net return of $458.45 per acre from a corn-soybean rotation (Helmers et al., 2001). Distinct reduced risk advantages were due to a combination of three factors: rotations involve diversification, an offsetting phenomenon where low returns in one year for one crop are combined with relatively high returns from a different crop; rotations are generally thought to reduce yield variability in comparison with monocultural practices; and rotations may result in higher overall yield as well as reduced production costs.

Most likely due to a host of these and other factors, farm producers in eastern Nebraska commonly grow corn and soybeans in a rotational mix. We could expect the benefits of integration to increase when other crops are added into the mix.

Enterprise Tasks

To establish the base model, the typical tasks, their durations, and approximate dates when they are needed in a corn-soybean model were taken from those outlined by Olson (1998), expanded and refined with information from the farm managers at the UNL-ARDC agroforestry farm (see Table 3). The tasks were separated into those that are "critical", since they must happen in order for production to occur, and they must occur during available field growing time. The other tasks were labeled as "non-critical" as they need to occur in order to make production efficient, yet are not critical to specifically produce the crop and they do not necessarily need to occur during available field working time.

Table 3 – Base Corn-Soybean Farm Field and Non-Field Tasks

Critical Base Farm Tasks (during growing season)	Hours	Date
Disc corn - 320 acres	41.03	4/9-4/15
Disc soybeans - 320 acres	41.03	4/16-4/2
Apply fert (anhydrous + phos if needed-(1 in 10 yrs)) - 320 acres	32.99	4/23-4/29
Field culitivation - 640 acres	47.06	4/23-4/29
Plant corn - 320 acres	49.23	4/30-5/6
Spray corn - 320 acres	31.37	4/30-5/6
Plant soybeans - 320 acres	49.23	5/14-5/20
Spray soybeans - 320 acres	31.37	5/14-5/20
Cult. turn rows - 60 acres	3	6/11-6/17
Cultivate soybeans - 320 acres	47.06	6/25-7/1
Rogue soybeans - 320 acres	Custom	7/30-8/5
Combine corn - 320 acres	62.75	9/17-9/23
Combine soybeans - 320 acres	36.78	10/1-10/7
Total Hours	**472.90**	

Non-Critical Base Farm Tasks winter off-time (25 weeks)	Hours	Date 1/1-4/1 and 10/8-12/31
Winter maintenance & repair	94.58	
Bin Unloading & Cleanout	16	
Planning (soil test, seed & chem purc., billing, etc.) - HALF	40	
Shop work (not including equip maint) - HALF	40	
Building maintenance & repair (trash out, furnace maint, painting, etc.) - HALF	40	
Total Hours	**230.58**	Misc tasks (9.22hrs/wk)

Growing season off-time tasks (27 weeks)	Hours	Date 4/9-10/7
Summer maint & repair	40	
Mowing	80	
Building maintenance & repair (trash out, furnace maint, painting, etc.) - HALF	40	
Shop work (not including equip maint) - HALF	40	
Planning (soil test, seed & chem purc., billing, etc.) - HALF	40	
Total Hours	**240**	**Misc Tasks (8.89 hrs/wk)**
		Grand Hourly Total: 943.48

A summary of the inputs that were used in this operation and their costs are listed in Table A1-1 (Selley et al., 2001). Per acre bushel returns for corn and soybeans were taken from Olson (1998) and assumed to be 105 and 35 bushels/acre, respectively, in these dryland conditions. To determine the average return per bushel, a 17-year average of monthly values for these commodities was established from data published by the NASS (2001) (see Tables A1-2 and A1-3).

Enterprise Budgets

The tasks and their durations, inputs, and the machinery set and their associated costs were used to develop detailed enterprise budgets for the production of 320 acres of corn and 320 acres of soybean on a typical eastern Nebraska farm. See Table 4 for a simplified version, and Table A1-4 for the complete information used for this analysis. A labor rate of $15 per hour was used to illustrate the value that should be placed on a farm producer's time, given that they could make this amount or higher in other private industries with hard labor. In this scenario, the farm producer would receive an annual salary of $14,152.20. Without the addition of crop subsidies, this scenario resulted in a net loss to the farming enterprise of $4,752.97, highlighting the current need for crop subsidies in U.S. agriculture with production focused on only two crops.

Table 4 – Simplified Corn-Soybean Base Farm Enterprise Budget for 640 Acres

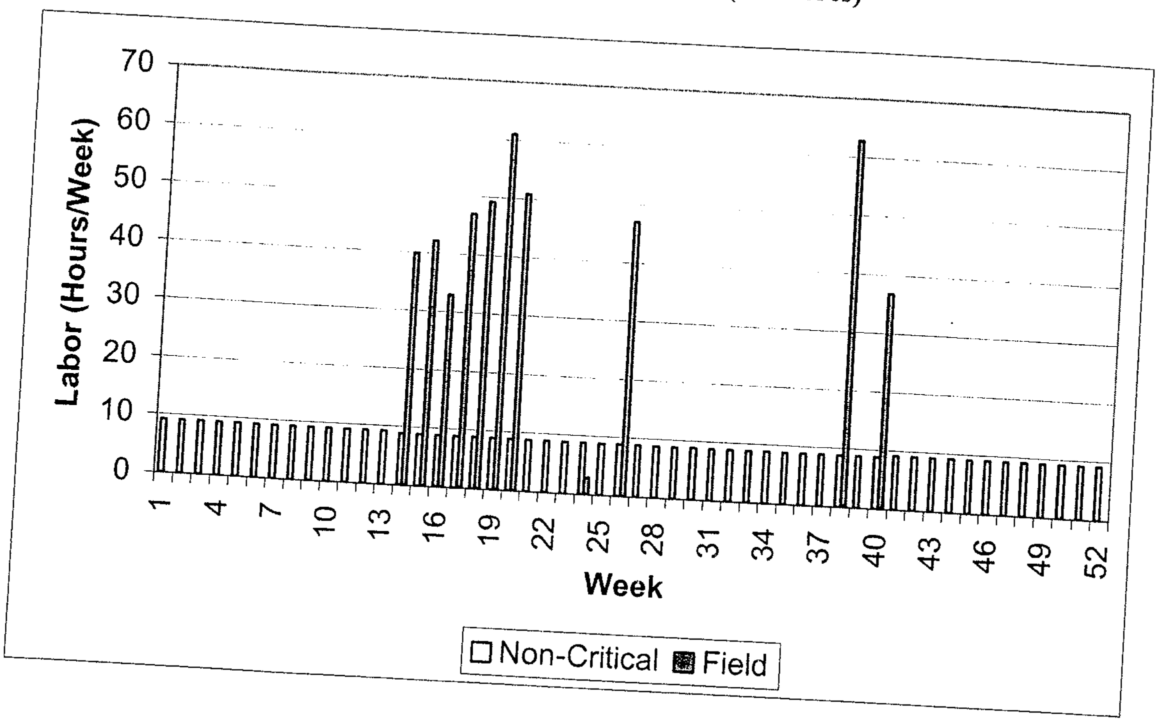
(See Table A1-4 for the Complete Information)

Week	Date	Task	Time/Field	Time/Other	Equipment	Cost
1 to 13	1/1-4/1	Misc		119.86		
14 to 40	4/2-10/7	Misc		240.03		
14	4/2-4/8	Start disk corn	39.91		Tractors & Disk	1626.14
15	4/9-4/15	Disk corn & soybeans	42.15		Tractors & Disk	1717.04
16	4/16-4/22	Apply anyhydrous	32.99		Tractors & Applicator	5004.11
17	4/23-4/29	Field cultivation	47.06		Tractors & Cultivator	1825.84
18	4/30-5/6	Plant corn	49.23		Tractors & Planter	9528.86
19	5/7-5/13	Spray corn & plant soybeans	61.06		Tract., Planter, & Spray.	13314.56
20	5/14-5/20	Plant & spray soybeans	50.91		Tract., Planter, & Spray.	13075.41
24	6/11-6/17	Cultivate turn rows	3		Tractors & Cultivator	127.85
26	6/25-7/1	Cultivate soybeans	47.06		Tractors & Cultivator	1769.36
31	7/30-8/5	Rogue Soybeans			Custom	1801.6
38	9/17-9/23	Combine corn	62.75		Combine & Corn Head	18971.11
40	10/1-10/7	Combine soybeans	36.78		Combine & Grain Head	7430.44
41 to 52	10/8-12/31	Misc		110.64		
		Totals	472.9	470.53		76192.32
					Fixed Costs	53961.78
					Labor @ $15/hour	14150.88
					Total Costs	144304.98
					Total Returns	139552
					Net Income	**-4752.98**

Labor Bottlenecks and Labor Availability

The simplified enterprise budget shown in Table 4 illustrates that the total annual labor needed to accomplish this operation is only 943.39 hours, or an average of only 18.14 hours per week on an annual basis. However, this labor is distributed unevenly throughout the year, being highly concentrated and almost unmanageable during the spring and fall, while leaving various other time periods open. These 'bottlenecks of labor' are illustrated in Graph 1. This illustrates how farm producers are able to seek off-farm employment, and also highlights those time periods where integration of supplemental crops may be possible.

Graph 1- Corn-Soybean Base Farm Labor Distribution (640 acres)



Subsidies

The new Farm Security and Rural Investment Act of 2002 includes provisions authorizing direct and counter cyclical payments over the next five years to help farm producers recover from these net losses. The payments are determined using base acres enrolled in the program and program yields. This new bill includes three types of payments: direct payments, counter-cyclical payments, and loan deficiency/marketing loan payments.

The ratio for calculating direct payments is:

Per Bushel Payment Rate X Program Yield X (Base Acres x .85)

The per bushel payments rates for 2002-2007 are: corn $0.28, soybean $0.44, and wheat $0.52 (University of Illinois Cooperative Extension, 2002).

The ratio for calculating counter-cyclical payments is:

(Trigger Price – higher of loan or season average price) X Yield X (Base Acres x .85)

The trigger price equals a target price minus the direct payment rate. The maximum per bushel values for 2002-2003 are: corn $0.34, soybean $0.36, and wheat $0.52 (University of Illinois, 2002).

The loan Deficiency Payment (LDP) and marketing loan provisions are essentially the same as those under the 1996 Farm Bill. Payments received in Saunders County Nebraska in 2001 were taken from information provided by the Center for Agriculture and Rural Development (CARD). Corn and wheat county LDP rates were negative and thus were not figured into the aid analysis; however, LDP payments for soybean were $0.18 per bushel (CARD, 2002).

[See Table 5 for a summary of the subsidy rates used for corn and soybeans, and Table 8 in the cabbage integration section for a summary of the subsidies used for wheat production.]

With subsidies, the hypothetical producer ended up with a subsidy payment of $26,244.74, which eliminated the deficit and brought up the annual net return to $21,491.77.

Table 5 – Subsidy Payments for Corn and Soybeans

Payment								
Direct								
Corn	0.28	X	(105 X .935)	X	(320 X .85)	equals	$7,477.01	or $23.37/acre
Soybeans	0.44	X	(35 X .935)	X	(320 X .85)	equals	$3,916.53	or $12.24/acre
						Total	**$11,393.54**	
Counter-Cyclical								
Corn	0.34	X	105	X	(320 X .85)	equals	$9,710.40	or $30.35/acre
Soybeans	0.36	X	35	X	(320 X .85)	equals	$3,427.20	or $10.71/acre
						Total	**$13,137.60**	
Loan Deficiency								
Soybeans	0.18	X	35	X	(320 X .85)	equals	$1,713.60	or $5.36/acre
						Total	**$1,713.60**	
						Total	**Payment**	**$26,244.74**

Cattle Integration

Benefits

The grazing of crop residues offers a unique opportunity for livestock producers, providing a cheap, quality feed source for livestock. As long as cattle have leaves and grain to select, corn and sorghum residues are comparable in nutritional value to good quality grass hay (Rasby, 1998). In addition to the nutrition available, grazing can reduce wear and tear on drylot facilities, reduce equipment and operating costs, and reduce labor needed for feeding and manure removal (Rasby, 1998). It can also offer unique opportunities and advantages for the grain producer. Farming systems that are ecologically, biologically, and socio-economically sound not only involve animals, but also depend on their integration with other farm practices (Parker, 1990). However, today we have almost entirely uncoupled plant and animal production, eliminating the contributions that each can make to the other and substituting other synthetic productions and services. This specialization makes the farming unit more reliant on off-farm inputs, often from great distances away. By substituting economic integration for ecological integration, we have obscured ecological relationships in our present agricultural systems (Hardesty and Tiedeman, 1996).

The reintegration of livestock, particularly ruminant animals such as cattle, can provide numerous economic and ecological benefits to a grain operation simply by the activity of grazing stalk residues. The utilization of crop residues is significant and provides an economic stabilizer for grain production, providing income from an otherwise underutilized resource, eliminating the expense and labor needed to shred the stalks, and reducing the problem of volunteer corn in the following years' soybean crop in a corn-soybean rotation (Rasby, 1998). Recent advances in electric fencing have reduced the labor demands associated with this practice, reduced fixed costs, and increased its efficiency.

Livestock presence in a grain field can also promote the cycling of nutrients, potentially increasing soil fertility and reducing input costs, as nutrients are more quickly recycled and additional nutrients supplied to the system as supplements are fed to the animals during the grazing period. Major portions of the important plant nutrients ingested by ruminants are returned to the soil via feces and urine. Mott (1974) reported that, of the plant nitrogen and minerals consumed by grazing, 75% to 95% of the nitrogen and 90% to 96% of the minerals are returned to the soil. Additionally, salt, phosphorus, calcium, vitamin A, and crude protein are commonly fed to animals during grazing, thus increasing potential soil fertility increases from fertilizer application (MCC, 1999-2000).

Additional, non-tangible benefits of animal integration include increased soil and water conservation, as residues remain intact during critical times, and biological weed control. Grazing animals can be intensively managed to control vegetation, acting as gleaners or "biological scrubbers" to control many species of undesirable plants, thus reducing herbicide costs (Parker, 1990).

While critics have argued that grazing of stalk residues can actually decrease subsequent crop yields due to compaction, research at the UNL-ARDC has shown otherwise. Lesoing et al. (1996) performed a study to examine the impacts of grazing crop residue on subsequent crop yield and found no significant effects on crop yields for corn and soybeans. They concluded that when normal stocking rates are used, grazing does not have any adverse effects on crop production. Another study by Erickson et al.

(2001) found that the spring grazing of corn stalks led to increased yields of subsequent soybean crops. Researchers hypothesize that this could be due spring grazing resulting in a firmer seedbed, which may lead to faster warming of the soil (Wilson, 2002).

Finally, while livestock production is expected to continue to grow as consumer demand for meat products continues to climb, there has also been a rise in consumer demand for sustainably produced meat products, such as those labeled as "range-fed". This may be due to consumer awareness of the environmental, health and social costs associated with large confinement operations, such as soil and water contamination by waste products, antibiotic resistance, offensive odors, and animal cruelty charges. This could provide an increasing market opportunity for those farmers willing to graze animals on crop residue.

While the full integration of plant and animal resources to achieve optimal biomass output may be the ultimate goal of sustainable farming systems, it is beyond the scope of this study. This level of integration should be explored in further research. A recent report by the Council on Agricultural Science and Technology (CAST, 1988) indicated that the best strategy for economic viability is flexibility within agricultural systems for food and fiber production. The report suggested that enterprise flexibility can be achieved through reduced input costs and increased diversification of operations. Also, these types of integrated agroecosystems with animals should provide a greater stabilizing effect against short-run fluctuations in net return (Parker, 1990). Integrated crop and animal systems also have the opportunity to increase efficiency in agricultural production, as Parker (1990) estimates that "at present, 60 % of the corn crop is sold for livestock production, with the balance going to human food and export markets." Finally, as the number of livestock produced in confinement continues to climb, waste removal costs for these confinement operations, and the associated cost for use of this waste as fertilizer for grain crops will also continue to climb as they become farther apart physically. Animal manure still is a major potential source of soil nutrients, but consolidation of confined livestock farms into specialized production facilities with little associated cropland has made use of this resource less economically feasible. Such consolidation results in not only an underutilized manure nutrient resource, but also can lead to major problems with water pollution and stench (Hardesty and Tiedeman, 1996). Integration thus could reduce these costs and lead to greater efficiency in production.

The grazing of crop residues provides a unique opportunity for both grain and livestock producers, providing numerous economic and non-tangible benefits. It has the potential to increase the efficiency of production systems by integrating decoupled agricultural production practices while making use of synergistic relationships to increase ecological sustainability as well. While these benefits can be substantially increased by the full integration of livestock into grain production systems, the analysis is beyond the scope of this study. However, based on the various perceived benefits, these systems merit future research efforts.

Economics

An estimate of what a grain producer in eastern Nebraska can expect to receive for the grazing of stalk residues is approximately $6 per acre (Wilson, personal communication, 2002). This average rate can be expected on corn and soybean stubble, as well as wheat, sunflower, and cabbage that will be explored in subsequent sections. Therefore, the hypothetical producer in this model can expect to receive \$3,840 (640 x 6) annually, simply by allowing their acres to be grazed, as well as receiving all of the numerous other non-tangible benefits associated with animal integration and fallow winter grazing.

A dryland field provides an average of 2,500 pounds per acre of feed for grazing, or approximately 4.2% of the corn and soybean yield (Rasby et al., 2000). One animal unit month (AUM), the amount of forage required to sustain a 1,000-pound cow or equivalent for one month, can be expected for each acre of dryland grain production (Rasby et al, 2000). So, a farm with 640 acres of grain stubble could sustain 160 cows for 4 months.

Cabbage Integration

Justification for the integration of agricultural systems based on numerous potential benefits has been thoroughly explored above. However, an assessment must now be made to determine the feasibility of integrating supplemental crops into an existing corn-soybean rotation based on resource constraints and agronomic feasibility. One option is the integration of an annual vegetable crop such as cabbage. Schatzer et al. (1986) demonstrated the potential feasibility and economic benefits of integrating vegetable enterprises into a cow-calf grain operation. However, will this be possible in eastern Nebraska? Hodges (personal communication, 2002) has demonstrated the successful production of both spring and fall cabbage in eastern Nebraska, and identified potential markets for this product close by at coleslaw production plants along the Missouri River.

However, to determine whether integration of a supplemental crop into an existing rotation is possible, a producer must consider whether the new crop is compatible with the current rotation. For example, will any allelopathic tendencies of one crop interfere with another? Next, operators will need to examine whether the chemicals sprayed on one crop potentially could have a negative impact on any of the other crops. For example, some of the newer broadleaf herbicides such as the sulfonylureas and imidiazoles are very toxic to vegetables and have a long residual effect. As an alternative, the hypothetical farm producer in the model could use 2,4-D on the grain crop with little concern for residual activity affecting cabbage production (Hodges, personal communication, 2002). Similarly, the use of trifluralin as an herbicide does not threaten sunflower production (Hodges, personal communication, 2002). In this case, corn, soybeans, and cabbage seem to be compatible physiologically, and the hypothetical chemicals used in this model, characteristic of the typical eastern Nebraska farm practices, also are compatible. However, a determination must now be made of whether they will be compatible operations given labor constraints, and if so, how much cabbage can be produced?

Cabbage is a short season crop requiring only 85 days from transplanting to harvest. The average growing time in eastern Nebraska is 150 days. This allows for a number of possible variations in a crop rotation, such as winter wheat with fall cabbage, or sunflower with spring cabbage.

Benefits

Cabbage is considered an inexpensive crop to produce, requires minimal capital or specialized equipment, and is very tolerant of unskilled production techniques; it is a very "forgiving" crop (Hodges, personal communication, 2002). Likewise, neither the production of winter wheat or sunflowers requires any additional machinery or specialized knowledge beyond that to produce corn and soybean crops. Cabbage can be used as a nitrate "clean-up" crop, reducing the negative ecological impacts of soil and water contamination that are commonly associated with corn production that utilizes synthetic fertilizers.

The production of cabbage in conjunction with winter wheat provides a distinct advantage in terms of fertilizer use. Commercial fertilizer use for particular crops such as corn is very high; 98% of the average producers in the top ten corn producing states applied commercial fertilizers (ERS, 1997). Most manure applications from a feedlot are applied to grain fields during the fall after corn and soybean harvest. While the use of manure may be more economical and stable than anhydrous ammonia applications, it can be more expensive in the short run. For example, fall application costs of manure by the Mead Feedlot near the ARDC farm with a delivery distance of 5 miles are $45 per acre, versus only $ 9.35 per acre ($0.17/lb. X 55 lbs. per acre) for the application of anhydrous ammonia. However, Mead Cattle Company organic fertilizer at 25 tons contains 195 lbs nitrogen (N), 135 lbs phosphorous (P), 167 lbs potassium (K), and 35 lbs sulfur (S) for $45.00 per acre (at 25 tons/acre application rate), whereas commercial fertilizers providing these same nutrients would cost approximately $79.19 per acre (MCC, 1999-2000). Mead Cattle Company (MCC) manure fertilizer also contains magnesium, calcium, sodium, iron and traces of copper, manganese and zinc (MCC, 1999-2000). The Mead Cattle Company also provides deep chisel cultivation and a disc operation to incorporate the manure, as well as a soil test for nutrient levels prior to, and after application as part of their fertilization package.

The production of winter wheat allows for a reduced cost application of manure as a fertilizer source for the operation. This added benefit is possible because wheat harvest occurs in July, with a potential window for manure application at any time after harvest. During this time, the Mead Cattle Company offers a reduced rate for manure application at $28/acre (Cieslik, personal communication, 2002). This unusual time availability (for eastern Nebraska) also allows the producer to benefit from reduced costs for lime application and time to work on field terraces.

The use of manure has many benefits over the use of anhydrous as a fertilizer resource. Synthetic fertilizer can influence the growth of weeds as well as crops

(Moomaw, 1987). For example, studies conducted with synthetic nitrogen fertilizer indicate that it can increase both the rate and the total number of weed seed germination and may promote weed growth more than crop growth (Di Tomaso, 1995). Synthetic fertilizer can also increase disease susceptibility (Jenkyn, 1976). However, organic matter from manure can decrease pest and disease incidence by increasing species diversity in favor of natural enemies (Altieri, 1985). Increased organic matter from manure can absorb and inactivate pesticides, and provide alternative food for marginal crop pests (Edwards, 1966 and 1989). Beef cattle feedlot manure contains approximately 15% carbon. This element improves soil physical and chemical properties, especially for low organic matter or eroded soil, where the additional carbon can be more important than the manure's other nutrients (Eghball, 2000). Decomposition by bacteria in manure improves soil aeration, improves permeability, increases water-holding capacity, provides pH buffering, and increases levels of carbon dioxide (CO_2) in the plant canopy (MCC, 1999-2000). Soil pH can be increased by feedlot manure or compost application because feed rations in a cattle feedlot contain calcium carbonate $CaCO_3$, and may reduce the need for lime applications (Eghball, 1999).

Nitrogen from manure may be more ecologically sensitive and persist longer, thus decreasing input costs over time for the producer. Inorganic N fertilizer applications are available immediately after application, and unused N can be quickly converted into nitrate and leached into the groundwater leading to significant water quality problems. Alternatively, in times of drought, crop stubble in fields heavily fertilized with inorganic nitrogen can contain excessive amounts of nitrate, leading to highly toxic conditions for livestock when this stressed crop is used as feed. However, of the organic nitrogen applications from feedlots during the previous growing season, approximately 11% was mineralized from composted manure, and 21% from non-composted manure during the succeeding growing season (Eghball, 2000). This highlights not only the potential decrease in ecological problems associated with organic versus synthetic fertilizer amendments, but also shows that the benefits of application can persist and may extend over several seasons.

Crop yields are known to increase following composted feedlot and dairy manure application compared to synthetic fertilizer application. Erickson et al. (2001) found that adding compost to irrigated corn, irrigated soybeans, and dryland corn acres significantly increased yields, with four-year average increases of 2.3, 1.5, and 2.7%, respectively. Since the needed crop N was adequately supplied by both the synthetic and organic fertilization treatments, the yield increase may be due to the availability of P alone, or could be from the presence of P, organic matter, and K in combination (Erickson et al, 2001).

However, despite the benefits that can be achieved by the incorporation of inorganic manure as a fertilizer resource, its application must occur at least one month prior to the planting of a vegetable crop such as cabbage. If this is not possible, then the manure will have to be composted for an acceptable temperature and length of time prior to application, or a synthetic fertilizer source will have to be used alternatively.

Winter Wheat/Fall Cabbage Model

The tasks and costs to produce an acre of cabbage were taken from an enterprise budget for integrated crop management at Rutgers Cooperative Extension (1996). These tasks and their associated costs were adapted to include specific duration and time intervals needed for production based on local conditions from Hiller and Hodges (personal communications, 2002) (see table 6). The tasks and the costs involved for winter wheat production were obtained from the Mead agroforestry farm managers (Bolander and Cieslik, personal communications, 2002).

Table 6 – Winter Wheat/Fall Cabbage Field and Non-Field Tasks

Critical Base Farm Tasks (during growing season)	**Hours**	**Date**
Wheat starter fertilizer - 1 acre	0.08	3/26-4/1
Spray wheat - 1 acre	0.1	5/21-5/27
Harvest wheat - 1 acre	0.15	7/2-7/8
Apply manure - 1 acre	custom	7/9-7/15
Disk cabbage & apply herbicide - 1 acre	0.26	7/9-7/15
Cultivate cabbage - 1 acre	0.07	7/16-7/22
Plant cabbage - 1 acre (+ 8 hrs hired labor)	4	7/16-7/22
Set up irrigation - 1 acre	4	7/23-7/29
Irrigation (7 weeks) - 1 acre	24.5	7/23-9/9
Cultivate cabbage for weed control - 1 acre	0.07	8/13-8/19
Cabbage pest control (4 weeks) - 1 acre	0.4	8/13-9/9
Harvest cabbage - 1 acre	10	9/10-9/16
Plant wheat - 1 acre	0.07	10/8-10/15
Non-Critical Base Farm Tasks	**Hours**	**Date**
winter off-time (25 weeks)		1/1-4/1 and 10/8-12/31
Marketing	10	
Same misc tasks as corn-soybean	0.3602	
	Hours	**Date**
Growing season off-time (27 weeks)		4/9-10/7
Same misc tasks as corn-soybean	0.3753	
Total Operator Hours	54.44	(8 hrs hired labor)

A summary of the inputs for the hypothetical cabbage model, are listed in Table A2-1. Table 7 lists all costs in comparison to the Rutgers Enterprise Budget and notes where the information was obtained. Two assumptions were made for the cabbage production model: there is no broker, cabbage is sold directly to the slaw plants or minimally processed salad plants; and there are no cooling costs, due to direct daily delivery to the processor.

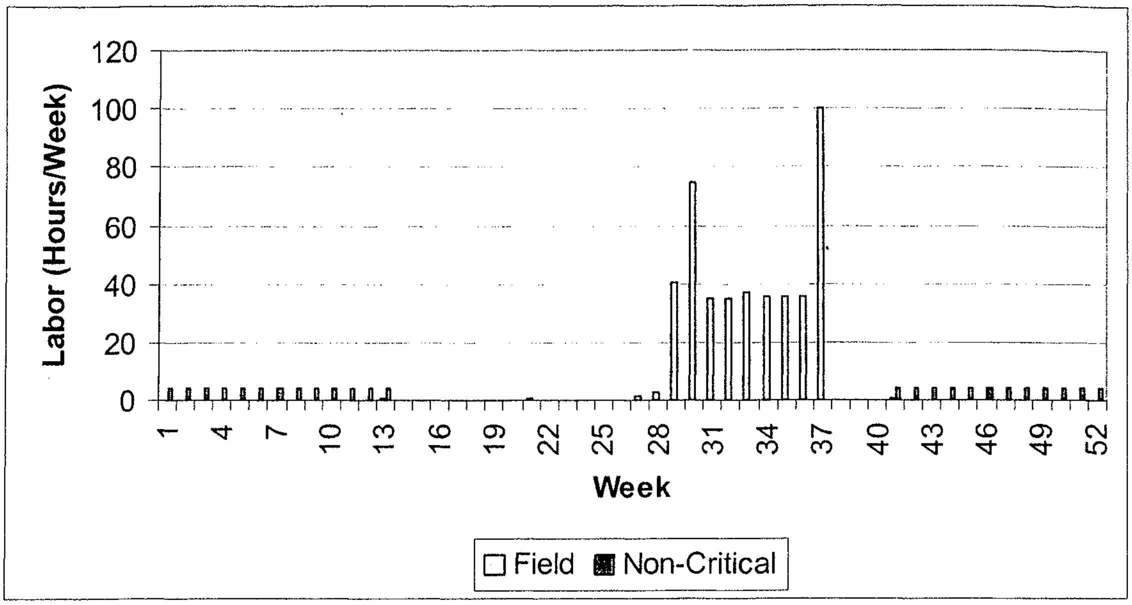
In our model production costs are higher than those for Rutgers (see Table 7), as other production variables were included such as purchase of a used transplanter, trucking, product liability insurance, and a higher wage rate. However, there are also costs listed as zero in the model such as repair and maintenance and land charges, as these costs are accounted for later after the cabbage and wheat crop have been examined together. This was done to evaluate the economic efficiencies that can be realized with integrated crop production strategies. For instance, since winter wheat and cabbage are produced in the same year, on the same acres, the land costs can be divided between the two crops.

Table 7 – Model comparison to Rutgers

Task	Rutgers	Current Study	Notes
Returns	600crts*8.45=5070	47392.6*0.17=8056.74	Hodges (2002) - (Yield 13,939 heads/acre X 4 lbs/head X 0.85 % harvestable) and Chicago Wholesale Price for Cabbage $ 0.17/ pound
Lime & Fert	114.65	28	Selley et al. (2001)
Herbicide	32.87	5.42	Selley et al. (2001)
Fungicide	46.5	19.13	Rutgers Enterprise Budget (1996)
Pesticide	46.55	22.2	Selley et al. (2001)
Plants	500	696.95	Hodges (2002) - 28 day old transplants/$0.05 each
Total Labor	822.94 (98.24 hrs)	876.3 (62.42 hrs)	Hodges and Hiller personal comm. (2002)
Irrigation	192	192	Rutgers Enterprise Budget (1996)
Repair & Maint	92.79	0	(included elsewhere)
Packing Crates	900	521.32	Hodges (2002) - $11/1,000 lb bin
Selling Charge	152.1	0	(selling directly to plant)
Int. on operating capital	61.37	0	(included elsewhere)
Tractors	98.19	0	(included elsewhere)
Implements	58.5	0	(included elsewhere)
Land Charge	100	0	(included elsewhere)
Mngt. Fee	218.29	0	(included elsewhere)
Used Transplanter		2000	Gempler's (2002)
Trucking	0	71.09	Selley et al. (2001)
Product Liability	0	500	Hodges (2002)
Total Cost	$3,436.75	$4,932.41	
Net Returns	**$1,633.25**	**$3,124.33**	

Graph 2 shows the labor distribution that would be required to produce ten acres of winter wheat and cabbage. By comparing the corn-soybean labor needs in Graph 1 with the labor needs of winter wheat/fall cabbage in Graph 2, it can be seen that the two options have labor requirements during different time periods and thus allow for feasible integration.

Graph 2 – Winter Wheat/Fall Cabbage Labor Distribution (10 acres)



<u>Spring Cabbage/Sunflower Model</u>

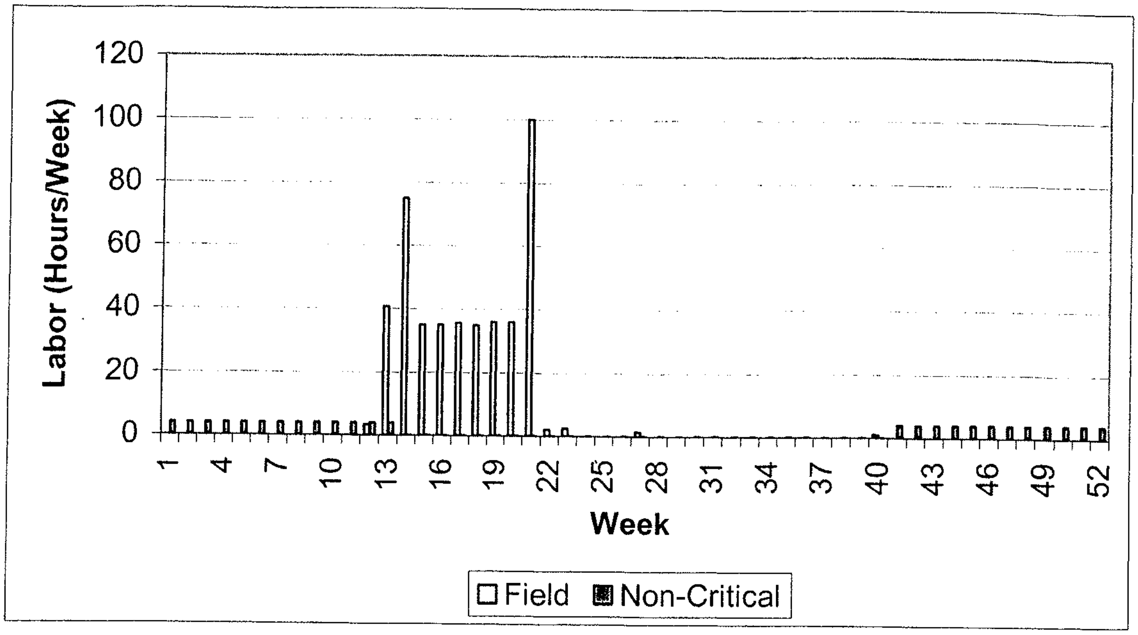
The production of spring cabbage is essentially the same as that of fall cabbage, so the model includes the same data that was used in the production of fall cabbage, although different dates for the activities were used corresponding to spring production. However, with spring cabbage production, there will generally be less insect pressure (Hodges, personal communication, 2002), so a producer would probably not have to apply insecticide. And the spring cabbage/sunflower model uses synthetic fertilizer, which is more expensive than the manure applied to fertilize the fall cabbage model. Table 8 outlines the tasks, their durations and dates for the production of spring cabbage and sunflower.

Table 8 – Spring Cabbage/Sunflower Field and Non-Field Tasks

Critical Base Farm Tasks (during growing season)	Hours	Date
Apply herbicide & disk cabbage - 1 acre	0.26	3/19-3/25
Fertilize cabbage - 1 acre	0.08	3/19-3/25
Cultivate cabbage - 1 acre	0.07	3/26-4/1
Plant cabbage - 1 acre (+ 8 hrs hired labor)	4	3/26-4/1
Set up irrigation - 1 acre	4	4/2-4/8
Irrigation (7 weeks) - 1 acre	24.5	4/2-5/13
Cabbage pest control (4 weeks) - 1 acre	0.2	5/7-5/20
Harvest cabbage - 1 acre	10	5/21-5/27
Disk sunflower - 1 acre	0.13	5/28-6/3
Fertilize sunflower - 1 acres	0.08	5/28-6/3
Spray pre-emergent herbicides - 1 acre	0.1	6/4-6/10
Plant sunflower - 1 acre	0.15	6/4-6/10
Cultivate (depends)	0.15	7/2-7/8
Combine sunflower	0.11	10/1-10/7
Non-Critical Base Farm Tasks	**Hours**	**Date**
winter off-time (25 weeks)		1/1-4/1 and 10/8-12/31
Marketing	10	
Same misc tasks as corn-soybean	0.3602	
	Hours	**Date**
Growing season off-time (27 weeks)		4/9-10/7
Same misc tasks as corn-soybean	0.3753	
Total Hours	57.57	(8 hrs hired labor)

Graph 3 illustrates the labor distribution that would be required to produce ten acres of spring cabbage and sunflower. By comparing the labor requirements of spring cabbage/sunflower in Graph 3 to the labor requirements of corn-soybean in Graph 1 it can be seen that the majority of the tasks involved in spring cabbage/sunflower production occur during off times for corn-soybean production allowing for feasible integration of the two. However, due to the high labor requirements of both options in regard to spring planting, integration of spring cabbage/sunflower will probably not be as compatible as the winter wheat/fall cabbage option.

