

# Vermicomposting technology: An effective cluster based entrepreneurship development approach among farm women

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*Vermicomposting technology is a successful approach for promoting compost utilization, organic farming, economic development and improving soil health. However, principal bottleneck of this technology dissemination in broad scale is the lack of proper scientific knowledge about composting and the limited productivity due to discrete production leading to unstable production rate and poor marketing possibilities. Considering this scenario, Sasya Shyamala KVK took an initiative of cluster based entrepreneurship development approach with the farm women of 5 villages of South 24 Parganas district, West Bengal through trainings followed by establishment of compost production unit (32 nos.) and regular monitoring for quality compost production. The success of this approach is not only limited to the pooled amount of compost production (14–16 t/year) by the beneficiaries throughout the year, but also a significant horizontal dissemination among other interested farmers (35 nos.) by observing the economic benefit (₹5000/year/unit) through marketing of compost, vermish and earthworms. This endeavour not only helps in proper utilization of agri wastes, but also increases compost production and utilization, reduces fertilizer requirement, alternative income source, women empowerment and sustainable soil health management.*

**Keywords:** Entrepreneurship, Organic farming, Vermicompost

IN recent days, different organic composts in semi-urban and rural areas are in demand as a result of increasing awareness regarding proper utilization of agricultural wastes and need for improving soil health and crop quality. Considering the health and environmental aspects, urban population is getting inclined to the consumption of organic based products resulting high demand for their urban gardening. The farmers are also becoming serious about the incorporation of different composts in their management practices to reduce the use and cost of inorganic fertilizers, minimize the soil and water pollution and more importantly to improve their soil health. Thus, the commercial production of compost is now becoming a profitable venture to the farmers and rural youths. Generally, farmers were used to either discard

or dump their agricultural wastes in a pit for long and produce little efficient farmyard compost. In rural areas, more than 60% of total available cow dung was utilized for fuel purpose as the process is easy and economically profitable. Utilization of cow dung as compost was either from heaping in a open pit or through broadcasting the dried cow dung in the field. But both the practices are not considered as good nutrient supply processes to improve soil health or re-establish

the soil organic reserve. Among the different composts prepared from the green wastes, animal excreta or agricultural residues, vermicompost is the best option in respect of nutrient source and economic profitability from the entrepreneurship development. Though a few farmers who have already produced the vermicompost for their own utilization either used the less efficient local earthworms or their production techniques are unscientific for higher production.



Training and practical demonstration on vermicomposting technology at village level by Sasya Shyamala KVK

Basically, the bottleneck of the adaptation of vermicomposting technology to most of the farmers was the lacking of proper scientific knowledge and technical skills about composting process in respect of compost quality and productivity. In this regard, intensive extension activities of Krishi Vigyan Kendras (KVKs) regarding awareness and technical skills buildup for proper utilization of agricultural wastes by producing vermicompost make a considerable step throughout the India (Table 1).

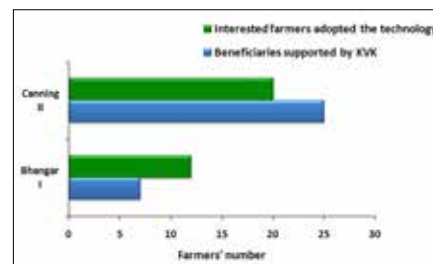
Sasya Shyamala Krishi Vigyan Kendra, RKMVERI, Arapanch, Sonarpur, West Bengal primarily assessed the scenario of the vermicomposting technology in different villages of different Blocks of South 24 Parganas district of West Bengal and took an initiative for popularizing the vermicomposting technology to the farmers of 4 villages (Moushul, Andulgaria, Shewraberia) of Bhargar I and Majherpara village of Canning II Block of the district. Through the PRA, it was identified that the requirement of compost was high but the constraint was the availability of the compost. Considering this initially a number of awareness cum training programmes were conducted. For proper dissemination of the waste utilization technologies, vermicomposting was taken as the lead technology to fulfill three objectives of demonstration-enhancing income generation, compost production and increasing

crop yield with higher productivity, and reduced cost of cultivation.

Different initiatives through trainings, group discussions, farm clinic etc. were taken to gear up their knowledge and skills for vermicompost production in scientific way followed by demonstration in their villages during 2019–2021. After assessing the interest and technical skills of the farmers, total 32 numbers of farmers, farm women and rural youths were selected as beneficiaries from the villages and one vermicompost unit was developed for each of them in their own household under the financial support from ICAR-ATARI and ICAR-NBSSLUP, Kolkata Regional Center during 2019 to 2021. The composting processes were regularly monitored by the expert from KVK and compost quality was evaluated. In addition, the horizontal expansion of the composting technology to the villages was also monitored to assess the success of the technology dissipation.

