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UTILISATION OF SUGAR WASTE FOR MAIZE CULTIVATION IN PERIYAKULAM TALUK OF THENI DISTRICT: A CASE STUDY

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ABSTRACT

The changes in production technology have been taking place in Indian agriculture over the past two decades. A significant breakthrough as, however, been achieved only recently with the introduction and spread of high-yielding varieties of crops and intensive application of complementary and modern farm inputs which herald the transformation of Indian agriculture from a 'traditional' to a 'modern' state. Utilisation of bio-manure has been one of the recent advent in Indian agriculture. This has brought in its wake new opportunities for investment in Indian agriculture because of the high rate of returns to such investment now made feasible. It promises agricultural growth and improvement in the welfare of the farm people. The present study attempts to highlight the profitability in utilization of sugar waste as bio-manure for maize cultivation.

KEYWORDS: Bio-manure, Spentwash and Pressmud, Chemical fertilizer, Cost and returns.

INTRODUCTION

The changes in production technology have been taking place in Indian agriculture over the past two decades. A significant breakthrough as, however, been achieved only recently with the introduction and spread of high-yielding varieties of crops and intensive application of complementary and modern farm inputs which herald the transformation of Indian agriculture from a 'traditional' to a 'modern' state. Utilisation of bio-manure has

been one of the recent advent in Indian agriculture. This has brought in its wake new opportunities for investment in Indian agriculture because of the high rate of returns to such investment now made feasible. It promises agricultural growth and improvement in the welfare of the farm people. The present study attempts to highlight the profitability in utilization of sugar waste as bio-manure for maize cultivation.

The specific objectives of the study are:

1. To study the economic utilization of spentwash and pressmud in maize production in the study area.
2. To make a comparative analysis of the cost and return structure of farmers using fertilizer and bio-manure in the study area.

SOURCES OF DATA

The present study is based on primary data as well as secondary data. Researcher has used personal interviews and unbiased observations methods to collect data from farmers. For this a pre-tested interview schedules has been used. Information collected through the direct field enquiries from the respondents form the database for the study. Secondary data were collected from the office of the Assistant Director's Statistical Office, Theni and Taluk Statistical Office, Periyakulam. The period of study pertained to 2011-2013.

SAMPLING DESIGN

The study covers economic utilization of pressmud and spentwash generated by Rajshree Sugars and Chemical Limited, Varadaraj Nagar in Periyakulam taluk of Theni district of Tamilnadu. The main products of this company are white sugar and rectified spirit. The factory generates large quantities of bagasse, pressmud and spentwash as wastes. The industry has developed innovative downstream processes to convert these wastes into useful by-products. The pressmud generated from its sugar unit and the spent wash generated from the distillery is converted into Bio-manure and renewable energy is produced from bagasse.

The systematic random sampling technique has been adopted to select 90 sample farms from 4 villages in the study area. Out of 90 sample farms, 40 farms cultivated planted maize using bio-manure and the remaining 50 farms cultivated planted maize using chemical fertilizers. An attempt was made to study the utilization of organic manure and utilization of chemical fertilizers by these respondents. The main field survey and data collection were carried out during the period from June 2011 to December 2013. Season I implies the advent of South-West Monsoon in the month of June to September and Season II implies the advent of North-East Monsoon during the months October to December.

Considering the serious environmental problems faced by distillery units in India, a 'Zero Discharge Composting Technology' for conversion of press mud and distillery spentwash into organic manure was developed and adopted in large scale at Rajshree Sugars and Chemicals Limited. The organic manure production process adopted by Rajshree Sugars and Chemicals Limited is the World's First ISO 9001:2000 certified process. 'Green Plus' the organic manure produced by Rajshree Sugars and Chemicals Limited is reportedly the first organic manure in India certified as 'Organic' by Skal Interantional, Netherlands accredited by Apeda, (Agricultural Produces Export Promotion Agency, Government of India) as it meets the European norms for pesticide residues and heavy metals prescribed for organic products. It is being used for the

production of 'organic' spices, coffee, tea, grapes, fruits, vegetables, cotton and food grains meant for export market. The sugar waste generated by this company is being utilized as bio-manure by the farmers in the study area for the cultivation of maize.

COST AND RETURNS STRUCTURE

In the present study, cost concept has been used: Cost A comprises the cost of human labour, bullock labour, chemical fertilizer, pesticides, seeds, farm yard manure, irrigation, interest on working capital and packaging and transportation. Table 1 illustrates the per acre average cost and returns structure of using bio-manure by farmers cultivating maize.

