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Clarence Mends
South Dakota State University

Thomas Dobbs
South Dakota State University

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EFFECTS OF INCLUDING ALFALFA IN WHOLE-FARM PLANS: COMPARISON OF CONVENTIONAL, RIDGE TILL, AND ALTERNATIVE FARMING SYSTEMS*

by

Clarence Mends and Thomas L. Dobbs**

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**Mends is a Research Associate and Dobbs is a Professor of Agricultural Economics, both in the Economics Department at South Dakota State University.

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EFFECTS OF INCLUDING ALFALFA IN WHOLE-FARM PLANS: COMPARISONS OF CONVENTIONAL, RIDGE TILL, AND ALTERNATIVE FARMING SYSTEMS

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Introduction

South Dakota State University (SDSU) has been conducting research trials since 1985 at its Northeast Research Station (near Watertown, S.D.) to compare various conventional, reduced tillage, and low chemical input ("alternative") farming systems. In one set of comparisons, Conventional and Ridge Till systems consisting of rotated corn, soybeans, and spring wheat are compared with an Alternative (no purchased chemical input) system consisting of rotated oats, alfalfa, soybeans, and corn. The alfalfa is just harvested one year (the year after underseeding in oats) in this system. Economics results for the first 5 years of comparing these systems are reported under Study I in Mends, et al. (1989) and Dobbs and Mends (1990). In those comparisons, the Alternative farming system was the most profitable system in 2 out of the 5 years and its 5-year average profitability was the highest of the three systems.

A question that arises out of this analysis concerns whether it is simply having alfalfa in the crop mix, rather than the rotational effect of alfalfa, which made the Alternative system more profitable than the other systems in 1985-1989. Therefore, the objective of this paper is to determine what the inclusion of alfalfa in the Conventional and Ridge Till whole farm systems would do to the net returns of those systems, in comparison to the Alternative system. Crop mix, cultural practices, yields, selling prices, and Federal farm program provisions all affect the net returns of these farming

systems. Here, we wish to isolate the crop mix effect of including alfalfa in the whole farm plans.

Baseline Results

Smolik and Dobbs (1991) report average results over the first 5 years for the Conventional, Ridge Till, and Alternative systems. These results are reproduced in Table 1. Alfalfa is not part of the crop mix of the Conventional and Ridge Till systems in this baseline analysis. Federal farm program provisions for 1985 through 1989, as well as relevant market prices for crops during those years, were used for the baseline analyses. The Alternative system is a 4-year rotation that involves no commercial chemical fertilizers or pesticides. The Conventional and Ridge Till systems are each 3-year rotations, in which synthetic chemical fertilizers and herbicides are applied at rates recommended by SDSU agronomists.

The first five columns of data in Table 1 show various cost and return measures for each system on a per acre basis. The per acre measures are made up of all crops and set-aside in each system as a whole. "Direct costs other than labor" gives an indication of the required out-of-pocket expenses incurred for each system. "Gross income" is derived from yield data in combination with farm program (e.g., deficiency payment) and selling price information. "Net income over all costs except land, labor, and management" is a return to land, all labor (whether family or hired), and management. "Net income over all costs except land and management" is derived in the same way as the previous measure, except that a charge for labor (including family labor) has now been included. The next measure, "income over all costs except management", indicates the profitability of each system when all costs except management are accounted for; what remains is the residual return to management. The last column shows "whole farm net incomes over all costs

Table 1. Five-year (1985-1989) Average Results of Farming Systems Analyses, Farming Systems Study I.

System[1]	Direct Costs Other Than Labor	Gross Income	$/Acre Net Income Over All Costs Except Land, Labor, and Management	$/Acre Net Income Over All Costs Except Land and Management	$/Acre Net Income Over All Costs Except Management	Whole Farm, Net Income Over All Costs Except Management[2] ($)
1. Alternative (oats-alfalfa-soybeans-corn)	43	133	59	47	20	11,121
2. Conventional (corn-soybeans-s. wheat)	61	140	51	41	15	8,248
3. Ridge Till (corn-soybeans-s. wheat)	66	137	44	35	9	4,750

[1]Crops are shown in the order in which they occur in each rotation.

[2]For farm with 540 tillable acres. Figures in this column are equivalent to 540 multiplied by "prerounded" figures in the "all costs except management" column.

except management" for a farm with 540 tillable acres.

The Alternative system had the lowest five-year average "direct costs other than labor" and the lowest "gross income" per acre over the 5-year (1985 - 1989) period. However, the Alternative system had the highest whole farm net income over all costs except management ($11,121). It was followed by the Conventional system ($8,248), and the Ridge till system had the lowest net income ($4,750). The Alternative system average profit was 35 percent higher than that of the Conventional system and 134 percent higher than that of the Ridge Till system.

