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Economics of lentil cultivation in Nadia district of West Bengal

S. CHATTERJEE, J. RAY, [1]R. NATH, [1]S. K. GUNRI, [2]T. BISWAS AND [3]A. SARKER

Dept. of Ag. Economics, [1]Dept. of Agronomy,[2] Dept. of Ag. Chemistry and Soil Science
Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, 741252, Nadia, West Bengal
[3]ICARDA South Asia- China Regional Program, New Delhi

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ABSTRACT

The diversification of cereal based production systems, adding legumes to the mix, is a strategy that boost nutritional and food security, improve incomes and livelihoods in rural communities of West Bengal. Lentil is one of the most nutritious cool season pulse crop in West Bengal. Lentil productivity in West Bengal is higher (762 kg ha^{-1}) compared to all India average (697 kg ha^{-1}). The economic analysis of lentil production along with identification of constraints in its way has been studied. The study was based on the data for the year 2012-13. Simple tabular analysis was carried out for calculating inputs and materials used, cost of cultivation, gross return, net return and benefit - cost ratio. Crop performance was studied through composite index score. The Garret's ranking technique was used to identify and prioritize the constraints of lentil production. Results revealed that average cost of production was ' 22479/- ha^{-1} and average gross and net return were in the tune of ' 42640/- and ' 20161/- ha^{-1} and benefit –cost ratio was 2.00 respectively. The main constraints were non availability of quality lentil seeds in time, lack of soil testing facilities, high price of seeds, lack of processing units and storage facilities disease and pest incidence and lack of credit facilities etc.

Keywords: Constraints, cost of cultivation, crop performance indices, lentil, return

The green revolution in India provided the driving force to our country to scale up agricultural productivity after seventies and eighties. It has made India self sufficient in food production as well as brought rural prosperity. Despite of achievements in the overall productivity of crop sector, it is argued that malnutrition still exists as a predominant vice in the country because of the excessive rate of population growth (Chatterjee *et al.,* 2014). In this context, sustainable agricultural development catering to the nutrition needs of the country is of prime necessity. While studying on the role of pulse production in India in the light of food and nutritional security, Shalendra *et al*. (2013) came into conclusion that in spite of impressive growth of Indian agriculture after Green Revolution, the challenge of food and nutritional security still exists due to imbalanced growth in agriculture which was biased towards wheat and rice production. In this context, Vishwajith *et al*. (2014) has also reported that in a populous developing country like India, production of pulses can play a pivotal role in nutritional security of the country as it has still been treated as poor man's meat with comparatively cheaper sources of protein in balancing human diet. It has been examined at various levels of field crop researches that the production of pulses in the recent decade has increased but not in a pace with the increase in population. To add further, it has also been pointed out that the decline in pulse consumption (15 MT in 2002-03 to 6 MT in 2011-12) leads to malnutrition which would be abolished by a well built institutional and policy support, wider adoption of HYV pulses, and adoption of low cost technologies. In this context, Singh *et al*. (2013) has also commented that farmers should be trained and aware properly about improved production technology for the overall productivity enhancement in pulses as well as nutritional security. Keeping the above views in mind, the present study attempts to analyze and work out various input used in lentil cultivation, their break-up cost components and expected returns across six major villages in Nadia district, West Bengal. The author has also tried to measure the composite crop performance scoring amongst lentil growers under different villages and to identify and prioritize the major constraints faced in lentil cultivation in this region.

MATERIAL AND METHODS

Selection of study area

The study is based on the data for the year 2012- 13. A sample of 10 households has been selected by multistage random sampling from 6 selected villages of 3 blocks making the total sample of 60 households (2 villages each from 1 block). Simple tabulation method was carried out for analyzing the materials and inputs used in lentil cultivation, its cost of cultivation, gross return, net return and benefit – cost ratio of the sample lentil growers.

