FARMER INSPIRED DEMONSTRATION WORK IN CONTINUOUS NO-TILL IN THE NORTH CAROLINA WESTERN PIEDMONT

Stephen G. Gibson[1*], Wayne Yarboro[2], Max Hamrick[3], Sammy Thompson[3], and Ronnie King[4]

[1]Cleveland County Center, North Carolina Cooperative Extension Service, 130 S. Post Rd. Suite 1, Shelby, NC 28152
[2]Farmer, 1824 Shelby Road, Kings Mtn. NC 28086
[3]Hamrick Bros. Inc., P. O. Box 802, Boiling Springs, NC 28017-802
[4]Farmer, 310 Warlick Rd., Lawndale, NC 28090

*Corresponding author's e-mail address: Stephen_Gibson@ncsu.edu

ABSTRACT

In addition to regular programming, County Agricultural Extension agents are asked many times to respond to questions, suggestions and concerns by their farmer clientele. In North Carolina as in other states an advisory leadership system is in place and farmers can formally and informally make suggestions and requests for on-farm demonstrational work. In many cases what the farmers are observing in their fields and/or things they have read "spark" the interactions with agents. Such has been the case in Cleveland County, NC. For example in the early continuous no-till era many area farmers were concerned about soil compaction. Measurements and simple demonstrations conducted by the Cleveland and Lincoln County agents and supported by the NCSU Soil Science Department and Cleveland County Government helped alleviate these concerns. Later as fields were in continuous no-till for 5 or more years, farmers began to notice a greater than expected development of their crops prior to major applications of fertilizer nitrogen. These observations led to a replicated test in wheat conducted by the Cleveland County Agricultural Extension agent comparing a field in a 2 year no-till wheat soybean rotation verses a nearby field in a 5 year continuous no-till wheat soybean rotation. Also a 6 year replicated test was initiated on Cleveland County owned land that had been in continuous no-till for 10 years. The test was set up as a continuous soybean corn rotation and in addition to the standard dryland portion, irrigation was used in part of the study to simulate a "good" corn year. Five nitrogen rates were used. The economics of the cost of fertilizer nitrogen was used to demonstrate that the Realistic Yield Expectation (RYE) method for determining nitrogen rates was very much applicable in continuous no-till. Both the wheat and corn tests indicated that residual soil nitrogen was indeed becoming a major factor in continuous no-till for these field crops and when farmers considered the realities of the weather very likely nitrogen rates can be reduced with confidence.

SUMMARY

In 1993 a soil penetrometer was purchased but found to not be a reliable indication of measuring soil compaction. The NCSU Soil Science Department supplied a more scientific device that was used to make two comparisons of fields in continuous no-till verses some nearby fields in which tillage had disrupted continuous no-till. Six locations were sampled at random in each of the four fields in the study. In all cases the top 2 centimeters in the continuous no-till fields had lower bulk densities than the top 2 centimeters in the fields in which tillage had been used. The average bulk density for the balance of the soil to a depth of 6 inches in one of the comparisons was slightly less in the field that had had some tillage (1.44 vs. 1.54) however the average bulk density was slightly less in the 6 to 9 inch depth in the continuous no-till field (1.52 vs. 1.55). This comparison was from an area with a clay loam soil. The other comparison was in an area with some unusually sandy soil for our region

of the state. In this comparison the average bulk densities for the 2 cm to the 6 inch depth was the same for the continuous no-till and the conventionally planted field (1.48). However the 6 to 9 inch depth for the field with recent tillage had a much lower average bulk density than the field in continuous no-till (1.50 vs. 1.65).

In 1992 a John Deere 71 demonstrational planter was fitted with an in row shank and closure wheels thanks to the expertise of a local farmer. The rig was used in 4 comparisons (2 in cotton, one in corn and another in soybeans). A significant yield response was achieved at one of the cotton locations to the shank (319 lb. lint vs. 272 lb.). The yields were low due to a very early October freeze. At the other location for cotton the study was not even harvested because the in row shank treatment resulted in such a cloddy seedbed that an adequate stand was not obtained. This likewise was the case with the soybeans. For both of these sites adequate stands were obtained with coulter only no-till planting. It was concluded that the use of in row tillage for our soils would very likely cause more problems than were solved. For corn the coulter only treatment slightly outyielded the in row shank treatment (69.5 bu. vs. 68.4 bu.). Upon presenting the results of the bulk density sampling and in row tillage work during subsequent winter meetings farmers were satisfied that in row tillage simply is not practicle for our area.

Beginning in 1995 some of our farmers began to notice that the crops in fields in 5 or more years of continuous no-till seemingly were developing faster than normal despite the lack of significant application of fertilizer nitrogen. One farmer noted this prior to wheat topdressing time and another noted the same in a remote field that he had forgotten to apply any fertilizer nitrogen to.

The farmer who had observed the situation in wheat offered two of his fields for a test, one had been in continuous no-till for 5 years and the other for only 2. The wheat received 20 pounds N per acre in the fertilizer used at planting in late November of 1996. Among the additional treatments in the replicated test were 62 and 96 pounds of topdressed N as ammonium nitrate for 82 pounds and 116 pounds total N. The test was replicated 4 times in each field. For the 2-year no-till field the 20 pound N treatment yielded only 34.6 bu. per acre. In contrast the field that had been in continuous no-till for 5 years yielded 58.2 bu. per acre. The 82 and 116 pounds total treatments were closer to the same in the 2 year and 5 year no-till fields (74.6 and 85.4 bu. vs. 79.7 and 89.7 bu.).

Sparked by the farmer who had forgotten to fertilize the remote field of corn, a replicated long-term test was initiated in 1996 in a Cleveland County owned field that had been in continuous no-till for 10 years. The test was set up as a continuous corn and soybean rotation and such that half of the study was planted in soybeans, the other half in corn and the following year the crops rotated. In addition half was irrigated to simulate a “good” corn year, not for maximum yields by any means. A stress tolerant variety of corn was used and for all of the fertilizer nitrogen ammonium nitrate was used to reduce the possible variability from N losses from urea forms of N. The nitrogen treatments were 30 pounds at planting only, 30 pounds topdressed N for a total of 60, 60 pounds topdressed N for a total of 90, 90 pounds topdressed N for a total of 120 and 120 pounds topdressed N for a total of 150. Individual plots were periodically soil sampled and limed separately to decrease variability from the different acidifying effects of the different amounts of N used. Each year the cost per pound of N as ammonium nitrate was recorded as was the price per bushel of corn.

For the dryland portion average yields for the 30, 60, 90, 120 and 150 pound N treatments were 72, 84, 89, 88 and 92 bus. per acre respectively. The value of the corn less the cost of the applied fertilizer N was $187, $213, $216, $208 and $208. For the irrigated portion average yields were 91, 114, 133, 136 and 144 bushels per acre. The value of the corn less the cost of the fertilizer N was \$241, \$296, \$341, \$341 and \$355.

These data indicate that the Realistic Yield Expectation method for determining nitrogen rates is indeed a valid approach when considering the realities of the weather. It is interesting to note that even at the lowest nitrogen rate of 30 pounds per acre that 72 bushels were produced in the dryland portion and 91 in the irrigated portion. These levels exceed the bushel expected yield per pound of applied fertilizer N (RYE) indicating that in continuous no-till residual soil nitrogen may indeed be becoming a major factor.

As farmers continue to practice continuous no-till no doubt additional benefits and unfortunately problems will be observed. For land grant universities to remain on the cutting edge, Agricultural Extension agents must react. Many times the appropriate reaction will be either conducting local tests and demonstrations or passing on the ideas to specialists at the university level.