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Is Organic Rice bean (*Vigna umbellata*) Farmers Economically better Off? An Empirical Analysis

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ABSTRACT

The study was conducted in North Eastern Hill (NEH) region of India during 2018-2020. Multistage sampling technique was adopted. Sikkim was selected purposively as the control state and Nagaland was selected based on the highest area and production under pulses. 60 respondents each from organic adopter and non-adopter were selected making a total sample size of 120. The growth rate in area, production and productivity at the world, India and NEH states were found to be positive. However, higher growth rate were observed for the NEH region. Significance difference was observed only on cost of fertilizers. The total cost of rice bean cultivation was lower in organic adopter by 1.71 per cent. The average yield was significantly higher for the organic adopter. The gross income and net income were also higher for the organic adopter. Organic farming was found to be more profitable and it can enhance the farmer's income. Allocative efficiency indicates that all the resources used in the region need to be increase so as to achieve the maximum potential yield and henceforth increase the returns.

INTRODUCTION

Organic farming has a significant advantage in increasing farmers' income and reducing external input cost, increasing employment opportunities and enhancing food security by increasing the purchasing power of the people (Jouzi et al., 2017). Organic farming is promoted based on the multiple benefits it provides; healthier food, improved farm environment and a contribution to the rural economy (Pretty, 2002). It has also a significant advantage in lowering the cost of cultivation (Kumar et al., 2006), higher productivity and gross return (Laxmi et al., 2017; Issaka et al., 2016) and higher net returns (Singh and Grover, 2011). In India the inherited tradition of organic farming is an added advantage, it ranks 9th in terms of world's organic agricultural land and 1st in terms of total number of producers. India's organic share of total agricultural land is 0.7 per cent (FIBL & IFOAM, 2018). The total area under organic certification was 5.71 million hectares during 2015-16 and the North Eastern Hill region (hereafter NEH) contributed about 6.53 per cent of the total area under organic certification in India (APEDA, 2017). Among the NEH region, Sikkim contributed 5.21 per cent of the organic land (since it is the organic state) and Nagaland (0.33%) respectively (APEDA, 2017).

India is the largest producer of pulse in the world producing 18.15 million tonnes with the percentage share of 22 per cent (GoI, 2018). Pulse plays an important role in Indian diet as larger part of the Indian population is vegetarian (Singh et al., 2010) and pulses constituted a richest source of protein (Singh et al., 2009) for the vegetarian diet. In India, frequency of pulses consumption is much higher than any other source of protein, which indicates the importance of pulses in their daily food habits (Singh et al., 2019). Like other Vigna species, rice bean (*Vigna umbellata*) is a multipurpose legume which are grown mainly as a dried pulse, it is

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also important as a fodder and green manure. Sometimes it is considered as neglected and underutilised (Joshi et al., 2008). In Nagaland, rice bean is an important pulse crop and the cultivation of pulses is widely followed in the state with a total area of 38.65 thousand hectares. But despite of knowing the important benefits of organic farming and pulse as a whole, no systematic attempt has been made to understand the positive effects of the system in the organic hub of India *i.e.* NEH region. Efficiency studies help in understanding the current performance and opportunities to improve the production performance of the crop.

METHODOLOGY

The study was conducted in two states of the NEH region, India. Multistage sampling technique was adopted for the study. Since Sikkim has been declared as an organic state (www.thehindu, 15 March 2019), it was selected purposively as the control state. For the control district, East Sikkim district was selected randomly. Under pulses, Nagaland stood the highest in terms of area (38.65 thousand ha) and production (44.48 MT) in the NEH region. One major producing crop under pulses was selected. Since rice bean was one of the common pulses which was widely grown by the people in the study areas rice bean was selected. Kohima district was selected purposively under rice bean as it stood highest in terms of area (820 ha) and production (940 mt) (GoN, 2017). From the control district, Martam block was selected and two villages namely upper Marchak and lower Marchak were selected randomly. From Kohima, Chiephobozou block was selected randomly out of which Dihoma and Kijumetouma villages were selected. 60 respondents each from organic adopter and non-adopter were selected thus making a total sample of 120 respondents.

Primary data were collected from the sample respondent through personal interview on a well-structured schedule comprising of land preparation, labour cost, planting cost, farm yard manure (FYM), bio-fertilizers, chemical fertilizer, machinery use, harvesting, various implements used by the respondents and yield *etc.* were collected pertaining for the agricultural year 2018-19. Simple descriptive statistics and *t* test to know the significant difference between the organic adopter and non-adopter were applied. To know the growth performance of pulse, compound annual growth rate (CAGR) for area, production and productivity of pulse were calculated using time series data of 10 years *i.e.* from 2008-2017 of total pulse crops in the world, India and the NEH region (GoI, 2018; FAOSTAT, 2018). Before calculating the growth rate, the exponential function of area, production and yield was estimated.

