MT-4F
1986

TITLE: Maximizing Winter Wheat Production with Conservation Tillage in the Northern Great Plains

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PROJECT DURATION: July 1, 1984 through June 30, 1988

EXPERIMENTAL LOCATION: Central Montana

OBJECTIVES:

1. Maximize winter wheat production in semiarid regions of the Northern Great Plains. The winter wheat yield goal will be 10 bu/acre/inch of investigations outlined in objectives 2-5.

2. Determine the timing and extent of water and nutrient extraction from the soil by winter wheat varieties as affected by summer fallow and conservation tillage cropping systems.

3. Compare root exploration patterns of winter wheat varieties on summer fallow and conservation tillage acreage.

4. Differentiate winter wheat varieties relative to nutrient and water use efficiencies and yield and protein response to tillage and nutrient variables.

5. Determine the optimum seeding rate and row spacing needed for maximum winter wheat production on no-till and fallow conditions.

RESULTS:

Objective 1:

Spring wheat was seeded in 1986 instead of winter wheat due to the extremely wet weather during August, September and October 1985. However, some of the highest spring wheat yields on record were measured this year. With adequate nutrients, spring wheat yields often exceeded winter wheat, however, most farmers did not fertilize for a cool, moist growing season.

With the 10.14 inches of growing season precipitation and the 8.5 inches of available water stored in five feet of soil, then almost 19 inches of water were available to crop this year. There were no differences in stored soil water between the no-till and fallow areas, soils in both research areas were full of water. Maximum yield was 67 bu/A. with Glenman Spring Wheat and 120 lbs. N/A or 3.5 bu/acre-inch of water. Soil water was difficult to measure accurately due to gravel in the soil profile which occurred anywhere from 2 to 5 feet.

Objective 2 & 3:

Soil water use by Newana Spring Wheat are plotted in figures 1 through 3. The figures show water use and root activity down to four feet. There does not appear to be any difference between soil water use or rooting patterns in fallow or no-till cropping systems.

Due to funding cuts water use measurements were curtailed and nutrient measurements were eliminated.

Objective 4:

The effect of variety and fertilizer treatments on the grain yield and protein content, test weight and grain producing tillers are shown in tables one through four. The grain yield, protein content and test weight data are most interesting this year and deserve careful consideration because only one growing season is represented.

Several unusual observations were noted this year. No-till, recrop yields were higher than fallow. Seldom are recrop and fallow yields equal or recrop higher even when soil water levels are similar. If the treatments are compared between no-till and fallow, (table 1), no-till grain yields are higher than fallow in 19 of 24 treatments which is significant according to the sign test. The interaction between variety and fertility level was non-significant. Careful examination of the N variables indicate that both varieties have classical and similar N response curves even though Glenman had significantly higher yield than Newana. Although the field design will not allow separation, a cropping system, N, P and K interaction seems to be evident. Phosphorus, potassium and sulfur responses are evident in some cases, but inconsistent. With identical fertility levels, placing all fertilizer below the seed seemed to have a consistent but non-significant yield increase over the nitrogen topdressed treatments. Three more years of data should help "clean up" some of the inconsistent differences observed this year.

Fertility level, cropping system and variety selection usually has an effect on grain protein content - this year was no exception. Grain protein levels in spring wheat are very important because of the price premium or discount a producer may receive for a crop with protein levels above or below 14%. This year a protein premium or discount is about $0.10 per bushel for each 0.25% of protein above or below 14%, respectively. The data shown in table 2 indicate the difficulty in producing 14% protein in spring wheat under recrop conditions and that Newana has higher protein content than Glenman even at similar yield levels. The difference between 90-0-0-0 (4) and other similar N treatments is quite surprising and difficult to interpret.

Test weight is another quality consideration that producers must consider when making crop management decisions. These data are summarized in table three, and the numbers show that test weights produced under no-till conditions can be significantly greater than fallow. There appears to be an interaction between cropping systems and varieties, however, the field design prohibits the evaluation of a test weight interaction. Sometimes increasing nitrogen delays maturity and decreases test weight, however, this observation did not occur this year.

Objective 5:

The effect of row spacing and seeding rate under fallow and no-till conditions on grain yield, protein content, test weight and head producing tillers are shown in table five through eight. Grain yields (table 5) were higher with 12" row spacing than 24", but the difference was only 2 bu/A under the no-till system. Again no-till yields were greater than fallow. It appears that the usual seeding rate recommendations of 15 seeds/sq. ft. (45 lbs/A) under fallow conditions and 20 seeds/sq. ft. (60 lbs/A) under no-till conditions should not be changed.

