Potential Use of the Conservation Security Program to Encourage Diverse Crop Rotations in Eastern South Dakota

by
Thomas L. Dobbs and Nicholas J. Streff*
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*Dobbs is a Professor of Agricultural Economics at South Dakota State University in Brookings, South Dakota. Streff is with the US Department of Agriculture's National Agricultural Statistics Service in Columbia, Missouri.

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Preface

This research report provides greater detail on research methods and data than a companion paper that we presented at the 2005 Annual Meeting of the American Agricultural Economics Association (AAEA). That paper, also authored by Thomas Dobbs and Nicholas Streff, is titled "Potential for the Conservation Security Program to Induce More Ecologically Diverse Crop Rotations in the Western Corn Belt". The AAEA paper contains a more extensive policy discussion of the implications of our empirical findings. It can be accessed at:

http://agecon.lib.umn.edu/cgi-bin/detailview.pl?paperid=16070.

As we have explained in the present report, our assumptions about implementation of the Conservation Security Program (CSP) were based on the original (2002) legislation and information that was available by early 2004, before rules and payment rates were finalized for the first CSP signup. Actual implementation rules in the initial signup in 2004 and subsequent signups have differed from our assumptions in some important respects. We deal briefly with some of those differences in the AAEA paper cited above. An internship paper by Pauline Lenormand, a student from the École Nationale Supérieure Agronomique de Toulouse (France), contains an examination of CSP implementation rules for the second signup, which took place in 2005. Lenormand compared rules and payment rates in eligible South Dakota watersheds with rules and rates that were assumed for the analyses in our AAEA paper and the present research report. Her unpublished internship paper—"Implementation of the USA Conservation Security Program of the 2002 Farm Bill"—was supervised by Thomas Dobbs, and is available from him at: Thomas.Dobbs@sdstate.edu.

The research on which this report is based was supported by the South Dakota State University Agricultural Experiment Station, under the Economics Department project "Agri-environmental Policy Options and Implementation Based on Multifunctionality". We appreciate the careful review of a draft version of this report by Dr. Gary Taylor. However, any remaining mistakes or shortcomings of the report are our responsibility.

TLD and NJS
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I. Introduction

A central concern in many discussions of ecological sustainability in agricultural regions of the U.S. Midwest and Great Plains is that of crop system diversity. Many factors have contributed to the loss of crop system diversity over that last half-century (Dumke and Dobbs), one of which is public policy. The U.S. Farm Security and Rural Investment Act of 2002 ('2002 Farm Bill') provided for a new agri-environmental program that could have potential to help restore some of the crop system diversity that has been lost. The Conservation Security Program (CSP) is that program. This report, drawn from a Master of Science in Economics thesis by one of us (Streff), contains results of an examination of the CSP's potential to help induce more crop system diversity in southeastern South Dakota (SD).

The Conservation Security Program (CSP)

The CSP is an agri-environmental program intended to provide financial and technical assistance to producers who advance the conservation and improvement of soil, water, air, energy, and plant and animal life—as well as other conservation purposes—on Tribal and private working lands. The US Secretary of Agriculture's vision for the CSP was spelled out as follows:

> (1) To identify and reward those farmers and ranchers meeting the very highest standards of conservation and environmental management on their operations;
>
> (2) To create powerful incentives for other producers to meet those same standards of conservation performance on their operations; and
>
> (3) To provide benefits for generations to come (NRCS, 2004, p. 10).

The CSP established three tiers in which farmers could enroll land. A Tier 1 contract would consist of a maximum annual payment of $20,000, and a 5-year contract that is renewable for 5 to 10 years with a possible upgrade to a higher tier level. Tier 1 would require only partial farm enrollment, and the farmer would address one significant resource of concern for the enrolled portion of land. A Tier 2 contract would have a maximum annual payment of $35,000 and a 5 to 10-year contract that is renewable for up to 10 years. Tier 2 would require whole farm enrollment and would need to address at least one significant resource of concern for the entire operation. A Tier 3 contract would have a maximum annual payment of $45,000 with a 5 to 10-year contract that is renewable for up to 10 years. A Tier 3 contract would requires whole farm enrollment, and the farmer would have to apply a resource management system that addresses all resources of concern for the entire operation. Annual payments for each tier level are to consist of base payments, cost share payments, and enhanced payments. The payment rates would vary for each tier level (NRCS, 2003b).

<u>CSP assumptions for this study</u>

At the time the thesis on which this report draws was being completed in the spring of 2004, only the proposed CSP "rule," from the *Federal Register*, was available for study. The proposed "rule" was published on January 2, 2004, and had a 60-day comment period that ended March 2, 2004. This proposed "rule" was a general outline of the CSP program. It identified five options for implementation of the CSP. The alternatives ranged from changing the rates for base and cost share payments to limiting the CSP enrollment to specific geographic regions in order to stay within budgetary constraints set for the CSP. For our analysis, the original framework for the CSP as designated in the 2002 Farm Bill and information from the proposed "rule" were used to develop the majority of the assumptions for the CSP.

Study purpose

The overall purpose of this study was to analyze the incentives in the Conservation Security Program for developing longer, more ecologically sustainable crop rotations for farming systems in the Western Corn Belt. Specific research objectives were to:

1) Develop a "representative" farm model for southeastern South Dakota, including "typical" and alternative, longer crop rotations.
2) Analyze the economic incentives for the operator of a "representative" southeastern South Dakota farm to use the CSP for longer crop rotations.

II. The Study Region in Eastern South Dakota

The study area lies in southeastern South Dakota, covering much of the Big Sioux Aquifer (Figure 1). This area constitutes a major portion of the Big Sioux River drainage area in South Dakota. The aquifer underlying the Big Sioux River provides drinking water for a large portion of the state's population. Therefore, agricultural practices that potentially affect the river and underlying aquifer are of great interest to both farmers and the general public (Dobbs and Carr). This area is on the edge of the Western Corn Belt, with corn and soybeans being the dominant crops (Dumke and Dobbs).

Major crops

The six counties that were included in the study area are Moody, Minnehaha, Lincoln, Turner, Union, and Clay. Major crops grown in the six-county area during the last 5 years are shown in Figure 2. The major crops are corn and soybeans, and there also is a small but significant proportion of cropped land planted to alfalfa. The numbers represent the 5-year average (1997-2001) of the acres harvested for these crops. This is the average based on the total acres covered by these specific crops and does not include all cropland in the study area or pastureland. An earlier study by Dobbs and Carr detailed the profiles of Moody and Minnehaha Counties, which are the two northern counties in our study area. Dobbs and Carr showed that corn had been a major crop in these two counties since at least the 1950s. Soybeans did not become a major crop until the 1980s. Small grain acreage diminished significantly over the same time period.

