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Cost and return analysis of tomato cultivation in Central Brahmaputra Valley Zone of Assam

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Abstract

Vegetables are considered as a very important source of nutrients, vitamins and minerals. Cultivation of vegetables can create employment generation for the rural youths as well as the farmers. The farmers of Assam cultivate tomato which can fulfill the requirement of the state. The farmers in the state hardly maintain records on cost and return of the farming practices. Therefore, a study was conducted during 2020-21 to know about the farming experience in vegetable growers and to estimate the economics of tomato production in different categories of farms. To know the demographic pattern and vegetable farming experience the statistical tools like percentage, mean was used. The economics of tomato cultivation in the study area was estimated as per the standard cost concept. The study revealed that 92 percent farmers had vegetable farming experience more than five years. The average cost C2 per hectare for all farmers' groups was calculated as Rs.1,40,416 per hectare. The per hectare average net return of all farms over cost C2 was calculated as Rs. 1,15,142. The average all farm B:C ratio was computed as 1.82. The cultivation of tomato could be considered as a profitable and a good enterprise for income generation.

Keywords: Nutrients, farming, net return, cost c2, b:c ratio

Introduction

Vegetables are important source of different nutrients, vitamins and minerals. It is considered as the major source of dietary micronutrients [1]. It is grown by most of the farmers for their household requirements. It covers 10.1 million hectare area in India. The per capita vegetable consumption in Asia is far below the required level to satisfy the recommended dietary micronutrient intakes. Empirical evidence and discussion show that enhanced vegetable production and consumption in Asia can play a catalytic role in the overall economic development by improving the nutritional status, learning capabilities and managerial capacities of farmers, generating incomes and jobs in both the farm and non-farm sectors and improving resource use efficiency in agriculture. Most vegetable crops possess high medicinal value for curing certain diseases [2].

Cultivation of vegetables can provide better income and employment opportunities to rural youths. As compared to other crops like cereals, pulses and oilseeds, vegetable crops can enhance a higher farm gate income [3, 4, 5]. Commercial vegetable cultivation may lead to enhance the economic growth of the farmers. Vegetables can give 350% higher monthly net return than rice [6].

Tomato is a nutrient dense super food that offers benefit to a range of bodily systems. India ranks second in the world in terms production of tomato. It can help to protect against cancer, maintain high blood pressure and reduce blood glucose in people with diabetes. Tomatoes are an intensely nutritious plant food and so it is considered a high value crop.

The farmers in the state of Assam have been growing vegetables both in rabi and kharif seasons. They have been using all sorts of inputs to get a higher production. But they have no formal education on cultivation of vegetable crops. It is observed that the farmers in the state do not maintain records on cost and return of their farming practices. Based on the experience and knowledge gained from the fellow farmers they usually grow vegetable crops. Therefore, the study was conducted with the objective to know the farming experience of farmers in vegetable cultivation and to estimate the economics of tomato production.

Materials and Methods

There are six agro-climatic zones in the state of Assam. Out of these agro-climatic zones, one agro-climatic zone namely, Central Brahmaputra Valley zones was selected for the study. Nagaon district from the zone was selected purposively for study based on the area under vegetable cultivation. Two Agriculture Development Officer circles were selected for the study purposively based on the area under vegetable cultivation. Five villages from each circle and 15 vegetable growing farmers from each village were selected. A total of 150 numbers of respondent farmers were selected for the study. The farmers were categorized as group I, group II and group III based on the area under vegetable cultivation using the Cumulative Square Root

frequency method [7]. Group I included the farmers having vegetable cultivation area less than 0.4 ha, group II included the farmers having vegetable growing area 0.4-0.8 ha and the group III included the farmers having more than 0.8 ha vegetable growing area.

For analysis of data, especially to know the demography and vegetable farming experience the statistical tools like percentage, mean was used. The economics of tomato cultivation in the study area was estimated as per the standard cost concept such as cost A1, cost A2, cost B1, cost B2, cost C1, cost C2 and cost C3. The cost items were calculated based on the following norms.

