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The Budgetary Analysis of Vermicompost Production in College Farm, College of Agriculture, Rajendranagar, PJTSAU

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ABSTRACT: Vermicomposting is the process of producing compost by utilizing earthworms to turn the organic waste into high-quality compost. Vermicompost improves the physical, chemical and biological properties of the soil as well contribute to soil conditioning. The present study on budgetary analysis of vermicompost production was carried out during 2021 in Hyderabad district of Telangana. The study revealed that the total cost of production of vermicompost per annum was Rs. 7,25,805. The total revenue earned per year was Rs. 10,22,400 and Rs. 16,74,000 at PJTSAU and market prices respectively. Net returns and B: C ratio values indicated that the vermicompost production unit was economically viable at both the prices. Few challenges faced during vermicompost production were scarcity of water in summer and death of earthworms due to adverse conditions. Intensive labour requirement was also an important challenge.

Keywords: Vermicompost, vermiwash, vermiculture, college farm, PJTSAU.

INTRODUCTION

Vermicomposting is a process by which earthworms, primarily the species *Eisenia foetida*, break down organic material and transform it into fine granular manure known as vermicompost. Vermicompost improves the physical, chemical and biological properties of the soil as well contribute to organic enrichment (Chauhan and Singh 2013). Vermicompost is rich in nutrients with 3% nitrogen, 1% phosphorus and 1.5% potash. Vermicompost is a long-term source of both micro- and macro-nutrients which are assimilated by crops very easily (Atiyeh *et al.*, 2000). Sengupta *et al.* (2020) investigated the potential of vermicompost through its Zn and Fe enrichment for augmenting the soil quality as well as increasing the Zn and Fe bioavailability in the grain. Suthar and Singh (2008) found that the content of nutrients such as N, P, K, Ca, Cu, Mg, Fe and Zn is much higher in vermicompost than in farmyard manure, and it resulted in increased growth and yield of garlic (*Allium sativum*). Vermicompost increases the surface area, provides strong absorbability and retention of nutrients as well and retain more nutrients for a longer period of time. It serves as an excellent base for beneficial free living and symbiotic microbes. There is presence of nitrogen fixing and phosphorus-solubilizing bacteria in vermicompost (Yatoo *et al*., 2020). It is a peat like material with desirable structure, porosity, aeration, drainage and moisture holding capacity (Dominguez *et al.*, 1997). Hence acts as a very good soil conditioner and promotes better crop establishment.

Beneficial effects of vermicompost include stimulation of root and shoot development, increasing seed germination, leaf area, root branching, fruit yield, nutritional quality, stimulation of plant flowering, affecting the biomass, photosynthetic pigments, photosynthesis and respiration rates (Usmani *et al.*, 2019). Application of vermicompost also enhances the quality of produce. For example, application of vermicompost at 4 tonnes per ha enhanced sweetness in banana according to studies conducted by Jadhav *et al.* (2019). According to study conducted by Wani and Rao (2012) plant height, number of leaves and fruit weight were higher in the vermicompost treated field as compared to control and no disease incidence was observed in the fruits of vermicompost treated plots. Vermicompost teas applied at 2% increased rooting in sugarcane and mint stem cuttings due to the combination of auxins, cytokinins, GA and humic acids found in vermicompost tea (Arancon *et al*., 2020). A meta-analysis has shown that adding vermicompost to soil on an average enhances commercial crop production by 26%, overall biomass by 13%, root and shoot biomass by 57 and 78%, respectively (Blouin *et al*., 2019). Application of biofortified vermicompost suppresses diseases like Fusarium wilt in tomato (Basco *et al*., 2017). Vermicompost can manage pests such as

mites (*Tetranychus urticae*), mealy bugs (*Pseudococcus* sp.), aphids (*Myzus persicae*) (Arancon *et al*., 2017).

With the increase in awareness regarding organic farming and sustainable agriculture, vermicompost is finding a greater scope as a soil amendment and an organic source of fertilizer. Incorporation of vermicompost saved half NPK input in tomato (Jadhav *et al*., 2019). A cost analysis of vermicompost and chemical fertilizer was carried out and it was observed that overall costs (fertilizer and labor) were lower in vermicompost grown plants relative to chemical-grown plants (Mahmud *et al.,* 2018).Vermicompost could substitute the chemical inputs and may also lead to organic produce which fetches higher price in the market (Kaplan, 2016). Hence research on vermicomposting will provide farmers with an environment-friendly fertilizer and assist in promoting the agriculture sector towards a greener future (Devi and Kumar 2020).