Budgets and Rotations Including Alfalfa

Although no alfalfa currently is included in the Conventional and Ridge Till systems under study at SDSU's Northeast Research Station, two farming systems representing Farming Systems Study I (FSSI) with inclusion of alfalfa were "designed" for purposes of comparison. The two "designed" systems were used in comparisons with the "actual" baseline Conventional and Ridge Till systems. Like the baseline systems, the designed systems were comprised of 540 tillable acres. The designed whole farm Conventional and Ridge Till systems each consisted of 3-year corn-soybeans-spring wheat rotations along with alfalfa. It was assumed that the alfalfa in the designed systems would remain in one field or set of fields permanently; it is not rotated with the other crops. The alfalfa in the designed systems was assumed to be reseeded every sixth year.

The Alternative system in FSSI, which involves no chemical fertilizers or herbicides, remains the same as in the baseline and is compared with the "designed" Conventional and Ridge till systems. Fertilizers and herbicides on corn, soybeans, and spring wheat in the designed Conventional and Ridge Till

systems are assumed to be the same as in the baseline systems. Inclusion of alfalfa in the "designed" systems requires different assumptions with respect to cultural practices than were used for the alfalfa in the baseline Alternative system in FSSI. For example, in FSSI's Alternative system, the alfalfa is established with oats as a companion crop in all years after the first year. The oats are harvested as grain, with no alfalfa harvested in the establishment year. With the "designed" Conventional and Ridge Till systems, first year alfalfa was assumed to be directly seeded without a companion crop; the herbicide Eptam was used. This is the way it was done in the first year of the baseline analysis with the Alternative system. We assumed that the alfalfa in the "designed" systems would have a 5-year stand (a more traditional stand than in the Alternative system). At the end of the fifth year, the alfalfa fields were assumed to be chiseled under in the Ridge Till system and plowed under with a moldboard plow in the Conventional system; this is followed by a fall discing in each system.

All costs for establishment of the continuous alfalfa were allocated to the first year budget, without prorating those costs over the 5-year stand life. Details of tillage practices, chemical fertilizer applications, and herbicide use--based upon recommendations by plant scientists for each "designed" system--are contained in Tables 2a and 2b. The cultural practices are the same for each "designed" system except during the fifth year of the stand, when the Conventional system involves a moldboard plow to turn the alfalfa under and the Ridge Till system involves a chisel plow to do that. Alfalfa seeding rates for the designed system were based upon a recommendation of 12 pounds per acre. This differs from the rate used in the baseline Alternative system in FSSI. Fertilizer application rates were based upon

Table 2a. Cultural Practices for Alfalfa in the "Designed" Conventional System.

	1985	1986	1987	1988	1989
Disk	2x				F1x
Field Cultivator					
Harrow	1x				
Field Cultivator w/Harrow					
Planter* (Drill)	1x				
Rotary Hoe					
Regular Cultivator					
Ridge Cultivator					
Hand Weeding					
Fertilizer**		N - 0 P - 45 K - 125	N - 0 P - 45 K - 125	N - 0 P - 45 K - 125	N - 0 P - 45 K - 125
Herbicide***	Eptam 3 lb. ai per acre				
Swather	2x	3x	3x	3x	3x
Hay Baler	2x	3x	3x	3x	3x
Combine					
Manure Spreader					
Chisel Plow					
Chisel w/Subsurface Sweep					
Moldboard Plow****					1x
Planting Date					
Yield	2.01 T/a 2 cuttings	6.14 T/a 3 cuttings	4.45 T/a 3 cuttings	2.89 T/a 3 cuttings	2.64 T/a 3 cuttings

*Planter: Alfalfa was seeded with a drill with a packer.
**Fertilizer: P & K were applied with a fertilizer spreader.
***Herbicide: Eptam was applied with a sprayer.
****The costs of moldboard plowing this 5-year alfalfa stand may be somewhat greater than we have estimated. Greater power and fuel requirements could add around 50¢/acre--on a whole-farm basis--to costs in 1989.

Table 2b. Cultural Practices for Alfalfa in the "Designed" Ridge Till System.

	1985	1986	1987	1988	1989
Disk	2x				F1x
Field Cultivator					
Harrow	1x				
Field Cultivator w/Harrow					
Planter*	1x				
Rotary Hoe					
Regular Cultivator					
Ridge Cultivator					
Hand Weeding					
Fertilizer**		N - 0 P - 45 K - 125	N - 0 P - 45 K - 125	N - 0 P - 45 K - 125	N - 0 P - 45 K - 125
Herbicide***	Eptam 3 lb. ai per acre				
Swather	2x	3x	3x	3x	3x
Hay Baler	2x	3x	3x	3x	3x
Combine					
Manure Spreader					
Chisel Plow****					1x
Chisel w/Subsurface Sweep					
Moldboard Plow					
Planting Date					
Yield	2.01 T/a 2 cuttings	6.14 T/a 3 cuttings	4.45 T/a 3 cuttings	2.89 T/a 3 cuttings	2.64 T/a 3 cuttings

*Planter: Alfalfa was seeded with a drill with a packer.
**Fertilizer: P & K were applied with a fertilizer spreader.
***Herbicide: Eptam was applied with a sprayer.
****It could easily require two chisel plowings, rather than one, to turn down this 5-year alfalfa stand. Power and fuel costs per chisel plow operation may also be greater than we have assumed for this alfalfa. These adjustments, combined, could add around $1.80/acre--on a whole-farm basis--to costs in 1989.

recommendations of plant scientists and are shown in Tables 2a and 2b.