Cost A1: All actual expenses in cash and kind incurred in production by the producer. The following items are included in cost A1

1. Wages of hired human labour
2. Wages of permanent labour
3. Wages of contract labour
4. Wages of hired bullock labour
5. Imputed value of owned bullock labour Charges of hired machinery
6. Imputed value of owned machinery
7. Market rate of manures and fertilizer
8. Market rate of seed
9. Imputed value of owned seed
10. Imputed value of manure
11. Market value of pesticides, herbicides, hormones, etc.
12. Irrigation charges
13. Land revenue, cess and other tax
14. Depreciation on farm machinery, implements, equipment farm buildings,
15. Irrigation structures, etc.
16. Interest on working capital
17. Miscellaneous expenses

Cost A2: Cost A1 + Rent paid for leased in land

Cost B1: Cost A1 + Interest on the fixed capital excluding land+ rental value of owned land

Cost B1: Cost A1 or A2 + Interest on amount of owned capital invested in the business excluding the value to land

Cost B2: Cost B1 + Rental value of owned land less land revenue + Rent paid for leased in land

Cost C1: Cost B1 + Imputed value of family labour

Cost C2: Cost B2 + Imputed value of family labour

Cost C3: Cost C2 + 10 percent of Cost C2

Results and Discussion

Distribution of family members of the respondents according to sex

The population structure in Assam as well as India is very uneven. It varies from location to location, zone to zone and state to state. Table 1 presents the distribution of family members of the respondents according to sex.

The average size of household was calculated by dividing the total number of populations in the households by the total number of households. The average size of household was calculated as 5.84 in the study area. This size was much higher than our national average (4.90) [8] and the Assam state average (4.87) [9].

The farmers' group wise analysis revealed that the average size of household was found the highest in group III (6.65) and the lowest was calculated for group I (5.30). This made it very clear that the farmers under study did not follow the family planning as per recommendation of the Government of India. It might be due to the unawareness of people about family planning, lower educational standasrd or might be religious reason. A study conducted in Nigeria revealed that amongst the tomato farmers in Kogi State, the average family size was 7 [10].

The sex ratio is the ratio of males to females in a population. Sex ratio is used to describe the number of females per 1000 males. The average sex ratio in the study area was calculated as 931 which was lower than the average of the state of Assam (958) [9] but it was almost same that with the National average (930) [11]. Farmers' group wise analysis reveals that in group I, the sex ratio was less than both national and Assam state average whereas in group II it was more than the national average but less than the Assam state average and in group III, it was more than both the national average and the Assam state average.

Table 1: Distribution of family members of the respondents according to sex

Farmers' groups	Frequency		Total	Percentage		Average size of households	Sex ratio
	Male	Female		Male	Female		
Group I	213	190	403	52.85	47.15	5.30	892
Group II	144	135	279	51.61	48.39	5.58	938
Group III	78	75	153	50.98	49.02	6.65	962
Total	435	400	835	51.81	48.19	5.84	931

Distribution of respondents according to educational standards

It is observed from Table 2 that out of the total respondents, 6.67 percent were found who attained up to Lower Primary (LP) standard, 18.00 percent were attained up to Middle English (ME) standard, 22.00 percent were High School standard, 38.00 percent were Higher Secondary standard, 13.33 percent passed Degree and above. Only 2.00 percent respondents were found illiterate. It meant that farmers were literate. It helped them to adopt the technical concept on improved vegetable cultivation.

The Farmers' group wise analysis reveals that in group I the highest 40.79 percent farmers were found attained Higher Secondary standard followed by Degree and above (19.74 percent). Both ME and High school standard recorded the same (15.79 percent). Only 2.63 percent respondents were found illiterate. Like group I, in group II and group III, the highest percentage of respondents were attained the Higher Secondary standard. It was followed by High school standard. In group II only 2.00 percent respondents were found illiterate whereas in group III, no respondents were found illiterate.

A study in Bangladesh reported that about 41% and 25% of farmers accomplished their primary and secondary education respectively [12]. In the study conducted at Yewa North Local Government Area of Ogun State, Nigeria reported that most of the tomato farmers were literate with an average of secondary school education standard [13].

