Madras Agric.J., 2023; https://doi.org/10.29321/MAJ.10.201084

RESEARCH ARTICLE

Profitability and Soil Nutrient Status of Brinjal under Organic and Conventional Production Systems in Tamil Nadu

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ABSTRACT

The study analyzed the input use patterns, soil nutrient status, costs, and returns of brinjal under organic and conventional production systems in Tamil Nadu. Purposive sampling was employed to select the sample respondents. A total of 86 respondents were selected for the present study. Soil samples were analysed to examine the nutrient status in both the organic and conventional fields. The results showed that the amount spent (Rs.15389 /ha) on inorganic inputs by conventional farmers was found to be higher than an organic inputs spent by organic farmers. The analysis of soil nutrient status in both the production systems revealed that the availability of total major nutrient was higher in organic fields ranging from 34-53 per cent over conventional fields. The total cost of cultivation of organic brinjal was lower in organic fields than conventional field by Rs. 15732/- per hectare. Yield was 1660 kg lower in organic farms than conventional farms. However, net return per ha from brinjal cultivation under organic methods was found to be higher than conventional method by Rs. 45981/-. This is mainly due to higher price for produce, and reduction in cost of cultivation. It is evident that organic farming helps to achieve higher profitability and also to enhance soil fertility due to the use organic inputs.

Keywords: *Organic farming; Conventional farming; Input use; Soil nutrient status; Costs and Returns.*

INTRODUCTION

Organic farming systems have become more and more popular in the recent years because of their presumed advantages in the agricultural sector. Increased sustainability, preservation of non-renewable resources, and environmental conservation are all potential benefits of organic farming (Charyulu *et al.*, 2016). According to United States Department of Agriculture (USDA, 1995), crop rotations, residual crops, compost, off-farm

organic waste, and biological systems for nutrient mobilization and plant protection are the pillars of organic farming, which eliminates or uses minimal amounts of synthetic inputs such as fertilizers, pesticides, hormones, feed additives, etc.

Organic farming is a unique approach to production management that promotes and enhances the health of the agro-ecosystem, including biological cycles, biodiversity, and soil biological activity, by utilizing on-farm agronomic, biological, and mechanical techniques instead of any synthetic off-farm inputs (FAO, 2018). Certified organic soil management practices generally restrict the use of chemically-processed highly soluble plant nutrients (Abbott *et al.*, 2015). Being a heavy populated country, India cannot afford to lose out on crop yield, henceforth finding alternatives to the use of these dangerous chemicals in agriculture is essential. The use of pesticides in agriculture has come under heavy fire in recent years because, they are classified as a pollutant with major environmental consequences. Since they have a direct impact on crop productivity, the growing nutrient imbalance in the soil caused by the use of chemical fertilizers is a serious problem in India (Pimentel, 2006).

Farmers everywhere are drawn to the organic farming concept because of its many benefits over modern farming methods. Instead of using inorganic solutions like chemicals or genetically modified organisms, organic farming systems supports and strengthens biological processes. Comparing this type of farming to inorganic farming in irrigated areas, production costs can be lowered by as much as 10–30%. Nonetheless, the yield from inorganic farming was either negligible or comparable, which can be readily offset by the higher price (Fess *et al.*, 2018).

Research on the effectiveness of organic farming in the Karnataka district of Shimoga revealed that various organic farming systems were used by the farmers to cultivate sugarcane and paddy. The yield of sugarcane was 18.10 per cent higher and the yield of paddy was 21.93 per cent higher for the organic farmers than inorganic farmers. In comparison to inorganic farms, the average cost of cultivation per acre of sugarcane and paddy on organic farms was lower. With positive net returns on both types of farms, organic farms had higher per-acre gross returns from both crops than inorganic farms (Huchhappalavar, 2001).

(Delate *et al.*, 2003) used certified organic production techniques to compare the agronomic and financial performance of conventional and organic systems in Iowa**.** Study results revealed that the returns on corn in the corn-soybean-oat and corn-soybean-oat-alfalfa organic rotations were considerably higher at $51/acre than the returns on conventional corn-soybean rotations. The returns for soybean in the corn-soybean-oat-organic and corn-soybean-oat-alfalfa rotations were $470/acre and $505/acre, respectively and did not differ significantly. In the corn-soybean rotation, organic soybean returns were much higher than conventional soybean returns ($95/acre).