Email: soumitra.soum123123@gmail.com

Cost concepts

The present study has followed the concept of costs as proposed by the Commission for Agricultural Costs and Prices (CACP), Ministry of Agriculture, Govt. of India. Here only the components of paid out cost plus imputed value of family labour have been considered for convenience in the research study. The various cost components used here are as follows:

Cost A_1: It covers all actual expenses of cash and kind incurred in production of lentil by the owner. It includes various components like:

i) Value of hired human labour (both casual and attached labour)
ii) Value of hired bullock labour
iii) Value of owned bullock labour
iv) Value of owned machinery labour
v) Hired machinery charges
vi) Value of seed (both farm produced and purchased)
vii) Value of insecticides and pesticides
viii) Value of manure (owned and purchased)
ix) Value of inorganic fertilizer
x) Depreciation on implements and farm buildings
xi) Irrigation charges
xii) Land revenue, cesses and other taxes
xiii) Interest on working capital
xiv) Miscellaneous expenses (Artisans etc.)

Cost A_2: Cost A_1 + Rent paid for leased-in-land

But, Cost A_2 = Cost A_1 (as, there is no leased- in- land for the sample farmers under the study)

Final cost = Cost A_1 + FL

Where, FL signifies the imputed value of family labour that has been taken in consideration for marginal and small farming community who has no capacity to hire labour from outside. So, cost A_1 + FL includes the realistic cost and that has been considered as the final cost for this research study. However, cost B1, B2 includes rental value of own land and operational cost of land with interest on own fixed capital, which has not been considered realistic for this study.

Net return= Gross return- Cost of cultivation

Benefit- cost analysis

For measuring the production efficiency of lentil amongst the lentil cultivators, benefit cost ratio worked out as follows

$$\text{Benefit cost ratio} = \frac{\text{Gross return from sale of output}}{\text{Total cost of input used}}$$

Methodology for performance indices

The criterion for judging the farmer-wise performance index scoring on lentil cultivation has been worked out by aggregating four indicators with due weight to individual indicator. The process is better known as *computing a composite index*. These indicators are: (a) total operational size of the holding, (b) area under lentil cultivation, (c) level of lentil productivity and (d) return per rupee of investment. The procedure for computing a composite index follows two steps:

Step I: Transformation of the original variable to a new one.

Let $X_{ij\#}$ denotes the value of ith indicator for j^{th} village (#). Then we can define a new variable $Y_{ij\#}$ such that

$$Y_{ij\#} = \{X_{ij\#} - \text{Min}(X_{ij\#})\} / \{\text{Max}(X_{ij\#}) - \text{Min}(X_{ij\#})\}, \ldots\ldots(1)$$

where, Max ($X_{ij\#}$) and Min ($X_{ij\#}$) denote the maximum and minimum values of i^{th} indicator for j^{th} village. Value of the newly transformed variable ($Y_{ij\#}$) varies from zero to one. This step is followed for other indicators (m-1) of the j^{th} village for lentil.

Step II: Aggregation of the newly transformed indicators for the j^{th} village as:

$$Y_{j\#} = \sum_{i=1}^{m} w_i Y_{ij\#} \ldots\ldots\ldots\ldots\ldots\ldots(2)$$

where, w_i ($0<w_i<1$ and $w_i = 1$) are arbitrary weights. The calculation of weight is done as follows:

$$w_i = K/(\text{Var}(Y_{ij\#}),$$

$$\text{where } K = \{\sum_{i=1}^{m} (1/(\text{Var}(Y_{ij\#})\}^{-1} \quad ..(3)$$

Each indicator has been assigned to a weighted transformed indicator where a value K has been assigned in such a manner as the inverse of the sum of inversed variance of the original indicator. Finally the weight has been assigned as inverse variance of the original variable ($Y_{ij\#}$) multiplied by K. The entire methodology of calculating weighted composite scoring has been followed from the work of Ludovic *et. al.* (1984).

Garrett's ranking technique

Garrett *et al.* (1969) have proposed a ranking technique method and that has been further used by Rangaswamy *et al*. (2007) to prioritize the major constraints faced by the co-operative and private dairy plants in Tamil Nadu. However, the same technique was used in this study to prioritize the major constraints and problems faced by the lentil growers. According to this technique, the respondents were asked to assign ranks to different problems using the following formula.

