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Economic Assessment and Labour Utilization of Organic Kidney Beans and Black Gram

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ABSTRACT

The present study examined the economics, production, and labour utilization of organic kidney beans and black gram crops. The study is based on 60 organic producers of kidney beans and black gram from the Chamba district of Himachal Pradesh. Three-stage random sampling was done to collect the data from the respondents. High utilization of human labour was noticed in the case of black gram (64 human days/ha) followed by kidney beans (61 human days/ha) on the overall farm category. The total cost of cultivation of organic kidney beans and black gram per hectare was worked out to be Rs. 39,494 and Rs. 34,676 per farm, respectively. The net income per hectare was Rs. 47,704 and Rs. 23,308 respectively. Organic farming is generally profitable in both pulse crops due to premium prices. The regression analysis has revealed that the coefficient of multiple determinations (R^2) was 0.53 for organic Kidney beans and 0.55 for black gram were explained by the independent variables. Market surplus of organic kidney beans was 37.57 per cent and 45.11 per cent in black gram, while family consumption of kidney beans and black was 50.89 and 41.64 per cent on overall farms, respectively.

Key words: *Organic farming; Labour utilization; cost and return structure; regression analysis*

India is an agriculture-based country, with farming and associated sectors employing 67 per cent of the population and 55 per cent of the workforce. Agriculture provides for the fundamental requirements of India's fastest-growing population, accounting for 30% of total revenue (*Das et al, 2020*). Organic farming has been discovered to be an ancient Indian tradition that has been practiced in many rural and farming communities for millennia. With the introduction of modern techniques and a rise in population, there has been a shift away from traditional farming. While technology-induced agriculture is required for feeding the surging population, the excessive use of chemicals, fertilizers, pesticides, weedicides, and genetically modified techniques in agriculture has caused problems to all living beings on the earth (*Singh, 2021*). So, the demand for organically grown products increases (S*harma et al, 2016*) as people become more conscious of food safety and quality. Further, organic farming is environmentally sustainable and has productivity at its core, in addition to the founder's concerns for healthy soil, healthy food, and healthy people (*Kumar, 2016*). As a result, farmers are encouraged to convert their existing farms into organic farms to sustain their productivity and better livelihood (*Satyajeet et al, 2018*). Organic farming also offers a lot of potential for making profits (*Bhardwaj and Dhiman, 2019*). In India, the soil is endowed with a variety of naturally available organic nutrient supplies that help organic farming (*Adolph and Butterworth, 2002; Reddy, 2010; Deshmukh and Babar, 2015*). India has a well-established traditional farming system, astute farmers, vast grasslands, and

minimal usage of artificial fertilizers and pesticides. Furthermore, enough rainfall in the country's northeast hilly areas, where few insignificant chemicals are used for a long time, results in natural or organic fields (*Gour, 2016*). Traditional Indian farmers have a profound understanding of soil fertility and pest control based on their expertise, thorough observation, tenacity, and methods that are beneficial in increasing organic production and subsequent economic growth in India. Organic agriculture has made significant advances. In 2019, India became the world's largest organic producer and ranked 8th globally with 2.30 million hectares of organic agriculture land (*Willer et al, 2021*).

In Himachal Pradesh, the total area under organic crops was about 21,743 hectares, with 39,780 registered farmers during 2018-19. The state government promotes organic and natural farming under different schemes such as Paramparagat Krishi Vikas Yojana (PKVY), Subhash Palekar Natural Farming (SPNF), and Zero Budget Natural Farming (ZNBF). The main objective of these schemes is to increase farmers' income by reducing the share of costly synthetic fertilizers & pesticides and providing more employment to family labour by lowering the hired labour. Thus, it is imperative to study the economics of organic pulse crops and their labour utilization.