The effects of organic farming on the economics of sugarcane cultivation in Maharashtra was examined by Kshirsagar (Kshirsagar, 2008). The results revealed that yield from organic farming was 6.79 per cent lower than conventional crop yield. The price premium obtained and yield stability observed on organic farms were more than conventional farms with overall profits from organic farming being 15.63 per cent higher

than those from inorganic farming. Additionally, organic farming increased employment of human labour by 16.9 per cent and decreased cultivation costs by 14.2 per cent.

Similarly, the economic analysis of organic farming in Denmark (Lampkin, 1994) revealed that organic farms used about twice as much labour per hectare as the conventional farms and major price premiums on output and public support were necessary for the organic farms to be economically viable. Yield differences were most noticeable for intensive crops like wheat and potatoes with the yields from organic farms were about half of the conventional averages. Likewise, the cost of cultivation per ha was 28.56 % lower in brinjal, yield per ha also 25 % lower in case of brinjal under organic farming. However, net income per ha was 10.21 % higher in brinjal (Anjugam *et al.*, 2016). Similarly, highest level of shoot and fruit borer infestation leads to decrease in marketable yield of brinjal (Praneetha, 2017).

The importance of organic farming and its role in promoting food security and sustainable agricultural growth have recently captured the attention of stakeholders. In this context, an attempt has been made i) to analyse the profitability of brinjal and ii) to analyse the soil nutrient status under organic and conventional production systems in Tamil Nadu.

MATERIALS AND METHODS

This section covers the sampling and research methodology used in the current study with regard to study area selection, data collection, soil sample analysis, and analytical methods.

Sampling

The study was carried out in two districts namely Dindigul and Salem districts in Tamil Nadu which had the highest percentage of area under organic certification. A list of certified organic farmers and their contacts in each district was obtained from the Tamil Nadu Organic Certification Department. Purposive sampling method was used to select the sample respondents. In each district, 60 certified organic farmers and 60 conventional farmers were selected. Thus, the total sample was 120 farmers. Based on the post stratification of the sample, 43 organically certified brinjal farmers and 43 conventionally grown brinjal farmers were selected for the analysis of data. Conventional farmers within 5 km of organic fields were contacted for the study. The primary data were collected using a pretested interview schedule and information on profile of the sample respondents, input use, costs and returns were gathered from the sample farmers.

Soil Sample Analysis

In order to analyse the soil nutrient status and soil organic carbon, soil samples were collected in both the districts. A total of 23 soil samples were collected. Samples of soil were taken at a depth of 15 cm, sieved, dried in the shade and then brought to a lab for additional processing and analysis. The soil samples were analysed in the soil laboratories in the Joint Director of Agriculture office in the respective study districts. Using standard techniques, the samples were examined for soil organic carbon, available N, P, and K in the farmer's field. The Alkaline Permanganate method was used to estimate the amount of available nitrogen (Subbiah *et al.*, 1956). Olsen's method was used to estimate available potassium (Olsen, 1954) and neutral

ammonium acetate extraction and flame photometry (Merwin *et al.*, 1951) were used to estimate available phosphorus. Wet digestion using Walkley and Black was used to estimate the amount of organic carbon in the soil (Walkley *et al.*, 1934). Standard procedures were also used to estimate the physical parameters of the soil (Richards, 1954) (Richards, 1954)

Analytical Tools

Descriptive Analysis

Descriptive statistical tools viz., average and percentage analysis were used to analyse input use pattern, costs and returns of brinjal under organic and conventional production systems.

Cost of Cultivation of Crops

a) **Fixed Cost:** It included land tax paid, depreciation on fixed capital items, interest on fixed capital and rental value of owned land.
b) **Variable Cost:** It included the cost of physical inputs such as seed, organic manures and fertilizers, insecticides and pesticides, value of owned / hired machinery, value of hired/family labour, cost of machine power, cost on bio fertilizers and interest on working capital.
c) **Total Cost :** It includes both fixed cost and variable cost .
d) **Gross Return:** Gross returns includes value of main product and by product produced on farm. The value of main product was computed by multiplying the quantity of output obtained per hectare with respective selling prices.

$$\text{Gross Return (Rs./ha)} = (Q_M \times P_M)$$

Where, Q_M = Quantity of Main Product; P_M = Price of Main product

e) **Net Return:** It is the difference between gross return and total cost incurred by the farmers which indicates the profit or loss.

$$\text{Net Return (Rs./ha)} = \text{Gross Return} - \text{Total Cost}$$

Depreciation for fixed capital items such as farm machinery and buildings were calculated at the rate of five per cent for buildings and ten per cent for implements. The interest on working capital was calculated at the rate of seven per cent. The interest on value of fixed asset were calculated at the rate of 10% per annum.

