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Alfalfa : An Economic Alternative to Corn?

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EC 772

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COOPERATIVE EXTENSION SERVICE
SOUTH DAKOTA STATE UNIVERSITY
U.S. DEPARTMENT OF AGRICULTURE

Summary and conclusions

Research trials in Butte County have shown that yields of over 5 T/A of alfalfa hay on heavy clay soils and of over 7 T/A on the better soils are realistic under good management conditions. Given the above yields and price relationships, alfalfa returns in relation to shelled corn and corn silage can be competitive on class 1 and 2 lands under intensive management. On class 3 and 4 land alfalfa may have a more distinct economic advantage.

It must be noted that the relative prices of the different crops determine how they rank in comparison to one another. It is difficult at best to determine what constitutes "comparable" prices between crops. The tables containing the returns at numerous different prices should be helpful in making comparisons.

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ALFALFA: AN ECONOMIC ALTERNATIVE TO CORN?

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Alfalfa is produced in every county in South Dakota and adapted to most irrigable soils. Of the crops currently raised, alfalfa is one of the best for production under irrigation.

In spring 1974, irrigated alfalfa trials on the Belle Fourche Irrigation District in extreme western South Dakota were begun by SDSU personnel. The trials demonstrated how existing technology can be used to boost alfalfa yields. Then some economic comparisons had to be made.

In this report, production costs and returns of alfalfa for different levels of management and at different prices are compared to shelled corn and corn silage, the major crops grown on the Belle Fourche Irrigation District. It is hoped this report will help producers make meaningful economic comparisons among the three crops.

For you to make realistic comparisons for your operation, work columns have been provided in the cost and return tables for your own figures. In this way irrigators outside the Belle Fourche district may be able to adjust the figures to suit their particular situation.

Production and management levels

Personal contacts with several producers on the district helped establish average and above average production levels for all three crops on two land classes. (For this report, class 1 and 2 lands have been combined and class 3 and 4 lands have been combined.)

Average alfalfa production was estimated to be about 5 T/A on class 1 and 2 land and 3 T/A on class 3 and 4.

Production results from the Butte County alfalfa trials provide a basis for economic evaluation of the returns from more intensive management of alfalfa. Research results have shown that intensive management through increased irrigation, fertility, and variety selection can increase production to more than 7 T/A on class 1 and 2 land and to more than 5 T/A on class 3 and 4 land.

It was estimated that average shelled corn production was 115 bu/A on class 1 and 2 land and 60 bu/A on class 3 and 4 land. With a conversion factor of 1 ton silage to 6 bushels of shelled corn this converts to 19 T/A and 10 T/A of corn silage.

Estimated production costs

Table 1 lists 1976 per acre values of agricultural land in Butte County. The projected market value ranged from $618 for class 1 to $412 for class 4. The 1976 sales assessment ration (weighted county average) on agricultural land was 22.8% of the projected market value. The tax mill rate of the Newell Independent School District for 1976 was 38.59.

This gives a property tax levy of $4.44/A for class 1 and and $3.63/A for class 4. Averages for classes 1 and 2 and classes 3 and 4 have been used in calculation of production costs. A land charge of

7% of the average market value was charged as an opportunity cost of having capital invested in land.

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Water rates on the irrigation district ranged from $7.00/A for class 1 land to $4.82/A for class 4 (Table 1). This is a fixed per acre charge for irrigation water with no additional charge for extra irrigations. An average figure is used for the land class groups. The only expense involved in extra irrigations is a labor charge of $1/A per irrigation. This may not be the case in other parts of the state, especially for irrigators using pumped water.

Estimated costs and returns for alfalfa establishment are presented in Table 2. Tables 3 and 4 itemize production costs and returns from established alfalfa at two levels of management for both classes of land.

The management differences were in the amount of fertilizer used and the number of irrigations applied, which are indicated in footnotes to the tables. These differences then reflect on the cost of production, yield, and net return.