Figure 1. Big Sioux River and Study Area

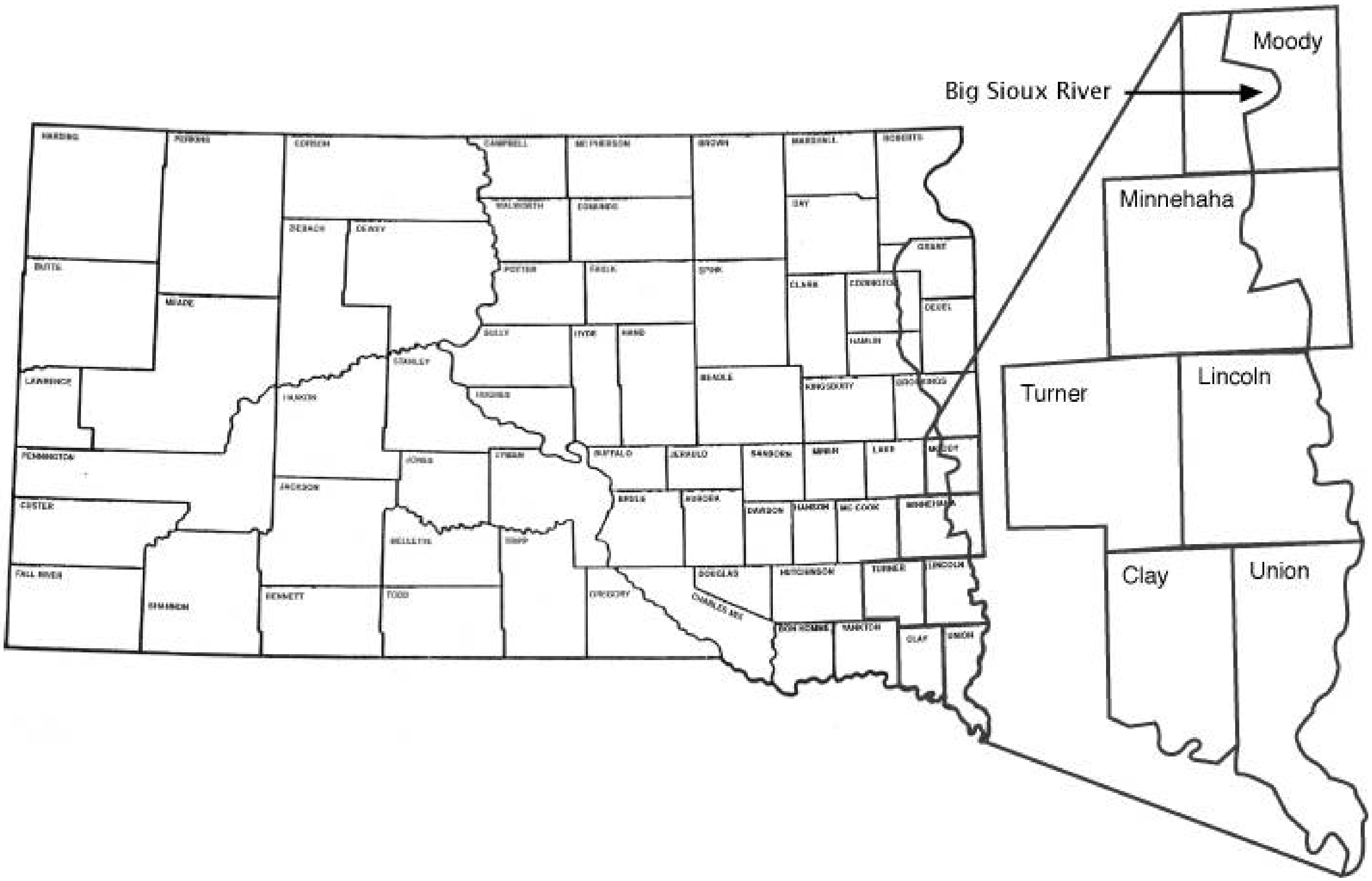
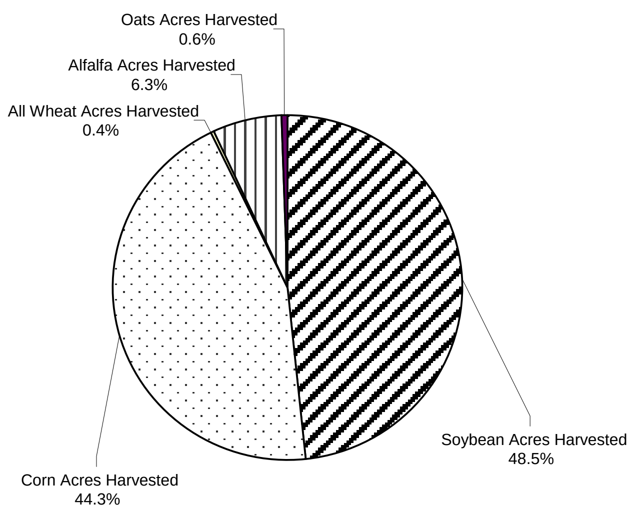


Figure 2. Six-County Study Region Profile:

1997-2001 Average Acres Harvested



Source: SDASS 1998-2002

Soybeans had the largest proportion of harvested acres in the study area in 1997-2001, with a 5-year average of nearly 49 percent (Figure 2). Corn was the second most common crop, accounting for 44 percent of the total acres harvested. Alfalfa had the third largest 5-year average, at 6 percent. For small grains, oats had a 5-year average of less than 1 percent. Wheat did not account for a significant number of harvested acres, but nonetheless was included in the analysis. Wheat acres expanded some in Moody County during the 1970s when wheat prices rose significantly (Dumke and Dobbs), and wheat continues to have good agronomic potential for crop rotations in southeastern SD that include small grains.

Farm sizes

The average farm size for the study area was determined using 1997 Census of Agriculture data for South Dakota (data from the 2002 Census had not yet been released when the profile was constructed). The average farm size for each county is presented in Table 1. Using the total acres of land in farms and the total number of farms for the six-county area, an average farm size of 438 acres was established. However, farms with 260 to 499 acres represent only 20 percent of the farms and 17 percent of the land within the study area. To capture a larger portion of land within the study area, the “representative” farm size range was assumed to be 500-1,999 acres. Based on 1997 Census of Agriculture data, this range captures almost 30 percent of the number of farms and over 60 percent of the land within the study area.

Table 1. Study Region Farm Size Analysis, by County

	Minnehaha	Moody	Clay	Lincoln	Turner	Union	Total
Number of Farms	1125	549	397	806	832	494	4203
Land in Farms	406280	283783	225902	318707	352353	254028	1841053
Farm Size	361	517	569	395	424	514	438
Farm Size Analysis							
Farms w/ 260-499 Acres	204	119	81	161	188	92	845
Total Acres	77555	43119	30495	60507	68983	33517	314176
Percent of Total Farms	18.13%	21.68%	20.40%	19.98%	22.60%	18.62%	20.10%
Percent of Total Acres	19.09%	15.19%	13.50%	18.99%	19.58%	13.19%	17.07%
Farms w/ 500-999 Acres	175	114	105	155	194	107	850
Total Acres	120997	80332	76186	105200	133378	74593	590686
Percent of Total Farms	15.56%	20.77%	26.45%	19.23%	23.32%	21.66%	20.22%
Percent of Total Acres	29.78%	28.31%	33.73%	33.01%	37.85%	29.36%	32.08%
Farms w/ 1000-1999 Acres	83	72	54	66	64	68	407
Total Acres	107976	98604	72339	82778	86734	89587	538018
Percent of Total Farms	7.38%	13.11%	13.60%	8.19%	7.69%	13.77%	9.68%
Percent of Total Acres	26.58%	34.75%	32.02%	25.97%	24.62%	35.27%	29.22%
Farm w/ 2000+ Acres	19	10	12	9	7	14	71
Total Acres	48528	36049	29590	25872	23140	34877	198056
Percent of Total Farms	1.69%	1.82%	3.02%	1.12%	0.84%	2.83%	1.69%
Percent of Total Acres	11.94%	12.70%	13.10%	8.12%	6.57%	13.73%	10.76%
Grouping Farm Sizes*							
Farms w/ 500-1999 Acres	258	186	159	221	258	175	1257
Total Acres	228973	178936	148525	187978	220112	164180	1128704
Percent of Total Farms	22.93%	33.88%	40.05%	27.42%	31.01%	35.43%	29.91%
Percent of Total Acres	56.36%	63.05%	65.75%	58.98%	62.47%	64.63%	61.31%

* Farms with 259 acres of land or less are not shown here, but the percentage calculations are based on all farms, including those in the smallest category.
Source: NASS 1997 Census of Agriculture

Based on the above information, the average farm size of 438 acres does not sufficiently represent the farms within the study area. The Census data suggest that a farm between 500 and 1,999 acres provides a more complete representation of the study area. A 1,000-acre farm was determined to best represent the study area.

The 1997 Census of Agriculture data also suggested that the typical farm in the study area did not have a livestock enterprise. The data indicated that 34 percent of the 4,203 farms in the study area had beef cattle and only 14 percent of the farms had swine included as part of the operation.

Using 1997 Census of Agriculture and National Agricultural Statistics Service data, a “representative” farm for the study area was determined to have 1,000 cropland acres and no livestock enterprises. Based on cropland acres planted and harvested data of the major crops in the study area (Figure 2), soybeans and corn are the two major crops for the area, covering 93 percent of the cropland harvested based on the 1997-2001 average of the major crops. Alfalfa was a distant third, accounting for 6 percent of the land under major crops within the six-county region, and oats and wheat acreage each made up less than 1 percent.

III. Methods for Representative Farm Analysis

The "representative" farm for the study region was developed using the study region profile presented in section II, previous SDSU research, SDSU Extension Economist expertise, County Extension Educator interviews, and interviews with farmers. Although the size of the farm has now been specified, other features of the "representative" farm—such as crop rotation and tillage practices—also had to be specified. The following information covers the steps taken to develop the "representative" farm and the associated enterprise budgets.

The 'representative farm'

The "representative" rotation for the study region was determined to be a corn and soybean rotation. The need for small grains and forage has declined, since most of the farmers within the study area do not have livestock enterprises. In addition, commodity prices and Federal farm program payments for cash crops such as soybeans and corn have been appealing to many producers.

"Conventional tillage," used by the majority of farmers in the study region, was determined to be a tillage system consisting of chiseling corn stalks and small grain stubble after fall harvest and either field cultivating or disking soybean and wheat residue in the spring as needed to incorporate fertilizer and herbicides during seedbed preparation. Conventional tillage, as defined for this study, does not include a moldboard plow. Interviews suggested that no-till farming systems are also frequently used, especially when planting soybeans. In the case of the corn-soybean rotation, drilled soybeans, which include soybeans planted in less than 30-inch rows with a no-till drill or air seeder, were just as common as conventionally planted soybeans in 30-inch rows in some parts of the study area. We decided to include both a conventionally rowed soybean system and a system in which soybeans are no-till drilled in 15-inch rows.

The tillage system of a farm can play a large role in the bottom-line for the operation, but with the increased use of genetically modified organisms (GMOs) in seed varieties, the seed type can also play a role in the profitability of the operation. The primary types of seeds planted in the study region are varieties of GMO corn and GMO soybeans. Results of interviews indicated that Bt corn, which includes a gene that makes the plant produce a substance that kills the European corn borer, was the most common type of corn planted. Roundup Ready (RR) soybeans, which have an added gene that inhibits the effects of the quickly-degrading Roundup herbicide, was the most commonly planted soybean seed variety in the study region.