$\ln Y_t = A + \beta_t + u_t$

Where, Y_t = Area/production/ productivity of pulse, t =Time variable (1, 2... n) for each period, A = Constant, β_t = Regression coefficient, $u_{t=}$ Error term

Compound Growth Rate was estimated as:

r = [antilog (β) –1] X 100

Resource productivity

Specific functional form was selected based on economic criteria *i.e.,* sign and value of the estimated parameters, statistical criteria like the statistical significance of estimated parameters and co-efficient of multiple determination (R^2). Log-log production function was found to be the best fit hence it was preferred over other production function.

Functional form for the organic adopter

$Y = f(X_1,) X_2,) X_3,) X_4)$...(1)

Y = gross return, X_1 = wage of the human labour in rupee, X_2 = value of seed per hectare in rupee, X_3 = value of farm yard manure in rupee, X_4 = capital cost

In case of non-adopter,

$Y = f(X_1, X_2,) X_3, X_4, X_5)$...(2)

where, Y = gross return, X_1 = wage of the human labour in rupee, X_2 = value of seed per hectare in rupee, X_3 = value of fertilizers used per hectare in rupee, X_4 =value of farm yard manure in rupee, X_5 = capital cost

Allocative efficiency

Allocative efficiency (AE) was determined by calculating the ratio of the marginal value product (MVP) to the marginal factor cost (MFC)

AE = MVPD MFC

$MVP = MPP_i * P_y$

Where, MVP= Marginal value product, MPP_i = Marginal physical product of the i[th] input, P_y = Price of output

$MPPi = b_i \bar{Y} / \bar{X}_i$

where, b_i = Elasticity coefficient of the i[th] independent variable, $\bar{Y}$ = Geometric mean of the output, $\bar{X}_i$ = Geometric mean of the i[th] input

RESULTS AND DISCUSSION

Compound Annual Growth rate of pulses

Perusal of Table 1 revealed that at the world level the growth performance in terms of area, production and productivity were positive. The area, production and productivity increased at 2.59 per cent, 3.92 per cent and 1.31 per cent respectively over the years. Similarly, for India, positive growth rate has been observed in area, production and productivity with 2.50 per cent, 4.74 per cent and 2.18 per cent respectively. However, the growth rate of production in India (4.74%) was found to be more compared to the growth rate of the world. The NEH region also encountered a positive growth rate in area, production and productivity with the annual growth rate of 4.99 per cent, 6.24 per cent and 2.33 per cent respectively. The productivity of pulses in NEH was found to be higher than the India level, signifying the greater prospect of pulses production in the region.

Table 1. Growth Performance of area, production and productivity of pulses

	CAGR (%)		
	Area	Production	Productivity
World	2.58	3.92	1.31
India	2.50	4.74	2.18
NEH	4.99	6.24	2.33

Cost of production

Table 2 depicted the total cost incurred in rice bean production per hectare for both the organic and inorganic adopter. Human labour was found to be a major cost component out of the total cost in both the farms (organic adopter and non-adopter) constituting 81.22 per cent and 77.54 per cent respectively. The rental charges were the second major cost component followed by seeds, manure, depreciation of farm assets. Fertilizer cost constituted 5.16 per cent of the total cost for the non-organic adopter. The per cent difference in various cost components have been worked out and observed that there was 100 per cent cost saving in fertilizers for the organic adopter. Cost incurred in human labour was higher for the organic adopter (2.46%), manure (59.79%), seeds (2.34%), depreciation (0.11%) and rental charges (0.46%). The cost differences can be observed from the Table 3, where cost of fertilizer in organic rice bean production shows a significant difference over the inorganic rice bean production but the cost on human labour, manure and seeds were found to be statistically non-significant.

Table 2. Cost of rice bean Production

Particulars	Organic adopter	Non-adopter	Percent difference (over non-adopter)
Human labour (₹/ha)	24754.76 (81.22)	24160.00 (77.54)	2.46
Manures (₹/ha)	1100.79 (3.61)	688.89 (2.21)	59.79
Fertilizers (₹/ha)	0.00 (0.00)	1606.98 (5.16)	-100.00
Seeds (₹/ha)	1053.90 (3.46)	1029.78 (3.78)	2.34
Depreciation (₹/ha)	302.92 (0.99)	272.07 (0.87)	0.11
Rental charges of land (₹/ha)	3266.67 (10.72)	3251.67 (10.44)	0.46
Total cost	30479.04 (100.00)	31009.38 (100.00)	-1.71

Note: Figures in the parentheses indicates the percentage to the total

Returns

The rice bean yield was significantly higher for the organic adopter with the mean difference of 316.71 kg/ha (Table 4). The gross returns and net returns obtained by the organic adopter were higher compare to the non-adopter by ₹ 1028.67 and ₹ 720.26 but not significantly. The higher net returns for the organic adopter may be due to the lower cost incurred by them. Organic rice bean production has a higher potential in improving the economic life of the farmer as indicated by the higher net returns. Gills et al., (2021) pointed out that organic practices have more capacity of sustainability towards out that ecology, economic and social. Singh et al., (2019) also observed that organic farming based on local resources is good and profitable. It is an alternate form of agriculture which can improve their income.

