Economic Affairs, Vol. 62, No. 1, pp. 113-119, March 2017
DOI: 10.5958/0976-4666.2017.00034.1

An Economic Appraisal of Strawberry Orchard in Meghalaya

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Received: 04-11-2016 Revised: 10-01-2017 Accepted: 25-02-2017

ABSTRACT

The present study was undertaken with a view to study the costs and returns of strawberry orchard in Meghalaya state. Three categories of strawberry orchard was selected for the investigation. The costs of cultivation of strawberry revealed to be higher with the size of the orchard, *i.e.,* the total cost of cultivation in large category was found to be higher as compared to both of the small and medium category of strawberry cultivation. Similarly, the returns from the strawberry orchard was also revealed to be higher with higher of the strawberry orchard. Further, the benefit cost ratio of the categories proven that large categories are more beneficial irrespective to its investment. The pay-back period of strawberry cultivation indicate that large category takes minimum time to meet their expenditure as compared to the other categories of strawberry orchard. However, the constraints regarding the adaptation of strawberry cultivation shows that the unavailability of runners was the major problem for the farmers to adopt the crop. Whereas, the economics study of the crop indicated that strawberry fruit is very much profitable for the farmers and it is suggested that initiative through various channels from the line of government or organisation to encourage the farmers for strawberry cultivation which ultimate help to improve the economic condition of the state as a whole.

Keywords: Strawberry, appraisal, economic, pay-back and benefit-cost ratio

Strawberry is one of the most important small fruit among the berries which is originated in France (cultivated as wild crop and known as garden plant). It is cultivating throughout the world such as USA, Turkey, Spain, Egypt, Mexico and many others. Strawberry has a great dietetic values and a good source of vitamin. It is offend consume as fresh or processed product. Strawberry is cultivated at lower altitude in the month of November and start bearing fruit in April till late March. The fruit require low chilling temperature for it better growth and development therefore it can be grown successfully in tropical and subtropical regions. At the elevation above 800m above sea level it can be grown as perennial crop but below this level it can be grown successfully only as the annual crop.

Meghalaya is known as the agrarian state, as of which 60 per cent of the people depend their living on agriculture (GoM, 2010). But the state mainly on the traditional way of cultivating crops, which leads to low production and low quality of their produce ultimately results to lacking of competition and low return for the farmers. Therefore, as consequence of increasing competition of modern competition and declining returns to traditional agricultural commodities, many farmers in the state have embarked on an aggressive search for viable alternative agricultural commodities. One of the commodities that have gained to the attention of the farmers is strawberry fruit (*Fragaria xananassa)*. Also, several factors are responsible for the attention given to this fruit, *e,i.,* the promising of high net returns even with small area of cultivating, strawberry is therefore known as the high value and low volume crop. In Meghalaya strawberry cultivation was recently grown in Sohlya village of Ri-Bhoi district which is now known as Strawberry village and 30 km away from the heart of the city. Because of its popularity in strawberry cultivation, the village use to perform strawberry festival every year. Though the strawberry cultivation was newly practice in the state but gives has a great impact to the livelihood of the people (Banerjee, 2010). For the reason of its

promising high net income, farmers from various villages of the state now are moving forward for cultivating strawberry. However, at present scenario Ri-Bhoi district (61.46 %) was the leading producer of strawberry, followed by East Khasi Hills district (37.23 %) and East Garo Hills district (1.29%) (GoM, 2014). Strawberry is an important small fruit, grown throughout the world such as USA, Turkey, Spain, Egypt, Mexico and many others. It is deep red in colour with unique shape and flavour (Loghmanpor *et al*). It is commercially consumed as fresh fruits, processed products like ice cream, soft drink, confectionary, chewing gum and preserved like jams, jellies and squashes which can be used in off season (Galletta and Bringhurst, 1995). Strawberry also has a great dietetic values and a good source of vitamin C. 100 gm edible portion of strawberry contains 89 gm water, 0.07 gm protein, 0.5 gm fats, 8.4 gm carbohydrates and 59 mg ascorbic acid edible.