Table 1: Frequency distribution of sample farmers raising lentil in Nadia district of West Bengal

Sl. No.	Selected villages in Nadia district	No. of farmers
1.	Panpur	10
2.	ChapraDhantala	10
3.	Mollapara	10
4.	Bayre Sonakhali	10
5.	Hemayetpur	10
6.	Rautari	10
	Total	**60**

Table 2: Materials and inputs used per hectare in lentil cultivation in Nadia district of West Bengal

Components	Name of the villages						
	Mollapara	**Rautari**	**Bayer Sonakhali**	**Panpur**	**Chapra Dhantala**	**Hemayetpur**	**Pooled**
Seed (kg)	31.00	30.00	28.20	28.93	44.50	30.00	32.11
Fertilizer (kg nutrient)	72.32	63.64	28.34	61.82	86.35	71.91	64.06
Organic manure (q)	0.00	0.00	0.00	0.00	1.05	0.00	0.18
Bullock labour(pair hour)	10.67	8.00	27.00	5.14	11.25	20.63	13.78
Human labour (man hour)	537.33	438.00	804.00	469.71	576.00	540.00	560.84
Machine hour	17.33	15.00	13.50	16.29	24.00	15.00	16.85

Table 3: Mean cost of cultivation per hectare for selected lentil growers in Nadia district of West Bengal

Components	**Sample lentil growers of the selected villages**						
Cost A_1 (Materials and input cost)	**Mollapara**	**Rautari**	**Bayer Sonakhali**	**Panpur**	**Chapra Dhantala**	**Hemayetpur**	**Average**
Seed	2049.00	2070.00	1945.80	1996.07	3070.50	2070.00	2200.23
Fertilizer	2809.17	2456.25	1323.00	2873.57	2953.88	2859.38	2545.88
Organic manure	0.00	0.00	0.00	0.00	105.00	0.00	17.50
Hired machine labour	2850.00	2550.00	3375.00	3042.86	3390.00	2062.50	2878.39
Owned machine labour	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hired bullock labour	1725.00	150.00	1200.00	450.00	1875.00	2343.50	1290.58
Owned bullock labour	466.67	250.00	2400.00	321.43	375.00	3562.50	1229.27
Hired human labour	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Irrigation charges	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Insecticides	166.67	287.50	0.00	0.00	542.50	0.00	166.11
Miscellaneous	1700.00	1375.00	3663.00	1200.00	0.00	750.00	1448.00
Interest on working capital @11.75%/annum	427.78	339.00	508.52	351.93	499.61	465.56	432.07
Cost A_1	**12194.29**	**9477.75**	**14415.32**	**10235.86**	**12811.49**	**14113.44**	**12208.03**
Family labour	**10075.00**	**8212.50**	**12060.00**	**8087.14**	**13200.00**	**10125.00**	**10293.27**
Final Cost= Cost A_1+ family labour	**22269.29**	**17690.25**	**26475.32**	**18323.00**	**26011.49**	**24238.44**	**22501.30**

Table 4: Economics of lentil cultivation in Nadia district of West Bengal

Sl. No.	Lentil growers	Mean gross return (Rs. ha^{-1})	Mean cost of cultivation (Rs. ha^{-1})	Surplus over cost (Rs. ha^{-1})	Mean benefit-cost ratio
1	Panpur	23575	18323	5252	1.29
2	Chapra Dhantala	63014	26011	37003	2.52
3	Mollapara	53775	22269	31506	2.69
4	Bayre Sonakhali	27750	26475	1275	1.08
5	Hemayetpur	49350	24238	25112	2.10
6	Rautari	38377	17691	20686	2.30
	Pooled	**42640**	**22501**	**20139**	**2.00**

$$\text{Percent position} = \frac{[100\ (R_{ij} - 0.5)]}{N_j}$$

Where R_{ij} = Rank given for ith problem by jth individual, N_j = Number of problems ranked by the jth individual

The per cent position of each rank has been converted into scores by referring table given by Garrett and Woodworth (1969). Then for each problem, the scores of individual respondents were added and divided by the total number of respondents. The mean scores for all the problems were arranged in descending order and thus rank were assigned to the problems faced by the respondents.