Tables 5 and 6 itemize production costs and returns at one level of production for both shelled corn and corn silage on both sets of land classes. Most cost figures in Tables 2-6 were adapted from budgets prepared by Dr. W. Aanderud, Extension economist, SDSU, and from interviews with producers on the Belle Fourche district.

Variable field costs include fuel, oil, grease, and repairs for field machinery. An average cost of $17/A was used with all levels of alfalfa production. With the number of cuttings remaining the same with each level of production, the major cost variables that might be affected by yields are baling and farm hauling, and it was felt the differences in hauling would have little effect on total costs.

TABLE 1

Taxes, Values, and Water Costs for
Butte County Agricultural Land ($/A)
January 1977[1/]

Class	Taxable Value	Projected Market Value	Taxes	Water Cost
1	$141.00	$618.00	$5.44	$7.00
2	125.00	548.00	4.82	6.30
3	108.00	473.00	4.17	5.20
4	94.00	412.00	3.63	4.82

Sales assessment ratio 22.8%
Tax mill rate 38.59 (Newell Independent School District #9-2C)

1/ Tax information from Butte County Director of Equalization, water costs from Belle Fourche Irrigation District office.

TABLE 2

Estimated Costs and Returns Per Acre For Alfalfa Establishment on Belle Fourche Irrigation District 1977

Kinds of Costs	Land Class 1 & 2	Land Class 3 & 4	Your Operation
Variable in field costs	$18.55	$18.55	
Water charge	6.65	5.01	
Seed @ $1.50/1b	10.50	15.00	
Twine ($1.48/ton)	4.44	2.22	
Capital charge on above costs (8% for 6 mos.)	1.61	1.63	
Fixed machinery (DITI)*	20.50	20.50	
Labor	21.00	21.00	
Management fee	4.00	4.00	
Land taxes	5.13	3.90	
Production costs	92.38	91.81	
Land charge ($583, $442 @ 7%)	40.81	30.94	
TOTAL COST	$133.19	$122.75	
Expected yield	3 ton	1.5 ton	
Expected price	$50.00/ton	$50.00/ton	
Expected gross	$150.00	$ 75.00	
Net returns (Expected gross minus TOTAL COST)	$ 16.81	$-47.75	

*Depreciation, interest, taxes, and insurance.

TABLE 3

Estimated Costs and Returns Per Acre From Alfalfa
On Belle Fourche Irrigation District
Class 1 & 2 Land - 1977

Kinds of Costs	(3 cuttings) Average Management	Intensive Management	Your Operation
Variable in field costs	$17.00	$17.00	_____
Water charge	6.65	6.65	_____
Fertilizer	10.20	20.40	_____
Twine ($1.48/ton)	7.40	10.36	_____
Weed and insect control	3.50	3.50	_____
Farm overhead	3.00	3.00	_____
Capital charge on above costs (8% 6 mos.)	1.91	2.44	_____
Fixed machinery (DITI)*	20.50	20.50	_____
Labor	21.00	23.00	_____
Management fee	4.00	4.00	_____
Land taxes	5.13	5.13	_____
Production costs	100.29	115.98	_____
Land charge ($583 @ 7%)	40.81	40.81	_____
TOTAL COST	$141.10	$156.79	_____
Expected yield	5 ton	7 ton	_____
Expected price	$50.00/ton	$50.00/ton	_____
Expected gross	$250.00	$350.00	_____
Net returns (Expected gross minus TOTAL COST)	$108.90	$193.21	_____
Number of irrigations	3	5	_____
Fertilizer application (P_2O_5 lbs/acre)	60	120	_____

*Depreciation, interest, taxes, and insurance

TABLE 4

Estimated Costs and Returns Per Acre From Alfalfa
On Belle Fourche Irrigation District
Class 3 & 4 Land - 1977