RESULTS AND DISCUSSION

General Characteristics of Sample farmers

The profile characteristics of the sample farmers revealed that the mean age of the respondents was 44 for organic farmers and 49 for conventional farmers. The mean family size of the respondents was 3.63 and 3.98 for organic and conventional farmers. About 28 per cent of the organic farmers were educated up to the level of secondary education in the study area, whereas, 25 per cent of the conventional farmers were

educated up to primary and secondary level of education. Around 63 – 65 per cent of the farmers were doing agriculture only. Mean experience on organic farming was 4.3 years among organic farmers.

Input Use Pattern

The sample farmers in the study area used various organic inputs for the enhancement of fertility status of soil (Table 1). Majority of the organic farmers used Meenamino amilam (62.79 per cent) as a growth regulator for increasing plant growth and soil fertility. About 63 per cent of them used mixed leaves extract for controlling pests and diseases. About 60 per cent of the organic farmers used Themorkaraisal which helps to reduce pests and diseases for growth of crops. Other bio inputs such as neem-based products, vermi compost and bio fertilizers were used by them. However, inorganic farmers used only inorganic materials such as chemical fertilizers (100 per cent), plant protection chemicals (86.05 per cent) and herbicides (48.84 per cent) for controlling weeds, pests and diseases and also for increasing the productivity of crops.

In terms of input use per hectare, organic farmers used farmyard manure to the extent of 902 kgs in brinjal cultivation. Whereas, inputs like Vermicompost, Panchakavya, Meenamilam, Neem cake were used to the extent of 1.29 tons, 0.68 litre, 1.50 litre and 137.50 kgs per hectare, respectively. They also used bio fertilizers such as Rhizobium to the extent of 4.16 kgs, Phosphobacteria by 6.75 kgs and Trichoderma by 6.50 kgs per hectare, respectively. However, conventional farmers used 851.65 kgs of fertilizers, 3.57 litres of herbicides and 3.21 litres of plant protection chemicals per hectare, respectively. In terms of amount spent on organic inputs for brinjal by the organic farmers, it was estimated to Rs. 5198 per ha, whereas it was Rs. 20588 per ha for conventional farming. From this analysis, it is inferred that the amount spent on inorganic inputs by conventional farmers were found to be higher than an organic inputs spent by organic farmers by Rs. 15389 per ha. It is also inferred that organic farmers used only farm produced bio inputs for the management of weeds, pests and diseases in brinjal production.

Soil Physical Properties and Nutrient Status of Organic and Conventional fields

Soil nutrient status in organic and conventional fields was assessed by using standard methodologies and results are presented in Table 2. It is observed that the total available nitrogen was 169.12 kg/ha and 128.45 kg/ha in organic and conventional fields, total phosphorous was 26.65 kg/ha and 12.56 kg/ha in organic and conventional fields and total potassium was 399.35 kg/ha and 243.47 kg/ha in organic and conventional fields in study area. Soil organic carbon was found to be 0.88 % per ha and 0.58 % per ha in organic and conventional fields, respectively. Soil properties such as pH was neutral and EC in normal condition in both the production systems. It was found that the total macro nutrients were found higher in organic fields than inorganic fields i.e. ranged from 34-53 per cent over conventional fields. The reason might be that organic farmers used higher amount of organic inputs to enrich the soil nutrients status in the soil.

Cost of Cultivation and Net return of brinjal under Organic and Conventional fields

The details on cost of cultivation and net return of brinjal cultivation under both organic and conventional farming are presented in Table 3. Independent 't' test was performed between the organic and conventional brinjal farmers. The results indicated that the value of human labour and value of seeds were found to be

significant at one and five percent level of significance. The results revealed that, the total cost of cultivation of brinjal per hectare was found to be Rs.64832 and Rs.80564 under organic and conventional farming, respectively. The total variable cost was Rs.52746 and Rs.69076 per ha under organic and conventional brinjal cultivation which accounted for 81.36 per cent and 85.72 per cent to the total cost, respectively.

