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Economics of Mustard Seed Production - An Analytical Study from Terai Zone of West Bengal

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ABSTRACT

The study analysed the economics of mustard seed production to determine the cost of cultivation, technical efficiency, allocative efficiency, marketing and constraints in Terai zone of North Bengal during 2018-19. The multistage sampling technique was used to select 60 mustard seed growers. On an average 40.50 per cent of net cropped area was devoted for seed production programme. At 2018-19 prices, the Total Variable Cost of cultivation (₹/acre) was observed ₹ 20135.70 and ₹ 18923.54 respectively for seed and non seed conventional production. The net return (GI-Cost C_3) in seed production (₹ 9138.67/acre) revealed 128.56 per cent higher than conventional production practice. Based on Cost C_3, the evaluated input-output ratio for seed production examined as 1:1.32. The overall contribution of different resources in variation of income found 76.72 per cent ($R^2 = 0.7672$). The factors viz. seed, inorganic fertilizers and agrochemical revealed significant impact on money return (at 5% level each). The MVP and RUE were worked out and found positive for the resources viz. human labour, inorganic fertilizers and irrigation. In respect of marketing, although marketing efficiency was observed to be ranging from 120 to 175 per cent but producer's share in consumer rupee revealed below 65 per cent only for value addition in successive stage. Diseases and pest attack, low price of output, weed infestation, non-availability of credit and high price of inputs were the major impediments of mustard seed production.

Keywords: Economic efficiency, Marginal value product, Marketing efficiency, Mustard seed production and Resource use efficiency

INTRODUCTION

India is one of the major oilseeds growers vis-a-vis importer of edible oils also. India's vegetable oil economy is world's fourth largest after USA, China and Brazil. The oilseed accounts for 13 per cent of the Gross Cropped Area, 3 per cent of the GNP and 10 per cent value of all agricultural commodities (nmoop.gov.in). During 2017-18 with per capita consumption of edible oils is 19.30 kg/person/year and the total demand touched to 25.88 million tonnes against total domestic production 10.52 million tonnes (DAC & FW). As production and productivity of rapeseed-mustard is low at national level (Kumar *et al.*, 2016), a substantial portion of edible oil has to meet through import of palm oil mainly from Indonesia and Malaysia. India needs to produce 17.84 MT of edible oils to meet the nutritional fat needs of projected population of 1685 million by 2050 (Narayan, 2017).

Mustard accounts nearly one-third of the oil produced in India, making it the country's key edible oilseed crop after Soybean. Globally, India account for 19.29 per cent and 11.27 per cent of the total area and

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production of mustard respectively (USDA, 2013). In terms productivity, amongst ten top mustard producing countries, India took the last position (State of Indian Agriculture 2015-16) and could not hold any position among top ten mustard seed producing countries (FAOSTAT, 2018). Hence for India, the attainment of self-sufficiency in edible oils, particularly through mustard, good quality seed of suitable variety and their timely transfer to the oilseed cultivators is highly required and the usage of farm saved seed is to be reduced (Habib *et al.,* 2005). Within India, Rajasthan is the giant rapeseed-mustard growing state and alone contributes 46.08 per cent of the total mustard production but in terms of productivity Haryana and Gujrat are well ahead than other states. West Bengal occupied 5th position but in terms of productivity it ranked 8th position, much lower than national average (1304 kg/ha) (Agricultural Statistics at a glance, 2018). One of the common causes behind low yield of mustard crop in West Bengal is non-availability of quality seed and widespread throughout the state and more acute in northern part in particular (Roy, 2014). Moreover majority (91.3%) of the growers (of West Bengal) purchase seed from open market (Ghebreslassie *et al.,* 2014). This has been associated with the failure of the formal seed sector to multiply sufficient quantities of the new variety seeds and make it available to the farming communities (Rubyogo *et al.,* 2010).

To augment in situ supply of TL / Certified mustard seed a campaign was made amongst the mustard growing farmers of North Bengal to venture for seed production as an alternative choice over conventional one that ensure higher net return. The said process operates within a frame of farmer producer organization duly catered by government agencies as mentor. However, in varied investment level the success of such endeavour is finally to be established. The present study was made to discern the input output return behaviour of mustard seed production practice at farm level of North Bengal.