Kinds of Costs	(3 cuttings) Average Management	Intensive Management	Your Operation
Variable in Field costs	$17.00	$17.00	_____
Water charge	5.01	5.01	_____
Fertilizer	5.10	10.20	_____
Twine ($1.48/ton)	4.44	7.40	_____
Weed and insect control	3.50	3.50	_____
Farm overhead	3.00	3.00	_____
Capital charge on above costs (8% 6 mos.)	1.52	1.84	_____
Fixed machinery (DITI)*	20.50	20.50	_____
Labor	21.00	23.00	_____
Management fee	4.00	4.00	_____
Land taxes	3.90	3.90	_____
Production costs	88.97	99.35	_____
Land charge ($442 @ 7%)	30.94	30.94	_____
TOTAL COST	$119.91	$130.29	_____
Expected yield	3 ton	5 ton	_____
Expected price	$50.00/ton	$50.00/ton	_____
Expected gross	$150.00	$250.00	_____
Net returns (Expected gross minus TOTAL COST)	$ 30.09	$119.71	_____
Number of irrigations	3	5	_____
Fertilizer application (P_2O_5 lbs/acre)	30	60	_____

*Depreciation, interest, taxes, and insurance

TABLE 5

Estimated Costs and Returns Per Acre From Corn
On Belle Fourche Irrigation District
Class 1 & 2 Land - 1977

Kinds of Costs	Shelled	Your Operation	Silage	Your Operation
Variable in field costs	$13.00		$18.60	
Water charge	6.65		6.65	
Seed	10.00		10.00	
Fertilizer	43.05		43.05	
Weed and insect control	6.67		6.67	
Farm overhead	3.00		3.00	
Capital charge on above costs (8% 6 mos.)	3.30		3.52	
Fixed machinery (DITI)*	20.00		21.50	
Labor	14.50		21.00	
Management fee	4.00		4.00	
Land taxes	5.13		5.13	
Production costs	129.30		143.12	
Land charge ($583 @ 7%)	40.81		40.81	
TOTAL COST	$170.11		$183.93	
Expected yield	115 bu.		19 ton	
Expected price	$ 2.50		$ 17.00	
Expected gross	$287.50		$323.00	
Net returns (Expected gross minus TOTAL COST)	$117.39		$139.07	
Number of irrigations	3		3	
Fertilizer (P_2O_5/acre)	65		65	
Fertilizer (N/acre)	150		150	

*Depreciation, interest, taxes, and insurance

TABLE 6

Estimated Costs and Returns Per Acre From Corn
On Belle Fourche Irrigation District
Class 3 & 4 Land - 1977

Kinds of Costs	Shelled	Your Operation	Silage	Your Operation
Variable in field costs	$13.00	_____	$14.60	_____
Water charge	5.01	_____	5.01	_____
Seed	10.00	_____	10.00	_____
Fertilizer	22.50	_____	22.50	_____
Weed and insect control	7.50	_____	7.50	_____
Farm overhead	3.00	_____	3.00	_____
Capital charge on above costs (8% 6 mos.)	2.44	_____	2.50	_____
Fixed machinery (DITI)*	20.00	_____	21.50	_____
Labor	14.50	_____	21.00	_____
Management fee	4.00	_____	4.00	_____
Land taxes	3.90	_____	3.90	_____
Production costs	105.85	_____	115.51	_____
Land charge ($442 @ 7%)	30.94	_____	30.94	_____
TOTAL COST	$136.79	_____	$146.45	_____
Expected yield	60 bu.	_____	10 ton	_____
Expected price	$ 2.50	_____	$ 17.00	_____
Expected gross	$150.00	_____	$170.00	_____
Net returns (Expected gross minus TOTAL COST)	$ 13.21	_____	$ 23.55	_____
Number of irrigations	3	_____	3	_____
Fertilizer application (P_2O_5 lbs/acre)	50	_____	50	_____
Fertilizer application (N lbs/acre)	60	_____	60	_____

*Depreciation, interest, taxes, and insurance

For corn production, a cost of $13/A was used for shelled corn on both land classes. For silage, $14.60 was used on class 3 and 4 land and $18.60 on class 1 and 2 land (due to increased tonnage). The cost of alfalfa seed was figured at $1.50 per pound and 7 pounds/A for seeding class 1 and 2 land and 10 pounds/A for class 3 and 4. The cost used for seed corn was $35 per bushel or $10/A (16 pounds seed/A).

