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COOPERATIVE EXTENSION SERVICE

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by

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Interest in conservation tillage continues to grow among farmers of South Dakota. The Soil Conservation Service estimates that the percentage of total cropland in South Dakota, under some form of conservation tillage, grew from 19% to 29% during the years 1982 through 1985. Conservation tillage (also referred to as minimum tillage) offers a variety of tillage practices that control soil loss, reduce the number of trips over the field and save on labor and fuel costs. True conservation tillage is defined as any tillage and planting system that retains at least 30 percent residue cover on the soil surface after planting. This may include any of the following Soil Conservation Service classifications:

NO-TILL: The soil is left undisturbed prior to planting. Planting is completed in a narrow seedbed approximately 1-3 inches wide. Weed control is accomplished primarily with herbicides.

RIDGE-TILL: The soil is left undisturbed prior to planting. Planting is completed on ridges usually 4-6 inches higher than the row middles. Weed control is accomplished with a combination of herbicides and cultivation. Ridge till cultivators are used to rebuild the ridges.

STRIP-TILL: The soil is left undisturbed prior to planting. Approximately 1/3 of the soil surface is tilled in the planting row at planting time. This is done with the use of a rototiller, in-row chisel, row cleaners, etc. Weed control is accomplished with a combination of herbicides and cultivation.

MULCH-TILL: The total soil surface is disturbed by tillage prior to planting. Tillage tools such as chisels, field cultivators, discs, sweeps, or blades are used. Weed control is accomplished with a combination of herbicides and cultivation.

REDUCED-TILL: Any other method of tillage, not covered above, that meets the 30 percent residue requirement.

Economics Newsletter No. 225 in July of 1985 reported on a study which showed that the technology of reduced tillage places an increased demand on management. Significant reductions in machine costs may be realized through reduced tillage, but many factors influence the chemical costs as well as the machine costs on an individual farm. There is an increased concern for such things as chemical selection, timing of application, placement of chemicals, field monitoring for special problems and proper machine operations. The many alternative production systems and/or practices that may be selected have given rise to uncertainty regarding the most profitable system to use.

Therefore, a study was initiated in 1986 to identify tillage systems being used by South Dakota farmers and to investigate farmers' opinions and experience with conservation tillage. This newsletter reports on the results of the 1986 study.

Farmer Survey

The overall study was accomplished in two parts. Part 1 involved a 12% random sample mail survey of all farmers in South Dakota with farms larger than 40 acres in crop reporting districts 1, 2, 3, 4, 5, 7 & 8. Part 2 of the survey was a cooperative effort with the SDSU Plant Science Department in a special study of corn and soybean production in crop reporting districts 6 and 9, conducted by Pamela Hutchinson, graduate research assistant.

Part 1 of the survey provided 320 usable responses from farmers in 7 out of 9 South Dakota crop reporting districts. Sixty-nine percent of the respondents indicated they were currently using conserva-

tion tillage practices on their farm. Fifty-nine percent of those using conservation tillage were using mulch tillage, 14 percent strip tillage, 5 percent ridge till and 22 percent no till. Ninety-five respondents did not identify the type of system being used. Of those not using conservation tillage, 46 percent of them indicated they were considering its use in the near future.

Table 1. Major Grain Crops Produced and Number of Farms Using the Moldboard Plow in Seedbed Preparation for the Crop.

Crop	No. of farms Producing the Crop	No. of farms Using a Plow
Spring Wheat	176	66
Corn	157	112
Oats	138	44
Winter Wheat	91	3
Barley	91	26
Sorghum	32	4
Soybeans	24	13

Table 1 identifies the major grain crops produced and whether or not a moldboard plow is used to prepare a seedbed. Out of 157 corn growers, 112 indicated that they used the moldboard plow to prepare a corn seedbed; 13 of 24 soybean growers used the moldboard plow and 66 out of 176 spring wheat growers used the moldboard plow to prepare a seedbed. If elimination of the moldboard plow is used as the criterion to identify conservation tillage practices, these findings indicate that 29% of the corn growers, 54% of the soybean growers and 62% of the spring wheat growers are using conservation tillage practices. This compares with 69% of the total respondents who indicated they were currently using some form of conservation tillage. It must be noted that farmers are using conservation tillage on one crop and not necessarily on all crops. Also, many farmers are in the process of testing the system and may be using some form of reduced tillage on portions of their total crop production. Ninety-three percent of the respondents believe that conservation tillage can help to control soil erosion in their area of the state.

