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An Assessment of Productivity, Input, Operational Costs and Marketing Efficiency of Lentil in the Central Brahmaputra Valley Zone of Assam, India

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ABSTRACT

Background: Lentil is a legume crop renowned for its nutritional significance in the human diet. India accounts for approximately 1.41 million hectares under lentil cultivation, contributing nearly 20 percent of the global area and 25 per cent of total world production. Despite this, the country remains insufficient in overall pulse production, indicating the urgent need for both horizontal and vertical expansion of high yielding lentil varieties. The lentil growers of Nagaon and Hojai district of Assam face multiple risks and uncertainties influenced by biophysical and socioeconomic factors. In this context, the present study was attempted to evaluate the performance and challenges of lentil cultivation in the region, offering insights to enhance its sustainability and profitability.

Methods: The present study was carried out in 2024-25 to examine the input and operational costs, marketing efficiency of lentil crop in Central Brahmaputra Valley Zone of Assam, India covering 200 lentil growers in Nagaon and Hojai district by using multistage random with the help of interview method of data collection where different operational cost and marketing efficiencies and correlation between inputs and yield were measured.

Result: Under Central Brahmaputra Valley Zone, at Raha block preparatory cost of lentil field was significantly higher (3435/ha) as compared to others blocks of Nagaon and Hojai district It is seen that highest cost was incurred in seed cost at Kampur (34350) block followed by Raha block (33000/ha) of Nagaon district. However, the rest blocks in Nagon and Hojai are on par. Four marketing channels of the lentil from producer (farmers) to the consumers were identified *i.e* Producer-village merchant-Commission Agent-Wholesaler-retailer-consumer. It was found that 11.50 per cent of total lentil flowed through this channel from farmer to consumer which was the longest channel. The result revealed that highest marketing cost was observed in Channel IV while highest margin was observed in Channel I. Marketing efficiency was observed 1.019, 2.955, 1.746 and 1.467 for Channel I, Channel II, Channel III and Channel IV, respectively. In case of Channel II and channel III cost incurred was almost equivalent but margin difference is high. In channel I price received farmer is highest indicating that channel I is the most efficient marketing channel without middlemen involvement.

Key words: Adoption, Economics, Lentil, Marketing constraints, Technical constraints, Trend.

INTRODUCTION

Lentil is a legume crop, renowned for its nutritional values required for our diet. Area under lentil India is 1.41 million ha which is contribution of 20 per cent of the world's total area and 25 per cent of global production. India till now not sufficient in pulse production, therefore, horizontal and vertical expansion of high yielding varieties of lentil is utmost required. Kumar and Malik (2022) analyse the compound growth rates from 1970-71 to 2016-17(CGRs) of area, production and yield of pulses in India with 0.14, 1.09 and 0.97 per cent respectively. For increasing lentil production optimum allocation of resources are required. Low energy inputs, infertile soil, fragmented land holding are the major constraints of lentil cultivation which leads to deficit in pulse production apart from some biophysical factors. Singh *et al.* (2020) revealed that due to variation in agro-climatic parameters, soil fertility, biotic stresses, socio-economic status and management practices gap, technology gap and index percentage were observed and which can be minimized by encouraging the farmers to adopt sustainable technological practices for enhancing the production and productivity of pulse crops. In Indian and Assam Farming system, pulse is an important component. But farmers are unaware about high yielding varieties of pulse especially

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lentil in Assam. Singh *et al.* (2022) revealed in their 3 years study that improved variety viz. PL-8 and IPL-316 increased the average productivity by 32.53 percent, 59.69 percent and 44.85 percent respectively and increased the net return by approximately Rs. 15,431.00. Bhowmik *et al.* (2022) assessed that lentil var. KL-320, chickpea variety NBEG-49 and field pea variety IPFD-10-12 have good potentiality and most suitable for West Bengal Region.

