Plain English Summary

Research Project SPC1C - Final Report

Composted organic wastes as soil amendments for sustainable cotton production.

Many of the soils used for cotton-growing are now considered deficient in the organic-matter needed for maintenance of soil structure and efficient use of water and nutrients. While conserving crop-residues has shown benefits, growers have recognized the need for supplementary organic-matter to maintain levels required to sustain cotton production on these soils.

Until recently, substantial quantities of organic wastes from cotton-processing have been dumped and left to degrade in stockpiles around the gins. This gin-trash has been identified as a potential source of the organic-matter needed to improve soil conditions. Local growers have trialled composting the cotton-wastes and also vermicomposting, through additional processing with worms, to produce finely-divided organic residues. While these materials are reputed to produce superior growth responses in plants, there have been no adequate guidelines on appropriate applications compatible with commercial cotton management.

To evaluate the benefits of organic-wastes as soil amendments for cotton production, trials were established in cooperation with commercial growers. Soil treatments with composted gin-trash from local cotton-processing and vermicompost from worm-worked cattle-feedlot or pig-manure, were superimposed on the current growing practices. The organic amendments were incorporated in the soil or spread on the surface of the beds at rates considered commercially viable as a supplement to normal fertilizer applications.

Effects on establishment, growth, flowering and fruit development were determined on some 4,000 plants. A similar number of plants were harvested, and yield and vegetative components assessed. Module weights were recorded for each treatment, and lint and bale yields determined after ginning.

In the first season, vermicompost incorporated in the soil during seed-bed preparation increased cotton yields by up to 15%; manure at comparable rates had no effect on the growth or development of cotton. The organic amendments showed continuing growth responses in the second year, with an increase in the vegetative growth; weights of raw cotton were up to 20% higher. But plant density was lower, and lint yields were actually reduced with higher rates of vermicompost and manure.

When the vermicompost and gin-trash was applied at seeding, there was a clear response in plant growth. The higher rates of vermicompost and the gin-trash significantly increased plant height and the number of nodes developing at flowering. But yields associated with the organic amendments were lower than with cotton harvested on adjacent untreated plots. The increase in boll numbers and weights at harvest were not sufficient to compensate for a substantial reduction in plant density; cotton yields were at least 5% lower.

In the following year, measurements indicated that plants treated with the compost amendments were larger and had more bolls developing after flowering. But increased plant spacing suggested that the extra organic-matter had adversely affected germination and establishment. The harvest confirmed substantially improved plant growth, with larger plants and increased boll number and weights with the compost. But with the reduced plant density, overall yields were reduced by 25% with the supplementary organic-matter.

Composted organic wastes from three separate sources, viz. cattle-manure, pig-manure and cotton gin-trash, all increased plant growth, but significantly reduced germination and plant density. This resulted in significant reductions in cotton yields, related to the higher rates of organic-matter. These differences persisted for up to three successive years of cotton, irrespective of the timing or methods of application of the organic amendments.

The effects on cotton establishment are unlikely to be attributed to composted organic-matter which has been considered a 'safe' soil supplement. Before committing to broadacre use of composts, manures and crop-residues, growers should consider small-scale trials to determine the growth-responses on the soils to be sown with cotton.