

INTEGRATED SOIL MANAGEMENT APPROACH TO ENHANCE THE GROWTH AND YIELD OF CHILLI (*CAPSICUM ANNUM*)

H.M.P.T.K. HETTIGEDARA¹, M.A.P.W.K. MALAVIARACHCHI¹,
R.A.C.J.PERERA¹, W.M.W. WEERAKOON¹, S.P. NISSANKA²,
U.R. SANGAKKARA² AND G.H.K. DE SILVA¹

¹ *Field Crops Research and Development Institute, Mahailuppallama, Sri Lanka*

² *Faculty of Agriculture, University of Peradeniya*

EXTENDED ABSTRACT

Chilli is one of the most important cash crops grown in Sri Lanka. It has become an essential ingredient in Sri Lankan meals. Though the potential yield is approximately 15 t/ha for green chilli and 3.5 t/ha for dry chilli, the national average yield in 2014 is about 5.13 t/ha and 1.01 t/ha for green chilli and dry chilli respectively (Agstat, 2015). This indicates a large yield gap leading with a very low productivity of chilli crop. A field experiment was carried out at the Field Crops Research and Development Institute, Mahailuppallama (DL1b agro-ecological region) of Sri Lanka during *Maha* 2011/2012, *Yala* 2012 and *Maha* 2012/2013 seasons with the objective of identifying a package of practices that includes compost application, mulching and deep ploughing to enhance the growth and yield of chilli. The experiment consisted of two plough depths (Deep, 50-60 cm and normal, 20 cm) in the main plot, mulching at the rate of 5 t/ha (Gliricidia mulch and no mulch) and organic manure application at the rate of 10 t/ha (compost application and no compost) in sub plots. Three soil management practices were tested in a split plot design with three replicates. The depth to the gravel layer was at 40 cm in the tested location. The chilli variety MI Green was used as the test crop.

Land preparation was done separately for deep ploughing block and normal ploughing block. The normal ploughing block was prepared using the disk plough and the deep ploughing block was prepared by a backhoe machine to turn the soil up to a depth of 60 cm. Thereafter, the sub plots were prepared within the main plot. Compost made using straw and cattle manure was applied one week before planting at the rate of 5 t/ha and one month after planting at a rate of 5 t/ha to the beds of the relevant treatments and mixed well with the soil. Air dried Gliricidia leaves were applied as a mulch at the rate of 5 t/ha (dry weight basis) to the relevant treatments at one and two months after planting. For the second and third seasons, to test the long term impact of deep ploughing over seasons, experimental field was prepared using mamoties without using disk plough or backhoe machine. Thus, the land preparation treatment (deep ploughing and normal

ploughing) was applied only one time during the three seasons of the experiment. During the *Yala* 2012 season the rainfall was very low and due to limitation of irrigation water the crop could not continue for more than three red chilli picks.

Compared to the initial values at the site, bulk density reduced with ploughing. The bulk densities of deep ploughed plots were lower compared to the normal ploughed plots at 35-40 cm soil depth suggesting that the soil layer was loosened due to deep ploughing. At the end of the season, it was clearly shown that the bulk density in the top layer remained same with surface compaction due to cultural practices and surface irrigation while the layer below 25 cm had maintained lower bulk density. The bulk density has reduced in the 2nd season both in deep ploughed and normal ploughed treatments. Although deep ploughing was not done at the commencement of the 2nd season the addition of gliricidia and compost may have contributed to reduce the bulk density values.

In first two seasons (*Maha* 2011/2012 and *Yala* 2012), the shoot dry weight at the harvesting stage (120 days after planting) was significantly higher in the deep ploughed plots than the normal ploughed plots. The effect of deep ploughing was not significantly different during the 3rd season (*Maha* 2012/2013) for the shoot dry weight. The positive impact of deep ploughing on the plant growth may have reduced with time. The root dry weight was significantly higher in the deep ploughed plots than the normal ploughed plots only during the 1st season. This suggests that the effect of deep ploughing was limited to one season and the impact reduced with time. With the deep ploughing compact layer is broken and the roots are allowed to penetrate into deeper layers.

Interaction effects of the applied treatments on dry chilli yield were not significant. The integrated effects of the applied treatments showed that the total yield was significantly higher during the *Maha* 2011/2012 season having yield advantage of 136 % in the treatment where deep ploughed, compost and gliricidia mulch were applied than the control where normal ploughed and nor compost or gliricidia mulch were added. The yield in the treatment where normal ploughing, compost and gliricidia mulch was applied was higher than the treatment where deep ploughed but gliricidia or compost was not applied. Therefore, in a situation when the deep ploughing is impossible even in the shallow depth soils application of compost and mulching with gliricidia leaves will enhance the yield by about 69%. Compared to the *Maha* 2011/2012 season the yields were very much lower during the *Yala* 2012 season as the drought conditions prevented irrigation water supply and the crop could not continue for more than three picks of red chilli. Application of poultry manure at 5 t/ha, coir dust at 5 t/ha and straw mulch at 4 t/ha

combined with half the quantity of recommended chemical fertilizer proved to be the best combination to obtain significantly higher (36%) rice yield than usual nutrient management practice (Jayasundara, 2001).

Number of pods per hill and dry chilli yield were significantly higher in the deep ploughed plots than the normal ploughed plots only during the *Maha* 2011/2012 season. This is because of the better growth of plants in the deep ploughed plots with more biomass. The positive impact of deep ploughing on number of pods per hill and dry chilli yield was not shown in the 2nd and 3rd seasons indicating that the effect of deep ploughing had reduced with time. A study done in India with groundnut showed a significantly higher mean plot yield under annually deep ploughed plots than shallow ploughing (Sharma *et al.*, 2014).

The dry chilli yield was significantly higher in the treatments applied with gliricidia mulch than the treatments with no mulch in all three seasons. The positive impact of mulching on the yield was due to addition of organic matter from the gliricidia mulch, additional nutrients from them and moisture conservation. The number of pods per hill and dry chilli yield were significantly higher in the treatments applied with compost than the treatments without compost during the 1st and 3rd seasons. That is due to additional nutrients from compost and physical and biological improvement of the soil due to compost application. Application of compost at the rate of 10 t/ha and recommended levels of N, P and K fertilizers increased the number of pods per hill and dry chilli yield in the present study. Deep ploughing up to 50-60 cm depth enhanced the growth and yield of chilli in soils having shallow depth to the gravel layer. Application of compost at the rate of 10 t/ha and gliricidia mulch at the rate of 5 t/ha improved growth and yield of chilli. In situations where deep ploughing cannot be practiced in soils having shallow depth to the gravel layer, application of compost at the rate of 10 t/ha and gliricidia mulch at the rate of 5 t/ha could be recommended as viable crop management practices to enhance the growth and yield of chilli.

REFERENCES

- Agstat, 2015. Pocket book of Agricultural statistics. Vol XII. Department of Agriculture, Peradeniya, Sri Lanka.
- Jayasundara, J.M.P.B. 2001. Effect of integrated application of organic and chemical fertilizer on dry seeded rice (*Oryza sativa* L.). Annals of the Sri Lanka Department of Agriculture. 3: 61-70.
- Sharma, G., Maruthi Sankar, G., Akbari, K., Sreenivas Reddy, K., and Sutaria, G. 2014. Efficient Tillage Practice for Maximum Infiltration, Rainwater Use Efficiency, and Profitability from Groundnuts under Semiarid Vertisols in Western India. *J. Irrig. Drain Eng.* 140(3), 04013019.