Graph 3 – Spring Cabbage/Sunflower Labor Distribution (10 acres)



Economic/Enterprise Budgets

Table 9 lists the government crop subsidies that can be received for wheat production. Tables A2-2 and A2-3 illustrate how the average price per bushel of winter wheat and sunflower, respectively, were obtained by information from NASS (2002). Tables 10 and 11 outline the simplified enterprise budgets used in this model for winter wheat/fall cabbage and spring cabbage/sunflowers respectively. Tables A2-4 and A2-5 include the complete enterprise budgets that were used for this analysis.

Winter wheat/fall cabbage and spring cabbage/sunflower production are highly labor intensive, requiring approximately 55 hours per acre for each of the two scenarios. However, these labor requirements occur during non-critical times for the production of corn and soybean (see Graph 1).

Table 9 – Subsidy Payments for Wheat

Payment									
Direct Wheat	0.52	X	(48 X 0.935)	X	(5 X 0.85)	equals	$99.18	or $19.84/acre
Counter-Cyclical Wheat	0.52	X	48	X	(5 X 0.85)	equals	$110.16	or $22.03/acre
						Total	**Payment**	**$41.87/acre**

Table 10 – Simplified Winter Wheat/Fall Cabbage Enterprise Budget

(See Table A2-4 for the complete information)

Week	Date	Task	Time/Field	Time/Other	Equipment	Cost
1 to 13	1/1-4/1	Misc + marketing		5.187		
14 to 40	4/2-10/7	Misc		0.3753		
13	3/26-4/1	Starter fertilizer	0.08		Tractors & spreader	14.35
21	5/21-5/27	Spray wheat	0.1		Tractors & sprayer	15.69
27	7/2-7/8	Wheat harvest	0.15		Combine & soybean head	30.85
28	7/9-7/15	Apply manure	custom			28
28	7/9-7/15	Disk cabb & app herb	0.26		Tractors, disk, sprayer & herb	15.49
29	7/16-7/15	Cultvate cabbage	0.07		Tractors & cultivator	2.85
29	7/16-7/22	Plant Cabbage	4		8 hrs hired help & transplanter	756.95
30	7/23-7/29	Set up irrigation	4		Irrigation equipment	192
30-36	7/23-9/9	Irrigate	24.5			
33	8/13-8/19	Cultivate cabbage	0.07		Tractors & cultivator	2.85
33-36	8/13-9/9	Pest control	0.4		Sprayer & insecticide	55.14
37	9/10-9/16	Harvest cabbage	10			592.41
41	10/8-10/15	Plant wheat	0.07		Tractors, planter & seed	11.54
		Misc + marketing		5.1732		
		Totals	43.7	10.7355		1718.12
					Fixed Costs	84.32
					Product Liability Insurance	500
					Used Transplanter	2000
					Labor @ $15/hour	816.53
					Total Costs	5118.97
					Total Returns	8211.24
					Net Income	**$3,092.27**

Table 11 – Simplified Spring Cabbage/Sunflower Enterprise Budget

(See Table A2-5 for the complete information)

Week	Date	Task	Time/Field	Time/Other	Equipment	Cost
1 to 13	1/1-4/1	Misc + marketing		5.187		
14 to 40	4/2-10/7	Misc		0.3753		
12	3/19-3/25	Disk cabb & app herb	0.26		Tractors, disk, sprayer & herb	15.49
12	3/19-3/25	Fertilize cabbage	0.08		Tractors & Spreader	64.11
13	3/26-4/1	Cultivate cabbage	0.07		Tractors & cultivator	2.85
13	3/26-4/1	Plant cabbage	4		8 hrs hired help & transplanter	756.95
14	4/2-4/8	Set up irrigation	4		Irrigation equipment	192
15 to 19	4/9-5/13	Irrigate	24.5			
17	4/23-4/29	Cultivate cabbage	0.07		Tractors & cultivator	2.85
19-20	5/7-5/20	Pest control	0.2		Sprayer & insecticide	26.04
21	5/21-5/27	Harvest cabbage	10			592.41
22	5/28-6/3	Disk sunflower	0.13		Tractors & disk	5.22
22	5/28-6/3	Fertilize sunflower	0.08		Tractors & spreader	19.56
23	6/4-6/10	Spray pre-emg. herb	0.1		Tractors & sprayer	42.73
23	6/4-6/10	Plant sunflowers	0.15		Tractors & planter	18.35
27	7/2-7/8	Cultivate if needed	0.15		Tractor & cultivator	5.53
40	10/1-10/7	Combine sunflower	0.11		Combine & grainhead	20.42
41 to 52	10/8-12/31	Misc + marketing		5.1732		
		Totals	43.9	10.7355		1764.51
					Fixed Costs	84.32
					Product Liability Insurance	500
					Used Transplanter	2000
					Labor @ $15/hour	819.53
					Total Costs	5168.36
					Total Returns	8211.24
					Net Income	**$3,042.88**

The net return per acre, approximately $3,000 for each scenario, is very high compared to what can be expected from the production of one acre of either corn or soybean (see Tables 10 and 11). As additional cabbage acres are added, the net return will be even higher per acre of cabbage, as the farm producer already owns the transplanter. While it now seems to make sense that these two scenarios could be integrated successfully into an existing corn-soybean rotation, the next step in this analysis will be to determine how many acres can be produced reasonably given the labor and other resource constraints that are faced by the typical eastern Nebraska producer. This will be explored in subsequent material, with a linear programming analysis.

Agroforestry Integration

Another possible option that could make use of, not only the temporal benefits of integration, but the spatial benefits as well, is the integration of agroforestry into the existing corn-soybean rotation. Agroforestry is intensive land management that optimizes the benefits (physical, biological, ecological, social) arising from biophysical interactions when trees and/or shrubs are deliberately combined with crops and/or livestock (Garrett et al., 1994). Relevant services of these woody species to agroecosystems are that they increase crop yields (nitrogen fixation, increased soil organic matter, nutrient cycling, soil and water conservation), create environmental resilience (niche diversification, food web complexity, carbon sequestration, reduced greenhouse gas emissions), and provide social benefits (boundary delineation, shade, wildlife habitat) (Leakey, 1999).

Current activities at the International Centre for Research in Agroforestry (ICRAF) are focusing on the development of agroforestry as "a dynamic, ecologically based, natural resource management system that, through the integration of trees on farms and in the landscape, diversifies and sustains production for increased social, economic, and environmental benefits" (Leakey, 1999). This new paradigm for sustainable land use focuses on two aspects of biodiversity: it diversifies agroecosystems while generating cash income, and utilizes services that support and enhance ecosystem function by capturing and enhancing intraspecific diversity. As a sustainable land use strategy, agroforestry practices can further the land stewardship concept (Weber, 1991). These systems provide assurance to landowners that they are meeting their ownership responsibility to provide healthy ecosystems for future generations while revitalizing rural communities that have become socially depressed due to economic problems within the local agricultural industry (Garrett et al., 1994).

Despite these numerous benefits, many landowners remain skeptical about introducing this type of integrated system into their overall farm management strategy. A recent listening session for rural landowners in the U.S. identified four major problems about agroforestry that would greatly limit its acceptability: poor economic expectations due to excessive direct costs including labor and the loss of land area for annual cash grain crops; too complex, requiring new skills and too much attention; too risky in the long run; and fear of regulation including the loss of property rights (Lassoie and Buck, 2000).

Windbreak Benefits

One opportunity for realizing the benefits of agroforestry is the implementation of windbreaks or shelterbelts to reduce wind speed. The benefits to producers include protection for crops and livestock, the provision of conservation services, increased energy efficiency of the farmstead, and the creation of wildlife habitat.

Windbreaks reduce wind speed and alter the microclimate in sheltered areas. As a result crop yields increase, water use efficiency of the crop increases, risks associated with drought are reduced, and wind erosion and the damage caused by wind-blown soil are reduced. Crop yields have been improved in sheltered areas anywhere from 5-45% over the long term, with increases in corn, soybeans and winter wheat being, 10-15%, 12-17%, and 20-25%, respectively (Brandle et al., 2000). The temperature increase in the protected areas can increase the rate of crop development, improve crop quality, and lead to earlier marketing opportunities. For example, flowering of soybean occurred four to ten days earlier in sheltered versus unsheltered areas (Ogbueni and Brandle, 1982); similar results have been observed in corn and vegetable production. Cabbage reached maturity three to ten days earlier in sheltered versus unsheltered areas (Hodges and Brandle, 1996). This can lead to distinct marketing advantages for vegetable crops and may result in a premium price, as vegetable crops tend to be much more sensitive to microclimate conditions and thus tend to respond more positively than grain crops to wind protection (Brandle and Hodges, 2000). Various perennial crops can also be grown within the windbreak, with labor requirements that occur during off times for typical annual grain crops, thus providing feasible, economic opportunities for grain producers.

Livestock can also be protected from the dangers of winter chill by windbreaks. Livestock in protected areas experience less cold temperature stress, improved health, increased feeding efficiency, and improved reproduction because of lower stress (Brandle et al., 2000).

Windbreaks can help provide conservation services. For example, they have the ability to influence global climate change through carbon storage. Woody species have the potential to capture and store significant amounts of carbon dioxide, which has been contributing to global climate change. In the future, this could provide an additional economic benefit to landowners, as researchers and policy makers are currently exploring methods to provide monetary rewards to farm producers who are able to effectively store carbon, and thus be given carbon credits for this practice. Windbreaks also add permanence and biodiversity to agricultural systems, by adding structural diversity and increasing perennialism. And, they are successful in the control of wind erosion and blowing snow.

Windbreaks can reduce the energy costs associated with the heating and cooling structures of the farmstead. During winter months, dense, multi-row windbreaks reduce the effects of cold winter winds and provide energy savings of 10-40% (Quam and Gardner, 1991). They also can reduce cold stress in humans, making outdoor work in cold weather more tolerable for producers, while also redistributing snowdrifts, reducing labor and energy demands.

Windbreaks also provide substantial habitat for wildlife and beneficial insects, contributing to overall social and potential economic benefits to the landowner. For instance, beneficial insects can reduce damage to crops and decrease the associated need for pesticides. Further, many landowners in Nebraska may receive income by providing hunters an opportunity to use their land (Brandle, personal communication 2001).

Despite their numerous benefits, agroforestry systems, including windbreaks, require increased management skills and labor and have relatively high initial costs. Therefore, long term, whole farm system analyses must be performed determine their profitability. For instance, while windbreaks initially occupy land and remove it from annual grain production, by the seventh year the system will begin to increase net crop yields and profits (Brandle and Hodges, 2000). Fortunately, governmental cost sharing programs are also in place to help producers manage the high initial costs until productivity begins to increase and losses can be recouped.

Windbreak System

A windbreak system was developed for integration into the hypothetical corn-soybean rotation. Four windbreaks, each measuring 20 feet by 5100 feet were established. They each consist of two rows of eastern red cedar (ERC), with space available for additional specialty shrubs that will be discussed in subsequent material. Each ERC tree requires at least 36 to 64 square feet of spacing, and each woody shrub requires approximately 49 square feet. These species will provide a windbreak density of approximately 40-60%. The total land that would be taken out of annual grain production for this system is 14.52 acres, with 9.37 of those being allocated to the two-row ERC windbreak. See Table A3-1 for an example of the calculations used to derive this system.

The windbreaks will provide a protected area on their windward side of 2-5 H, where H is the height of the barrier, and 10-20 H on their leeward side (Brandle et al., 2000). Since each windbreak is expected to reach approximately 35 feet in height, they should each provide protection up to 175 feet windward, and 700 feet leeward. Since the problem wind direction in this area is southwest, the four windbreaks will be installed in a north, west, and south E shape. The windbreaks can be expected to reach maturity in 30 years, each with a total lifespan of 50 years.

Woody Floral System

Woody floral shrubs have the potential to provide supplemental income while helping to protect the environment. The growth of specialty forest products such as shrubs have been dubbed 'productive conservation' by Josiah (2001), since they offer good opportunities for garnering substantial returns, while also providing many of the benefits of agroforestry systems. Josiah (2001) describes these woody decorative florals, as any woody plant species that has a colorful or unusually shaped stem, bud, flower, fruit, or leaf.

The three species used in this model were chosen for their agronomic feasibility in eastern Nebraska, as well as their commercial success. These include Scarlet Curls Willow (*Salix "scaruisam" Hybrid*), French Pussy Willow or Goat Willow (*Salix caprea*), and Bailey Redtwig Dogwood (*Cornus sericea "Bailey"*). Their feasibility for integration rests on the fact that their maintenance requirements are minimal once established, and their harvest requirements generally occur in the winter months during a low labor time for corn-soybean production.

Agroforestry Model

The tasks associated with the implementation of a windbreak system are outlined bin Boechner and Brandle (1991). Because the initial time requirements for planting are relatively high and occur during the same time required for planting corn and soybean, the model assumes that the local Lower Platte North Natural Resource District (NRD) will perform planting. Cost-share programs are available for tree seedling costs, planting, and spraying to encourage windbreak establishment.

The tasks associated with the implementation of the woody floral crops were taken from an on-going study being performed by Josiah (personal communication, 2002) at the agroforestry farm. Labor requirements and costs were derived from this on-going project.

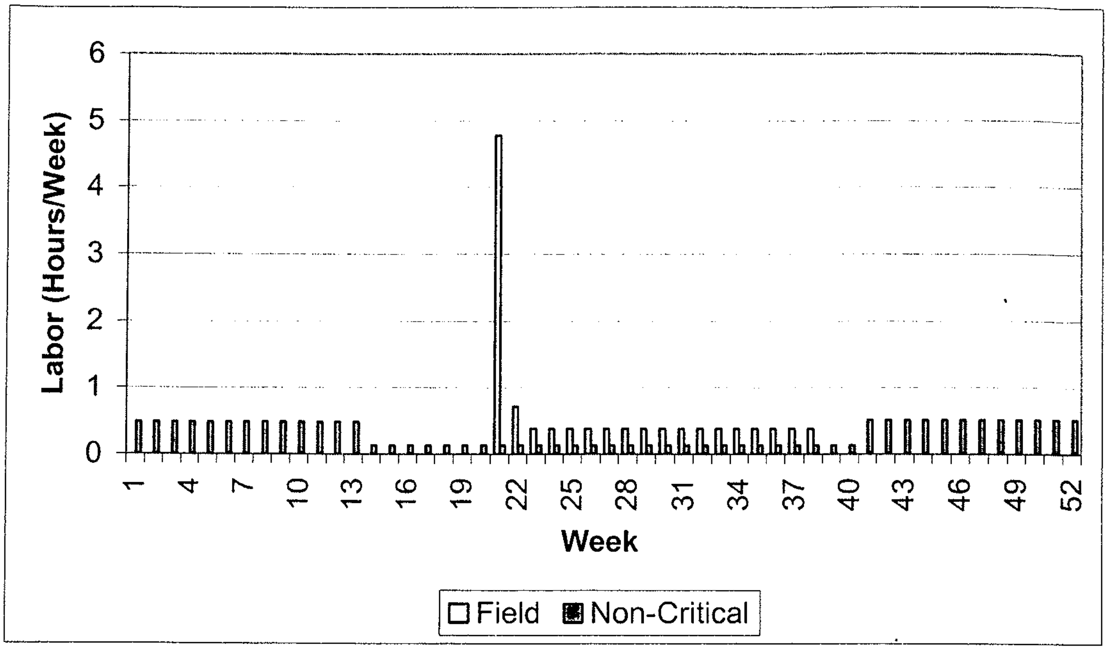
The tasks listed in Tables 12 to 18 represent those required for the implementation of 9.37 acres of a windbreak system, and 0.06 acres or 500 feet for the implementation and harvest of each of the three woody floral crops. However, woody floral harvest will vary depending on species and on the management and harvesting procedures. Graphs 4 to 7 illustrate the labor requirements of the agroforestry system beginning in the first to third years of production to the fourth year and beyond.

It can be noted from these tables that although the labor requirements for these crops occur during off-times for corn-soybean production, their labor needs are quite high. Requirements vary from 34 hours in the first year to 86 hours during the second harvest in the fourth and fifth years. It is expected that the labor requirements of the second and subsequent harvests will remain similar.

The high labor requirements emphasizes the fact that this system would only be feasible on a small scale and as supplemental income, unless adequate part-time seasonal labor is available to assist during critical times.

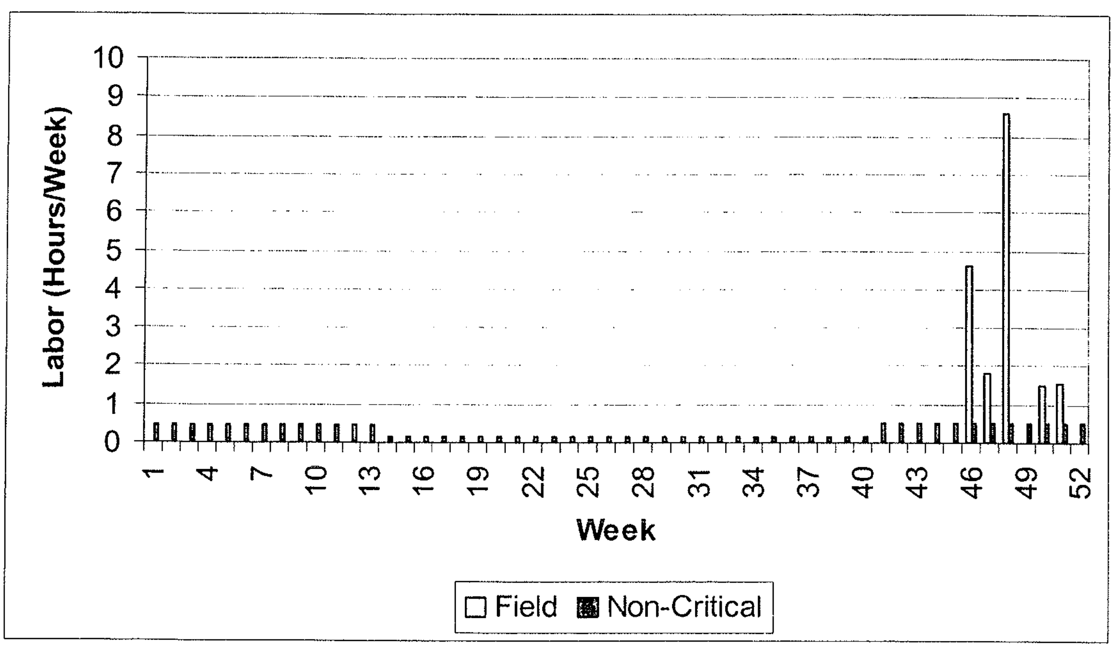
Graph 4 – Year 1: Agroforestry Labor Distribution

(9.37 acres windbreak and 13,500 sq. ft. of three woody floral crops)



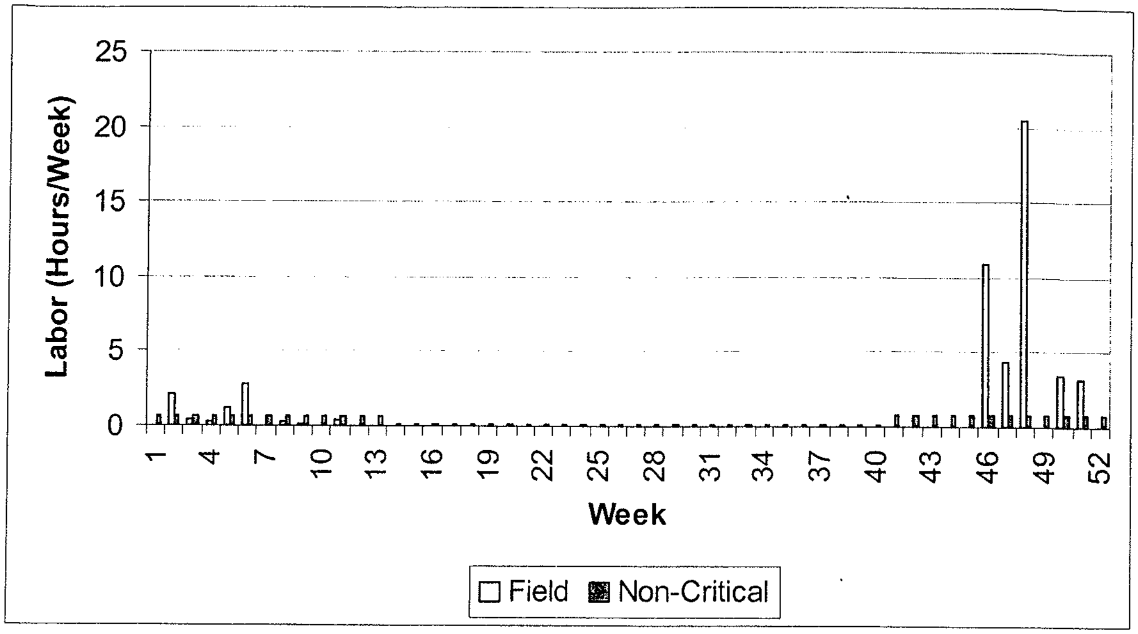
Graph 5 – Year 2: Agroforestry Labor Distribution

(9.37 acres windbreak and 13,500 sq. ft. of three woody floral crops)



Graph 6 – Year 3: Agroforestry Labor Distribution

(9.37 acres windbreak and 13,500 sq. ft. of three woody floral crops)



Graph 7 – Year 4 Agroforestry Labor Distribution

(9.37 acres windbreak and 13,500 sq. ft. of three woody floral crops)

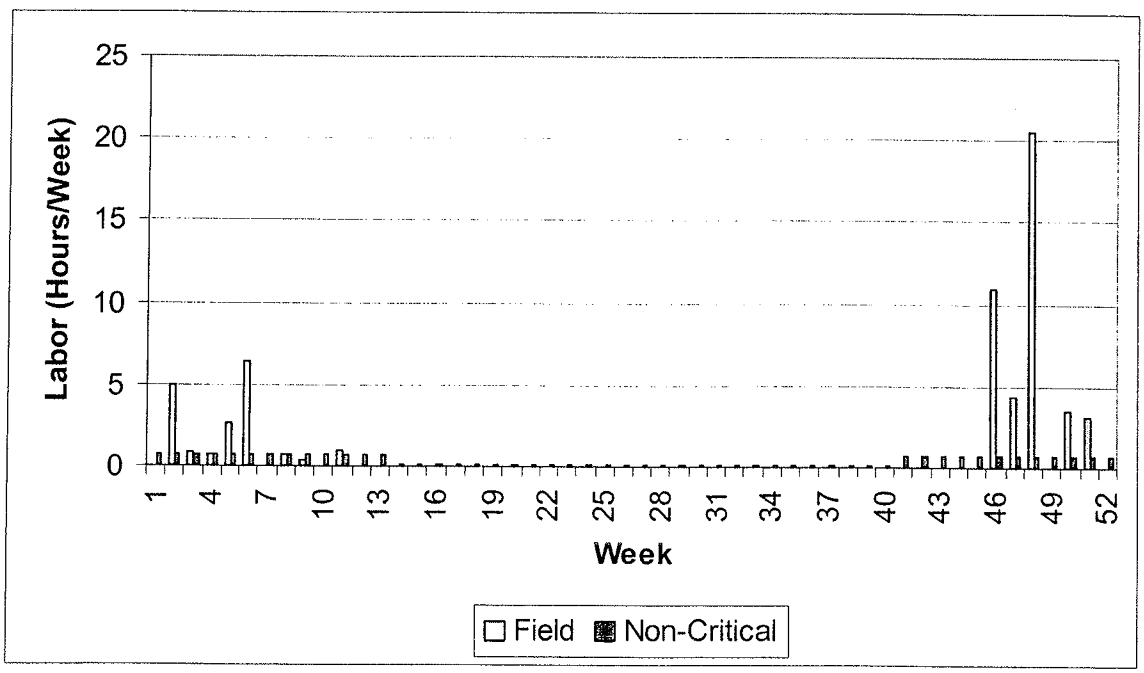


Table 12 – Year 1: Agroforestry Field and Non-Field Tasks

Critical Base Farm Tasks (during growing season)	Hours	Date
Site preparation – 9.37 acres windbreak & 0.18 acres woody florals	4.685	5/21-5/27
Plant -- 9.37 acres windbreak & 0.18 acres woody florals	Custom	5/21-5/27
Set up irrigation - 0.18 acres woody florals	0.72	5/28-6/3
Irrigate - 0.18 acres woody florals	6.12	6/4-9/23
Non-Critical Base Farm Tasks	**Hours**	**Date**
winter off-time (25 weeks)		1/1-4/1 and 10/8-12/31
Misc - 14.52 acres windbreak & 0.18 acres woody florals	3.4368	
Marketing	9	
	Hours	**Date**
Growing season off-time (27 weeks)		4/9-10/7
Same misc tasks as corn-soybean	3.5815	
Total Hours	27.54	

Table 13 – Year 2: Agroforestry Field and Non-Field Tasks

Critical Base Farm Tasks (during growing season)	Hours	Date
Replant & spray 20% of – 9.37 acres windbreak & 0.18 acres woody florals	Custom	5/21-5/27
Harvest, grade, and delivery - 0.18 acres woody florals	4.59	11/12-11/18
Cut, grade, and delivery - 0.18 acres woody florals	1.82	11/19-11/25
Grade, cut, and bundled - 0.18 acres woody florals	8.61	11/26-12/2
Cut, grade, and delivery - 0.18 acres woody florals	1.48	12/10-12/16
Grade, and bundle - 0.18 acres woody florals	1.54	12/17-12/23
Non-Critical Base Farm Tasks	**Hours**	**Date**
winter off-time (25 weeks)		1/1-4/1 and 10/8-12/31
Misc – 9.37 acres windbreak & 0.18 acres woody florals	3.4368	
Marketing	9	
	Hours	**Date**
Growing season off-time (27 weeks)		4/9-10/7
Same misc tasks as corn-soybean	3.5815	
Total Hours	34.06	

Table 14 – Year 3: Agroforestry Field and Non-Field Tasks

Critical Base Farm Tasks (during growing season)	Hours	Date
Grade, bundle, and delivery - 0.18 acres woody florals	2.1	1/8-1/14
Harvest & ready for tomorrow - 0.18 acres woody florals	0.38	1/15-1/21
Grade - 0.18 acres woody florals	0.28	1/22-1/28
Harvest and grade – 0.18 acres woody florals	1.14	1/29-2/4
Grade, bundle, and delivery - 0.18 acres woody florals	2.73	2/5-2/11
Harvest - 0.18 acres woody florals	0.3	2/19-2/25
Grade and bundle - 0.18 acres woody florals	0.14	2/26-3/4
Grade - 0.18 acres woody florals	0.42	3/12-3/18
Harvest, grade, and delivery - 0.18 acres woody florals	10.93	11/12-11/18
Cut, grade, and delivery - 0.18 acres woody florals	4.33	11/19-11/25
Grade, cut, and bundled - 0.18 acres woody florals	20.51	11/26-12/2
Cut, grade, and delivery - 0.18 acres woody florals	3.52	12/10-12/16
Grade, and bundle – 0.18 acres woody florals	3.17	12/17-12/23
Non-Critical Base Farm Tasks	**Hours**	**Date**
winter off-time (25 weeks)		1/1-4/1 and 10/8-12/31
Misc – 9.37 acres windbreak & 0.18 acres woody florals	3.4368	
Marketing	15	
	Hours	**Date**
Growing season off-time (27 weeks)		4/9-10/7
Same misc tasks as corn-soybean	3.5815	
Total Hours	71.97	

Table 15 – Years 4 and 5: Agroforestry Field and Non-Field Tasks

Critical Base Farm Tasks (during growing season)	Hours	Date
Grade, bundle, and delivery - 0.18 acres woody florals	5	1/8-1/14
Harvest & ready for tomorrow - 0.18 acres woody florals	0.91	1/15-1/21
Grade - 0.18 acres woody florals	0.67	1/22-1/28
Harvest and grade - 0.18 acres woody florals	2.72	1/29-2/4
Grade, bundle, and delivery - 0.18 acres woody florals	6.49	2/5-2/11
Harvest - 0.18 acres woody florals	0.72	2/19-2/25
Grade and bundle - 0.18 acres woody florals	0.34	2/26-3/4
Grade - 0.18 acres woody florals	1	3/12-3/18
Harvest, grade, and delivery - 0.18 acres woody florals	10.93	11/12-11/18
Cut, grade, and delivery - 0.18 acres woody florals	4.33	11/19-11/25
Grade, cut, and bundled - 0.18 acres woody florals	20.51	11/26-12/2
Cut, grade, and delivery - 0.18 acres woody florals	3.52	12/10-12/16
Grade, and bundle - 0.18 acres woody florals	3.17	12/17-12/23
Non-Critical Base Farm Tasks	**Hours**	**Date**
winter off-time (25 weeks)		1/1-4/1 and 10/8-12/31
Misc – 9.37 acres windbreak & 0.18 acres woody florals	3.4368	
Marketing	15	
	Hours	**Date**
Growing season off-time (27 weeks)		4/9-10/7
Same misc tasks as corn-soybean	3.5815	
Total Hours	82.33	

Economics/Enterprise Budgets

Table 16 provides a summary of the costs and information sources that are associated with the initial implementation of this windbreak and woody floral system. The total cost of implementation to the windbreak and woody floral crops, including an assumed need for replant at 20% that will vary depending on site and climactic conditions, was $5897.94 and $599.97, respectively.

Table 16 – Agroforestry Establishment Costs

Costs	Description	Source
	Economics of Windbreaks	
Maintanence	$449.06/acre over 50 yr life = $8.98/acre annual cost	WBECON (2002)
Site preparation	$37.26/acre X9.37 = $349.14	WBECON (2002)
	7.5 ft spacing = 680 trees per 5100 ft	
	680 X 2 rows per windbreak = 1360 trees	
	1360 trees X 4 windbreaks = 5440 trees	
Seedling, plant & spray	5440 trees x 0.85 = $4,624	NRD (2002)
Replant	@ 20% = $924.80	
Removal	$25,450.00	WBECON (2002)
Total implementation cost	**$5897.94**	
	Economics of Woody Floral Crops	
Site Preparation	$46.47/acre X 0.06= $2.79/each, or $8.37 per all three (500 X 5 ft = 2500 ft)/(43560 sq. ft./acre) = 0.06 acres per specialty crop	WBECON (2002)
Scarlet Curls Seedlings	$2.40 each x 100 plants = $240	Josiah pers. comm. (2002)
Goat Willow Seedlings	$0.78 each x 100 plants = $78	Josiah pers. comm. (2002)
Bailey Redtwig Seedlings	$0.70 each x 100 = $70	Josiah pers. comm. (2002)
Planting & spraying	$0.35 each x 300 = $105	NRD (2002)
Replant	20% (SC $48, GW $15.60, BR $14 and $7/variety planting & spraying) is $98.60	
Total	**$599.97**	

The Federal Conservation Reserve Program (CRP) offers many financial incentives for both the installation of the woody species within the windbreaks, as well as an annual payment for the first ten years of growth until the financial returns of the windbreak system to the landowner can be realized (Ricaurte, personal communication, 2002). One requirement of the CRP program is that crops within it cannot be harvested, as the goal of the program is to take sensitive land out of production. Due to this, the acreage occupied by the woody floral crops is not included under the CRP program. The benefits that can be provided by the CRP program are summarized in Table 17. However, it must be noted that these payments will vary by county, and other site productivity conditions. Therefore the values listed here represent the average of those received by Saunders County landowners. With these benefits, the total cost of implementation of the windbreak system to the landowner in this model is $589.79, with an annual return per acre of $98.95 for the first ten years of production.

Table 17 – CRP Payment Benefits

General - Pays 50% of installation costs
Practice Incentive Program (PIP) - pays another 40% of installation under continuous signup
PIP - $5-10 annual maintenance fee per acre
Signing Incentive Payment (SIP) - $10/acre/year for up to 10 years
General - Annual payment per acre: Saunders County average (1987-2003) -$83.95
Total Installation Costs $5897.94 (producer pays 10%) = $589.79
Annual Payment per acre for first 10 years (5+10+83.95) = $98.95

Despite the monetary benefits that a producer can receive through the CRP program, for a system to be profitable, the long-term average yield increase from the protected zones must be large enough to compensate for the land occupied by the windbreak, for the crop losses within the zone of competition, and for the costs associated with planting and maintaining the windbreak (Brandle et al., 2000). Since it can take a relatively long time for a producer to be able to experience the benefits of increased crop yields that are associated with a windbreak, Brandle and Kort (1991) developed an interactive computer model to evaluate economic returns to grain producers when crops are protected by a windbreak. This modeling system, called WBECON and WBINT, performs an analysis that includes the cost of windbreak establishment and maintenance, loss of crop land due to areas planted to trees, the loss of productivity associated with the zone of competition between the woody species and the crop, length of time required to grow the windbreak, and the cost of removal at some point in the future. The specific site requirements of the area under consideration are programmed along with the specific costs. However, an average set of costs exists within the model if specific costs are not available. Table 18 lists the hypothetical financial benefits after expenses that the producer in this model could expect over the life of their windbreak.

Table 18 – Crop yield benefits over the lifetime of a windbreak

Crop Information Per Acre			
Crop	**Unsheltered Yield**	**Crop Prices**	**Crop Inputs**
Corn (Grain)	105 bu	2.27	141.29
Soybean	35 bu	5.65	100.68
Winter Wheat	48 bu	3.13	118.57
Leafy Vegetables	47392.6 lbs	0.17	1651.69
Sunflower	15 bu	10.3	111.81
Annual Benefits of the Shelterbelt at Maturity Per Acre			
Crop	**Sheltered Yield**	**% Increase**	**Economic Benefits**
Corn (Grain)	108.4 bu	3.2	7.68
Soybean	36.6 bu	4.7	9.24
Winter Wheat	49.4 bu	2.9	4.41
Leafy Vegetables	50155.3 lbs	5.8	169.65
Sunflower	15.7 lbs	4.4	6.77
Total Economic Benefit over Shelterbelt Lifetime			
In Constant Dollars	$2,236,667		
In Present Dollars (Discounted at 5% annually)	$444,629		
Benefit/Cost Ratio	3.88		
Internal Rate of Return	13.80%		

While these costs are certainly important to a landowner considering the option of integrating a windbreak system into their agroecosystem, it is beyond the scope of this study to perform an analysis of this long-term detail. Therefore only the first six years of integration will be analyzed, where the payments from the CRP program will be taken into account.

