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An economic analysis of tissue-cultured banana and sucker-propagated banana in India

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An economic analysis of tissue-cultured banana and sucker-propagated banana has been presented through studying their costs and returns in production. The problems in cultivation of tissue-cultured banana have been highlighted. The study has been conducted in the Jalgaon district of Maharashtra using personal interview method. The tabular analysis has been employed to find out the socio-economic characteristics, cost and returns in banana crop production through two methods. The study has revealed that tissue-cultured banana is more profitable to farmers than sucker-propagated banana. Higher price of Plantlets, lack of government subsidy on plantlets and lack of plantlets selling government outlets are the major problems in tissue culture banana production. Also, the lack in reliable market facilities, lack of expertise about identifying the pests, diseases and knowledge of plant protection and non availability of genuine planting material are problems in tissue culture banana. The study has suggested that farmers should be encouraged to adopt tissue culture banana (TCB) to get higher yield and profits.

Key words: Constraints productions, tissue culture banana, sucker.

INTRODUCTION

Banana is one of the oldest tropical fruit which is cultivated by man from prehistoric times in India with great socio-economic significance, interwoven in the cultural heritage of the country. Owing to its multifaceted uses and high economic returns it is referred to as “Kalpatharu” (a plant of virtues). It is also fourth important food crop in terms of gross value after paddy, wheat and milk products and constitutes a large proportion of the total fruit production in India. India ranks first in area and production of banana in the world. It supports livelihood of million people, with total annual production of 24870 thousand metric tonnes from 722 thousand hectare with national average of 34.5 metric tonnes per hectare during 2012-13 (Annonymous, 2012). Tamil Nadu is the leading

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producer of banana followed by Maharashtra, Gujarat, Karnataka, Andhra Pradesh and Madhya Pradesh. These six states contribute more than 78% of total banana production in the country. In banana, the difficulty to obtain large number of uniform disease free plants with high yield potential by the conventional propagation of techniques is one of the major limiting factors in increasing productivity. Conventionally, one banana plant produces only five to ten suckers in a year depending on the variety. Through tissue culture large quantities of clean banana plantlets are produced within a short period. Other advantages associated with tissue-cultured banana include optimal yield, uniformity, viral disease free planting material and true to type plants (Robinson et al., 1993).

The Indian Government has identified micro-propagation of plants through tissue culture as an industrial activity under (D&R) Act, of 1951 made effective in 1991. During 1994 there were 14 units engaged in micro-propagation of fruit crops, 12 are producing banana, 5 are aseptically multiplying strawberry, while 3 each are engaged in papaya and pineapple production. Only 6 units are producing 7 forest tree species leaving enough scope for expansion (Govil and Gupta, 1997). The micropropagation industry is particularly well suited for India as it is environment friendly and labour-intensive.

In recent years growing of tissue culture banana becoming popular in this area. In spite of the viable alternative for banana cultivation, there are problems in tissue culture banana viz., high initial investment, somoclonal variation and disease spreading through tissue culture, etc. Under these circumstances, it is essential to focus on economics of tissue culture banana and comparing of tissue culture banana cultivation with traditional (sucker propagated) method of cultivation, so as to facilitate the farmers and others concerned in appropriate decision making for the cultivation of banana. Keeping in view the importance of this technology in the agricultural economy of the Maharashtra state, the present study was formulated to assess the impact of tissue culture technology in Jalgaon district of Maharashtra with specific objectives of to estimate the costs and returns of tissue culture banana over sucker propagated banana and to identify the problems encountered in production of tissue culture banana.

MATERIALS AND METHODS

For in-depth investigations, a sample of 120 farmers was chosen using the multi-stage random sampling method. In the first stage, the districts with highest area under banana crop and availability of required primary data in Maharashtra and Madhya Pradesh during 2010-2011, namely, Jalgaon and Burhanpur districts were selected for the study. Secondly, Raver, Sawda, talukas were purposively selected for the study as the cultivation of tissue culture banana and sucker's banana, respectively, was mostly concentrated in these talukas. At the third stage , four villages from among the predominantly cotton-growing villages in each of these talukas were randomly selected. Finally, a sample of 60 farmers from selected villages was randomly chosen. For evaluating the specific objectives of the study, requisite primary data pertaining to the agricultural year 2010-2011 were collected from the sampled farmers by personal interview method with the help of pre-tested and well-structured schedule.