Fertilizer costs vary with projected yields. The amount of fertilizer applied is shown at the bottom of tables 3-6. Prices of 17 cents/lb (application included) of phosphate and 20 cents/lb of nitrogen with $2/A application cost were used. An average annual weed and insect control cost was estimated at $3.50/A for alfalfa on both class 3 and 4 and class 1 and 2 lands. For corn production on class 1 and 2 land, a cost of $6.67/A was used, but a higher per acre cost of $7.50 was estimated for class 3 and 4 land. Producer interviews indicated a higher application rate for soil herbicides and insecticides on the heavy clay soil.

Farm overhead costs are those associated with the use of the farm pickup, tools, machine shop, etc. These were estimated at $3/A for all crops and land classes. Fixed machinery costs are the costs of machinery used in production and harvesting of the crops. These costs include depreciation, interest on borrowed money, personal taxes, and insurance. They were estimated at $20.50/A for alfalfa, $20/A for shelled corn, and $21.50/A for corn silage. An $18 charge was used as the amount necessary to handle all field labor operations for alfalfa. In addition, $1/A per irrigation of alfalfa was added. Labor costs on shelled corn were estimated at $10/A and $16.50/A for corn silage, with $1.50 added for each irrigation.

Estimated returns

Returns should probably be viewed in several ways:

Intensity of management. First, compare the differences in net returns from alfalfa due to better management and increased production. From Table 4, it can be seen that increasing production from 5 to 7 T/A on class 1 and 2 land increased net return from $109 to $193/A. Increasing alfalfa production on class 3 and 4 lands from 3 to 5 T/A increased net return from $30 to $120/A (Table 5). In both cases the 2 T/A increases netted approximately $90.

The main costs that were increased as production increased under more intensive management were fertilizer, twine, and additional labor for irrigation. There were no additional costs for water as a result of more applications.

It should be noted that some operators may take four cuttings per year instead of three. This does not necessarily increase yield but may result in higher quality hay due to cutting in earlier stages of maturity. The extra cutting would increase production costs by about $2 to $6/A.

Alternative crops. The second comparison is of established alfalfa, shelled corn, and corn silage as alternative crops. Any time such a comparison is made, you must try to determine a "comparable" price for each crop and "comparable" management or production levels. The following discussion is limited to "average" and "intensive" management levels with the corresponding production and prices used in Tables 2-6.

On class 1 and 2 land under average management, net return for the three crops compared as follows: corn silage, $139; shelled corn, $117; and alfalfa $109. At the higher production levels net return was alfalfa, $193; corn silage, $170; and shelled corn, $152. Average production on class 3 and 4 lands gave returns of alfalfa, $30; corn silage, $24; and shelled corn $13. Intensive management comparisons were alfalfa $120; corn silage, $37; and shelled corn, $34.

Establishment year. Thirdly, when looking at average returns for alfalfa over a rotation period, the year of alfalfa establishment must be included. A rotation period of 5 years was used for class 1 and 2 land and 8 years for class 3 and 4. Net returns for establishment year alfalfa were $17/A for class 1 and 2

land and -$48/A for class 3 and 4 (Table 3).

Average annual net returns from alfalfa on class 1 and 2 lands is lowered to $91/A under average management and to $158/A under intensive management (Table 7). Net returns from alfalfa remain lower than shelled corn or corn silage under average management but the difference increased. Under intensive management alfalfa moves from highest net returns to intermediate between shelled corn and corn silage.

On class 3 and 4 lands net returns from alfalfa are reduced to $20/A (Table 8) and rank between shelled corn and corn silage under average management. At the higher levels of production net return from alfalfa drops to $99/A (Table 8), but it is still considerably higher than either corn crop.