Table 1. Cost and returns structure per acre of maize cultivation by farmers using Bio-manure

Cost components(in Rs.)	Season		Per acre cost and returns(in Rs.) All season
	I	II	
Human labour	2940	3275	6215
Bullock labour	2940	530	1050
Pesticides	200	203	403
Seeds	810	795	1605
Manure	1250	1290	2500
Irrigation	214	208	422
Packaging and Transportation	640	636	1276
Total operating cost (Cost A)	6574	6937	13511
Yield per acre in quintals	19	20	39
Gross returns (Rs.)	15390	16100	31490
Net income (Rs.)	8816	9163	17979

Source: Computed data

The table shows that an yield of 20 quintals per acre worth Rs.16, 100 per acre was obtained by farmers by using bio-manure during season II. The net income over the total cost turned out to be Rs.9, 163 per acre out of the total cost of cultivation of Rs.6,937. Among costs, expenditure on human labour formed the major input component and it was Rs. 3,275 of the total cost. Farm yard manure assumed the second largest share (Rs. 1,290) of the total cost. During season I, yield obtained per acre was 19 quintals and the gross returns realized was Rs.15, 390 with a net income of Rs.8, 816. The major constituent of total cost was humanlabour, accounting for Rs. 2,940. It was followed by manure and packaging and transportation and it constituted Rs.1, 250 and Rs.640 of the total cost respectively. The cost of all the inputs except human labour and farm yard manure exhibited almost the same pattern in both season I and II. It is to be noted that inspite of the higher cost of maize cultivation in using bio-manure by farmers, season II produced higher yields and thereby higher net income. Thus, it is inferred from the analysis that season II was found to be more beneficial than season I, both cost wise and income wise. In the case of pooled category, yield obtained per acre was 39 quintals and the gross returns realized was Rs.31,490 with a net income of Rs.17,979. Out of the total cost of cultivation of Rs.13,511.

Table 2. Cost and returns structure per acre of maize cultivation by farmers using Chemical Fertilizer

Cost components(in Rs.)	Season		Per acre cost and returns(in Rs.) All season
	I	II	
Human labour	3275	3250	6525
Bullock labour	640	670	1310
Pesticides	400	360	760
Seeds	810	815	1625
Manure	840	820	1660
Irrigation	235	225	460
Packaging and Transportation	660	640	1300
Total operating cost (Cost A)	6860	6780	13640
Total cost of production (Cost C)	6860	6780	13640
Yield per acre in quintals	18	17	35
Gross returns (Rs.)	14220	13430	27650
Net income (Rs.)	7360	6650	14010

Source: Computed data

Table 2 shows that in the case of farmers using chemical fertilizer an yield of 18 quintals per acre worth Rs.14,220 per acre was obtained during season I. The net income over the total cost turned out to be Rs.7,360 per acre out of the total cost of cultivation of Rs.6,860. Among costs, expenditure on human labour formed the major input component and it was Rs. 3,275 of the total cost. Chemical fertilizer which assumed the second largest share (Rs.9,840) of the total cost. During season II, yield obtained per acre was 17 quintals and the gross returns realized was Rs.13,430 with a net income of Rs.6,650. The major constituent of total cost was human labour accounting for Rs.3,250. It was followed by chemical fertilizer and packaging and transportation and its constituted Rs.820 and Rs.640 of total cost respectively. The cost of all inputs except human labour and chemical fertilizer exhibited almost the same pattern in both season I and II. Thus, it is inferred from the analysis that season I was found to be more beneficial than season II, both cost wise and income wise. In the case of pooled category, yield obtained per acre was 35 quintals and the gross returns realized was Rs.27,650 with a net income of Rs.14,010 out of the total cost of cultivation of Rs.13,640. It is observed that a cost returns per acre was high among the farmers who utilized bio-manure for cultivation when compared to the farmers who utilized chemical fertilizers for cultivation of maize. Through cost and return analysis it was found that the net income earned by farmers using bio- manure for cultivating maize was Rs. 17,979 which was much higher than the net income earned by farmers using chemical fertilizer that is Rs 14,010.

FACTORS INFLUENCING THE YIELD OF MAIZE

To analyse the influence of the factors like human labour per acre, bullock labour per acre, farmyard manure per acre and pesticides cost per acre on yield of maize in the study area multiple log linear regression model was fit.

$$\log Y = {}_0 + {}_1 \log X_1 + {}_2 \log X_2 + {}_3 \log X_3 + {}_4 \log X_4 + U$$

where, Y = Yield per acre in kilos; X_1= Human labour per acre (in Rs.); X_2 =Bullock labour per acre (in Rs.); X_3 = Farm yard manure per acre (in Rs.); X_4 = Pesticides cost per acre (in Rs.).