In the state of Assam, the area under pulse and its production are also quite low compared to other states as mentioned by Deka *et al.* (2025). It is seen that area under lentil cultivation in Nagaon district is 1753 ha having multiple risks and uncertainties. The lentil growers of Nagaon and Hojai district of Central Brahmaputra Valley Zone of Assam, India faces multiple risks and uncertainties influenced by biophysical and socioeconomic factors. Importance of lentil study in terms of production and marketing aspects is utmost necessary in Assam. Barman *et al.* (2025) stated in their study that availability is pulse is 7858 MT and demand for the same is 50247.8856 indicating deficit in the pulse in the district. To meet the deficit, pulse productivity should be increased from .632 MT/ha to 4.40 MT/ha with the help of technology backstopping, high-yielding varieties and policy interventions. Therefore, the present study was carried out to examine the input and operational costs, marketing efficiency of lentil crop in Central Brahmaputra Valley Zone of Assam, India.

MATERIALS AND METHODS

The study was conducted during 2024-25 in Central Brahmaputra Valley Zone of Assam comprising of two districts *viz.,* Nagaon and Hojai. The sampling design followed for the study was four stage stratified stage random sampling, where Central Brahmaputra Valley Zone is the first stage unit, Nagaon and Hojai were the second stage unit, villages were the third and the sample farmers were the fourth and ultimate stage of units. In Nagaon district, Puronigudam, Sologuri villages were selected for Bajiagaon block and Gahi Bhatikuri and Pachim salmara villages were selected under Raha block, Bengenaati and Sialmari villages under Pakhimoria block and Borkacharigaon and Rangaloo villages were selected under Kathiatali block. Similarly, under Hojai district, barbeel and Dakhin Jaroni villages were selected. After selection of the villages, 20 farmers from each village were selected. Thus, a total of 200 number of lentil growers were selected for the study. With the help of pretested schedule, primary where data were collected. The collected data were compiled and tabulated for the purpose of analysis. In order to get economics of lentil cultivation, different cost concept is used.

The details of cost concepts which were used in the study are as under:

Cost-A: It includes:

1. Value of hired human labour.
2. Value of hired bullock labour.
3. Value of owned bullock labour.
4. Value of tractor charges.
5. Value of seed/seedlings (both farms produced and purchased).
6. Value of manure and cakes (owned farm and purchased).
7. Value of fertilizers.
8. Value of insecticides and pesticides.
9. Irrigation charges.
10. Depreciation on farm building and implements.
11. Interest on working capital.
12. Other paid out expenses, if any.

Cost-B= Cost A + Rental value of owned land + Interest on value of owned fixed capital (excluding land).

Cost C1= Cost B + imputed value of family labour.

Cos C2= Cost C1 + 10 per cent of cost C1, as managerial charges [B].

Net returns Net return per hectare at the different costs concept was worked by deducting the respective costs from the gross returns per hectare.

Again, in order to examine marketing aspect of lentil, data were collected not only from sample cultivators but from intermediaries also. A list of all the markets in Hojai and Nagaon were obtained from farmer growers. Four marketing channels were identified. From each selected market channel, 10 numbers of wholesalers, commission agent, village merchant, retailer were selected, thereby constituting 40 intermediaries in the study, where marketing efficiency and price spread were calculated.

Market efficiency = Net price received by producer + total marketing cost + total margins of intermediaries.

RESULTS AND DISCUSSION

Many factors affected the yield of lentil under the study area. The following factors are listed as mentioned.

Operational cost

Tillage cost for preparatory

From Table 1, it is clearly revealed that in Raha block, the preparatory cost of lentil field was significantly higher (Rs.3435.00/ha) as compared to others blocks of Nagaon and Hojai district. This might be due to poorly drained soil, requiring more tillage than other blocks. Priya *et al.* (2022) also stated that because of a greater number of cultural operations and labour charges leading to higher cost of cultivation with chickpea and oats fodder (2:1) than other intercropping method.

Irrigation before sowing

In Raha block, pre-sowing irrigation cost is higher at Rs.345.00/ha among the other blocks of study area followed by Kathiatali, Pakhimori, Lanka and Bajiagaon at Rs.310.00/ha, Rs.250.00/ha, Rs.255.00/ha and Rs.210.00/ha respectively indicating all were on par with each other. Bajiagaon block (Rs.210.00/ha) need less irrigation cost before sowing which might be due to flat area in the lentil field which retain moisture resulting in less cost involvement.

