



Economics and Constraint Analysis of Pineapple Cultivation in Assam

A. Tovinoli Shohe¹, C. Hazarika¹, Ajanta Borah¹, Singyala Chiphang², Soibam Peter Singh¹

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ABSTRACT

Background: The present study was conducted with the objective to study the economics of pineapple cultivation in Assam and to identify the constraints limiting its production and marketing so that suitable measures can be suggested to address the existing gaps hindering its growth.

Methods: A multistage sampling technique was used to select 100 pineapple growers from Dima Hasao and Karbi Anglong districts of Assam. For cost estimation, the budgeting techniques and cost concepts were followed, while, Garrett ranking technique was followed for studying the constraints faced by producers.

Result: The per hectare total cost of cultivation on average was worked out to be ₹ 242715.79 and was found higher in Group III (₹ 265748.21/ha) as compared to Group II (₹ 242347.12/ha) and Group I (₹ 220052.05/ha). Of the total cost incurred in pineapple cultivation, cost on labour constituted the major cost item across all farm groups and accounted about 71.11 per cent of the total cost, implying pineapple cultivation to be labour intensive. The per hectare average yield of the fruit in the study area was 19.16 tonnes and the highest net income of ₹ 117459.75 per hectare was obtained by group III, followed by group II (₹ 76033.69/ha) and group I (₹ 34746.10/ha). The benefit cost ratio on average was 1.13, indicating pineapple cultivation in the state to be economically viable. The major production constraints reported were damage of fruits by rodents, lack of finance and high labour cost while low price of fruit during glut, lack of cold storage and processing unit and lack of proper connectivity linking production clusters to market were major marketing constraints reported by the producers in the study area.

Key words: Benefit-cost ratio, Constraint, Pineapple.

INTRODUCTION

Pineapple (*Ananas comosus*) is a major commercial fruit crop occupying an important place in the horticultural wealth and economy of India. India ranked fifth in production among the pineapple producing countries and contributing nearly 10 per cent of world pineapple production with an annual output of 1.96 million tonnes (NHB, 2018). Pineapple from the country is exported to countries like Qatar, Saudi Arabia, UAE, Maldives, etc. and in the year 2016-17, the total quantity exported stood at 5208.39 MT valued at Rs. 2616.31 lakhs (NHB, 2018). The conditions prevailing in large parts of our country are suitable for pineapple cultivation and it is being cultivated in high rainfall and humid coastal regions of peninsular India and hilly areas of entire North-Eastern region. The North East region holds a significant position in pineapple production, covering an area of about 67.37 per cent of the total area under pineapple and producing about 51.97 per cent of the country's pineapple production, out of which 90 to 95 per cent of the pineapple from the region is organic (GoI, 2018).

Assam, a state in North East Region of India, is the second largest producing state of pineapple in India, ranks next to West Bengal and accounts for about 15.37 per cent of country's total production of pineapple. The prevailing agro climate of the state make it suitable for pineapple cultivation in all the districts with higher production concentrated at Dima Hasao, Karbi Anglong, Kamrup, Cachar, Hailakandi, Chirang and Sonitpur. During 2017-

¹Department of Agricultural Economics and Farm Management, College of Agriculture, Assam Agricultural University, Jorhat-785 013, Assam, India.

²Department of Agricultural Economics, Central Agricultural University, Imphal-795 004, Manipur, India.

Corresponding Author: A. Tovinoli Shohe, Department of Agricultural Economics and Farm Management, College of Agriculture, Assam Agricultural University, Jorhat-785 013, Assam, India. Email: shohetovinoli@gmail.com
ORCID: 0000-0002-5681-966X

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18, area under pineapple in Assam was 16.30 thousand hectares and production was 296.52 thousand MT. The productivity recorded during the same period was 18.19 MT/ha which was higher than national productivity of 16.57 MT/ha (GoI, 2018). Under the intervention of schemes like Chief Minister's Organic Farming Scheme, Parampragat Krishi Vikash Yojana (PKVY) and Mission Organic Value chain Development in North East Region (MOVCD-NER), the crop has been covered and this has benefitted the pineapple growers in the state. In fact, the fruit is also a main income source for majority of the growers in the study area.

Pineapple cultivation in the state is organic by tradition and this provides an opportunity to explore global markets in context of increased demand for organic produces both at national and global level. Also, with the prevailing climatic conditions supporting its cultivation in all the districts, the state also has the scope to venture in agro processing and value addition, which, in turn will create new avenues for investment and employment. Keeping in view the importance of the fruit in the economy of the state, the study was carried out with the objective to study the economics of pineapple cultivation in the state and to identify the constraints in production and marketing of the fruit and suggest suitable measures to address the existing issues hindering its growth.

