NO-TILL PRODUCTION OF TOMATOES

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INTERPRETIVE SUMMARY

Reduced tillage and conservation tillage systems have been popular for row crops for many years in the Southeastern United States. Adoption of these practices for vegetable crops has been slower due to the high risk nature of most vegetable crops. Interest in reduced tillage has increased as research has shown several advantages to these systems compared with conventional production systems. Many producers are limited in available land for recommended crop rotations on level to slightly sloping land. Producers are receptive to incorporation of reduced tillage programs into their cropping systems if crops can be produced on slopes ranging from 3 to 10% slope with little or no increase in erosion and runoff and if yields and profitability can be maintained on sloping land. Several other advantages are inherent in reduced tillage systems that will encourage further adoption of these systems.

In 1996 and 1997, research was instituted at a private farm and at a university experiment station to determine the feasibility of no-till or reduced tillage tomatoes on 8 to 10% slopes. Six research plots of 20 by 75 ft were installed on a 10% slope on a private farm in Cocke County, Tennessee. The soil type on the plots was a Jefferson sandy loam with an assigned soil erodibility factor of K=0.227. Six additional research plots were installed at the Plant Sciences Unit of the Knoxville Agricultural Experiment Station about five miles southeast of Knoxville. The soil type on the experiment station plots was Etowah silt loam with an assigned soil erodibility factor of K=0.303. Three research plots at each location were planted with tomatoes using conventional tillage practices and the remaining three plots at each location were planted with tomatoes into undisturbed fescue sod with a no-till transplanter. At the Knoxville location only, six research plots were planted in burley tobacco, three no-till and three conventional tillage, to compare data collected with the tomato plots. All research plots were irrigated with 0.45 GPM drip tape. To prevent runoff from adjacent areas from entering the research plots, each plot was protected by an 8-inch high berm completely surrounding the plots. A collection triangle was constructed at the base of each research plot to catch runoff from the plots for measurement of soil, water, and nutrient losses. After each significant rainfall event, samples from each plot were collected and analyzed for runoff volume, sediment, N loss, and phosphorus loss.

Runoff from all test plots was calculated as a percentage of the total rainfall that fell on each plot. Runoff tended to be less from no-till plots compared with conventional till plots. Runoff from the tobacco plots tended to be significantly less from no-till plots than from conventional till plots. Sediment losses were significantly different for the no-till and conventional plots. Sediment losses on no-till tomato plots were four to 11 times less than on conventional tomato plots. Sediment losses were generally much greater from tobacco than from tomato plots. Sediment losses on no-till tobacco plots were 72 to 90 times less than from conventional tillage plots. Much of this loss from conventional tillage tobacco plots can be attributed to multiple cultivations throughout the growing season on a 10% slope.

Nutrient losses from the research plots were measured during the 1997 growing season only.

Overall, there was less total N loss from no-till than conventional till, and less total N loss from tomatoes than from tobacco. The greatest amounts of N were lost near the beginning of each growing season. Tillage method also seemed to have an effect on NO_3 and NO_4 movement. There was less NO_3 and NO_4 loss from no-till than from conventional till and less NO_3 and NO_4 loss from tomatoes than from tobacco. Total N losses in tomatoes were about three times greater in conventional till than no-till. Total N losses in tobacco were 21 times greater for conventional till than from no-till. NO_3 and NO_4 made up 4 to 10% of the total N losses. Total phosphorus (P) losses on all plots were similar to total N losses. However, PO_4 losses were much higher on no-till plots than on conventional till plots. A larger percentage of the total P from no-till plots was made up of PO, than the total P from the conventional till plots.

Although the primary objectives of this study were to compare runoff, sediment and nutrient losses on no-till plots with conventional till plots, yield comparisons on the tomato plots were compared to determine effects of no-till on tomato yields. All no-till tomato plot yields at all locations were equal to or better than conventional till plot yields. Quality of fruit on all no-till plots were equal to or better than fruit quality on conventional plots. Tobacco yields on no-till plots were generally equal to yields on conventional till plots.

In addition to reduced runoff and sediment losses and higher fruit yields, several other advantages of no-till tomato production compared with conventional till production were noted during the course of this research work. Less irrigation water was used on no-till plots compared with conventional plots. Application of crop protection chemicals was more timely due to mulch cover, which permitted operation of equipment on wet soil conditions. Less cleaning and preparation of fruit was required for marketing due to minimal soil splatter on fruit after rainfall events. Less weed control chemical was needed due to the suppression effect of cover mulch between the rows.