Use of 'Cost and Returns Estimator' (CARE) program

The assumptions for yields, prices, machinery use, and land charges were entered into the Cost and Returns Estimator (CARE) program to calculate each crop's enterprise budget. CARE was developed by the USDA's Natural Resource Conservation Service, and is designed to evaluate the costs and returns for growing a specific crop or crop rotation. Other cost assumptions such as interest costs, insurance costs, pesticide costs and application amounts, fuel costs, and management costs were obtained from budgets developed by Peterson. When budgets needed to be altered with respect to fertilizer, recommendations were obtained from Gerwing and Gelderman.

Repair costs for machinery were based on long-run average repair costs; that is, the estimated total repair cost over the life of a machine was divided by its total hours of use. This number was used to calculate the repair cost per acre. As a result, these budgets likely overstate repair costs for newer machines and understate repair costs for older machines. The algorithms used for calculating machine costs were developed by the American Society of Agricultural Engineers, and the prices used for those algorithms were obtained from Lazarus and Selley.

An enterprise budget was developed for each crop. In some cases, a specific crop had multiple budgets, differing with each rotation. Input costs such as fertilizer expense sometimes vary for a single crop with multiple budgets, depending in part on the fertilizer credits from previous crops in the rotation. Yield and price assumptions for each crop did not vary with rotation, except for the organic system prices and yields, which were adjusted based on results of previous studies.

Alternative and organic crop rotations

After formulating the "representative" farm for the study region and a baseline rotation, alternative and organic crop rotations were formulated for CSP analyses and comparisons with baseline systems. The alternative and organic rotations include rotations of various lengths and crop mixes. Information from County Educator and farmer interviews, together with data from SDSU's Southeast South Dakota Experiment Farm, were used to specify alternative rotations. The alternative and organic rotations were compared to the baseline corn-soybean rotation, to measure profitability and the potential effects of CSP payments.

Winter wheat was added to the corn-soybean rotation to make it a 3-year rotation. A similar 3-year rotation was developed using spring wheat. Although winter and spring wheat are not major crops in the study region—nor have they been over most of the last 50 years (Dobbs and Carr)—the comments from interviewees suggested that if small grains were added to the corn and soybean rotation, wheat would be the first choice. There was no clear preference between spring and winter wheat. The corn-soybeans-spring wheat rotation models a rotation that is being studied at the Southeast Experiment Farm.

Alfalfa was included in several rotations. Alfalfa represents the third largest crop acreage harvested in the study area. Research has shown that alfalfa sometimes enhances the profitability of farming systems (Henning and Dobbs, Mends and Dobbs). Alfalfa also is included in current rotation studies at the Southeast Experiment Farm. Alfalfa was both straight-seeded and planted with a nurse crop in the enterprise budgets, because interview data and past research did not provide a clear consensus about how alfalfa is typically planted in the study area. Oats and spring wheat were used as nurse crops for alfalfa in the rotations we analyzed.

Oats represent the largest acreage harvested for any small grain in the study region. Oats account for less than 1 percent of the harvested acres in the study area (of the six major crops considered). County Educators and farmers indicated that oats are primarily used as a nurse crop for alfalfa.

Organic rotations also were developed for analysis. The organic rotations were developed in part from recent studies in Minnesota and Iowa. In the Minnesota study, Porter et al. compared 2 and 4-year crop rotations. The rotations included a 4-year corn-soybean-oat/alfalfa-alfalfa organic rotation. The Iowa study included a similar 4-year rotation (Delate et al.). Both studies concluded that organic rotations are competitive with conventional corn-soybean rotations under normal growing conditions. Porter et al. concluded that while there was a reduction in both corn and soybean yields in the 4-year organic rotation compared to a conventional 2-year corn-soybean rotation, the organic rotation had lower production costs than the conventional rotation; consequently, net returns for the two rotations, without taking into account organic price premiums, were roughly equivalent. The results of Porter et al. and Delate et al. are consistent with those of several other studies conducted at land-grant universities in the Midwest, and suggest that organic production systems can be competitive with conventional production systems under at least some conditions.

The baseline, alternative, and organic rotations that were analyzed are listed in Table 2. The rotations ranged in length from the 2-year corn-soybean rotation used as the baseline to an 8-year oats/alfalfa-alfalfa-alfalfa-alfalfa-corn-soybeans-corn-soybeans rotation. Some rotations included both GMO and non-GMO seed varieties. Only one rotation, baseline 2, had no-till soybeans; otherwise, all rotations with soybeans were assumed to be planted with a min-till planter in 30-inch rows. The organic rotations follow National Organic Program guidelines and practices commonly accepted for organic certification—the use of manure for fertilization, no synthetic chemical pesticides or insecticides, and use of certified organic seed (non-GMO).

Table 2. Baseline, Alternative, and Organic Rotations Evaluated

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Baseline Rotations*

Baseline 1 Corn-Soybeans
--Soybeans planted in 30-inch rows

Baseline 2 Corn-Soybeans
--Soybeans planted w/ no-till drill in 15-inch rows.

Alternative Rotations*

A. Corn-Soybeans-Spring Wheat

B. Corn-Soybeans-Winter Wheat

C. Alfalfa-Alfalfa-Alfalfa-Alfalfa-Corn-Soybeans-Corn-Soybeans

D. Oats/Alfalfa-Alfalfa-Alfalfa-Alfalfa-Corn-Soybeans-Corn-Soybeans
--This rotation is evaluated with both GMO and conventional seed varieties.

E. Alfalfa-Alfalfa-Alfalfa-Corn-Soybeans-Winter Wheat
--This rotation is evaluated with both GMO and conventional seed varieties.

F. Spring Wheat/Alfalfa-Alfalfa-Alfalfa-Alfalfa-Corn-Soybeans
--This rotation is evaluated with both GMO and conventional seed varieties.

G. Oats/Alfalfa-Alfalfa-Alfalfa-Corn-Soybeans-Corn

Organic Rotations**

A. Corn-Soybeans-Oats/Alfalfa-Alfalfa

B. Corn-Soybeans-Oats/Alfalfa-Alfalfa-Alfalfa

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*Baseline and alternative rotations use GMO seed varieties unless otherwise noted.

**Organic rotations use certified organic seed varieties.

Major budgeting assumptions

Budgeting assumptions about machinery costs, crop prices, yields, and land charge were as follows.

Machinery costs. It was assumed, regardless of rotation, that the same size and type of implement would be used for any given tillage practice. We also assumed that an implement would be used for the same number of acres or hours per year, regardless of rotation. This was done to isolate differences in enterprise costs due to differences in tillage practices, rather than to differences in efficiency of machinery use. In other words, costs per acre of any given machinery operation (such as disking corn stubble) were assumed to be the same wherever the operation was applicable, regardless of the crop rotation. Machine costs for fall tillage operations were included in costs for crops planted and harvested in that same calendar year. Lazarus and Selley provided the information for machinery replacement costs and labor charges used in the enterprise budgets.

Prices. The crop price assumptions were based on data from May and Diersen (2003). The prices used in the enterprise budgets were the South Dakota 5-year (1997-2001) average prices for each commodity, since 2001 was the most recent year with complete price data available at the time calculations were made. The prices used in the enterprise budgets are shown in Table 3.

In the case of the organic rotations, an organic premium is included in some of the selling prices for organically produced crops. Streff and Dobbs reported price comparisons for organically grown crops and conventionally grown crops. An organic farm price-to-South Dakota cash price ratio was established for corn, soybeans, and oats from 1998 through 2002. The organic prices used for the enterprise budgets were calculated by taking the 5-year average organic farm and South Dakota cash price ratios and applying the ratios to the conventional prices used in the enterprise budgets. The organic premiums were discounted to account for the 3-year transition period required for a farmer to become certified organic, at which time they are eligible for the organic premium. Based on a 10-year time frame, a farmer transitioning from conventional to organic practices would be eligible for the organic premium 8 of 10 years, or 80 percent of the time. Therefore, the prices used for organic crops reflected the assumption that conventional prices would be received 20 percent of the time. Organic prices shown in Table 3 reflect that transition period adjustment. Table 4 shows the organic farm-to-South Dakota cash price ratios.

Yields. A 5-year average per acre yield was calculated for each crop in the study region. This 5-year average was used as the per acre yield in each crop's enterprise budget. With the exception of organic systems, the yield for each crop was assumed to be the same for each rotation, which means corn in the baseline rotation yields the same as corn in an 8-year rotation. Also, it was assumed that yields are the same in different tillage systems. The yields for each crop are presented in Table 3.