Table 3. Multiple log linear regression of factors in particular bio-manure influencing maize yield

Items	Constant	X_1	X_2	X_3	X_4
Regression co-efficient	4.6731	0.3984	0.0213	0.2392	-0.0937
Standard error	0.1071	0.7961	0.527	0.0604	1.0050
Estimated 't' value	2.681	0.140	1.530	-0.648	4.650

Source : Computed data

From table 3 it is observed that the regression coefficients for all variables are positive except for the variable X_4 denoting pesticides cost. The regression co-efficient for X_2 denoting utilization of bullock labour per acre is positive but insignificant. It was found that β_1 and β_3 are statistically significant at 5 per cent level of significance and β_2 and β_4 are insignificant. It indicates that the variables X_1 denoting the human labour per acre, X_3 denoting utilization of bio-manure are the major contributors in increasing the yield of maize. It is observed that the farmers (40) did not utilize bullock labour per acre significantly and there was no intensification in the use of pesticides which was required to boost the yield of maize per acre.

In order to find out the influence of human labour per acre, bullock labour per acre, chemical fertilizer per acre, pesticides cost per acre on maize yield, the following multiple log linear regression model was fit.

$$\log Y = {}_0 + {}_1 \log X_1 + {}_2 \log X_2 + {}_3 \log X_3 + {}_4 \log X_4 + U$$

where, Y = Yield per acre in kilos; X_1= Human labour per acre (in Rs.); X_2 = Bullock labour per acre (in Rs.), X_3 = Chemical fertilizer per acre (in Rs.), X_4 = Pesticides cost per acre (in Rs.). This model was used to analyze the influence of the utilization of chemical fertilizer on the yield of maize crop utilised in 50 farms in the study area.

Table 4.Multiple log linear regression of factors in particular chemical fertilizer influencing maize yield

Items	Constant	X_1	X_2	X_3	X_4
Regression co-efficient	0.1237	0.1263	-0.0275	-0.1536	-0.2592
Standard error	1.1761	0.1358	0.1166	0.3682	10.1329
Estimated 't' value	0.845	-0.187	-1.012	-1.641	-0.121

Source: Computed data

From the table 4 it was observed that the regression co-efficients for all variables are negative except for the variable X_1 denoting human labour per acre. The regression co-efficient for X_1 is positive but is insignificant. It is found that β_1, β_2, β_3 and β_4 are statistically insignificant at 5 per cent level of significance. It indicates that the farmers (50) utilizing fertilizers along with human labour, bullock labour and pesticides for maize cultivation were not getting good yield of maize.

INFLUENCE OF BIO-MANURE

Null Hypothesis: Bio-manure has no positive influence on the yield of maize crop.

Table 5. Relationship between yield per acre of maize and utilization of bio-manure by farmers (t – test analysis)

Variable	Co-efficient	Estimated t value (t*)	R-square
Intercept	**4.673**	**4.65**	**0.90**
Utilization of bio-manure	**0.2392**	**1.73**	

Source: Computed data

Table 5 shows that estimated t* value (1.73) is greater than tabulated t (1.65) at 5% level of significance. Since t* > t (tabulated) the hypothesis is rejected. Hence, bio-manure has positive influence on the yield of maize crop in the study area. There has been significant increase in the yield of maize crop due to intensive utilization of bio – manure by farmers in the study area.

Analysis using chi-square test:-

Null Hypothesis: There is no variation in yield in maize cultivation due to change in the utilization of bio-manure instead of chemical. Chi-square test was applied to test the null hypothesis: $\chi^2 = \Sigma \frac{(O-E)^2}{E}$

where O = Observed values, E = Expected values. Calculated χ^2 =20.52 was greater than the table value of χ^2 =3.841 at 5% level of significance. Therefore, the hypothesis was rejected. This showed that there was high variation in yield in maize cultivation due to the utilization of bio-manure instead of chemical fertilizer.

FINDINGS & CONCLUSION

The analysis of cost and returns revealed that the cost returns per acre was high among the farmers who utilized bio- manure for cultivation when compared to the farmers who utilized chemical fertilizer for cultivation of maize.

The influence of factors like human labour per acre, bullock labour per acre, bio-manure / fertilizer per acre, farm yard manureper acre and pesticides cost per acre on the yield of maize in the study area was analysed by applying multiple log linear regression model. It was observed that there was significant influence of the utilization of bio – manure by the farmers in the cultivation of maize. The statistical t- test applied revealed that bio – manure had positive influence on the yield of maize crop in the study area. The analysis of chi – square test showed high variation in yield in maize cultivation due to change in the utilization of bio –manure instead of chemical fertilizer. It was found that yield of maize crop was high when bio –manure is utilized.

Thus, it may be concluded from the analysis, that the cultivation of using bio-manure by farmers was more beneficial in terms of both yield and profit per acre. It showed that this could be the outcome of the better economic and institutional position of utilization of bio-manure by farmers compared to utilization of chemical fertilizer by farmers.

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