Meghalaya state exhibits certain desirable soil types and distinct climatic condition that enhance its prospect suitability for strawberry cultivation. Strawberry required chilling climatic conditions and grows well in different type of soil condition (Afridi *et al.)*. Also, being the delicious fruit, strawberry can be easily cultivated and grown (Jafar and Patil), Meghalaya state has that potentiality. Strawberry cultivation has now changed the mindset of the people even toward the diversification in agriculture for improving sustainability and productivity. This will improve their farm income and also generating gainful employment among them (Bhat *et al*). Further, the harvesting of the crop in the early summer help generates revenue, as few other fruit crop is available in the market, however strawberry is very demanding enterprise (Aad, 1997).

Despite of the potentiality of growing strawberry in the state, farmers are facing continuous problem for cultivating the crop. As growing of this crop depend on the availability of the runners to great extent. Since, runners need to be imported from outside the country; the purchasing price of the runners is high. Therefore, taking in to consideration the cost involved in strawberry cultivation the study on costs and return from strawberry cultivating have been undertaken to know the economic important and profitability of the crops in the state.

METHODOLOGY

Data

The present study was based on the primary data collected for attaining the objectives undertaken. The relevant data pertaining to the year 2014-15 was collected from the strawberry grower through personal interviewed using a pre-tested interview schedule.

Sampling plan

The present study was limited to Ri-Bhoi district of Meghalaya which was selected on the basis of highest area under strawberry in the state. Four villages *viz;* Mawtynrah, Sohlya, Umkteih and Umran Niangbyrnai were selected purposively. A sample of 40 strawberry growers and 20 non-strawberry growers was drawn randomly proportionate to population size from the selected villages. The list of strawberry growers was arranged in ascending order on the basis of number of runners cultivate in the farm. Then, the list was stratified in to three categories *viz.,* small (up to 2500 nos. of runners), medium (2501 to 2890 nos. runners) and large (2891 nos. and above number of runners) categories. Out of 40 strawberry growers, small, medium and large categories were, 17, 14 and 9, respectively, were selected.

Analytical tools

Cost of cultivation using cost concepts given by the expert committee (1980, GoI), *viz.,* Cost A1, Cost A2, Cost B1, Cost B2, Cost C1 and Cost C2 were used to work out the costs of strawberry cultivation. To work out the returns from strawberry cultivation, the economics measures were used. Log-log regression model was used to identify the determinant of yield of strawberry with the given following specification:

$$\text{Log } Y = \log a + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + b_5 \log X_5 + b_6 \log X_6 + b_7 \log X_7 + u$$

Where,

Y = Yield of strawberry (₹/ha)

X_1 = Cow dung (₹/ha)

X_2= Drip irrigation (₹/ha)

X_3= Mulching (₹/ha)

X_4= Bone meal (₹/ha)

X_5= DAP (₹/ha)

X_6 = Runners (₹/ha)

X_7= Labour (₹/ha)

Benefit Cost Ratio (BCR)

i) On the basis of the total cost: GFI ÷ Cost C_2

ii) On the basis of paid out cost: GFI ÷ Cost A_1

Pay-back period

To work out the Pay-back period of strawberry fruits the following formula was used.

$$P = \frac{I}{E}$$

Where,

P = Payback Period

I = Investment of the project

E = Annual net cash revenue in rupee

Problem in strawberry cultivation

To analyse the various factors cultivation of strawberry tabular analysis was used.n