Analytical tools and techniques employed

The impact indicators like changes in crop management practices and resource use pattern, estimating farm level productivity gains/input savings, changes in resource use efficiency and change in quantity of pesticides used were studied using partial budgeting method as follows:

$$\Delta R = R_{BI} - R_{NB}$$

Where, ΔR = productivity gains/input saving, R_{BI} = per hectare net return on farm with adopted technology, and R_{NBI} = per hectare net return on farm without technology

Garrett's ranking technique was used to identify and rank the constraints to adoption of tissue culture technology. The following formula had used:

Where, R_{ij} = rank given for i^{th} factor by j^{th} individual, and N_j = number of fators ranked by j^{th} individual.

For each factors the scores of individual respondents was added together and divided by the total number of respondents. Percent position of each rank was then converted into scores referring to the table given by Garret (1952). These scores for all the factors were arranged in descending order, ranks were given and finally important factors were identified.

RESULTS AND DISCUSSION

Socio-economic characteristics of sample farmers

Understanding of general characteristics of sample farmers is expected to provide bird's eye view of the general features prevailing in the study area. Therefore an attempt has been made in the study to analyse some of the important characteristics of the sample farmers. The general characteristics on size of holding, age, education, size of family, popular varieties in study area and occupation of farmers was presented in Table 1. The average family size of tissue culture banana growers was 8 and the average family size of sucker propagated banana growers was 6. In case of sucker banana producing farmers 30% were illiterate, 26% had primary level education, 38% had secondary level education and only 6% of the people were having higher secondary and above level education. Similarly, in case of tissue culture banana producers 24% were uneducated, 26% were up to primary level education, 44% had secondary education level and only 6% of the farmers had higher secondary and above level education.

In the study area, 87% of families' main occupation was agriculture and 13% of the farmers were following non agricultural activities in sucker banana producing samples. But, in case of tissue culture banana producing

Table 1. Age, education, size of family and occupation pattern of Banana farmers.

S/N	Particulars	Jalgaon		Average total
		Sucker's banana	Tissue culture banana	
I	Average farm size (ha)	9	10	9
II	Average age of farmer (years)	50	48	49
	Average family size (No. of family labourer)	6	8	7
	Growing varieties	Basrai, Shrimanti and Ardhapuri	Grand Naine	-
III	Education levels:			
	Illiterate	9 (30)	7 (24)	16(27)
	Primary	8 (26)	8 (26)	16(27)
	Secondary	11 (38)	13 (44)	24(40)
	Higher secondary and above	2 (6)	2 (6)	4(6)
IV	Main occupation agriculture	26 (87)	25 (84)	51(85)
V	Subsidiary occupation agriculture	4 (13)	5 (16)	9 (15)
	Total	**30**	**30**	**60 (100)**

Table 2. Socio-economic profiles of sample farmers in Maharashtra.

Particulars	Sucker's banana and tissue culture banana	Jalgaon
Banana farmers	Sucker's banana growers	30(50)
	Tissue culture banana growers	30(50)
Community of sample farmers	SC	2(3)
	ST	11(18)
	OBC	28(47)
	Others	19(32)
Type of family	Joint	37(62)
	Nuclear	23(38)
Total sample size		60 (100)

Figures in parentheses indicate percentage of sample farmers and percentage to the total.

samples, 84% of the respondents' main occupation was agriculture and 16 per cent of respondents were following non agricultural activities. Average size of farm in case of sucker propagated and tissue culture banana was 9 and 10 ha, respectively. The average size of banana farm in the study area was 9 ha. All the farmers were growing local variety called Basrai, Shrimanti and Ardhapuri in sucker banana production and Grand Naine was used in case of tissue culture banana.

The number of selected farmers in the Maharashtra state was 60, of which sucker's propagated farmers formed 50% viz., 30 and tissue culture banana propagated farmers formed the rest with 50% viz., 30 (Table 2). The farmers from SCs and STs comprised 3 and 18%, respectively in total sample size and the OBCs and others formed 47 and 32% in total sample size respectively. The sample farmers have joint and nuclear families in a proportion of 62 and 38%, respectively in total sample.

Cost structure of banana production in two methods

Per hectare cost of production of sucker propagated and tissue culture banana in the study area is presented in the Table 3. The total cost of production of tissue culture banana was Rs. 210035 per hectare which was higher than the cost of production of sucker propagated banana Rs. 163306 in case of main crop. Total material cost of sucker banana was Rs. 102487 which was lower than the total material cost incurred on tissue culture banana Rs. 140257. The major difference in the materials costs between the two methods of production was mainly due to difference in cost of suckers and plant protection chemical.