Table 1: Operational Cost incurred in the production of lentil in Central Brahmaputra Valley zone.

District	Block	Preparatory tillage (Rs/ha)	Irrigation before sowing (Rs/ha)	Sowing (Rs/ha)	Fertilizer application (Rs/ha)	Manual hoeing (Rs/ha)	Harvesting (Rs/ha)	Threshing (Rs/ha)	Transportation charges (Rs/ha)
Nagaon	Raha	3435	345	1098	3780	210	4450	4234	255
	Kathiatali	3056	310	1100	3500	215	4567	4327	321
	Bajiagaon	2976	210	1240	3200	198	4326	4437	345
	Pakhimoria	2930	250	1159	3980	155	4489	4980	445
	Pooled	3099.25	278.75	1149.25	3615.00	194.50	4458.00	4494.5	341.5
Hojai	Lanka	2950	255	1234	3978	154	4321	4876	298

Table 2: Correlation between inputs and yield.

Input used	Yield
Seed quantity	0.005
FYM quantity	0.243**
DAP (kg/ha)	0.018
Irrigation	0.181*
Chemical weeding	0.015
Manual weeding	0.457**
Insecticide	0.014

*Significant at P= 0.05 level; **Significant at P = 0.0001 level.

Cost of sowing

The cost of sowing is highest at Bajiagaon block (Rs.1240.00/ha) than Raha, Kathiatali and Pakhimoria blocks of Nagaon district but on par with Lanka block (Rs.1234.00/ha) of Hojai district. In Bajiagaon block, sowing cost is highest might be due to labour availability and wage rate which significantly increase the cost of sowing.

Fertilizer application, manual hoeing

Fertilizer application was highest in Pakhimoria followed by Raha, Kathiatali and Bajiagaon respectively. This might be due to input availability and improper agricultural practices prevails in those areas, where extension services might be needed to reduce cost and increase efficiency. But among all blocks of Nagaon and Hojai district, at Pakhimoria block, manual hoeing is lowest (Rs.155.00/ha).

Harvesting, threshing and transportation cost

The harvesting cost was higher at Nagaon district (Rs.4458.00/ha) than Hojai district (Rs.4321.00/ha). Among all blocks of Nagaon district, harvesting cost was highest at Kathiatali block (Rs.4489.00/ha) followed by Pakhimoria (Rs.4489.00/ha), Raha (Rs.4450.00/ha) and Bajiagaon (Rs.4326.00/ha) respectively. It was estimated that threshing cost was higher at Hojai district (Rs.4876.00/ha) than Nagaon (Rs.4494.50/ha). Similarly, transportation charges also higher in case of Pakhimoria (Rs.445.00/ha) block than the other blocks.

Input cost and correlation between input and yield

Independent variable cost is presented on Table 3 and it is seen that highest cost was incurred in seed cost at Kampur block (Rs.34350.00/ha) followed by Raha block (Rs.33000.00/ha) in Nagaon district. However, the rest blocks in Nagon and Hojai were on par. Similarly, cost of fertilizer application and seed treatment were on par in all the blocks with exception in Kathiatali block in cost of fertilizer and its application which was lowest (Rs.778.00/ha). Seed cost was highest among all the independent variable and chemical weeding hoeing and manual, insecticide cost, disease cost are lowest among all independent variable. Similar results were observed in the research findings of Ghimire *et al.* (2024) and Leharwan *et al.* (2023).

Table 2 explained the correlation between dependent and independent variables. It was observed that FYM quantity, irrigation and manual weeding had positive and significant impact on yield whereas the other four independent variable *viz.,* input used, DAP (kg/ha), chemical weeding and insecticide had found insignificance impact on yield. FYM quantity (r= 0.243, P<0.05), Irrigation (r=0.181, P<0.05) and Manual weeding (r=0.457, P<0.05) had positive and significant impact on yield. Singh *et al.* (2016) conducted a study on lentil based existing cropping system and observed that in lentil-based cropping systems (B: C ratio -3.11-3.77) was economically efficient than non-lentil-based cropping system (B:C ratio -1.17 to 1.72).