#### Development of vermicompost demonstration units

From the experiences of working in the field of vermicomposting, the KVK observed superiority of the *Eudrilus eugeniae* over commonly used sp. *Eisenia foetida*. For demonstration purpose, one cemented compost tank (height = 2 feet, length = 8 feet, width = 4 feet) was developed within the budget of ₹5000–6500 in the beneficiaries'



Horizontal dissipation of the vermicomposting technology at villages of Bhargar I and Canning II Blocks, South 24 Parganas, West Bengal

household. The tank floor had the internal slope of 1% with an outlet to collect the vermiwash properly. The shades of the units were developed by the beneficiaries at their own cost.

#### Earthworm types

One kilogram of matured earthworm sp. *Eudrilus eugeniae* (African Night Crawler) was distributed to the farmers for vermicomposting process. The increased population of the earthworms in their vermicompost unit were further used either for next compost production or partly marketed to the local new compost producers.

#### Improved composting process with KVK technical support

Generally, the common practice included the use of only cow dung, direct incorporation of earthworms to the cow dung excluding the preparation of the partly decomposed cow dung as earthworm's feed. This approach not only trimmed down the composting

**Table 1.** Knowledge gaps regarding the traditional composting process by the farmers

| Common practice                                                        | Lacking of information                                                                                                                                                               | Improvement of the knowledge after KVK interventions                                                                                                                                                                                                                                                                         |
|------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Long term heaping of cow dung                                          | In absence of turning of the staked cow dung, partial decomposed compost was produced due to incomplete composting                                                                   | Adapting regular turning and mixing of the cow dung heap to release the temperature, smell and gases and for better aeration                                                                                                                                                                                                 |
| Using of only cow dung for composting                                  | Absence of knowledge of using different agricultural green waste                                                                                                                     | Incorporation of agricultural green waste for composting                                                                                                                                                                                                                                                                     |
| Using unsuitable earthworms for composting                             | Absence of awareness about the efficiency of proper variety of earthworms                                                                                                            | Uses proper earthworm variety i.e. <i>Eudrilus eugeniae</i>                                                                                                                                                                                                                                                                  |
| Poor maintenance of the composting materials during composting process | Insufficient knowledge regarding the requirement of optimal conditions (feed quality, temperature, moisture content, aeration and bedding materials) for better growth of earthworms | Preparing the good quality of earthworm feed by utilizing different wastes, pre decomposing the cow dung<br>Maintaining the moisture content, temperature and aeration for better growth and activity of earthworms<br>by shading the pit, covering by gunny bag, sprinkling, scraping the composting materials respectively |
| Improper techniques for earthworm collection                           | The common practice includes the collection of earthworms by sieving of the prepared compost that increases the mortality risk and egg loss                                          | Adapting the earthworm harvest techniques includes incubation and feed supplementing based collection process                                                                                                                                                                                                                |

**Table 2.** List of waste materials used for vermicomposting process to enrich the quality

| Component used for composting                   | Source                                 | Quantity available               | Benefit                                                                                                                                                                                             |
|-------------------------------------------------|----------------------------------------|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Water hyacinth ( <i>Eichhornia crassipes</i> )  | Local pond and narrow irrigation canal | 10–12 tonnes green biomass/bigha | It reduces the requirement of cow dung<br>It increases the nitrogen content of compost                                                                                                              |
| Water lettuce ( <i>Pistia Stratiotes</i> Linn.) | Local pond and narrow irrigation canal | 3–4 tonnes green biomass/bigha   | It is preferred by the earthworms as feed<br>Its hairy root clumps provides the good space for egg laying and hatching by earthworms                                                                |
| Mushroom straw waste                            | Local mushroom unit                    | 1.8–2.2 kg/cylinder              | It contains discarded mushroom having high amount of protein, carbohydrate, nutrients (N, P, Ca, Mg) which helps the growth of organic matter decomposing microorganisms                            |
| Pseudo stem of banana                           | Banana field                           | 40–50 kg green biomass/plant     | It contains cellulose, hemi cellulose, pectin that promote the growth of organic matter decomposing microorganisms<br>It contains high amount of potassium (5–6%) that improves the compost quality |