Vermicomposting is a source of creating self employment and revenue generation. Mahila SHG at Mehsana district produced 4,350 kg of vermicompost and got net return of Rs. 21,740.00 after skill training by KVK, Mehsana (Soni and Patel 2020). Apart from vermicompost, vermiwash and earthworms can also be sold to generate additional revenue. Vermiwash is a reddish colour liquid, with an alkaline reaction having dissolved nutrients, collected in a small chamber connected through drainage pipes fitted at the bottom of the vermicompost tank. A farmer at Guntur produced vermicompost commercially and got benefit cost ratio of 2.1:1 (Devi *et al.*, 2020). The present study makes an attempt in analysing the economics of one such vermicompost unit at Hyderabad.

MATERIALS AND METHODS

Data required for the study is collected from the vermicompost unit located at college farm, College of Agriculture, Rajendranagar, Professor Jayashankar Telangana State Agricultural University, Hyderabad. It is a permanent unit established in 2019 which consists of two sheds of 86′ × 30′ dimension each. Each shed comprises of ten beds, every bed measuring 24′ × 3′ × 1.6′ (115.2 cuft). Devi *et al*. (2020) presented a case study on enriched vermicompost production by a Guntur farmer who adopted bed and pit methods for composting. In bed method, composting was done on the pucca / kachcha floor by making bed (6′ × 2′ × 2′ size) of organic mixture whereas, composting was done in the cemented pits of size 5′ × 5′ × 3′ in pit method. In the present study open pit method (anaerobic) is adopted which takes 60 to 75 for the compost to be ready.

Primary data essential for economic analysis was collected from the above mentioned unit in the year 2021. Data obtained is used to calculate economic measures which are analysed to evaluate the viability and profitability of the unit.

The total cost of production was calculated by adding total fixed cost and total variable cost. Total fixed cost included interest on fixed capital and depreciation. Total variable cost included cost of organic wastes, electricity, labour, maintenance, nutrient testing and interest on working capital. The method of determining cost of production was in accordance with the one followed by Ashfaq *et al.* (2017).

Fig. 1. Addition of cowdung slurry to the vermicompost pit.

Fig. 2. Filling of the pit with organic manure (FYM).

Fig. 3. Watering the pit to retain sufficient moisture.

Fig. 4. Sieving to separate earthworms and vermicompost.

Fig. 5. Weighing and filling the bags with vermicompost.

Fig. 6. Weighed, stitched bags which can be readily sold.

RESULTS AND DISCUSSION

A. Initial Capital Investment for establishment of vermicompost unit

Initial fixed capital includes costs incurred in construction of the shed and procurement of necessary implements. Total fixed capital required for development of a functional vermicompost unit was Rs.17,34,205. Depreciation was determined for all fixed assets based on their individual life span. Total depreciation per annum was Rs. 49,253 as mentioned in Table 1.

B. Total cost per annum including fixed and variable cost

It was observed that total fixed cost per annum was Rs. 66,595(9.17% of total cost) and total variable cost per annum was Rs. 6,59,210 (90.8% of total cost) as mentioned in Table 2 and 3 respectively. As a result, total cost (gross cost) of vermicompost production per annum summed up to Rs. 7,25,805. The study conducted by Devkota *et al*. (2015) revealed that variable cost and fixed cost comprised about 68 % and 32 % of the total cost of production respectively. The cost of production per unit quantity of vermicompost, vermiwash and earthworms was Rs.7.1, Rs. 1,210 and Rs.1,008 respectively (Table 4: Total production per annum). The total cost of production was Rs. 15.68 per kg compost and was Rs. 0.40 per earthworm according to the studies conducted by Devkota *et al*. (2015).

Table 1: Cost and depreciation of particulars for establishing the vermicompost unit.