The returns from the production of the three woody floral species can be realized within the second and third year after establishment. The number of marketable stems was derived from data Josiah (2002). There was some browse damage to some of the stems, which decreased yields slightly. The estimated yields for 500 feet of each of the three woody floral crops are listed in Table 19. The gross value for these stems were taken from Josiah (2002), and were based on actual stem sales to wholesalers in eastern Nebraska.

Table 19 – Woody Florals Cost and Returns

500' of each crop	SC	RD	GW
Year 1 - Establishment Costs			
site prep	2.79	2.79	2.79
100 plants	240	70	78
plant & spray by NRD	35	35	35
replant tree cost	48	14	15.6
replant plant & spray cost	7	7	7
Total	**$332.79**	**$128.79**	**$138.39**
Year 2 & 3 - 1st Harvest			
labor (hrs)	13.07	3.93	8.19
Yield	2220	921.88	1338
Value	$1047.5	$276.57	$204.11
Year 3 & 4 - 2nd Harvest			
labor (hrs)	31.12	9.36	19.5
Yield	5283	1450	4261
Value	$2492.5	$435	$650

Despite the high economic potential of these specialty crops, their production will be constrained by the market demand. Most of the materials currently in the floral market are produced on the west coast of the U.S. and Canada or in the tropics. However, there are good opportunities in the Midwestern U.S. for producing and marketing decorative stems of a numbers of species and cultivars with substantial financial returns (Josiah, 2002). To address this, Josiah (2002) conducted a mail and phone survey of 125 wholesale and retail florists in states east of the Rocky Mountains in the Midwest Region. The results of these surveys, along with a 20 and 30% market share for the hypothetical producer in this study, are listed in Table 20. Even with a low market share, production of these crops as a supplemental enterprise could provide substantial income.

Table 20 – Woody Floral Market Potential

Variety	Value/stem	NE Market Potential	Prct.	Market Share	Gross Return	MW Market Potential	Market Share 5%	Gross Return
Scarlet Curls	$0.46	68,400	0.2	13680	$6,292.80	902,000	45,100	$20,746.00
			0.3	20520	$9,439.20			
Goat Willow	$0.15	70,500	0.2	14100	$2,115.00	331,000	16,550	$2,482.50
			0.3	21150	$3,172.50			
Red Dogwood	$0.30	3,500	0.2	700	$210.00	47,855	2,393	$717.83
			0.3	1050	$315.00			

With knowledge of the potential labor requirements, costs and returns for the agroforestry option, an assessment must now be made of the amounts of these crops that could feasibly be produced by the hypothetical eastern Nebraska corn-soybean producer given labor and resource constraints. The enterprise budgets for this assessment are listed in Tables 21 to 24 in simplified form. The complete enterprise budget for the first five years of production is given in Table A3-2.

Table 21 – Year 1: Simplified Agroforestry Enterprise Budget

(See Table A3-2 for the Complete Information)

Week	Date	Task	Time/Field	Time/Other	Equipment	Cost
1 to 13	1/1-4/1	Misc + marketing		6.29		
14 to 40	4/2-10/7	Misc		3.58		
21	5/21-5/27	Site preparation	4.78			41.63
21	5/21-5/27	Plant	Custom			955.40
22	5/28-6/3	Set up irrigation	0.72		Irrigation equipment	34.56
23 to 28	6/4-9/23	Irrigate	6.12			
41 to 52	10/8-12/31	Misc + marketing		6.15		
		Totals	11.62	16.02		1031.58
					WB maint. costs	84.14
					Fixed Costs	805.26
					Labor @ $15/hour	414.50
					Total Costs	2251.33
					Total Returns	927.16
					Net Income	**$-1408.32**

Table 22 – Year 2: Simplified Agroforestry Enterprise Budget

(See Table A3-2 for the Complete Information)

Week	Date	Task	Time/Field	Time/Other	Equipment	Cost
1 to 13	1/1-4/1	Misc + marketing		6.29		
14 to 40	4/2-10/7	Misc		3.58		
21	5/21-5/27	Replant & spray	Custom			191.08
46	11/12-11/18	Harvest, grade & delivery	4.59			
47	11/19-11/25	Cut, grade & delivery	1.82			
48	11/26-12/2	Grade, cut & bundled	8.61			
50	12/10-12/16	Cut, grade & delivery	1.48			
51	12/17-12/23	Grade & bundle	1.54			
41 to 52	10/8-12/31	Misc + marketing	6.15			
		Totals	18.04	16.02		191.08
					WB Maint. Costs	84.14
					Fixed Costs	805.26
					Labor @ $15/hour	510.87
					Total Costs	1591.36
					Total Returns	1514.91
					Net Income	**$-76.44**

Table 23 – Year 3: Simplified Agroforestry Enterprise Budget

(See Table A3-2 for the Complete Information)

Week	Date	Task	Time/Field	Time/Other	Equipment	Cost
1 to 13	1/1-4/1	Misc + marketing		9.29		
14 to 40	4/2-10/7	Misc		3.58		
2	1/8-1/14	Grade, bundle & delivery	2.1			
3	1/15-1/21	Harvest & ready for tomorrow	0.38			
4	1/22-1/28	Grade	0.28			
5	1/29-2/4	Harvest & grade	1.14			
6	2/5-2/11	Grade, bundle & delivery	2.73			
8	2/19-2/25	Harvest	0.3			
9	2/26-3/4	Grade & bundle	0.14			
11	3/12-3/18	Grade	0.42			
46	11/12-11/18	Harvest, grade & delivery	10.93			
47	11/19-11/25	Cut, grade & delivery	4.33			
48	11/26-12/2	Grade, cut & bundled	20.51			
50	12/10-12/16	Cut, grade & delivery	3.52			
51	12/17-12/23	Grade & bundle	3.17			
41 to 52	10/8-12/31	Misc + Marketing		9.15		
		Totals	49.95	22.02		0
					WB Maint. Costs	84.14
					Fixed Costs	805.26
					Labor @ $15/hour	1079.52
					Total Costs	1968.92
					Total Returns	3243.51
					Net Income	**$1274.59**

Table 24 – Years 4 and 5: Simplified Agroforestry Enterprise Budget

(See Table A3-2 for the Complete Information)

Week	Date	Task	Time/Field	Time/Other	Equipment	Cost
1 to 13	1/1-4/1	Misc + marketing		9.29		
14 to 40	4/2-10/7	Misc		3.58		
2	1/8-1/14	Grade, bundle & delivery	5			
3	1/15-1/21	Harvest & ready for tomorrow	0.91			
4	1/22-1/28	Grade	0.67			
5	1/29-2/4	Harvest & grade	2.72			
6	2/5-2/11	Grade, bundle & delivery	6.49			
8	2/19-2/25	Harvest	0.72			
9	2/26-3/4	Grade & bundle	0.34			
11	3/12-3/18	Grade	1			
46	11/12-11/18	Harvest, grade & delivery	10.93			
47	11/19-11/25	Cut, grade & delivery	4.33			
48	11/26-12/2	Grade, cut & bundled	20.51			
50	12/10-12/16	Cut, grade & delivery	3.52			
51	12/17-12/23	Grade & bundle	3.17			
41 to 52	10/8-12/31	Misc + marketing		9.15		
		Totals	60.31	22.02		0
					WB Maint. Costs	84.14
					Fixed Costs	805.26
					Labor @ $15/hour	1079.52
					Total Costs	2124.37
					Total Returns	4504.63
					Net Income	**$2380.26**

Linear Programming Matrix

When farm producers consider adopting new practices or supplemental enterprises, their two biggest concerns are usually the labor required and its likely financial return, as well as whether it will fit in with their existing activities. Further, the design of any new system will require a planning process that analyzes the wants, needs, and objectives of the producer along with the land and producer's suitability to help determine the proper system to implement and sustain.

Linear programming (LP) is a mathematical procedure that searches for a combination of activities that maximizes a specified value, such as total profit, subject to certain constraints, such as labor availability. Since the early 1960's, several large LP models have been developed to help farmers search for more profitable and efficient cropping systems. Purdue University utilizes such a model in their "Top Farmer" workshops and ISU extension utilizes one called Crop-Opt in their outreach efforts (Edwards, 1992).

Linear programming can be used to determine the optimal crop mix given various alternatives and the constraints faced by the individual enterprise. It also has the potential to identify what factors may be constraining the solution so that sensitivity analyses can be explored. For instance, the user of a model may be concerned with how recommendations of the model are altered by changes in the input data. For example, if the entire budget were used in the original solution, it may indicate that adding one more dollar to the budget would be worth a $3.48 return in terms of net present value. This would suggest a fairly substantial return per dollar invested, and the farm producer may wish to consider a loan. Sensitivity analyses can reveal which pieces of information should be estimated more carefully.

Field and Non-Field Labor Availability

The first step in establishing a linear programming matrix to discover the optimal production scenario for a typical eastern Nebraska corn-soybean producer is to establish the constraints that they would face. Since the primary objective of this study was to address the labor constraints of this typical producer, a detailed assessment was performed to determine the maximum time available for both field and non-field tasks. Field time availability indicates the time available for farm production tasks such as tillage, spraying, and harvest. Estimates of available field time are useful in planning and scheduling labor during critical field periods.

Throughout Nebraska, records of the observed field days suitable for field operations throughout the growing season are recorded by the Nebraska Agricultural Statistics Service (NASS). This assessment is based on various factors including temperature and soil moisture conditions as influenced by factors such as rainfall, wind velocity, and relative humidity. To determine the days suitable for fieldwork on this model farm, these data were obtained from NASS for Saunders County and an eleven-year average (1991-2001) calculated on a weekly basis (See Table A4-1).

Next, it was necessary to determine the length of daylight hours to determine how many hours per week the producer could expect to be available for fieldwork. The sunrise and sunset information for Mead, NE were obtained from the U.S. Naval Observatory to determine the daylight hours available (See Table A4-2). Farm producers often work into twilight hours or use lights on their equipment to gain more flexibility during critical times; however this was not included in the present analysis.

With this information, a detailed assessment of the total field labor available was made (see Table A4-3). Because there are many farm tasks such as equipment repair, bookkeeping, input purchases, and marketing that do not necessarily need to occur during field time, an 'other' labor availability category was developed.

It was assumed that a typical producer would work, at the most, six days per week, allowing at least one day off for holidays or personal activities. The total number of available hours per week was determined. This was then split between hours suitable for fieldwork and hours allocated to 'other' activities. In the LP model, it was programmed so that the unused labor in each time period allocated to available fieldwork was transferred to the 'other' time availability category to allow for tasks that are not necessarily required to occur during field time. For example, while the harvest of woody florals occurs outside during the daylight hours, it does not require a maximum temperature or certain soil moisture characteristics to occur and can therefore be performed during this 'other' time availability.

While the initial analysis focused on the optimal cropping mix given one full time producer, additional analyses were performed with an increase in the labor available. Sensitivity analyses were performed to determine the optimal cropping mix given another full time person, being a spouse or hired hand, and/or the availability of part-time labor during critical times.

The labor constraints were entered into the LP model in bi-weekly increments as to ease restrictions in the analysis since some activities could be stretched to the following week.

Enterprise Budgets per Acre

The next step in building the LP model was to determine the labor, costs, and return of each cropping option per acre (see Tables A4-4 to A4-10). Since corn and soybean are grown in rotation over a two-year period, their respective constraints were averaged into single values to represent this one-acre being half corn and half soybean. Since the winter wheat/fall cabbage and spring cabbage/sunflower options have both crops grown on the same acre in one year, their respective constraints were summed to determine singular values to go into the LP model.

The agroforestry option was figured differently. Since this analysis was figured only over the first six years, the LP program would not be aware of the long-term economic benefits of the windbreak system in terms of increased crop yields. In this respect, if given the option, the optimal LP solution would probably not have allocated any acreage to the windbreak system. Therefore, the model was programmed to accept the 9.37 acres of the windbreak system and subtract these acres from those considered variable to be optimized and allocated to the various alternatives. However, the constraints of the three woody floral crops were still held variable in the analysis. The fixed costs per acre, including cost such as land and machinery, were held constant across all options.

Six-Year Average

To allow the LP model to determine the optimal solution considering all variables over time, a six-year average of the various alternatives was used to help account for the synergies of integrated production strategies, (see Tables A4-11 to A4-17). For example, in the corn-soybean rotation, a producer must apply nitrogen fertilizer every other year. However, the winter wheat/fall cabbage model assumes a three-year rotation of corn, followed by soybean, followed by winter wheat/cabbage. In this scenario, the production of winter wheat allows the inexpensive application of manure as a fertilizer resource, applied only every third year. Similarly, the production of the woody floral cultivars have high initial costs and no returns during the first year, but can achieve high returns in successive years.

Results and Discussion

Linear Programming Analysis

The initial analysis using linear programming first examined each alternative for supplementation separately in relation to the existing corn-soybean rotation, and then examined the alternative options together; see Table 25 for partial results and Table A5-1 for the full results. The model focused on the labor constraints of one, full-time, typical farm producer in eastern Nebraska. Available capital was regarded as unlimited, as this was not the limiting factor in this analysis. Land was held at 640 acres. Option 1, the corn-soybean base production strategy was examined with and without stalk grazing. Each subsequent analysis was performed with and without the addition of crop subsidies.

The results are meant to indicate the optimal annual acreage allocation of each crop scenario given the overall constraints programmed in the model. As expected, the integration of cattle grazing stalk residues helps improve the economic situation of the producer, but does not change the optimal cropping scenario. All three different supplemental scenarios, when considered separately in comparison with option 1, increased the profitability of the farming enterprise. Given the labor constraints, the second option, the integration of winter wheat/fall cabbage, seemed to be the most profitable, giving the farm a total net return of $34,502.72 without crop subsidies and $60,754.79 with subsidies. Option 4, the integration of agroforestry is second best within the single comparisons, giving the farm a total net return of $13,052.45 without crop subsidies, and $38,883.63 with subsidies when it was not constrained by markets. Option 3, spring cabbage/sunflowers, also improved profitability. However, since both it and option 1 have high labor requirements in the spring in regards to planting, this option was constrained by available labor more than option 2, giving the farm a total net return of $3,489.66 without subsidies, and $29,686.05 with subsidies.

The addition of crop subsidies makes a large impact on the producers' profitability; however it does not have enough of an effect to affect the optimal acreage solution. This is probably due to the fact that the operation is constrained by labor, whereas if more

Table 25 – LP Analysis :One Full-Time Operator

Comparion	Subsidies	Grazing	Land Allocation (Acres)	Total Oper. Labor Used	Net
Option 1	No	no	C-S: 640	944 hrs	-4,765.44
Option 1 vs 2	No	yes	C-S: 619.74 & WW/FC: 20.26	1301.14 hrs	$34,502.72
Option 1 vs 3	No	yes	C-S: 636.34 & SC/S: 3.66	1008.69 hrs	$3,489.66
Option 1 vs 4 (no mrkt constraint)	No	yes	C-S: 629.89 WB: 9.37 SC: 0.74	1249.94 hrs	$13,052.45
Option 1, 2 & 3	No	yes	C-S: 615.59 WW/FC: 20.30 SC/S: 4.11	1374.41 hrs	$35,714.55
Option 1,2,3 & 4 (no mrkt constraint)	No	yes	C-S: 608.85 WW/FC: 19.70 SC/S: 1.36 WB:9.37 SC: 0.72 GW: 0 BR:0	1612.90 hrs	$49,152.07
Option 1,2,3 & 4 (w/ 20% mrkt constraint)	no	yes	C-S: 608.85 WW/FC: 19.70 SC/S: 1.36 WB:9.37 SC: 0.24 GW: 0.32 BR: 0.04	1511.91 hrs	$40,637.44
Option 1	yes	no	C-S: 640	944 hrs	$21,480.96
Option 1	yes	yes	C-S: 640	944 hrs	$25,320.96
Option 1 vs 2	yes	yes	C-S: 619.74 & WW/FC: 20.26	1301.14 hrs	$60,754.79
Option 1 vs 3	yes	yes	C-S: 636.34 & SC/S: 3.66	1008.69 hrs	$29,686.05
Option 1 vs 4 (no mrkt constraint)	yes	yes	C-S: 629.89 WB: 9.37 SC: 0.74	1249.94 hrs	$38,883.63
Option 1 vs 4 (w/ 20% mrkt constraint)	yes	yes	C-S:630.03 WB: 9.37 SC: 0.24 GW: 0.32 BR: 0.04	1140.82 hrs	$30,011.95
Option 1, 2 & 3	yes	yes	C-S: 615.59 WW/FC: 20.30 SC/S: 4.11	1374.41 hrs	$61,910.47
Option 1,2,3 & 4 (no mrkt constraint)	yes	yes	C-S: 608.85 WW/FC: 19.70 SC/S: 1.36 WB:9.37 SC: 0.72 GW: 0 BR:0	1612.90 hrs	$74,971.60
Option 1,2,3 & 4 (w/ 20% mrkt constraint)	yes	yes	C-S: 608.85 WW/FC: 19.70 SC/S: 1.36 WB:9.37 SC: 0.24 GW: 0.32 BR: 0.04	1511.91 hrs	$66,456.97

labor were to be made available, the optimal allocation of land would be transferred to the non-subsidy, higher value cropping options. It can also be noted from this analysis that, as these higher value supplemental cropping options are added to the mix, net profit increased reducing the need for subsidies.

When the two cabbage options are both considered in the LP program, the winter wheat/fall cabbage option was reduced slightly and the spring cabbage/sunflower option is increased. This is due to the labor being shifted away from the corn-soybean option in favor of the cabbage production. When the fourth option, agroforestry, was added to the mix, the acreage allocated to cabbage production was reduced in favor of the available labor being allocated to the higher value agroforestry crops.

Finally, out of the three woody floral crops, scarlet curls willow was the most profitable, and all labor was allocated to its production until marketing constraints enter the scenario. When markets for these crops are constrained to 20% of the Nebraska market as identified by Josiah (2002), production of scarlet curls willow was reduced to within its market constraints, and the production of the other two woody floral crops were increased. However, they too were limited by their market constraints.

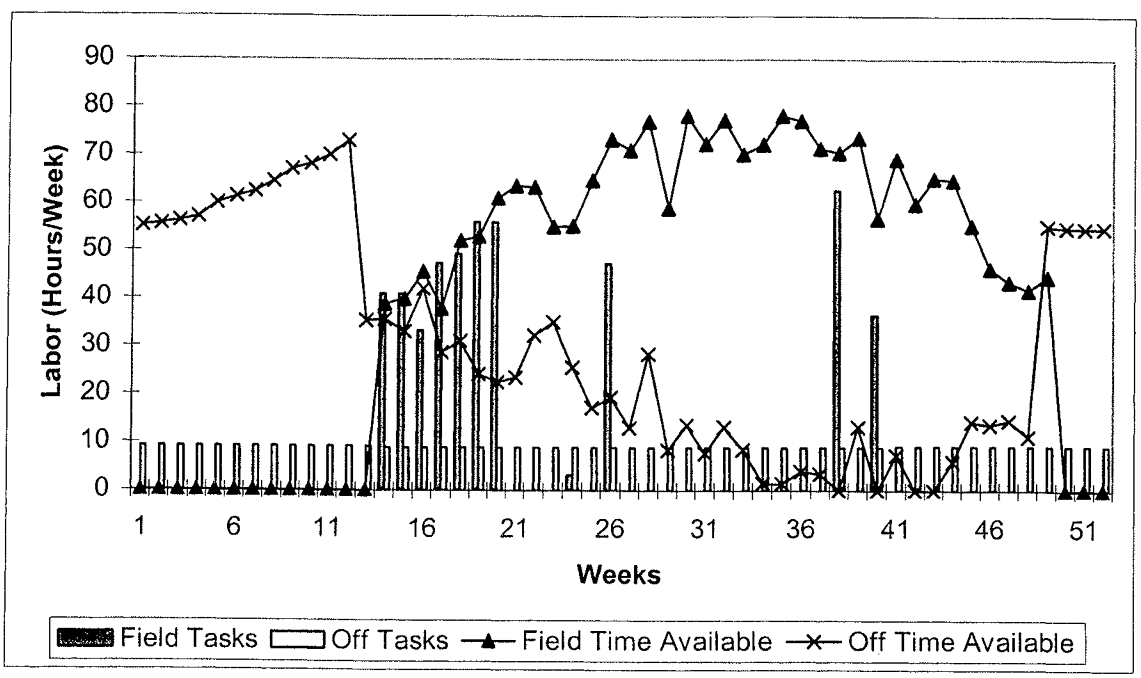
A graphic illustration of the constraints being placed on the production of these crops, is included in Graphs 8 to 14. In Graph 8, the field and non-critical tasks for the production of corn and soybean are listed separately, as are both the field and off-time labor availability constraints for a typical eastern Nebraska producer. Note, when time is leftover in regard to field tasks, that leftover time was transferred to off-time availability in the LP model. This allowed production to occur where it may appear in the graph to be constrained by non-critical tasks that occur during off-time availability. However, the graphs illustrate how the crop production was constrained by the total labor available in general.

In Graphs 9 to 14, the field and non-critical tasks of the supplemental activities being explored were combined. They illustrate how production of the various crop combinations are being constrained by the time availability, and where bottlenecks of labor occur, prompting the need for additional labor in order to increase production of the supplemental crops.

In Graphs 13 and 14, when market constraints are included in the LP analysis with regard to the woody floral crops, production is constrained by market availability and not by labor availability.

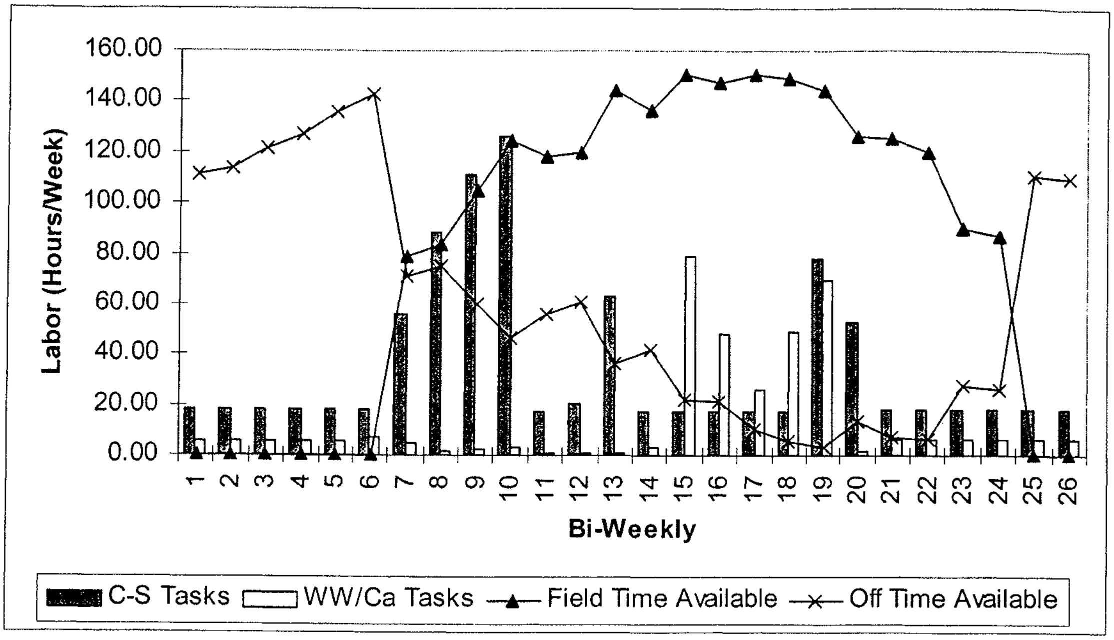
Graph 8 – C-S Production Given Constraints on Tasks

(640 acres C-S)



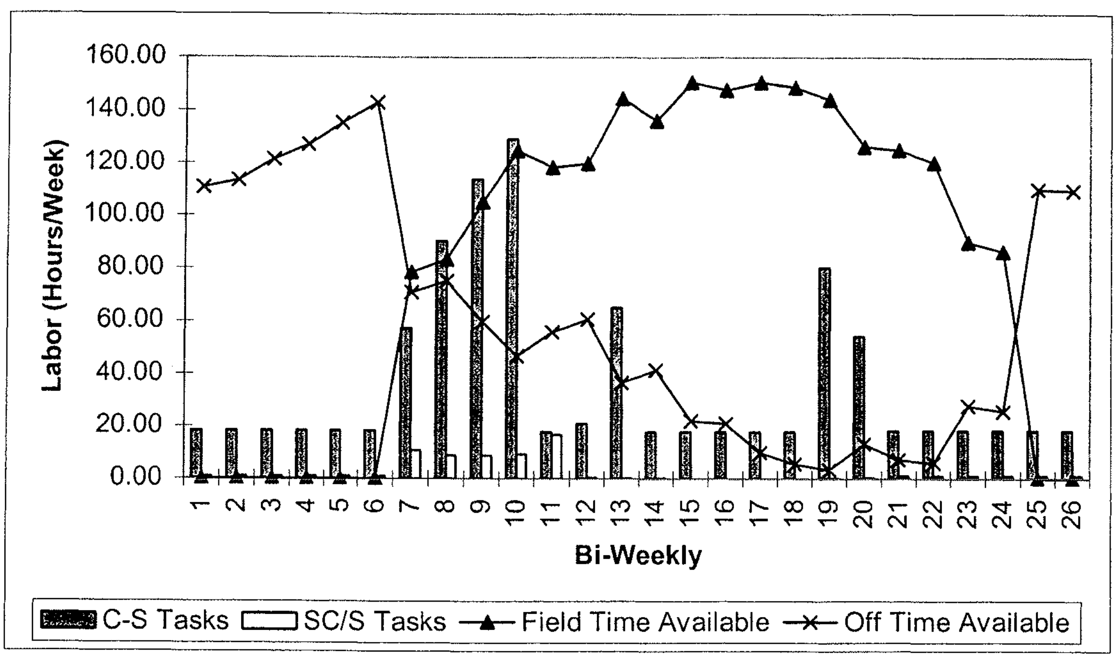
Graph 9 – C-S and WW/FC Production Given Constraints on Tasks

(619.74 acres C-S and 20.26 acres WW/FC)



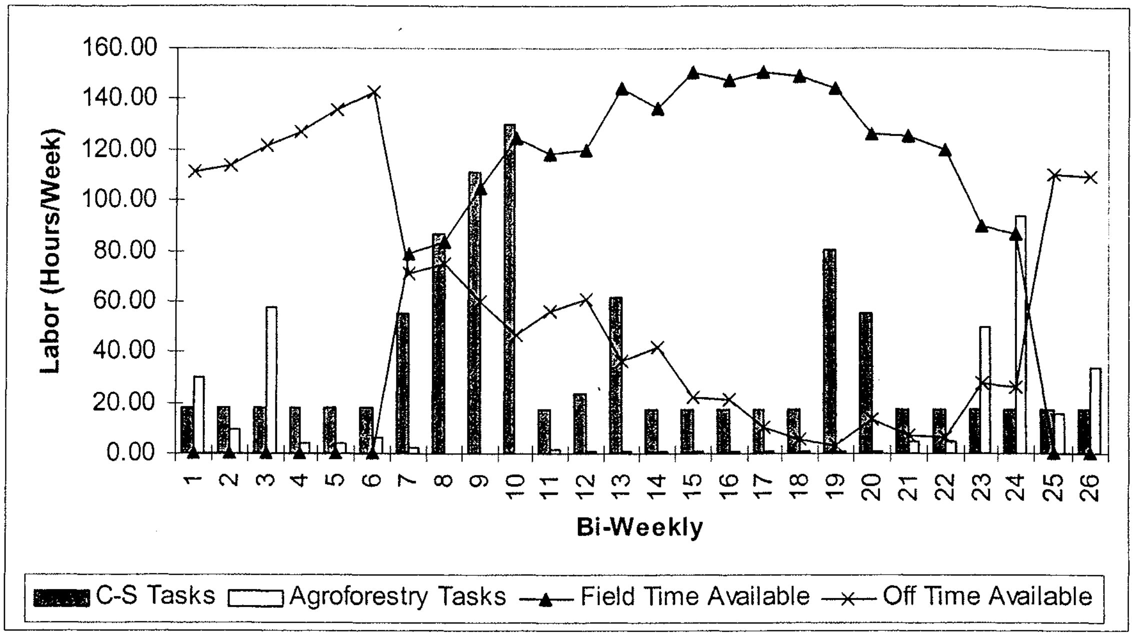
Graph 10 – C-S and SC/S Production Given Constraints on Tasks

(636.34 acres C-S and 3.66 acres SC/S)



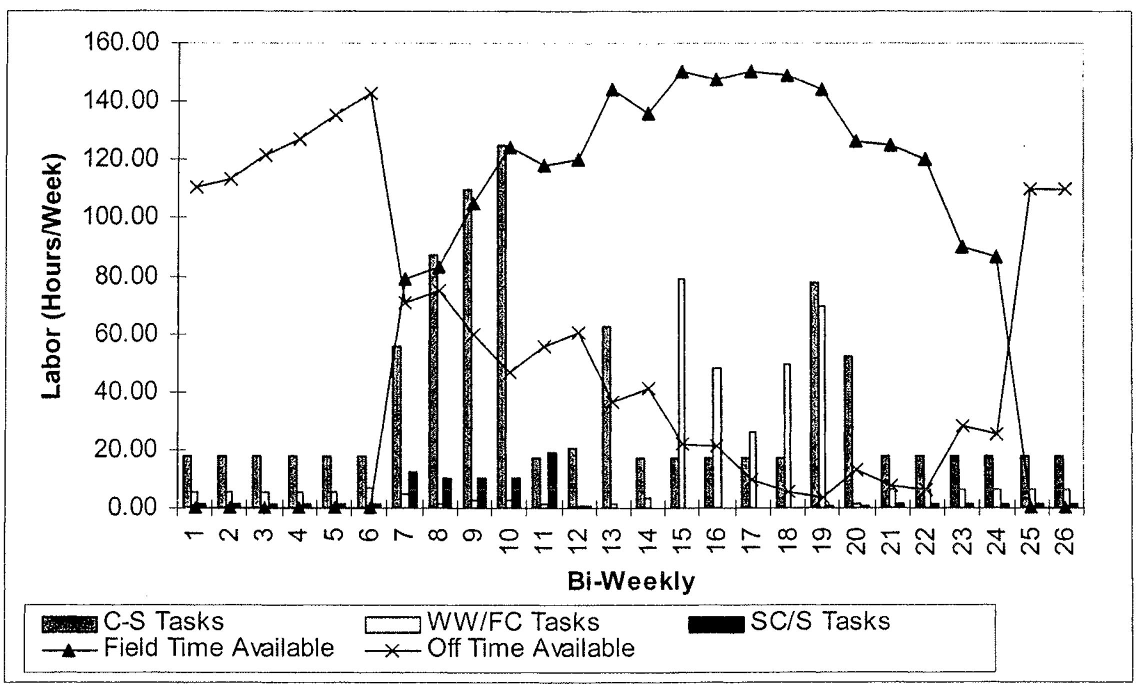
Graph 11 – C-S and Agroforestry Production Given Constraints on Tasks

(624.76 acres C-S and 14.52 acres Windbreak with 0.74 acres Scarlet Curls)



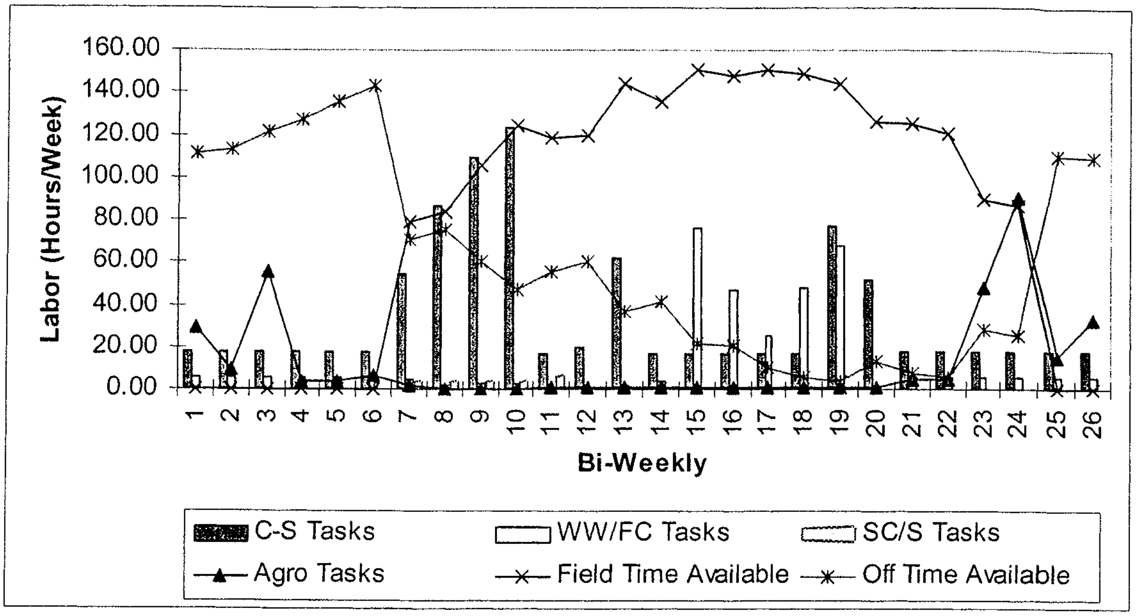
Graph 12 – C-S, WW/FC and SC/S Production Given Constraints on Tasks

(615.59 acres C-S 20.30 acres WW/FC and 4.11 acres SC/S)



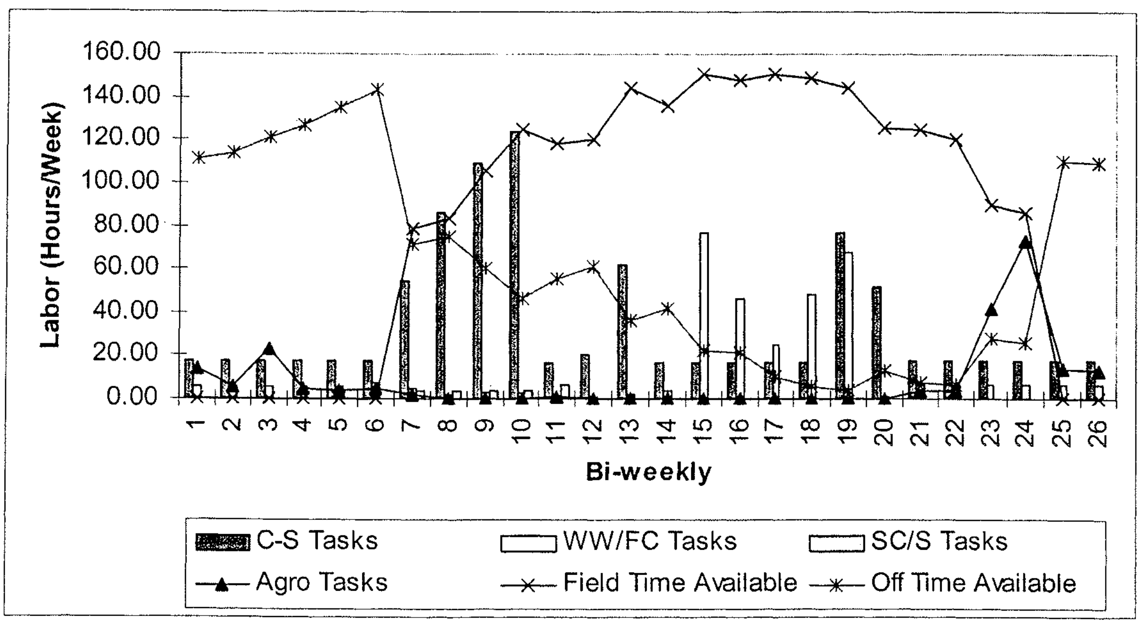
Graph 13 – Production Given All Options With Constraints on Tasks

(608.85 C-S, 19.70 WW/FC, 1.36 SC/S, 9.37 WB with 0.72 SC, and no mrkt. constraints)



Graph 14 – Production Given All Options With Marketing Constraints

(608.85 C-S, 19.70 WW/FC, 1.36 SC/S, 9.37 WB with 0.24 SC, 0.32 GW and 0.04 BR, with 20% mrkt. constraints)



Sensitivity Analysis

Because the availability of labor was found to be a major constraining factor in regards to the increased production of the high value supplemental crops and associated profitability, the availability of additional labor was considered in the sensitivity analyses; (see Table 26 for partial results and Table A5-1 for the full results). The first analysis focused on the additional labor that could be made available from an additional full-time skilled operator. This position was compensated at $15 per hour. Unexpectedly, this did not result in any changes to the optimal cropping allocation. This may be due to the high cost of this additional labor. It should also be noted that while this option would provide an additional labor resource during the crucial 'bottleneck' periods, it would result in a greater amount of unused productive time for two people during off times.