Table 3. Crop Yield and Price Assumptions

Crop	Yield (bu/ac)	Price ($/bu)
Corn	124	$1.75
Soybeans	37	$4.77
Spring Wheat	44	$3.03
Spring Wheat/Alfalfa*	32	$3.03
Winter Wheat	46	$2.59
Oats/Alfalfa	67	$1.30
Organic Corn	112	$3.30
Organic Soybeans	31	$12.47
Organic Oats	67	$2.07
	Tons/ac.	**Price $/ton.**
Alfalfa Yr. 1**	1.50	$66.00
Alfalfa Yr. 2-3	4.50	$66.00
Alfalfa Yr. 4	4.00	$66.00
Organic Alfalfa Yr. 1***	no-cutting	--
Organic Alfalfa Yr. 2-3	4.05	$66.00

*Spring wheat seeded with alfalfa – only spring wheat is harvested
**Alfalfa straight seeded or with oats has the same yield – Alfalfa Yr.1
***Organic alfalfa is seeded with oats – only the oats are harvested in Org. Alfalfa Yr.1

Table 4. Organic Farm-to-South Dakota Cash Price Ratios 1998-2002

Crop	Ratio
Corn	2.106
Soybeans	3.016
Oats	1.740

Source: Streff and Dobbs

Porter et al. indicated that organically grown corn yields were, on average, 92 percent of the conventionally grown corn yields in their study. Also, their organically grown soybean yields were approximately 83 percent of conventional yields. Porter et al. also found that organic alfalfa yield was 92 percent of the conventional yield, but organic oats yields were similar to conventional yields. The average organic corn yield reported in Delate et al. was 96 percent of the conventional yield, and the average organic soybean yield was higher than the conventional yield. To present a conservative approach to the organic rotations, we utilized ratios similar to those of Porter et al.—90 percent for corn and alfalfa and 84 percent for soybeans. The yields for each organic crop are presented in Table 3.

Land charge. The land charge used for the enterprise budgets was the 2003 average cropland cash rental rate for the six-county area as reported by SDASS (2003), approximately $90 per acre. Our analysis compares each crop rotation's profitability on the same "representative" farm, assuming land charges and other land ownerships costs are not affected by the rotation selected.

IV. Policy Assumptions for Analyses

Prior to conducting the analyses, policy assumptions had to be established. These assumptions are described next, first for so-called ‘commodity program’ provisions and then for the CSP.

Commodity program assumptions

Since this study focused on the potential incentives for a “representative” farmer to switch from a baseline rotation to an alternative or organic rotation, Federal farm program payments assumptions—which include direct payments (DPs), counter-cyclical payments (CCPs), and loan deficiency payments (LDPs)—had to be the same for all rotations developed and analyzed. The 2002 Farm Bill left producers with several options to update base acres and payment yields used for certain commodity program payments. For this analysis, the producer was assumed to update his or her base acres and payment yields with the baseline rotation of corn or soybeans in mind.

Direct payments. Direct payments are decoupled from current prices and production and are determined by the base acres and base yields. DP rates are per bushel payments that were to remain fixed over the life of the 2002 Farm Bill. We assumed that the base acres were updated to reflect the average acres planted, plus those prevented from planting due to weather conditions, during crop years 1998-2001. In the case of the “representative” farm with a corn-soybean rotation, a base of 500 acres of corn and 500 acres of soybeans was assumed.

The payment yield for the “representative” farm for corn was obtained from Farm Service Agency (FSA) data for the study region. The corn payment yield was determined to be 85 bushels/acre. The soybean payment yield was derived as outlined in the FSA Direct Payment guidelines. That yield (29 bushels/acre) was calculated as the 1998-2001 average yield for the study region, backed up to equivalent 1981-1985 yields, or approximately 78 percent of the current yield.

Counter-cyclical payments. Counter-cyclical payments are available for covered commodities whenever the effective price is less than the target price. Target prices were fixed for 2002-2003, and rose for most commodities for 2004-2007. The payment amount is equal to the product of the payment rate, the payment acres (85 percent of base acres), and the payment yield. The payment rate for a commodity is the target price minus [(the higher of the average national loan rate or the average national yearly price) plus the direct payment]. CCPs are intended to support and stabilize farm income when commodity prices are less than target prices.

According to the FSA data, most South Dakota farmers updated their based acres according to the 1998-2001 average acreage planted. Most South Dakota producers also chose to update their counter-cyclical payment yields to 93.5 percent of the farm's 1998-2001 average yields. The base acres for corn and soybeans remained the same, at 500 acres each, but the base yields were updated to 93.5 percent of the 1998-2001 average corn and soybean yields for the study region. Assuming the operator of our representative farm did the same, the payment acreage base was 500 acres each of corn and soybeans, and payments were based on 85 percent of those acreages. CCP yields were 121 bushels for corn and 35 bushels for soybeans.

Loan deficiency payments. LDPs are coupled to current production and prices. Producers can take LDPs any day after harvesting their crop and before losing beneficial interest in the commodity. The LDP is equal to the loan rate minus that day's posted county price (PCP). In the case of our "representative" farm, the PCP for each commodity was assumed to be the same as the 5-year average (non-organic) price used in the enterprise budgets (Table 3). The loan rates used to determine the LDPs were the average 2002 loan rates for the six-county area that we obtained from FSA data. We assumed that the operator of the representative farm received an LDP for a commodity if the loan rate was greater than the PCP.

Conservation Security Program assumptions

Payments for the CSP consist of three types. First, there is a base payment. The base payment was supposed to be based on the average national per acre rental rate for a specified use during 2001 or an appropriately adjusted rate to ensure regional equity (NRCS, 2004).

The second portion of a CSP payment was to be derived from the average county cost of adopting or maintaining the practice for the 2001 crop year. Average county costs were to be determined by the US Secretary of Agriculture. A cost share payment could cover up to 75 percent (up to 90 percent for beginning farmers) of the cost of maintaining or implementing a practice (NRCS, 2004).

The third portion of a CSP payment is an "enhanced payment." Enhanced payments were to be determined by the Secretary and involve payments for producers who exceed contract expectations, such as by participating in on-farm conservation research (Duffy; NRCS, 2004).

CSP framework. In establishing our CSP assumptions, we used tier definitions and base payment levels as specified in the original legislative language. We applied the CSP to each alternative and organic rotation, but not to the baseline rotations. The CSP payment rates varied for each rotation because the rotations were assumed to be enrolled in different tiers.

Base payments were to be derived from the 2001 average national per-acre rental rate or a related regional or local rate to prevent geographical bias. According to legislation, the base payment for Tier 1 was to be 5 percent of the rental rate, but the payments could not exceed $5,000. The base payment for Tier 2 was to be 10 percent of the rental rate, not to exceed $10,500. The base payment for Tier 3 was to be 15 percent of the rental rate, not to exceed $13,500 (NRCS, 2003b).

For our analyses, the 2001 average cropland cash rental rate for the six-county area (as published by the SDASS) was used. This was $84 per acre. The legislative language specified that 2001 data would be used for the life of the program regardless of the actual year (NRCS, 2003b).

Each rotation (other than the baseline rotations) was enrolled in Tier 1, 2, or 3, based on definitions set forth in the CSP legislation and assumptions that we made about the potential environmental gains each rotation might provide. A Tier 1 contract would receive a base payment per acre enrolled equal to 5 percent of the $84 rental rate, or $4.20 per acre. A Tier 2 contract base payment would be equal to 10 percent of the $84 rental rate, or $8.40 per acre. A Tier 3 contract would receive a base payment equal to 15 percent of the $84 rental rate, or $12.60 per acre.

The base payments rates were subject to change by the time CSP rules were finalized. Our assumed payment rates were based on the original CSP legislation. Alternatives that were under consideration implied substantially lower base payments (NRCS, 2003a). In fact, rules used in initial CSP signups have not allowed base (now called "stewardship") payment rates as high as allowed in the legislation and assumed in our analyses.

According to the CSP legislation, both costs of new practices and costs of maintaining existing practices can be eligible for cost share payments (NRCS, 2003b). Although the cost share payments were under review by policymakers when our analyses were conducted, and the payments could be reduced to only 5 percent cost share, we assumed 75 percent cost share as allowed in the original legislative language. The cost share payments were applied only to rotations that contain alfalfa, since the establishment costs for alfalfa tend to be relatively high. The cost share payments for alfalfa included only the establishment costs. Establishment costs include spring tillage operations, fertilizer, seed, and planting. We assumed that a farmer participating in the CSP would receive a payment equal to 75 percent of the alfalfa establishment costs.

Enhanced payments, according to the CSP legislation, may be provided if the CSP's activities will increase conservation performance as a result of additional effort made by the producer that: improves a resource of concern to a condition that exceeds the minimum eligibility requirements for the participant's tier of participation or for other actions; addresses local conservation priorities in addition to the concerns for the agricultural operation; or involves the producer in research and demonstration projects, cooperation with other producers to implement watershed or regional conservation plans covering at least 75 percent of the targeted area, or assessment and evaluation activities relating to practices included in a conservation security plan. Rates for the enhanced payments had not been determined at the time our analyses were conducted. Therefore, we did not include them. Although farmers adopting some of our alternative and organic systems might be eligible for enhanced payments, without clear guidelines for estimating payment rates at the time of our analyses, a defensible method for specifying payment rates could not be established.

Resources of concern. A CSP contract must address resource concerns faced by a farm operation. Resource concerns may include, but are not limited to: soil erosion, water quality/quantity, air quality (wind erosion), animal grazing productivity, or wildlife (NRCS, 2003a). The main resource concerns outlined in the proposed "rule" were water quality/quantity and soil erosion. To achieve the goal of maintaining the resource of concern at a non-degradation standard, which means maintaining the resource at a level adequate to protect and prevent degradation, the producer may employ any number of conservation practices outlined and approved by the NRCS. The proposed "rule" asserted that the CSP might be limited to sensitive aquifer areas (such as the Big Sioux Aquifer). However, in our analyses, we assumed that the CSP would not be limited to particular geographic areas or specifically to soil and water concerns.

