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ORIGINAL RESEARCH ARTICLE

Performance and supply chain analysis of Binalebu-1 in some selected areas of Bangladesh

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ABSTRACT

The study was conducted to find out the performance and supply chain of Binalebu-1 in four major Binalebu-1growing areas of Bangladesh, namely Cumilla, Mymensingh, Rangpur and Dhaka districts. Simple random sampling technique was followed for this study. The average cost of lemon production was estimated at Tk. 206127 per hectare of which about 68% was variable cost and 32% was fixed cost. Human labour cost was the lion share (32%) of total cost and it followed by irrigation cost (6.63%), Insecticide (2.64%) sapling (2.60%), and in the study areas. The average yield of Binalebu-1 was recorded 28.32 t/ha in all study areas while it was highest in 3rd year (30.24 t/ha) followed by 2nd year (28.17 t/ha) and 1st year (26.58 t/ha). The average gross return, gross margin and net return of lemon were found to be Tk 744517.62/ ha, Tk 454521.67/ha, and Tk 538390.75/ha, respectively. Average BCR was found to be 2.71 on the basis of total cost. Supply chain was classified into four types: Channel 1: Accounts for 40 % which was ranked as I; Channel II: Accounts for 20 % which was Ranked as II; Channel III: Accounts for 18 % which was Ranked as III, Channel IV: Accounts for 12 % which was ranked as IV; Channel V: Accounts for 10 % which was Ranked as V. It was revealed that the value addition of the Faria, Bepari, Paiker, Arathdar, Retailer were Tk.135, Tk.95, Tk.55, Tk.39 and, Tk155 per quintal, respectively.

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INTRODUCTION

Lemon, belonging to the family of Rutaceae. Presumably it is native to Assam (a region in northeast India), northern Burma, and China. Lemon is very important in respect of its nutritional values especially in Vitamin C (Sfgate, 2017). Citrus lemon is an evergreen, small, medium-size plant that are cultivated in the tropical and subtropical regions (Ismail and Zhang, 2004). It is also distributed widely throughout the Arab World and Mediterranean region (Julia, 1987). This is well known for its regenerative fragrance, thirst-mitigating ability, and dietary allowance, providing the recommended adequate vitamin C. In Bangladesh, mean intake of Vitamin C is far below from the recommended dietary allowance (Ahmed *et al*., 1998; Hels *et al*., 2003; Khan and Ahmed, 2005). Lemon is used as raw materials of shampoo, soap, medicine and varies delicious items like salad, drink, jam, etc. Recently there has been established many commercial lemon orchards in different agro-ecosystems of Bangladesh, which allows enough space for the cultivation of different crops in between the two line of lemon trees (Bony *et al*., 2021). Although Bangladesh is an important center of origin, especially for lemon and lime, the overall production is not satisfactory and cannot fulfill the country requirement. Among the factors responsible for low production and also low fruit quality, insect pests are of major concern. Elachi and Kagozi lemon were found the most widely cultivated varieties of

lemon with high intensity of pest attack (Hasan *et al.*, 2021a). Keeping this in mind Bangladesh Institute of Nuclear Agriculture, BINA invented Binalebu-1 variety which produces fruits throughout the year. The fruit is oval and fragment and about seedless. The fruits weight is 90-150g and per hectare yield is 24-32 M. T (BINA, 2022). Profitability of Binalebu-1 was conducted in four major Binalebu-1growing areas of Bangladesh, namely Cumilla, Mymensingh, Rangpur and Dhaka districts of Bangladesh. The specific objectives were (i) to estimate the costs and return of Binalebu-1 production in the study areas; (ii) to find out the key players involved in the supply chain of Binalebu-1; and (iii) to suggest some policy guidelines to improve the performance of the supply chain.