Seeding rate or row spacing had very little effect on protein content (table 6) although there was a slight increase in protein content with the wide rows under fallow conditions. Test weight differences are shown in table seven, and no differences are indicated between row spacings. However, no-till test weights were slightly higher than fallow, and the 5 and 10 seeds/sq. ft. test weights were less when compared with the remaining treatments. The 5 and 10 seeds/sq. ft. seeding rates delayed maturity this year which is probably the reason for the lower test weights.

YIELD LIMITING FACTORS OBSERVED THIS YEAR:

Some water stress was observed during the last 2 weeks of June which probably reduced yields. Grasshoppers were a big factor this year, but an aggressive spray program kept the yield losses to a minimum level.

PLANNED CHANGES FOR NEXT YEAR:

The variety 'Neeley' was substituted for MT 8003 since seed was unavailable this year. Also two fertilizer treatments were added this year, 90-53-25 (11-53-25 w/seed and 79-0-0 topdressed as ammonium nitrate at Feekes scale 4.) and 90-53-25 in which all the fertilizer was deep banded at seeding. These extra treatments were added to fit the plots into the research area.

Soil water and nutrient monitoring during the growing season will be eliminated due to funding cuts. The grant funds already received should allow completion of the project as changed.

CAN PPI/FAR CITE DATA?

Yes.

DO THE DATA SHOW ANY ECONOMIC ADVANTAGES FROM THE DIFFERENT TREATMENTS?

Yes, particularly with the spring wheat data that were gathered this year, because the data show yield and grain quality differences due to different cropping system, fertility program and variety selection.

Fig. 1. Accumulative Soil Water Use by Spring Wheat as Affected by Seeding Rate and Row Spacing. I No-Till Conditions