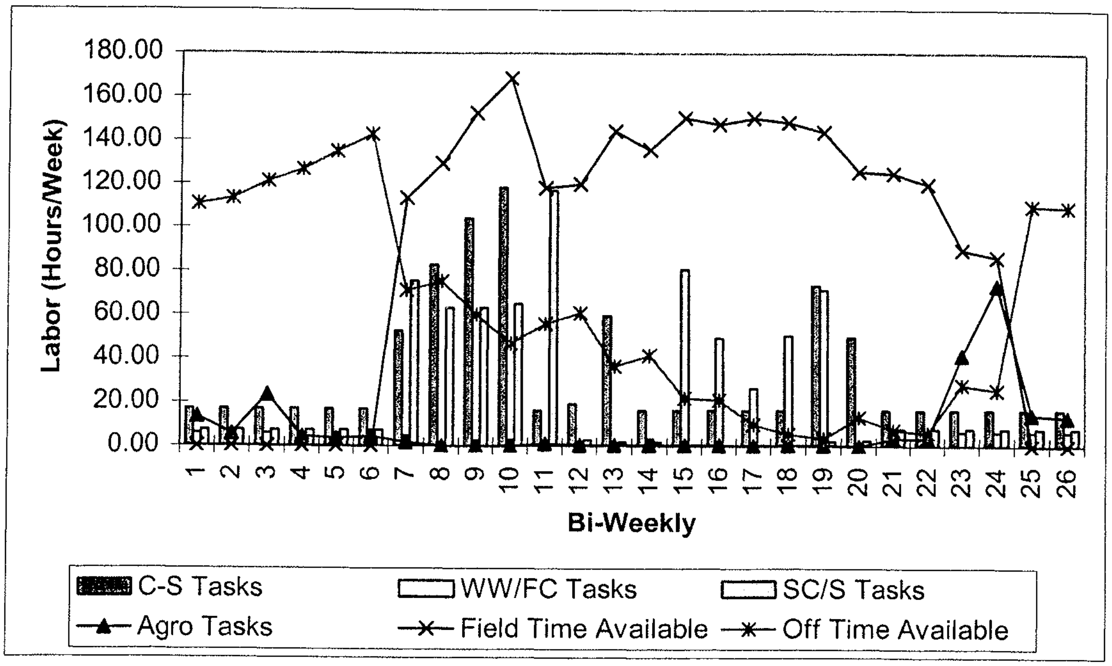
Table 26 – Sensitivity Analysis in Regard to Labor Availability Changes

Comparion	Labor	Land Allocation (Acres)	Total Oper. Labor Used	Net
Option 1,2,3 & 4	One full time operator	C-S: 608.85 WW/FC: 19.70 SC/S: 1.36 WB:9.37 SC: 0.24 GW: 0.32 BR: 0.04	1511.91 hrs	$66,456.97
Option 1,2,3 & 4	Two full time operators	C-S: 608.85 WW/FC: 19.70 SC/S: 1.36 WB:9.37 SC: 0.24 GW: 0.32 BR: 0.04	1511.91 hrs	$66,456.97
Option 1,2,3 & 4	One operator w/ pt labor during critical times	C-S: 583.08 WW/FC: 20.79 SC/S: 25.48 WB:9.37 SC: 0.24 GW: 0.32 BR: 0.04	1956.90 hrs	$111,443.93 (198 hired hrs)

When the additional part-time labor was allocated a wage of only $7.50 per hour and added to the LP model during only critical time periods, production of the supplemental crops and producer profitability increased dramatically, (see Graph 15). At this point, the production of the woody floral crops was constrained by market share, and cabbage production was constrained by labor needs that were not considered as non-critical time periods in the initial analyses. In this regard, the operator would be faced with the option of adding more part time labor, transforming the operation into an intensively managed 640 acres. However, as is common in rural NE, they would probably be constrained by available employees as rural communities continue to empty.

Graph 15 - Production Given All Options with added Part-Time Labor

(583.08 C-S, 20.79 WW/FC, 25.48 SC/S, 9.37 WB with 0.24 SC, 0.32 GW and 0.04 BR)



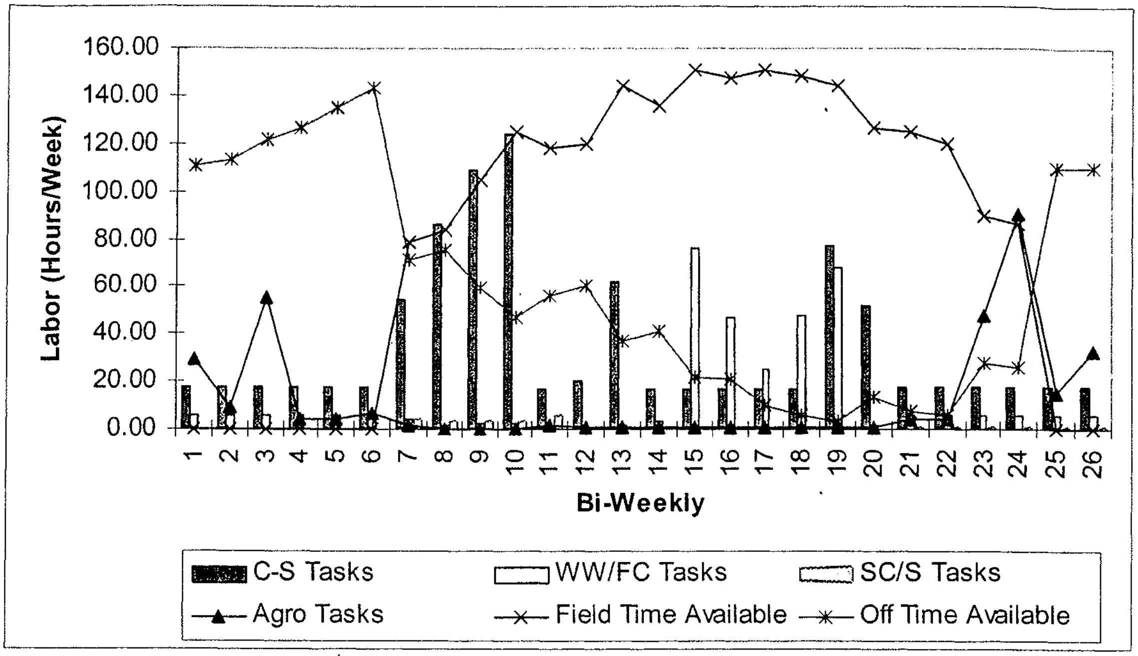
Since marketing was found to be a constraining factor in the increased production of the high value woody floral crops, a sensitivity analysis was performed (see Table 27 for the partial results and Table A5-1 for the full results). With only one full-time operator, as market opportunities increase, the production of the woody floral crops increased and eventually shifts to production of only the highest value crop, scarlet curls willow. However, the model is still ultimately constrained by labor availability, see Graph 16 for an illustration.

Table 27 – Sensitivity Analysis in Regard to Labor and Marketing

Comparion	Marketing	Land Allocation (Acres)	Total Oper. Labor Used	Net
Option 1,2,3 & 4 One full time operator	30 % NE Mrkt	C-S: 608.85 WW/FC: 19.70 SC/S: 1.36 WB:9.37 SC: 0.36 GW: 0.32 BR: 0.06	1568.98 hrs	$68,749.84
Option 1,2,3 & 4 One full time operator	5% MW Mrkt	C-S: 608.85 WW/FC: 19.70 SC/S: 1.36 WB:9.37 SC: 0.72 GW: 0 BR: 0	1611.05 hrs	$74,890.75
Option 1,2,3 & 4 One full time operator	No Limits	C-S: 608.85 WW/FC: 19.70 SC/S: 1.36 WB:9.37 SC: 0.72 GW: 0 BR: 0	1611.05 hrs	$74,971.60
Option 1,2,3 & 4 Two full time operators	30 % NE Mrkt	C-S: 608.85 WW/FC: 19.70 SC/S: 1.36 WB:9.37 SC: 0.36 GW: 0.48 BR: 0.06	1616.74hrs	$68,981.36
Option 1,2,3 & 4 Two full time operators	5% MW Mrkt	C-S: 608.85 WW/FC: 19.70 SC/S: 1.36 WB:9.37 SC: 0.79 GW: 0.37 BR: 0.15	1785.08 hrs	$77,041.65
Option 1,2,3 & 4 Two full time operators	No Limits	C-S: 608.85 WW/FC: 19.70 SC/S: 1.36 WB:9.37 SC:1.60 GW: 0 BR: 0	1992.34 hrs	$91,537.48
Option 1,2,3 & 4 One operator w/ pt labor during critical times	30 % NE Mrkt	C-S: 583.62 WW/FC: 20.68 SC/S: 25.43 WB:9.37 SC: 0.36 GW: 0.48 BR: 0.06	2059.52 hrs	$114,488.67 (198 hired hrs)
Option 1,2,3 & 4 One operator w/ pt labor during critical times	5% MW Mrkt	C-S: 582.48 WW/FC: 20.72 SC/S: 26.12 WB:9.37 SC: 0.79 GW: 0.37 BR: 0.15	2241.06 hrs	$123,457.53 (254 hired hrs)
Option 1,2,3 & 4 One operator w/ pt labor during critical times	No Limits	C-S: 583.06 WW/FC: 20.68 SC/S: 25.32 WB:9.37 SC: 1.10 GW: 0.47BR: 0	2398.34 hrs	$126,717.69 (307 hired hrs)

Graph 16 - Production with One Full-Time Operator and No Market Limits

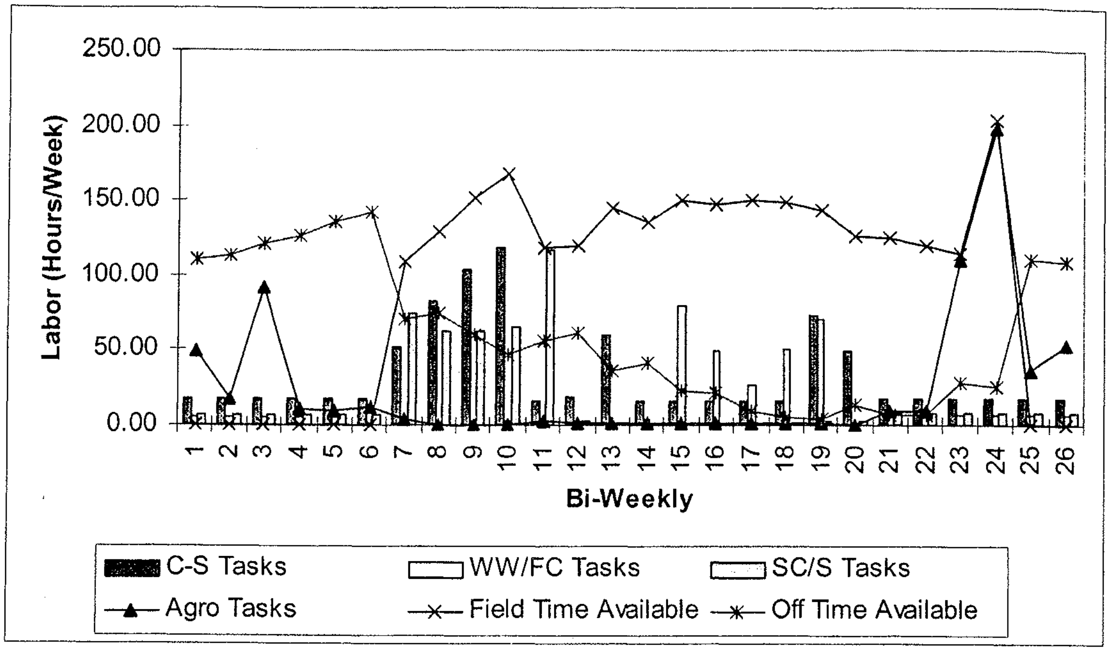
(608.85 C-S, 19.70 WW/FC, 1.36 SC/S, 9.37 WB with 0.72 SC, 0 GW and 0 BR)



With two full-time operators, as market availability increased, the production of woody floral crops increased, eventually shifting towards the production of only the highest value crop, scarlet curls willow. Although cabbage was not considered profitable enough by the LP model to increase its production due to the expensive labor, woody floral production did not seem to be affected by this. Again, when no limits were constraining the solution, labor became the constraining factor to increased production see Graph 17 for an illustration.

Graph 17 - Production with Two Full-Time Operators and No Market Limits

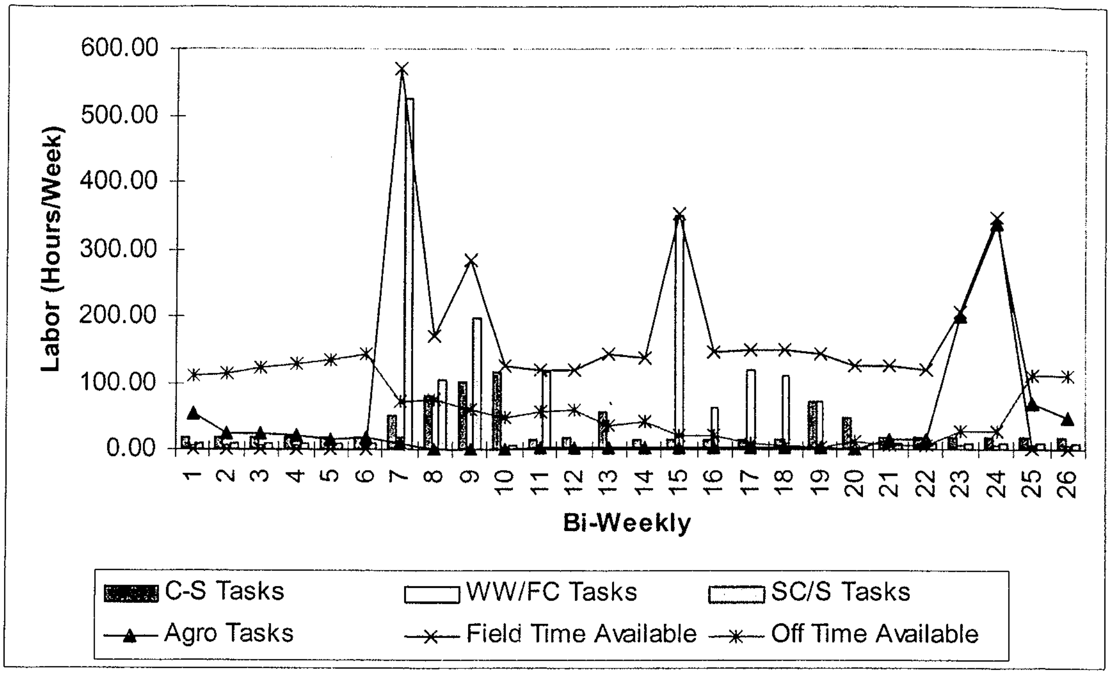
(608.85 C-S, 19.70 WW/FC, 1.36 SC/S, 9.37 WB with 1.60 SC, 0 GW and 0 BR)



When the market constraints were increased in conjunction with part-time labor availability during critical time periods, woody floral production increased to a very profitable level, being constrained only by markets. When no market limits were constraining the production situation, labor constraints during off-times became the only constraining factor in increased production, see Graph 18 for an illustration.

Graph 18 - Production with Part-Time Help and No Market Limits

(580.87 C-S, 20.68WW/FC, 25.32 SC/S, 9.37 WB with 1.10 SC, 0.47 GW and 0 BR)



In summary, the addition of supplemental cropping enterprises to the initial cropping scenario increased producer profitability, especially with respect to the agroforestry crops. Labor and markets were highly significant factors in the production allocation, whereas the addition of part-time labor during critical time periods clearly was the most effective option to maximize profitability. At their highest levels, cropping subsidies for production of the commodity crops was no longer necessary to sustain the farm enterprise. In fact, if subsidies were eliminated, the producer could probably become even more profitable by eliminating production of corn and soybean entirely and subsisting on fewer acres.

Conclusions

Current agroecosystems in the U.S., and specifically eastern Nebraska, are beset with economic, ecological and social problems. Our modern industrialized system of agriculture has encouraged farm producers to maximize their 'economies of size' by specializing and streamlining their production to a limited number of commodity crops on larger and larger acreages. In response to the withdrawal of all price supports and stabilization provisions beginning with the 1996 Freedom to Farm Act, overproduction of these few crops continues to rise and market prices are falling. As farm producers continue to become ever more reliant on crop subsidies to survive, small family farm operations are going under and large corporate-style producers are taking over. While some may argue that this is efficiency at work in a free-market capitalistic system, rural communities are being eroded and the negative environmental externalities associated with this large-scale industrialized production are growing. While some may see this system as efficient, producing an amazing surplus of crops to "feed the world", the environmental and social consequences of this production are usually not included in the analyses, allowing these systems to be seen as more efficient and successful than they really are.

One potential option, that advocates argue will allow small scale family farming enterprises to remain viable while also being more environmentally sustainable, is lower-input, diversified, or integrated farming systems. While lower-input, diversified farming systems are more complex and require more intensive "hands-on" resource management than do higher-input specialized systems, their potential synergistic gains from effective integration of enterprises and activities within diversified farming systems may more than offset the alternative gains from specialization (Ikerd, 1996). These systems seek to work more closely with nature, rather than against it, by utilizing the potential benefits that biodiversity can provide to the farming system. These ecological services include benefits such as nutrient cycling, regulation of microclimate and local hydrological processes, suppression of undesirable organisms, and detoxification of noxious chemicals. Integrated systems may provide the opportunity to help revitalize rural communities by maintaining small family farms, minimize negative environmental externalities by decreasing pesticide and synthetic fertilizers, and help reduce the farming systems reliance on fossil fuels. Studies have shown that these systems can also be just as agronomically and economically productive as their large-scale counterparts.

However, while these benefits remain strong in theory, farm producers need a concrete model that illustrates how integration is possible and what cropping combinations will be successful for them. Crop modeling procedures have been found to be an effective, low cost method with little risk to help evaluate a large number of alternatives.

Most farm producers in eastern Nebraska utilize a corn and soybean rotation and own most of the equipment to accomplish the tasks that are involved with this production. In this respect, most farm producers would not be expected to make a radical crop systems change from what they currently produce, but would instead look for supplemental crops that could be integrated into their existing operations. This was the impetus for this study, to explore whether the integration of various supplemental crops was feasible, and if so, in what combinations given current resource constraints. The various alternatives that were examined included the grazing of stalk residues by cattle, annual cabbage crops grown in conjunction with either winter wheat or sunflower, and a perennial scenario involving windbreaks with woody floral crops.

These alternative supplemental crops were initially chosen on the basis that studies have shown them to be viable crops for eastern Nebraska given their agronomic and market feasibility. Further, none of them require extensive specialized equipment or production knowledge beyond what is needed in the production of corn or soybean. Finally, the timing that is required for the production of these supplemental crops fits into those time periods that have low labor requirements in the corn and soybean rotation. For instance, corn and soybean production has high labor requirements in both the spring planting and fall harvest, however, throughout the rest of the year they have minimal labor requirements resulting in bottlenecks of labor availability. Alternatively, the labor requirements for fall cabbage occur primarily during the summer months, and the labor requirements for decorative woody florals occur primarily during the winter.

Detailed enterprise budgets were constructed for each cropping scenario. These went beyond typical enterprise budgets to include the approximate labor required for each task in the production process and when it occurred. Time requirements and durations, as well as costs for each task were broken down into per acre requirements for production. Each alternative-cropping scenario was then averaged over a period of six years to highlight the benefits that can be received from the synergies that occur during integrated production. For example, while corn and soybean production requires synthetic fertilizer application every other year, the winter wheat/fall cabbage production scenario is rotated every third year into the corn-soybean rotation and involves the application of manure as a fertilizer resource. With this scenario, fertilizer is applied to the system only every third year. Alternatively, the agroforestry system has relatively high initial costs and does not provide any net returns until after two years into the production process.

These six-year averages for each cropping scenario were then entered into a linear programming (LP) model to determine the optimal annual acreage allocation for each scenario. The LP model was programmed to maximize the net present value of the farm producer, by determining the optimal annual acreage allocation for a typical eastern Nebraska producer, given specific weekly labor and other resource constraints. The main focus was to concentrate on the optimal scenario given labor constraints; however, market constraints were also explored, as they were a constraining factor to the increased production of the supplemental activities, particularly with regard to the woody floral crops. While an attempt was made to make each of the cropping scenarios as accurate as possible, actual tasks and their associated timing may vary from an actual farm operation, or from farm to farm. While these details may alter the fine-tuning of the model, it is not expected that these changes would affect the major conclusions. Overall, whole farm analysis using a linear programming model is an excellent tool to give an indication of what would be expected to occur in an actual farming operation.

The results of the LP analysis suggest that all supplemental cropping scenarios have the potential to increase producer profitability. The grazing of stalk residues increased profitability without any additional labor responsibility to the grain producer, but did not affect the overall annual acreage allocation. When each alternative supplementation scenario was analyzed with the base corn-soybean system individually, the production of the winter wheat/fall cabbage improved the producer's profitability the most. The woody floral crops grown in association with field windbreaks also substantially increased profitability, yet they were constrained by market availability. The spring cabbage/sunflower option also increased profitability, however it was constrained by the fact that it and the corn-soybean system have high labor needs in the spring.

Because labor was the most constraining factor in regards to the increased production of the supplemental cropping scenarios, a sensitivity analysis was used to determine the effects on the optimal cropping scenario given additional labor. The addition of another full-time skilled operator did not have an effect on increasing cabbage production, as the cost of this additional labor was too high. Additional labor did increase production of the woody florals; however, overall production was still constrained by market access. The addition of part-time labor during critical time periods increased the profitability of both the cabbage and woody floral crop scenarios. The constraining factor eventually became the labor requirements during periods that were not constraining the model in the initial analyses. At this point, if the producer were not constrained by available part-time labor as is common in rural Nebraska, they would face the option of transforming the small-scale family farming enterprise into an intensively managed business with many part-time workers.

Market constraints also were included in the sensitivity analyses to determine their effects on the optimal acreage allocation as well. As available markets for the woody floral crops increased, their production also increased, with the available labor shifting initially towards the highest value crop, scarlet curls willow, and then increasing production of the other two corps as the scarlet curls market became saturated.

The analyses performed in this study clearly indicate that the integration of various animal, annual and perennial cropping scenarios into an existing corn-soybean operation in eastern Nebraska is possible and will result in the increased profitability to the producer. However, whether these integrated systems have the potential to increase the social and ecological sustainability of the operation was beyond the scope of this analysis. Fortunately, this study could provide the impetus for further research into this area as well as serve as a model to determine the feasibility of the integration of various other supplemental cropping strategies. For instance, both the social and ecological benefits of the integration of livestock into a grain production system were outlined. These included quicker and more efficient nutrient cycling, a cheaper fertilizer source with many additional nutrients, and the reduction of the waste disposal costs of animal confinement units.

Another situation that could be more thoroughly explored is the agroforestry option. Studies have shown that windbreaks provide numerous benefits to the agroecosystem including crop protection and increased yields, habitat provision for beneficial organisms to crop production, and energy savings to the farm dwelling and inhabitants. Further, as acreage is allocated to these perennial structures, synthetic chemical inputs and machinery operation costs will be reduced. Finally, the high labor requirements involved with the specialty crops that can be produced in these agroforestry systems could provide many jobs within the community while stabilizing the farm producer's security, thus potentially increasing social sustainability of the agroecosystem.

In conclusion, lower-input, diversified or integrated farming systems offer an agronomically and economically viable option for small family-sized farming operations to be sustained in the face of the growing large-scale industrialized farming sector. While they require more intensive "hands-on" management techniques, in a small-scale farm system they have the potential to greatly increase producer profitability while also hypothetically contributing to social and ecological sustainability as well.

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Appendix 1 – Corn-Soybean Base Model

Table A1-1 – Base Corn Soybean Farm Inputs

Inputs	Corn	Soybeans	Cost
Anydrous	55 lbs/ac		0.17/lb
P_2O_2	25 lbs/ac	25 lbs/ac	0.29/lb
Corn Seed	20K/ac		98.66/80K
Soybean Seed		1 bag/ac	17.4/bag
Corn Herbicide			22.93/ac
Soybean Herbicide			27.39/ac

Table A1-2 – Average Corn Price per Bushel Price

Year	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	*Average*
1985	2.56	2.60	2.61	2.66	2.66	2.61	2.62	2.43	2.40	2.23	2.22	2.27	**2.49**
1986	2.31	2.28	2.27	2.30	2.41	2.36	2.22	1.83	1.51	1.45	1.51	1.49	**2.00**
1987	1.50	1.43	1.45	1.50	1.66	1.70	1.62	1.50	1.50	1.55	1.61	1.71	**1.56**
1988	1.71	1.79	1.82	1.86	1.88	2.28	2.69	2.66	2.56	2.58	2.45	2.47	**2.23**
1989	2.62	2.56	2.50	2.49	2.53	2.46	2.45	2.20	2.21	2.18	2.18	2.24	**2.39**
1990	2.22	2.27	2.33	2.37	2.53	2.56	2.56	2.43	2.32	2.20	2.21	2.21	**2.35**
1991	2.25	2.26	2.30	2.40	2.39	2.32	2.28	2.33	2.30	2.29	2.28	2.29	**2.31**
1992	2.34	2.40	2.44	2.45	2.43	2.45	2.34	2.14	2.13	2.08	2.02	2.02	**2.27**
1993	2.05	2.02	2.10	2.15	2.12	2.07	2.21	2.26	2.23	2.28	2.46	2.65	**2.22**
1994	2.66	2.74	2.70	2.61	2.61	2.65	2.37	2.18	2.12	2.13	2.07	2.15	**2.42**
1995	2.21	2.22	2.29	2.37	2.43	2.53	2.69	2.70	2.78	2.76	2.85	2.96	**2.57**
1996	3.02	3.30	3.39	3.78	4.24	4.54	4.65	4.55	3.73	2.92	2.68	2.61	**3.62**
1997	2.66	2.62	2.74	2.75	2.63	2.53	2.42	2.43	2.42	2.49	2.52	2.44	**2.55**
1998	2.47	2.48	2.50	2.40	2.32	2.22	2.11	1.83	1.72	1.92	1.91	1.92	**2.15**
1999	1.97	1.96	1.98	1.96	1.93	1.94	1.72	1.72	1.67	1.66	1.67	1.70	**1.82**
2000	1.79	1.90	1.99	2.01	2.08	1.93	1.67	1.52	1.60	1.81	1.86	1.99	**1.85**
2001	1.97	1.95	1.98	1.95	1.81	1.77	1.86	1.90	1.87	1.86	1.85	1.91	**1.89**
												17 Yr. Avg	**2.27**

Table A1-3 Average Soybean Price per Bushel Price

Year	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	*Average*
1985	5.64	5.64	5.68	5.72	5.51	5.55	5.36	4.94	4.82	4.70	4.72	4.84	**5.26**
1986	4.94	4.96	5.02	5.01	5.06	5.08	5.00	4.86	4.64	4.40	4.51	4.50	**4.83**
1987	4.51	4.52	4.58	4.77	5.09	5.28	5.17	4.94	4.88	4.89	5.11	5.47	**4.93**
1988	5.40	5.74	5.91	6.21	6.75	7.87	8.73	8.39	7.91	7.47	7.37	7.41	**7.10**
1989	7.53	7.26	7.38	7.23	7.11	6.85	6.76	5.90	5.57	5.33	5.38	5.42	**6.48**
1990	5.33	5.33	5.43	5.66	5.82	5.77	5.81	5.87	5.77	5.77	5.57	5.54	**5.64**
1991	5.45	5.44	5.55	5.65	5.57	5.49	5.32	5.62	5.61	5.41	5.37	5.32	**5.48**
1992	5.40	5.45	5.51	5.55	5.74	5.81	5.50	5.25	5.16	5.06	5.15	5.30	**5.41**
1993	5.34	5.39	5.46	5.54	5.63	5.73	6.44	6.47	6.05	5.81	6.22	6.52	**5.88**
1994	6.57	6.56	6.64	6.44	6.64	6.66	5.79	5.36	5.21	5.02	5.17	5.24	**5.94**
1995	5.21	5.20	5.37	5.41	5.46	5.54	5.86	5.70	5.90	5.99	6.25	6.57	**5.71**
1996	6.64	6.83	6.87	7.31	7.66	7.35	7.57	7.66	7.53	6.82	6.78	6.78	**7.15**
1997	6.96	7.24	7.71	7.84	7.85	7.70	7.42	6.90	6.64	6.35	6.72	6.60	**7.16**
1998	6.46	6.40	6.23	6.09	6.10	5.99	5.94	5.18	4.89	5.05	5.20	5.18	**5.73**
1999	5.09	4.67	4.46	4.46	4.34	4.62	4.04	4.29	4.42	4.34	4.26	4.25	**4.44**
2000	4.42	4.61	4.79	5.00	5.20	4.94	4.42	4.34	4.55	4.37	4.46	4.68	**4.65**
2001	4.54	4.29	4.25	4.10	4.16	4.33	4.67	4.80	4.39	4.00	4.09	4.06	**4.31**
											17	**Yr. Avg.**	**5.65**

Table A1-4 – Base Corn-Soybean Model Enterprise Budget

Week	Date	Task	Acres	Acres/Hr	Task Time/F	Task Time/O	Equip/Mater.	Cost/hr (operation)	Cost/hr (ownership)	Cost/ac (Operat)	Total Cost	Tot. Field Labor/Wk	Tot. Cost/Wk
1	1/1-1/7	Misc				9.22						0	0
2	1/8-1/14	Misc				9.22						0	0
3	1/15-1/21	Misc				9.22						0	0
4	1/22-1/28	Misc				9.22						0	0
5	1/29-2/4	Misc				9.22						0	0
6	2/5-2/11	Misc				9.22						0	0
7	2/12-2/18	Misc				9.22						0	0
8	2/19-2/25	Misc				9.22						0	0
9	2/26-3/4	Misc				9.22						0	0
10	3/5-3/11	Misc				9.22						0	0
11	3/12-3/18	Misc				9.22						0	0
12	3/19-3/25	Misc				9.22						0	0
13	3/26-4/1	Misc				9.22						0	0
14	4/2-4/8	Start Disk Corn	311.3	7.8	39.91		120 hp tractor	8.67	28.65		744.73		
							100 hp tractor	8.04	22.11		601.65		
							disk	-	3.11	0.5	279.77		
		Misc				8.89							
												39.91025641	1626.14
15	4/9-4/15	Disk Corn	8.7	7.8	1.12		120 hp tractor	8.67	28.65		20.81		
							100 hp tractor	8.04	22.11		16.81		
							disk	-	3.11	0.5	7.82		
		Disk Soybeans	320	7.8	41.03		120 hp tractor	8.67	28.65		765.54		
							100 hp tractor	8.04	22.11		618.46		
							disk	-	3.11	0.5	287.59		
		Misc				8.89							
												42.14	1717.04

Table A1-4 – Base Corn-Soybean Model Enterprise Budget Cont.

Week	Date	Task	Acres	Acres/Hr	Task Time/F	Task Time/O	Equip/Mater.	Cost/hr (operation)	Cost/hr (ownership)	Cost/ac (Operat)	Total Cost	Tot. Field Labor/Wk	Tot. Cost/Wk
16	4/16-4/22	Apply Anydrous	320	9.7	32.99		120 hp tractor	8.67	28.65		615.59		
							100 hp tractor	8.04	22.11		497.32		
	(at Mead	fall manure)					Any. Appli. Ren			2.81	899.2		
							Anyh(55lbs/ac)	(.17/lb)		9.35	2992.00		
		Misc				8.89							
												32.99	**5004.11**
17	4/23-429	Field Cultivation	640	13.6	47.06		120 hp tractor	8.67	28.65		878.12		
							100 hp tractor	8.04	22.11		709.41		
	(at Mead	done in fall)					Field Cultivator		2.48	0.19	238.31		
		Misc				8.89							
												47.06	**1825.84**
18	4/30-5/6	Plant Corn	320	6.5	49.23		120 hp tractor	8.67	28.65		918.65		
							100 hp tractor	8.04	22.11		742.15		
							planter		4.86	1.91	850.46		
							Seed(20K/ac)	(98.66/80K)		24.67	7017.6		
		Misc				8.89							
												49.23	**9528.86**
19	5/7-5/13	Spray Corn	320	10.2	31.37		120 hp tractor	8.67	28.65		585.41		
							100 hp tractor	8.04	22.11		472.94		
							Sprayer		0.44	0.1	45.80		
							Herbicide			22.93	7337.6		
		Start Plant Soy	193	6.5	29.69		120 hp tractor	8.67	28.65		554.06		
							100 hp tractor	8.04	22.11		447.61		
							planter		4.86	1.91	512.93		
							Seed(1 bag/ac)			17.4	3358.2		
		Misc				8.89							
												61.06	**13314.56**
20	5/14-5/20	Plant Soybeans	127	6.5	19.54		120 hp tractor	8.67	28.65		364.59		
							100 hp tractor	8.04	22.11		294.54		
							planter		4.86	1.91	337.53		
							Seed(1 bag/ac)			17.4	2209.8		
		Spray beans	320	10.2	31.37		120 hp tractor	8.67	28.65		585.41		
							100 hp tractor	8.04	22.11		472.94		
							Sprayer		0.44	0.1	45.80		
							Herbicide			27.39	8764.8		
		Misc				8.89							
												50.91	**13075.41**
21	5/21-5/27	Misc				8.89							
												0	**0**

Table A1-4 – Base Corn-Soybean Model Enterprise Budget Cont.