MATERIALS ANDMATHODS

The study was conducted to find out the performance and supply chain of Binalebu-1 in four major Binalebu-1growing areas of Bangladesh, namely Cumilla, Mymensingh, Rangpur and Dhaka districts. Simple random sampling technique was followed for this study. Two different kinds of the questionnaire were used, one for cultivators and another for market intermediaries involved in the supply chain. A total of 240 respondents taking 40 farmers and 20 traders/intermediaries were randomly selected from each of the aforesaid districts. Necessary data was collected through a pretested interview schedule from Binalebu-1 farmers. Data were categorized according to the year of cultivation. The age of the lemon garden was classified as 1st year, 2nd year, 3rd year. Then the collected data were edited, summarized, tabulated and analyzed to fulfill the objectives of the study. Profit model, descriptive statistics was used in analysing the collected data.

The following profit equation was employed to assess the profitability of Binalebu-1 production (Dillon and Hardaker, 1993).

$$\Pi = \sum_{i=1}^{n} P_i Q_i - TC = \sum_{i=1}^{n} P_i Q_i - (VC + FC) \quad (1)$$

Where,

Π = Profit or value addition from Binalebu-1 production

Q_i = Quantity of Binalebu-1 of i^{th} farmers (kg/ha)

P_i = Average price of Binalebu-1 of i^{th} farmers (Tk/kg)

TC = Total cost (Tk/ha)

VC = Variable cost (Tk/ha)

FC = Fixed cost (Tk/ha)

i = 1, 2, 3, ..., n

Per hectare profitability of growing Binalebu-1 from the view points of individual farmers was measured in terms of gross return, gross margin and net return.

Gross return: Gross return was calculated by simply multiplying the total volume of output with it's per unit of price in the harvesting period.

Gross margin: Gross margin calculation was done to have an estimate of the difference between total return and variable costs. The argument for using the gross margin analysis is that the farmers of Bangladesh are more interested to know their return over variable costs.

Net return: The analysis considered fixed cost (which included land rent and family supplied labour). Net margin was calculated by deducting all costs (Variable and Fixed) from gross return.

Land preparation: Land preparation included, ploughing, laddering, pit preparation and other activities needed to make the soil suitable for plantation of seedling. In the study areas, all the farmers ploughed their land with the help of power tiller and the number of ploughings.

Human labour: Human labour is one of the most important components for lemon cultivation. Machine power could not replace human labour fully for cultivation till now in our country. Farmers used both families supplied and hired labour. Family labour includes the operator himself and other working member of the family, while the hired labour includes permanent hired labour, labour employed on monthly contract basis, casual labour and labour employed on the other contract basis.

Sapling: Most of the farmers purchase saplings from market or research station for lemon cultivation.

Cow dung and fertilizer: Cow dung is useful for increasing organic matter in the soil to eventually increase crop yields. On the other hand, proper use of fertilizer can enhance agricultural production largely and help to retain or improve soil fertility. The sample farmers used four kinds of chemical fertilizers namely; TSP, MoP and Gypsum, Boron in the survey plot. Farmers did not use any Urea for lemon cultivation in the study areas.

Pesticide: Pesticide mainly insecticide and fungicide were used by most of the sample farmers and applied to survey plot with different rates. The cost of pesticide was computed based on the price that the farmers have actually paid. Farmers used different pesticide for lemon production etc.

Staking/pillars: Bamboo, rope, was used for Staking. The cost of bamboo was calculated following a straight-line method as the present value minus salvage value divided by the life of bamboo (total year). It is reported by the sample farmers that the life of bamboo is two years.

Pruning: It was done by the farmer in its first or second year make it easier to harvest.

Irrigation: Almost all the farmers in the study areas used irrigation water in their plot in dry season through manual irrigation method for irrigation purpose.

Land rent: Land rent is one of the biggest fixed cost items for the production process. Rental value of land was estimated for the cropping period at the rate prevailing in the study area. In this analysis, cropping period was considered as 10-11months.

RESULTS AND DISCUSSION

Cost of cultivation

Cost of lemon production included human labour, seedling/ saplings, manures, fertilizers, insecticide, land development, irrigation and pillar/support etc. The average cost of lemon production was estimated at Tk. 206127 per hectare of which about 68% was variable cost and 32% was fixed cost (Table 1). Human labour cost was the lion share (32%) of total cost and it followed by irrigation cost (6.63%), Insecticide (2.64%) sapling (2.60%), and in the study areas.