RESULT AND DISCUSSION

Cost of strawberry cultivation

The cost of strawberry cultivation under different categories of strawberry orchard is worked out and presented in the Table 1. The table depicts the variable cost, fixed cost and the total cost incurred by the categories of strawberry growers. The study estimated ₹609.51 thousand per ha as total variable cost incurred on large farm, ₹449.82 thousand and ₹542.73 thousand per ha was estimated under small and medium category of strawberry farm. Overall, ₹518.32 thousand per ha of total variable cost was estimated. Similarly, the estimated total fixed cost across the categories of strawberry growers was worked out ₹21.00 thousand per ha, of which ₹23.00 thousand per ha was estimated in large category, ₹21.53 thousand per ha in small and ₹19.09 thousand per ha in medium category. The expenditure on variable cost revealed almost similar trend in all the categories, but the expenditure of large category farmer on runners was more which was estimated ₹465.95 thousand per ha as compared to ₹391.71 thousand per ha and ₹319.73 thousand per ha in medium and small categories of strawberry growers. The used of hired labour during the process of cultivation was found to be higher in small (1.42%) category as compared to 0.85 per cent in medium and 0.79 per cent in large category of strawberry orchard. Cow dung, lime application, bone meal and DAP, plant protection and plastic mulching was accorded in all the categories, the study revealed that the used of cow dung and plastic mulching was maximum since it help for improving the production of fruit. Though, small and medium farmer use less runners as comparison to large farmers but small and medium farmers uses more quantity of cow dung and whose expenditure was estimated ₹27.58 thousand and ₹31.26 thousand per ha as compared to ₹24.01 thousand per ha on large farm. On the other hand the expenditure on plastic mulching estimated higher in large *i.e.*, ₹27.01 thousand per ha as compared to small and medium farmer which incurred ₹22.99 thousand per ha and ₹24.67 thousand per ha. The study further reported that the expenditure made for plant protection, lime application, bone meal and DAP by all categories was least (Table 1). Further, marketing cost and interest on working capital was also worked out. In the case of the amount spend on fixed cost was estimated more or less same for all the categories (Table 1).

Keeping in view the overall cost incurred on cultivating of strawberry in the selected study revealed that maximum expenditure was estimated on runners *i.e.*, 377.82 thousand per ha, followed by cow dung (28.06 thousand/ha), Plastic mulching (24.48 thousand/ha) and among others (Table 1). Hence, taking in to consideration for all types cost incurred, the total cost incurred including family labour was estimated higher on large farm orchard (632.51 thousand/ha) as compared to small and medium farmer which estimated 471.35 thousand per ha and 561.87 thousand per ha, respectively. Similarly, the total cost excluding the family labour was worked out higher in large, followed by medium and small category of strawberry orchard (Table 1).

Further information on cost of strawberry cultivation by using cost concepts applied by the Special Expert Committee govt. of India (GoI, 1980) was worked out for all categories of strawberry orchard and presented in the Table 2. Cost A_1 was higher in large farmer which was estimated ₹605.02 thousand per

ha, followed by medium (₹534.54 thousand/ha) and small (₹446.89 thousand/ha) farmers of strawberry orchard the study estimated. Whereas, Cost A_2 revealed the same for all categories since none of the respondents leases in the land for cultivation. The estimated Cost B_1 of large farm revealed ₹620.68 thousand per ha higher than medium and small farmer which was estimated ₹546.48 thousand and ₹461.09 thousand per ha, respectively. Similarly, Cost B_2 was worked out higher in large farmer which was estimated ₹626.24 thousand per ha in comparison to ₹552.27 thousand and ₹466.79 thousand per ha in medium and small farm of strawberry orchard. Further, the study reported that Cost C_1 was estimated higher in large farm, followed by medium and small farm of strawberry orchard which was estimated ₹626.95 thousand, ₹556.08 thousand and ₹465.64 thousand per ha. Also Cost C_2 was reported higher in Large (₹632.51 thousand/ha), followed by medium (₹561.87 thousand/ha) and small (₹471.35 thousand/ha) categories of strawberry orchard. Hence, the cost concepts revealed that the cost incurred of strawberry cultivation in the orchard tense to be increased with the increase of farm (Table 2).

