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AGRONOMY NOTES

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Some Effects of Shifting to Conservation Tillage Systems For Intensive Production of Corn and Soybean

K.L. Wells, H.C. Vaught, and David Heisterburg

BACKGROUND

About three-fourths of Kentucky's cropland base occurs on sloping land with some degree of erosion hazard. During the past decade, production of soybeans and corn increased rapidly in Kentucky, particularly on sloping land. This resulted in severe erosion on many farms, particularly in the intensive grain producing counties. Much of this field erosion could be greatly reduced by developing a system for each field that would incorporate use of such agronomic practices as sod waterways, no-till planting, contour plowing, minimum tillage, strip cropping, double-cropping, winter cover crops, crop residue management and rotations. It is believed that the current acreage of corn and soybean can be maintained and even expanded in some areas if such production-oriented erosion control practices were widely used.

A farm in Barren County, Kentucky, was selected in 1982 to serve as a demonstration farm to test applicability of an intensive grain production system that University of Kentucky agronomists (1) had shown in a plot study to have promise for continuous grain (corn-wheat-soybean) production on sloping land without erosion. This system was based on:

- (1) establishing strips of constant width in each field, somewhat along the contour of the slope
- (2) annual rotation of corn and soybean between strips
- (3) seeding wheat for winter cover (wheat was killed for use as a mulch when corn was planted and was harvested for grain when soybean were planted)
- (4) no-till planting of corn and soybean
- (5) double cropping wheat and soybean

This was one of four farms selected to participate in a farm demonstration program under the leadership of the University of Kentucky College of Agriculture to demonstrate effective soil and water conservation practices for intensive grain production. The USDA-Soil Conservation Service (SCS), USDA-Agricultural Stabilization and Conservation Service (ASCS), and the Tennessee Valley Authority (TVA) cooperated with UK in conducting this program.

FARM DESCRIPTION

The farm selected is operated by Maurice and Hilda Furlong. It is a full time cash grain operation of 312 acres, 237 acres of which are owned, and 75 acres of which are leased. Income from this operation represents the major source of livelihood. The Furlong's owned acreage occurs on a strongly dissected and sloping landscape, which has undergone moderate to severe erosion of topsoil from past management practices. Major soils are 3 to 6 percent sloping Crider silt loam on broader ridges with 6 to 12 percent sloping Christian, Talbott, and Baxter soils on narrower ridgetops and sideslopes. Risk of erosion from production of row crops on such soils is great, and additionally, estimated yield potential on all except the Crider soil is limited. Although Mr. Furlong had previously no-tilled some fields, a johnsongrass infestation in others required clean seedbed preparation in order to incorporate johnsongrass control herbicides.

SYSTEM DEMONSTRATED

The system described above was implemented in 1982, except that full season instead of double crop soybean production was used. Mr. Furlong chose not to double-crop since he preferred the higher potential yields of earlier planted full-season soybeans. Strips were laid out by SCS on 80 acres of land that averaged 10 to 12 percent slope, and on which a wheat cover crop had been sown in the fall of 1981. The strips were 72 ft. wide and were planted in 3-ft row spacing, resulting in 24 rows per strip. Strip width was matched to machinery available and to the slope of the field. Alternate strips of killed wheat were planted to no-till corn in April and no-till soybean in late May. Grass waterways were maintained in major drainage channels on hillsides. Because of the successful experience in 1982-83, the same strip rotation was established on an additional 25-acre sloping field in 1984.

PROGRAM RESULTS

Except for the severe drought in 1983, corn and soybean yields from this system were considered to be excellent (Table 1). Yield estimates from the strip rotation were considerably better than the whole-farm yield averages for corn and soybean, and were similar to those reported from the UK small plot test of this system. This intensive grain system on 3 to 12 percent sloping land successfully withstood over 14 inches of rainfall during August of 1982, 9 of which fell during two events, without any visible erosion. The program was concluded in 1985, following a multi-county field day in 1984 that emphasized intensive production of grain on erosive land with low-cost agronomic erosion control practices. The field day was attended by 450 people. Farmers, Extension agents, SCS Conservationists, and ASCS County personnel from the Mammoth Cave, Lincoln Trail, and Lake Cumberland Areas (south-central Kentucky) were the target audience. The farming system tested here was also used for in-service training of Extension agricultural agents and several other tour groups, including one international group.