METHODOLOGY

The study was carried out in three districts *viz.*, Cooch Behar, Alipurduar and Jalpaiguri of Terai zone of West Bengal in 2018-19. The primary data was collected from 60 mustard seed growers using multi-stage sampling taking a district as the first-stage unit, a block as the second-stage unit, a gram panchayat (GP) as the third stage unit, a village at the fourth stage unit and mustard seed growers as the ultimate unit of sampling. The districts were selected purposively based on maximum concentration of mustard seed production. One block from each district viz. Sital Kuchi from Cooch Behar district, Alipurduar-II from Alipurduar district and Maynaguri from Jalpaiguri district were selected purposively based on maximum concentration of mustard seed growers. Again, one GP from each block and two villages from each were selected purposively based on the maximum area devoted under seed cultivation of the said crop. From each village 10 number of mustard seed growers were selected randomly. Thus a total number of 60 mustard seed growers were taken as respondent for the study. The primary data was collected with the developed schedule from respondents through personal interview method.

Descriptive statistical analyses such as mean, percentage etc. were carried out to compute cost of cultivation. The farm management analysis and related farm income measures at Cost A_1, Cost A_2, Cost B_1, Cost B_2, Cost C_1, Cost C_2 and Cost C_3 were done. The efficiency measures were also carried out to examine the resource productivity in seed production.

In order to study the resource productivity and resource use efficiency among different types of production function, Cobb-Douglas production function in logarithmic form was used given below:

$$Y = aX_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} X_5^{b5} X_6^{b6} U_1$$

The Cobb-Douglas production function was transformed into the following double log or log linear form so that it could be solved by the least square method:

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

Where, Y = production (₹/Acre), X_1 = Human labour (₹/Acre), X_2 = Seed (₹/Acre), X_3 = Organic fertilizers (₹/Acre), X_4 = Inorganic Fertilizer (₹/Acre),

X_5 = Agro-chemical (₹/Acre), X_6 = Irrigation (₹/Acre), a = constant and U_i = Error-term

The estimated coefficients of independent variables were used to compute the marginal value products (MVP) and the resources-use efficiency (RUE) was worked out using formula given by Rahman and Lawal (2003). MVP was estimated at their respective geometric mean level and MFC was taken as unit price of the factor.

RUE = MVP / MFC

Where, MVPi = $\beta_i \frac{\bar{y}}{\bar{x}_i} Py$

Where, MVPi = Marginal value product of the i^{th} input, $\bar{y}$ = Geometric mean of value of output, $\bar{x}_i$ = Geometric mean of i^{th} input, β_i = Estimated partial elasticity co-efficient of the i^{th} input and P_y = Price of output

Marketing margin of the middleman was calculated as the difference between the total payment (marketing cost + purchase price) and receipts (sale price) of the middleman and calculated as:

Ami = Pri - (Ppi + Cmi)

Where, Ami= Absolute marketing margin of i^{th} middleman, Pri = Sale price per unit, Ppi = Purchase price per unit, Cmi = Cost incurred on marketing per unit.

Marketing efficiency is the ratio of market output to marketing inputs. An increase in this ratio represents improved efficiency and decrease denotes reduced efficiency. Marketing efficiency was calculated by using Acharya's index of marketing efficiency.

This is stated as: ME = $\frac{FP}{MC+MM}$

Where, ME = Index of marketing efficiency, FP = Price received by the farmer, MC = Total marketing cost, MM = Marketing margins

The Garrett's ranking technique was used to study the opinion of farmers regarding the constraints faced by them in cultivation and marketing of mustard seed. The percent position of each rank is converted into scores by referring tables given by Garrett and Woolworth (1971). The constraint with the highest mean value was considered as the most important one and the others followed in that order. The percent position of each rank was found out by the following equation

Present Position = $\frac{100(\text{Rij} - 0.5)}{Nij}$

Where, R_{ij} = Rank given for the i^{th} constraint by j^{th} individual, N_{ij} = Number of constraints ranked by the j^{th} individual.

RESULTS AND DISCUSSION

The cost and return analysis by using standard cost concepts was done in comparative approach between seed production and conventional production practice, depicted in Table 1. The table shows that on an average the total variable cost of cultivation for seed production (₹ 20135.70) was 6.40 per cent higher than conventional mustard cultivation (₹ 18923.54). The reason might be the comparatively more use of both organic and inorganic fertilizer as well as agrochemicals to the tune of 26.67, 9.99 and 18.25 per cent, respectively in seed production process than conventional production system. However, the expenditure of purchasing of seed was 27.78 per cent higher in seed production practice. It was observed that mustard seed grower used lower quality seed in conventional production system and higher quality seed (foundation or certified seed) for seed production purpose. The major items of cost in seed production was human labour charges followed by expenditure for organic manure application, machinery charges, irrigation charges and expenditure for application of inorganic fertilizers accounting 36.76, 15.85, 13.75, 12.13 and 10.47 per cent, respectively, collectively constitute 88.96 per cent of the total variable cost of cultivation. The table also shows that out of total human labour employed, family labour constituted 53.96 per cent in both production processes. Further, the calculated fixed cost for cultivation of mustard was found ₹ 6251.86 /acre in both production processes. Accordingly, on an average, total cost of cultivation per acre estimated as ₹ 26387.56 in seed production and ₹ 25175.40 in general production process. While, the