The cost of suckers was Rs. 13645 where as cost of tissue culture plantlets were Rs. 48451. The cost incurred on plant protection chemicals in sucker banana was Rs. 2827 where as it was Rs. 1822 in tissue culture banana. There was no large difference was observed in other

Table 3. Inputs use pattern for sucker's banana and tissue culture banana growers.

Particulars (Rs. /ha)	Jalgaon (Maharashtra) (N=60)	
	Sucker's banana	Tissue culture banana
	Mean	Mean
Land preparation	6762(4)	6495(3)
Plantlets	13645 (8)	48451(23)
Plant nutrient	57151(35)	57411(27)
Irrigation	16966(10)	16047 (8)
Human labour	37090(23)	47236(22)
Pesticide	2827(2)	1822(1)
Others cost (propping, wind break, bunching etc.)	28864(18)	32573(16)
Material costs (2+3+6+7)	102487	140257
Total cost	163306(100)	210035(100)

Figures within parentheses indicate percentage of total cost of production.

Table 4. Yield pattern in sucker's banana and tissue culture banana growers

Particulars	Jalgaon (Maharashtra) (N=60)	
	Sucker's banana	Tissue culture banana
	Mean	Mean
Production (MT/ha)	45.50	60.50
Gross returns (Rs./ha)	344522	524248
Net returns (Rs./ha)	181216	301605

(land preparation and irrigation) costs between the two methods of production. Total human labour cost incurred in sucker banana was Rs. 37090 and in tissue culture banana was Rs. 47236. Out of total labour cost, human labour cost was major item compared to machine and bullock labour.

Yield and returns pattern in banana production

Per hectare production, gross returns and net returns pattern of sucker banana and tissue culture banana have been presented in Table 4. The Per hectare yield in tissue culture banana was 60.50 metric tonnes which was higher than the yield of sucker banana (45.50 metric tonnes). By products of banana includes suckers and leaves. The gross returns obtained per hectare of tissue culture banana were Rs. 4, 58,991 which was higher than the gross returns obtained from sucker banana (Rs. 3, 44, 522). The net returns obtained in sucker banana were Rs. 1, 81, 216 and in tissue culture banana were Rs. 3, 01, 605.

Constraints faced by growers in production of tissue culture banana

The farmers were interviewed to elicit the problems faced by them relating to various aspects of banana production crop in the study area and it has been presented in Table 5. Out of Total sample size, 30 farmers were interviewed in sucker propagated and 30 in tissue culture plantlets propagated banana crop. The survey data on constraints of tissue culture banana cultivation analysis in Jalgaon districts of Maharashtra indicated that more than 76% farmers had faced the problem of higher price of tissue culture plantlets was limiting in its cultivation by the economically poor farmers and 74% farmers expressed that the lack of government subsidy on tissue culture plantlets. About 61, 55 and 52% farmers expressed that they were facing the problems of lack of government outlets for plantlets sale, pest and disease attacked on plantlets and lack in reliable market facilities, respectively. Finally, lack of knowledge about identifying the pests, diseases and knowledge of plant protection, no fruit price variation, non availability of genuine planting material and lack in availability of cheap irrigation facilities were also problems in cultivation of tissue culture banana plantlets.

Conclusion

In this research paper, we have analyzed the cost and yield benefits of tissue culture banana technology over

Table 5. Constraints faced by farmers in adoption of tissue culture banana in Jalgaon.

Constraints faced by farmers	Garrett's rank score (%)	Rank
Plantlets price variations	76	I
Government subsidy availability	74	II
Government retailer facility	61	III
Disease and pests attack on crop	55	IV
Reliable market facility	52	V
Fruit price variation	39	VI
Lack of expertise	38	VII
Desire quantity	34	VIII
Cheap irrigation facility available	22	IX

the sucker's propagated banana in Jalgaon district, using primary survey data. Based on found out socio-economically benefits of tissue culture technology over sucker propagated banana, the implementation of new technology should be carried out with local community participation and based on the existing capacity of its natural resources as well as its human resources both individually or in group. Last but not least, government interventions in technology spread is also play an important role in technology adoption.

Conflict of Interest

The authors have not declared any conflict of interest.

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