METHODOLOGY

Primary data was obtained from chosen agricultural households to meet the study's requirements. The information was gathered using well-designed survey schedules and the personal interview approach in the Chamba district of Himachal Pradesh, India, during March and April 2019. For the selection of organic farmers, a three-stage random sampling technique was used. Two blocks (Mehla and Chamba) were selected randomly in the first step. Three clusters were selected randomly from each block in the second sampling step. In the third step, 150 farmers were selected, and they cultivated organic kidney beans and black gram under Paramparagat Krishi Vikas Yojana (PKVY). 60 farmers fully adopted organic farming. Out of which 44 were marginal farmers (less than 1 hectare), and 16 were small farmers (more than 1 hectare). The Department of Agriculture, Chamba, created these organic clusters under the Paramparagat Krishi Vikas Yojana (PKVY), which stipulates that a minimum of 65 per cent of farmers in each cluster belong to the small and marginal categories, respectively (*GoI, 2017*).

Cost and Return : The cost of cultivation and profitability were calculated using different cost concepts based on the data collected. The different cost components used in the analysis were as follows.

Variable cost : It includes labour cost, seed cost, fertilizer cost, plant protection chemical cost, irrigation cost, and interest on working capital.

Fixed cost : It includes interest on fixed capital, land revenue & other taxes, and the rental value of owned land

Total cost : It includes both variable and fixed costs.

Return analysis : The following types of farm income were considered for analyzing the returns from kidney beans and black gram crops.

Gross income (GI) = Total value of the main product (Quantity of main product X price of main product)

Net returns over variable cost = Gross income - Total variable cost

Output input ratio = Gross income/ Net returns over variable cost

Regression analysis : In the present investigation, the data was compiled and analyzed. Simple statistical tools such as arithmetic mean, percentage, and ratios were used. Cobb-Douglas production function was used for estimating factors influencing total production (*Meshram et al, 2012; Shanmugasundaram et al, 2021; Verma et al, 2021*). The production function used was of the following form:

$$Y = A \prod_{i=a}^{n} X_i^{bi} \, e^{u}$$

where,

Y represents the value of productivity per hectare of organic kidney beans and black gram; Xi is the selected explanatory variable (per hectare); A is the technical efficiency parameter; bi is the coefficient of production elasticity of the respective variable at the mean level of input used and output obtained. The 'e' is an error term (*Grover and Singh, 2007*). The estimated form of the equation becomes:

$$\text{In } Y = \text{In } A + \sum_{i=1}^{n} b_1 \ln X_1 + u$$

$$\text{In } Y = \text{In } A + b_1 \ln X_1 + b_2 \ln X_2 + \ldots\ldots + b_n \ln X_n + u$$

where,

Y = Value productivity of Kidney beans & black gram (Rs./ha),
X1 = Seed cost (Rs./ha),
X2 = FYM and Vermi-compost cost (Rs./ha),
X4 = Liquid manures cost (Rs./ha),
X5 = Bio- pesticides cost (Rs./ha),
X6 = Machine labour cost (Rs./ha), and
X7 = Human labour cost (Rs./ha)

RESULTS AND DISCUSSION

Cropping pattern : The cropping pattern of the study area is given in Table 1. The net cultivated and total cropped area on an overall farm situation was estimated to be 0.6553 and 1.1263 ha, respectively. The cropping intensity was about 176, 169, and 174 per cent on the marginal, small, and overall farm categories, respectively. In the *kharif* season, on overall farm situation, cereals occupied the highest area (29.31%) followed by vegetables (11.18%), pulses (8.06%), fodder (2.56%). During the *rabi* season, among the different organic crops, the area under cereals (27.51%) followed by vegetables (13.20%), fodder (5.02%), and oilseeds (3.16%). Among the different pulse crops, the highest area was allocated for the production of black gram, followed by kidney beans and horse gram having acreage of 0.2861, .0440, 0.0425, and 0.0327 hectares, respectively. The area allocated to each crop depends upon productivity, home consumption, and market prices.