In our study, we were concerned with the conservation practice of a resource-conserving crop rotation. We assumed that alternative and organic rotations would fall within the guidelines for a resource-conserving crop rotation. A resource-conserving crop rotation or conservation crop rotation is defined as a crop rotation that includes at least one resource-conserving crop, reduces erosion, improves soil fertility and tilth, interrupts pest cycles, and reduces depletion of soil moisture (Harkin et al.). By definition, this means growing various crops in a planned sequence. This sequence may involve growing high residue producing crops such as corn or wheat in rotation with low residue producing crops such as vegetables or soybeans, as stated in the NRCS Field Office Technical Guide (FOTG).

Alternative rotations A and B may not qualify as resource-conserving crop rotations, since they may not have a large or diverse enough crop mix to provide sufficient environmental benefits. However, we assumed that rotations A and B each would be eligible for a Tier 1 CSP contract. Alternative rotations C through G and the organic rotations that we considered, in our view, clearly should be considered resource-conserving rotations. Alternative rotations C through G were assumed to be enrolled in Tier 2 CSP contracts. Organic rotations were assumed to address all resources of concern for the operation, resulting in Tier 3 CSP contracts.

V. Results

Results of the rotation analyses are shown for various income definitions, from 'net income without Government payments' to 'net income with all Government payments'. Impacts on net income of adding CSP payments are shown explicitly.

The same farm program assumptions were applied to each rotation analyzed. The rotations all were applied to the same 1,000-acre "representative" farm that was described in Section III. In the following presentation, results are presented on a 'per acre' basis, derived from the 1,000-acre representative farm.

A spreadsheet model was developed to allow all rotations to be compared on a systematic basis. Analyses started with the enterprise budgets for each individual crop. Each budget was generated from the CARE program and applied to the same 1,000-acre "representative" farm. The crops in each rotation were divided equally on the cropland of this farm. In the case of the baseline rotation, only corn and soybeans were produced, which means there were 500 acres of corn and 500 acres of soybeans planted. The longer rotations have less corn and soybeans. For example, rotation D, which is an 8-year crop rotation, has only 250 acres each of corn and soybeans and 125 acres for each stage of alfalfa development. The spreadsheet produced an average per acre net return for that specific rotation.

The terms used to analyze profitability of rotations must now be explained. Net income without Government payments (NI w/o Govt payments) refers to the net return generated only from the sale of the crops in the rotation. Net income with program payments (NI w/ prog payments) includes income generated from the sale of the crops plus any payments received from DPs, CCPs, or LDPs. Net income with all Government payments (NI w/ all Govt payments) includes all of the above plus any payments received from the CSP.

Farm program payments in the rotation are shown on a per acre basis. The direct and counter-cyclical payments were calculated based on the assumptions presented in Section IV. The DP was $15.54 per acre and the CCP was $18.98 per acre for each rotation, when baseline crop prices were used. The payments remained the same for each rotation, since the same 'base acres and yields' were assumed for each rotation. In other words, even if a farmer operating the "representative" farm changes rotations, the DP and CCP calculations for that farm do not change.

The LDPs for each rotation also are shown on a per acre basis. The LDPs resulted from the eligible crops assumed to be grown in each rotation. As previously stated, prices used for analyses were the 5-year average prices for each crop. With these prices, corn, soybeans, oats, and winter wheat were eligible for LDPs. Winter wheat had the highest per bushel LDP of $.26, or $11.96 per acre. Corn produced in the non-organic rotations had a $.05 per bushel LDP, or $6.20 per acre, and non-organic-soybeans received an LDP of $.06 per bushel, or $2.22 per acre. The LDP for oats was $.05 per bushel, or $3.35 per acre. Spring wheat was the only crop not eligible for an LDP when baseline crop prices were assumed, since the PCP was greater than the loan rate.

LDPs for organically produced crops are generally less than the conventionally produced crops on a per acre basis. Organically produced crops are eligible for LDPs even if the farmer receives a premium for the crop. Organically produced crops received the same per bushel payment, but since the yields for some organically produced crops were assumed to be less than the non-organic yields, the LDPs per acre were less.

LDPs for each crop are shown in the Table 5. The PCP is the 5-year average price that was used in the enterprise budgets. The loan rate represents the average 2002 loan rate for the study region.

Table 5. Loan Deficiency Payment Calculations

Crop	PCP $/bu	Loan Rate $/bu	LDP $/bu	Yield bu/ac	LDP $/ac
Corn	$1.75	$1.80	$.05	124	$6.20
Soybeans	$4.77	$4.83	$.06	37	$2.22
Winter Wheat	$2.59	$2.85	$.26	46	$11.96
Oats	$1.30	$1.35	$.05	67	$3.35
Org Corn	$1.75	$1.80	$.05	112	$5.60
Org Soybeans	$4.77	$4.83	$.06	31	$1.86
Org Oats	$1.30	$1.35	$.05	67	$3.35

Baseline analysis

Baseline rotations 1 and 2 were the rotations developed from the study region profile and County Educator and farmer interviews. These rotations represent the rotations that are mostly likely to be grown within the study region and serve as the basis for comparison to other rotations. They provide a basis for the estimated returns for a "representative" farm in the study region.

Table 6 contains a summary of the economic results for all of the crop systems analyzed, including the baseline 1 and 2 reference rotations. Results are shown for net income without Government payments and net income with commodity-related program payments. 'Commodity payments' are also broken down into DPs, CCPs, and LDPs for each rotation. All results are shown in terms of a per-acre average for each rotation system. The portion of the table relating to CSP payments will be discussed later in this report.

Baseline rotation 1 has one of the lowest net income without Government payment values. The average per acre return for the rotation is -$41.63. With the addition of the DP, CCP, and LDP, the net income with program payments return is -$2.90 per acre (Table 6). Inclusion of the DPs, CCPs, and LDPs, which total $38.73 per acre, causes the rotation to nearly break even (when the land charge of $90 per acre is included).

Table 6. Rotation Net Returns with Baseline Prices and Yields

Rotation	Crops	NI w/o Govt Payments	LDP	CCP	DP	Total Prog Payments	NI w/ Prog Payments	CSP Base Payment	CSP Cost Share Payment	Total CSP Payment	NI w/ all Govt Payments
Baseline 1	c,s	-$41.63	$4.21	$18.98	$15.54	$38.73	-$2.90	--		$0.00	-$2.90
Baseline 2	c,s	-$44.08	$4.21	$18.98	$15.54	$38.73	-$5.35	--		$0.00	-$5.35
A	c,s,sw	-$43.66	$2.81	$18.98	$15.54	$37.33	-$6.33	$4.20		$4.20	-$2.13
B	c,s,ww	-$48.36	$6.79	$18.98	$15.54	$41.32	-$7.04	$4.20		$4.20	-$2.84
C	a,a,a,a,c,s,c,s	-$4.29	$2.11	$18.98	$15.54	$36.63	$32.34	$8.40	$5.85	$14.25	$46.59
D -- GMO	o/a,a,a,a,c,s,c,s	$2.48	$2.52	$18.98	$15.54	$37.05	$39.53	$8.40	$5.94	$14.34	$53.86
D -- Conv	o/a,a,a,a,c,s,c,s	$5.30	$2.52	$18.98	$15.54	$37.05	$42.34	$8.40	$5.94	$14.34	$56.68
E -- Gmo	a,a,a,c,s,ww	-$11.62	$3.40	$18.98	$15.54	$37.92	$26.30	$8.40	$7.80	$16.20	$42.50
E -- Conv	a,a,a,c,s,ww	-$9.74	$3.40	$18.98	$15.54	$37.92	$28.18	$8.40	$7.80	$16.20	$44.38
F -- Gmo	sw/a,a,a,a,c,s	$9.40	$1.40	$18.98	$15.54	$35.93	$45.33	$8.40	$7.18	$15.58	$60.91
F -- Conv	sw/a,a,a,a,c,s	$11.28	$1.40	$18.98	$15.54	$35.93	$47.20	$8.40	$7.18	$15.58	$62.79
G	o/a,a,a,c,s,c	-$1.27	$1.96	$18.98	$15.54	$36.48	$35.22	$8.40	$7.91	$16.31	$51.53
Org A -- No Premium	c,s,o/a,a	-$24.45	$2.70	$18.98	$15.54	$37.23	$12.78	$12.60	$8.54	$21.14	$33.92
Org A -- Org Premium	c,s,o/a,a	$62.02	$2.70	$18.98	$15.54	$37.23	$99.25	$12.60	$8.54	$21.14	$120.39
Org B -- No Premium	c,s,o/a,a,a	-$3.20	$2.16	$18.98	$15.54	$36.68	$33.48	$12.60	$6.83	$19.43	$52.91
Org B -- Org Premium	c,s,o/a,a,a	$65.97	$2.16	$18.98	$15.54	$36.68	$102.65	$12.60	$6.83	$19.43	$122.09

Baseline rotation 2, which has no-till soybeans, shows an even lower net income without Government payments (-$44.08 per acre). The rotation had -$5.35 per acre in net income with all Government payments (Table 6). Baseline 2 receives the same commodity program payments as baseline 1. The baseline 2 net income—however measured—is $2.45 per acre less than the baseline 1 net income. The difference can be attributed mostly to the higher seed cost for soybeans in a no-till system. If yields actually are higher, on average, for no-till soybeans than for soybeans rowed with a min-till planter, then the net income comparison would be different.

