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Conventional and Reduced Tillage Methods in Corn Production

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Reduced tillage practices may provide benefits in corn production. Applying reduced tillage methods will result in reduced operating expenses and time spent in the fields. By retaining surface cover, it will reduce soil erosion and may increase the percentage of rainfall stored as soil moisture, thus providing ready moisture for seed germination and early crop growth.

However, there are potential hazards associated with reduced tillage. A weed problem may develop after several years of reduced tillage on a continual basis. Herbicide and/or cultivation may not be able to control all weeds. Yields then may suffer, thereby reducing the economic incentives of reduced tillage.

This study reports a comparison of yields, weed control, and production cost for conventional and reduced tillage practices. The tests were conducted on irrigated corn for 8 years (1974-1981) at the same location on the Scandia Irrigation Experiment Field in North Central Kansas.

AGRICULTURAL EXPERIMENT STATION

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Materials and Methods

Tests were made using four tillage systems (Table 1) in a split-plot design with four replications. Subplots were composed of cultivation when necessary and no cultivation. The D-P-D-S and D-D-S plots were 100 feet by 15 feet and planted with a 6-row IHC Cycle planter. The D and N plots were 100 feet by 10 feet and planted with a 4-row Buffalo Till planter.

Herbicides were applied to all tillage treatments. Treatments D-P-D-S, D-D-S, and D were banded at planting with Lasso/Atrazine (2.5 qts. and 2 lbs/acre) in 20 gallons of water per acre in 1974 and 1975. 2,4-D was broadcast before planting on the N plots at 1.5 pints and 1.0 pints per acre during 1974 and 1975, respectively. Lasso/Atrazine, at the above rates, was broadcast to all treatments after planting with 20 gallons of water per acre for 1976 through 1978. Beginning in 1979 through 1981 the water was increased to 40 gallons per acre and broadcast after planting to all plots. The rates of Lasso/Atrazine remained the same ex-

cept during 1981 the Lasso was reduced to 2.0 quarts per acre.

All plows were furrowed for surface irrigation except in 1975. During 1975 a wet spring prevented entering the field until the corn was too tall for furrowing. Alternate rows were irrigated for 24 hours during 1974 and 1975. The duration was changed to 48 hours for 1976 through 1981.

Fertilizer and insecticide, Furadan at 10 pounds per acre, were applied uniformly to all plots.

Results and Discussion

Corn hybrids and yields are reported in Table 2. Prior to 1979 the yields indicated significant differences among tillage methods with the no preplant tillage (N) being inferior. However, the 8-year summary indicates no significant differences among tillage methods. The trend of a significant difference prior to 1979, then no significant difference for the 8-year (1981) summary is reflected in the plant population (Table 3).

Table 1. Tillage Treatments and 1980 Custom Costs.

Notation	Treatment	1980 Custom Rate (\$/Acre)
D-P-D-S	Disk, Plow, Disk, Springtooth	\$19.45
D-D-S	Disk, Disk, Springtooth	\$11.59
D	Disk only	\$ 4.33
N	No Preplant Tillage	none

Table 2. Yields for Corn Tillage Treatments.

Tillage Treatments	Yields* (bu. acre)								
	1974	1975	1976	1977	1978	1979	1980	1981	Avg.
D-P-D-S	171	175	127	128	177	158	141	156	154
D-D-S	165	173	96	140	176	138	147	140	147
D	163	172	112	165	162	154	139	157	153
N	147	165	100	159	150	168	144	165	150
L.S.D. (.05)	18	N.S.	13	18	N.S.	22	N.S.	N.S.	N.S.
Hybrid	Dekalb XL72A	NC+ 85SX	Dekalb XL75	Dekalb XL75	Dekalb XL75	Pioneer 3195	Dekalb XL72A	Dekalb XL74A	

* Yields corrected to 15.5% moisture

In 1979, two changes were made that may account for this reversal of trend. Prior to 1979, there was a significant difference in plant population attributed to the difference in planters. Adjustments to the Buffalo Till planter in 1979 provided comparable plant populations in 1979 through 1981. Also, before 1979, herbicides were applied in 20 gallons of water per acre, then beginning in 1979 the water was increased to 40 gallons per acre. The additional 20 gallons of water per acre may have provided better herbicide-soil contact thereby providing equivalent weed control among tillage methods from 1979 through 1981 (Table 4). Either or both of these changes made in 1979 may be responsible for the reversal of the 6-year trend in yields and plant populations established in 1979.

There were no significant differences among tillage methods for yields or plant populations for the 8-year period of this study. The practice or absence of cultivation was not significant between tillage methods

Table 3. Tillage Treatment Plant Populations.

Tillage Treatments	Plant Population (1,000 plants per acre)									
	1974	1975	1976	1977	Year		1980	1981	Avg.	
D-P-D-S	22.2	25.3	23.4	25.4	1978	23.3	23.8	25.4	23.4	24.0
D-D-S	24.0	22.9	26.5	27.6	1979	23.4	20.2	24.4	23.4	24.1
D	23.0	19.8	18.2	27.6	1980	20.2	23.1	24.6	24.7	22.7
N	21.1	17.6	18.0	27.1	1981	19.3	25.1	25.3	25.5	22.4
L.S.D. (.05)	1.6	3.4	3.4	N.S.	1978	2.0	2.7	N.S.	N.S.	N.S.

Table 4. Tillage Treatment Broadleaf Weed Control.

Tillage Treatments	Broadleaf Weed Control (%)									
	1974	1975	1976	1977	Year		1980	1981	Avg.	
D-P-D-S	96	68	80	94	1978	87	100	89	96	89
D-D-S	100	79	58	91	1979	86	100	86	100	88
D	87	70	14	81	1980	36	99	78	98	70
N	73	58	21	64	1981	40	99	85	100	68
L.S.D. (.05)	17	14	19	12	1978	16	N.S.	N.S.	N.S.	17

for yield, plant population, and weed control in both the sixth- and eighth-year summaries.

However, there is a difference in the cost associated with each tillage method. Table 1 shows the 1980 custom cost of the tillage systems. All applications of herbicides, fertilizers, and insecticides were applied uniformly to all plots and are excluded from the system cost.

One hypothesis at the beginning of the experiment was that a weed problem may develop after several years on the reduced tillage plots. A shatter cane problem did develop. Yet, there was no significant difference between tillage methods for control of shatter cane.

Conclusions

Reduced tillage produces comparable yields at reduced cost if there are comparable plant populations. Conventional tillage is just as likely to develop a weed problem as reduced tillage. Weeds uncontrolled by herbicides may necessitate the rotation of crops with the use of different herbicides for weed control. Herbicides applied to no preplant tillage should be applied with 40 gallons per acre of carrier.

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