MATERIALS AND METHODS

The study was purposively conducted in Assam as it is the largest producer of pineapple among the Northeast states covering about 24 per cent of total NE area and about 33 per cent of total NE production of pineapple (Gol, 2018). Pineapple cultivation was observed in all the districts of the state, however, only Dima Hasao and Karbi Anglong districts was purposively selected based on dominance in area and production under pineapple (GoA, 2016). This was followed by purposive selection of two blocks based on large area as well as production of pineapple, namely, Harangajao block under Dima Hasao and Nilip block under Karbi Anglong district after consultation with the District Agriculture office. In the next stage, two to three villages under each block was selected randomly drawing a random sample of 50 farmers under each block. Thus, a cross-sectional data were obtained from 100 pineapple growers following the multistage stratified sampling technique. The primary data pertaining to agricultural year 2019-2020 was collected from respondents through personal interview with the help of pre-tested and well-structured schedule. Secondary data related to the state and districts in particular covering various aspects were collected from publications of concerned state departments and other Government publications to arrive at relevant inferences.

For cost estimation, the budgeting techniques and cost concepts proposed by Special Expert Committee on 1979, 30th January (Sen and Bhatia, 2004) were followed. A summary of cost concepts used are as follows,

Cost A₁: All recurring expenses incurred to produce material inputs and expenditure on hired labour, all types of machine labour and including land revenue, depreciation and interest on working costs.

Cost A₁: Cost A₁+ rent paid for leased-in land.

Cost B₁: Cost A₂+ interest on value of owned fixed capital assets (excluding 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 per cent of Cost C₂ to account for managerial input of the farmer.

The returns from pineapple cultivation has been computed as follows,

Gross farm income (GFI) = Value of main product+ by product

Farm business income = Gross income-Cost A₂

Family labour income = Gross income-Cost B₂

Managerial income = Gross income-Cost C₃

Net farm income = GFI – Cost C₂

Farm investment income = Farm business income - imputed value of family labour

The economic efficiency measures like Benefit-Cost ratio was estimated as,

B:C ratio = Gross farm income ÷ Cost C₂

The Garrett ranking technique was used for studying the constraints faced by producers in pineapple cultivation, where, problems ranked by producers were converted into per cent position by using the following formula given by Garrett and Woodworth, 1969.

$$\text{per cent position} = \frac{100 (R_{ij} - 0.5)}{N_j}$$

Where,

R_{ij} = Rank given for ith factor by jth individual.

N_j = Number of factors ranked by jth individual.

The per cent position computed using the above mentioned formula was converted into score by referring the Garrett ranking table.

RESULTS AND DISCUSSION

General characteristic of farmers in Assam

Table 1 presents the general characteristic of respondents in the study area. The average age of the respondent farmers in the study area was 48 years and had average family size of 5 members with minimum household of 2 persons and maximum household of 10 persons. The educational status reflected that majority of the sample farmers were literate and had at least attained primary level education. With regard to area under pineapple cultivation, the average cultivated area under pineapple in the study area was only 1.01 hectare and the average experience of farmers in pineapple farming was 14 years in the study area.

Costs and returns from pineapple cultivation in Assam

For calculating the costs and returns from pineapple cultivation, the sample farmers were categorized into three

Table 1: Descriptive statistics of pineapple growers in the study area.

Particulars	Mean	Observations
Age of respondent (in years)	48.34	N = 100
Family size	5.04	
Education level of respondent	1.45	
Area under pineapple farming (in ha)	1.01	
Pineapple farming experience (in years)	13.91	

groups based on their area under pineapple cultivation and presented in Table 2. As average area under pineapple cultivation in the study area was 1.01 hectare and standard classification could not be followed in this case, the farmers were categorized as Group I (≤ 0.58 Ha), Group II (0.59 to 1.13 Ha) and Group III (≥ 1.14 ha) so as to represent proportionately the sample respondents in all category. As evident in Table 2, 52 per cent of the respondents in the study area was under Group II category, followed by 32 per cent under Group III and 16 per cent under Group I category.