The value of human labour accounted for the major share (52.77 per cent) to the total cost followed by value of organic manures and bio fertilizers (8.02 per cent) under organic farms, whereas, in conventional brinjal cultivation, human labour accounted for 43.60 per cent followed by chemical fertilizers (22.10 per cent).

The yield of brinjal per hectare was found to be 7314 kg at organic fields and 8894 kg at conventional fields which is 1660 kg lower in organic fields. Gross returns from organic and conventional cultivation of brinjal was found to be Rs. 252590 per hectare and Rs. 222341 per ha, respectively. Net returns realized from organically produced brinjal was Rs. 187759 per hectare. Whereas, in conventional production, it was Rs. 141778 per hectare, respectively. It is inferred that gross return was found to be higher in organic fields than conventional fields by Rs. 30249 per hectare. Similarly, net returns in brinjal cultivation under organic fields was higher than conventional fields by Rs. 45981 per ha.

Output and Returns of Brinjal production

The comparison of per hectare results on total cost of cultivation, yield, gross return and net return are reported in Table 4. Independent 't' test was performed between the organic and conventional brinjal farmers. The results indicated that there exists the significant difference between organic and conventional brinjal farmers on all variables such as total cost of cultivation, yield, gross return and net return at one, five and ten per cent significant level. It also indicates that the organic farmers spent Rs. 8.86 per kilogram of brinjal produced, while the net returns of organic fields were Rs. 26 per kilogram of brinjal. But the conventional farmers spent Rs. 9.05 per kilogram of brinjal produced and the net returns were Rs. 16 per kilogram of brinjal produced.

Even though the yield of organic brinjal was low compared to conventional brinjal, the net returns realized under organic farming was found to be greater than conventional farming. The reason behind this was the higher price of organic brinjal due to higher demand, as it is perceived to be more nutritious, good taste and safe for consumption.

Table 1. Input Use Pattern of Brinjal under Organic and Conventional fields

(Per hectare)

S. No	Inputs (unit)	Organic fields			Conventional fields		
		Nos. (N=43)	Qty.	Value (Rs.)	Nos. (N=43)	Qty.	Value (Rs.)
1	Meenamino amilam (lit)	27 (62.79)	1.50	330.00	-	-	-
2	Mixed leaves extract (mL)	27 (62.79)	40.74	20.58	-	-	-
3	Themor Karaisal (mL)	26 (60.47)	12.76	5.75	-	-	-

4	Farm yard manure (kgs)	21 (48.84)	902.00	675.00	-	-	-
5	Panchakavya(lit)	19 (44.19)	0.68	40.80	-	-	-
6	Vermicompost (tonne)	17 (39.53)	1.29	6.47	-	-	-
7	Asafoetida (kgs)	14 (32.56)	0.64	403.75	-	-	-
8	Neem leaf Extract (mL)	13 (30.23)	30.38	13.67	-	-	-
9	Neem oil (lit)	10 (23.26)	3.70	185.00	-	-	-
10	Rhizobium(kgs)	9 (20.93)	4.16	166.40	-	-	-
11	Neem cake (kgs)	6 (13.95)	137.50	2750.00	-	-	-
12	Phosphobacteria (kgs)	4 (9.30)	6.75	270.00	-	-	-
13	Trichoderma (kgs)	3 (6.98)	6.50	260.00	-	-	-
14	Fertilizers (kgs)	-	-	-	43 (100.00)	851.65	17807.71
15	Plant protection chemicals (lit)	-	-	-	37 (86.05)	3.21	2499.78
16	Herbicides (lit)	-	-	-	21 (48.84)	3.57	280.15
	Total			5198.29			20587.64

Source: Field Survey, 2023
(Figures in the parentheses indicates percent to total farms)

Table 2. Soil Physical Properties and Nutrient Status of Organic and Conventional Fields

S.No	Nutrients	Organic fields	Conventional fields	Difference over Conventional	% change
1	pH	7.68	7.80	0.12	1.56
2	EC (dS/m)	0.21	0.20	-0.01	-4.76
3	N (kg/ha)	169.12	128.45	-40.67	-24.05
4	P (kg/ha)	26.65	12.56	-14.09	-52.87
5	K (kg/ha)	399.35	243.47	-155.88	-39.03
6	SOC/ha (%)	0.88	0.58	-0.30	-34.09
7	Total (N+P+K)	594.97	384.48	-210.49	-54.75

Source: Data analysed in the Soil laboratory.