Week	Date	Task	Acres	Acres/Hr	Task Time/F	Task Time/O	Equip/Mater.	Cost/hr (operation)	Cost/hr (ownership)	Cost/ac (Operat)	Total Cost	Tot. Field Labor/Wk	Tot. Cost/Wk
22	5/28-6/3	Misc				8.89							
												0	0
23	6/4-6/10	Misc				8.89							
												0	0
24	6/11-6/17	Cult. Turn row	60	20	3.00		120 hp tractor	8.67	28.65		55.98		
							100 hp tractor	8.04	22.11		45.23		
		(9 out of 10 do on ly turn r ows).......					rowcrop cult.		1.28	0.38	26.64		
		Misc				8.89							
												3.00	127.85
25	6/18-6/24	Misc				8.89							
												0	0
26	6/25-7/1	Cultivate beans	320	6.8	47.06		120 hp tractor	8.67	28.65		878.12		
							100 hp tractor	8.04	22.11		709.41		
							rowcrop cult.		1.28	0.38	181.84		
		Misc				8.89							
												47.06	1769.36
27	7/2-7/8	Misc				8.89							
												0	0
28	7/9-7/15	Misc				8.89							
												0	0
29	7/16-7/22	Misc				8.89							
												0	0
30	7/23-7/29	Misc				8.89							
												0	0
31	7/30-8/5	Rogue Beans	320		-		Hired crew			5.63	1801.6		
		Misc				8.89							
												0	1801.6
32	8/6-8/12	Misc				8.89							
												0	0
33	8/13-8/19	Misc				8.89							
												0	0
34	8/20-8/26	Misc				8.89							
												0	0
35	8/27-9/2	Misc				8.89							
												0	0
36	9/3-9/9	Misc				8.89							
												0	0
37	9/10-916	Misc				8.89							
												0	0

Table A1-4 – Base Corn-Soybean Model Enterprise Budget Cont.

Week	Date	Task	Acres	Acres/Hr	Task Time/F	Task Time/O	Equip/Mater.	Cost/hr (operation)	Cost/hr (ownership)	Cost/ac (Operat)	Total Cost	Tot. Field Labor/Wk	Tot. Cost/Wk
38	9/17-9/23	Combine Corn	320	5.1	62.75		combine	24.89	130.48		9748.71		
							corn head		10.71	0.47	822.4		
							(yield:320*105=33600)						
							truck corn			(.14/bu)	4704		
							dry grain			(.11/bu)	3696		
		Misc				8.89							
												62.75	18971.11
39	9/24-9/30	Misc				8.89							
												0	0
40	10/1-10/7	Combine beans	320	8.7	36.78		combine	24.89	130.48		5714.76		
							grain head		3.58	0.05	147.68		
							(yield:320*35=11,200)						
							truck beans			(.14/bu)	1568		
		Misc				8.89							
												36.78	7430.44
41	10/8-10/15	Misc				9.22							
												0	0
42	10/16-10\21	Misc				9.22							
												0	0
43	10/22-10/28	Misc				9.22							
												0	0
44	10/29-11/4	Misc				9.22							
												0	0
45	11/5-11/11	Misc				9.22							
												0	0
46	11/12-11/18	Misc				9.22							
												0	0
47	11/19-11/25	Misc				9.22							
												0	0
48	11/26-12/2	Misc				9.22							
												0	0
49	12/3-12/9	Misc				9.22							
												0	0
50	12/10-12/16	Misc				9.22							
												0	0
51	12/17-12/23	Misc				9.22							
												0	0
52	12/24-12/30	Misc				9.22							
												0	0

Table A1-4 – Base Corn-Soybean Model Enterprise Budget Cont.

Week	Date	Task	Acres	Acres/Hr	Task Time/F	Task Time/O	Equip/Mater.	Cost/hr (operation)	Cost/hr (ownership)	Cost/ac (Operat)	Total Cost	Tot. Field Labor/Wk	Tot. Cost/Wk
					Grand Totals	470.53						472.89	76192.31
									Owned Land Cost		288 ac-owned	Cost - 46.20/ac	13305.60
									Rented Land Cost		352 ac.rented	Cost-86/ac	30272.00
					Total Hours	943.39			Pickup		Ownership+	Operation costs	2715.76
									Interest of operating capital				4090.7
									Overhead				3257.72
									Soil Test (32 @$10/each)				320
									Hourly Wage @ $15				14150.88
											Corn Income	(@2.27/bu)	76272
											Bean Income	(@5.65/bu)	63280
											Tot. Income		139,552
					Hourly	**Totals**					Tot. Expenses		144304.97
					Field	Other							
											Net Income		-4,752.97
					472.89	470.50							

* The machinery costs were averaged among the alternative tasks within the budget to account for flexibility in the operation as a whole.

Appendix 2 – Cabbage Integration

Table A2-1 Cabbage Inputs

	Price	Source	Rate	Source	Total Cost	Applications	Cost/App	Time/Acre
Herbicides								
Treflan	$28.50/gal	NE Crop Budgets	0.19/ac	Rutgers	$5.42	1	$5.42	4 hrs
Fungicides								
Kocide	$4.75/lb	Hummert Int'l	1lb/ac	Hodges	$4.75	2	$2.38	4 hrs
Maneb	$3.00/lb	MSU	1.5lb/ac	MSU	$4.50	2	$2.25	4 hrs
Bravo 720	$52/gal	MSU	0.19/ac	MSU	$9.88	2	$4.94	4 hrs
Pesticides								
Dipel	$12.25/lb	MSU	1 lb/ac	Rutgers	$12.25	4	$3.06	4 hrs
Safer Insect Soap	$9.95/3 gal	MSU	3 gal/ac	Bonsai Boy	$9.95	4	$2.49	4 hrs
Fertilizers								
Calcium Lime	$27.65/ton	MSU	1 ton	MSU	$27.65	1	$27.65	0.08 hrs
Nitrogen	$0.26/lb	NE Crop Budgets	125 lbs	Rutgers	$32.50	1	$32.50	0.08 hrs

Table A2-2 Average Wheat per Bushel Price

Year	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	*Average*
1985	3.25	3.23	3.19	3.18	2.99	2.98	2.85	2.63	2.65	2.75	2.92	3	**2.97**
1986	2.95	2.91	2.92	2.95	2.9	2.19	2.1	2.03	2.05	2.15	2.2	2.25	**2.47**
1987	2.21	2.33	2.41	2.38	2.41	2.31	2.17	2.19	2.3	2.3	2.44	2.56	**2.33**
1988	2.57	2.5	2.55	2.6	2.59	3.22	3.32	3.39	3.53	3.67	3.73	3.91	**3.13**
1989	3.88	3.93	4.04	4.04	4.11	3.92	3.87	3.74	3.78	3.74	3.8	3.86	**3.89**
1990	3.82	3.6	3.54	3.51	3.43	3.08	2.73	2.48	2.42	2.38	2.38	2.38	**2.98**
1991	2.31	2.33	2.44	2.49	2.48	2.55	2.56	2.69	2.86	3.1	3.34	3.46	**2.72**
1992	3.63	4.04	3.87	3.89	3.64	3.74	3.11	2.82	3.1	3.14	3.31	3.34	**3.47**
1993	3.43	3.3	3.3	3.17	2.97	2.94	2.87	2.76	2.79	2.91	3.2	3.49	**3.09**
1994	3.44	3.32	3.16	3.11	3.03	3.03	3.04	3.26	3.51	3.72	3.66	3.72	**3.33**
1995	3.62	3.56	3.42	3.39	3.65	3.94	4.29	4.21	4.42	4.62	4.53	4.76	**4.03**
1996	4.81	4.96	5.02	5.47	5.91	5.63	4.77	4.58	4.07	4.06	4.17	4.02	**4.79**
1997	4.11	4.09	4.05	4.24	4.08	3.52	3.24	3.37	3.42	3.28	3.17	3.12	**3.64**
1998	3.13	3.15	3.19	3.03	3	2.79	2.6	2.28	2.24	2.58	2.74	2.72	**2.79**
1999	2.74	2.51	2.57	2.62	2.34	2.41	2.13	2.24	2.27	2.05	1.99	2.03	**2.33**
2000	2.21	2.25	2.26	2.16	2.25	2.44	2.42	2.29	2.58	2.76	2.84	2.89	**2.45**
2001	2.97	2.84	2.93	2.88	2.9	2.97	2.77	2.7	2.68	2.66	2.75	2.71	**2.81**
												17 Yr. Avg	**3.13**

Table A2-3 Average Sunflower per Bushel Price

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1985	11.47	11.47	11.47	12.03	12.17	11.40	10.87	9.71	7.53	10.43	8.86	8.77	**10.52**
1986	8.55	7.89	7.67	7.21	6.96	7.22	6.54	6.15	6.25	6.91	6.39	6.39	**7.01**
1987	6.44	6.88	6.59	6.95	7.35	8.07	7.32	7.21	6.96	6.93	7.08	7.18	**7.08**
1988	7.93	8.63	7.86	8.75	9.22	10.90	13.58	13.48	13.10	12.88	12.85	12.90	**11.01**
1989	12.23	13.13	11.70	11.65	11.33	9.65	10.43	10.54	10.72	10.31	11.10	11.41	**11.18**
1990	10.22	10.66	10.86	10.89	12.44	12.80	12.40	13.70	12.29	10.72	10.47	10.31	**11.48**
1991	10.82	10.86	10.90	10.84	11.06	10.85	10.34	10.81	8.65	8.25	8.12	8.44	**10.00**
1992	8.47	8.64	8.54	8.54	8.77	9.00	9.24	9.33	9.20	9.15	8.83	9.45	**8.93**
1993	10.26	10.38	10.76	10.74	11.22	10.94	11.84	13.08	13.34	11.26	11.88	13.30	**11.58**
1994	13.74	15.00	15.20	15.86	16.76	14.58	13.32	14.16	10.78	10.79	10.78	10.60	**13.46**
1995	10.52	10.63	10.43	10.56	10.41	10.56	11.48	11.50	11.22	11.26	10.90	10.84	**10.86**
1996	11.12	11.56	12.22	12.80	13.24	14.44	13.62	12.20	12.06	12.08	11.84	11.74	**12.41**
1997	12.10	12.28	12.15	12.48	12.05	11.95	11.13	10.60	11.48	10.75	11.00	10.95	**11.58**
1998	11.08	11.73	12.05	12.80	13.68	14.10	15.10	14.23	11.43	10.86	11.02	11.01	**12.42**
1999	11.32	12.14	10.59	9.79	9.48	10.04	8.82	8.64	8.92	8.40	7.27	8.21	**9.47**
2000	7.89	8.43	8.10	8.93	8.74	7.83	8.33	7.59	7.48	6.19	6.24	6.87	**7.72**
2001	6.83	7.48	7.29	7.78	7.64	8.12	8.63	9.60	9.23	8.64	9.13	9.88	**8.35**
												17 Yr. Avg	**10.30**

Table A2-4 Winter Wheat/Fall Cabbage Enterprise Budget

Cabb Acres: 1

Wk	Date	Task	Acres	Acres/Hr	TaskTime/F	Task Time/O	Equip/Mater.	Cost/hr (operation)	Cost/hr (ownership)	Cost/ac (Operat)	Total Task Cost	Total Cost
1	1/1-1/7	Misc + Cab Mark	1			0.3990						
2	1/8-1/14	Misc + Cab Mark	1			0.3990						
3	1/15-1/21	Misc + Cab Mark	1			0.3990						
4	1/22-1/28	Misc + Cab Mark	1			0.3990						
5	1/29-2/4	Misc + Cab Mark	1			0.3990						
6	2/5-2/11	Misc + Cab Mark	1			0.3990						
7	2/12-2/18	Misc + Cab Mark	1			0.3990						
8	2/19-2/25	Misc + Cab Mark	1			0.3990						
9	2/26-3/4	Misc + Cab Mark	1			0.3990						
10	3/5-3/11	Misc + Cab Mark	1			0.3990						
11	3/12-3/18	Misc + Cab Mark	1			0.3990						
12	3/19-3/25	Misc + Cab Mark	1			0.3990						
13	3/26-4/1	Starter Fertilzer Wheat	1	12.82	0.08		120 hp tractor	8.67	28.65		1.46	
							100 hp tractor	8.04	22.11		1.18	
							spreader			1.32	1.32	
							Fert (10-34)	(1.30/gal)		10.4	10.40	
		Misc + Cab Mark	1			0.3990						
												14.35
14		Misc	1			0.0139						
15		Misc	1			0.0139						
16		Misc	1			0.0139						

Table A2-4 Winter Wheat/Fall Cabbage Enterprise Budget Cont.

Wk	Date	Task	Acres	Acres/Hr	TaskTime/F	Task Time/O	Equip/Mater.	Cost/hr (operation)	Cost/hr (ownership)	Cost/ac (Operat)	Total Task Cost	Total Cost
18		Misc	1			0.0139						
19		Misc	1			0.0139						
20		Misc	1			0.0139						
21	5/21-5/27	Spray Wheat	1	10.2	0.10		120 hp tractor	8.67	28.65		1.83	
							100 hp tractor	8.04	22.11		1.48	
							Sprayer		0.44	0.1	0.14	
							Herbicide			12.24	12.24	
		Misc	1			0.0139						
												15.69
22		Misc	1			0.0139						
23		Misc	1			0.0139						
24		Misc	1			0.0139						
25		Misc	1			0.0139						
26		Misc	1			0.0139						
27	7/2-7/8	Wheat Harvest	1	6.6	0.15		combine	24.89	130.48		23.54	
							grain head		3.58	0.05	0.59	
							(yield: 48bu/ac)					
							truck wheat			(.14/bu)	6.72	
		Misc	1			0.0139						
												30.85
28	7/9-7/15	Apply Manure	1				Custom			28	28.00	
		Apply Herbicide & Disk Cabbage	1	3.9	0.26		120 hp tractor	8.67	28.65		4.78	
							100 hp tractor	8.04	22.11		3.87	
							Sprayer		0.44	0.01	0.12	
							Herbicide			5.42	5.42	
							disk	-	3.11	0.5	1.30	
		Misc	1			0.0139						
												43.49

Table A2-4 Winter Wheat/Fall Cabbage Enterprise Budget Cont.

Wk	Date	Task	Acres	Acres/Hr	TaskTime/F	Task Time/O	Equip/Mater.	Cost/hr (operation)	Cost/hr (ownership)	Cost/ac (Operat)	Total Task Cost	Total Cost
29	7/16-7/22	Cultivate Cabbage	1	13.60	0.07		120 hp tractor	8.67	28.65		1.37	
							100 hp tractor	8.04	22.11		1.11	
							field cultivator		2.48	0.19	0.37	
		Plant Cabbage (28 day old trans)	1	0.25	4.00		Transplants	(0.05/each)	(13,939/acre)		696.95	
							hired help			60	60	
		Misc	1			0.0139						
												759.80
30	7/23-7/29	Set up irrigation	1	0.25	4.00		Irrigation equip				192	
		Irrigate	1	0.29	3.50							
		Misc	1			0.0139						
												192.00
31	7/30-8/5	Irrigate	1	0.29	3.50							
		Misc	1			0.0139						0
32	8/6-8/12	Irrigate	1	0.29	3.50							
		Misc	1			0.0139						0
33	8/13-8/19	Irrigate	1	0.29	3.50							
		Cultivate Cabbage	1	13.60	0.07		120 hp tractor	8.67	28.65		1.37	
							100 hp tractor	8.04	22.11		1.11	
							field cultivator		2.48	0.19	0.37	
		Cab. Pest Con	1	10.2	0.10		120 hp tractor	8.67	28.65		1.83	
							100 hp tractor	8.04	22.11		1.48	
							Sprayer		0.44	0.1	0.14	
							Pesticide			5.55	5.55	
		Misc	1			0.0139						
												11.85
34	8/20-8/26	Irrigate	1	0.29	3.50							
		Cab. Pest Con	1	10.2	0.10		120 hp tractor	8.67	28.65		1.83	
							100 hp tractor	8.04	22.11		1.48	
							Sprayer		0.44	0.1	0.14	
							Pesticide			5.55	5.55	
		Misc	1			0.0139						
												9.00

Table A2-4 Winter Wheat/Fall Cabbage Enterprise Budget Cont.

Wk	Date	Task	Acres	Acres/Hr	TaskTime/F	Task Time/O	Equip/Mater.	Cost/hr (operation)	Cost/hr (ownership)	Cost/ac (Operat)	Total Task Cost	Total Cost
35	8/27-9/2	Irrigate	1	0.29	3.50							
		Cab. Pest Con	1	10.2	0.10		120 hp tractor	8.67	28.65		1.83	
							100 hp tractor	8.04	22.11		1.48	
							Sprayer		0.44	0.1	0.14	
							Pest & Fung			15.12	15.12	
		Misc	1			0.0139						
												18.57
36	9/3-9/9	Cab. Pest Con	1	10.2	0.10		120 hp tractor	8.67	28.65		1.83	
							100 hp tractor	8.04	22.11		1.48	
							Sprayer		0.44	0.1	0.14	
							Pest & Fung			15.12	15.12	
		Irrigate	1	0.29	3.50							
		Misc	1			0.0139						
												18.57
37	9/10-9/16	Harvest Cabb	1	0.10	10.00		(yield 13,939*4*0.85=47392.6lbs)					
							bulk bins		(per 1000 pounds)	(11/bin)	521.32	
							truck cabbage			(3.00/ton)	71.09	
		Misc	1			0.0139						
												592.41
38	9/17-9/23	Misc	1			0.0139						
39	9/24-9/30	Misc	1			0.0139						
40	10/1-10/7	Misc	1			0.0139						
41	10/8-10/15	Plant Wheat	1	14.7	0.07		120 hp tractor	8.67	28.65		1.27	
							100 hp tractor	8.04	22.11		1.03	
							planter		1.69	1.93	2.04	
							Seed(1 bag/ac)			7.2	7.2	
		Misc + Cab Mark	1			0.4311						
												11.54
42	10/16-10/21	Misc + Cab Mark	1			0.4311						
43	10/22-10/28	Misc + Cab Mark	1			0.4311						
44	10/29-11/4	Misc + Cab Mark	1			0.4311						

Table A2-4 Winter Wheat/Fall Cabbage Enterprise Budget Cont.

Wk	Date	Task	Acres	Acres/Hr	TaskTime/F	Task Time/O	Equip/Mater.	Cost/hr (operation)	Cost/hr (ownership)	Cost/ac (Operat)	Total Task Cost	Total Cost
45	11/5-11/11	Misc + Cab Mark	1			0.4311						
46	11/12-11/18	Misc + Cab Mark	1			0.4311						
47	11/19-11/25	Misc + Cab Mark	1			0.4311						
48	11/26-12/2	Misc + Cab Mark	1			0.4311						
49	12/3-12/9	Misc + Cab Mark	1			0.4311						
50	12/10-12/16	Misc + Cab Mark	1			0.4311						
51	12/17-12/23	Misc + Cab Mark	1			0.4311						
52	12/24-12/30	Misc + Cab Mark	1			0.4311						
				Total Hours	43.69	10.72					**Total**	1718.13
							Fixed Costs					84.32
							Product Liability Insurance					500.00
							Hourly Wage (@15)					816.19
							Used Transplanter					2000.00
										Total Expenses		5118.64
									Cabbage Income	(@0.17/lb)		8056.74
									Wheat Income	(@3.13/bu)		150.24
									Total Income			**8206.98**
										Net Income		**3088.35**

* The machinery costs were averaged among the alternative tasks within the budget to account for flexibility in the operation as a whole.

Table A2-5 – Spring Cabbage/Sunflower Enterprise Budget

Cabb Acres: 1

Wk	Date	Task	Acres	Acres/Hr	TaskTime/F	Task Time/O	Equip/Mater.	Cost/hr (operation)	Cost/hr (ownership)	Cost/ac (Operat)	Total Task Cost	Total Cost
1	1/1-1/7	Misc + Cab Mark	1			0.3990						
2	1/8-1/14	Misc + Cab Mark	1			0.3990						
3	1/15-1/21	Misc + Cab Mark	1			0.3990						
4	1/22-1/28	Misc + Cab Mark	1			0.3990						
5	1/29-2/4	Misc + Cab Mark	1			0.3990						
6	2/5-2/11	Misc + Cab Mark	1			0.3990						
7	2/12-2/18	Misc + Cab Mark	1			0.3990						
8	2/19-2/25	Misc + Cab Mark	1			0.3990						
9	2/26-3/4	Misc + Cab Mark	1			0.3990						
10	3/5-3/11	Misc + Cab Mark	1			0.3990						
11	3/12-3/18	Misc + Cab Mark	1			0.3990						
12	3/19-3/25	Apply Herbicide &	1	3.9	0.26		120 hp tractor	8.67	28.65		4.78	
		Disk Cabbage					100 hp tractor	8.04	22.11		3.87	
							Sprayer		0.44	0.01	0.12	
							Herbicide			5.42	5.42	
							disk	-	3.11	0.5	1.30	
		Fert Cabbage	1	12.82	0.08		120 hp tractor	8.67	28.65		1.46	
							100 hp tractor	8.04	22.11		1.18	
							spreader			1.32	1.32	
							Calcium Lime	(27.65/ton)		27.65	27.65	
							Nitrogen	(0.26/lb)	125 lbs	32.5	32.50	
		Misc + Cab Mark	1			0.3990						
												79.59

Table A2-5 – Spring Cabbage/Sunflower Enterprise Budget Cont.

Wk	Date	Task	Acres	Acres/Hr	TaskTime/F	Task Time/O	Equip/Mater.	Cost/hr (operation)	Cost/hr (ownership)	Cost/ac (Operat)	Total Task Cost	Total Cost
13	3/26-4/1	Cultivate Cabbage	1	13.60	0.07		120 hp tractor	8.67	28.65		1.37	
							100 hp tractor	8.04	22.11		1.11	
							field cultivator		2.48	0.19	0.37	
		Plant Cabbage (28 day old trans)	1	0.25	4.00		Transplants	(0.05/each)	(13,939/acre)		696.95	
							hired help			60	60	
		Misc + Cab Mark	1			0.0139						
												759.80
14	4/2-4/8	Set up irrigation	1	0.25	4.00		Irrigation equip				192	
		Irrigate	1	0.29	3.50							
		Misc	1			0.0139						
												192
15	4/9-4/15	Irrigate	1	0.29	3.50							
		Misc	1			0.0139						
												0
16	4/16-4/22	Irrigate	1	0.29	3.50							
		Misc	1			0.0139						
												0
17	4/23-4/29	Irrigate	1	0.29	3.50							
		Cultivate Cabbage	1	13.60	0.07		120 hp tractor	8.67	28.65		1.37	
							100 hp tractor	8.04	22.11		1.11	
							field cultivator		2.48	0.19	0.37	
		Misc	1			0.0139						
												2.85
18	4/30-5/6	Irrigate	1	0.29	3.50							
		Misc	1			0.0139						
												0
19	5/7-5/13	Irrigate	1	0.29	3.50							
		Cab. Pest Con	1	10.2	0.10		120 hp tractor	8.67	28.65		1.83	
							100 hp tractor	8.04	22.11		1.48	
							Sprayer		0.44	0.1	0.14	
							Fungicide			9.57	9.57	
		Misc	1			0.0139						
												13.02
20	5/14-5/20	Cab. Pest Con	1	10.2	0.10		120 hp tractor	8.67	28.65		1.83	
							100 hp tractor	8.04	22.11		1.48	
							Sprayer		0.44	0.1	0.14	
							Fungicide			9.57	9.57	
		Irrigate	1	0.29	3.50							
		Misc	1			0.0139						

Table A2-5 – Spring Cabbage/Sunflower Enterprise Budget Cont.

Wk	Date	Task	Acres	Acres/Hr	TaskTime/F	Task Time/O	Equip/Mater.	Cost/hr (operation)	Cost/hr (ownership)	Cost/ac (Operat)	Total Task Cost	Total Cost
21	5/21-5/27	Harvest Cabb	1	0.10	10.00		(yield 13,939*4*0.85=47392.6lbs)					
							bulk bins		(per 1000 pounds)	(11/bin)	521.32	
							truck cabbage			(3.00/ton)	71.09	
		Misc	1			0.0139						
22	5/28-6/3	Disk Sunflowers	1	7.8	0.13		120 hp tractor	8.67	28.65		2.39	592.41
							100 hp tractor	8.04	22.11		1.93	
							disk	-	3.11	0.5	0.90	
		Fert Sunlfowers	1	12.82	0.08		120 hp tractor	8.67	28.65		1.46	
							100 hp tractor	8.04	22.11		1.18	
							spreader			1.32	1.32	
							Nitrogen	(0.26/lb)	60 lbs	15.6	15.60	
		Misc	1			0.0139						
23	6/4-6/10	Spray Pre-emergent Herb	1	10.2	0.10		120 hp tractor	8.67	28.65		1.83	24.78
							100 hp tractor	8.04	22.11		1.48	
							Sprayer		0.44	0.1	0.14	
							Herbicide			39.28	39.28	
		Plant Sunflowers	1	6.5	0.15		120 hp tractor	8.67	28.65		2.87	
							100 hp tractor	8.04	22.11		2.32	
							planter	-	4.86	1.91	2.66	
							seed (5 lb/ac)	(2.10/lb)		10.5	10.50	
		Misc	1			0.0139						
24		Misc	1			0.0139						
25		Misc	1			0.0139						61.08
26		Misc	1			0.0139						
27	7/2-7/8	Cultivate (maybe)	1	6.8	0.15		120 hp tractor	8.67	28.65		2.74	
							100 hp tractor	8.04	22.11		2.22	
							rowcrop Cult.	-	1.28	0.38	0.57	
		Misc	1			0.0139						
28		Misc	1			0.0139						5.53
29		Misc	1			0.0139						

Table A2-5 – Spring Cabbage/Sunflower Enterprise Budget Cont.

Wk	Date	Task	Acres	Acres/Hr	TaskTime/F	Task Time/O	Equip/Mater.	Cost/hr (operation)	Cost/hr (ownership)	Cost/ac (Operat)	Total Task Cost	Total Cost
30		Misc	1			0.0139						
31		Misc	1			0.0139						
32		Misc	1			0.0139						
33		Misc	1			0.0139						
34		Misc	1			0.0139						
35		Misc	1			0.0139						
36		Misc	1			0.0139						
37		Misc	1			0.0139						
38		Misc	1			0.0139						
39		Misc	1			0.0139						
40	10/1-10/7	Combine Sunflowers	1	8.7	0.11		combine	24.89	130.48		17.86	
							grain head		3.58	0.05	0.46	
							(yield: 15cwt/acre)					
							truck sunflowers			(.14/cwt)	2.1	
		Misc	1			0.4311						
												20.42
41		Misc	1			0.4311						
42		Misc	1			0.4311						
43		Misc	1			0.4311						
44		Misc	1			0.4311						
45		Misc	1			0.4311						
46		Misc	1			0.4311						

Table A2-5 – Spring Cabbage/Sunflower Enterprise Budget Cont.

Wk	Date	Task	Acres	Acres/Hr	TaskTime/F	Task Time/O	Equip/Mater.	Cost/hr (operation)	Cost/hr (ownership)	Cost/ac (Operat)	Total Task Cost	Total Cost
48		Misc	1			0.4311						
49		Misc	1			0.4311						
50		Misc	1			0.4311						
51		Misc	1			0.4311						
52		Misc	1			0.4311						
				Total Hours	43.90	10.34					**Total**	1764.50
							Fixed Costs					84.32
							Product Liability Insurance					500.00
							Hourly Wage (@15)					813.51
							Mist Blower					2000.00
										Total Expenses		5162.32
									Cabbage Income	(@0.17/lb)		8056.74
									Sunflower Income	(@10.30/cwt)		154.50
									Total Income			**8211.24**
										Net Income		**3048.92**

*** The machinery costs were averaged among the alternative tasks within the budget to account for flexibility in the operation as a whole.**

Appendix 3 – Agroforestry Integration

Table A3-1 – Windbreak Calculations

Potential Windbreak Area
2 rows cedar, 1 rows spec. crops on leeward (south) side
Each Red Cedar Tree Requires at least 36 to 64 sq. ft.
Each Woody Floral Shrub requires 49 sq. ft
Length = 5100 ft of the 5250 ft. length of the field
Width = 2 X 10 + 11 = 31 feet
Each Shelterbelt 31 ft X 5100 ft each or 158,100 sq. ft.
Total Area = 158,100 X 4 = 632,400 sq. ft.
632,400 sq ft./ (43,560 ft per acre) = 14.52 acres

Table A3-2 – Agroforestry Enterprise Budget

	Acres
WB	9.37
WF-SC	0.06
WF-GW	0.06
WF-BR	0.06

Year 1

Week	Date	Task	Acres	Acres/Hr	Task Time/F	Task Time/O	Equip/Mater.	Cost/hr (operation)	Cost/hr (ownership)	Cost/ac (Operat)	Total Cost	Tot. Field Labor/Wk	Tot. Cost/Wk
1 to 13	1/1-4/1	Misc WB	9.37			1.7520							
		Misc SC	0.06			0.0112							
		Misc GW	0.06			0.0112							
		Misc BR	0.06			0.0112							
												0	0.00
1 to 13	1/1-4/1	SC Marketing	0.06			1.5000							
		GW Marketing	0.06			1.5000							
		BR Marketing	0.06			1.5000							
												0	0.00
14 to 40	4/2-10/7	Misc WB	9.37			3.5140							
		Misc SC	0.06			0.0225							
		Misc GW	0.06			0.0225							
		Misc BR	0.06			0.0225							
												0	0.00
21	5/21-5/27	WB site prep	9.37	2.00	4.69		CRP help			3.73	34.91		
		WB plant & spray	9.37	custom			(plants included)			49.35	462.40		
		WF-SC site prep	0.06	2.00	0.03					37.26	2.24		
		WF-GW site prep	0.06	2.00	0.03					37.26	2.24		
		WF-BR site prep	0.06	2.00	0.03					37.26	2.24		
		WF-SC plant & spray	0.06	custom			plants & planting			4583.33	275.00		
		WF-GW plant & spray	0.06	custom			plants & planting			1883.33	113.00		
		WF-BR plant & spray	0.06	custom			plants & planting			1750.00	105.00		
												4.78	**997.02**
22	5/28-6/3	Set up Irrigation-SC	0.06	0.25	0.24		irrigation equip			192.00	11.52		
		Set up Irrigation-GW	0.06	0.25	0.24		irrigation equip			192.00	11.52		
		Set up Irrigation-BR	0.06	0.25	0.24		irrigation equip			192.00	11.52		
												0.72	**34.56**
23 to 38	6/4-9/23	Irrigate-SC	0.06	0.50	2.04								
		Irrigate-GW	0.06	0.50	2.04								
		Irrigate-BR	0.06	0.50	2.04								
												6.12	**0.00**

Table A3-2 – Agroforestry Enterprise Budget Cont.

Week	Date	Task	Acres	Acres/Hr	Task Time/F	Task Time/O	Equip/Mater.	Cost/hr (operation)	Cost/hr (ownership)	Cost/ac (Operat)	Total Cost	Tot. Field Labor/Wk	Tot. Cost/Wk
41 to 52	10/8-12/31	Misc WB	9.37			1.6200							
		Misc SC	0.06			0.0104							
		Misc GW	0.06			0.0104							
		Misc BR	0.06			0.0104							
												0	0.00
41 to 52	10/8-12/31	SC Marketing	0.06			1.5000							
		GW Marketing	0.06			1.5000							
		BR Marketing	0.06			1.5000							
												0	0.00
				Total hrs	11.62	16.02						Total	1031.58
												Hourly wage @ $15	414.50
												WB Maint. Costs	84.14
												Fixed Costs	805.26
												Total Expenses	2335.48
												Agroforestry Income WB CRP Payments (98.95/ac)	927.16
												Net Income	-1408.32

Year 2

Week	Date	Task	Acres	Acres/Hr	Task Time/F	Task Time/O	Equip/Mater.	Cost/hr (operation)	Cost/hr (ownership)	Cost/ac (Operat)	Total Cost	Tot. Field Labor/Wk	Tot. Cost/Wk
1 to 13	1/1-4/1	Misc WB	9.37			1.7520							
		Misc SC	0.06			0.0112							
		Misc GW	0.06			0.0112							
		Misc BR	0.06			0.0112						0	0.00

Table A3-2 – Agroforestry Enterprise Budget Cont.

Week	Date	Task	Acres	Acres/Hr	Task Time/F	Task Time/O	Equip/Mater.	Cost/hr (operation)	Cost/hr (ownership)	Cost/ac (Operat)	Total Cost	Tot. Field Labor/Wk	Tot. Cost/Wk
1 to 13	1/1-4/1	SC Marketing	0.06			1.5000							
		GW Marketing	0.06			1.5000							
		BR Marketing	0.06			1.5000							
												0	0.00
14 to 40	4/2-10/7	Misc WB	9.37			3.5140							
		Misc SC	0.06			0.0225							
		Misc GW	0.06			0.0225							
		Misc BR	0.06			0.0225							
												0	0.00
21	5/21-5/27	WB replant & spray	1.874	custom			(plants included)			49.35	92.48		
		WF-SC replant & spray	0.012	custom			plants + planting			4583.33	55.00		
		WF-GW replant & spray	0.012	custom			plants + planting			1883.33	22.60		
		WF-BR replant & spray	0.012	custom			plants + planting			1750.00	21.00		
												0.00	191.08
41 to 52	10/8-12/31	Misc WB	9.37			1.6200							
		Misc SC	0.06			0.0104							
		Misc GW	0.06			0.0104							
		Misc BR	0.06			0.0104							
												0	0.00
41 to 52	10/8-12/31	SC Marketing	0.06			1.5000							
		GW Marketing	0.06			1.5000							
		BR Marketing	0.06			1.5000							
												0	0.00
46	11/12-11/18	h,g,&d - SC	0.06	0.03	2.07	(1st harvest)							
		h,g,&d - GW	0.06	0.02	2.52	(1st harvest)							
		h,g,&d - BR	0.06			(1st harvest)							
												4.5900	0.00
47	11/19-11/25	c,g,&d - SC	0.06	0.08	0.77	(1st harvest)							
		c,g,&d - GW	0.06			(1st harvest)							
		c,g,&d - BR	0.06	0.06	1.05	(1st harvest)							
												1.8200	0.00
48	11/26-12/2	g,c,&b - SC	0.06	0.02	3.36	(1st harvest)							
		g,c,&b - GW	0.06	0.01	4.13	(1st harvest)							
		g,c,&b - BR	0.06	0.05	1.12	(1st harvest)							
												8.6100	0.00

Table A3-2 – Agroforestry Enterprise Budget Cont.