Returns from strawberry cultivation

Considering the average prevailing price (164/kg) of strawberry in the market (At producer's level), the study revealed that the gross income per ha of strawberry orchard was higher in large farm (₹1584.94 thousand/ha), followed by medium (₹1408.94 thousand/ha) and small (₹1071.90 thousand/ha) categories of strawberry orchard. On the other hand the net return including family labour of large farmer of strawberry orchard was estimated to be ₹952.43 thousand per ha and that of medium and small farmer was estimated ₹846.77 thousand and ₹600.56 thousand per ha. Similarly, the net return excluding family labour of large farm was estimated ₹958.70 thousand per ha higher than medium and small farmer which was estimated ₹856.37 thousand and ₹605.11 thousand per ha, respectively. Further investigation reported that net farm income of strawberry orchard on large farm was higher *i.e.*,₹962.53 thousand per ha, followed by ₹866.76 thousand per ha of medium farmer and ₹606.88 thousand per ha of small farmers. Similarly, the farm investment income from strawberry orchard of large farm was estimated ₹973.64 thousand per ha higher than that of medium (₹864.50 thousand per ha) and small (₹620.46 thousand per ha) categories of strawberry orchard. Hence, the study reported that the return from strawberry orchard depend on the size of land holding of the growers. Higher profit prevailed with the increase of size of orchard which therefore revealed the economies of scale (Table 3). Whereas, the data on output-input ratio of medium farm was worked out to higher which was estimated to be 2.64 in comparison to 2.62 in large and 2.40 in small farm, which revealed the benefit cost ratio of medium farm was higher as compared to large and small farmer which may be due to the influence of factors used toward the yield of strawberry production. Hence, keeping in view the benefit cost ratio prevailed in the study area, the study indicates the economic viability of strawberry production in the state.

The functional analysis of input used of strawberry cultivation have been regressed and presented in the Table 4. The results revealed that the coefficient of multiple determinants (R^2) was 0.89 which indicates that 89 per cent of the variations in the yield of strawberry were explained by the independent variables in the model. The analysis further revealed that that with one per cent increased of expenditure for cow dung, drip irrigation, mulching, DAP, runners and labour would increase the return of strawberry by 2.16 per cent, 0.85 per cent, 5.59 per cent, 0.08 per cent, 2.08 per cent and 0.62 per cent, respectively. Whereas, bone meal was worked out negatively significant to the yield of strawberry production.

Payback period of strawberry cultivation

The payback period in strawberry cultivation was estimated to be positive for all the categories of strawberry growers (Table 5). However, the payback period in large category was found to take lesser payback period to meet their expenditure in strawberry cultivation as compared to medium and small categories. The Benefit cost ratio of strawberry cultivation further revealed that the large category was found to achieve higher benefit cost ratio as compared to both of the strawberry growers in small and medium categories. Hence, from the study it indicated that a strawberry fruits is highly beneficial to the farmers which may became as one

of the major crop in the state form the economy point of view. Therefore, farmers are recommended to continuing cultivating the crops to further improve their livelihood situation.

Problems in strawberry cultivation

Most of the non growers practiced strawberry cultivation long back but due to various constraints many of them left cultivating this crop. The constraints were classified into production and marketing constraint, among production constraints 90 per cent of the non grower was reported due to inability to reproduce the runners as the runner's propagation was not possible on their fields and to propagate it, proper knowledge is needed. About 85 per cent of non growers were reported the problem of capital as it required huge initial investment and the mostly non growers were resource poor. Non affordability to purchase of runners was reported by 70 per cent of non growers which limited their strawberry cultivation, as the runners need to purchase from abroad or outside the state which incur high cost. Strawberry unlike any other crop is very fragile and sensitive to direct contact such as hails storm and it was found to be 55 per cent of the constraint of cultivating strawberry was due to this factor. More over strawberry is a seasonal crop, timely availability of runners is required for cultivation of strawberry and 45 per cent of non growers reported about non availability of runners in time, limited them to cultivate it. Availability of strawberry played a vital role in yield of strawberry. Further, the quality of runners is very essential as it is the base maternity in cultivation of strawberry but 40 per cent of the non growers left the production due to non availability of quality runners. Strawberry cultivation is labour intensive crop and required more labour to maintain the crop. About 30 per cent of the non grower left strawberry cultivation due to these factors.

Furthers, under the marketing constraint 85 per cent of non growers were reported lack of storage facilities in their fields as strawberry is highly perishable in nature, proper storage is needed. The next constraint was the low of price due to seasonal glut (70%), followed by non availability of packing material (50%), and few respondents reported lack of transportation (25%) and non availability of market (15%). From the above discussion it may be concluded that because of these reasons, most of the growers left strawberry cultivation in the state and become none growers.