Table 2: Distribution of respondents according to educational standards

Farmers' Groups	Educational standards						Total number of farmers
	Illiterate	LP	ME	High School	Higher Secondary	Degree and above	
Group I	2 (2.63)	4 (5.26)	12 (15.79)	12 (15.79)	31 (40.79)	15 (19.74)	76 (100.00)
Group II	1 (2.00)	4 (8.00)	13 (26.00)	14 (28.00)	17 (34.00)	1 (2.00)	50 (100.00)
Group III	0 (0.00)	2 (8.33)	2 (8.33)	7 (29.17)	9 (37.50)	4 (16.67)	24 (100.00)
All groups	3 (2.00)	10 (6.67)	27 (18.00)	33 (22.00)	57 (38.00)	20 (13.33)	150 (100.00)

The figure in brackets indicate percentage to the total

Number of respondents involved in tomato cultivation in the study area

Out of 150 numbers of respondents, 41 were engaged in tomato cultivation in the study area (Table 3) which accounted for 27.33 percent. Famers' group wise analysis revealed that in group I and group II equal percentage of farmers (10.67 percent) practiced the tomato cultivation and 6.00 percent were engaged in group III. The farmers do not prefer to cultivate tomato owing to the problem of the Late Blight disease. The number of farmers engaged in tomato cultivation has been presented in Fig 1.

Table 3: Number of respondents involved in tomato cultivation in the study area (N= 150)

Farmers' Group	Number of respondents
Group I	16 (10.67)
Group II	16 (10.67)
Group III	9 (6.00)
Total of all groups	41 (27.33)
Total	150 (150.00)

Figures in the bracket indicate percentage to the total

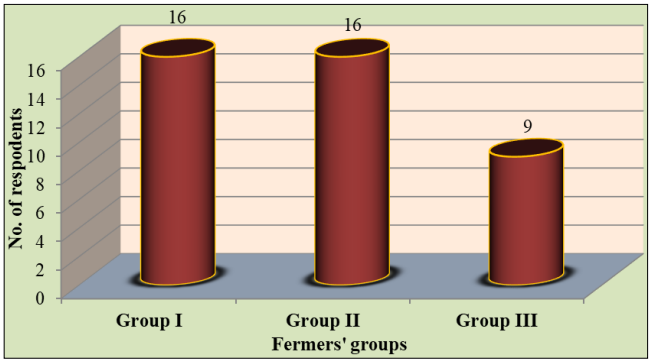

Fig 1: Number of respondents involved in tomato cultivation

Distribution of respondents based on vegetable farming experience

The respondents under study had lots of vegetable farming experiences (Table 4). The experience of the respondents had been grouped in 5 years interval i.e., 0-5 year experience, 5-10 years' experience, 10-15 years' experience, 15-20 years' experience, 20-25 years' experience and more than 25 years' experience. From the table it was observed that the highest 32.67 percent farmers were experienced with 10-15 years of vegetable cultivation followed by 5-10 years' experience (26.67 percent) and 15-20 years' experience (18.00 percent). The lowest 6.00 percent farmers had more than 25 years vegetable farming experience. Farmers' group wise analysis reveals that in group I, the highest 36.84 percent farmers were experienced with 10-15 years followed by 5-10 years' experience (22.37 percent) and 15-20 years' experience (15.79 percent). The lowest 6.58 percent farmers were 0-5 years of experience. In group II, the highest 32.00 percent farmers were experienced with 5-10 years followed by 10-15 years' experience (28.00 percent) and 15-20 years' experience (22.00 percent) with the lowest 2.00 percent farmers had more than 25 years of experience. In group III, for both 5-10 years and 10-15 years of farming experience of farmer was computed as 29.17 percent followed by 15-20 years' experience (16.67 percent) and there was no farmer who had more than 25 years of experience.

Table 4: Distribution of respondents based on vegetable farming experience

Farmers' Group	Farming experiences						Total number of farmers
	0 – 5 years	5 – 10 years	10 – 15 years	15 – 20 years	20 – 25 years	More than 25 years	
Group I	5 (6.58)	17 (22.37)	28 (36.84)	12 (15.79)	6 (7.89)	8 (10.53)	76 (100.00)
Group II	4 (8.00)	16 (32.00)	14 (28.00)	11 (22.00)	4 (8.00)	1 (2.00)	50 (100.00)
Group III	3 (12.5)	7 (29.17)	7 (29.17)	4 (16.67)	3 (12.50)	0 (0.00)	24 (100.00)
Total of all groups	12 (8.00)	40 (26.67)	49 (32.67)	27 (18.00)	13 (8.67)	9 (6.00)	150 (100.00)

