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Vermicomposting: An Alternative Manure for Sustainable Agriculture

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Abstract
Regular replenishing our soils depleted of nutrients after every season demands the use of fertilizers. But due to ill effects of heavy use of chemical fertilizers, soils were found to be degraded and water contaminated due to leaching of fertilizers. Another two issues were high cost of chemical fertilizers and imbalanced nutrition to crop plants. Hence, an effort to explore for cheaper and safer alternatives resulted in vermicomposting. Benefits of vermicompost for soil fertility and use of on-farm input of vermicompost was found to enhance sustainability to agriculture. Hence this vermicompost production technology is being promoted among small and marginal farmers through exposure visits and short training programmes to give them hands on skill training and convince them th adopt on a wider scale.

Introduction
Green Revolution has changed India's status from a starving nation to one of the world's leading agricultural nation. Though, the green revolution proved a boon for hungry India, severe consequences have resulted on our ecosystem and its sustainability. The over use of chemical fertilizers and plant protection chemicals led to the buildup of chemical residues in soil and water through leaching and runoff. With the result, our natural resources of soil and water got degraded and demand urgent ameliorative action. Finally, we have reached to a stage where the whole system of agriculture needs to be revitalized gradually to bring a sustainable outlook to our ecosystem.

There is need to reduce the use of chemical fertilizer as it is responsible fordegradation of soil health, air and water pollution and thus ultimately affect the health of human beings. Now, the search for potential alternatives to chemical fertilizers to maintain stable agricultural production on a sustainable basis is indeed a formidable one. Synthetic external inputs, which have made the green revolution possible, have the limitations of higher costs and causing damage to the environment. Unless we recognize this and take immediate measures to tackle the environmental problems, the food and economic security of our country will be in great risk.

Need for alternative sources of plant nutrition
Production of NPK fertilizers in India is less than the required amount, and it is estimated that about 5 to 7 million metric tons of NPK fertilizer would be the shortfall in the next two decades. Organic manures such as vermicomposting, compost, green manure and

biofertilizers would help bridge this gap. Besides, the limitations of conventional agriculture have driven the Indian farmer to adopt alternate agricultural systems that are more sustainable. It is in this context vermicomposting manure assumes greater practical significance.

A proper technology is needed to meet the shortage of plant nutrients through organic resources and their application in a balanced way to enhance soil fertility for maintaining soil productivity. Composting is a microbiological non-polluting and safe method for disposal and recycling of organic waste by its conversion to organic manures. The compost prepared by using earthworms is called vermicompost.

Vermicompost is a compost of plant biomass decomposed by earthworms and is entirely a natural product and found to be more economical and profitable to farmers as it is cheaper than chemical fertilizer. Vermicompost has great sale potential in urban and rural areas. It has a visible impact on the economic upliftment of resource-poor small and marginal farmers and provided with self-employment opportunities to the youth. The transfer of vermiculture technology is highly successful and widely adopted by the farming community. Adoption of the vermiculture technology constitutes an essential component of integrated farming system. The vermiculture takes care of supplying essential nutrients to plants in an organic form.

Vermicomposting for Small and Marginal Farmers

Out of three ecological varieties of earthworms, the *epigeics* in particular and *anecics* in general, have largely been harnessed for the use in the vermicomposting processes. The vermicomposting is carried out in different types of pits i.e. *low cost bamboo pit* and *concrete pit* of 4 m X 1m X 0.75 m size, loaded with partially decomposed (30-45 days) cow dung, organic waste and soil mixture in the ratio of 3:2:1 at optimum temperature (< 35 ^{0} C) , moisture (75% w/w) , which will allow for decomposition. Suitable strains of earthworms @1500-2000 worms per cubic meter are inoculated per 100 kg of waste. Earthworms are not disturbed during course of decomposition. To protect the earthworms from rain and wind, a polythene sheet or temporary shed of about 5 feet height above the ground level is required to cover the pit. Compost becomes ready in 60-80 days. Nutritive value of vermicompost is given in Table 1 below.

Table 1: Nutrient composition in vermicompost

No.	Nutrient	Content
1.	Organic carbon	9.0 – 17.00 %
2.	Total Nitrogen	1.5 – 2.1%
3.	Total Phosphorus	1 – 1.5%
4.	Total Potassium	0.60%
5.	Calcium & Magnesium	22 – 70 me/100g
6.	Available Sulphur	128 – 548 ppm
7.	Copper	100 ppm
8.	Iron	1800 ppm
9.	Zinc	50 ppm

Source: Sethi (2018)

To acquaint farmers about the proper technology of vermicomposting, a short training course of one or two days will give a good exposure to the farmers. To equip the farmers with hands-on training on handling different operations involved in vermicomposting seven-day long training programmes will convince them to adopt vermicomposting in their farm yards. Earthworms are ideal agents for quick biodegradation of organic crop residues. With the help of vermicomposting technologies, the organic wastes can be recycled, processed and put to

productive use for maintaining soil quality and reduce the dependency on chemical fertilizers. Addition of vermicompost in Integrated Nutrient Management (INM) system will help to achieve the advantages, manifolds. Vermicompost, is an excellent soil conditioner, which improves the soil quality by three modes of actions (physically, chemically and biologically).
In a state like Bihar, farmers are adopting the vermicomposting technology at high pace because there is a severe dearth of chemical fertilizers during the cropping season. Different programmes were initiated by state government to promote vermicomposting and organic farming which includes the heavy subsidy in production and use of vermicompost. So, there is a very high potential for production and consumption of vermicompost (Sushant, 2013). So, several training programmes were conducted to encourage wide spread adoption of vermicomposting technology as a profitable and sustainable alternative to chemical fertilizers.

Conclusion

Vermicompostin technology is accepted by farmers today as a viable and cheaper replacement of chemical fertilizers. Training programmes have provided adequate knowledge, skill and conviction to adopt production process of vermicomposting. Farmers were also convinced about the nutritive value of vermicompost in supplementing minor nutrients in enabling balanced use of manures. Vermicompost became a major alternative to chemical fertilizer and source of livelihood and income generation for the farmers today.

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