The assumed corn and soybean yields (Table 3) contribute to the negative net returns in the baseline systems. Although the yields may be considered low by some people, they do represent 5-year averages for the study region, based on SDASS data. While our analyses were based on 124-bushel corn, yields at the Southeast Experiment Farm have ranged from 120 to 180 bushels an acre, depending on the year.

Crop market prices used in the budgets also influence the net return results. As previously stated, the prices used were 5-year averages. In the case of corn, the $1.75 per bushel price that was used is at least $.14 higher than the average price in three of the years used to compute the 5-year average. The soybean price of $4.77 per bushel that was used is higher than the average price in 4 of the years used to compute the 5-year average. The reader should keep in mind, however, that the CCPs and LDPs included in the profitability analyses for our representative farm have inverse relationships to corn and soybean market prices.

The land charge used in the budgets is critical to the net return calculations. The not-quite-break-even net returns for the baseline corn/soybean systems suggest that the $90 per acre cash rent fully captured Government payments.

Analysis of diverse crop rotations

The alternative and organic rotations shown in Table 2 represent forms of longer rotations that "representative" farmers might be enticed to adopt through CSP contracts. The rotations vary in length and crop mix. All rotations receive the same DPs and CCPs, based on previously stated farm program assumptions. LDPs differ among the rotations, however.

Alternative non-organic rotations. The first alternative rotation developed was a corn-soybean-spring wheat rotation, rotation A. Rotation A models a rotation being studied at SDSU's Southeast Experiment Farm. Although the rotation is only a slight variation from the baseline, the addition of spring wheat has some economic implications.

The rotation has a net income without Government payments of -$43.66 per acre, similar to baseline rotations 1 and 2. Spring wheat is the only crop that does not qualify for an LDP based on the price assumptions used in the enterprise budgets. This leads to LDPs of only $2.81 per acre for the rotation, which is less than the $4.21 average per acre LDP in the baseline rotations. Net income with Government farm program (but not CSP) payments came to -$6.33 per acre for rotation A (Table 6).

Rotation B—with winter wheat, rather than the spring wheat that is in rotation A—shows a greater net loss (excluding CSP payments) than rotation A and baselines 1 and 2. The net income without Government payments for rotation B is -$48.36 per acre and the net income with program payments is -$7.04 (Table 6). Winter wheat has a $.26 per bushel, or $11.96 per acre, LDP. Consequently, rotation B has the highest average LDPs per acre of all the rotations. Nevertheless, the baseline rotations perform slightly better than rotation B in terms of net income with program payments.

Rotation C is the first rotation analyzed that contains alfalfa. Previous research has shown that alfalfa can significantly enhance the profitability of a farming operation, but the relative contribution of alfalfa to overall profitability of any system is affected by the price received for alfalfa relative to the prices received for other crops (Henning and Dobbs). The alfalfa price used for all the rotations was the 5-year average, $66 per ton (Table 3).

Rotation C is an alfalfa-alfalfa-alfalfa-alfalfa-corn-soybeans-corn-soybeans rotation. This rotation incorporates a forage legume but also has a strong row crop presence. The alfalfa in this rotation is straight seeded in the first year, with one cutting taken in the establishment year. It was assumed that in the following years there would be three cuttings per year, with yields changing as the alfalfa stand ages.

Rotation C has a net income without Government payments of -$4.29 per acre. Although this value is negative, it is substantially higher than any of the other rotation net returns discussed thus far. Rotation C is the first rotation analyzed that has a positive net income with program payments included. Including program payments, rotation C has an average per acre net return of $32.34. This value is $35.24 higher than the baseline 1 value (Table 6).

The economic contribution of alfalfa to rotation C is substantial. Rotation C's net income *without Government payments* is very similar to the previously mentioned rotations' net income *with program payments*. Not only does alfalfa contribute directly to net returns, but also corn following alfalfa in the budgets has lower input costs because of legume credits from alfalfa (Gerwing and Gelderman).

Rotation C shows considerable economic incentive for producers to change to a longer rotation from the baseline rotation, but factors also exist that discourage producers from a longer rotation such as this. A study by Henning and Dobbs on the contribution of alfalfa to whole-farm profitability concluded that, although alfalfa may add profitability to a farm system, there appears to be more price risk associated with alfalfa than with grain and oilseed crops. The high establishment cost and price risk associated with alfalfa may be some of the reasons it is no longer included in many crop rotations.

Rotation D was the first rotation in which we considered both GMO and non-GMO seed varieties. The rotation consists of oats/alfalfa-alfalfa-alfalfa-alfalfa-corn-soybeans-corn-soybeans. The oats constitute a nurse crop for alfalfa. In the establishment year for alfalfa, the oats are harvested for grain and one cutting of alfalfa also is assumed to be harvested. Results show this rotation, with conventional seed, to be the third highest performing non-organic alternative rotation in the analysis. The conventional seed rotation has a net income with program payments of $42.34 per acre. The GMO version is just slightly lower, at $39.53 per acre (Table 6). The difference in net returns can be attributed mostly to seed costs. The estimated GMO seed cost for Bt corn was $42 per acre at the time of our study, while the estimated conventional seed cost was $28 per acre, a difference of $14. The estimated cost for RR soybeans in 30-inch rows was $29.04 per acre, while the estimated conventional seed cost was $19.04 per acre, a difference of $10.

In this analysis, a farmer using GMO seed varieties appears to be at a slight economic disadvantage compared to one using conventional seed. However, research suggests that improved pest control is the major factor in farmers' adoption of GMO seed varieties (Van Scharrel and Van der Sluis). Improved yields and reduction of labor and herbicide costs also have been cited as key reasons farmers choose to grow Bt corn and RR soybeans. Lacking a firm basis for assigning different yields to the GMO and non-GMO crops, we assumed the same yields. To the extent GMO crops may actually average higher yields, the net return comparisons would differ from those reported here. Our main focus in this study was not a GMO/non-GMO comparison, however, so readers should exercise caution in drawing conclusions about whether or not to use GMO seed from our alternative versions of rotations D, E, and F.

Rotation E involves 3 years of alfalfa and 1 year each of corn, soybeans, and winter wheat. This rotation is the only rotation that uses a forage legume, row crops, and small grain as major crops. Other rotations contain all three, but the small grain is used as a nurse crop. The alfalfa is straight seeded in rotation E, and the winter wheat is not used as a nurse crop.

Rotation E is not as profitable as other alternative rotations with alfalfa (Table 6). This can be attributed to the low price of winter wheat. Rotation E, however, does have significantly better net income figures than the baseline rotations. The conventional seed variation of rotation E—as also noted for rotation D—is more profitable than the GMO variation.

Both GMO and conventional seed versions of Rotation F also are shown in Table 6. This is the most profitable non-organic alternative rotation. The conventional seed version results in $11.28 per acre of net income without Government payments, while the GMO figure is $9.40 per acre. The net income *with program payments* value for conventional seed is $47.20 per acre, and the GMO value is $45.33 per acre. These net income with program payments values are approximately $50 higher than the corresponding baseline rotation (corn/soybean system) values.

Spring wheat in rotation F is used as a nurse crop for establishing the alfalfa. In this rotation, the spring wheat is harvested as grain, and there is no alfalfa cutting in the first year. Oats are generally planted as a nurse crop for alfalfa, but spring wheat sometimes is used. A comparison between the straight seeded alfalfa, spring wheat/alfalfa, and oats/alfalfa enterprise budgets shows that establishing alfalfa with oats has the highest net return in the establishment year, given cost and yield assumptions we used.

Rotation G has respectable net income figures and a considerable economic advantage over the baseline rotation systems (Table 6). This oats/alfalfa-alfalfa-alfalfa-corn-soybeans-corn rotation has an extra year of corn relative to soybeans. One reason we included this rotation is that interviews indicated that recent changes in farm program commodity payments might lead some farmers to expand the share of corn in their crop mix.

In summary, most of the alternative rotations analyzed here out-perform the baseline rotations (Table 6). Only rotations that include alfalfa show positive net incomes with Government program payments included.

Organic rotations. Organic rotation systems are assumed by many people to generally represent relatively high levels of ecological stewardship. Certified organic rotations require the utmost attention to detail when selecting a crop rotation. Without the help of synthetic chemicals, an organic farmer must use careful management of crop rotations and tillage practices to ensure that insect, weed, and disease cycles are controlled. The CSP may provide economic incentives for some farmers to consider organic agriculture. We expected organic rotations to have potential to qualify for Tier 3 CSP contracts.