Farmer Opinions

Table 2 reflects the opinions of respondents regarding possible benefits from

Table 2. Opinions as to the Benefits of Conservation Tillage.

Possible Benefit	Number of Respondents who: Agree	Disagree	No Response
Helps to conserve moisture	392 (91%)	9	19
Fuel costs are lowered	276 (86%)	21	23
Reduces labor requirement	267 (83%)	33	20
Machine costs are reduced	206 (64%)	84	30
Total cash costs are lowered	172 (54%)	102	46
More profitable than conventional tillage	166 (52%)	95	59
Yields are usually higher	125 (39%)	130	55

conservation tillage. These data indicate no consensus of opinion on many of the possible benefits. The benefits having the highest consensus of opinion, with 75% or more of the respondents in agreement, include a reduction in labor requirements, lower fuel costs and moisture conservation. Less than 40% of the respondents agreed that disease and pest control and higher yields were possible benefits of conservation tillage. Fifty-two percent of the respondents agreed that conservation tillage is more profitable than conventional tillage; 30 percent disagreed with the proposition and 18% expressed no opinion.

A rating of possible problems with conservation tillage is presented in Table 3. Farmers were asked to rate each of the problems as to its importance with respect to conservation tillage. A rating of 1 indicates that the problem statement is not true and is of very little importance. A rating of 10 indicates that the problem statement is true and is highly important. Problems with the highest average rating include difficulty in weed control, use of chemicals being undesirable and high machine investment. All of the problems received ratings high enough to be deserving of attention by researchers and educators.

Table 3. Rating of Potential Problems with Conservation Tillage

Problem	Average Rating	Problem Rating: Low Importance 0	1	2	3	4	5	6	7	8	9	High Importance 10
		No. of Respondents										
Weed control is a special problem	8.02	18	13	3	12	5	32	10	11	45	21	151
New machine investment is too high	6.91	20	35	9	12	14	40	13	11	35	21	111
Use of chemicals is undesirable	6.76	26	33	7	30	9	39	19	10	30	[illegible]	103
There are too many problems in general	5.66	31	41	18	23	17	52	13	19	36	16	45
Technology is difficult to manage	4.91	27	41	17	33	25	77	31	19	20	5	26
Chemical use is too technical	3.88	21	95	34	31	26	37	13	18	20	5	21
Higher risk of crop losses	3.72	31	93	38	27	32	45	19	10	12	5	19

Fifty-five percent of the respondents rated the technology of conservation tillage as being 5 or above in level of importance on a rating scale of 1 to 10. Twenty-six respondents rated the difficulty with technology as being very low in ortance, while 26 rated it as being of the highest importance. The distribution of opinions regarding the difficulty of understanding the technology is such that conservation tillage should be looked upon as a higher level technology and not a simplification of production systems.

[M]achine Costs

In Part 2 of the survey, farmers were asked to identify the machine operations on two major grain crops produced on their farm. Each respondent specified the machine operation, number of times over, implement size, tractor size, custom hired operations and tandem hookups used. Part 2 of the survey included crop reporting districts 6 and 9 in Southeastern South Dakota. Thus, data on machine operations were obtained from all crop reporting districts in the state.

A computer program was written to calculate machine costs for each farm; typical operating costs were determined based upon implement and tractor size plus other information specified by the farmer on each machine operation. Implement costs per acre include repair, housing, insurance, interest on investment and depreciation. Tractor costs are based upon hourly cost of operation and include fuel, repair, housing, insurance, interest on investment and depreciation. Current custom rates were used if an operation was custom hired.

Table 4 shows an average cost of $26.21 per acre for corn production on 770 farms. This does not include harvest cost. Only field operations up to the time of harvest are included--such as disking, planting, cultivating and spraying for weed or pest control. Costs for corn production ranged from a low of $10.21 per acre to a high of $54.91 per acre. Wide variations in cost per acre between individual farms are revealed in this analysis. The data show that many farmers are realizing significant reductions in machine costs through reduced tillage systems. Table 5 presents data on the number of times over the field with different machine operations. Perhaps the single most important cause for machine cost variations among farmers is a difference in the number of trips over the field with machines. For example, with corn production there is a range from 2 times over to 12 times over. Similar variations are found for all of the crops. Other factors, such as the number of tractors and size of tractors used also affected the costs.