Table 1: Costs of cultivation of strawberry in Ri-Bhoi district of Meghalaya (2014-15) (in thousand/ha)

Particulars	Category of strawberry grower			
	Small	Medium	Large	Overall
(A)Variable cost				
Hired labour	6.69 (1.42)	4.78 (0.85)	4.99 (0.79)	5.64 (1.05)
Family labour	4.55 (0.97)	9.60 (1.71)	6.27 (0.99)	6.71 (1.24)
Runners	319.73 (67.83)	391.71 (69.71)	465.95 (73.67)	377.82 (70.05)
Cow dung	27.58 (5.85)	31.26 (5.56)	24.01 (3.80)	28.06 (5.20)
Lime application	0.37 (0.08)	-	-	0.16 (0.03)
Bone meal	4.35 (0.92)	4.97 (0.89)	3.37 (0.53)	4.35 (0.81)
DAP	0.98 (0.21)	0.95 (0.17)	0.07 (0.01)	0.76 (0.14)
Plant protection	0.03 (0.01)		0.29 (0.05)	0.08 (0.01)
Plastic mulching	22.99 (4.88)	24.67 (4.39)	27.01 (4.27)	24.48 (4.54)
Marketing cost	53.73 (11.40)	64.19 (11.42)	65.59 (10.37)	60.09 (11.14)
Interest on working capitals (@ 4%)	7.75 (1.87)	9.36 (1.89)	10.64 (1.89)	8.96 (1.88)
Total variable cost (TVC)	449.82 (95.43)	542.78 (96.60)	609.51 (96.36)	518.32 (96.11)
(B)Fixed cost				
Rental value of land	5.71 (0.34)	5.79 (0.24)	5.56 (0.28)	5.70 (0.29)
Depreciation	1.62 (1.21)	1.36 (1.03)	1.79 (0.88)	1.57 (1.06)
Interest on fixed capital (@ 8.75%)	14.20 (3.01)	11.94 (2.13)	15.66 (2.48)	13.74 (2.55)
Total fixed cost (TFC)	21.53 (4.57)	19.09 (3.40)	23.00 (3.64)	21.00 (3.89)
Total cost including family labour (TVC+TFC)	471.35 (100)	561.87 (100)	632.51 (100)	539.32 (100)
Total cost excluding family labour (TVC+TFC-family labour)	466.79 (99.03)	552.27 (98.29)	626.24 (99.01)	532.62 (98.76)

Note: Figures in the parentheses are the percentage to the total

Table 2: Cost of strawberry cultivation using cost concepts in Ri-Bhoi district of Meghalaya (2014-15) (in thousand/ha)

Particulars	Category of strawberry grower			
	Small	Medium	Large	Overall
Cost of runners	319.74 (67.83)	391.71 (69.71)	465.95 (73.67)	377.82 (70.05)
Plant protection	0.03 (0.01)	-	0.29 (0.05)	0.08 (0.01)
Cow dung	27.58 (5.85)	31.26 (5.56)	24.01 (3.80)	28.06 (5.20)
DAP	0.98 (0.21)	0.95 (0.17)	0.07 (0.01)	0.76 (0.14)
Lime	0.37 (0.08)	-	-	0.16 (0.03)
Bone meal	4.35 (0.92)	4.97 (0.89)	3.37 (0.53)	4.35 (0.81)
Plastic mulching	22.99 (4.88)	24.67 (4.39)	27.01 (4.27)	24.48 (4.54)
Hired labour	6.69 (1.42)	4.78 (0.85)	4.99 (0.79)	5.64 (1.05)
Depreciation	1.62 (0.34)	1.36 (0.24)	1.79 (0.28)	1.57 (0.29)
Marketing cost	53.73 (11.40)	64.19 (11.42)	65.59 (10.37)	60.09 (11.14)
Interest on working capital	8.82 (1.87)	10.64 (1.89)	11.95 (1.89)	10.16 (1.88)
Cost A_1	446.89 (94.81)	534.54 (95.14)	605.02 (95.65)	513.18 (95.15)
Rent paid for leased-in land	-	-	-	-
Cost A_2	446.89 (94.81)	534.54 (95.14)	605.02 (95.65)	513.18 (95.15)
Interest on fixed capital	14.20 (3.01)	11.94 (2.13)	15.66 (2.48)	13.74 (2.55)
Cost B_1	461.09 (97.82)	546.48 (97.26)	620.68 (98.13)	526.92 (97.70)
Rental value of land less land revenue + rent paid for leased in	5.71 (1.21)	5.79 (1.03)	5.57 (0.88)	5.70 (1.06)
Cost B_2	466.79 (99.03)	552.27 (98.29)	626.24 (99.01)	532.62 (98.76)
Imputed value of family labour	4.55 (0.97)	9.60 (1.71)	6.27 (0.99)	6.71 (1.24)
Cost C_1	465.64 (98.79)	556.08 (98.97)	626.95 (99.12)	533.62 (98.94)
Cost C_2	471.35 (100)	561.87 (100)	632.51 (100)	539.32 (100)