COSTS FOR IMPLEMENTING THE CONSERVATION PRACTICES

Farm records were kept through the UK Farm Analysis Program and total costs per acre of tillable land for fertilizer, pesticides, seed, and labor for the total farm operation are shown in Table 2. Although the records were kept on an enterprise basis rather than a field basis, it is apparent that cost of implementation of the conservation tillage practices in 1982 did not cause total costs to materially differ from those of the preceding two years when the entire farm acreage of corn and soybeans was grown in a conventionally prepared seedbed. Except for herbicides, there were no direct added production costs in using land in this manner to produce corn and soybeans as compared with more conventional methods. The necessary equipment -- no-till planter, spray rig, combine, and disk harrow -- were already owned by Mr. Furlong.

Indirect costs associated with this system relate to less effective grain acreage per field since a sod turn-strip of about 30-foot width must be left open on each end of the field and natural drainageways must be maintained in sod. However, improved corn and soybean yields related directly to rotation, no-till production, and border-row effect of the strips should about

off-set loss of grain production from sod turn strips and sod waterways. The greatest long-term value of the system is the reduction of topsoil loss with associated short-term economic savings in lime and fertilizers which would be required to replace that lost by erosion.

CONCLUSION

A strip crop rotation of corn and full season soybean no-tilled into a wheat cover crop was effective in controlling erosion from gently sloping to sloping Crider, Christian, Talbott, and Baxter soils. Yields obtained from these eroded soils were higher than expected, possibly due to improved moisture utilization from the no-till planting and rotation practices used. Four years of actual farm demonstration indicated that low-cost, effective erosion control can be obtained on gently sloping to moderately sloping fields with use of a no-till/minimum till strip rotation in continuous production of corn and soybeans.



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FOOTNOTE

Mr. Furlong has continued use of this system of intensified corn and soybean production. However, due to johnsongrass control problems in corn, he has modified the system described above, as follows: soybean residues are used as winter cover instead of wheat on strips following soybeans. These strips are then chisel plowed and disked in the spring prior to planting corn in order to enable incorporation of herbicides for johnsongrass control during corn production.

REFERENCE

1. Wells, K.L., H.C. Vaught, M.J. Bitzer, and M.W. Russell. 1980. A cropping system for intensive grain production on sloping land. Agronomy Notes. Univ. of Kentucky Dept. of Agronomy, Vol. 13, No. 1.

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Table 1. Acreage and average yield of corn and soybeans.

Year	<u>1/</u>				<u>2/</u>			
	Whole Farm				Strip Crop Rotation			
	Corn	Soybeans			Corn	Soybeans	Corn	Soybeans
Year	Acres	bu/A	Acres	bu/A	Acres	bu/A	Acres	bu/A
1980 ^{3/}	200	82	0	-	-	-	-	-
1981 ^{3/}	104	132	116	39	-	-	-	-
1982	112	136	71	47	34	160	34	57
1983 ^{4/}	109	51	123	18	34	65	34	24
1984	151	119	65	39	45	163	45	not sampled
1985	144	105	65	39	45	161	45	not sampled

1/ includes acreage and production from strip rotation.

2/ yield estimated from subsampling the strips.

3/ benchmark years; program implemented in 1982.

4/ severe drought during 1983.

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Table 2. Gross returns and cost of fertilizer, pesticides, seed, and labor per tillable acre^{1/}.

Year	Cost Per Tillable Acre For:				Gross Returns Per Tillable Acre
	Fertilizer	Pesticides	Seed	Labor ^{2/}	
-----dollars-----					
1980 ^{3/}	28	8	5	41	189
1981 ^{3/}	41	16	13	49	243

1982 ^{4/}	52	16	12	58	230 ^{4/}
1983	44	11	11	49	152
1984	53	16	18	60	246
1985	52	12	9	58	250

^{1/} Average for whole farm acreage of tillable land.

^{2/} Increased labor costs shown for 1982-85 were the result of a change made in labor accounting rather than being directly related to labor costs/tillable acre.

^{3/} Benchmark years; program implemented in 1982.

^{4/} Severe drought during 1983 greatly reduced yields and gross returns.

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