Week	Date	Task	Acres	Acres/Hr	Task Time/F	Task Time/O	Equip/Mater.	Cost/hr (operation)	Cost/hr (ownership)	Cost/ac (Operat)	Total Cost	Tot. Field Labor/Wk	Tot. Cost/Wk
50	12/10-12/16	c,g,&d - SC	0.06	0.12	0.52	(1st harvest)							
		c,g,&d - GW	0.06	0.08	0.73	(1st harvest)							
		c,g,&d - BR	0.06	0.26	0.23	(1st harvest)							
												1.4800	0.00
51	12/17-12/23	g & b - SC	0.06	0.04	1.54	(1st harvest)							
		g & b - GW	0.06			(1st harvest)							
		g & b - BR	0.06			(1st harvest)							
												1.5400	0.00
				Total hrs	18.04	16.02						Total	191.08
												Hourly wage @ $15	510.87
												WB Maint. Costs	84.14
												Fixed Costs	805.26
												Total Expenses	1591.36
												Agroforestry Income	
												WB CRP Payments (98.95/ac)	927.16
												WF (117.55/wk x 5)	587.75
												Total Income	1514.91
												Net Income	-76.44

Table A3-2 – Agroforestry Enterprise Budget Cont.

Year 3

Week	Date	Task	Acres	Acres/Hr	Task Time/F	Task Time/O	Equip/Mater.	Cost/hr (operation)	Cost/hr (ownership)	Cost/ac (Operat)	Total Cost	Tot. Field Labor/Wk	Tot. Cost/Wk
1 to 13	1/1-4/1	Misc WB	9.37			1.7520							
		Misc SC	0.06			0.0112							
		Misc GW	0.06			0.0112							
		Misc BR	0.06			0.0112							
												0.0000	0.00
1 to 13	1/1-4/1	SC Marketing	0.06			2.5000							
		GW Marketing	0.06			2.5000							
		BR Marketing	0.06			2.5000							
												0.0000	0.00
2	1/8-1/14	g,b,&d - SC	0.06	0.04	1.54	(1st harvest)							
		g,b,&d - SC	0.06	0.29	0.21	(1st harvest)							
		g,b,&d - SC	0.06	0.17	0.35	(1st harvest)							
												2.1000	0.00
3	1/15-1/21	h, rfl - SC	0.06	2.00	0.03	(1st harvest)							
		h, rfl - SC	0.06	1.50	0.04	(1st harvest)							
		h, rfl - SC	0.06	0.19	0.31	(1st harvest)							
												0.3800	0.00
4	1/22-1/28	g -sc	0.06	0.21	0.28	(1st harvest)							
		g -sc	0.06			(1st harvest)							
		g -sc	0.06			(1st harvest)							
												0.2800	0.00
5	1/29-2/4	h & g - SC	0.06	0.05	1.14	(1st harvest)							
		h & g - SC	0.06			(1st harvest)							
		h & g - SC	0.06			(1st harvest)							
												1.1400	0.00
6	2/5-2/11	g,b,&d -SC	0.06	0.03	2.03	(1st harvest)							
		g,b,&d -SC	0.06	0.17	0.35	(1st harvest)							
		g,b,&d -SC	0.06	0.17	0.35	(1st harvest)							
												2.7300	0.00
8	2/19-2/25	h - SC	0.06			(1st harvest)							
		h - SC	0.06	0.43	0.14	(1st harvest)							
		h - SC	0.06	0.38	0.16	(1st harvest)							
												0.3000	0.00

Table A3-2 – Agroforestry Enterprise Budget Cont.

Week	Date	Task	Acres	Acres/Hr	Task Time/F	Task Time/O	Equip/Mater.	Cost/hr (operation)	Cost/hr (ownership)	Cost/ac (Operat)	Total Cost	Tot. Field Labor/Wk	Tot. Cost/Wk
9	2/26-3/4	g & b - SC	0.06			(1st harvest)							
		g & b - SC	0.06			(1st harvest)							
		g & b - SC	0.06	0.43	0.14	(1st harvest)							
												0.1400	0.00
11	3/12-3/18	g - SC	0.06	0.43	0.14	(1st harvest)							
		g - SC	0.06			(1st harvest)							
		g - SC	0.06	0.21	0.28	(1st harvest)							
												0.4200	0.00
14 to 40	4/2-10/7	Misc WB	9.37			3.5140							
		Misc SC	0.06			0.0225							
		Misc GW	0.06			0.0225							
		Misc BR	0.06			0.0225							
												0.0000	0.00
41 to 52	10/8-12/31	Misc WB	9.37			1.6200							
		Misc SC	0.06			0.0104							
		Misc GW	0.06			0.0104							
		Misc BR	0.06			0.0104							
												0.0000	0.00
41 to 52	10/8-12/31	SC Marketing	0.06			2.5000							
		GW Marketing	0.06			2.5000							
		BR Marketing	0.06			2.5000							
												0.0000	0.00
46	11/12-11/18	h,g,&d - SC	0.06	0.01	4.93	(2nd harvest)							
		h,g,&d - GW	0.06	0.01	6.00	(2nd harvest)							
		h,g,&d - BR	0.06			(2nd harvest)							
												10.9300	0.00
47	11/19-11/25	c,g,&d - SC	0.06	0.03	1.83	(2nd harvest)							
		c,g,&d - GW	0.06			(2nd harvest)							
		c,g,&d - BR	0.06	0.02	2.50	(2nd harvest)							
												4.3300	0.00
48	11/26-12/2	g,c,&b - SC	0.06	0.01	8.00	(2nd harvest)							
		g,c,&b - GW	0.06	0.01	9.84	(2nd harvest)							
		g,c,&b - BR	0.06	0.02	2.67	(2nd harvest)							
												20.5100	0.00
50	12/10-12/16	c,g,&d - SC	0.06	0.05	1.23	(2nd harvest)							
		c,g,&d - GW	0.06	0.03	1.73	(2nd harvest)							
		c,g,&d - BR	0.06	0.11	0.56	(2nd harvest)							
												294.9333	0.00

Table A3-2 – Agroforestry Enterprise Budget Cont.

Week	Date	Task	Acres	Acres/Hr	Task Time/F	Task Time/O	Equip/Mater.	Cost/hr (operation)	Cost/hr (ownership)	Cost/ac (Operat)	Total Cost	Tot. Field Labor/Wk	Tot. Cost/Wk
51	12/17-12/23	g & b - SC	0.06	0.02	3.17	(2nd harvest)							
		g & b - GW	0.06			(2nd harvest)							
		g & b - BR	0.06			(2nd harvest)							
												3.1700	0.00
				Total hrs	49.95	22.02						Total	0.00
												Hourly wage @ $15	1079.52
												WB Maint. Costs	84.14
												Fixed Costs	805.26
												Total Expenses	1968.92
												Agroforestry Income	
												WB CRP Payments (98.95/ac)	927.16
												WF (117.55/wk x 8)	940.40
												WF (275.19 X 5)	1375.95
												Total Income	3243.51
												Net Income	1274.59

Year 4

Week	Date	Task	Acres	Acres/Hr	Task Time/F	Task Time/O	Equip/Mater.	Cost/hr (operation)	Cost/hr (ownership)	Cost/ac (Operat)	Total Cost	Tot. Field Labor/Wk	Tot. Cost/Wk
1 to 13	1/1-4/1	Misc WB	9.37			1.7520							
		Misc SC	0.06			0.0112							
		Misc GW	0.06			0.0112							
		Misc BR	0.06			0.0112							
												0.0000	0.00

Table A3-2 – Agroforestry Enterprise Budget Cont.

Week	Date	Task	Acres	Acres/Hr	Task Time/F	Task Time/O	Equip/Mater.	Cost/hr (operation)	Cost/hr (ownership)	Cost/ac (Operat)	Total Cost	Tot. Field Labor/Wk	Tot. Cost/Wk
1 to 13	1/1-4/1	SC Marketing	0.06			2.5000							
		GW Marketing	0.06			2.5000							
		BR Marketing	0.06			2.5000							
												0.0000	**0.00**
2	1/8-1/14	g,b,&d - SC	0.06	0.02	3.67	(2nd harvest)							
		g,b,&d - SC	0.06	0.12	0.50	(2nd harvest)							
		g,b,&d - SC	0.06	0.07	0.83	(2nd harvest)							
												5.0000	**0.00**
3	1/15-1/21	h, rfl - SC	0.06	0.86	0.07	(2nd harvest)							
		h, rfl - SC	0.06	0.60	0.10	(2nd harvest)							
		h, rfl - SC	0.06	0.08	0.74	(2nd harvest)							
												0.9100	**0.00**
4	1/22-1/28	g -sc	0.06	0.09	0.67	(2nd harvest)							
		g -sc	0.06			(2nd harvest)							
		g -sc	0.06			(2nd harvest)							
												0.6700	**0.00**
5	1/29-2/4	h & g - SC	0.06	0.02	2.72	(2nd harvest)							
		h & g - SC	0.06			(2nd harvest)							
		h & g - SC	0.06			(2nd harvest)							
												2.7200	**0.00**
6	2/5-2/11	g,b,&d -SC	0.06	0.01	4.83	(2nd harvest)							
		g,b,&d -SC	0.06	0.07	0.83	(2nd harvest)							
		g,b,&d -SC	0.06	0.07	0.83	(2nd harvest)							
												6.4900	**0.00**
8	2/19-2/25	h - SC	0.06			(2nd harvest)							
		h - SC	0.06	0.18	0.33	(2nd harvest)							
		h - SC	0.06	0.15	0.39	(2nd harvest)							
												0.7200	**0.00**
9	2/26-3/4	g & b - SC	0.06			(2nd harvest)							
		g & b - SC	0.06			(2nd harvest)							
		g & b - SC	0.06	0.18	0.34	(2nd harvest)							
												0.3400	**0.00**
11	3/12-3/18	g - SC	0.06	0.18	0.33	(2nd harvest)							
		g - SC	0.06			(2nd harvest)							
		g - SC	0.06	0.09	0.67	(2nd harvest)							
												1.0033	**0.00**
14 to 40	4/2-10/7	Misc WB	9.37			3.5140							
		Misc SC	0.06			0.0225							
		Misc GW	0.06			0.0225							
		Misc BR	0.06			0.0225							
												0.0000	**0.00**

Table A3-2 – Agroforestry Enterprise Budget Cont.

Week	Date	Task	Acres	Acres/Hr	Task Time/F	Task Time/O	Equip/Mater.	Cost/hr (operation)	Cost/hr (ownership)	Cost/ac (Operat)	Total Cost	Tot. Field Labor/Wk	Tot. Cost/Wk
41 to 52	10/8-12/31	Misc WB	9.37			1.6200							
		Misc SC	0.06			0.0104							
		Misc GW	0.06			0.0104							
		Misc BR	0.06			0.0104							
												0.0000	0.00
41 to 52	10/8-12/31	SC Marketing	0.06			2.5000							
		GW Marketing	0.06			2.5000							
		BR Marketing	0.06			2.5000							
												0.0000	0.00
46	11/12-11/18	h,g,&d - SC	0.06	0.01	4.93	(3rd harvest)							
		h,g,&d - GW	0.06	0.01	6.00	(3rd harvest)							
		h,g,&d - BR	0.06			(3rd harvest)							
												10.9300	0.00
47	11/19-11/25	c,g,&d - SC	0.06	0.03	1.83	(3rd harvest)							
		c,g,&d - GW	0.06			(3rd harvest)							
		c,g,&d - BR	0.06	0.02	2.50	(3rd harvest)							
												4.3300	0.00
48	11/26-12/2	g,c,&b - SC	0.06	0.01	8.00	(3rd harvest)							
		g,c,&b - GW	0.06	0.01	9.84	(3rd harvest)							
		g,c,&b - BR	0.06	0.02	2.67	(3rd harvest)							
												20.5100	0.00
50	12/10-12/16	c,g,&d - SC	0.06	0.05	1.23	(3rd harvest)							
		c,g,&d - GW	0.06	0.03	1.73	(3rd harvest)							
		c,g,&d - BR	0.06	0.11	0.56	(3rd harvest)							
												3.5200	0.00
51	12/17-12/23	g & b - SC	0.06	0.02	3.17	(3rd harvest)							
		g & b - GW	0.06			(3rd harvest)							
		g & b - BR	0.06			(3rd harvest)							
												3.1700	0.00
		(prob a % here - for WB)		**Total hrs**	60.31	22.02						**Total**	0.00
												Hourly wage @ $15	1234.97
												WB Maint. Costs	84.14
												Fixed Costs	***805.26***

Table A3-2 – Agroforestry Enterprise Budget Cont.

Week	Date	Task	Acres	Acres/Hr	Task Time/F	Task Time/O	Equip/Mater.	Cost/hr (operation)	Cost/hr (ownership)	Cost/ac (Operat)	Total Cost	Tot. Field Labor/Wk	Tot. Cost/Wk
												Total Expenses	2124.37
												Agroforestry Income	
												WB CRP Payments (98.95/ac)	927.16
												WF (275.19 X 13)	3577.47
												Total Income	4504.63
												Net Income	2380.26

Year 5

Week	Date	Task	Acres	Acres/Hr	Task Time/F	Task Time/O	Equip/Mater.	Cost/hr (operation)	Cost/hr (ownership)	Cost/ac (Operat)	Total Cost	Tot. Field Labor/Wk	Tot. Cost/Wk
1 to 13	1/1-4/1	Misc WB	9.37			1.7520							
		Misc SC	0.06			0.0112							
		Misc GW	0.06			0.0112							
		Misc BR	0.06			0.0112							
												0.0000	0.00
1 to 13	1/1-4/1	SC Marketing	0.06			2.5000							
		GW Marketing	0.06			2.5000							
		BR Marketing	0.06			2.5000							
												0.0000	0.00
2	1/8-1/14	g,b,&d - SC	0.06	0.02	3.67	(3rd harvest)							
		g,b,&d - SC	0.06	0.12	0.50	(3rd harvest)							
		g,b,&d - SC	0.06	0.07	0.83	(3rd harvest)							
												5.0000	0.00
3	1/15-1/21	h, rfl - SC	0.06	0.86	0.07	(3rd harvest)							
		h, rfl - SC	0.06	0.60	0.10	(3rd harvest)							
		h, rfl - SC	0.06	0.08	0.74	(3rd harvest)							
												0.9100	0.00
4	1/22-1/28	g -sc	0.06	0.09	0.67	(3rd harvest)							
		g -sc	0.06			(3rd harvest)							
		g -sc	0.06			(3rd harvest)							
												0.6700	0.00

Table A3-2 – Agroforestry Enterprise Budget Cont.

Week	Date	Task	Acres	Acres/Hr	Task Time/F	Task Time/O	Equip/Mater.	Cost/hr (operation)	Cost/hr (ownership)	Cost/ac (Operat)	Total Cost	Tot. Field Labor/Wk	Tot. Cost/Wk
5	1/29-2/4	h & g - SC	0.06	0.02	2.72	(3rd harvest)							
		h & g - SC	0.06			(3rd harvest)							
		h & g - SC	0.06			(3rd harvest)							
												2.7200	**0.00**
6	2/5-2/11	g,b,&d -SC	0.06	0.01	4.83	(3rd harvest)							
		g,b,&d -SC	0.06	0.07	0.83	(3rd harvest)							
		g,b,&d -SC	0.06	0.07	0.83	(3rd harvest)							
												6.4900	**0.00**
8	2/19-2/25	h - SC	0.06			(3rd harvest)							
		h - SC	0.06	0.18	0.33	(3rd harvest)							
		h - SC	0.06	0.15	0.39	(3rd harvest)							
												0.7200	**0.00**
9	2/26-3/4	g & b - SC	0.06			(3rd harvest)							
		g & b - SC	0.06			(3rd harvest)							
		g & b - SC	0.06	0.18	0.34	(3rd harvest)							
												0.3400	**0.00**
11	3/12-3/18	g - SC	0.06	0.18	0.33	(3rd harvest)							
		g - SC	0.06			(3rd harvest)							
		g - SC	0.06	0.09	0.67	(3rd harvest)							
												1.0033	**0.00**
14 to 40	4/2-10/7	Misc WB	9.37			3.5140							
		Misc SC	0.06			0.0225							
		Misc GW	0.06			0.0225							
		Misc BR	0.06			0.0225							
												0.0000	**0.00**
41 to 52	10/8-12/31	Misc WB	9.37			1.6200							
		Misc SC	0.06			0.0104							
		Misc GW	0.06			0.0104							
		Misc BR	0.06			0.0104							
												0.0000	**0.00**
41 to 52	10/8-12/31	SC Marketing	0.06			2.5000							
		GW Marketing	0.06			2.5000							
		BR Marketing	0.06			2.5000							
												0.0000	**0.00**
46	11/12-11/18	h,g,&d - SC	0.06	0.01	4.93	(4th harvest)							
		h,g,&d - GW	0.06	0.01	6.00	(4th harvest)							
		h,g,&d - BR	0.06			(4th harvest)							
												10.9300	***0.00***

Table A3-2 – Agroforestry Enterprise Budget Cont.

Week	Date	Task	Acres	Acres/Hr	Task Time/F	Task Time/O	Equip/Mater.	Cost/hr (operation)	Cost/hr (ownership)	Cost/ac (Operat)	Total Cost	Tot. Field Labor/Wk	Tot. Cost/Wk
47	11/19-11/25	c,g,&d - SC	0.06	0.03	1.83	(4th harvest)							
		c,g,&d - GW	0.06			(4th harvest)							
		c,g,&d - BR	0.06	0.02	2.50	(4th harvest)							
												4.3300	0.00
48	11/26-12/2	g,c,&b - SC	0.06	0.01	8.00	(4th harvest)							
		g,c,&b - GW	0.06	0.01	9.84	(4th harvest)							
		g,c,&b - BR	0.06	0.02	2.67	(4th harvest)							
												20.5100	0.00
50	12/10-12/16	c,g,&d - SC	0.06	0.05	1.23	(4th harvest)							
		c,g,&d - GW	0.06	0.03	1.73	(4th harvest)							
		c,g,&d - BR	0.06	0.11	0.56	(4th harvest)							
												3.5200	0.00
51	12/17-12/23	g & b - SC	0.06	0.02	3.17	(4th harvest)							
		g & b - GW	0.06			(4th harvest)							
		g & b - BR	0.06			(4th harvest)							
												3.1700	0.00
				Total hrs	60.31	22.02						**Total**	0.00
												Hourly wage @ $15	1234.97
												WB Maint. Costs	84.14
												Fixed Costs	805.26
												Total Expenses	2124.37
												Agroforestry Income	
												WB CRP Payments (98.95/ac)	927.16
												WF (275.19 X 13)	3577.47
												Total Income	4504.63
												Net Income	2380.26
												5 year income	6141.70

*** The machinery costs were averaged among the alternative tasks within the budget to account for flexibility in the operation as a whole.**

Appendix 4 – Linear Programming Matrix

Table A4-1 – Days Suitable for Fieldwork in Eastern Nebraska

Week	Dates	2001	2000	1999	1998	1997	1996	1995	1994	1993	1992	1991	Average
1	Jan 1-7	-	-	-	-	-	-	-	-	-	-	-	0.00
2	Jan 8-14	-	-	-	-	-	-	-	-	-	-	-	0.00
3	Jan 15-21	-	-	-	-	-	-	-	-	-	-	-	0.00
4	Jan 22-28	-	-	-	-	-	-	-	-	-	-	-	0.00
5	Jan 29-4	-	-	-	-	-	-	-	-	-	-	-	0.00
6	Feb 5-1	-	-	-	-	-	-	-	-	-	-	-	0.00
7	Feb 12-18	-	-	-	-	-	-	-	-	-	-	-	0.00
8	Feb 19-25	-	-	-	-	-	-	-	-	-	-	-	0.00
9	Feb 26-4	-	-	-	-	-	-	-	-	-	-	-	0.00
10	Mar 5-11	-	-	-	-	-	-	-	-	-	-	-	0.00
11	Mar 12-18	-	-	-	-	-	-	-	-	-	-	-	0.00
12	Mar 19-25	-	-	-	-	-	-	-	-	-	-	-	0.00
13	Mar 26-1	-	-	-	0.2	5.9	2.0	-	-	-	4.6	3.0	3.14
14	Apr 2-8	0.2	6.7	6.2	0.5	4.4	3.2	0.4	6.2	0.4	2.1	4.6	3.17
15	Apr 9-15	1.9	6.6	1.5	0.1	1.8	6.4	4.6	7.0	0.4	4.4	3.6	3.48
16	Apr 16-22	5.4	6.3	1.9	1.8	1.6	3.7	1.0	2.7	0.2	5.5	1.1	2.84
17	Apr 23-29	5.6	5.3	2.8	6.0	2.3	5.9	1.3	6.0	1.0	1.3	5.1	3.87
18	Apr 30-6	2.9	5.8	2.2	4.6	3.6	2.6	2.2	4.6	4.8	4.6	3.7	3.78
19	Mau 7-13	3.9	6.5	2.0	6.7	5.6	2.4	1.3	3.9	3.7	7.0	-	4.30
20	May 14-20	6.0	6.3	4.1	5.7	6.7	0.9	1.0	6.4	1.0	6.2	-	4.43
21	May 21-27	3.9	6.0	2.3	3.0	6.9	3.9	4.9	6.1	5.2	2.2	3.8	4.38
22	May 28-3	2.7	5.7	5.4	4.3	0.6	0.6	3.2	6.8	5.1	4.1	3.1	3.78
23	Jun4-10	3.7	6.0	2.4	3.7	6.3	3.5	2.0	4.3	2.7	3.6	2.2	3.67
24	Jun 11-17	4.7	7.0	3.7	0.4	6.8	6.1	2.4	3.4	4.8	3.9	4.1	4.30
25	Jun 18-24	5.5	6.2	3.4	1.9	6.6	5.2	6.3	6.6	3.0	3.6	5.2	4.86
26	Jun 25-1	6.6	5.6	3.8	4.5	2.3	4.4	6.9	2.9	2.6	6.4	5.9	4.72
27	Jul 2-8	6.2	5.6	1.7	6.2	3.7	5.8	6.7	6.7	2.4	5.0	6.4	5.13
28	Jul 9-15	6.6	4.2	5.8	3.4	4.4	6.6	5.8	0.8	1.1	1.8	4.1	4.05
29	Jul 16-22	5.8	6.8	6.3	6.8	6.5	6.3	7.0	3.4	1.3	2.5	6.9	5.42
30	Jul 23-29	6.4	4.9	6.7	4.0	6.8	4.8	6.9	5.4	0.5	2.5	6.7	5.05
31	Jul 30-5	7.0	5.8	6.9	5.6	6.2	6.1	6.2	5.5	2.0	2.0	6.7	5.45
32	Aug 6-12	7.0	6.5	6.0	4.4	6.4	2.9	5.5	4.1	6.0	2.1	4.6	5.05
33	Aug 13-19	5.5	7.0	4.3	6.6	2.5	5.3	6.8	4.8	6.3	3.6	6.4	5.37
34	Aug 20-26	6.3	6.6	5.6	6.0	5.3	3.7	6.5	6.9	5.3	5.9	6.7	5.89
35	Aug 27-2	6.1	6.2	7.0	4.5	6.2	5.8	5.4	6.3	6.6	3.9	6.8	5.89
36	Sep 3-9	5.3	6.6	6.2	7.0	4.0	6.6	6.2	6.2	2.0	5.5	6.9	5.68
37	Sep 10-16	5.0	6.9	6.3	7.0	5.2	6.3	6.6	5.0	5.7	3.7	5.2	5.72
38	Sep 17-23	3.9	7.0	6.9	7.0	6.6	4.5	6.5	7.0	6.3	4.3	6.7	6.06
39	Sep 24-30	6.4	6.2	6.3	5.9	1.7	3.2	3.3	4.8	2.0	6.9	6.9	4.87
40	Oct 1-7	5.9	6.2	6.5	6.0	6.6	6.4	6.3	4.2	5.7	6.9	6.3	6.09
41	Oct 8-14	4.8	5.4	7.0	3.8	7.0	6.9	4.4	2.7	6.0	4.0	6.9	5.35
42	Oct 15-21	6.7	7.0	7.0	5.9	4.2	7.0	5.9	6.7	3.3	-	6.9	6.06
43	Oct 22-28	6.1	6.8	7.0	6.5	6.3	6.7	7.0	2.9	-	-	6.7	6.22
44	Oct 29-4	7.0	5.0	7.0	5.0	0.8	6.4	6.5	6.9	-	-	4.1	5.41
45	Nov 5-11	7.0	3.4	7.0	2.0	5.2	6.8	3.6	6.3	-	-	0	4.59
46	Nov 12-18	7.0	1.8	7.0	1.4	6.1	4.7	6.0	6.7	-	-	0.4	4.57
47	Nov 19-25	-	-	6.0	5.6	6.9	1.1	4.8	6.6	3.9	-	0.7	4.45
48	Nov 26-2	-	-	4.7	6.9	6.8	-	6.7	-	3.6	-	0.1	4.80
49	Dec 3-9	-	-	-	-	-	-	-	-	-	-	-	0.00
50	Dec 10-16	-	-	-	-	-	-	-	-	-	-	-	0.00
51	Dec 17-23	-	-	-	-	-	-	-	-	-	-	-	0.00
52	Dec 24-30	-	-	-	-	-	-	-	-	-	-	-	0.00

Table A4-2 – Daylight Hours on an Eastern Nebraska Farm

	JAN				FEB				MAR				APR			
Day	Rise	Set	Daylight Hours	Week Average	Rise	Set	Daylight Hours	Week Average	Rise	Set	Daylight Hours	Week Average	Rise	Set	Daylight Hours	Week Average
1	752	1708	9.16		737	1743	10.06		700	1817	11.17		609	1851	12.42	**12.34**
2	752	1709	9.17		736	1744	10.08		659	1818	11.19		607	1852	12.45	
3	752	1710	9.18		735	1745	10.10		657	1819	11.22		606	1853	12.47	
4	752	1711	9.19		734	1747	10.13	**10.00**	655	1820	11.25	**11.17**	604	1854	12.50	
5	752	1712	9.20		733	1748	10.15		654	1822	11.28		602	1856	12.54	
6	752	1713	9.21		732	1749	10.17		652	1823	11.31		601	1857	12.56	
7	752	1714	9.22	**9.19**	730	1750	10.20		651	1824	11.33		559	1858	12.59	
8	751	1715	9.24		729	1752	10.23		649	1825	11.36		557	1859	13.02	**12.59**
9	751	1716	9.25		728	1753	10.25		647	1826	11.39		556	1900	13.04	
10	751	1717	9.26		727	1754	10.27		646	1827	11.41		554	1901	13.07	
11	751	1718	9.27		726	1755	10.29	**10.22**	644	1828	11.44	**11.36**	553	1902	13.09	
12	750	1719	9.29		724	1757	10.33		642	1830	11.48		551	1903	13.12	
13	750	1720	9.30		723	1758	10.35		641	1831	11.50		549	1904	13.15	
14	750	1721	9.31	**9.27**	722	1759	10.37		639	1832	11.53		548	1905	13.17	
15	749	1722	9.33		720	1800	10.40		637	1833	11.56		546	1906	13.20	**13.12**
16	749	1723	9.34		719	1802	10.43		636	1834	11.58		545	1907	13.22	
17	748	1724	9.36		718	1803	10.45		634	1835	12.01		543	1908	13.25	
18	748	1726	9.38		716	1804	10.48	**10.40**	632	1836	12.04	**11.67**	542	1909	13.27	
19	747	1727	9.40		715	1805	10.50		631	1837	12.06		540	1910	13.30	
20	747	1728	9.41		713	1806	10.53		629	1838	12.09		539	1912	13.33	
21	746	1729	9.43	**9.38**	712	1808	10.56		627	1839	12.12		537	1913	13.36	
22	745	1730	9.45		711	1809	10.58		626	1840	12.14		536	1914	13.38	**13.30**
23	745	1732	9.47		709	1810	11.01		624	1842	12.18		534	1915	13.41	
24	744	1733	9.49		708	1811	11.03		622	1843	12.21		533	1916	13.43	
25	743	1734	9.51		706	1812	11.06	**10.75**	621	1844	12.23	**12.15**	531	1917	13.46	
26	742	1735	9.53		705	1814	11.09		619	1845	12.26		530	1918	13.48	
27	741	1737	9.56		703	1815	11.12		617	1846	12.29		529	1919	13.50	
28	741	1738	9.57	**9.51**	702	1816	11.14		616	1847	12.31		527	1920	13.53	
29	740	1739	9.59						614	1848	12.34		526	1921	13.55	**13.48**
30	739	1740	10.01						612	1849	12.37		525	1922	13.57	
31	738	1742	10.04						611	1850	12.39					

Table A4-2 – Daylight Hours on an Eastern Nebraska Farm Cont.

	MAY				JUN				JUL				AUG			
Day	Rise	Set	Daylight Hours	Week Average	Rise	Set	Daylight Hours	Week Average	Rise	Set	Daylight Hours	Week Average	Rise	Set	Daylight Hours	Week Average
1	523	1923	14.00		455	1953	14.58		457	2003	15.06	**15.07**	522	1942	14.20	
2	522	1924	14.02		455	1953	14.58		457	2002	15.05		522	1941	14.19	
3	521	1925	14.04		455	1954	14.59	**14.56**	458	2002	15.04		523	1940	14.17	
4	520	1927	14.07		454	1955	15.01		459	2002	15.03		524	1939	14.15	
5	518	1928	14.10		454	1955	15.01		459	2002	15.03		525	1938	14.13	**14.19**
6	517	1929	14.12	**13.99**	454	1956	15.02		500	2001	15.01		526	1936	14.10	
7	516	1930	14.14		453	1957	15.04		500	2001	15.01		527	1935	14.08	
8	515	1931	14.16		453	1957	15.04		501	2001	15.00	**15.02**	528	1934	14.06	
9	514	1932	14.18		453	1958	15.05		502	2000	14.58		529	1933	14.04	
10	513	1933	14.20		453	1958	15.05	**15.03**	502	2000	14.58		530	1931	14.01	
11	511	1934	14.23		453	1959	15.06		503	1959	14.56		531	1930	13.59	
12	510	1935	14.25		453	1959	15.06		504	1959	14.55		532	1929	13.57	**13.92**
13	509	1936	14.27	**14.20**	452	2000	15.08		505	1958	14.53		533	1927	13.54	
14	508	1937	14.29		452	2000	15.08		505	1958	14.53		534	1926	13.52	
15	507	1938	14.31		452	2001	15.09		506	1957	14.51	**14.55**	535	1925	13.50	
16	506	1939	14.33		452	2001	15.09		507	1957	14.50		536	1923	13.47	
17	505	1940	14.35		453	2001	15.08	**15.08**	508	1956	14.48		538	1922	13.44	
18	505	1941	14.36		453	2002	15.09		509	1955	14.46		539	1920	13.41	
19	504	1942	14.38		453	2002	15.09		510	1955	14.45		540	1919	13.39	**13.47**
20	503	1943	14.40	**14.35**	453	2002	15.09		510	1954	14.44		541	1917	13.36	
21	502	1944	14.42		453	2002	15.09		511	1953	14.42		542	1916	13.34	
22	501	1944	14.43		453	2003	15.10		512	1952	14.40	**14.45**	543	1914	13.31	
23	501	1945	14.44		454	2003	15.09		513	1951	14.38		544	1913	13.29	
24	500	1946	14.46		454	2003	15.09	**15.09**	514	1950	14.36		545	1911	13.26	
25	459	1947	14.48		454	2003	15.09		515	1950	14.35		546	1910	13.24	
26	459	1948	14.49		455	2003	15.08		516	1949	14.33		547	1908	13.21	**13.29**
27	458	1949	14.51	**14.46**	455	2003	15.08		517	1948	14.31		548	1906	13.18	
28	457	1950	14.53		456	2003	15.07		518	1947	14.29		549	1905	13.16	
29	457	1950	14.53		456	2003	15.07		519	1946	14.27	**14.33**	550	1903	13.13	
30	456	1951	14.55		456	2003	15.07		520	1945	14.25		551	1902	13.11	
31	456	1952	14.56						521	1943	14.22		552	1900	13.08	

Table A4-2 – Daylight Hours on an Eastern Nebraska Farm Cont.