Table 4. Machine Costs per Acre, per Farm for Major Crops

	No. of Farms	Total Machine Cost per Acre			Fuel Cost Per Acre		
		Low	High	Average	Low	High	Average
Corn	770	$10.21	$54.91	$26.21	$0.49	$8.67	$2.82
Soybeans	473	2.83	55.81	21.81	0.00	9.75	2.35
Spring Wheat	120	5.26	32.47	17.10	0.22	4.06	1.44
Winter Wheat	45	5.26	41.25	13.23	0.00	2.70	0.91
Oats	51	5.92	32.74	15.22	0.45	4.52	1.34
Barley	39	5.28	28.36	13.84	0.25	2.65	1.07
Sorghum	11	14.02	25.72	19.22	0.66	2.96	1.74
Sunflowers	6	13.15	27.18	17.09	0.68	1.49	1.17

Table 5. Times Over and Machine Hours per Acre per Farm for Major Crops

	No. of Farms	Over the Field			Hours per Acre		
		Low	High	Average	Low	High	Average
Corn	621	2	12	7.0	0.145	1.738	0.839
Soybeans	473	1	11	5.9	0	3.1	0.692
Spring Wheat	120	1	8	4.3	0.018	1.018	0.400
Winter Wheat	45	1	8	4.6	0.018	0.683	0.251
Oats	51	1	7	3.7	0.126	0.926	0.465
Barley	39	1	8	3.9	0.036	0.728	0.311
Sorghum	11	3	8	5.5	0.148	1.012	0.516
Sunflowers	6	3	7	5.3	0.221	0.760	0.472

Care must be exercised in interpreting the results. For instance, in corn production, the data do not indicate that all farmers should necessarily expect to realize the low costs of $10.21 per acre. In some instances the low fuel cost per acre is realized on a farm with 0 fuel costs. This is because all operations were custom hired and fuel cost was part of the custom hire charge. The data do show that farmers are experiencing a wide range of machine costs per acre and that significant reductions in machine costs may be realized through reduced tillage operations.

Table 6 identifies the number of tractors used in tillage operations and the number of tractors per farm. Most tillage operations are carried out with tractors in the 80 to 150 horsepower range. However, low horsepower tractors continue to be used for tillage operations. In corn production, for instance, 35% of the tractors were 80 horsepower or less.

Table 6. Number of Tractors Used in Tillage Operations for Major Crops

Crop	Number of Tractors Per Farm	Tractor Horsepower					
		0-60	60-80	80-100	100-120	120-150	150+
		------ No. of Tractors ------					
Corn	2.19	332	257	401	335	243	116
Soybeans	2.03	181	129	229	202	149	71
Spring Wheat	1.85	40	22	46	47	47	20
Winter Wheat	1.5	6	8	12	12	21	9
Oats	1.7	26	10	27	16	6	2
Barley	1.7	10	7	17	12	14	7
Sorghum	1.8	2	3	4	4	4	3
Sunflowers	2.17	2	3	2	2	3	1

Summary and Conclusions

The results of a survey of South Dakota farmers support the conclusion that a significant reduction in costs may be realized through reduced tillage operations. Many farmers are experiencing satisfactory yields as well as reduced cost.

However, there is a diversity of opinion regarding the possible benefits of conservation tillage. The diversity of opinion regarding the difficulty of understanding the technology suggests that conservation tillage should be looked upon as a higher level technology and not a simplification of production systems.

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Address Correction Requested

Increased attention must be given by management to such things as chemical selection, timing of chemical application, placement of chemicals, field monitoring for special problems and proper machine operation.

Potential problems evaluated by farmers in this survey received ratings diverse enough to require serious attention by researchers as well as educators. The most serious problems were those concerned with weed control, use of chemicals as an undesirable feature and the cost of new machine investment. There was no consensus of opinion among respondents regarding the profitability of conservation tillage. However, 93% of the respondents believed that conservation tillage could help to control erosion in their area of the state. Thus, farmer experience indicates a potential for significant benefits. However, continued research and educational work is essential to the solution of problems associated with conservation tillage.

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