Table 1: Analysis of cost of cultivation of Mustard (size of farm: 1 acre)

S. No.	Costs item	Seed production			Conventional production		
		Amount / number	Rate (₹/unit)	Total (₹ /acre)	Amount / number	Rate (₹/unit)	Total (₹/acre)
1.	Seed	3.45 kg	200	690	3.86	140	540.40
2.	Family labour	17	235*	3995	17	235*	3995.00
3.	Hired labour	14.5	235*	3407.50	14.50	235*	3407.50
4.	Organic fertilizers	19.76qtls	161.52	3191.64	15.60qtls	161.52	2519.71
5.	Inorganic Fertilizer (10:26:26, Urea & MOP)	51.41 kg 60.48 kg 29.06 kg	267 12	2108.74	45.81 kg 53.90 kg 29.06 kg	267 12	1917.08
6.	Plant Protection (Agro Chemical)	946 ml	1.20	1135.20	800 ml	1.20	960.00
7.	Irrigation	15.76 hrs	155	2442.80	15.76 hrs	155	2442.80
8.	Machinery labour / charges	-	-	2770.00	-	-	2770
9.	Interest on working capital. @ 8 per annum	-	-	394.82	-	-	371.05
	Total variable cost			**20135.70 (100)**			**18923.54 (100)**
1.	Rental value of own land	-	-	5445.00	-	-	5445.00
2.	Land revenue	-	-	143.82	-	-	143.82
3.	Depreciation	-	-	200.00	-	-	200.00
4.	Interest on fixed capital	-	-	463.04	-	-	463.04
	Total fixed cost			**6251.86**			**6251.86**
	Total Cost			**26387.56**			**25175.40**
	Yield (Gross return)	**4.933 qtl**	**7660**	**37786.78**	**4.499**	**6960**	**31313.04**

*235 is the average wage rate of both male and female labour
Figure in the parenthesis indicates the percentage share of the respective total

average gross return fetched from mustard seed production (₹ 37786.78 / acre) revealed 20.67 per cent higher than conventional production.

From the analysis of different cost and income measures, presented in Table 2, the per acre Cost C_3, Farm Business Income and Family Labour Income were worked out as ₹ 28648.11, ₹ 21646.08 and ₹ 15738.04 respectively in seed production and ₹ 27314.74, ₹ 16384.50 and ₹ 10476.46, respectively in conventional production process. Although the Cost C_3 found almost same but the net income (Gross income – Cost C_3) was examined 128.56 per cent higher in seed production practice than conventional production practice numerically ₹ 9138.67 in seed production and ₹ 3998.38 in conventional production. The higher level of productivity and higher market price of output in seed production were examined to be the main reasons behind it. For calculation of Cost C_3, 10 per cent cost of Cost C_2 was taken as managerial cost. In respect of technical efficiency, the input-output ratio based on Cost C_3 and total cost were observed as 1:1.32 and 1:1.43, respectively in seed production and 1:1.15 and 1:1.24 in conventional production practice. The findings were commensurate with the study of Kumar *et al.* (2017). Based on Cost C_3, the per quintal cost of production in seed production (₹ 5807.44) was 4.34 per cent lower than cost of production (₹ 6071.29) in conventional production process. Hence, an inference can be drawn that due to higher level of productivity of mustard in seed production practice than conventional production practice, the cost of production was lower in seed production although the total cost of cultivation found to be almost same in both cases. On the other hand in context to farm business

Table 2: Cost of cultivation and related income measures

Particular	Seed production (₹/Acre)	Conventional production (₹/Acre)
Cost A_1	16140.70	14928.54
Cost A_2	16140.70	14928.54
Cost B_1	16603.74	15391.58
Cost B_2	22048.74	20836.58
Cost C_1	20598.74	19386.58
Cost C2	26043.74	24831.58
Cost C_3	28648.11	27314.74
Gross Income	37786.78	31313.04
Farm Business Income	21646.08	16384.50
Family Labour Income	15738.04	10476.46
Farm Investment Income	17651.08	12389.50
Net Income (GI- Cost C_3)	9138.67	3998.30
Input Output Relationship		
On the basis of Cost C_2	1.45	1.26
On the basis of Cost C_3	1.32	1.15
On the basis of TVC	1.88	1.65
On the basis of TC	1.43	1.24
Cost C_3/qtl	**5807.44**	**6108.77**

income, family labour income, farm investment income and net income the seed production enjoyed superiority at 32.11, 50.22, 42.47 and 128.56 per cent, respectively over conventional practice.