We assumed the same alfalfa yields and numbers of cuttings each year in the designed systems as was recorded for the FSSI Alternative system (see Tables 2a and 2b).

Crop product selling prices, Federal farm program assumptions, and deficiency payment levels used in the budget analyses are shown in Table 3.

Acreage was allocated to each crop on the "designed" 540-acre farms in such a way that both the "designed" Conventional and Ridge Till systems were forced to grow the same number of acres of alfalfa as were grown in the baseline Alternative system of FSSI during each year of the study period (1985 - 1989). This was done to control for the effect of having alfalfa in the crop mix. Also, the "designed" farms had to be in compliance with Federal support program set-aside requirements from 1985 - 1989 and equal acreages had to be allocated to corn, soybeans, and spring wheat in any given year. The procedure for calculating the acreage distribution (after subtracting the alfalfa acres) is described and demonstrated in Dobbs, et al. (1987). Alfalfa acres, set-aside acres, and resulting acres for other crops in the "designed" 540-acre farms are shown in Table 4.

Yield data used in these analyses during the reference years 1985 through 1989 are reported in Table 5. These are actual results from FSSI. The baseline Alternative system actual yields for alfalfa were used as estimates for the "designed" systems.

Given the acreage allocation assumptions, estimated costs and yields for alfalfa in the designed Conventional and Ridge Till systems, and Federal support and market prices, it was possible to proceed to estimate whole farm net returns for the systems.

Table 3. Assumptions about Federal Farm Program and Market Prices used in the Budgets.

Crop	Year 1985	1986	1987	1988	1989
Corn					
Codington county loan rate ($/bu.)	2.33	1.68	1.63	1.61	1.53
Target price ($/bu.)	3.03	3.03	3.03	2.93	2.84
Acreage reduction program (%)	10.0	17.5	20.0	20.0	10.0
Deficiency payments ($/bu.)	.48	1.11	1.09	.38*	.70*
Selling price ($/bu.)	2.33	1.68	1.63	2.50*	2.05*
Spring Wheat					
Codington county loan rate ($/bu.)	3.41	2.38	2.26	2.15	2.05
Target price ($/bu.)	4.38	4.38	4.38	4.23	4.10
Acreage reduction program (%)	20.0	22.5	27.5	27.5	10.0
Deficiency payments ($/bu.)	1.08	1.98	1.81	.58*	.30*
Selling price ($/bu.)	3.41	2.42	2.53	3.95*	3.80*
Oats					
Codington county loan rate ($/bu.)	1.21	.87	.90	.85	.81
Target price ($/bu.)	1.60	1.60	1.60	1.55	1.50
Acreage reduction program (%)	10.0	17.5	20.0	5.0	5.0
Deficiency payments ($/bu.)	.29	.39	.20	0*	.23*
Selling price ($/bu.)	1.21	1.28	1.60	2.60*	1.55*
Barley					
Codington county loan rate ($/bu)	2.00	1.45	1.35	1.34	1.22
Target price ($/bu.)	2.60	2.60	2.60	2.51	2.43
Acreage reduction program (%)	10.0	17.5	20.0	20.0	10.0
Deficiency payments ($/bu.)	.52	.99	.79	0*	.23*
Selling price ($/bu.)	2.00	1.45	1.45	2.50*	1.80*
Soybeans					
Codington county loan rate ($/bu.)	4.39	4.39	4.59	4.59*	4.25*
Selling price ($/bu.)	4.39	4.58	5.15	7.65*	5.50*
Alfalfa					
Selling price ($/ton)	47.00	32.00	36.00	70.00*	70.00*

*Estimates

Source: Dobbs and Mends (1990).

Table 4. Acreage Allotments for the "Designed" Conventional and Ridge Till Systems.

Year	Corn	Soybeans	S. Wheat	Alfalfa	Set-Aside	Total
1985	123	123	123	128	43	540
1986	119	119	119	122	61	540
1987	116	116	116	120	72	540
1988	114	114	114	125	73	540
1989	127	127	127	130	29	540

Table 5. Farming Systems Yield Comparisons, 1985 - 1989, FSSI.