Table 3 presents the initial establishment cost which comprised of cost involved in field preparation, digging and planting, cost of planting material and fencing cost for different category of sample farmers. The average establishment cost of pineapple was estimated to be ₹ 74089.16 per hectare and cost was found higher for Group III (₹ 86014.36) as compared to Group II (₹ 72851.20) and Group I (₹ 63401.92). For all three category of farm size, digging and planting cost incurred the maximum cost item and was computed to be ₹ 35865.99, ₹ 30061.35 and ₹ 29841.59 in Group III, Group II and Group I respectively. The next major cost item was cost of planting material, which was found highest in group III (₹ 25341.85), followed by Group II (₹ 22158.75) and Group I (₹ 17897.95). Field preparation cost was also observed to be highest in Group III (₹ 24806.52), followed by Group II (₹ 20631.10) and Group I (₹ 15662.37).

The growers have to incur certain expenditure in carrying out various operations like weeding and mulching,

gap filling and harvesting. The costs involved in carrying out these operations was worked out for first three years and presented in Table 4. The per hectare cost incurred by Group I, Group II and Group III category in maintenance of pineapple orchard are ₹ 109973.26, ₹ 121133.66 and ₹ 129785.72 respectively. While, the overall operational cost on average was computed to be ₹ 120297.54 per hectare, out of which, 71.18 per cent of the total cost was incurred in weeding and mulching, followed by picking and collecting cost which accounted 27.67 per cent of the total cost and cost of gap filling accounted 1.50 per cent of the total cost. It was observed that across all categories of farm, major cost in maintenance of orchard was in weeding and mulching, indicating pineapple cultivation as labour intensive.

Per hectare total cost of pineapple cultivation computed for first three years was worked out to be ₹ 242715.79 for overall category (Table 5) and it was found highest in Group III (₹ 265748.21/ha), followed by Group II (₹ 242347.12/ha) and Group I (₹ 220052.05/ha). It was observed that variable cost constituted the major cost item and accounted 85.89 per cent of the total cost while remaining 14.11 per cent of the total cost was from fixed cost for overall category. Similar findings where variable cost constitutes the major share of the total cost in pineapple cultivation was reported by Singh *et al.* (2016). Of the total variable cost, major cost item was imputed value of family labour in all farm groups and was computed to be ₹ 117438.80, ₹ 129639.86 and ₹ 126820.65 per hectare for group I, group II and group III respectively. The next major cost item was hired labour and was worked out to be ₹ 38038.42, ₹ 42186.25 and ₹ 63637.58 per hectare for group I, group II and group III respectively. Other variable cost components like planting material and interest on working capital together accounted 13.84 per cent, 14.94 per cent and 15.43 per cent of the total cost in Group I, Group II and Group III respectively. Among fixed cost, rental value of land constituted major cost in all category of farm and was worked to be ₹ 30000

Table 2: Distribution of farmers into groups based on area under pineapple cultivation.

Category	Area	Frequency of farmers
Group I	≤ 0.58 Ha	16
Group II	0.59 to 1.13 Ha	52
Group III	≥ 1.14 Ha	32
Total		100

Table 3: Establishment cost of pineapple cultivation in different farm size groups (in ₹ /ha).

Particulars	Group I	Group II	Group III	Overall
Field preparation	15662.37 (24.70)	20631.10 (28.32)	24806.52 (28.84)	20366.67 (27.49)
Digging and planting	29841.59 (47.07)	30061.35 (41.26)	35865.99 (41.70)	31922.98 (43.09)
Cost of planting material	17897.95 (28.23)	22158.75 (30.42)	25341.85 (29.46)	21799.52 (29.42)
Total	63401.92 (100.00)	72851.20 (100.00)	86014.36 (100.00)	74089.16 (100.00)

Note: Figures in the parentheses are percentage to total cost in each category.

Table 4: Operational cost of pineapple cultivation in different farm size groups (in ₹ /ha).

Particulars	Group I	Group II	Group III	Overall
Weeding and mulching	80157.28 (72.89)	86144.68 (71.85)	89688.98 (69.11)	85330.31(71.18)
Gap filling	1109.44 (1.01)	1797.30 (1.50)	2477.47 (1.91)	1794.74 (1.50)
Picking and collecting	28706.53 (26.10)	33191.68 (27.68)	37619.26 (28.99)	33172.49 (27.67)
Total	109973.26 (100.00)	121133.66 (101.03)	129785.72 (100.00)	120297.54 (100.34)

Note: Figures in the parentheses are percentage to total cost in each category.

per hectare. The rental value of land which is considered as the opportunity costs is assumed to remain the same to offset price fluctuations. Other fixed cost components like depreciation and interest on fixed capital together accounted 1.87, 1.78 and 1.62 per cent of the total cost in Group I, Group II and Group III respectively.