The regression coefficients of different inputs were estimated and shown in Table 3. The table shows that elasticity of all individual input was less than unity

Table 3: Production elasticities of input factors in mustard seed production

Particular	Coefficients	t-Stat	Sig.
Log. a	14.00099***	3.697173	0.0049
X_1 (Human Labour)	0.123407	0.686133	0.5099
X_2 (seed)	-0.57016**	-2.35134	0.0432
X_3 (Organic fertilizer)	-0.35333	-1.54961	0.1556
X_4 (Inorganic Fertilizer)	0.263619**	3.672053	0.0051
X_5 (Agro-Chemical)	-0.34469**	-2.39499	0.0402
X_6 (Irrigation)	0.30725	1.01899	0.3348
R^2 0.767202			

***Significant at 1% level and **Significant at 5% level

implying decreasing marginal productivity to each input. On overall basis the coefficient for expenditure on seed (X_2), inorganic fertilizer (X_4) and agro-chemical (X_5) are significant at 5 per cent level but the contribution of seed (X_2) and agrochemical (X_5) revealed negative towards variation of output. The others variable viz. human labour, organic fertilizer and irrigation showed insignificant. Statistically insignificancy of these vital factors may be due to imbalanced use them by sample farmers. Since the coefficient of multiple determinants (R^2) revealed 0.7672 indicate that the model could explain 76.72 per cent variation of income in mustard seed production.

The allocative efficiencies of resources used in production of mustard seed were estimated and presented in Table 4. The RUE ratio indicates the potential for further use of input. The resource is said to be allocated efficiently or optimally if RUE = 1 or

Table 4: Allocative efficiency in mustard seed production

Particular	Variables					
	X_1 (Human Labour)	X_2 (Seed)	X_3 (Organic fertilizer)	X_4 (Inorganic fertilizer)	X_5 (Agro-chemical)	X_6 (Irrigation)
GM (₹)	7328.978	684.812	2959.175	2450.818	1127.24447	1888.429
byx	0.123407	-0.57016	-0.35333	0.263619	-0.34469	0.30725
Price (₹)/unit	235	200	161.52	14	120	155
MVP (₹)	144.46	-6078.94	-704.07	54.98	-1339.57	920.65
RUE	0.61	-30.39	-4.36	3.93	-11.16	5.94

GM = Geometric mean, Byx = Coefficient of input *Aggregated mean price
MVP-Marginal Value Product, RUE = Resource use efficiency

MVP = MFC. The MVP and RUE for three factors viz. human labour, inorganic fertilizer and irrigation found positive implying the positive impact towards income. But for rest others variables viz. seed, organic fertilizer and agro-chemical MVP and RUE revealed negative indicating overuse of above inputs and suggests reduction in present level of their use. From the given analysis it may be inferred that mustard seed growers are operating beyond the economic optimality in context to each of the given inputs. They also used seed rate more than optimality to compensate germination. There was no further scope to increase output of mustard seed production through use of the said factors unless there is a change in the production technology. As the MVP of three inputs viz. X_1, X_4 and X_6 showing greater than zero, therefore it indicated that further increase in use of these factors would result in to an increase in seed production and to be coupled with change in production technology. The MVP is positive and highest for the input irrigation (₹ 920.65) followed by human labour (₹ 144.46) and inorganic fertilizer (₹ 54.98). It is also observed that RUE was greater than zero only for two inputs viz. irrigation (5.94) and inorganic fertilizer (3.93) inferring that by one unit extra use these two inputs; the quantity of output would be added by 5.94 units and 3.93 units respectively.

In the study area government agricultural departments like office of the agricultural development officer, KVKs and agricultural university were the most reliable sources for the desired information and technology for quality mustard seed production. Of course, there was farmer's clubs "Registered Seed Producer Group (RSPG)" as the trusted information point for seed production technology. The farmer's club, Agricultural University and KVKs were the major sources of quality seed and more than 70 per cent seed was supplied to the seed growers by the Agricultural University and KVKs jointly. Two marketing channels were identified for marketing of output (mustard seed).

Channel I: Seed grower → RSPG → Wholesaler → Retailer → Consumer.