RESULTS AND DISCUSSION

The frequency distribution of sample farmers under cultivation of lentil across the selected villages in Nadia district as well as per hectare materials and inputs used by the farm households have been illustrated in table 1 and 2 respectively. It has observed from the table 2 that, amongst all the locations, lentil growers of Chapra Dhantala exhibits highest seed and fertilizer use (44.50 kg ha^{-1} and 86.35 kg-nutrients ha^{-1} respectively).

Break-up cost components of all paid out cost including imputed value of family labour in lentil cultivation across the selected villages in Nadia district is viewed in table 3. The average cost of cultivation for one hectare of lentil turns to be ‘ 22501.30/-, however, it varies across the sample villages. The table shows that lentil growers of Chapra Dhantala village incurred maximum cost in all sorts of input use like seed, fertilizer, organic manure, hired machineries, hired bullock labour, plant protection measures and family labour use. Bayer Sonakhali has exhibited highest cost A_1 as more cost incurred in transportation and communication (Rs 3663/-) of lentil to the market. This particular village too has exerted more cost incurred for family labour use as highest man hour of labour consumption *per* hectare (804.0) was recorded in this village results in highest final cost incurred for lentil cultivation.

Table 4, represents the economics of lentil cultivation across six selected villages of Nadia district, West Bengal where the average gross return and net return from one hectare of lentil cultivation is ‘ 42640/- and ‘ 20139/- respectively. Farmers belong to Chapra Dhantala has exhibited the highest gross return (Rs 63004/-) as well as net return (Rs 37003/-) followed by Mollapara (Rs. 53775/- and Rs 31506/- respectively). Bayer Sonakhali and Panpur has shown miserable performances with a moderately low level of economic return (1.08 and 1.29 respectively). Average economic return was found to be 2.00 in the entire location under study where it features moderately high in Mollapara and Chapra Dhantala (2.69 and 2.52 respectively).

Composite crop performance scoring has been performed for each lentil growers taken under consideration. The criterion based on such scoring are the operational size of holding, area under lentil cultivation, productivity of lentil and economic return per rupee of investment. Bayre Sonakhali and Rautari have shown the highest average composite scores (0.56), ensures that there are much scope to enhance the acreage as well as productivity level of lentil in these region followed by Panpur, Chapra Dhantala and Mollapara (0.49 each) and somewhat less (0.46) in Hemayetpur. The overall average composite score was found to be 0.51 (Table 5).

Table 5: Village-wise composite crop performance scoring of lentil growers in Nadia district, West Bengal

Villages	Average composite score
Panpur	0.49
Chapra Dhantala	0.49
Mollapara	0.49
Bayer Sonakhali	0.56
Hemayetpur	0.46
Rautari	0.56
Pooled	**0.51**

Regarding problems and constraints faced by the lentil growers, six major constraints over the location was identified and prioritized. It is the non-availability of quality lentil seed material which ranked first (mean score 68.17) followed by high price level that makes the barrier for the poor farmer to use quality seed material for lentil cultivation (Table 6). Also lack of soil testing facilities in time has been identified as one of the major constraints in lentil cultivation over the study locations. Lack of suitable plant protection measures and adequate credit facilities have become also the constraints and problems identified in these locations regarding lentil cultivation.

Table 6: Garrett's ranking for various constraints faced by the lentil growers in Nadia district of West Bengal

Constraints	Mean score	Rank by order of merit
Non availability of quality lentil seeds in time	68.17	I
High price of seeds	59.76	II
Lack of soil testing facilities in time	57.56	III
Lack of processing units	40.41	IV
High pest and disease incidence at flowering time	31.46	V
Lack of credit facilities for the lentil farmers	26.18	VI

The study reveals that cultivation of lentil is the most labour-intensive. Utilization of family labour is markedly higher in comparison to that of hired labour and gainful utilization of family labour can be made possible through the cultivation of this crop. Surpluses and benefit- cost ratios are observed to be remunerative and hence encouraging to lentil growers. Average crop performance score values ensure that there is much scope to enhance the acreage as well as productivity level of lentil in these regions. However, the crisis of good seed material for the farmers has become the prime barrier for the productivity gaining of lentil in Nadia district. Location specific intense research and extension is very much needed to guide the lentil growers for their overall development.

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