Return of lemon cultivation

The average yield of Binalebu-1 was recorded 28.32 t/ha in all study areas while it was highest in 3rd year (30.24 t/ha) followed by 2nd year (28.17 t/ha) and 1st year (26.58 t/ha) (Table 2). The average gross return, gross margin and net return of lemon were found to be Tk 744517.62/ha, Tk 454521.67/ha, and Tk 538390.75/ha, respectively. Average benefit cost ratio was found to be 2.71 on the basis of total cost.

Supply chain of lemon cultivation

The following table 3 explains the major channels of trade in Binalebue-1 among the study areas. Based on the point of sale the supply chain can be classified into four types: Channel 1: Accounts for 40 % which was ranked as I; Channel II: Accounts for 20 % which was Ranked as II; Channel III: Accounts for 18 % which was Ranked as III, Channel IV: Accounts for 12 % which was ranked as IV; Channel V: Accounts for 10 % which was Ranked as V. It was revealed from the study that the value addition of the Faria, Bepari, Paiker, Arathdar, Retailer were Tk.135, Tk.95, Tk.55, Tk.39 and, Tk155 per quintal, respectively (Table 4).

Problem of lemon cultivation

Farmers in the study areas were facing various problems in lemon cultivation. From Table 5 it is seen that the highest problem was for lack of capital (58%) which was ranked as I and the lowest was for lack of sapling (20%) ranked as V. The other problem was high price of sapling, disease infestation and lack of adequate marker facilities, similar results was found by Hasan *et al.* (2021b).

Table 1. Per hectare cost of lemon cultivation.

Particulars	Years			Average	%of total cost
	1st year	2nd year	3rd year		
Cost of land preparetion	5362	3258	1258	3293	1.60
Hired labour	38247	30856	20536	29880	14.50
Cost of sapling	11580	2480	2005	5355	2.60
Cow dung	3480	3560	5784	4275	2.07
Urea	0	0	0	0	0.00
TSP	1530	2352	4638	2840	1.38
MoP	400	800	1000	733	0.36
DAP	286	286	1286	619	0.30
Gypsum	360	400	800	520	0.25
Irrigation	14148	12258	14583	13663	6.63
Insecticides	4630	5680	6000	5437	2.64
Bamboo stick	5810	1200	500	2503	1.21
Sub-total	85833	63130	58390	69118	33.53
IOC@ 6% for 1 year	2574.99	1893.9	1751.7	2074	1.01
Total variable cost	174240.99	128153.9	118531.7	140309	68.07
Family labour	30568	40568	41250	37462	18.17
Land use cost	28356	28356	28356	28356	13.76
Total fixed cost	58924	68924	69606	65818	31.93
Total cost	233164.99	197077.9	188137.7	206127	100.00

Table 2. Per hectare return of lemon cultivation (Figure in Tk.).

Particulars	1st Year	2nd year	3rd Year	Average
Yield (kg)	26586	28170	30240	28332
Price (Tk./kg)	25	26	27	26
Gross return	671562.36	739462.5	822528	744517.62
Total variable cost (TVC)	174240.99	128153.9	118531.7	140308.86
FC	58924	68924	69606	65818
Total cost (TC)	233164.99	197077.9	188137.7	206126.86
Gross margin	364339.41	486600.38	512625.23	454521.67
Net return	438397.37	542384.6	634390.3	538390.75
BCR	2.88	2.55	2.70	2.71

Table 3. Supply chain of lemon cultivation.

Major supply chain	% of product flow	Rank
Farmer>Faria>Bepari>Arathder (local)>Arathdar (city)>Retailer> Consumer	40	I
Farmer>Bepari (local)> Bepari (City)>Retailer> Consumer	18	III
Farmer> Faria>Paiker> Retailer> Consumer	20	II
Farmer> Paiker> Retailer> Consumer	12	IV
Farmer> Retailer> Consumer	10	V

Table 4. Margin (NM) and value add of different intermediaries of Binalebu-1 (Tk/qt.).