Table 3 depicted the correlation between inputs and yield, where yield was found to be positively correlated with FYM quantity (r = 0.243, P<0.0001), manual weeding (r=0.181, P<0.05) and irrigation (r = 0.272, P<0.0001). It means that the lentil growers in Central Brahmaputra Valley must take care of application of FYM in their fields, irrigation and manual weeding in order to get good yield.

Fig 1 shows the distribution channel of the lentil from producer (farmers) to the consumers through different intermediaries. The channels identified were as follows:

1. Producer-consumer.
2. Producer-village merchant-retailer-consumer.
3. Producer-village merchant- Commission Agent-retailer-consumer.
4. Producer-village merchant-Commission Agent- Wholesaler-retailer-consumer.

Producer-consumer

This channel was the shortest channel which accounted for 55 percent of the total total lentil marketed. In this channel larger amount of lentil was sold to consumer.

Producer-village merchant-consumer

The study of this channel showed that 10.00 per cent of the total produced lentil flowed through this channel. The village merchants bought from the farmers and directly sold to the consumer in local market.

Producer-village merchant-commission agent-retailer-consumer

This channel showed that 23.00 per cent of the total marketed lentil flows from this channel. The village merchant purchased lentil from farmers and sold to the Commission agent and Commission agent sold to retailer and ultimately retailer sold to the consumer.

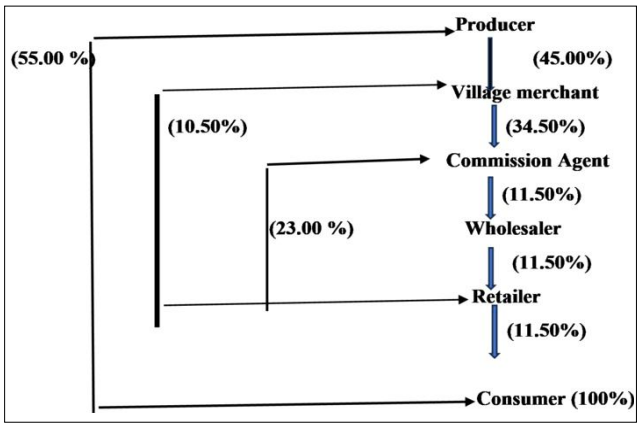


Fig 1: Marketing channel of lentil.

Producer-village merchant-commission agent-wholesaler-retailer-consumer

It was found that 11.50 per cent of total lentil flowed through this channel from farmer to consumer which was the longest channel.

The data depicted in Table 4 and Table 5 represent marketing cost, margin of different intermediaries along with price spread. It was depicted in Table 5 that Channel 1 is the best efficient channel as price spread is 0 as the difference beteen the price paid by the consumer and price received by the producer is called price spread. Price spread is different from channel to channel. The result revealed that highest marketing cost was observed in Channel IV while highest margin was observed in Channel I. Marketing efficiency was observed 1.019, 2.955, 1.746 and 1.467 for Channel I, Channel II, Channel III and Channel IV respectively. In case of Channel II and channel III cost incurred was almost equivalent but margin difference is high. In channel I, price received by the farmers are highest indicating that channel I is the most efficient marketing channel without middlemen involvement. This finding is in conformity with Singh *et al.* (2020) and Verma *et al.* (2023) that marketing channel-III (producer and processor only) was found most efficient with an efficiency of 12.03. The producers' share in consumer rupee is highest in Channel I at 81.82 per cent followed by Channel II, Channel III and Channel IV at 62.50, 57.89 and 54.46 per cent respectively.

Table 3: Input cost in lentil production in Central Brahmaputra valley zone.