	Yield (bu.)/Acre					
	Corn			Soybeans		
	Alternative	Conventional	Ridge Till	Alternative	Conventional	Ridge Till
1985	70.6	82.1	86.6	18.4	27.0	26.6
1986	99.5	114.6	119.6	29.8	28.1	24.7
1987	86.9	124.4	121.4	31.6	31.0	28.5
1988	39.0	19.0	31.7	10.9	9.0	9.4
1989	79.0	89.7	87.1	20.6	24.5	23.1
	Spring Wheat			Alfalfa (Ton)/Acre		
	Alternative	Conventional	Ridge Till	Alternative	Conventional	Ridge Till
1985	N/A	44.1	42.4	2.01	N/A	N/A
1986	N/A	57.9	50.9	6.14	N/A	N/A
1987	N/A	43.6	39.8	4.45	N/A	N/A
1988	N/A	18.6	14.8	2.39	N/A	N/A
1989	N/A	28.8	26.5	2.64	N/A	N/A

N/A = Not applicable

Sources: Mends, et al. (1989) and Plant Science Department (1990).

Results

Economic results for the "designed" systems from 1985 through 1989 are summarized in Table 6 through Table 10. The Alternative system baseline results are shown in those same tables. Gross income, direct costs other than labor, and whole farm net income over all costs except management for the years 1985 through 1989 are plotted in Figures 1, 2, and 3. Five year average results of the economic analyses for the baseline and the "designed" farming systems are shown in Table 11.

We will focus our discussion here on the "net income over all costs except management" results (Table 11 and Figure 3). Results shown in Table 11 indicate that all systems were profitable, on average. However, the Conventional system with alfalfa showed greater average net income than the Alternative and the Ridge Till (with or without alfalfa) systems over the 5-year period. The Alternative system ranked second of the five actual and designed systems. Both the Conventional and the Ridge Till systems were more profitable when alfalfa was included as part of the whole farm plan ("designed" systems) than when it was excluded (baseline systems). Inclusion of alfalfa in the Ridge till system did not make that system as profitable as the Alternative system, but it did make it nearly as profitable ($18/acre compared to $20/acre for the Alternative system).

In three of the five years, the Conventional with alfalfa system was the most profitable (Figure 3). The Conventional system was most profitable in one of the years (the first year) and the Alternative system was profitable in the other year (1988). All systems had positive net returns over the entire time period, except for 1988, when the Alternative system was the only one which had positive net returns.

Table 6. Results of Farming Systems Analyses Based upon 1985 Yields, Farm Program, and Prices.

System[1]	$/Acre Direct Costs Other Than Labor	Gross Income	Net Income Over: All Costs Except Land, Labor, and Management	Net Income Over: All Costs Except Land and Management	Net Income Over: All Costs Except Management	Whole Farm, Net Income Over all Costs Except Management[2] ($)
1. Alternative (oats-alfalfa-soybean-corn)	46	122	45	31	5	2,765
2. "Designed" Conventional (corn-soybean-s.wheat-alfalfa)	64	144	50	39	13	7,248
3. "Designed" Ridge Till (corn-soybean-s.wheat-alfalfa)	65	144	50	39	13	7,026

[1]Crops are shown in the order in which they occur in each rotation, except the alfalfa in the conventional and ridge till systems, which is permanent and not part of the rotations.

[2]For farm with 540 tillable acres. Figures in this column are equivalent to 540 multiplied by "prerounded" figures in the "all costs except management" column.

Table 7. Results of Farming Systems Analyses Based upon 1986 Yields, Farm Program, and Prices.

System[1]	$/Acre Direct Costs Other Than Labor	Gross Income	Net Income Over: All Costs Except Land, Labor, and Management	Net Income Over: All Costa Except Land and Management	Net Income Over: All Costs Except Management	Whole Farm, Net Income Over All Costs Except Management[2] ($)
1. Alternative (oats-alfalfa-soybean-corn)	46	150	72	60	34	18,436
2. "Designed" Conventional (corn-soybean-s.wheat-alfalfa)	61	173	82	71	45	24,373
3. "Designed" Ridge Till (corn-soybean-s.wheat-alfalfa)	70	168	69	60	34	18,328

[1]Crops are shown in the order in which they occur in each rotation, except the alfalfa in the conventional and ridge till systems, which is permanent and not part of the rotations.

[2]For farm with 540 tillable acres. Figures in this column are equivalent to 540 multiplied by "prerounded" figures in the "all costs except management" column.

Table 8. Results of Farming Systems Analyses Based upon 1987 Yields, Farm Program, and Prices.

System[1]	$/Acre Direct Costs Other Than Labor	Gross Income	Net Income Over: All Costs Except Land, Labor, and Management	Net Income Over: All Costs Except Land and Management	Net Income Over: All Costs Except Management	Whole Farm, Net Income Over All Costs Except Management[2] ($)
1. Alternative (oats-alfalfa-soybean-corn)	44	142	66	55	29	15,774
2. "Designed" Conventional (corn-soybean-s.wheat-alfalfa)	58	162	75	64	38	20,744
3. "Designed" Ridge Till (corn-soybean-s.wheat-alfalfa)	61	157	67	58	32	17,415

[1]Crops are shown in the order in which they occur in each rotation, except the alfalfa in the conventional and ridge till systems, which is permanent and not part of the rotations.