Table 6 presents the results of per hectare costs computed using cost concepts up to first bearing year. Cost C_2 for overall category was worked out to be ₹ 242715.79 and was found highest in Group III (₹ 265748.21/ha) as compared to Group II (₹ 242347.12/ha) and Group I (₹ 220052.05/ha). Cost A_1 computed for group I, group II and group III farm size was ₹ 69344.39, ₹ 79420.08 and ₹ 105639.97 per hectare respectively. Cost A_2 which includes rent paid for leased in land was found same as cost A_1 in all category of farm group, as there was no leased in land reported. Cost C_3 which measures the overall returns to management was estimated to be ₹ 242057.25,

₹ 266581.83 and ₹ 292323.03 per hectare in group I, group II and group III respectively.

As evident in Table 6, the average yield was 19.16 tonnes per hectare and it was observed that group III had higher yield (23.03 tonnes) as compared to group II (19.13 tonnes) and group I (15.31 tonnes). The average price of the fruit was ₹ 16.64 per kg and the gross farm income per hectare for group I, group II and group III was estimated to be ₹ 254798.15, ₹ 318380.80 and ₹ 383207.96 respectively. The managerial income was found lowest in group I (₹ 12740.90) as compared to group II (₹ 51798.97) and group III (₹ 90884.93). The net income computed for all farm groups showed highest net farm income of ₹ 117459.75 per hectare for group III, followed by group II (₹ 76033.69/ha) and group I (₹ 34746.10/ha). The benefit cost ratio computed over total cost on an average was 1.30 and for group I, group II and group III farm it was worked out to be 1.16, 1.31 and 1.44 respectively, indicating pineapple

Table 5: Share of various categories of cost in pineapple cultivation in Assam (in ₹ /ha).

Particulars	Group I	Group II	Group III	Overall
A). Variable cost				
Hired labour	38038.42 (17.29)	42186.25 (17.41)	63637.58 (23.95)	47954.09 (19.76)
Family labour	117438.80 (53.37)	129639.86 (53.49)	126820.65 (47.72)	124633.10 (51.35)
Planting material	17897.95 (8.13)	22158.75 (9.14)	25341.85 (9.54)	21799.52 (8.98)
Interest on working capital @7.25%	12569.70 (5.71)	14063.90 (5.80)	15645.51 (5.89)	14093.04 (5.81)
Total variable cost	185944.87 (84.50)	208048.76 (85.85)	231445.59 (87.09)	208479.74 (85.89)
B). Fixed cost				
Land revenue	-	-	-	-
Rental value of own land	30000.00 (13.63)	30000.00 (12.38)	30000.00 (11.29)	30000.00 (12.36)
Depreciation	838.31 (0.38)	1011.17 (0.42)	1015.03 (0.38)	954.84 (0.39)
Interest on fixed capital	3268.86 (1.49)	3287.18 (1.36)	3287.59 (1.24)	3281.21 (1.35)
Total fixed cost	34107.17 (15.50)	34298.36 (14.15)	34302.62 (12.91)	34236.05 (14.11)
Total cost (A+B)	220052.05 (100.00)	242347.12 (100.00)	265748.21 (100.00)	242715.79 (100.00)

Note: Figures in the parentheses are percentage to total costs in each category.

Table 6: Per hectare cost and returns from pineapple cultivation in Assam (in ₹ /ha).

Particulars	Group I	Group II	Group III	Overall
Cost A1	69344.39	79420.08	105639.97	84801.48
Cost A2	69344.39	79420.08	105639.97	84801.48
Cost B1	72613.25	82707.26	108927.56	88082.69
Cost B2	102613.25	112707.26	138927.56	118082.69
Cost C1	190052.05	212347.12	235748.21	212715.79
Cost C2	220052.05	242347.12	265748.21	242715.79
Cost C3	242057.25	266581.83	292323.03	266987.37
Yield (t/ha)	15.31	19.13	23.03	19.16
Gross farm income	254798.15	318380.80	383207.96	318795.64
Farm business income	185453.76	238960.73	277567.99	233994.16
Family labour income	152184.90	205673.54	244280.40	200712.95
Managerial income	12740.90	51798.97	90884.93	51808.27
Net farm income	34746.10	76033.69	117459.75	76079.85
Farm investment income	68014.97	109320.87	150747.34	109361.06
Benefit cost ratio	1.16	1.31	1.44	1.30

Table 7: Production constraints faced by pineapple growers in Assam.