Vermicompost production in plastic drum unit and using of earthworms for composting

efficiency but also reduced the earthworm population and their reproduction rate. Moreover, it was observed that huge green biomass of aquatic plant (water hyacinth, water cabbage) and pseudo stem of banana were wasted in villages of these areas. Mushroom cultivation was one of the household level agri-entrepreneurship in these villages which produced large amount of mushroom straw waste. The compost production under this case study accounted the incorporation of these locally available wastes with cow dung to improve the compost quality and productivity (Table 2). Initially 7–10 days' old cow dung were properly mixed with different agricultural wastes (water hyacinth, *Pistia Stratiotes* Linn, mushroom waste straw, pseudo banana stem, green gram husk, weed waste etc.) in 3:1 ratio and kept for pre-decomposition for 15–20 days. The incorporation of the green materials helped to increase the NPK and microbial content of the vermicompost in comparison to the sole cow dung vermicompost (Table 3). Turning of the composting material regularly was followed to increase aeration,

minimize the temperature and expel out gases ( $\text{NH}_3$ ,  $\text{CO}_2$ ,  $\text{N}_2\text{O}$ ,  $\text{H}_2\text{S}$  etc.) which may cause unsuitable environment to the earthworms. Changing of colour of the mixture from yellowish brown to dark brown/black mud like appearance with normal temperature and absence of foul smell indicated the readiness of the material as the feed for the earthworms. After that the feed material was kept in tank with earthworms (@25–30 nos./sq. ft.) and covered with wet gunny bags to maintain the moisture and temperature. During the composting process, farmers maintained the moisture content as per the requirement and compost was harvested approximately within 55–60 days.

As per the technical guidance from KVK, they have efficiently harvested the earthworms by the optimal condition withdrawn method followed by “feed ball” method. They continued the composting process for two times annually per unit by using the produced earthworms successfully.

It has been observed that the beneficiaries are now producing vermicompost @4.5–6.5 quintal with 110–135 litre of vermiwash and 1.5–2.0 kg of earthworms per



Vermicompost and earthworms production for composting



Successful production of vermicompost for marketing purpose

unit annually. Initially they used minimum quantity of compost, but now 15–18% of the produced vermicompost is utilized in their own cultivation with an increase of 22–25% of the compost use. The remaining portion of the compost was marketed with increasing demand to the local farmers. Some of them purchased their produces for large scale marketing to the outside buyers. KVK has promoted the linkage between them and different NGOs, agri-farms and dealers through different extension activities. Farmers have reduced their inorganic fertilizer requirement to the tune of 16–18% with an effective adaptation of compost utilization.

As a significant success, horizontal adoption of the technology among farmer and farm women in these area was very encouraging. During the study period, 35 farm women adopted this enterprise successfully. They have started producing the compost in plastic drums, over the plastic sheet and plastic bag also in addition to the tank method.

Besides, use of quality organic



Utilization of the produced vermicompost in vegetable field for better yield

**Table 3.** Comparative quality assessment of the produced vermicompost

| Parameter                               | Compost produced by traditional process | Compost produced with technical guidance |
|-----------------------------------------|-----------------------------------------|------------------------------------------|
| Moisture content (%)                    | 24.3                                    | 43.6                                     |
| Colour                                  | Light brown                             | Dark brown to black                      |
| Particle size through 4 mm sieve        | 76% passed                              | 99% passed                               |
| Bulk density (g/cc)                     | 1.74                                    | 1.84                                     |
| pH                                      | 8.33                                    | 7.48                                     |
| Electrical conductivity (mS/cm)         | 6.50                                    | 2.80                                     |
| Total organic carbon (%)                | 52.50                                   | 19.3                                     |
| Total nitrogen (%)                      | 8.43                                    | 0.85                                     |
| C /N ratio                              | 6.23                                    | 22.7                                     |
| Total P <sub>2</sub> O <sub>5</sub> (%) | 0.43                                    | 0.73                                     |
| Total K <sub>2</sub> O (%)              | 0.55                                    | 0.94                                     |

manure like vermicompost by the farmers increases the quality and quantity of different crop production and improves soil health in the long run. From their feedback, it was observed that they

have successfully grown healthy vegetable seedlings from compost enriched seedbed and reduced inorganic fertilizer as well as the pesticides use in their cultivation practices.

### Economic benefit

Vermicomposting is a highly profitable enterprise. The farm women have received annually a net return of ₹5,000–6,500.00 per unit by marketing of vermicompost @ ₹12–15/kg, vermiwash ₹20.00/litre and earthworms @ ₹1600–1800/kg respectively. The annual pooled production of vermicompost comes to approximately 14–16 tonnes of total income of ₹1.92–2.15 lakh. Thus, vermicompost production showed a potential scope for cluster based entrepreneurship development that might support the women empowerment with an additional advantage of sustainable soil health.

### SUMMARY

It was observed that the promotion of vermicomposting technology not only generates awareness regarding the benefit of compost use, but also generates an additional income to the beneficiaries which helped in horizontal dissemination of the technology to the farmers and farm women. The availability of good quality vermicompost also helped to improve the soil health as well as the crop yield which also increased the interest of the farmers to avoid the practice of cow dung cake production as fuel and increased the vermicompost production at commercial scale. The increasing adoption of the vermicompost production by farm women helped to strengthen women empowerment through entrepreneurship development.

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