Chunnel II: Seed grower → RSPG → Consumer

The seed producers' used to sell their total output to RSGP who took the entire responsibility to perform the activities like cleaning, grading and all the procedures and formalities for certification of seed bought from the seed growers. From the marketing channel of mustard seed, the calculated net marketing margin was observed highest for RSGP, accounting ₹ 20.00 in channel I and ₹ 30.00 in channel II by spending same amount of marketing cost (₹ 13.40) in both channel (Table 5). The reason behind it might be that the RSGP has to perform most of the post-harvest operations and formalities to get the certification. The wholesaler placed them in 2nd position by fetching ₹ 16.50 as net marketing margin with the expenditure of ₹ 3.5 only as marketing cost in channel I. In marketing channel II, RSGP was the only

Table 5: Marketing margin and marketing efficiency of marketing channels

Marketing participants	MC (₹/kg)	Sale price (₹/kg)	Purchase price (₹/kg)	Net price (₹/kg)	Net marketing margin (₹/kg)	PSCR (%)	ME (%)
Channel-I							
Seed grower	-	76.6	-	76.6	-	54.71	120.82
RSPG	13.4	110	76.6	96.6	20		
Wholesaler	3.5	130	110	126.5	16.5		
Retailer	1.5	140	130	138.5	8.5		
Total	18.40	-	-	-	45.00		
Channel-II							
Seed grower	-	76.6	-	76.6	-	63.83	174.88
RSPG	13.80	120	76.6	106.5	30.00		

MC = Marketing Cost, ME = Marketing Efficiency, PSCR = Producer share in consumer rupee

middleman. It was also examined that the marketing efficiency of channel I and channel II was 120.82 per cent and 178.14 per cent, respectively. But from seed growers point of view the producer's share in consumer rupee was only 54.71 per cent and 63.83 per cent for channel I and channel II respectively. The main reasons might be the higher net marketing profit was taken by the middlemen in the marketing channels particularly by the RSGP.

A total twelve important constraints viz. unavailability of quality seed, weed problem, unavailability of quality fertilizers, technological problem, irrigation problems, disease and pest attack, shortage of labour in peak time, low price of output, high price of input, small holding of seed growers, non-availability of credit and inadequate storage facility for output were identified. Among twelve constraints, the disease pest attack, low price of output, weed infestation, availability of credit and high price of inputs were the major five constraints (Table 6), hindering the adoption and expansion of seed production at farmer's level. The prevailing high humid condition and mostly acidic soil might be reason of diseases and pest attack as well as high weed infestation. The impediments need to be addressed by technological breakthrough. The study of Sunita *et al.* (2016) also reported that lack of market and support price of output are one the major constraints in mustard cultivation.

Table 6: Constraint analysis of Mustard seed production (n = 60)

S. No.	Constraints	Total score	Mean score	Rank-ing
1.	Unavailability of quality seed	3233	53.88	8
2.	Weed problem	3352	55.87	3
3.	Unavailability of quality fertilizers	2979	49.65	12
4.	Technological problem	3262	54.37	7
5.	Irrigation problems	3326	55.43	6
6.	Disease and pest attack	3525	58.75	1
7.	Shortage of labour	3094	51.57	10
8.	Low price of output	3430	57.17	2
9.	High price of inputs	3332	55.53	5
10.	Small holding	3074	51.23	11
11.	Non-availability of credit	3335	55.58	4
12.	Inadequate storage facility	3143	52.38	9

CONCLUSION

The study revealed that mostly younger and educated small and marginal farmers choose the venture of mustard seed production as an alternative to their conventional practice. Both the average cost of cultivation (TVC) and productivity of seed mustard was slightly higher than conventional crop. But due to advantages in product price, the net income (based on Cost C_3) was comparatively more than double informer case. In production analysis, independent variables like seed, inorganic fertilizer and agro-chemical revealed significant at five per cent level each. In allocative efficiency point of view, the overall contribution of different resources in variation of output was 76.72 per cent ($R^2 = 0.7672$). The elasticity of all individual inputs observed less than unity implying decreasing rate of marginal productivity. The MVP and RUE examined negative for seed, organic fertilizers and agro chemical implying that these inputs were overused. In respect of marketing, share of individual seed producer farmer in consumer rupee revealed low as major portion of the profit is drawn away by registered seed producer group (RSPG) who also add value to the finished product. The major problems faced by the seed growers were disease and pest attack, low price of output, weed infestation, non-availability of credit and high price of inputs. Integrated pest-disease management system using information and communication technology, assurance of scientific warehouses, grading facilities and processing centre at village level, adequate training facilities and group approach of marketing could be an effective option to resolve the impediments.

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