CONSERVATION TILLAGE FOR BURLEY TOBACCO

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ABSTRACT

Work with conservation tillage for tobacco in Tennessee began in the mid 1980's, with investigation of no-till systems. Registration of new herbicides overcame original constraints due to poor weed control, but yield from no-till continued to be lower than from tilled tobacco. The yield reduction appeared be largely due to poor transplant placement and restricted early root growth. Work since 1999 with strip-till systems has shown that these systems are capable of producing equivalent yields to tilled systems. The primary key to success is proper transplant placement. The best results have been obtained with fall killed sod, cover crops killed a month before transplanting or previous year row crop residues. Careful attention to soil conditions after strip tillage and to proper transplanter depth is very important. One potential problem is that the low residues cover which results in the best strip-till performance may not leave adequate cover for erosion control.

SUMMARY

Work with conservation tillage tobacco in Tennessee began in the mid 1980's. The initial work was with no-till systems. Poor weed control was a major problem in these early tests and appeared to be the major constraint on successful no-till production. However, after the registration of new herbicides for tobacco solved the weed control problem, yields of no-till tobacco continued to be lower than those achieved in tilled systems. No-till tobacco grew much more slowly early in the season. This slow early season growth appeared to be related to restricted root growth and possible nitrogen deficiency. The transplanter used in these trials used a leading coulter and a double disk opener to allow penetration into the soil by the transplanter shoe. The sides of the slot in the soil formed by the double disk openers appeared to be sealed, and did not allow easy penetration of tobacco roots into the surrounding soil. Based on this preliminary work, it was decided to investigate strip-till systems with more soil disturbance in the row zone to permit more easy soil penetration by roots. In 1999, a study was initiated at the Highland Rim Experiment Station near Springfield, Tennessee. The study consisted of three tillage systems: 1) no-till with a single cutting coulter and double disk openers on the planter, 2)strip-till with an in-row subsoiler, and 3) conventional tillage with a chisel plow and disk. The study was conducted with dark fire-cured tobacco in 1999, 2000, and 2001, and with burley tobacco in 2000 and 2001. With both types, yield was highest in tilled systems and lowest in no-till, with strip-till being intermediate in yield. The three-year averages for dark tobacco were 2153, 1949 and 1651 pounds per acre for tilled, strip-till and no-till systems, respectively. Corresponding two-year averages for burley were 2536, 1938 and 1789 pounds per acre. A second experiment was conducted with burley in 2002 and 2003. This experiment compared three main tillage systems: tilled, strip-till and strip-till with starter fertilizer applied beneath the plant row. Each of the main tillage treatment plots was split into to N fertilization treatments: 1) all N preplant and 2) half the N preplant and half sidedressed about one month after transplanting. In the strip-till/ starter fertilizer treatment, 20 % of the N, P and K fertilizer was

applied in a band beneath the row using the subsoiler shank, with all other preplant fertilizer broadcast. In the strip-till and tilled systems, all preplant fertilizer was broadcast. Over the two years, tilled tobacco averaged 2620 pounds per acre in yield, while the strip-tilled treatments averaged 2286 pounds per acre. Neither in row fertilization nor splitting the nitrogen fertilizer affected yield. Continued lower yield in the strip till system appeared to be related to shallow transplanting and inadequate placement of soil around the transplant root ball by the transplanter closing wheels.

Another series of experiments was begun in 2006 and 2007 at the Highland Rim Research and Education Center and at the Research and Education Center at Greeneville, Tennessee, to investigate no-till and strip-till practices with different ground cover management practices. The first study evaluated cover management in established sod. Conventional tillage tobacco was compared to tobacco transplanted either no-till or strip-till into the following sod treatments: (a) spring killed sod, (b) fall killed sod without a winter cover crop, (c) fall killed sod, spring killed wheat cover, and (d) fall killed sod, spring killed rye cover. The second study evaluated the management of annual cover crops in no-till and strip-till systems. Conventional tillage tobacco was compared to tobacco transplanted either no-till or strip-till into the following ground cover treatments: (a) wheat cover, (b) wheat grazed, (c) rye cover, (d) rye grazed, (e) rye straw, and (f) soybean residue. In these studies, a no-till transplanter with a narrow shank in front of the transplanter shoe was used rather than a double disk opener to loosen the soil for transplanter shoe penetration. This transplanter was used in the strip-till treatments as well. In the strip-till treatments, the strip till rig was run multiple times as needed over a period of weeks prior to transplanting to achieve better soil conditions for transplanter operation. Depending on the soil and season, strip tillage was performed from one to three times. In both no-till and strip-till systems, extra care was taken to adjust transplanters to achieve proper transplant placement. In 2006, conventional tillage produced higher tobacco yields than conservation tillage in three out of four tests. Conservation tillage yields in the sod test at Highland Rim were equal to conventional tillage. Generally no-till yields were lower than strip-till, and tilled yields were higher than strip-till. In 2007, a generally drier year, strip till yields equaled tilled yields in all four tests. No-till yields were lower than tilled and strip tilled at Springfield, but not at Greeneville. Overall, the best strip–till systems generally gave yields as high as tilled, while no-till yields were lower, especially at Highland Rim. The best strip-till systems were those that involved fall killed sod with no cover crop or removal of cover crop residue by simulated grazing or as straw. Improved performance of strip till and no-till systems in these tests compared to earlier studies was attributed to better performance of the modified no-till transplanter, better soil conditions for transplanting in the strip till systems, and more attention to proper transplant placement.

Based on the success of the strip till systems, a new series of experiments was initiated in 2009 at Highland Rim and Greeneville evaluating strip-till systems. Systems evaluated were wide strip-till with an inrow subsoiler, narrow strip till with a narrow shank, rototill strip, and inrow subsoiler plus rototill strip. All of these were compared to no-till with the narrow shank opener and to full tillage. In 2009 all the strip till treatments were equal to full tillage in yield. No-till was lower at Highland Rim.

Overall, it appears that strip-till systems using well adjusted equipment are essentially equivalent to full tillage as alternatives in tobacco production. One problem with these systems is that they perform best with relatively light residue cover, and in the more aggressive strip-till systems cover may not be adequate for erosion control.