Sr. No.	Particulars	No.	Total Cost (Rs)	Life span in years	Depreciation Per annum
1.	Hand Rake	3	450	4	113
2.	Plastic Troughs	10	1,250	1	1,250
3.	Hose Pipe (30')	1	630	1	630
4.	Sieving Machine	1	15,000	10	1,500
5.	Weighing Machine	1	8,500	10	850
6.	Spades	5	375	4	94
7.	Electric Motor & Accessories	1	13,000	10	1,300
8.	Bore Well, Irrigation charges	1	80,000	15	5,350
9.	Sewing Machine	1	15,000	10	1,500
10.	Chaff Cutter	1	1,00,000	15	6,666
11.	Shed	1	15,00,000	50	30,000
	Total		**17,34,205**		**49,253**

Table 2: Details of Fixed Cost per annum.

Sr. No.	Item	Cost Incurred (Rs)
1.	Depreciation	49,253
2.	Interest on fixed capital @ 10%	17,342
	Total	**66,595**

Table 3: Details of Variable Cost per annum (6 cycles per year).

Sr. No.	Particulars	Quantity	Price (Rs)	Value per cycle (Rs)	Annual cost (6 Cycles) (Rs)
1.	Cow Dung	16 tons	1,500 per ton	24,000	1,44,000
2.	Paddy Straw & Crop Residues	6,000 kg	2 per kg	12,000	72,000
3.	Earthworms	200 kg	50 per kg	10,000	10,000
4.	Waste Decomposer	20 ml bottle	50	50	300
5.	Labour cost	100	545 (6 hours)	54,500	3,27,000
6.	Electricity Charges	Minimum units	250	250	1,500
7.	Maintenance charges	-	714	714	4,284
8.	Nutrient Testing Cost of sample	1	1000	1,000	6,000
9.	Cost of Bags	425 bags	20 per bag	8,500	51,000
10.	Interest on working capital @ 7% per annum				43,126
	Total				**6,59,210**

C. Total production per annum

Vermicompost production per cycle was 17,000 kg. Considering 6 cycles per year, total vermicompost production was 1,02,000 kg. Likewise, 600 L of vermiwash and 720 kg earthworms were produced per annum (Table 4). Chanu *et al.* (2018) in their research on financial profitability of vermicompost in Mymensingh district documented 2.25 tonnes of vermicompost production in a year from a vermi tank of dimension $10' \times 4' \times 2'$ assuming three harvests per year). In a study conducted by Thirunavukkarasu *et al*. (2022) with the duration of about 45 days for 1st year of harvesting, 8 cycles could be performed with a recovery of about 2400 kg/pit from 10 pits each. Likewise, 8000L of vermiwash and 200kg of live worms were produced.

D. Annual revenue generated

According to PJTSAU rates i.e., Rs. 9 per kg Vermicompost, Rs. 30 per L Vermiwash and Rs. 175 per kg Earthworms, the annual returns obtained were Rs. 9,18,000, Rs. 18,000 and Rs. 1,26,000 from vermicompost, vermiwash and earthworms respectively. The total revenue obtained per year from 6 cycles was Rs. 10,22,400 (Table 5). In an investigation conducted by Reddy *et al*. (2009) in Sothern Karnataka, the sale price of vermicompost was assumed to be Rs. 3.2 per kg and the price of earthworms from Rs. 200 to Rs. 300 per kg providing annual total returns of Rs. 35,408 per annum. According to an economic analysis on Production and marketing of vermicompost in Dharwad conducted by Shivakumar *et al.* (2009), the net present value for the vermicompost production was Rs. 99827, the benefit cost ratio at 12 per cent discount rate was 3.44.

As per the selling prices existing in the market, annual returns obtained from vermicompost, vermiwash and earthworms would be Rs. 15,30,000, Rs. 18,000 and Rs. 1,26,000 respectively. Total revenue generated per year would be Rs. 16,74,000 (Table 6). Vermicompost was valued at Rs. 15 per kg, the prices for vermiwash and earthworms remained the same. Farmer Ravuri Suresh Kumar obtained net income of Rs. 19,00,350/- by investing Rs. 8,99,650/- per annum for the production of value added vermicompost in Guntur district (Devi and Kumar 2020). In a study conducted by Thirunavukkarasu *et al*. (2022) market cost of vermicompost, vermiwash and earthworms were Rs.10/kg, Rs. 20/L and Rs.500/kg respectively. It was expected to get Rs.2.4 lakh for the 1st year from vermicompost and with an average increase of product cost at the rate of 5%, it was computed as Rs. 2.52 lakh and Rs.2.65 lakh for the 2nd & 3rd years respectively. Likewise, the benefit analysis for vermiwash was calculated with a recovery of 8000L/year. Eventually, the market value for live worms was Rs. 1 lakh for the 1st year with a recovery of 200 kg.