Table 3. Cost of Cultivation and Net Return of Brinjal under Organic and Conventional fields.

(Rs/ha)

S.No	Particulars	Organic fields	Conventional fields	Difference over Conv. fields
Variable cost				
1	Value of Human labour	34210.21 (52.77)	35128.81 (43.60)	918.60**
2	Value of Machine power	3167.96 (4.89)	4103.97 (5.09)	936.01
3	Value of Seeds	1881.84	2149.92	268.08***

		(2.90)	(2.67)	
4	Value of Organic manures and Bio fertilizers	5198.29 (8.02)	-	-5198.29
5	Value of Chemical Fertilizers	-	17807.71 (22.10)	17807.71
6	Irrigation Cost	4117.72 (6.35)	5279.83 (6.55)	1162.11
7	Value of Herbicides	-	280.15 (0.35)	280.15
8	Value of Plant Protection Chemicals	-	2499.78 (3.10)	2499.78
9	Miscellaneous Cost	2790.58 (4.30)	-	-2790.58
10	Interest on Working capital	1379.16 (2.13)	1805.62 (2.24)	426.46
A	Total Variable cost	52745.77 (81.36)	69055.80 (85.72)	16310.03
Fixed cost				
1	Land Revenue	39.07 (0.06)	17.87 (0.02)	-21.20
2	Depreciation	283.30 (0.44)	356.47 (0.44)	73.17
3	Rental Value of Owned Land	10665.12 (16.45)	10087.16 (12.52)	-577.96
4	Interest on Fixed capital	1098.75 (1.69)	1046.16 (1.30)	-52.59
B	Total Fixed cost	12086.24 (18.64)	11507.74 (14.28)	-578.50
	Total Cost (A+B)	64832.00 (100.00)	80563.54 (100.00)	15731.54
	Yield (Kg/ha)	7314.08	8893.66	1660.23
	Price (Rs/kg)	34.53	25.00	-9.53
C	Returns			
	Gross Return	252590.82	222341.44	-30.249.38
	Net Return	187758.82	141777.90	-45980.92

Note: *** denotes significance at one per cent level,
** denotes significance at five per cent level,

Table 4. Output and Returns of Brinjal Production (Rs/ha)

S.No	Output and Returns	Organic fields	Conventional fields	t-values
1	Total cost of cultivation (Rs/ha)	64832***	80563.54	-3.6362
2	Yield (kg/ha)	7314.08**	8893.66	-2.8656
3	Gross Return	252590.82*	222341.33	2.5031
4	Net Return	187758.82***	141777.90	3.5282
5	Cost of production (Rs./kg)	8.86	9.05	

6	Net Return (Rs./kg)	25.67	15.94

Note: *** denotes significance at one per cent level,
** denotes significance at five per cent level,
* denotes significance at ten per cent level

CONCLUSION

It is concluded from the results that the amount spent on inorganic inputs by conventional farmers were found to be higher than an organic inputs spent by organic farmers.

The availability of macro nutrients was greater in organic fields than inorganic fields ranging from 34-53 per cent over conventional fields. The reason might be that organic farmers used higher amount of organic inputs to enrich the soil nutrients status in the soil. Soil organic carbon was found to be higher (0.88 %) in organic fields than conventional fields (0.58 %).

The total cost of cultivation of brinjal was lower in organic farms than conventional farms by Rs. 15732 per ha. The yield was 1660 kg lower in organic farms than conventional farms. Though yield was low, net return realized from organically produced brinjal was higher than conventional fields by Rs. 45981 per hectare. This is mainly because, the organically produced brinjal were sold at higher price than conventionally produced brinjal and also by reduction of cost of cultivation. It is evident that organic farming helps to achieve higher profitability and also to enhance soil fertility by the use organic inputs.

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