The organic rotation results are shown two ways in Table 6. Both organic rotations were analyzed with the conventional crop prices used in the alternative and baseline budgets. However, those same organic rotations also were analyzed using premium organic prices. Certified organic crops qualify for premium prices in the market, presented previously in Table 3.

Organic rotation A is a corn-soybean-oats/alfalfa-alfalfa rotation modeled after rotations in recent organic farming studies by Delate et al. and Porter et al., cited in Section III. Organic rotation A without the organic price premiums has a net income with program payments of $12.78 per acre. This value is considerably higher than those for the baseline rotations; however, the organic per acre return is less than the alternative rotations that include alfalfa. Analysis of organic rotation A assuming organic price premiums leads to a quite different result, however. With premiums, this organic rotation out-performs the baseline and alternative rations by a considerable margin. With organic price premiums, organic rotation A's net income without Government payments is $62.02 per acre, much higher than that of the best performing non-organic rotation. Adding in Government program payments for organic rotation A results in a net income of $99.25 per acre (Table 6).

Organic rotation B shows results similar to those of organic rotation A, when compared to the baseline and alternative rotations. Assuming conventional crop prices in organic rotation B, the net income without Government payments is -$3.20 per acre; assuming organic price premiums, it is $65.97, $69.17 higher. Like rotation A, when assuming price premiums, the organic net income *without* Government program payments is higher than the baseline and alternative non-organic rotation net incomes *with* program payments.

As shown previously in Table 3, the yields used in the organic budgets are lower than those in the non-organic budgets, except in the case of oats. The lower yields also translate into smaller LDPs for the organic crop rotations. Helping to offset those lower yields are lower input costs, because the organic budgets do not include any synthetic chemicals. Without synthetic chemical pesticides, weeds and pests must be controlled through mechanized practices and rotations. In the case of organic soybeans, hand labor was assumed to be employed, along with mechanized tillage practices. The extra mechanization and hand labor practices result in higher fuel, machinery, and labor costs for the organic rotations.

Organic budgets entail other additional costs. In the case of organic soybeans and oats, a cleaning charge was imposed, based on data obtained from Brummond and Swenson. A cleaning charge of $.45 per bushel was assessed in enterprise budgets based on organic price premiums. The charge was assessed only in the budgets with price premiums because a producer would likely omit the cleaning process if he or she were planning to sell organic grains or soybeans at conventional prices.

The organic rotations included oats and alfalfa (oats/alfalfa) where oats are planted as a nurse crop. The oats are harvested as grain, but, unlike the non-organic budgets, the assumption for the organic rotations—based on interviews with organic farmers—is that there is no alfalfa cutting in the establishment year.

The two different price scenarios for the organic rotations were used to show the relatively higher returns a farmer could realize when he or she is able to capture organic price premiums. However, an organic farmer might not receive organic prices for the entire harvest. The crop might not qualify for the premium because of poor quality. Also, farmers sometimes may have trouble gaining access to organic markets. Consumer demand for organic products has increased over time, but organic crop acreage accounts for a very small fraction of total crop acreage, resulting in a limited number of market outlets. Results shown in Table 6 for the organic rotations under the two different price scenarios—*without* and *with* organic premiums—should be viewed as ranges of potential net returns per acre.

In summary, organic rotations have the highest potential per acre return when price premiums are included. Except for rotations A and B, all of the alternative and organic (both with and without price premiums) rotations examined have higher estimated per acre net incomes with program payments than do the baseline rotation systems (Table 6). These analyses, and other research, show that organic rotations can compete in many situations with conventional rotations.

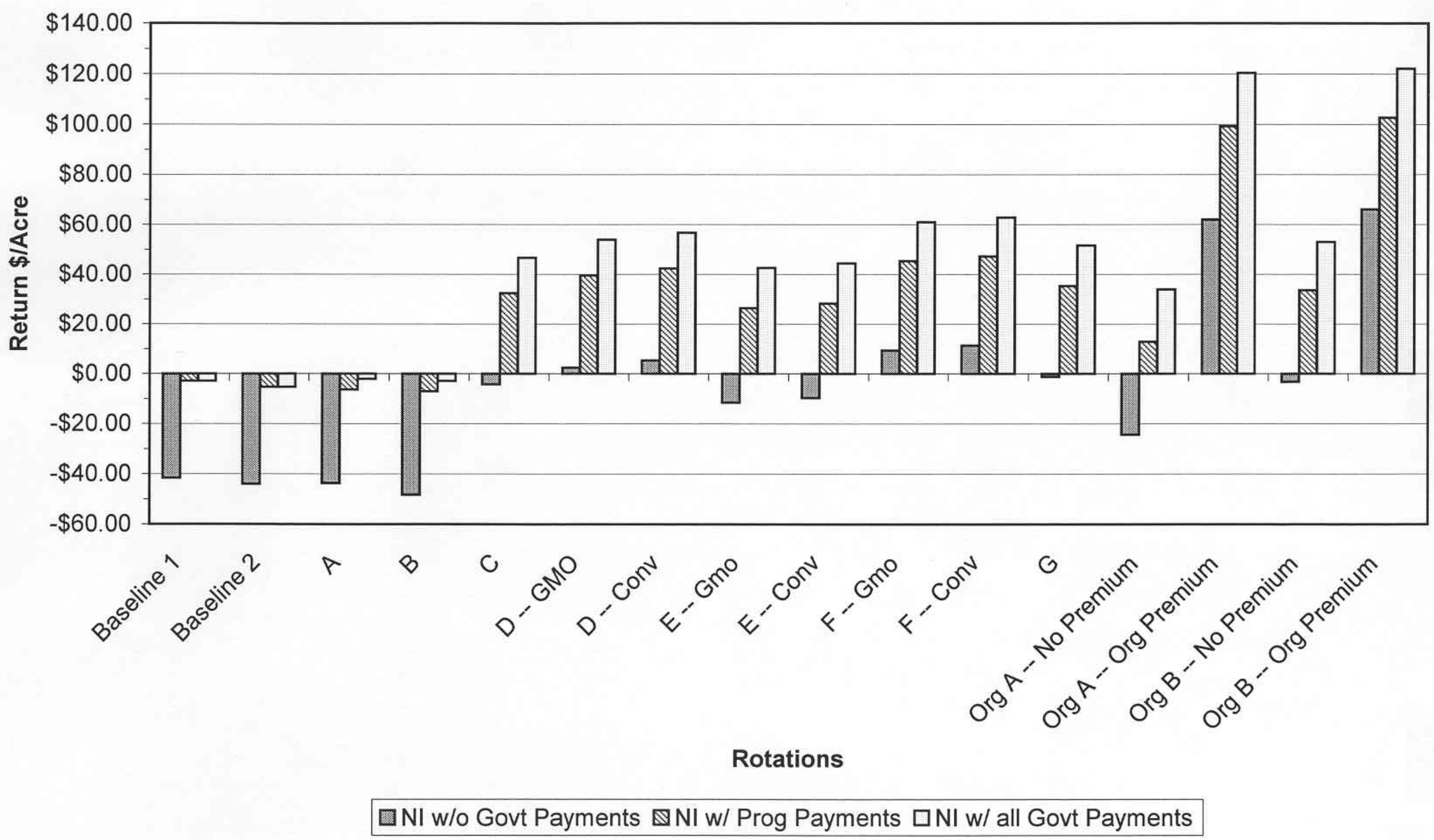
The contributions of government payments to net returns for each rotation system are illustrated graphically in Figure 3. The third bar in each comparison—representing net income with all government payments—includes the assumed CSP payments. Results of the analysis with those payments included are presented next.

Inclusion of CSP payments

The following analysis is focused on potential CSP payments and implications for the profitability of different rotation systems on the "representative" farm. Results are organized according to the CSP contract tiers described in Sections I and IV.

Rotation systems were placed in different tier levels based on potential environmental gains associated with each one. The base payment is different for each tier level. Tier 1 contracts receive the lowest base payment, while Tier 3 contracts receive the highest base payment. Cost share payments also vary, since each rotation has different costs that might be eligible for payments. Assumed CSP base and cost share payments for each rotation are shown in Table 6.

Figure 3. Returns per Acre with Baseline Price and Yield Assumptions: Progression of Govt Payments



The alternative organic and non-organic rotations represent potential conservation crop rotations that provide environmental benefits. Consequently, they were assumed to be eligible for CSP contracts. On the other hand, we assumed that the baseline rotations do not qualify as conservation crop rotations, because of the very limited crop mix and the lack of a small grain or forage or green manure legume. Therefore, the baseline rotations were not considered eligible for any level of CSP participation, simply by virtue of including two crops in the rotation. There may very well be conservation *practices* that a corn/soybean farmer could agree to carry out to qualify for some type of CSP contract, but non-rotation practices were not the focus of our analyses.

Tier 1 contract. A CSP Tier 1 contract requires a producer to enroll only a portion of his or her farm in the program. A Tier 1 contract in this analysis receives a base payment of $4.20 per acre. Alternative rotations A and B were assumed to qualify for Tier 1 contracts, and we assumed that all 1,000 acres on the representative farm were enrolled.