Particulars	Sale price	Purchase price	Gross margin	Marketing cost	Net margin
Farmer	2600	-			
Faria (Tk/ton)	2850	2600	250	115	135
Bepari	3150	2850	300	205	95
Paiker	3380	3150	230	175	55
Arathder	3600	3380	220	181	39
Retailer	3880	3600	280	125	155

Table 5. Problems of Binalebu-1 cultivation.

Problems	% of respondent	Rank
Lack of capital	58	I
Lack of sapling	20	V
High price of sapling	40	III
Insect/pest infestation	45	II
Lack of adequate market facilities	26	IV

Conclusion

Lemon or Binalebu-1 cultivation is profitable. The average benefit cost ration is 2.71. The highest cost was found in the first year and the lowest cost was in the 3rd year. The highest yield was found in the 3rd year and the lowest yield was in the first year. The highest net return was found in the 3rd year and the lowest yield was in the first year. The highest product flow was in Channel I i.e., 40%. It was revealed from the study that the value addition of the Faria, Bepari, Paiker, Arathdar, Retailer were Tk.135, Tk.95, Tk.55, Tk.39 and, Tk155 per quintal, respectively. Among the constraints the highest was for lack of capital in producing Binalebu-1 cultivation.

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REFERENCES

Ahmed, F., Zareen, M., Khan, M. R., Banu, C. P., Haq, M. N., & Jackson, A. A. (1998). Dietary pattern, nutrient intake and growth of adolescent school girls in urban Bangladesh. *Public Health Nutrition*, *1*(2), 83-92.

Bony, Z. F., Rahman, M. A., Al Riyadh, Z., Saha, S. R., & Zakaria, M. (2021). Productivity and Profitability Assessment of Lemon Based Agroforestry Systems in Bangladesh. *14*(2), 42-49

Bangladesh Institute of Nuclear Agriculture. Retrieved from http://bina.portal.gov.bd/ Accessed on 9 December, 2022

Dillon, J. J., & Hardaker, J. B. (1993). Farm Management Research for small Farmer development, Agricultural Services Bulletin, 41, FAO, Rome.

Hasan, S., Haque, M. E., Afrad, M. S. I., Alam, M. Z., Hoque, M. Z., & Islam, M. R. (20_{21a}). Pest risk analysis and management practices for increasing profitability of lemon production. *Journal of Agriculture and Ecology Research International*, *22*(1), 25-35.

Hasan, S., Haque, M. E., Afrad, M. S. I., Alam, M. Z., Hoque, M. Z., & Islam, M. R. (2021_b). Influences of socio-economic factors on lemon pest management practices in Tangail district of Bangladesh. *South Asian Journal of Social Studies and Economics*, *10*(3), 59-67.

Hels, O., Kidmose, U., Larsen, T., Hassan, N., Tetens, I., & Haraksingh Thilsted, S. (2003). Estimated nutrient intakes and adequacies in Bangladesh change when newer values for vitamin A, iron and calcium in commonly consumed foods are applied. *International Journal of Food Sciences and Nutrition*, *54*(6), 457-465.

Julia F. Morton (1987). "Lemon in Fruits of Warm Climates". Purdue University. 160– 168

Khan, M. R., & Ahmed, F. (2005). Physical status, nutrient intake and dietary pattern of adolescent female factory workers in urban Bangladesh. *Asia Pacific Journal of Clinical Nutrition*, *14*(1), 19.

Sfgate (2017). Do Lemons Provide Vitamin C Like Oranges Do? http://healthyeating.sfgate.com/lemonsprovide-vitamin-c-like-oranges-do-3508.html, access on April 9, 2017.

Ismail, M., & Zhang, J. (2004). Post-harvest citrus diseases and their control. *Outlooks on Pest Management*, *15*(1), 29-35.