Input costs (₹/ha)	Raha block	Kampur block	Bajiagaon block	Kathiatali block	Lanka block	F value	Pr>F
Seed cost/ha	33000[a]	34350	32590[b]	32060[b]	32190[b]	0.76	.996
Seed treatment cost/ha	270[a]	276[a]	278[a]	292[a]	290[a]	0.07	.987
FYM/ha	2500[a]	2543[a]	2310	2550[a]	2980	1.34	.954
Cost of fertilizer and its application	1080[a]	998[a]	1023[a]	778	980[a]	0.05	.675
Irrigation cost	105[a]	95[a]	271	165	189	0.02	.912
Chemical hoeing and weeding	45[a]	67[a]	79[a]	115	145	1.68	.768
Manual weeding cost	56[a]	74[a]	119[b]	981	109[b]	0.43	,754
Disease management cost	89[a]	104[a]	1211	119[a]	174	0.07	.954
Insecticide cost	34[a]	55[a]	58[a]	81[b]	99[b]	0.04	.990

Note: Similar alphabets are on par with each other.

Table 4: Channel wise marketing cost and marketing margin for lentil.

Marketing channel	Price received by the farmer (X/q)	Marketing cost (Y/q)	Margin (Z/q)	Producers' share in consumer rupee (%)	Marketing efficiency (ME) = X/(Y+Z)
Channel I	11000	200	10800	81.82	1.019
Channel II	6500	600	2200	62.50	2.955
Channel III	5500	700	3150	57.89	1.746
Channel IV	5500	900	3750	54.46	1.467

Table 5: Channel wise marketing cost and marketing margin for lentil (₹/quintal).

Particulars	Channel I	Channel II	Channel III	Channel IV
Price received by farmer	11000	6500	5500	5500
Charges borne by farmer	200	150	150	150
Price paid by village merchant	-	6500	6500	6500
Charges borne by village merchant	-	200	200	200
Net margin of village merchant	-	700	700	700
Price paid by commission agent	-	-	7400	7400
Charges borne by commission agent	-	-	100	100
Net margin of commission agent	-	-	1500	1500
Price paid by wholesaler	-	-	-	9000
Charges borne by wholesaler	-	-	-	250
Net margin of wholesaler	-	-	-	950
Price paid by retailer	-	7400	9000	10200
Charges borne by retailer	-	250	250	200
Net margin of retailer	-	1500	950	600
Price paid by consumer	11000	11000	10200	11000
Price spread	0	4500	4700	11000

CONCLUSION

Based on the study, it can be concluded that fertilizer application was highest in Pakhimoria followed by Raha, Kathiatali and Bajiagaon block respectively in Central Brahmaputra Valley Zone, Assam. This might be due to input availability and improper agricultural practices prevails in the study area, where extension services might be needed to reduce cost and increase efficiency. Again, result revealed that highest marketing cost was observed in Channel IV while highest margin was observed in Channel I. Marketing efficiency was observed 1.019, 2.955, 1.746 and 1.467 for Channel I, Channel II, Channel III and Channel IV respectively. In case of Channel II and channel III cost incurred was almost equivalent but margin difference is high. In channel I price received farmer is highest indicating that channel I is the most efficient marketing channel without middlemen involvement. In India, government procures lentil at MSP rate of Rs 6,425.00 per quintal and accordingly masur dal was collected from farmers through the marketing agency and to encourage and for self-sufficiency Government aimed to procure 100 per cent of tur, urad by 2028-29. There was need for government to subsidies price of seeds and to encourage more hybrid seeds that will enhance more outputs. It is seen that FYM quantity, Irrigation and manual weeding had positive significant impact on yield means that the lentil growers must take care of their application in their fields in order to get good yield.

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Disclaimers

The opinions and conclusions presented in this research article are exclusively those of the authors and do not necessarily reflect the perspectives of their affiliated institutions. While the authors have taken due care to ensure the accuracy and completeness of the information contained herein, they disclaim any responsibility or liability for any direct, indirect or consequential losses arising from the use of this content.

Informed consent

Prior to collecting data, informed consent was obtained from each of the respondents. These respondents received an explanation of the intent of the research, their freedom to decide whether or not to take part in this study, as their right to withdraw at any stage of this study. The confidentiality of the information collected was respected and used solely for research purposes. The research adhered to established guidelines for conduct of research in social sciences.

Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this article. No funding or sponsorship influenced the design of the study, data collection, analysis, decision to publish or preparation of the manuscript.

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