	SEP				OCT				NOV				DEC			
Day	Rise	Set	Daylight Hours	Week Average	Rise	Set	Daylight Hours	Week Average	Rise	Set	Daylight Hours	Week Average	Rise	Set	Daylight Hours	Week Average
1	553	1858	13.05		623	1808	11.45		657	1721	10.24		732	1658	9.26	
2	554	1857	13.03	**13.11**	624	1806	11.42		659	1720	10.21		733	1657	9.24	**9.28**
3	555	1855	13.00		625	1804	11.39		700	1719	10.19		734	1657	9.23	
4	556	1853	12.57		626	1803	11.37		701	1718	10.17	**10.24**	735	1657	9.22	
5	557	1852	12.55		627	1801	11.34		702	1716	10.14		736	1657	9.21	
6	558	1850	12.52		628	1759	11.31		703	1715	10.12		737	1657	9.20	
7	559	1848	12.49		629	1758	11.29	**11.37**	705	1714	10.19		738	1657	9.19	
8	600	1847	12.47		630	1756	11.26		706	1713	10.07		739	1657	9.18	
9	601	1845	12.44	**12.58**	631	1754	11.23		707	1712	10.05		740	1657	9.17	**9.20**
10	602	1843	12.41		632	1753	11.21		708	1711	10.03		741	1657	9.16	
11	603	1842	12.39		633	1751	11.18		709	1710	10.01	**10.09**	742	1657	9.15	
12	604	1840	12.36		635	1750	11.15		711	1709	9.58		742	1657	9.15	
13	605	1838	12.33		636	1748	11.12		712	1708	9.56		743	1657	9.14	
14	606	1837	12.31		637	1746	11.09	**11.18**	713	1707	9.54		744	1658	9.14	
15	607	1835	12.28		638	1745	11.07		714	1707	9.53		745	1658	9.13	
16	608	1833	12.25	**12.33**	639	1743	11.04		715	1706	9.51		745	1658	9.13	**9.14**
17	609	1831	12.22		640	1742	11.02		717	1705	9.48		746	1659	9.13	
18	610	1830	12.20		641	1740	10.59		718	1704	9.46	**9.52**	747	1659	9.12	
19	611	1828	12.17		642	1739	10.57		719	1704	9.45		747	1659	9.12	
20	612	1826	12.14		644	1737	10.53		720	1703	9.43		748	1700	9.12	
21	613	1825	12.12		645	1736	10.51	**10.76**	721	1702	9.41		748	1700	9.12	
22	614	1823	12.09		646	1734	10.48		722	1702	9.40		749	1701	9.12	
23	615	1821	12.06	**12.14**	647	1733	10.46		724	1701	9.37		749	1701	9.12	**9.12**
24	616	1819	12.03		648	1732	10.44		725	1700	9.35		750	1702	9.12	
25	617	1818	12.01		649	1730	10.41		726	1700	9.34	**9.39**	750	1703	9.13	
26	618	1816	11.58		650	1729	10.39		727	1659	9.32		750	1703	9.13	
27	619	1814	11.55		652	1728	10.36		728	1659	9.31		751	1704	9.13	
28	620	1813	11.53		653	1726	10.33	**10.41**	729	1659	9.30		751	1705	9.14	
29	621	1811	11.50		654	1725	10.31		730	1658	9.28		751	1705	9.14	
30	622	1809	11.47	**11.67**	655	1724	10.29		731	1658	9.27		751	1706	9.15	
31					656	1722	10.26						752	1707	9.15	**9.14**

Table A4-3 – Labor Availability for a typical Eastern Nebraska Farm

Week	Dates	Average Field Days	Other' Days Available	Daylight Hours	Total Field Availability	Total 'Other" Availability	Total Bi-wkly Field Avail.	Total Bi-wkly Other' Avail.
1	Jan 1-7	0	6	9.19	0.00	55.14		
2	Jan 8-14	0	6	9.27	0.00	55.62	0.00	110.76
3	Jan 15-21	0	6	9.38	0.00	56.28		
4	Jan 22-28	0	6	9.51	0.00	57.06	0.00	113.34
5	Jan 29-4	0	6	10	0.00	60.00		
6	Feb 5-1	0	6	10.22	0.00	61.32	0.00	121.32
7	Feb 12-18	0	6	10.4	0.00	62.40		
8	Feb 19-25	0	6	10.75	0.00	64.50	0.00	126.90
9	Feb 26-4	0	6	11.17	0.00	67.02		
10	Mar 5-11	0	6	11.36	0.00	68.16	0.00	135.18
11	Mar 12-18	0	6	11.67	0.00	70.02		
12	Mar 19-25	0	6	12.15	0.00	72.90	0.00	142.92
13	Mar 26-1	3.14	2.86	12.34	38.75	35.29		
14	Apr 2-8	3.17	2.83	12.59	39.91	35.63	78.66	70.92
15	Apr 9-15	3.48	2.52	13.12	45.66	33.06		
16	Apr 16-22	2.84	3.16	13.3	37.77	42.03	83.43	75.09
17	Apr 23-29	3.87	2.13	13.48	52.17	28.71		
18	Apr 30-6	3.78	2.22	13.99	52.88	31.06	105.05	59.77
19	Mau 7-13	4.3	1.7	14.2	61.06	24.14		
20	May 14-20	4.43	1.57	14.35	63.57	22.53	124.63	46.67
21	May 21-27	4.38	1.62	14.46	63.33	23.43		
22	May 28-3	3.78	2.22	14.56	55.04	32.32	118.37	55.75
23	Jun4-10	3.67	2.33	15.03	55.16	35.02		
24	Jun 11-17	4.3	1.7	15.08	64.84	25.64	120.00	60.66
25	Jun 18-24	4.86	1.14	15.09	73.34	17.20		
26	Jun 25-1	4.72	1.28	15.07	71.13	19.29	144.47	36.49
27	Jul 2-8	5.13	0.87	15.02	77.05	13.07		
28	Jul 9-15	4.05	1.95	14.55	58.93	28.37	135.98	41.44
29	Jul 16-22	5.42	0.58	14.45	78.32	8.38		
30	Jul 23-29	5.05	0.95	14.33	72.37	13.61	150.69	21.99
31	Jul 30-5	5.45	0.55	14.19	77.34	7.80		
32	Aug 6-12	5.05	0.95	13.92	70.30	13.22	147.63	21.03
33	Aug 13-19	5.37	0.63	13.47	72.33	8.49		
34	Aug 20-26	5.89	0.11	13.29	78.28	1.46	150.61	9.95
35	Aug 27-2	5.89	0.11	13.11	77.22	1.44		
36	Sep 3-9	5.68	0.32	12.58	71.45	4.03	148.67	5.47
37	Sep 10-16	5.72	0.28	12.33	70.53	3.45		
38	Sep 17-23	6.06	0	12.14	73.57	0.00	144.10	3.45
39	Sep 24-30	4.87	1.13	11.67	56.83	13.19		
40	Oct 1-7	6.09	0	11.37	69.24	0.00	126.08	13.19
41	Oct 8-14	5.35	0.65	11.18	59.81	7.27		
42	Oct 15-21	6.06	0	10.76	65.21	0.00	125.02	7.27
43	Oct 22-28	6.22	0	10.41	64.75	0.00		
44	Oct 29-4	5.41	0.59	10.24	55.40	6.04	120.15	6.04
45	Nov 5-11	4.59	1.41	10.09	46.31	14.23		
46	Nov 12-18	4.57	1.43	9.52	43.51	13.61	89.82	27.84
47	Nov 19-25	4.45	1.55	9.39	41.79	14.55		
48	Nov 26-2	4.8	1.2	9.28	44.54	11.14	86.33	25.69
49	Dec 3-9	0	6	9.2	0.00	55.20		
50	Dec 10-16	0	6	9.14	0.00	54.84	0.00	110.04
51	Dec 17-23	0	6	9.12	0.00	54.72		
52	Dec 24-30	0	6	9.14	0.00	54.84	0.00	109.56

Table A4-4 – Corn-Soybean Per Acre Costs

		Acres:	Corn 1.000		Soybeans 1.000		Corn/Soy .5/.5	
Week	**Dates**	**Task**	**Labor**	**Cost**	**Labor**	**Cost**	**Labor**	**Cost**
14&15	4/2-4/15	Disk corn	0.128	5.224			0.064	2.612
15	4/9-4/15	Disk soybean			0.128	5.224	0.064	2.612
16	4/16-4/22	Apply anyydrous	0.103	15.638			0.052	7.819
17	4/23-4/29	Field cultivation	0.074	2.853	0.074	2.853	0.074	2.853
18	4/30-5/6	Plant corn	0.154	29.778			0.077	14.889
19	5/7-5/13	Spray corn	0.098	26.381			0.049	13.190
19&20	5/7-5/20	Plant soybean			0.154	25.248	0.077	12.624
20	5/14-5/20	Spray soybean			0.098	30.841	0.049	15.420
24	6/11-6/17	Cult. turn row	0.005	0.200	0.005	0.200	0.005	0.200
26	6/25-7/1	Cultivate soybean			0.147	5.529	0.074	2.765
31	7/30-8/5	Rogue soybean				5.630		2.815
38	9/17-9/25	Combine corn	0.196	59.285			0.098	29.642
40	10/1-10/7	Combine soy			0.115	23.220	0.057	11.610
1 to 13		Misc tasks (off time)					0.187	
14 to 40		Misc tasks (off time)					0.375	
41 to 52		Misc tasks (off time)					0.173	
		Totals	**0.757**	**139.357**	**0.720**	**98.744**	**1.474**	**119.051**
		Labor Rate @ $15/hr	**11.362**	**150.719**	**10.804**	**109.548**	**22.111**	**141.161**
		Returns	**(105 X 2.27)**	**238.350**	**(35 X 5.65)**	**197.750**	**(52.5 X 2.27 + 17.5 X 5.65)**	**218.060**
							Variable Return	**76.899**
							Farm Fixed Costs/acre	**84.320**
							Net Return	**-7.421**

Table A4-5 – Winter Wheat/Cabbage Per Acre Costs

Week	Dates	Task	Wheat Labor	Wheat Cost	Cabbage Labor	Cabbage Cost	Wheat/Cabb Labor	Wheat/Cabb Cost
		Acres:	1.00		1.00		1.00	
1 to 13		Marketing			5.00		5.00	
13	3/26-4/1	Wheat starter fert	0.08	14.35			0.08	14.35
21	5/21-5/27	Spray wheat	0.10	15.69			0.10	15.69
27	7/2-7/8	Wheat harvest	0.15	30.85			0.15	30.85
28	7/9-7/15	Apply manure		28.00				28.00
28	7/9-7/15	Disk cab & apply herb			0.26	15.49	0.26	15.49
29	7/16-7/15	Cultivate Cabbage			0.07	2.85	0.07	2.85
29	7/16-7/22	Plant cabbage			4.00	756.95	4.00	756.95
30	7/23-7/29	Set up irrigation			4.00	192.00	4.00	192.00
30-36	7/23-9/9	Irrigate cab			24.50		24.50	
33	8/13-8/19	Cultivate Cabbage			0.07	2.85	0.07	2.85
33-36	8/13-9/9	Pest control			0.04	55.14	0.04	55.14
37	9/10-9/16	Harvest cabbage			10.00	592.41	10.00	592.41
41	10/8-10/15	Plant wheat	0.07	11.54			0.07	11.54
41-52		Marketing			5.00		5.00	
1 to 13		Misc tasks (off time)					0.19	
14 to 40		Misc tasks (off time)					0.38	
41 to 52		Misc tasks (off time)					0.17	
		Totals	**0.40**	**100.44**	**52.94**	**1617.69**	**54.07**	**1718.13**
		Labor Rate @ $15/hr	**5.94**	**106.38**	**794.10**	**2411.79**	**811.07**	**2529.19**
		Returns	**(48 X 3.13)**	**150.24**	**(47392.6 X 0.17)**	**8056.74**	**100% both returns**	**8206.98**
						4574.68	**Variable Return**	**5682.05**
							Farm Fixed Costs/acre	**84.32**
						500.00	**Product Liability Insurance**	**500.00**
						660.00	**Used Transplanter**	**2000.00**
						3414.68	**Net Return**	**$3097.73**

Table A4-6 – Spring Cabbage/Sunflower Per Acre Costs

			Cabbage		Sunflower		Cabb/Sunflower	
		Acres:	1.00		1.00		1.00	
Week	Dates	Task	Labor	Cost	Labor	Cost	Labor	Cost
1 to 13		Marketing	5.00				5.00	
12	3/19-3/25	Disk cab	0.26	15.46			0.26	15.49
12	3/19-3/25	Fertilize cabbage	0.08	64.11			0.08	64.11
13	3/26-4/1	Cultivate cabbage	0.07	2.85			0.07	2.85
13	3/26-4/1	Plant cabbage	4.00	756.95			4.00	756.95
14	4/2-4/8	Set up irrigation	4.00	192.00			4.00	192.00
15-19	4/9-5/13	Irrigate cab	24.50				24.50	
17	4/23-4/29	Cultivate cabbage	0.07	2.85			0.07	2.85
19-20	5/7-5/20	Pest control	0.20	26.04			0.02	26.04
21	5/21-5/27	Harvest cabbage	10.00	592.41			10.00	592.41
22	5/28-6/3	Disk sunflower			0.13	5.22	0.13	5.22
22	5/28-6/3	Fertilize sunflower			0.08	19.56	0.08	19.56
23	6/4-6/10	Spray sunflower			0.10	42.73	0.10	42.73
23	6/4-6/10	Plant sunflower			0.15	18.35	0.15	18.35
27	7/2-7/8	Cultivate sunflower			0.15	5.53	0.15	5.53
40	10/1/10/7	Combine sunflower			0.11	20.42	0.11	20.42
41-52		Marketing	5.00				5.00	
1 to 13		Misc tasks (off time)					0.19	
14 to 40		Misc tasks (off time)					0.38	
41 to 52		Misc tasks (off time)					0.17	
		Totals	**53.18**	**1652.67**	**0.72**	**111.81**	**54.46**	**1764.51**
		Labor Rate @ $15/hr	**797.70**	**2450.37**	**10.80**	**122.61**	**816.83**	**2581.34**
		Returns	**(47392.6 X 0.17)**	**8056.74**	**(15*10.3)**	**154.50**	**100% both returns**	**8211.24**
							Variable Return	**5629.91**
							Farm Fixed Costs/acre	**84.32**
							Product Liability Insurance	**500.00**
							Used Transplanter	**2000.00**
							Net Return	**$3,045.59**

Table A4-7 – Year 1-Agroforesty Costs for Windbreak and Woody Florals

	Year 1		R. Cedar		SC		GW		BR		WB/WF	
		Acres:	14.520		0.060		0.060		0.060			
Week	Dates	Task	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost
1 to 13		Marketing			1.500		1.500		1.500		4.500	
21	5/21-5/27	Site prep	7.260	67.480	0.030	2.790	0.030	2.790	0.030	2.790	7.350	75.850
21	5/21-5/27	Cstm plnt & spr		462.400		275.000		113.000		105.000	0.000	955.400
22	5/28-6/3	Set up irrigation			0.240	11.520	0.240	11.520	0.240	11.520	0.720	34.560
23	6/4-6/10	Irrigate			0.120		0.120		0.120		0.360	0.000
24	6/11-6/17	Irrigate			0.120		0.120		0.120		0.360	0.000
25	6/18-6/24	Irrigate			0.120		0.120		0.120		0.360	0.000
26	6/25-7/1	Irrigate			0.120		0.120		0.120		0.360	0.000
27	7/2-7/8	Irrigate			0.120		0.120		0.120		0.360	0.000
28	7/9-7/15	Irrigate			0.120		0.120		0.120		0.360	0.000
29	7/16-7/22	Irrigate			0.120		0.120		0.120		0.360	0.000
30	7/23-7/29	Irrigate			0.120		0.120		0.120		0.360	0.000
31	7/30-8/5	Irrigate			0.120		0.120		0.120		0.360	0.000
32	8/6-8/12	Irrigate			0.120		0.120		0.120		0.360	0.000
34	8/13-8/19	Irrigate			0.120		0.120		0.120		0.360	0.000
35	8/20-8/26	Irrigate			0.120		0.120		0.120		0.360	0.000
36	8/27-9/2	Irrigate			0.120		0.120		0.120		0.360	0.000
37	9/3-9/9	Irrigate			0.120		0.120		0.120		0.360	0.000
38	9/10-9/16	Irrigate			0.120		0.120		0.120		0.360	0.000
41-52		Marketing			1.500		1.500		1.500		4.500	
1 to 13		Misc tasks (off time)									2.749	
14 to 40		Misc tasks (off time)									5.513	
41 to 52		Misc tasks (off time)									2.543	
		Totals	**7.260**	**529.880**	**5.070**	**289.310**	**5.070**	**127.310**	**5.070**	**119.310**	**33.275**	**1065.810**
		L. Rate @ $15	**108.900**	**638.780**	**76.050**	**365.360**	**76.050**	**203.360**	**76.050**	**195.360**	**499.118**	**1564.928**
		Returns	**98.95/ac**	**1436.754**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**V. Return**	**1436.754**

Table A4-8 – Year 2-Woody Floral Costs

	Year 2		R. Cedar		SC		GW		BR		WB/WF	
		Acres:	14.520		0.060		0.060		0.060			
Week	Dates	Task	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost
1 to 13		Marketing			1.500		1.500		1.500		4.500	
21	5/21-5/27	Cstm replnt & spr		92.480		55.000		22.600		21.000		191.080
46	11/12-11/18	Harvest, grade & deliver			2.070		2.520				4.590	
47	11/19-11/25	Cut, grade & delivery			0.770				1.050		1.820	
48	11/26-12/2	Grade, cut & bundle			3.360		4.130		1.120		8.610	
50	12/10-12/16	Cut, grade & delivery			0.520		0.730		0.230		1.480	
51	12/17-12/23	Grade & bundle			1.540						1.540	
41-52		Marketing			1.500		1.500		1.500		4.500	
1 to 13		Misc tasks (off time)									2.749	
14 to 40		Misc tasks (off time)									5.513	
41 to 52		Misc tasks (off time)									2.543	
		Totals	0.000	92.480	11.260	55.000	10.380	22.600	5.400	21.000	37.845	191.080
		L. Rate @ $15/hr	0.000	92.480	168.900	223.900	155.700	178.300	81.000	102.000	567.668	758.748
		Returns	98.95/ac	1436.754							both returns	2024.500
											V. Return	1265.753

Table A4-9 – Year 3-Woody Floral Costs

	Year 3		R. Cedar		SC		GW		BR		WB/WF	
		Acres:	14.520		0.060		0.060		0.060			
Week	Dates	Task	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost
1 to 13		Marketing			2.500		2.500		2.500		7.500	
2	1/8-1/14	Grade, bundle & delivery			1.540		0.210		0.350		2.100	
3	1/15-1/21	Harvest, ready			0.030		0.040		0.310		0.380	
4	1/22-1/28	Grade			0.280						0.280	
5	1/29-2/4	Harvest & grade			1.140						1.140	
6	2/5-2/11	Grade, bundle & delivery			2.030		0.350		0.350		2.730	
8	2/19-2/25	Harvest					0.140		0.160		0.300	
9	2/26-3/4	Grade & bundle							0.140		0.140	
11	3/12-3/18	Grade			0.140				0.280		0.420	
46	11/12-11/18	Harvest, grade & delivery			4.930		6.000				10.930	
47	11/19-11/25	Cut, grade & delivery			1.830				2.500		4.330	
48	11/26-12/2	Grade, cut & bundle			8.000		9.840		2.670		20.510	
50	12/10-12/16	Cut, grade & delivery			1.230		1.730		0.560		3.520	
51	12/17-12/23	Grade & bundle			3.170						3.170	
1 to 13		Marketing			2.500		2.500		2.500		7.500	
1 to 13		Misc tasks (off time)									2.749	
14 to 40		Misc tasks (off time)									5.513	
41 to 52		Misc tasks (off time)									2.543	
		Totals	**0.000**	**0.000**	**29.320**	**0.000**	**23.310**	**0.000**	**12.320**	**0.000**	**75.755**	**0.000**
		L.Rate @ $15/hr	**0.000**	**0.000**	**439.800**	**439.800**	**349.650**	**349.650**	**184.800**	**184.800**	**1136.318**	**1136.318**
		Returns	**98.950**	**1436.754**							**both returns**	**3753.100**
											V. Return	**2616.783**

Table A4-10 - Years 4 & 5-Woody Floral Costs

	Year 4 & 5		R. Cedar		SC		GW		BR		WB/WF	
		Acres:	14.520		0.060		0.060		0.060			
Week	Dates	Task	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost
1 to 13		Marketing			2.500		2.500		2.500		7.500	
2	1/8-1/14	Grade, bundle & delivery			3.670		0.500		0.830		5.000	
3	1/15-1/21	Harvest, ready			0.070		0.100		0.740		0.910	
4	1/22-1/28	Grade			0.670						0.670	
5	1/29-2/4	Harvest & grade			2.720						2.720	
6	2/5-2/11	Grade, bundle & delivery			4.830		0.830		0.830		6.490	
8	2/19-2/25	Harvest					0.330		0.390		0.720	
9	2/26-3/4	Grade & bundle							0.340		0.340	
11	3/12-3/18	Grade			0.330				0.670		1.000	
46	11/12-11/18	Harvest, grade & delivery			4.930		6.000				10.930	
47	11/19-11/25	Cut, grade & delivery			1.830				2.500		4.330	
48	11/26-12/2	Grade, cut & bundle			8.000		9.840		2.670		20.510	
50	12/10-12/16	Cut, grade & delivery			1.230		1.730		0.560		3.520	
51	12/17-12/23	Grade & bundle			3.170						3.170	
41 to 52		Marketing			2.500		2.500		2.500		7.500	
1 to 13		Misc tasks (off time)									2.749	
14 to 40		Misc tasks (off time)									5.513	
41 to 52		Misc tasks (off time)									2.543	
		Totals	**0.000**	**0.000**	**36.450**	**0.000**	**24.330**	**0.000**	**14.530**	**0.000**	**86.115**	**0.000**
		L.Rate @ $15/hr	**0.000**	**0.000**	**546.750**	**546.750**	**364.950**	**364.950**	**217.950**	**217.950**	**1291.718**	**1291.718**
		Returns	**98.95/ac**	**1436.754**							**both returns**	**5014.220**
											V. Return	**3722.503**

Table A4-11 – Corn-Soybean Six-Year Average

	Year 1		Year 2		Year 3		Year 4		Year 5		Year 6		Average	
	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost
wk 14&15	0.06	2.61	0.06	2.61	0.06	2.61	0.06	2.61	0.06	2.61	0.06	2.61	0.06	2.61
wk 15	0.06	2.61	0.06	2.61	0.06	2.61	0.06	2.61	0.06	2.61	0.06	2.61	0.06	2.61
wk 16	0.05	7.82	0.05	7.82	0.05	7.82	0.05	7.82	0.05	7.82	0.05	7.82	0.05	7.82
wk 17	0.07	2.85	0.07	2.85	0.07	2.85	0.07	2.85	0.07	2.85	0.07	2.85	0.07	2.85
wk 18	0.08	14.89	0.08	14.89	0.08	14.89	0.08	14.89	0.08	14.89	0.08	14.89	0.08	14.89
wk 19	0.05	13.19	0.05	13.19	0.05	13.19	0.05	13.19	0.05	13.19	0.05	13.19	0.05	13.19
wk 19&20	0.08	12.62	0.08	12.62	0.08	12.62	0.08	12.62	0.08	12.62	0.08	12.62	0.08	12.62
wk 20	0.05	15.42	0.05	15.42	0.05	15.42	0.05	15.42	0.05	15.42	0.05	15.42	0.05	15.42
wk 24	0.01	0.20	0.01	0.20	0.01	0.20	0.01	0.20	0.01	0.20	0.01	0.20	0.01	0.20
wk 26	0.07	2.77	0.07	2.77	0.07	2.77	0.07	2.77	0.07	2.77	0.07	2.77	0.07	2.77
wk 31		2.82		2.82		2.82		2.82		2.82		2.82	0.00	2.82
wk 38	0.10	29.64	0.10	29.64	0.10	29.64	0.10	29.64	0.10	29.64	0.10	29.64	0.10	29.64
wk 40	0.06	11.61	0.06	11.61	0.06	11.61	0.06	11.61	0.06	11.61	0.06	11.61	0.06	11.61
wk 1 to 13	0.19		0.19		0.19		0.19		0.19		0.19		0.19	0.00
wk 41 to 40	0.38		0.38		0.38		0.38		0.38		0.38		0.38	0.00
wk 41-52	0.17		0.17		0.17		0.17		0.17		0.17		0.17	0.00
Total	1.48	119.05	1.48	119.05	1.48	119.05	1.48	119.05	1.48	119.05	1.48	119.05	1.48	119.05
Labor		22.13		22.13		22.13		22.13		22.13		22.13	0.00	22.13
Fixed C.		84.32		84.32		84.32		84.32		84.32		84.32	0.00	84.32
Return		218.06		218.06		218.06		218.06		218.06		218.06	0.00	218.06
Cattle Graze		6.00		6.00		6.00		6.00		6.00		6.00		6.00
Net		-1.44		-1.44		-1.44		-1.44		-1.44		-1.44	0.00	-1.44

Table A4-12 – Winter Wheat/Fall Cabbage Six-Year Average

	Year 1		Year 2		Year 3		Year 4		Year 5		Year 6		Average	
	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost
wk 1 to 13	5.00						5.00						1.67	0.00
wk 13	0.08	14.35					0.08	14.35					0.03	4.78
wk 14&15			0.06	2.61	0.06	2.61			0.06	2.61	0.06	2.61	0.04	1.74
wk 15			0.06	2.61	0.06	2.61			0.06	2.61	0.06	2.61	0.04	1.74
wk 17			0.07	2.85	0.07	2.85			0.07	2.85	0.07	2.85	0.05	1.90
wk 18			0.08	14.89	0.08	14.89			0.08	14.89	0.08	14.89	0.05	9.93
wk 19			0.05	13.19	0.05	13.19			0.05	13.19	0.05	13.19	0.03	8.79
wk 19&20			0.08	12.62	0.08	12.62			0.08	12.62	0.08	12.62	0.05	8.42
wk 20			0.05	15.42	0.05	15.42			0.05	15.42	0.05	15.42	0.03	10.28
wk 21	0.10	15.69					0.10	15.69					0.03	5.23
wk 24			0.01	0.20	0.01	0.20			0.01	0.20	0.01	0.20	0.00	0.13
wk 26			0.07	2.77	0.07	2.77			0.07	2.77	0.07	2.77	0.05	1.84
wk 27	0.15	30.85					0.15	30.85					0.05	10.28
wk 28		28.00						28.00					0.00	9.33
wk 28	0.26	15.49					0.26	15.49					0.09	5.16
wk 29	4.07	759.80					4.07	759.80					1.36	253.27
wk 30	4.00	192.00					4.00	192.00					1.33	64.00
wk 30	3.50						3.50						1.17	0.00
wk 31	3.50			2.82		2.82	3.50			2.82		2.82	1.17	0.00
wk 32	3.50						3.50						1.17	0.00
wk 33	3.50						3.50						1.17	0.00
wk 33	0.07	2.85					0.07	2.85					0.02	0.95
wk 33	0.10	13.79					0.10	13.79					0.03	4.60
wk 34	3.50						3.50						1.17	0.00
wk 34	0.10	13.79					0.10	13.79					0.03	4.60
wk 35	3.50						3.50						1.17	0.00
wk 35	0.10	13.79					0.10	13.79					0.03	4.60
wk 36	3.50						3.50						1.17	0.00
wk 36	0.10	13.79					0.10	13.79					0.03	4.60
wk 37	10.00	592.41					10.00	592.41					3.33	197.47
wk 38			0.10	29.64	0.10	29.64			0.10	29.64	0.10	29.64	0.07	19.76
wk 40			0.06	11.61	0.06	11.61			0.06	11.61	0.06	11.61	0.04	7.74

Table A4-12 – Winter Wheat/Fall Cabbage Six-Year Average Cont.

	Year 1		Year 2		Year 3		Year 4		Year 5		Year 6		Average	
	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost
wk 41	0.07	11.54					0.07	11.54					0.02	3.85
wk 41-42	5.00						5.00						1.67	0.00
wk 1 to 13	0.19		0.19		0.19		0.19		0.19		0.19		0.19	0.00
wk 41 to 40	0.38		0.38		0.38		0.38		0.38		0.38		0.38	0.00
wk 41-52	0.17		0.17		0.17		0.17		0.17		0.17		0.17	0.00
Total	54.43	1718.14	1.42	111.24	1.42	111.24	54.43	1718.14	1.42	111.24	1.42	111.24	19.09	644.99
Labor		816.47		21.35		21.35		816.47		21.35		21.35		286.39
Fixed C.		84.32		84.32		84.32		84.32		84.32		84.32		84.32
P.Lib. Ins.		500.00		0.00		0.00		500.00		0.00		0.00		166.67
Transplanter		2000.00		0.00		0.00		2000.00		0.00		0.00		666.67
Return		8206.98		218.06		218.06		8206.98		218.06		218.06		2881.03
Cattle Graze		6.00		6.00		6.00		6.00		6.00		6.00		6.00
Net		3094.06		7.16		7.16		3094.06		7.16		7.16		1038.00

Table A4-13 – Spring Cabbage/Sunflowers Six-Year Average

	Year 1		Year 2		Year 3		Year 4		Year 5		Year 6		Average	
	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost
wk 1 to 13	5.00						5.00						1.67	0.00
wk 12	0.26	15.46					0.26	15.46					0.09	5.15
wk 12	0.08	64.11					0.08	64.11					0.03	21.37
wk 13	4.07	759.80					4.07	759.80					1.36	253.27
wk 14	4.00	192.00					4.00	192.00					1.33	64.00
wk 14&15			0.06	2.61	0.06	2.61			0.06	2.61	0.06	2.61	0.04	1.74
wk 15	3.50		0.06	2.61	0.06	2.61	3.50		0.06	2.61	0.06	2.61	1.21	
wk 16	3.50		0.05	7.82	0.05	7.82	3.50		0.05	7.82	0.05	7.82	1.20	
wk 17	3.50		0.07	2.85	0.07	2.85	3.50		0.07	2.85	0.07	2.85	1.22	
wk 17	0.07	2.85					0.07	2.85					0.02	0.95
wk 18	3.50		0.08	14.89	0.08	14.89	3.50		0.08	14.89	0.08	14.89	1.22	
wk 19	3.50		0.05	13.19	0.05	13.19	3.50		0.05	13.19	0.05	13.19	1.20	8.79
wk 19&20	0.10	13.02	0.08	12.62	0.08	12.62	0.10	13.02	0.08	12.62	0.08	12.62	0.08	12.76
wk 20	3.50		0.05	15.42	0.05	15.42	3.50		0.05	15.42	0.05	15.42	1.20	
wk 20	0.10	13.02					0.10	13.02					0.03	4.34
wk 21	10.00	592.41					10.00	592.41					3.33	197.47
wk 21	3.50						3.50						1.17	0.00
wk 22	0.13	5.22					0.13	5.22					0.04	1.74
wk 22	0.08	19.56					0.08	19.56					0.03	6.52
wk 23	0.10	42.73					0.10	42.73					0.03	14.24
wk 23	0.15	18.35					0.15	18.35					0.05	6.12
wk 24			0.01	0.20	0.01	0.20			0.01	0.20	0.01	0.20	0.00	0.13
wk 26			0.07	2.77	0.07	2.77			0.07	2.77	0.07	2.77	0.05	1.84
wk 27	0.15	5.53					0.15	5.53					0.05	1.84
wk 31				2.82		2.82				2.82		2.82	0.00	1.88
wk 38			0.10	29.64	0.10	29.64			0.10	29.64	0.10	29.64	0.07	19.76
wk 40	0.11	20.42	0.06	11.61	0.06	11.61	0.11	20.42	0.06	11.61	0.06	11.61	0.07	14.55
wk 41-42	5.00						5.00						1.67	0.00
wk 1 to 13	0.19		0.19		0.19		0.19		0.19		0.19		0.19	0.00

Table A4-13 – Spring Cabbage/Sunflowers Six-Year Average Cont.

	Year 1		Year 2		Year 3		Year 4		Year 5		Year 6		Average	
	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost
wk 41 to 40	0.38		0.38		0.38		0.38		0.38		0.38		0.38	0.00
wk 41-52	0.17		0.17		0.17		0.17		0.17		0.17		0.17	0.00
Total	54.64	1764.48	1.48	119.05	1.48	119.05	54.64	1764.48	1.48	119.05	1.48	119.05	19.16	627.93
Labor		819.53		22.13		22.13		819.53		22.13		22.13		287.40
Fixed C.		84.32		84.32		84.32		84.32		84.32		84.32		84.32
P.Lib. Ins.		500.00		0.00		0.00		500.00		0.00		0.00		166.67
Transplanter		2000.00		0.00		0.00		2000.00		0.00		0.00		110.00
Return		8211.24		218.06		218.06		8211.24		218.06		218.06		2882.45
Cattle Graze		6.00		6.00		6.00		6.00		6.00		6.00		6.00
Net		3048.92		-1.44		-1.44		3048.92		-1.44		-1.44		1612.13

Table A4-14 – Windbreak Six-Year Average

	Year 1 Labor	Year 1 Cost	Year 2 Labor	Year 2 Cost	Year 3 Labor	Year 3 Cost	Year 4 Labor	Year 4 Cost	Year 5 Labor	Year 5 Cost	Year 6 Labor	Year 6 Cost	Average Labor	Average Cost
wk 21	7.26	67.48											1.21	11.25
wk 21		462.40		92.48									0.00	92.48
wk 1 to 13	2.72												0.45	0.00
wk 41 to 40	5.45												0.91	0.00
wk 41-52	2.51												0.42	0.00
Total	17.93	529.88	0.00	92.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.99	103.73
Labor		268.98		0.00		0.00		0.00		0.00		0.00		44.83
Fixed C.		1224.33		1224.33		1224.33		1224.33		1224.33		1224.33		1224.33
Return		1436.75		1436.75		1436.75		1436.75		1436.75		1436.75		1436.75
Net		-586.44		119.95		212.43		212.43		212.43		212.43		63.87

Table A4-15 – Scarlet Curls Willow Six-Year Average

	Year 1		Year 2		Year 3		Year 4		Year 5		Year 6		Average	
	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost
wk 1 to 13	1.50		1.50		2.50		2.50		2.50		2.50		2.17	0.00
wk 2					1.54		3.67		3.67		3.67		2.09	0.00
wk 3					0.03		0.07		0.07		0.07		0.04	0.00
wk 4					0.28		0.67		0.67		0.67		0.38	0.00
wk 5					1.14		2.72		2.72		2.72		1.55	0.00
wk 6					2.03		4.83		4.83		4.83		2.75	0.00
wk 8													0.00	0.00
wk 9													0.00	0.00
wk 11					0.14		0.33		0.33		0.33		0.19	0.00
wk 21	0.03	2.79	0.00		0.00								0.01	0.47
wk 21		275.00		55.00	0.00								0.00	55.00
wk 22	0.24	11.52											0.04	1.92
wk 23	0.12												0.02	0.00
wk 24	0.12												0.02	0.00
wk 25	0.12												0.02	0.00
wk 26	0.12												0.02	0.00
wk 27	0.12												0.02	0.00
wk 28	0.12												0.02	0.00
wk 29	0.12												0.02	0.00
wk 30	0.12												0.02	0.00
wk 31	0.12												0.02	0.00
wk 32	0.12												0.02	0.00
wk 34	0.12												0.02	0.00
wk 35	0.12												0.02	0.00
wk 36	0.12												0.02	0.00
wk 37	0.12												0.02	0.00
wk 38	0.12												0.02	0.00
wk 46			2.07		4.93		4.93		4.93		4.93		3.63	0.00
wk 47			0.77		1.83		1.83		1.83		1.83		1.35	0.00
wk 48			3.36		8.00		8.00		8.00		8.00		5.89	0.00

Table A4-15 – Scarlet Curls Willow Six-Year Average Cont.

	Year 1		Year 2		Year 3		Year 4		Year 5		Year 6		Average	
	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost
wk 41-52	1.50		1.50		2.50		2.50		2.50		2.50		2.17	0.00
1 to 13	0.01		0.01		0.01		0.01		0.01		0.01		0.01	0.00
14 to 40	0.02		0.02		0.02		0.02		0.02		0.02		0.02	0.00
41 to 52	0.01		0.01		0.01		0.01		0.01		0.01		0.01	0.00
Total	5.12	289.31	9.25	55.00	24.97	0.00	32.10	0.00	32.10	0.00	32.10	0.00	22.60	57.39
Labor		76.76		138.71		374.51		481.46		481.46		481.46		339.06
Fixed C.		5.06		5.06		5.06		5.06		5.06		5.06		5.06
Return		0.00		402.84		1603.20		2492.50		2492.50		2492.50		1580.59
Net		-371.13		204.07		1223.63		2005.98		2005.98		2005.98		1179.08

Table A4-16 – Goat Willow Six-Year Average

	Year 1		Year 2		Year 3		Year 4		Year 5		Year 6		Average	
	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost
wk 1 to 13	1.50		1.50		2.50		2.50		2.50		2.50		2.17	0.00
wk 2					0.21		0.50		0.50		0.50		0.29	0.00
wk 3					0.04		0.10		0.10		0.10		0.06	0.00
wk 4													0.00	0.00
wk 5													0.00	0.00
wk 6					0.35		0.83		0.83		0.83		0.47	0.00
wk 8					0.14		0.33		0.33		0.33		0.19	0.00
wk 21	0.03	2.79											0.01	0.47
wk 21		113.00		22.60									0.00	22.60
wk 22	0.24	11.52											0.04	1.92
wk 23	0.12												0.02	0.00
wk 24	0.12												0.02	0.00
wk 25	0.12												0.02	0.00
wk 26	0.12												0.02	0.00
wk 27	0.12												0.02	0.00
wk 28	0.12												0.02	0.00
wk 29	0.12												0.02	0.00
wk 30	0.12												0.02	0.00
wk 31	0.12												0.02	0.00
wk 32	0.12												0.02	0.00
wk 34	0.12												0.02	0.00
wk 35	0.12												0.02	0.00
wk 36	0.12												0.02	0.00
wk 37	0.12												0.02	0.00
wk 38	0.12												0.02	0.00
wk 46			2.52		6.00		6.00		6.00		6.00		4.42	0.00
wk 47													0.00	0.00
wk 48			4.13		9.84		9.84		9.84		9.84		7.25	0.00
wk 50			0.73		1.73		1.73		1.73		1.73		1.28	0.00
wk 51													0.00	0.00

Table A4-16 – Goat Willow Six-Year Average Cont.

