Vermi-compost to improve tomato production in Bangladesh

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Our objective was to test the effectiveness of vermi-compost as a substitute for inorganic fertilisers for sustainable, large-scale tomato production. The Green Revolution in Bangladesh promoted the indiscriminate use of factory fertilisers and pesticides to obtain better crop yields. Owing to poor soil management, the organic matter (OM) content is decreasing in some situations. The use of organic fertilisers along with effective soil management can restore soil OM and sustain soil health. Vermi-compost (VC) -mainly the excreta of earthworms- is rich in humus and nutrients. It also contains a lot of microorganisms beneficial to plant growth. As a soil amendment, VC may provide a tool for soil OM management.

During the last few years we have been promoting VC production in rural households and training farmers in its application. Usually the VC is used for homestead vegetable production. Large-scale farmers prefer factory fertiliser (FF). We undertook this study to assess the production and economic returns from the use of VC in large-scale tomato production. If VC can work effectively in large-scale production, farmers can produce VC at home and save on fertiliser costs, and reduce their dependency on FF, which is sometimes not available.

We compared VC with FF and cow dung (CD) on 'Raja' hybrid tomatoes. The treatments were arranged in a randomised complete block design with 3 replicates. The field experiments were undertaken in the Chiknagul Union under Jointapur upazila in Sylhet District of Bangladesh from November 2011 to February 2012. To generate the VC, the farmers added earthworms to CD; the VC was ready after 25–30 days. Twenty-five-day-old tomato seedlings were planted 40 cm apart in rows 60 cm apart. Each plot measured 600 m². VC was applied at 11.25 Mg ha^{-1} three times: during land preparation, 15 days after planting and at flowering (Chanda et al. 2011).

We adjusted the rate of the CD and the FF (urea, triple superphosphate, KCl) to supply the same N as the VC (Chanda et al. 2011). The FF comprised 600 kg urea ha^{-1}, 450 kg superphosphate ha^{-1} and 250 kg KCl ha^{-1} (Hussain et al. 2006). Two-thirds of the urea and all of the superphosphate and KCl were applied during land preparation, and the rest of the urea was applied 15 days after planting.

The CD was applied at 16 Mg ha^{-1} 3 times: during land preparation, 15 days after planting and at flowering. The dried CD was incorporated into the soil by hand hoe. The VC contained 2.2% N, 1.3% P, 2.4% K, 0.9% Ca, 0.18% Mg and 0.44% S. The CD contained 1.2% N, 1.0% P, 1.6% K, 0.13% S and 48.6% OM.

Pheromone traps were used for insect control. To control tomato wilt (a few symptoms of which were seen in the FF plots), 10% cow's urine was sprayed 3 times 10 days apart. Harvesting began on 13 January 2012. Five plants of each treatment were selected randomly to measure the yield.

The plants responded much better to VC than to the other fertilisers. The VC- and CD-treated plants showed more branching than the FF-treated plants, but overall stem lengths were greater in the FF-treated plants. The yield was highest in VC plots. The number of tomatoes per plant averaged 51.8 in VC, 45.6 in FF and 45.8 in CD plots. The weight of each tomato averaged 73.0 g in VC, 69.3 g in FF and 67.7 g in CD plots. Twenty farmers were invited to taste the ripened tomatoes; 12 farmers preferred the VC-treated tomatoes, and 7 preferred the CD-treated tomatoes.

On the other hand, FF gave the highest economic benefit. Some VC was purchased from the market or from neighbouring farmers at 8–10 BDT (≈ 0.10–0.12 USD) kg^{-1}. We assume that this cost can be reduced if the farmers produce their own VC, which we recommend. After the first year's experiment, we analysed the top 10 cm of the soil: the VC-treated plots had higher contents of organic carbon (0.50%), OM (0.86%) and total N (0.030%) than the CD-treated plots (0.31%, 0.54%, 0.016%, respectively). The C/N ratio was higher in CD (19.8), followed by VC (17.0) and FF (16.0). This indicates that the VC and CD treatments stabilise the soil and sequester carbon quickly.

These results show that VC can be used as an alternative to FF and can improve the fertility of the soil, enhancing the growth and yield of the tomato crop.

Keywords

Natural resource, nutrient management, livelihood, soil health, worm compost

References

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