1982

Conventional and Reduced Tillage Methods in Corn Production (1982)

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Recommended Citation
Powell, D. Michael and Raney, Robert J. (1982) "Conventional and Reduced Tillage Methods in Corn Production (1982)," Kansas Agricultural Experiment Station Research Reports: Vol. 0: Iss. 12.
https://doi.org/10.4148/2378-5977.7257

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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.
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 Cyclopath 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 except 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) |
|--------------------|--------------------|
|                    | Year 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. (0.05)      | 18 N.S. 13 N.S. 22 N.S. N.S. N.S. |
| Hybrid             | Dekalb NC+ Dekalb Dekalb Dekalb Pioneer Dekalb Dekalb |
|                    | XL72A 85SX XL75 XL75 XL75 3195 XL72A 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 | 1978 | 1979 | 1980 | 1981 | Avg. |
| D-P-D-S            | 22.2 | 25.3 | 23.4 | 25.4 | 23.3 | 23.8 | 25.4 | 23.4 | 24.0 |
| D-D-S              | 24.0 | 22.9 | 26.5 | 27.6 | 23.4 | 20.2 | 24.4 | 23.4 | 24.1 |
| D                  | 23.0 | 19.8 | 18.2 | 27.6 | 20.2 | 23.1 | 24.6 | 24.7 | 22.7 |
| N                  | 21.1 | 17.6 | 18.0 | 27.1 | 19.3 | 25.1 | 25.3 | 25.5 | 22.4 |
| L.S.D. (.05)       | 1.6  | 3.4  | 3.4  | N.S. | 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 | 1978 | 1979 | 1980 | 1981 | Avg. |
| D-P-D-S            | 96   | 68   | 80   | 94   | 87   | 100  | 89   | 96   | 89   |
| D-D-S              | 100  | 79   | 58   | 91   | 86   | 100  | 86   | 100  | 88   |
| D                  | 87   | 70   | 14   | 81   | 36   | 99   | 78   | 98   | 70   |
| N                  | 73   | 58   | 21   | 64   | 40   | 99   | 85   | 100  | 68   |
| L.S.D. (.05)       | 17   | 14   | 19   | 12   | 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.