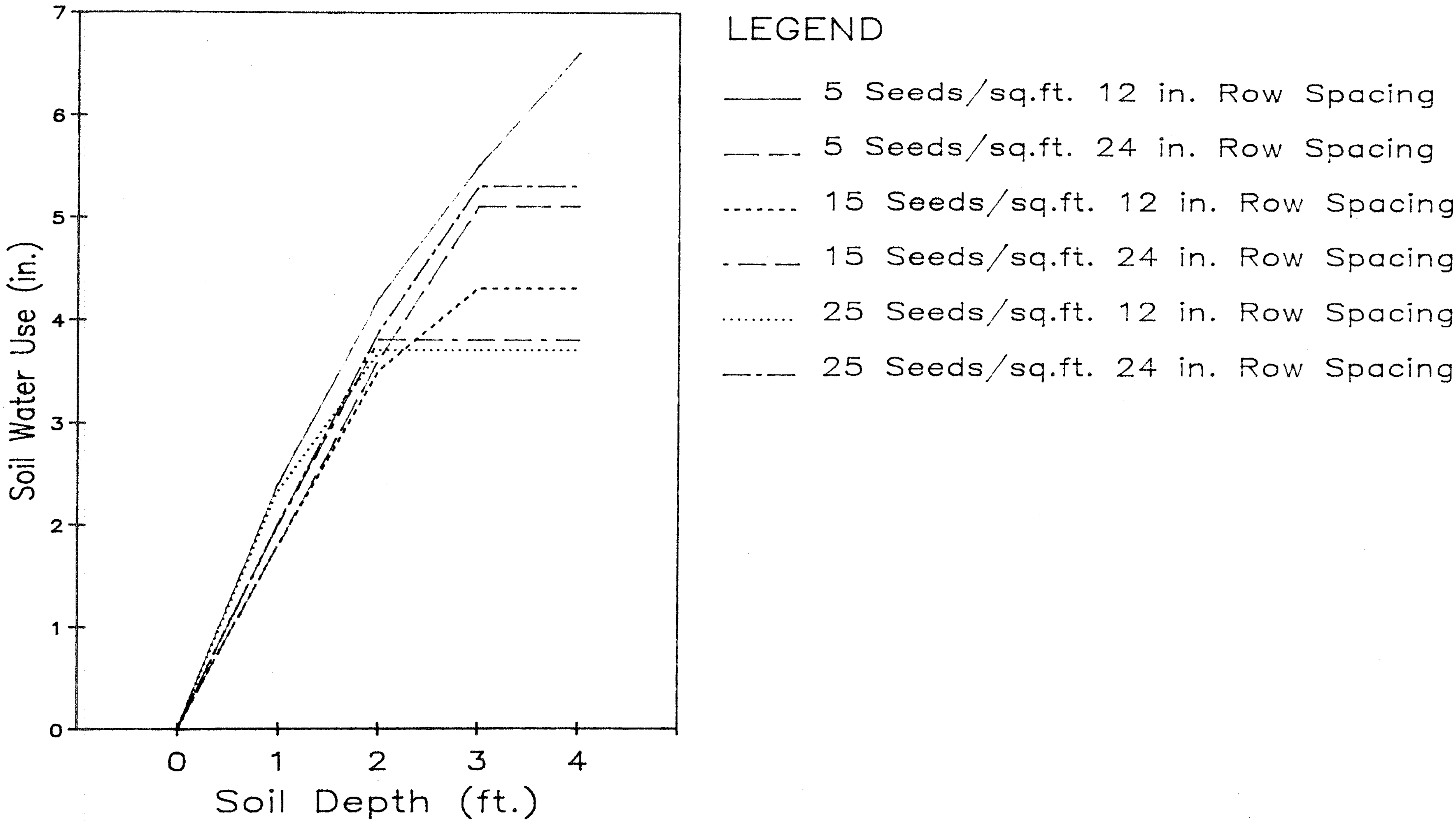

Fig. 2. Accumulative Soil Water Use by Spring Wheat as Affected by Seeding Rate and Row Spacing. II Fallow Conditions

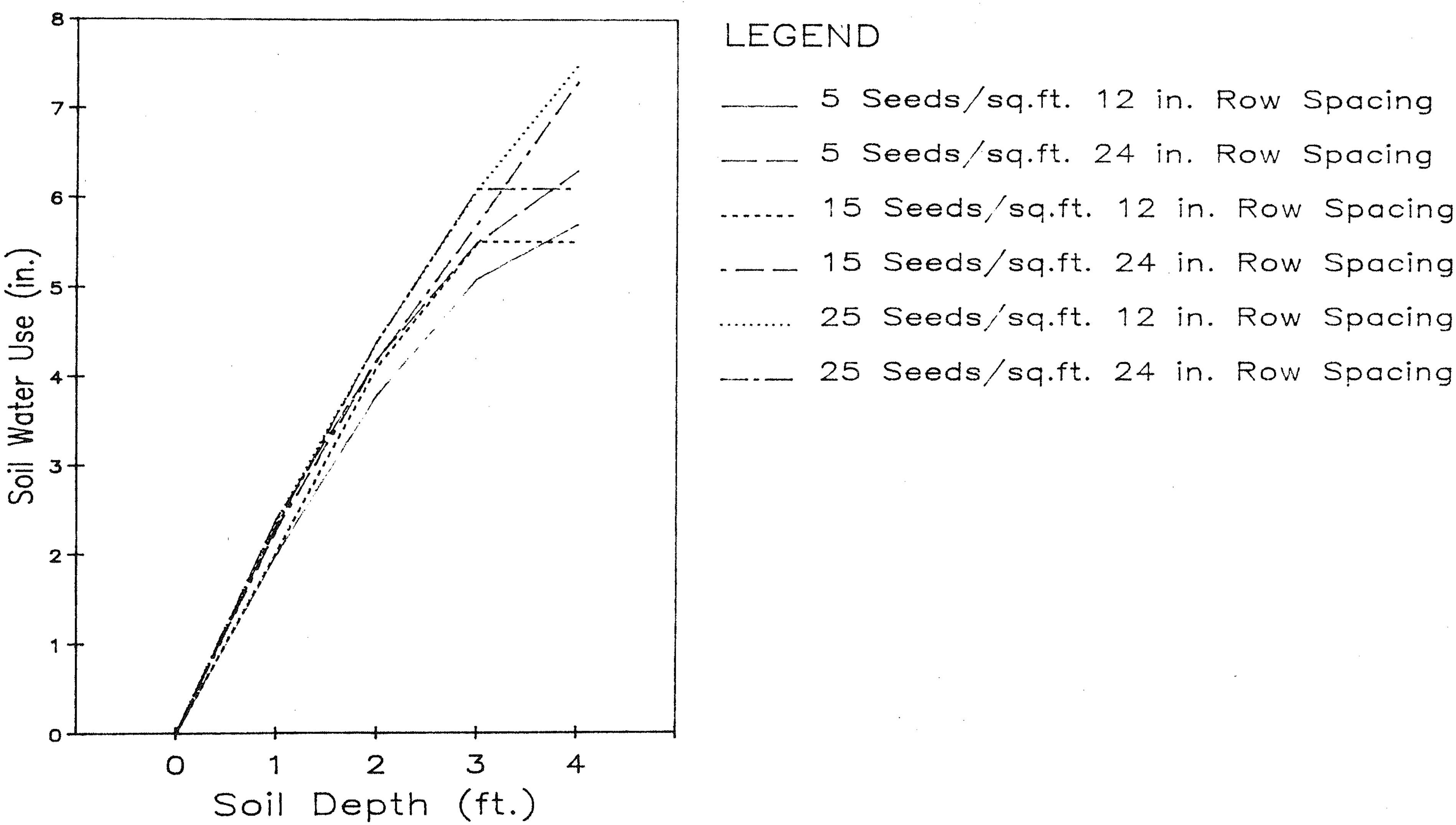

Fig. 3. Accumulated Soil Water Use by Spring Wheat as Affected by Fertilizer Rate and Cropping System