[2]For farm with 540 tillable acres. Figures in this column are equivalent to 540 multiplied by "prerounded" figures in the "all costs except management" column.

Table 9. Results of Farming Systems Analyses Based upon 1988 Yields, Farm Program, and Prices.

System[1]	$/Acre Direct Costs Other Than Labor	Gross Income	Net Income Over: All Costs Except Land, Labor, and Management	Net Income Over: All Costs Except Land and Management	Net Income Over: All Costs Except Management	Whole Farm, Net Income Over All Costs Except Management[2] ($)
1. Alternative (oats-alfalfa-soybean-corn)	37	114	46	35	9	4,894
2. "Designed" Conventional (corn-soybean-s.wheat-alfalfa)	49	95	20	12	-14	-7,805
3. "Designed" Ridge Till (corn-soybean-s.wheat-alfalfa)	51	99	22	15	-11	-6,144

[1]Crops are shown in the order in which they occur in each rotation, except the alfalfa in the conventional and ridge till systems, which is permanent and not part of the rotations.

[2]For farm with 540 tillable acres. Figures in this column are equivalent to 540 multiplied by "prerounded" figures in the "all costs except management" column.

Table 10. Results of Farming Systems Analyses Based upon 1989 Yields, Farm Program, and Prices.

System[1]	$/Acre					
			Net Income Over			
	Direct Costs Other Than Labor	Gross Income	All Costs Except Land, Labor, and Management	All Costs Except Land and Management	All Costs Except Management	Whole Farm, Net Income Over All Costs Except Management[2] ($)
1. Alternative (oats-alfalfa-soybean-corn)	44	139	64	52	25	13,737
2. "Designed" Conventional (corn-soybean-s. wheat-alfalfa)	59	157	68	57	31	16,524
3. "Designed" Ridge Till (corn-soybean-s. wheat-alfalfa)	61	152	61	50	24	13,135

[1]Crops are shown in the order in which they occur in each rotation, except the alfalfa in the conventional and ridge till systems, which is permanent and not part of the rotations.

[2]For farm with 540 tillable acres. Figures in this column are equivalent to 540 multiplied by "prerounded" figures in the "all costs except management" column.

Table 11. Five-year (1985 to 1989) Average Economic Results for "Baseline" and "Designed" Farming Systems.

System	$/Acre					
			Net Income Over			
	Direct Costs Other Than Labor	Gross Income	All Costs Except Land and Management	All Costs Except Land and Management	All Costs Except Management	Whole Farm, Net Income Over All Costs Except Management[1]
1. Alternative (Baseline)	43	133	59	47	20	11,121
2. Conventional						
a. Baseline	61	140	51	41	15	8,248
b. Designed (with alfalfa)	58	146	59	49	23	12,217
3. Ridge Till						
a. Baseline	66	137	44	35	9	4,750
b. Designed (with alfalfa)	62	144	54	44	18	9,952

[1]For farm with 540 tillable acres. Figures in this column are equivalent to 540 multiplied by "prerounded" figures in the "all costs except management" column.