Tables 7-10 allow the reader to make comparisons between all three crops, at several production levels, and over a wide range of prices. Returns for alfalfa are reported on both a production year basis (from an established stand) and the average returns for the rotation period (includes the year of establishment). For instance, on class 3 and 4 land, 4 tons of alfalfa at $45/T gives a return of $55/A for any production year and $41/A average return over the rotation period (Table 8).

TABLE 7

Estimated Net Returns Per Acre From Alfalfa
Hay, Class 1 & 2 Land, Belle Fourche Irrigation District
1977

Price Per Ton	7 Ton		6 Ton		5 Ton	
	Established Stand[a]	5 Yr Rotation[b]	Established Stand[a]	5 Yr Rotation[b]	Established Stand[a]	5 Yr Rotation[b]
$70	$333	$282	$270	$231	$209	$183
65	298	251	240	204	184	160
60	263	220	210	177	159	137
55	228	189	180	150	134	114
50	193	158	150	123	109	91
45	158	127	120	96	84	68
40	123	96	90	69	59	45
35	88	65	60	42	34	22

[a]Production costs were: 7 ton - $157/A; 6 ton - $150/A; 5 ton - $141/A

[b]Average annual net returns over rotation period including seeding year

TABLE 8

Estimated Net Returns Per Acre From Alfalfa Hay, Class 3 & 4 Land, Belle Fourche Irrigation District 1977

Price Per Ton	5 Ton		4 Ton		3 Ton	
	Established Stand[a]	8 Yr Rotation[b]	Established Stand[a]	8 Yr Rotation[b]	Established Stand[a]	8 Yr Rotation[b]
$70	$220	$190	$155	$133	$ 90	$ 77
65	195	167	135	115	75	62
60	170	145	115	97	60	48
55	145	122	95	78	45	34
50	120	99	75	60	30	20
45	95	76	55	41	15	6
40	70	53	35	23	0	- 8
35	45	31	15	4	-15	-22

[a]Production costs were: 5 ton - $130/A; 4 ton-$125/A; 3 ton - $120/A

[b]Average annual net returns over rotation period including seeding year

TABLE 9

Estimated Net Returns Per Acre From Shelled Corn and Corn Silage, Class 1 & 2 Land, Belle Fourche Irrigation District 1977

Price Per Bushel	Bushels Shelled Corn[a]			Price Per Ton	Tons Silage[b]		
	130	115	100		21	19	16
$ 2.80	$191	$152	$121	$ 21	$254	$215	$163
2.60	165	129	101	19	212	177	131
2.40	139	106	81	17	170	139	99
2.20	113	83	61	15	128	101	67
2.00	87	60	41	13	86	63	35
1.80	61	37	21	11	44	25	3

[a]Production costs were: 130 bu - $173/A; 115 bu - $170/A; 100 bu - $159/A

[b]Production costs were: 21 ton- $187/A; 19 ton- $184/A; 16 ton- $173/A

TABLE 10

Estimated Net Returns Per Acre From Shelled Corn and Corn Silage, Class 3 & 4 Land, Belle Fourche Irrigation District. 1977

Price Per Bushel	Bushels Shelled Corn[a]			Price Per Ton	Tons Silage[b]		
	70	60	50		11	10	8
$ 2.80	$ 55	$ 31	$ 7	$ 21	$ 81	$ 64	$ 29
2.60	41	19	- 3	19	59	43	13
2.40	27	7	-13	17	37	24	- 3
2.20	13	- 5	-23	15	15	4	-19
2.00	- 1	-11	-33	13	- 7	-16	-35
1.80	-15	-17	-43	11	-29	-36	-51

[a]Production costs were: 70 bu - $141/A; 60 bu - $137/A; 50 bu - $133/A

[b]Production costs were: 11 ton- $150/A: 10 ton- $146/A 8 ton- $139/A