Resource productivity

The resource productivity of inputs was also estimated and presented in Table 5. It was observed that for the organic adopter the labour cost (X_1) and manure (X_3) were significant at 5 per cent and 1 per cent level of significance indicating that with one per cent increase in the value of inputs, keeping other variables constant would result to an increase in the total value of production by 0.41

Table 3. Results of unpaired t test for mean difference of paid out cost

Inputs	Organic adopter	Non-adopter	Mean difference	t value
Human labour	24754.76	24160	594.76	0.3
Manure (FYM)	1100.79	688.89	411.9	1.41
Fertilizers	-	1606.98	-1606.98	4.09***
Seeds	1053.9	1177.56	-123.66	1.41
Total	26909.46	27633.42	-723.96	0.39

Note: *** indicate p<0.01

Table 4. Results of unpaired t test of returns from organic and inorganic cultivation

Particulars	Organic adopter	Non-adopter	Mean difference	t value
Yield (kg/ha)	2276.03	1959.32	316.71	2.861***
Gross income/ha	36335	35306.33	1028.67	0.505 *NS*
Net income/ha	4869.44	4149.18	720.26	0.206 *NS*

Note: *** indicate p<0.01

Table 5. Resource productivity of rice bean in NEH region

Variables	Coefficients		Standard error		p-value	
	OA	NA	OA	NA	OA	NA
Intercept	1.65	2.16	1.34	1.10	0.23	0.06
Labour	0.41**	0.59***	0.14	0.09	0.01	0.00
Seed	0.13	0.22***	0.12	0.07	0.32	0.00
Fertilizer	-	0.04	-	0.14	-	0.76
Manure	0.50***	0.01	0.12	0.06	0.00	0.82
Capital cost	0.03	0.06	0.09	0.10	0.72	0.55
R^2	74	82				

Note: ***&** indicates p<0.01 and p<0.05 respectively; OA-Organic adopter, NA- Non-adopter

Table 6. Allocative efficiency of rice bean cultivation in NEH region

Variables	Coefficients		MVP		MFC		MVC/MFC	
	OA	NA	OA	NA	OA	NA	OA	NA
Labour	0.41	0.59	57.14	68.14	1	1	57.14	68.14
Seed	-	0.22	-	30.92	-	1	-	30.92
Manures	0.50	-	63.39	-	1	-	63.39	-

Note: OA-Organic adopter, NA- Non-adopter

and 0.50 per cent respectively. The R^2 was 0.74 signifying that 74 per cent of the total variation in the return from rice bean was explained by the factors taken into consideration.

Similarly for the inorganic cultivation, variables like labour cost (X_1) and seed cost seed (X_2) were statistically significant at 1 per cent level indicating that with one per cent increase in the value of labour and seed, keeping other variables constant would result to an increase in the total value of production by 0.59 and 0.22 per cent respectively. The coefficient of multiple determinations (R^2) was 0.82 indicating that 82 per cent of the total variation in the return from rice bean cultivation were explained by the variables taken into consideration. The remaining variation might be due to others factors which were not considered in the model (Table 6).

Allocative efficiency

The allocative efficiency indicated the price response of the farmers. The allocative efficiency of less than 1 indicated the over utilization of that particular resource hence decreasing the amount or quantity use of that particular resource increase profits. The allocative efficiency of more than 1 indicated the under-utilization of that particular resource and scope in increase in its application. The allocative efficiency of 1 indicated that the resource is efficiently used and it is the point of optimum utilization of resource. Allocative efficiency ratio the NEHR was calculated for the significant inputs and are presented in Table 6. Variables labour cost, seed and farm yard manures show significant potential to use further as the efficiency ratios are greater than one for both the organic adopter and non-adopter, asserting that every additional rupee spent on these inputs would yield a return of ₹ 57.14 and ₹ 63.39 for the organic adopter while ₹ 68.14 and ₹ 30.92 for the non-adopter respectively.

CONCLUSION

The study revealed that the cost of cultivation of rice bean was lower for the organic adopter. The cost on human labour acted as one of the differentiating factors for cost differences between organic adopter and non-adopter. The yield was higher significantly for the organic adopter as compared to the non-adopter. The organic adopter was economically better off and have more resilient capacity for their livelihood indicated by their higher net profit. So far, the inputs usage is concerned there is still scope for increasing the usage of various inputs so as to increase the production and productivity of rice bean in the region. The study pointed out that the organic cultivation was a better option for the farmers in the study area. So, it is recommended that the farmers of other regions or other states within the region should also be encouraged to grow crops organically which will not only enhance their income and livelihood but minimize the environmental degradation due to non-usage of synthetic chemicals. Besides, efforts should be made from the respective state government in providing proper trainings, awareness or educating the farmers in efficient use of resources so as to enhance the production.

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