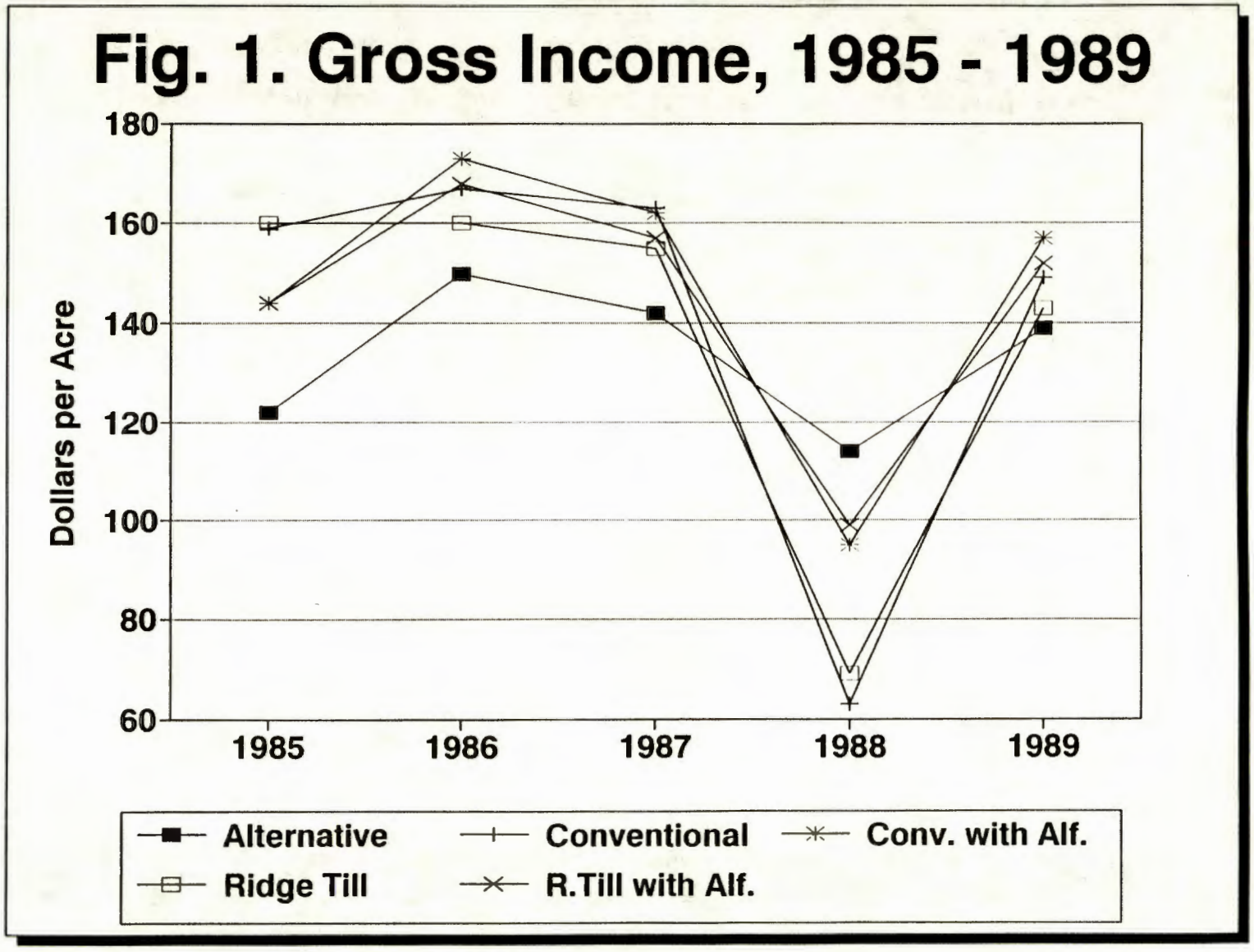
Fig. 1. Gross Income, 1985 - 1989
Dollars per Acre
180
160
140
120
100
80
60
1985
1986
1987
1988
1989
Alternative
Conventional
Conv. with Alf.
Ridge Till
R.Till with Alf.

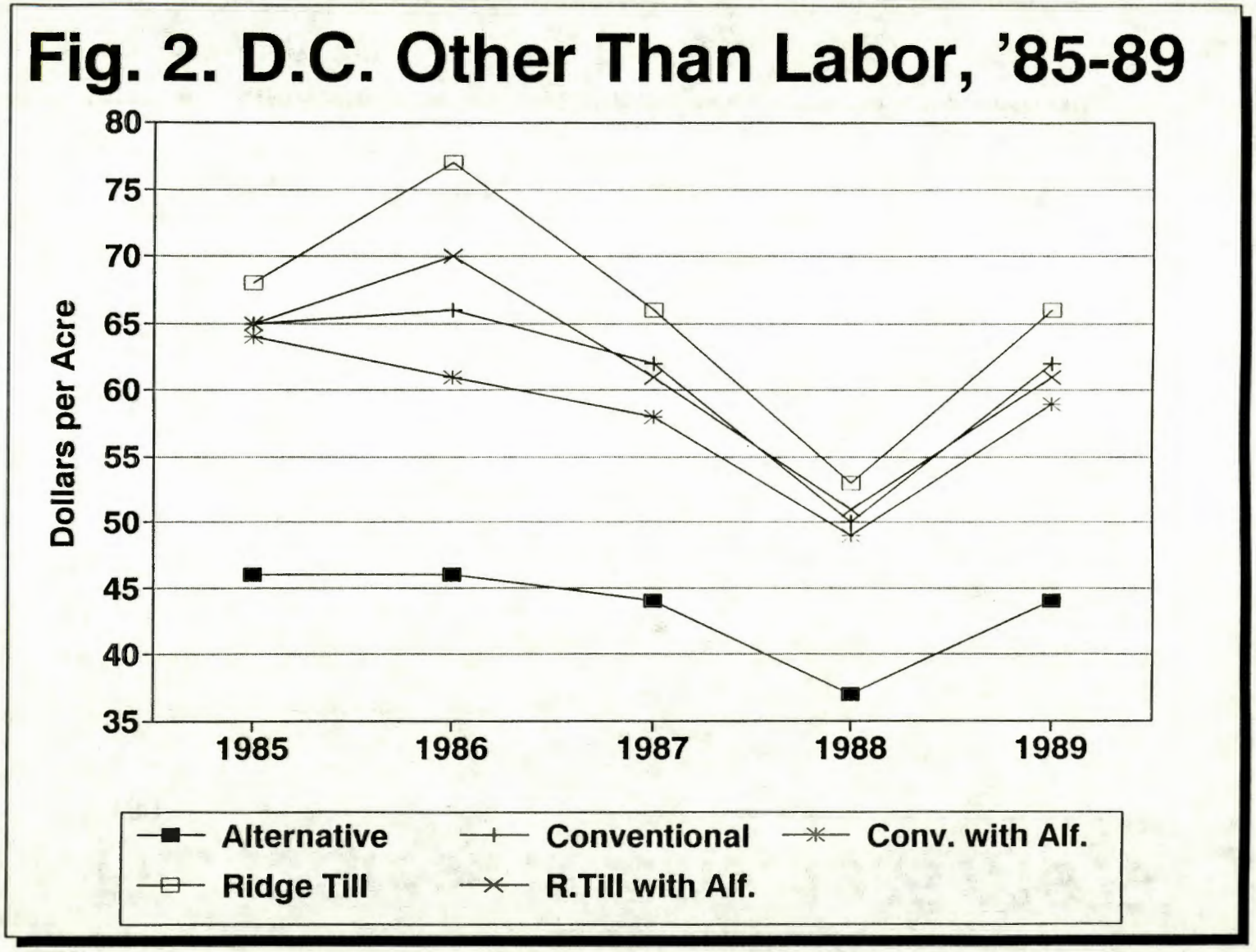
Fig. 2. D.C. Other Than Labor, '85-89
Dollars per Acre
80
75
70
65
60
55
50
45
40
35
1985
1986
1987
1988
1989
Alternative
Conventional
Conv. with Alf.
Ridge Till
R.Till with Alf.