Figures in the bracket indicate percentage to the total

Economics of Tomato cultivation

The per hectare cost-return analysis of tomato has been presented in Table 5. The table reveals that the percentage of total working capital to the cost C2 in the zone as a whole was calculated as 58.39 percent. Out of the total working capital, the highest was borne by group I farmers (59.76 percent) and the lowest was borne by the group II farmers (56.87 percent). In terms of the percentage of working capitals to the Cost C2 per hectare, the highest cost per hectare was involved for hired human labour (17.30 percent) followed by 17.11 percent for fertilizers and 5.61 percent for irrigating the crops, 4.78 percent for plant protection chemicals, 4.30 percent for manure, 4.21 percent for tractors/ power tillers for land preparation, 2.44 percent for repairing with the lowest cost involved for purchase of seeds

(0.82 percent). Thus, out of different cost items under total working capital, major part of the expenditure was incurred by the farmers for the purchase of hired human labour and fertilizers.

Farmers' group wise analysis reveals that in case of hired human labour, the highest percentage of money was invested by group II (17.66 percent) and the lowest was calculated for group I (16.77 percent) with an average 17.30 percent for all farms as a whole. The percentage of cost involved for tractor/ power tiller for land preparation per hectare area to the cost C2 was found the highest in group II (4.23 percent) and the group I and group III had invested the same percentage of money (4.20 percent). Fertilizers and manures were the very important factors of crop production for harvesting a better yield. The investment on purchase of fertilizers was recorded the highest for group I (17.89 percent) and the lowest was recorded for group II (16.27 percent. The percentage of cost invested for manure was found the highest in group I (5.70 percent) and the lowest was calculated for group II (2.92 percent). It was observed that farmers were using fertilizers and manures in their vegetable fields, but the cost analysis revealed that they did not use in a fixed proportion. The farmers generally used more quantity of fertilizers and comparatively lesser quantity of manures. It might be due to the farmers felt that fertilizers might enhance to increase the productivity of vegetable crops, ignorance about the effect of fertilizers and manures, non-availability of manures in the locality. The more is the application of manure, better is the soil health, more release of nutrients from the fertilizers and ultimately more nutrient uptake by the vegetables and thus obtain a better yield. Regarding the plant protection chemicals, it was observed that the highest percentage of money was spent by group III farmers (4.87 percent) and the lowest was spent by the groups I (4.70 percent). Irrigation has a direct impact on crop production. Out of 5.61 percent cost involved for irrigation, group II invested the highest (5.97 percent) and the lowest was invested by group I (5.33 percent). The most important factor for getting better yield was due to irrigating the crop in proper time. If one could not irrigate the crop at its critical growth stages, a good harvest could not be expected.

The imputed value of the family labour for all farms was found to be the highest in group II (20.76 percent) followed by group III (20.13 percent) and group I (19.63 percent) with an average 20.17 percent. The higher percentage of imputed value of family labour indicated involvement of more family labour in vegetable production and vice versa. It is advisable to the farmers that if there was enough family labour, then it would be better to engage them in their own farm activities so as to minimize the cost of hired human labour and this ultimately reduces the cost of cultivation.

The market price of the tomato changed with time. It is observed from the table that the average price received by the farmers changed with the farmers' group. The average price of tomato was estimated as Rs. 7.16 per kg out of which the highest average price was received by group III farmers (Rs. 7.28 per kg) followed by group II (Rs. 7.20 per kg) and group I (Rs. 7.00 per kg).

The cost C2 per hectare was calculated the highest for group III (Rs. 1,44,086) followed by group I (Rs. 1,40,388) and group II (Rs. 1,36,775) with an average of Rs.1,40,416 per hectare.

The per hectare average net return of all farms over cost C2 was calculated as Rs. 1,15,142. The farmers' group wise analysis revealed that the highest net return was received by group III (Rs. 1,24,983) followed by group II (Rs. 1,16,881) and group I (Rs. 1,03,562). Thus, it could be said that the group III farmers were more efficient in brinjal cultivation management practices. The B:C ratio was recorded as the highest in group III (1.87) followed by group II (1.85) and group I (1.74) in the zone with an average of 1.82. Thus, it could be said that cultivation of tomato is a profitable and it could generate good returns.

