

Poster Title: Small-scale roller/crimper designs for walk-behind tractors in conservation organic farming systems.

Author: Ted S. Kornecki, PhD., P.E., Agricultural Engineer, USDA, ARS, National Soil Dynamics Laboratory, Auburn, AL 36832; e-mail: ted.kornecki@ars.usda.gov; phone: 334-887-8596, ext. 2745.

In recent years, the use of unincorporated cover crops in no-till organic production systems has been steadily increasing. When cover crops are terminated at an appropriate growth stage, the residue forms a mulch layer that protects the soil from erosion, reduces runoff and soil compaction, reduces weed pressure, and conserves water; in addition, legume cover crops can be a nitrogen source for organically grown cash crops. In the Southern US, the recommended time to plant cash crops into residue cover is typically three weeks after rolling, when cover crop termination exceeds 90%, to minimize competition for resources between cover and cash crops. In no-till vegetable production, it is very important to meet recommended planting dates to reap optimum yields. The expansion of fresh food production by local small farming communities must therefore be linked with sustainable agricultural production methods that include no-till systems with proper cover crop management. Original rollers/crimpers designed for larger farms rely on bigger tractors, as effective crimping depends on the roller's large mass; however, the use of big tractors cannot be economically justified on small vegetable farms. In small-scale production scenarios, producers need equipment compatible with the smaller tractors already on the farm. In the fall of 2011 at the E. V. Smith Research Center in Shorter, Alabama, a three-year experiment was initiated to evaluate the effectiveness of different rollers designed to work with walk-behind tractors in terminating a rye cover crop. Three rollers/crimpers were tested: powered roller, two-stage roller (both developed at NSDL), and a chevron type curved roller from Earth Tools Inc., Owenton, KY. These rollers were operated at speeds of 1.0 and 2.0 mph. Rolling/crimping operations were performed one to three times per plot. Cover crop termination rates (0 to 100%) were evaluated one, two, and three weeks after rolling and compared to the control (standing rye). Results from the first growing season of 2012 have shown that, one week after rolling, the powered roller produced the highest termination rates (91%), followed by the two-stage roller (88%), and the chevron roller (75%); higher termination was obtained in 3rd gear (86%) compared to 2nd gear (83%). For standing rye, termination was 38% for the first week after rolling. Similarly, two weeks after rolling, the highest termination (94%) was generated by the powered roller; the two stage roller generated 93% termination and the chevron type produced 87% compared to 53% for standing rye. Results indicate that, two weeks after rolling, termination rates produced by the powered roller and two-stage roller were high enough to plant a cash crop into the rye residue cover. Three weeks after rolling no differences were detected among the roller types: 100%, 99% and 98% for two-stage, powered roller, and chevron roller/crimper, respectively, whereas termination rate for standing rye was 80%. Rolling three times in the higher gear generated increased termination rates one and two weeks after rolling compared to rolling once and twice. Three weeks after rolling, no difference in rye termination was observed between rolling three times and twice (100%), but a slightly lower rate was recorded for rolling once (98%).