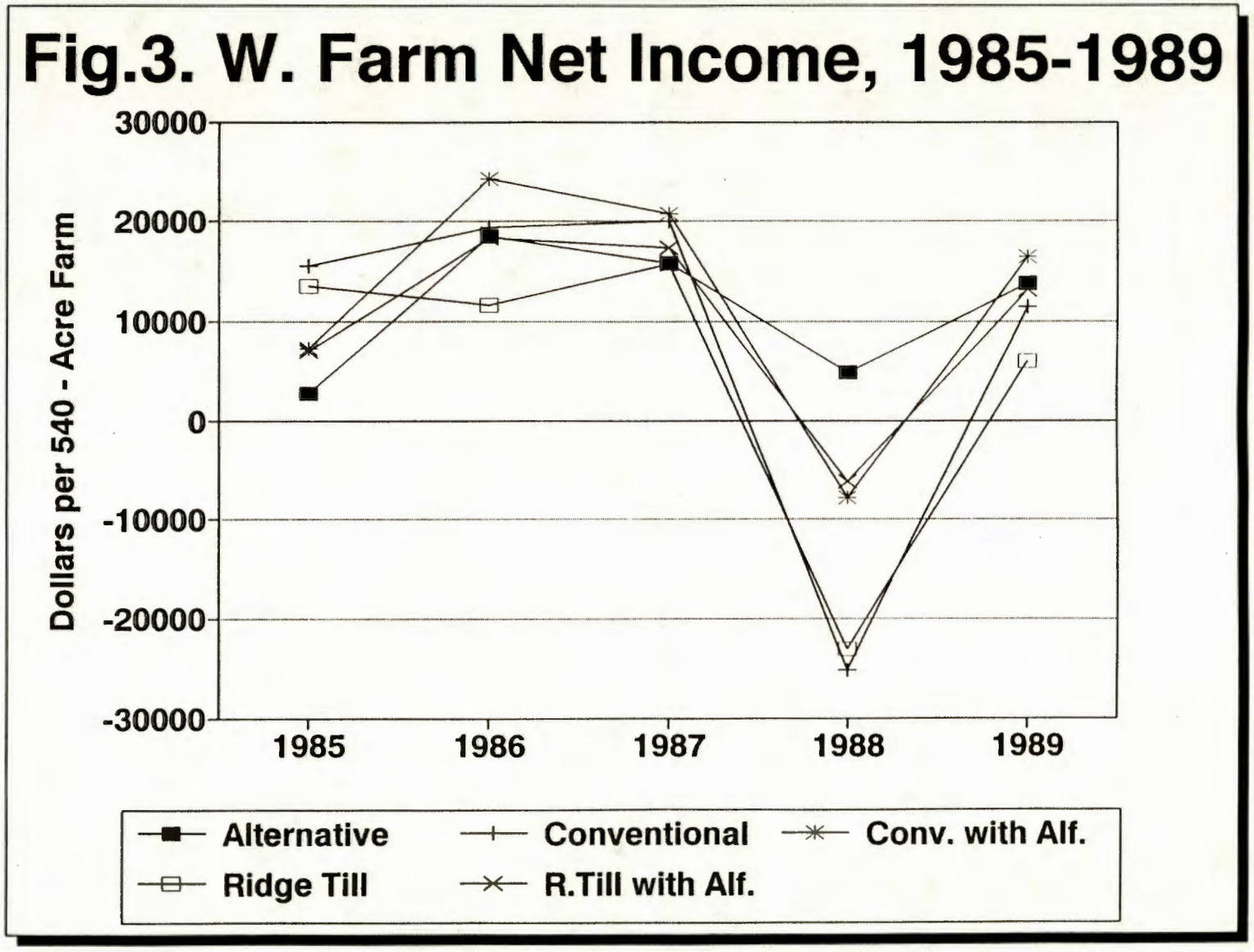
Fig.3. W. Farm Net Income, 1985-1989
Dollars per 540 - Acre Farm
30000
20000
10000
0
-10000
-20000
-30000
1985
1986
1987
1988
1989
Alternative
Conventional
Conv. with Alf.
Ridge Till
R.Till with Alf.