Note: Figures in parentheses are the percentage to Cost C_2

Table 3: Returns from strawberry cultivation in Ri-Bhoi district of Meghalaya (2014-15) (in thousand/ha)

Particulars	Category of strawberry grower			
	Small	Medium	Large	Overall
Production (kg/ha)	6536.00	8589.25	9664.25	7958.49
Gross income	1071.90	1408.64	1584.94	1301.19
Net return including family labour	600.56	846.77	952.43	765.87
Net return excluding family labour	605.11	856.37	958.70	772.58
Farm business income	625.01	874.10	979.91	792.01
Family labour income	615.01	846.73	948.77	772.58
Net farm income	606.88	866.76	962.53	765.87
Farm investment income	620.46	864.50	973.64	785.31

Table 4: Estimated regression function for the determinant of strawberry cultivation

Explanatory variables	Estimate strawberry	p-value	R^2
Intercept	-82.26	0.000	
Cow dung	2.16**	0.010	0.89
Drip irrigation	0.85**	0.011	
Mulching	5.59***	0.005	
Bone meal	-0.05***	0.007	
DAP	0.08***	0.001	
Runners	2.08**	0.015	
Labour	0.62**	0.015	

*Note: ** indicate at 5% level of significant*

**** indicate at 1% level of significant*

Table 5: Pay-back period of strawberry fruits

Particular	Small	Medium	Large	Overall
Payback period (year)	0.78	0.67	0.66	0.70
Benefit-Cost Ratio (in ₹)	2.40	2.62	2.64	2.54

Table 6: Factors limiting the spread of strawberry cultivation

(Number)

Particular	Frequency
Factors of production	
inability to reproduce the runners	18 (90.00)
Initial investment	17 (85.00)
High price of runners	14 (70.00)
Affected due to hailstorm	11 (55.00)
Unavailability of runners in time	9 (45.00)
Lack of water availability for irrigation	9 (45.00)
Non-availability of quality of runners	8 (40.00)
Lack of information on government subsidy	7 (35.00)
Non-availability of labour	6 (30.00)
Factors of marketing	
Lack of storage facilities	17 (85.00)
Low price due to seasonal glut	14 (70.00)
Non-availability of packing material	10 (50.00)
Lack of transportation	5 (25.00)
Non-availability of market	3 (15.00)
Total	20 (100)
Note: Figures in the parentheses are percentage to the total	

CONCLUSION

From the discussion it can be concluded that the strawberry production is economically viable and profitable. But, the cultivation of strawberry fruits in the state are still confined only in to a limited area, however the conducted study shows that strawberry fruit is economics benefited which indicated that strawberry has the potentiality to boost the economy of the state as well as to improve the source of income of the farmers. However, through the study large, medium and small categories of strawberry growers was investigated. The cost of cultivation of each categories of strawberry growers was higher irrespective to its size of cultivation as it is labour intensive as well as capital intensive. Due to unavailability of runners within the state, farmers has to depend on transportation of runners from out side the state, however higher cost has to be incurred by the farmers was found. Its benefit cost ratio which has been worked out indicated the economies of scale. Hence, it is recommended that strawberry fruit is having the economics efficiency which need to be realises by the farmers as well as by the government. Also, self supplement of strawberry runner within the state need to be popularise through training and awareness programme so that the economics efficiency of strawberry fruit would help the farmers to adopt the crop as source of income for their livelihood.

ACKNOWLEDGEMENTS

Authors are highly grateful to Central Agriculture University to conduct the Master research for partial fulfilment of M Sc Agricultural Economics in School of Social Sciences, College of Post Graduate Studies, Umiam, Meghalaya during the year of 2014-15 from which this paper has been prepared.

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