Production constraints	Average score	Rank
Lack of financial support	60.88	II
Shortage of labourers	22.78	VII
Damage caused by extreme weather conditions	49.67	V
Damage of fruits caused by rodents and wild animals	73.60	I
Lack of technical know how	50.70	IV
High cost of labour	51.19	III
Lack of modern tools for harvesting	41.86	VI

Table 8: Marketing constraints faced by pineapple growers in Assam.

Marketing constraints	Average score	Rank
Lack of proper road connectivity coupled with frequent blockade in the area due to ethnic conflict.	44.27	IV
Inaccessibility of the major markets	42.60	V
Low price received due to production glut	72.60	I
Lack of storage and cool-chain facilities	70.00	II
Lack of processing unit in the area	56.62	III
Lack of market information	39.58	VII
High transportation cost	40.63	VI
Lack of quick transport facilities	36.20	VIII

cultivation to be economically viable in the study area. The results obtained concur with the findings of Rymbai *et al.* (2012), Sharma *et al.* (2016) and Singh *et al.* (2016), who found pineapple cultivation to be feasible and profitable in the state of Meghalaya, Nagaland and Manipur.

Production constraints faced by pineapple growers in Assam

Damage of plants and fruits by rodents and wild animals was the major problem reported by the producers in the study area (Table 7). Similar problem on pineapple was reported by Marak *et al.* (2016) in West Garo Hills district of Meghalaya. This resulted in huge loss of fruit in the field with no measures adopted till date to address this problem. Lack of financial support was the second major problem encountered by the pineapple farmers. As pineapple cultivation is capital intensive, it limits the resource poor farmers to further expand and explore more in this profitable venture, as they are unable to cover the costs involved in its maintenance. High cost of labour was another constraint faced by the growers in the state. Its cultivation requires more manpower in carrying out various operations in the farm, thus, leading to more expenditure due to high labour cost. Other constraints reported were lack of technical knowhow with regard to improved cultivation practices, damage caused by extreme weather conditions, lack of modern tools for harvesting and scarcity of labour particularly during peak season was another constraint faced by the growers. Similar problem of labour scarcity, high labour cost, lack of technical know-how and lack of finance were corroborated by Keerthi (2008), Bhat *et al.* (2015), Maske and Jain (2011), Sagar *et al.* (2012), Dhurandher (2010) in their study on marketing of fruits.

Marketing constraints faced by pineapple growers in Assam

Table 8 presents the marketing constraints encountered by pineapple growers in the study area. Among the various marketing problems encountered, the low price received for the fruit due to production glut was ranked first by the farmers. The second major marketing problem reported was lack of storage and cool chain facilities in the production clusters, thus, compelling producers to sell even when they do not receive remunerative price for their produce. Similar marketing problem was reported by Anand (2024) in marketing of horticultural crops. The lack of processing unit in the area was another major setback encountered by producers. The study area also faced frequent blockade due to ethnic conflicts and in addition, the lack of proper road connectivity to market coupled with frequent landslides were obstacles encountered particularly in peak harvest months as most of the produce goes to waste when farmers are unable to transport to market. Other setbacks encountered during marketing were inaccessibility of the major markets, absence of proper transport facilities coupled with high transportation cost due to difficult terrain and lack of information about existing market price. Similar marketing constraints of absence of transport facilities accompanied by high transport cost and lack of storages were reported by Das *et al.* (2016), Chutia and Borah (2014) and David *et al.* (2018) in their study on pineapple.

CONCLUSION

The study found cultivation of pineapple as capital intensive but economically viable and feasible in the study area.

The category wise cost and return computed found increased costs but higher returns with increased farm size which implies the economies of scale. As cultivation of the crop is capital intensive, the provision of financial assistance would encourage farmers to go for area expansion under the crop. This will also free the growers from the hands of those few traders who act as their banker and dominate them. The damage of fruits by rodents and wild animals was the major problem reported by producers in the study area. Hence, if concerned Departments can undertake the initiative for capacity building of farmers in pest and disease management and also scientific management practices of the fruit through outreach and extension programme, it would benefit the growers. The study also suggests more investment in infrastructural facilities like cold storages and processing unit which is lacking in the area so as to reduce post harvest losses and at the same time help growers in obtaining remunerative price for their produce. In addition, constructing proper roads linking production cluster to market to facilitate evacuation and marketing of fruit in all kinds of weather will benefit the growers and protect their interest in the long run.

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Disclaimers

The views and conclusions expressed in this article are solely those of the authors and do not necessarily represent the views of their affiliated institutions. The authors are responsible for the accuracy and completeness of the information provided, but do not accept any liability for any direct or indirect losses resulting from the use of this content.

Conflict of interest

The authors declare that there is no conflict of interest.

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