E. Evaluation of economic viability of the vermicompost unit

The net return is the amount remaining after subtracting all costs and expenses (total cost) from revenue (gross returns). It was observed that gross returns and net returns were Rs. 10,22,400 and Rs. 2,96,595 at PJTSAU prices and Rs. 16,74,000 and Rs. 9,48,195 at market prices.

The benefit cost ratio for vermicompost unit was calculated by two ways: one by considering total variable cost (BCR_1) and another by considering total cost (BCR_2). BCR_1 was 1.55 and 2.54 at PJTSAU and Market prices respectively. Likewise, BCR_2 was 1.4 and 2.3 (Table 7). The values of gross returns, net returns and BCR were higher at market prices due to higher price of the product.

The study on financial profitability of vermicompost production conducted by Ashfaq *et al.* (2017) revealed that BCR_1 was 2.89 and BCR_2 was 2.24. The BCR values for the present study appeared comparatively lower as compared to findings made by Ashfaq *et al.* (2017). According to study conducted by Thirunavukkarasu *et al*. (2022) BCR was calculated to be 1.56 with NPW of cost and benefit as Rs.7.63 lakh and Rs. 11.94 lakh respectively at 15 % discounting rate**.** However, Net returns and B: C ratio values for both the prices indicate that the vermicompost production unit considered for this study is economically viable.

Table 4: Production of vermicompost, vermiwash and earthworms per cycle and per annum.

Sr. No.	Particulars	Qty (per cycle)	Qty (per annum i.e., 6 cycles)
1.	Vermicompost	17,000 kg	1,02,000 kg
2.	Vermiwash	100 L	600 L
3.	Earthworms	120 kg	720 kg

Table 5: Revenue generated as per PJTSAU prices.

Sr. No.	Particulars	Qty (per cycle)	Price per unit (Rs)	Value (per cycle)(Rs)	Annual value (Rs)
1.	Vermicompost	17,000 kg	9	1,53,000	9,18,000
2.	Vermiwash	100 L	30	3,000	18,000
3.	Earthworms	120 kg	175	21,000	1,26,000
	Total			**1,77,000**	**10,22,400**

Table 6: Revenue generated as per existing Market prices.

Sr. No.	Particulars	Qty (per cycle)	Price per unit (Rs)	Value (per cycle) (Rs)	Annual value (Rs)
1.	Vermicompost	17,000 kg	15	2,55,000	15,30,000
2.	Vermiwash	100 L	30	3,000	18,000
3.	Earth worms	120 kg	175	21,000	1,26,000
	Total			**2,79,000**	**16,74,000**

Table 7: Comparison of revenue generated at both the prices.

Sr. No.	Economic measures	Returns as per PJTSAU prices	Returns as per market prices
1.	Gross returns (Rs)	10,22,400	16,74,000
2.	Total variable cost (Rs.)	6,59,210	6,59,210
3.	Total cost (Rs.)	7,25,805	7,25,805
4.	Net Returns (Rs)	2,96,595	9,48,195
5.	BCR_1	1.55	2.54
6.	BCR_2	1.4	2.3

CONCLUSIONS

The vermicompost unit under evaluation was established in 2019. It consists of 2 sheds with 10 beds each. Total fixed capital required for establishment of the unit was recokened at Rs.17,34,205. Total cost of production of vermicompost per annum was Rs. 7,25,805, while the total revenue obtained per year summed up to Rs. 10,22,400 and Rs. 16,74,000 at PJTSAU and market prices respectively. The BCR_2 were 1.4 and 2.3 at PJTSAU and market prices respectively. Observing the values of Net returns and B: C ratio, economically viability of the vermicompost unit can be confirmed. Hence it can be concluded that vermicompost production provides net reasonable returns to farmers.

FUTURE SCOPE

- The scope for betterment of soil health using vermicompost and globalization as well as of our economy has opened up new vistas of business opportunity to commercially produce vermicompost of multiple social and rural economic values.
- Farmers friendly earth worms can be reared and commercialized by selling to rural as well as urban orchard, green house, shade nets houses and pisciculture.
- The commercially viable vermiwash can also be a big scope for a rural farmer to establish under the Micro Small & Medium enterprises

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Conflict of Interest. None.

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