Conclusion

Adding alfalfa to the whole farm plan of the Conventional and Ridge Till systems enhanced the profitability of those systems, on average, over the 1985-1989 time period. Changing those systems from ones without alfalfa to ones with alfalfa in the overall crop mix reduced the 5-year average total grain (including soybeans) production by approximately 153 tons (665 - 512) on a 540 acre farm, while increasing alfalfa hay production from none to approximately 454 tons (Table 12). Thus, for every ton of grain production foregone, approximately 3 tons (454 ÷ 153) of alfalfa was added to farm output.

To value this change in output mix, we can look at average grain and alfalfa hay prices. Over the period 1985-1989, the average price for grain (including government support payments) was 7¢/lb. and the average price for alfalfa hay was 2.6¢/lb. (Table 13). Thus, for every $140 (2000 lb. x 7¢/lb.) lost in grain production, $156 (3 tons x 2,000 lb. x 2.6¢/lb) is gained in alfalfa production. On a gross value basis, the gain is approximately $16 ($156 - $140) per ton of grain production foregone. With 153 tons of grain production foregone on a 540-acre farm that adds 125 acres of alfalfa to its crop mix, the gain in gross value of output is $2,448 (153 tons x $16/ton). Of course, changes in production costs must also be factored in to determine changes in whole farm net income.[1]

Including alfalfa in the crop mix of the Conventional system increased whole farm net income by $3,969. In the Ridge Till system, inclusion of

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[1]These gross value of output calculations are approximations based on the average figures shown in Tables 12 and 13. More accurate calculations and comparisons can be derived from the gross income figures in Table 11.

Table 12. Five-year (1985-1989) Average Yields and Estimated Total Production for the Conventional and Ridge Till Systems.

	Average Acres in Crop[1] (Acre)	Average Yield per Acre[2]	Average Total Production[3] (Ton)
Actual Conventional & Ridge Till (Corn + Soybeans + Wheat, no Alfalfa)			
Corn	156	88 bu.	384
Soybeans	156	23 bu.	108
Wheat	156	37 bu.	173
Set aside	72	--	--
Total	540		665 grain
Designed Conventional & Ridge Till (Corn + Soybeans + Wheat + Alfalfa)			
Corn	120	88 bu.	296
Soybeans	120	23 bu.	83
Wheat	120	37 bu.	133
Grain Subtotal			512 grain
Alfalfa	125	3.63 tons	454 alfalfa
Set aside	55	--	--
Total	540		

[1]Crop and set aside acres were compiled and averaged over the 5-year period for the two systems.

[2]Crop yields were compiled and averaged over the 5-year period for the two systems.

[3]In conversion to tons (2000 lbs/ton), corn = 56 lbs/bu., soybeans = 60 lbs/bu., and wheat = 60 lbs/bu.

Table 13. Five-year (1985-1989) Average Prices Received[1].

Crop	Price per Weight	Price per Pound	Total Average Price
Corn	$ 2.79/bu.	$0.05/lb.	
Soybeans	$ 5.55/bu.	$0.09/lb.	
Wheat	$ 4.37/bu.	$0.07/lb.	
Average of Grains[2]			$0.07/lb.
Alfalfa	$51.00/ton	$0.026/lb.	$0.026/lb.

[1]Prices used for corn, soybeans, and wheat reflect estimated selling price plus government payments--averaged over the 5-year period. Where the loan rate was found to be higher than the market price, the loan rate was used as the selling price. For alfalfa, selling prices were averaged over the 5-year period.

[2]Unweighted average of corn, soybeans, and wheat.

alfalfa increased whole farm net income by $5,202 (Table 11). We conclude that inclusion of alfalfa in the crop enterprise mix -- at least during the late 1980s in northeastern South Dakota -- would have enhanced farm profitability, over and above rotation effects reflected in the Alternative farming system.

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