Rotations A and B were the shortest alternative rotations developed for this analysis. According to our assumptions, adoption of rotation A or B represents the minimum change a farmer might make that involves a change in rotation. Although these rotations differ from the baseline, the assumption was that the environmental gains associated with rotations A and B are not substantial enough to qualify for a Tier 2 contract. Rotations A and B were assumed to qualify for a Tier 1 contract based on the environmental gains a farm operation may accrue as a result of winter or spring wheat being planted in rotation with corn and soybeans. Language for a Tier 1 contract was vague at the time of our study, but we assumed that a farmer could receive a CSP payment for implementing either rotation A or rotation B. The land rotated to wheat could be subject to less wind or water-induced soil erosion. We assumed that there would be no CSP cost share payments for these two rotations, because there are no significant ‘establishment’ costs associated with adding wheat to the corn/soybean rotation.

Even with the CSP payments, returns to rotations A and B fail to cover all costs (Table 6 and Figure3). The CSP base payment is $4.20 per acre, and the net incomes with all Government payments—which include the CSP payments—for rotations A and B are -$2.13 per acre and -$2.84 per acre, respectively. These net incomes are similar to that of baseline 1 (with no CSP payment).

<u>Tier 2 contract</u>. Alternative rotations C through G were assumed to qualify for Tier 2 contracts. Each rotation contains alfalfa and is at least 6 years long. These rotations have substantial crop mixes that include a forage legume and a small grain in addition to row crops. We assumed that these rotations would meet the requirements of a conservation crop rotation as defined by NRCS or a resource-conserving crop rotation as defined in the CSP legislation.

Each Tier 2 contract requires the farmer to address at least one resource of concern for the entire agricultural operation. The resource concern in this analysis was not explicitly defined, but a resource-conserving crop rotation can address many resource concerns. Rotations C through G are long rotations that involve significant changes in crop mix, compared to the baseline rotations, and we assumed whole farm involvement for our representative farm.

A Tier 2 contract in this scenario receives a base payment of $8.40 per acre. We also assumed that rotations C through G would be eligible for cost share payments for the establishment cost of alfalfa. The cost share payments differ among rotations, because alfalfa is established using different methods over a different number of years; cost share payments range from $5.85 to $7.91 per acre. The total CSP payments for rotations C through G range from $14.25 to $16.31 per acre (Table 6).

These rotations already were more profitable than the baseline rotations before addition of the CSP payments. With the addition of CSP payments, an even stronger case can be made for the rotations to be considered by farmers. The CSP payments for Tier 2 contracts are not large on a per acre basis, but the payments do add to the appeal of the alternative rotations. For example, a $15 per acre CSP payment on a 1,000-acre farm comes to $15,000. Rotations C through G with Tier 2 CSP contracts included show net incomes with all Government payments that are at least $45 per acre greater than net incomes for the baseline rotations (Figure 3).

Tier 3 contract. The Tier 3 contract represents the highest level of participation. In this tier, the farmer and NRCS personnel design a resource management system addressing all resources of concern for the entire agricultural operation. We assumed that the organic rotations would qualify for Tier 3 contracts. Operating a certified organic farm generally requires the farmer to implement a production plan that incorporates at least some resource-conserving practices throughout the farm. It is quite possible that some organic farms would need to add some practices to those they are already carrying out in order to qualify for a Tier 3 contract. However, those additional practices might well be eligible for additional CSP cost share that we have not included in our analysis.

Tier 3 contracts receive the highest base payments. The representative farm with a CSP contract for an organic rotation in our analysis was assumed to receive a base payment of $12.60 per acre (Table 6). There also could be cost share payments for the establishment of alfalfa—$8.54 and $6.83 per acre for organic rotations A and B, respectively. These cost share payments, of course, represent annual averages for the whole (1,000-acre) farm. If stated in terms of only the acres rotated into new (establishment) alfalfa each year, the per acre cost share payments would be much higher.

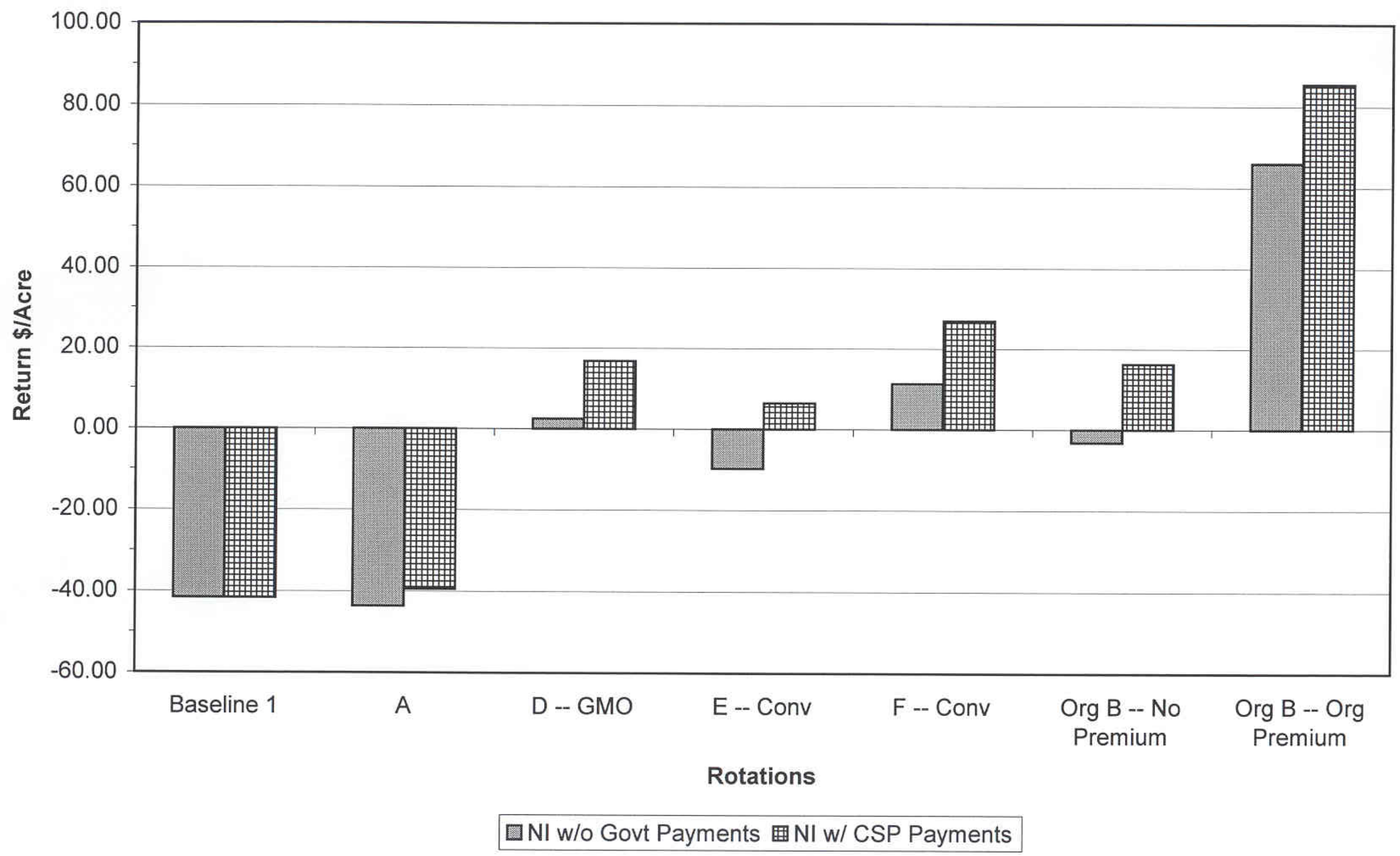
The total CSP payments received for a Tier 3 contract are $21.14 and $19.43 per acre for organic rotations A and B, respectively. The organic rotations appear to be competitive with a number of the non-organic rotations even without CSP contract payments, and the addition of CSP payments adds to their relative profitability.

VI. Summary

We have already observed in Figure 3 how the addition of CSP payments adds to net returns of the various rotation systems in southeastern South Dakota. Net return effects of potential CSP payments are shown another way for selected rotations in Figure 4. There, the only government payments that are included—in the second bar for each rotation—are CSP payments. Again, we see that the diverse rotations that include alfalfa (both organic and non-organic) are more profitable (or less unprofitable) than baseline rotation 1 (corn/soybeans) and rotation A (corn/soybeans/spring wheat), even without inclusion of CSP payments. The assumed CSP payments increase their profitability advantage, however.

One possible conclusion might be that CSP payments are not needed to induce more diverse crop rotation systems such as those included in our analyses. However, previous studies have shown that even though alternative rotations appear to be competitive with typical corn/soybean rotations, farmers tend to prefer the simple corn/soybean rotation. Therefore, some added incentive, such as that provided by CSP contracts, may be necessary if policy makers desire to restore more ecologically diverse crop rotation systems in areas where corn and soybeans are predominant. Even the CSP payment levels we assumed in our analyses would likely be inadequate to cause large-scale crop rotation shifts, so long as other farm program income and price support payments remain high and are somewhat coupled to ‘commodities’.

Figure 4. Effects on Returns of Including Only CSP Payments: Baseline Price Assumptions



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