	Year 1		Year 2		Year 3		Year 4		Year 5		Year 6		Average	
	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost
14 to 40	0.02		0.02		0.02		0.02		0.02		0.02		0.02	0.00
41 to 52	0.01		0.01		0.01		0.01		0.01		0.01		0.01	0.00
Total	3.61	127.31	8.92	22.60	20.85	0.00	21.87	0.00	21.87	0.00	21.87	0.00	16.49	24.99
Labor		54.09		133.74		312.69		327.99		327.99		327.99		247.42
Fixed C.		5.06		5.06		5.06		5.06		5.06		5.06		5.06
Return		0.00		78.50		375.60		650.00		650.00		650.00		400.68
Net		-186.46		-82.90		57.85		316.95		316.95		316.95		123.22

Table A4-17 – Bailey Redtwig Six-Year Average

	Year 1		Year 2		Year 3		Year 4		Year 5		Year 6		Average	
	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost
wk 1 to 13	1.50		1.50		2.50		2.50		2.50		2.50		2.17	0.00
wk 2					0.35		0.83		0.83		0.83		0.47	0.00
wk 3					0.31		0.74		0.74		0.74		0.42	0.00
wk 6					0.35		0.83		0.83		0.83		0.47	0.00
wk 8					0.16		0.39		0.39		0.39		0.22	0.00
wk 9					0.14		0.34		0.34		0.34		0.19	0.00
wk 11					0.28		0.67		0.67		0.67		0.38	0.00
wk 21	0.03	2.79											0.01	0.47
wk 21		105.00		21.00									0.00	21.00
wk 22	0.24	11.52											0.04	1.92
wk 23	0.12												0.02	0.00
wk 24	0.12												0.02	0.00
wk 25	0.12												0.02	0.00
wk 26	0.12												0.02	0.00
wk 27	0.12												0.02	0.00
wk 28	0.12												0.02	0.00
wk 29	0.12												0.02	0.00
wk 30	0.12												0.02	0.00
wk 31	0.12												0.02	0.00
wk 32	0.12												0.02	0.00
wk 34	0.12												0.02	0.00
wk 35	0.12												0.02	0.00
wk 36	0.12												0.02	0.00
wk 37	0.12												0.02	0.00
wk 38	0.12												0.02	0.00
wk 47			1.05		2.50		2.50		2.50		2.50		1.84	0.00
wk 48			1.12		2.67		2.67		2.67		2.67		1.97	0.00
wk 50			0.23		0.56		0.56		0.56		0.56		0.41	0.00
wk 41-52	1.50		1.50		2.50		2.50		2.50		2.50		2.17	0.00
1 to 13	0.01		0.01		0.01		0.01		0.01		0.01		0.01	0.00

Table A4-17 – Bailey Redtwig Six-Year Average Cont.

	Year 1		Year 2		Year 3		Year 4		Year 5		Year 6		Average	
	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost	Labor	Cost
Total	5.08	119.31	5.41	21.00	12.33	0.00	14.54	0.00	14.54	0.00	14.54	0.00	11.07	23.39
Labor		76.22		81.17		184.97		218.12		218.12		218.12		166.12
Fixed C.		5.06		5.06		5.06		5.06		5.06		5.06		5.06
Return		0.00		106.37		337.50		435.00		435.00		435.00		291.48
Net		-200.59		-0.86		147.47		211.82		211.82		211.82		96.92

Table A5-1 – Linear Programming Analysis Results

Comparision	Option 1 Land	Option 2 Land	Option 3 Land	Option 4 Land Windbreak	Option 4 Land Woody Floal	Total Operator Labor Used (hrs)	Costs		Returns	
Option 1 no subsidies	640 acres					944.00	Variable-Opt 1	76192.64	Corn	$76,272.00
							Fixed-Opt 1	53964.80	Soybean	$63,280.00
							Labor-Opt 1	14160.00		
							Total	**144317.44**	**Total**	**$139,552.00**
									NET	**-$4,765.44**
Option 1 w/subsidies	640 acres					944.00	Variable-Opt 1	76192.64	Corn	$76,272.00
							Fixed-Opt 1	53964.80	Soybean	$63,280.00
							Labor-Opt 1	14160.00	Subsidy-Opt 1	$26,246.40
							Total	**144317.44**	**Total**	**$165,798.40**
									NET	**$21,480.96**
Option 1 w/ grazing & subsidies	640 acres					944.00	Variable-Opt 1	76192.64	Corn	$76,272.00
							Fixed-Opt 1	53964.80	Soybean	$63,280.00
							Labor-Opt 1	14160.00	Subsidy-Opt 1	$26,246.40
									Cattle Grazing	$3,840.00
							Total	**144317.44**	**Total**	**$169,638.40**
									NET	**$25,320.96**
Option 1 & 2 w/grazing no subsidies	619.74 acres	20.26 acres				1301.14	Variable-Opt 1	73780.25	Corn	$75,467.00
							Variable-Opt 2	13088.58	Soybean	$62,612.53
							Fixed-Opt 1	52256.18	Wheat	$1,014.79
							Fixed-Opt 2	1708.62	F. Cabbage	$54,419.19
							Transplanter	2000.00	Cattle Grazing	$3,840.00
							Prod.Lia.Ins.	500.00		
							Labor-Opt 1	13711.67		
							Labor-Opt 2	5805.49		
							Total	**162850.79**	**Total**	**$197,353.51**
									NET	**$34,502.72**

Table A5-1 – Linear Programming Analysis Results Cont.

Comparision	Option 1 Land	Option 2 Land	Option 3 Land	Option 4 Land Windbreak	Option 4 Land Woody Floal	Total Operator Labor Used (hrs)	Costs		Returns	
Option 1 & 2 w/ grazing & subsidies	619.74 acres	20.26 acres				1301.14	Variable-Opt 1	73780.25	Corn	$75,467.00
							Variable-Opt 2	13088.58	Soybean	$62,612.53
							Fixed-Opt 1	52256.18	Wheat	$1,014.79
							Fixed-Opt 2	1708.62	F. Cabbage	$54,419.19
							Transplanter	2000.00	Subsidy-Opt 1	$25,415.39
							Prod.Lia.Ins.	500.00	Subsidy-Opt 2	$836.68
							Labor-Opt 1	13711.67	Cattle Grazing	$3,840.00
							Labor-Opt 2	5805.49		
							Total	**162850.79**	**Total**	**$223,605.58**
									NET	**$60,754.79**
Option 1 & 3 w/grazing no subsidies	636.34 acres	3.66 acres				1008.69	Variable-Opt 1	75757.14	Corn	$76,127.00
							Variable-Opt 3	2297.04	Soybean	$63,159.50
							Fixed-Opt 1	53656.35	S. Cabbage	$9,824.15
							Fixed-Opt 3	308.45	Sunflower	$188.39
							Transplanter	2000.00	Cattle Grazing	$3,840.00
							Prod.Lia.Ins.	500.00		
							Labor-Opt 1	14079.06		
							Labor-Opt 3	1051.34		
							Total	**149649.38**	**Total**	**$153,139.04**
									NET	**$3,489.66**
Option 1 & 3 w/ grazing & subsidies	636.34 acres	3.66 acres				1008.69	Variable-Opt 1	75757.14	Corn	$76,127.00
							Variable-Opt 3	2297.04	Soybean	$63,159.50
							Fixed-Opt 1	53656.35	S. Cabbage	$9,824.15
							Fixed-Opt 3	308.45	Sunflower	$188.39
							Transplanter	2000.00	Subsidy-Opt 1	$26,096.38
							Prod.Lia.Ins.	500.00	Subsidy-Opt 3	$100.01
							Labor-Opt 1	14079.06	Cattle Grazing	$3,840.00

Table A5-1 – Linear Programming Analysis Results Cont.

Comparision	Option 1 Land	Option 2 Land	Option 3 Land	Option 4 Land Windbreak	Option 4 Land Woody Floal	Total Operator Labor Used (hrs)	Costs		Returns	
							Labor-Opt 3	1051.34		
							Total	**149649.38**	**Total**	**$179,335.43**
									NET	**$29,686.05**
Option 1 & 4 w/grazing no subsidies	629.89 acres			9.37 acres	SC - 0.74 acres	1249.94	Variable-Opt 1	74989.12	Corn	$75,067.00
							Variable-Opt 4	774.08	Soybean	$62,280.44
							Fixed-Opt 1	53112.38	Windbreak	$927.16
							Fixed-Opt 4	852.42	Scarlet Curls	$19,475.56
							Labor-Opt 1	13936.33	Cattle Grazing	$3,779.34
							Labor-Opt 4	4812.72		
							Total	**148477.05**	**Total**	**$161,529.50**
									NET	**$13,052.45**
Option 1 & 4 w/ grazing & subsidies (no mrkt constraints)	629.89 acres			9.37 acres	SC - 0.72 acres	1249.94	Variable-Opt 1	74989.12	Corn	$75,067.00
							Variable-Opt 4	774.08	Soybean	$62,280.44
							Fixed-Opt 1	53112.38	Windbreak	$927.16
							Fixed-Opt 4	852.42	Scarlet Curls	$19,475.56
							Labor-Opt 1	13936.33	Subsidy-Opt 1	$25,831.18
							Labor-Opt 4	4812.72	Cattle Grazing	$3,779.34
							Total	**148477.05**	**Total**	**$187,360.68**
									NET	**$38,883.63**
Option 1 & 4 w/grazing & subsidies 20 % NE Mrkt	630.03 acres			9.37 acres	SC - 0.24 acres	1140.82	Variable-Opt 1	75005.85	Corn	$75,084.00
					GW - 0.32 acres		Variable-Opt 4	444.08	Soybean	$62,294.34
					BR - 0.04 acres		Fixed-Opt 1	53124.24	Windbreak	$927.16
							Fixed-Opt 4	840.57	SC	$6,290.75
							Labor-Opt 1	13939.44	GW	$2,114.99
							Labor-Opt 4	3172.89	BR	$210.01
							Total	**146527.07**	Subsidy-Opt1	$25,837.58
									Cattle Grazing	$3,780.19

Table A5-1 – Linear Programming Analysis Results Cont.

Comparision	Option 1 Land	Option 2 Land	Option 3 Land	Option 4 Land Windbreak	Option 4 Land Woody Floal	Total Operator Labor Used (hrs)	Costs		Returns	
									Total	**$176,539.02**
									NET	**$30,011.95**
Option 1, 2, & 3 w/ grazing no subsidies	615.59 acres	20.30 acres	4.11 acres			1374.41	Variable-Opt 1	75302.00	Corn	$75,302.00
							Variable-Opt 2	13111.09	Soybean	$62,476.06
							Variable-Opt 3	2579.79	Wheat	$1,016.54
							Fixed-Opt 1	51906.83	F. Cabbage	$54,512.75
							Fixed-Opt 2	5815.47	S. Cabbage	$11,033.44
							Fixed-Opt 3	346.42	Sunflower	$211.58
							Transplanter	2000.00	Cattle Grazing	$3,840.00
							PLI - Opt 2	500.00		
							PLI - Opt 3	500.00		
							Labor-Opt 1	13620.00		
							Labor-Opt 2	5815.47		
							Labor-Opt 3	1180.75		
							Total	**172677.82**	**Total**	**$208,392.37**
									NET	**$35,714.55**
Option 1, 2, & 3 w/ grazing & subsidies (no mrkt constraints)	615.59 acres	20.30 acres	4.11 acres			1374.41	Variable-Opt 1	75302.00	Corn	$75,302.00
							Variable-Opt 2	13111.09	Soybean	$62,476.06
							Variable-Opt 3	2579.79	Wheat	$1,016.54
							Fixed-Opt 1	51906.83	F. Cabbage	$54,512.75
							Fixed-Opt 2	5815.47	S. Cabbage	$11,033.44
							Fixed-Opt 3	346.42	Sunflower	$211.58
							Transplanter	2000.00	Subsidy-Opt 1	$25,245.48
							PLI - Opt 2	500.00	Subsidy-Opt 2	$838.12
							PLI - Opt 3	500.00	Subsidy-Opt 3	$112.32
							Labor-Opt 1	13620.00	Cattle Grazing	$3,840.00

Table A5-1 – Linear Programming Analysis Results Cont.

Comparision	Option 1 Land	Option 2 Land	Option 3 Land	Option 4 Land Windbreak	Option 4 Land Woody Floal	Total Operator Labor Used (hrs)	Costs		Returns	
							Labor-Opt 2	5815.47		
							Labor-Opt 3	1180.75		
							Total	**172677.82**	**Total**	**$234,588.29**
									NET	**$61,910.47**
Option 1, 2, 3, & 4										
w/grazing	608.85 acres	19.70 acres	1.36 acres	9.37 acres	SC - 0.72acres	1612.90	Variable-Opt 1	72484.20	Corn	$74,233.00
no subsidies							Variable-Opt 2	12724.62	Soybean	$61,588.67
(no mrkt constraints)							Variable-Opt 3	835.98	Wheat	$986.58
							Variable-Opt 4	755.62	F. Cabbage	$52,905.93
							Fixed-Opt 1	51338.23	S. Cabbage	$3,652.39
							Fixed-Opt 2	1661.11	Sunflower	$70.04
							Fixed-Opt 3	114.68	Windbreak	$927.16
							Fixed-Opt 4	850.79	SC	$18,967.08
							Transplanter	2000.00	Cattle Grazing	$3,780.00
							PLI - Opt 2	500.00		
							PLI - Opt 3	500.00		
							Labor-Opt 1	13470.81		
							Labor-Opt 2	5644.05		
							Labor-Opt 3	390.86		
							Labor-Opt 4	4687.83		
							Total	**167958.78**	**Total**	**$217,110.85**
									NET	**$49,152.07**
Option 1, 2, 3, & 4										
w/grazing	608.85 acres	19.70 acres	1.36 acres	9.37 acres	SC - 0.24 acres	1511.91	Variable-Opt 1	72484.20	Corn	$74,233.00
no subsidies					GW - 0.32 acres		Variable-Opt 2	12724.62	Soybean	$61,588.67
20% NE Mrkt					BR - 0.04 acres		Variable-Opt 3	835.98	Wheat	$986.58
							Variable-Opt 4	444.08	F. Cabbage	$52,905.93
							Fixed-Opt 1	51338.23	S. Cabbage	$3,652.39

Table A5-1 – Linear Programming Analysis Results Cont.

Comparision	Option 1 Land	Option 2 Land	Option 3 Land	Option 4 Land Windbreak	Option 4 Land Woody Floal	Total Operator Labor Used (hrs)	Costs		Returns	
							Fixed-Opt 2	1661.11	Sunflower	$70.04
							Fixed-Opt 3	114.68	Windbreak	$927.16
							Fixed-Opt 4	840.57	SC	$6,290.75
							Transplanter	2000.00	GW	$2,114.99
							PLI - Opt 2	500.00	BR	$210.01
							PLI - Opt 3	500.00	Cattle Grazing	$3,780.00
							Labor-Opt 1	13470.81		
							Labor-Opt 2	5644.05		
							Labor-Opt 3	390.86		
							Labor-Opt 4	3172.89		
							Total	**166122.08**	**Total**	**$206,759.52**
									NET	**-$40,637.44**
Option 1, 2, 3, & 4 w/ grazing & subsidies (no mrkt constraints)	608.85 acres	19.70 acres	1.36 acres	9.37 acres	SC - 0.72acres	1612.90	Variable-Opt 1	72484.20	Corn	$74,233.00
							Variable-Opt 2	12724.62	Soybean	$61,588.67
							Variable-Opt 3	835.98	Wheat	$986.58
							Variable-Opt 4	755.62	F. Cabbage	$52,905.93
							Fixed-Opt 1	51338.23	S. Cabbage	$3,652.39
							Fixed-Opt 2	1661.11	Sunflower	$70.04
							Fixed-Opt 3	114.68	Windbreak	$927.16
							Fixed-Opt 4	850.79	SC	$18,967.08
							Transplanter	2000.00	Subsidy-Opt 1	$24,968.94
							PLI - Opt 2	500.00	Subsidy-Opt 2	$813.41
							PLI - Opt 3	500.00	Subsidy-Opt 3	$37.18
							Labor-Opt 1	13470.81	Cattle Grazing	$3,780.00
							Labor-Opt 2	5644.05		
							Labor-Opt 3	390.86		
							Labor-Opt 4	4687.83		
							Total	**167958.78**	**Total**	**$242,930.38**
									NET	**$74,971.60**

Table A5-1 – Linear Programming Analysis Results Cont.

Comparision	Option 1 Land	Option 2 Land	Option 3 Land	Option 4 Land Windbreak	Option 4 Land Woody Floal	Total Operator Labor Used (hrs)	Costs		Returns	
Option 1, 2, 3, & 4	608.85 acres	19.70 acres	1.36 acres	9.37 acres	SC - 0.24 acres	1511.91	Variable-Opt 1	72484.20	Corn	$74,233.00
w/ grazing & subsidies					GW - 0.32 acres		Variable-Opt 2	12724.62	Soybean	$61,588.67
20% NE Mrkt					BR - 0.04 acres		Variable-Opt 3	835.98	Wheat	$986.58
							Variable-Opt 4	444.08	F. Cabbage	$52,905.93
							Fixed-Opt 1	51338.23	S. Cabbage	$3,652.39
							Fixed-Opt 2	1661.11	Sunflower	$70.04
							Fixed-Opt 3	114.68	Windbreak	$927.16
							Fixed-Opt 4	840.57	SC	$6,290.75
							Transplanter	2000.00	GW	$2,114.99
							PLI - Opt 2	500.00	BR	$210.01
							PLI - Opt 3	500.00	Subsidy-Opt 1	$24,968.94
							Labor-Opt 1	13470.81	Subsidy-Opt 2	$813.41
							Labor-Opt 2	5644.05	Subsidy-Opt 3	$37.18
							Labor-Opt 3	390.86	Cattle Grazing	$3,780.00
							Labor-Opt 4	3172.89		
							Total	**166122.08**	**Total**	**$232,579.05**
									NET	**$66,456.97**

SENSITIVITY

Labor

Comparision	Option 1 Land	Option 2 Land	Option 3 Land	Option 4 Land Windbreak	Option 4 Land Woody Floal	Total Operator Labor Used (hrs)	Costs		Returns	
Option 1, 2, 3, & 4	608.85 acres	19.70 acres	1.36 acres	9.37 acres	SC - 0.24 acres	1511.91	Variable-Opt 1	72484.20	Corn	$74,233.00
w/ grazing & subsidies					GW - 0.32 acres		Variable-Opt 2	12724.62	Soybean	$61,588.67
20% NE Mrkt					BR - 0.04 acres		Variable-Opt 3	835.98	Wheat	$986.58
second full time operator							Variable-Opt 4	444.08	F. Cabbage	$52,905.93
							Fixed-Opt 1	51338.23	S. Cabbage	$3,652.39
							Fixed-Opt 2	1661.11	Sunflower	$70.04
							Fixed-Opt 3	114.68	Windbreak	$927.16
							Fixed-Opt 4	840.57	SC	$6,290.75
							Transplanter	2000.00	GW	$2,114.99
							PLI - Opt 2	500.00	BR	$210.01

Table A5-1 – Linear Programming Analysis Results Cont.

Comparision	Option 1 Land	Option 2 Land	Option 3 Land	Option 4 Land Windbreak	Option 4 Land Woody Floal	Total Operator Labor Used (hrs)	Costs		Returns	
							PLI - Opt 3	500.00	Subsidy-Opt 1	$24,968.94
							Labor-Opt 1	13470.81	Subsidy-Opt 2	$813.41
							Labor-Opt 2	5644.05	Subsidy-Opt 3	$37.18
							Labor-Opt 3	390.86	Cattle Grazing	$3,780.00
							Labor-Opt 4	3172.89		
							Total	**166122.08**	**Total**	**$232,579.05**
									NET	**$66,456.97**
Option 1, 2, 3, & 4	583.08 acres	20.79acres	25.48 acres	9.37 acres	SC - 0.24 acres	1956.90	Variable-Opt 1	69416.03	Corn	$73,165.00
w/ grazing & subsidies					GW - 0.32 acres		Variable-Opt 2	13428.94	Soybean	$60,702.86
20% NE Mrkt					BR - 0.04 acres		Variable-Opt 3	16001.09	Wheat	$1,041.18
pt help during critical times							Variable-Opt 4	427.23	F. Cabbage	$55,834.32
at 7.50/hr							Fixed-Opt 1	49165.15	S. Cabbage	$68,434.71
							Fixed-Opt 2	1753.05	Sunflower	$1,312.34
							Fixed-Opt 3	2148.67	Windbreak	$927.16
							Fixed-Opt 4	841.29	SC	$6,290.75
							Transplanter	2000.00	GW	$2,114.99
							PLI - Opt 2	500.00	BR	$210.01
							PLI - Opt 3	500.00	Subsidy-Opt 1	$23,912.11
							Labor-Opt 1	12900.60	Subsidy-Opt 2	$858.42
							Labor-Opt 2	5956.45	Subsidy-Opt 3	$696.62
							Labor-Opt 3	7323.61	Cattle Grazing	$3,780.18
							Labor-Opt 4	3172.89		
							Hired Labor	2301.72		
							Total	**187836.72**	**Total**	**$299,280.65**
									NET	**$111,443.93**

Table A5-1 – Linear Programming Analysis Results Cont.

Comparision Marketing	Option 1 Land	Option 2 Land	Option 3 Land	Option 4 Land Windbreak	Option 4 Land Woody Floal	Total Operator Labor Used (hrs)	Costs		Returns	
Option 1, 2, 3, & 4	608.85 acres	19.70 acres	1.36 acres	9.37 acres	SC - 0.36 acres	1568.98	Variable-Opt 1	72484.20	Corn	$74,233.00
w/ grazing & subsidies					GW - 0.32 acres		Variable-Opt 2	12724.62	Soybean	$61,588.67
One operator					BR - 0.06 acres		Variable-Opt 3	835.98	Wheat	$986.58
30% NE Mrkt							Variable-Opt 4	568.75	F. Cabbage	$52,905.93
							Fixed-Opt 1	51338.23	S. Cabbage	$3,652.39
							Fixed-Opt 2	1661.11	Sunflower	$70.04
							Fixed-Opt 3	114.68	Windbreak	$927.16
							Fixed-Opt 4	852.88	SC	$9,439.13
							Transplanter	2000.00	GW	$2,147.53
							PLI - Opt 2	500.00	BR	$315.00
							PLI - Opt 3	500.00	Subsidy-Opt 1	$24,968.94
							Labor-Opt 1	13470.81	Subsidy-Opt 2	$813.41
							Labor-Opt 2	5644.05	Subsidy-Opt 3	$37.18
							Labor-Opt 3	390.86	Cattle Grazing	$3,780.00
							Labor-Opt 4	4028.95		
							Total	**167115.12**	**Total**	**$235,864.96**
									NET	**$68,749.84**
Option 1, 2, 3, & 4	608.85 acres	19.70 acres	1.36 acres	9.37 acres	SC - 0.72 acres	1611.05	Variable-Opt 1	72484.20	Corn	$74,233.00
w/ grazing & subsidies					GW - 0 acres		Variable-Opt 2	12724.62	Soybean	$61,588.67
One operator					BR - 0 acres		Variable-Opt 3	835.98	Wheat	$986.58
5% MW Mrkt							Variable-Opt 4	751.51	F. Cabbage	$52,905.93
							Fixed-Opt 1	51338.23	S. Cabbage	$3,652.39
							Fixed-Opt 2	1661.11	Sunflower	$70.04
							Fixed-Opt 3	114.68	Windbreak	$927.16
							Fixed-Opt 4	850.43	SC	$18,853.99
							Transplanter	2000.00	GW	$0.00
							PLI - Opt 2	500.00	BR	$0.00
							PLI - Opt 3	500.00	Subsidy-Opt 1	$24,968.94

Table A5-1 – Linear Programming Analysis Results Cont.

Comparision	Option 1 Land	Option 2 Land	Option 3 Land	Option 4 Land Windbreak	Option 4 Land Woody Floal	Total Operator Labor Used (hrs)	Costs		Returns	
							Labor-Opt 1	13470.81	Subsidy-Opt 2	$813.41
							Labor-Opt 2	5644.05	Subsidy-Opt 3	$37.18
							Labor-Opt 3	390.86	Cattle Grazing	$3,780.00
							Labor-Opt 4	4660.06		
							Total	**167926.54**	**Total**	**$242,817.29**
									NET	**$74,890.75**
Option 1, 2, 3, & 4 w/ grazing & subsidies One operator No Mrkt Limits	608.85 acres	19.70 acres	1.36 acres	9.37 acres	SC - 0.72acres	1612.90	Variable-Opt 1	72484.20	Corn	$74,233.00
							Variable-Opt 2	12724.62	Soybean	$61,588.67
							Variable-Opt 3	835.98	Wheat	$986.58
							Variable-Opt 4	755.62	F. Cabbage	$52,905.93
							Fixed-Opt 1	51338.23	S. Cabbage	$3,652.39
							Fixed-Opt 2	1661.11	Sunflower	$70.04
							Fixed-Opt 3	114.68	Windbreak	$927.16
							Fixed-Opt 4	850.79	SC	$18,967.08
							Transplanter	2000.00	Subsidy-Opt 1	$24,968.94
							PLI - Opt 2	500.00	Subsidy-Opt 2	$813.41
							PLI - Opt 3	500.00	Subsidy-Opt 3	$37.18
							Labor-Opt 1	13470.81	Cattle Grazing	$3,780.00
							Labor-Opt 2	5644.05		
							Labor-Opt 3	390.86		
							Labor-Opt 4	4687.83		
							Total	**167958.78**	**Total**	**$242,930.38**
									NET	**$74,971.60**
Option 1, 2, 3, & 4 w/ grazing & subsidies Two operators	608.85 acres	19.70 acres	1.36 acres	9.37 acres	SC - 0.36 acres	1616.74	Variable-Opt 1	72484.20	Corn	$74,233.00
					GW - 0.48 acres		Variable-Opt 2	12724.62	Soybean	$61,588.67
					BR - 0.06 acres		Variable-Opt 3	835.98	Wheat	$986.58

Table A5-1 – Linear Programming Analysis Results Cont.

Comparision	Option 1 Land	Option 2 Land	Option 3 Land	Option 4 Land Windbreak	Option 4 Land Woody Floal	Total Operator Labor Used (hrs)	Costs		Returns	
30% NE Mrkt							Variable-Opt 4	632.77	F. Cabbage	$52,905.93
							Fixed-Opt 1	51338.23	S. Cabbage	$3,652.39
							Fixed-Opt 2	1661.11	Sunflower	$70.04
							Fixed-Opt 3	114.68	Windbreak	$927.16
							Fixed-Opt 4	865.82	SC	$9,439.13
							Transplanter	2000.00	GW	$3,172.50
							PLI - Opt 2	500.00	BR	$315.00
							PLI - Opt 3	500.00	Subsidy-Opt 1	$24,968.94
							Labor-Opt 1	13470.81	Subsidy-Opt 2	$813.41
							Labor-Opt 2	5644.05	Subsidy-Opt 3	$37.18
							Labor-Opt 3	390.86	Cattle Grazing	$3,780.00
							Labor-Opt 4	4745.44		
							Total	**167908.57**	**Total**	**$236,889.93**
									NET	**$68,981.36**
Option 1, 2, 3, & 4 w/ grazing & subsidies Two operators 5% MW Mrkt	608.85 acres	19.70 acres	1.36 acres	9.37 acres	SC - 0.79 acres GW - 0.37 acres BR - 0.15 acres	1785.08	Variable-Opt 1	72484.20	Corn	$74,233.00
							Variable-Opt 2	12724.62	Soybean	$61,588.67
							Variable-Opt 3	835.98	Wheat	$986.58
							Variable-Opt 4	1032.60	F. Cabbage	$52,905.93
							Fixed-Opt 1	51338.23	S. Cabbage	$3,652.39
							Fixed-Opt 2	1661.11	Sunflower	$70.04
							Fixed-Opt 3	114.68	Windbreak	$927.16
							Fixed-Opt 4	900.29	SC	$20,745.99
							Transplanter	2000.00	GW	$2,482.49
							PLI - Opt 2	500.00	BR	$717.83
							PLI - Opt 3	500.00	Subsidy-Opt 1	$24,968.94
							Labor-Opt 1	13470.81	Subsidy-Opt 2	$813.41
							Labor-Opt 2	5644.05	Subsidy-Opt 3	$37.18
							Labor-Opt 3	390.86	Cattle Grazing	$3,780.00
							Labor-Opt 4	7270.53		
							Total	**170867.96**	**Total**	**$247,909.61**
									NET	**$77,041.65**

Table A5-1 – Linear Programming Analysis Results Cont.

Comparision	Option 1 Land	Option 2 Land	Option 3 Land	Option 4 Land Windbreak	Option 4 Land Woody Floal	Total Operator Labor Used (hrs)	Costs		Returns	
Option 1, 2, 3, & 4	608.85 acres	19.70 acres	1.36 acres	9.37 acres	SC - 1.60 acres	1992.34	Variable-Opt 1	72484.20	Corn	$74,233.00
w/ grazing & subsidies					GW - 0 acres		Variable-Opt 2	12724.62	Soybean	$61,588.67
Two operators					BR - 0 acres		Variable-Opt 3	835.98	Wheat	$986.58
No Mrkt Limits							Variable-Opt 4	1597.02	F. Cabbage	$52,905.93
							Fixed-Opt 1	51338.23	S. Cabbage	$3,652.39
							Fixed-Opt 2	1661.11	Sunflower	$70.04
							Fixed-Opt 3	114.68	Windbreak	$927.16
							Fixed-Opt 4	924.96	SC	$42,140.13
							Transplanter	2000.00	GW	$0.00
							PLI - Opt 2	500.00	BR	$0.00
							PLI - Opt 3	500.00	Subsidy-Opt 1	$24,968.94
							Labor-Opt 1	13470.81	Subsidy-Opt 2	$813.41
							Labor-Opt 2	5644.05	Subsidy-Opt 3	$37.18
							Labor-Opt 3	390.86	Cattle Grazing	$3,780.00
							Labor-Opt 4	10379.43		
							Total	**174565.95**	**Total**	**$266,103.43**
									NET	**$91,537.48**
Option 1, 2, 3, & 4	583.62 acres	20.68 acres	25.43 acres	9.37 acres	SC - 0.36 acres	2059.52	Variable-Opt 1	69480.13	Corn	$73,216.00
w/ grazing & subsidies					GW - 0.48 acres		Variable-Opt 2	13358.47	Soybean	$60,745.72
One operator w/ pt help					BR - 0.06 acres		Variable-Opt 3	15970.72	Wheat	$1,035.72
30% NE Mrkt							Variable-Opt 4	632.77	F. Cabbage	$55,541.32
							Fixed-Opt 1	49210.55	S. Cabbage	$68,304.83
							Fixed-Opt 2	1743.85	Sunflower	$1,309.85
							Fixed-Opt 3	2144.59	Windbreak	$927.16
							Fixed-Opt 4	865.82	SC	$9,439.13
							Transplanter	2000.00	GW	$3,172.50
							PLI - Opt 2	500.00	BR	$315.00
							PLI - Opt 3	500.00	Subsidy-Opt 1	$23,934.26
							Labor-Opt 1	12912.52	Subsidy-Opt 2	$853.88
							Labor-Opt 2	5925.20	Subsidy-Opt 3	$695.26

Table A5-1 – Linear Programming Analysis Results Cont.

Comparision	Option 1 Land	Option 2 Land	Option 3 Land	Option 4 Land Windbreak	Option 4 Land Woody Floal	Total Operator Labor Used (hrs)	Costs		Returns	
							Labor-Opt 3	7309.71	Cattle Grazing	$3,778.39
							Labor-Opt 4	4745.44		
							Hired Labor	1480.58		
							Total	**188780.35**	**Total**	**$303,269.02**
									NET	**$114,488.67**
Option 1, 2, 3, & 4	582.48 acres	20.72 acres	26.12 acres	9.37 acres	SC - 0.79 acres	2241.06	Variable-Opt 1	69344.83	Corn	$73,139.00
w/ grazing & subsidies					GW - 0.37 acres		Variable-Opt 2	13385.07	Soybean	$60,681.25
One operator w/ pt help					BR - 0.15 acres		Variable-Opt 3	16401.53	Wheat	$1,037.78
5% MW Mrkt							Variable-Opt 4	1032.60	F. Cabbage	$55,651.92
							Fixed-Opt 1	49114.71	S. Cabbage	$70,147.35
							Fixed-Opt 2	1747.32	Sunflower	$1,345.18
							Fixed-Opt 3	2202.44	Windbreak	$927.16
							Fixed-Opt 4	900.29	SC	$20,745.99
							Transplanter	2000.00	GW	$2,482.49
							PLI - Opt 2	500.00	BR	$717.83
							PLI - Opt 3	500.00	Subsidy-Opt 1	$23,887.50
							Labor-Opt 1	12887.37	Subsidy-Opt 2	$855.53
							Labor-Opt 2	5937.00	Subsidy-Opt 3	$714.12
							Labor-Opt 3	7506.89	Cattle Grazing	$3,775.94
							Labor-Opt 4	7284.61		
							Hired Labor	1906.85		
							Total	**192651.51**	**Total**	**$316,109.04**
									NET	**$123,457.53**
Option 1, 2, 3, & 4	583.06 acres	20.68 acres	25.32 acres	9.37 acres	SC - 1.10 acres	2398.34	Variable-Opt 1	69413.88	Corn	$73,141.00
w/ grazing & subsidies					GW - 0.47 acres		Variable-Opt 2	13356.42	Soybean	$60,681.23
One operator w/ pt help					BR - 0 acres		Variable-Opt 3	15901.92	Wheat	$1,035.56

Table A5-1 – Linear Programming Analysis Results Cont.

Comparision	Option 1 Land	Option 2 Land	Option 3 Land	Option 4 Land Windbreak	Option 4 Land Woody Floal	Total Operator Labor Used (hrs)	Costs		Returns	
No Mrkt Limits							Variable-Opt 4	1313.26	F. Cabbage	$55,532.78
							Fixed-Opt 1	49163.62	S. Cabbage	$68,010.56
							Fixed-Opt 2	1743.58	Sunflower	$1,304.00
							Fixed-Opt 3	2135.35	Windbreak	$927.16
							Fixed-Opt 4	922.13	SC	$28,982.37
							Transplanter	2000.00	GW	$3,110.28
							PLI - Opt 2	500.00	BR	$0.00
							PLI - Opt 3	500.00	Subsidy-Opt 1	$23,911.29
							Labor-Opt 1	12900.20	Subsidy-Opt 2	$853.88
							Labor-Opt 2	5924.28	Subsidy-Opt 3	$692.25
							Labor-Opt 3	7828.22	Cattle Grazing	$3,762.26
							Labor-Opt 4	9322.35		
							Hired Labor	2301.72		
							Total	**195226.93**	**Total**	**$321,944.62**
									NET	**$126,717.69**