

ON-FARM NO-TILL WHEAT RESEARCH AND ITS EFFECT ON THE SOIL AND ROTATIONAL CROPS

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Background:

A study at the University of Kentucky has shown benefits for no-till wheat on the production of soybeans and corn in rotation with the wheat. Both soybeans and corn were planted using no-till methods. The research showed a 5% yield benefit for soybeans and a 5% yield benefit for corn when those crops followed no-till wheat compared with tilled wheat. It appears that enhanced moisture availability in such continuous no-tilled systems is involved. Soil research in the different treatments found greater amounts of mid-range pore sizes in the soil, perhaps explained by enhanced microbial activity. This is caused by soil structure changes that occur in the no-till system.

These test results were obtained from small plot research on a specific location. So can farmers obtain similar corn and soybean yield benefit by planting their wheat crop by no-till methods? They will be integrating across more soil types and across more environmental conditions.

Objective:

1. To determine if no-till wheat production enhances yields of rotational corn and soybeans on Kentucky farms.
2. To determine if measurable soil characteristics can explain any variation in the response of corn soybeans to no-till wheat production across several Kentucky landscapes.

Research Approach:

The test was established on 3 locations in the fall of 2000 and 3 more in the fall of 2001. One location that was established in the fall of 2000 was lost due to a lease loss. Another location was added that has ½ the field in no-till wheat and ½ in tilled wheat. The soil types are predominantly Pembroke with some Nolin and Huntington soil types also present. The fields are large fields and the fields were split. Tilled wheat was planted on one side of the field and no-till wheat was planted on the other side. The original 6 fields had a history of tilled wheat plantings followed by no-tilled double-cropped soybeans and no-till corn the next year. The new field will already have a history of tilled vs. no-tilled wheat.

All sites were GPSed and specific topographic landscape areas in each field were identified (foot slopes, back slopes and summits) and GPSed to allow for proper scientific comparisons. These specific areas were sampled and analyzed for soil texture, bulk densities, aggregate size and water retention curves on an annual basis

Each field was harvested for wheat and double-cropped soybeans with a combine that had a calibrated GPS yield monitor or a weigh wagon. Yields of the identified topographical areas were selected for comparison.

Research and Discussion:

Wheat Yields

The average wheat yields for the fields over the six wheat crops grown since the beginning of the project are found in Table 1. The wheat yields with the two different practices are the same and are not significantly different.

Soybean Yields

When the yields of the six fields are averaged over the five years that soybeans have been grown, the yields are very similar and there are no statistical differences (Table 2). Based on previous research we would expect the yields of soybeans in the continuous no-tilled system to increase due to soil structural changes which are expected to take place with time.

Corn Yields

The average yields for the fields over the four years corn has been grown with this project are found in Table 3. The yields are almost identical, however, the yields from the portion of the fields with no-till wheat are increasing in some of the fields. See Soil Measurement Section.

Tillage	Yield (bu/ac)
No-Till	82.6
Till	82.9

Tillage	Yield (bu/ac)
No-Till	41.6
Till	42.8

Tillage	Yield (bu/ac)
No-Till	170.8
Till	170.3

Soil Measurements

Soil measurements are taken at least once a year. There were none or small changes between the no-tilled and tilled areas the first 2 years. Soil measurements for the fields that had been in the program 3 years showed significant soil changes taking place. The aggregate size and bulk density are significantly greater in the fields. The plant available water holding capacity in the surface 6 inches is greater but not significantly so. The soil changes are taking place in these fields but did not result in higher yields this year due to either 1) the soil changes are not great enough at this time or 2) the rainfall did not favor conditions that would result in an increased yield even with the soil changes.

Soil measurements taken in the fields that had been in the program 4 years showed significantly higher aggregate size and bulk density. The plant available water holding capacity was greater in no-till treatment on some of the fields. The soil structure change that occurred in some of the fields appear to be great enough to result in a yield difference. On some of the fields, aggregate size, bulk density and plant available water holding capacity was only marginally different and the yields on these fields do not favor the no-tillage system.

It appears that 4 years is long enough to change soil properties sufficiently on some of the fields, but only marginally on other fields. Either more time is required to make soil structure changes on soil in some of the fields or they were further behind in the beginning which would require more time.

Summary and Conclusions:

To this point, the yields of all three crops are similar when the tilled and no-tilled treatments are compared. The soil measurements taken on the fields are beginning to show structural differences after 4 years when compared between the two tillage treatments on some of the fields. The soil structure changes should allow more water storage in the soil to increase yields if the soil changes progress as they have in other similar research.