The cost of production for off season tomato per acre in Punjab was estimated as Rs. 5,46,841.04, Rs. 5,42,636.04 and Rs. 5,98,125.66 for small, medium and large farmers, respectively[14]. The economics of *kharif* tomato cultivation in Latur zone of Maharashtra revealed that per hectare gross returns from *kharif* tomato was estimated as Rs. 1,02,099.43 with a net profit of Rs. 26,309.71. The benefit-cost ratio was accounted as 1.35 [15]. The study carried out in Yewa North Local Government Area of Ogun State revealed that tomato production is a profitable venture. They also reported that farmers are to be educated on the appropriate combination of inputs for economic optimum output [16]. The cost of cultivation for tomato over the cost C2 was found Rs. 76,417.41 per hectare. The net return over cost C2 was found Rs. 65,139.23 per hectare with the benefit-cost ratio over C2 1.85 [17].

Table 5: Economics of Tomato cultivation (Rs./ha) of sample farmers according to cost concept

Cost items	Amount (in Rs.)			
	Group I	Group II	Group III	All farms
Cost A1				
Hired human labour	23545 (16.77)	24150 (17.66)	25160 (17.46)	24285 (17.30)
Tractor/ Power tiller	5900 (4.20)	5790 (4.23)	6050 (4.20)	5913 (4.21)
Seeds	1210 (0.86)	1100 (0.80)	1137 (0.79)	1149 (0.82)
Fertilizers	25112 (17.89)	22250 (16.27)	24715 (17.15)	24026 (17.11)
Manures	8000 (5.70)	4000 (2.92)	6100 (4.23)	6033 (4.30)
Plant protection chemicals	6600 (4.70)	6510 (4.76)	7014 (4.87)	6708 (4.78)
Irrigation	7480	8160	8000	7880

	(5.33)	(5.97)	(5.55)	(5.61)
Shed at nursery	1260 (0.90)	1300 (0.95)	1300 (0.90)	1287 (0.92)
Land preparation in nursery	1280 (0.91)	1270 (0.93)	1300 (0.90)	1283 (0.91)
Repairing	3510 (2.50)	3260 (2.38)	3500 (2.43)	3423 (2.44)
Total working capital	83897 (59.76)	77790 (56.87)	84276 (58.49)	81988 (58.39)
Interest on working capital	5034 (3.59)	4667 (3.41)	5057 (3.51)	4919 (3.50)
Depreciation	600 (0.43)	623 (0.46)	724 (0.50)	649 (0.46)
Land revenue	1060 (0.76)	1255 (0.92)	1109 (0.77)	1141 (0.81)
Miscellaneous (transportation, baskets, rope etc.)	11600 (8.26)	12500 (9.14)	12560 (8.72)	12220 (8.70)
Total of Cost A1	102191	96835	103726	100917
Rent paid for leased in land	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Total of Cost A2	102191	96835	103726	100917
Interest on value of owned fixed capital (excluding land)	1387 (0.99)	1290 (0.94)	1361 (0.94)	1346 (0.96)
Total of Cost B1	103578	98125	105086	102263
Rental value of owned land (Actual value to be paid for use of own land)	9250 (6.59)	10250 (7.49)	10000 (6.94)	9833 (7.00)
Total of Cost B2	112828	108375	115086	112096
Imputed value of family labour	27560 (19.63)	28400 (20.76)	29000 (20.13)	28320 (20.17)
Total of Cost C1	131138	126525	134086	130583
Imputed value of family labour	27560 (19.63)	28400 (20.76)	29000 (20.13)	28320 (20.17)
Total of Cost C2	140388 (100.00)	136775 (100.00)	144086 (100.00)	140416 (100.00)
10% of Cost C2	14039	13677	14409	14042
Total of Cost C3	154426	150452	158495	154458
Yield (q/ha)	34850	35230	36960	35680
Price (Rs. /kg)	7.00	7.20	7.28	7.16
Gross return (Rs.)	243950	253656	269069	255558
Net Return over Cost C2 (Rs.)	103562	116881	124983	115142
B:C ratio	1.74	1.85	1.87	1.82

Conclusion

Vegetables cultivation is a very important enterprise for upliftment of rural economy. It can create employment opportunity for the rural youths as well as the other farmers. To get a better harvest, the vegetable growers should strictly follow the improved cultivation practices so that the vegetables can be produced at a minimum cost and receive a maximum return maintaining the quality of products. For this the farmers should put more emphasis on integrated nutrient management, integrated pest and disease management practices. Generally, most farmers are not aware about these practices. So, they should be made aware and educated with the improved cultivation practices of vegetable cultivation. The government should make some policies to facilitate vegetable growers with some demonstrations and training programmes so that they can produce vegetables in a better way and earn more profit.

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