Human, bullock and mechanical labour usage : The operation-wise human, bullock, and mechanical labour usage patterns for organic kidney beans and black gram are presented in Table 2. In both the crops (kidney beans and black gram), the proportion of family labour on overall farm situation was found to be 100 per cent, respectively on marginal, small and overall farm situation. The total human labour used in kidney beans for different farm operations was estimated at 61, 62, and 61 human days per hectare on marginal, small, and overall farm situations. In contrast, the black gram was estimated at 64, 63, and 64 human days per hectare on marginal, small, and overall farms. Bullock labour and tractor/power-tiller requirement were highest in kidney beans, about 6.06 pair days/ha and 5.29 hours/ha, while in black gram, it was only 4.97 pair days/ha and 5.08 hours/ha on overall farms, respectively. In hilly areas, tractors/power-tillers and sprayers are provided to farmers at subsidized rates (*Sharma et al, 2021*). The maintenance cost of pair of bullocks was reported to be quite higher than the hiring charges of tractor/machinery (*Singh, 2019*). Therefore, to reduce the cost of cultivation, the farmers should be motivated to use mechanical power for performing land operations.

Cost of cultivation of organic kidney beans and black gram : The cost of cultivation of organic kidney beans and black gram has grown by the farmers are presented in Table 3. The total cost of cultivation of kidney beans was estimated to the tune of Rs. 39,483 per hectare, Rs. 39,508 per hectare and Rs. 39,494 per hectare on marginal, small, and overall farm situations, respectively. The

Table 1. Cropping pattern on sample farms (ha/farm)

Particular	Marginal		Small		Overall	
	Area	%	Area	%	Area	%
A. Kharif	0.3628	51.52	1.1612	50.77	0.5757	51.11
1. Cereals	0.2058	29.22	0.672	29.38	0.3301	29.31
2. Pulses	0.0601	8.53	0.1755	7.68	0.0909	8.06
i. Kidney beans	0.0204	2.90	0.0665	2.91	0.0327	2.90
ii. Black gram	0.0296	4.20	0.078	3.41	0.0425	3.77
iii. Horse gram	0.0101	1.43	0.031	1.36	0.0157	1.39
3. Fodder	0.0129	1.83	0.073	3.17	0.0288	2.56
4. Vegetables	0.0840	11.94	0.241	10.54	0.1259	11.18
B. Rabi	0.3414	48.48	1.1259	49.23	0.5506	48.89
1. Cereals	0.1916	27.21	0.6351	27.77	0.3098	27.51
2. Oilseeds	0.0234	3.32	0.0688	3.00	0.0356	3.16
3. Fodder	0.0326	4.63	0.1227	5.37	0.0566	5.02
4. Vegetables	0.0938	13.32	0.2993	13.09	0.1486	13.20
Total cropped area	0.7042		2.2871		1.1263	
Net cultivated area	0.4010		1.3545		0.6553	
Cropping intensity (%)	175.64		168.85		173.83	

Table 2. Human, bullock, and mechanical labour usage in selected pulse crops (/ha)

Particulars	Kidney beans			Black gram		
	Marginal	Small	Overall	Marginal	Small	Overall
Human labour (in days/ha)	61.05	62.34	61.39	64.33	62.63	63.88
Field preparation	13.45 (22.03)	13.44 (21.56)	13.45 (21.90)	18.48 (28.73)	17.79 (28.40)	18.30 (28.64)
FYM application	2.18 (3.57)	2.08 (3.34)	2.15 (3.51)	2.15 (3.34)	2.44 (3.90)	2.23 (3.49)
Sowing/Transplanting	10.71 (17.54)	11.28 (18.09)	10.86 (17.69)	14.57 (22.65)	14.34(22.90)	14.51 (22.71)
Org.manure application	2.29 (3.75)	1.32 (2.12)	2.03 (3.31)	3.68 (5.72)	3.21 (5.13)	3.55 (5.56)
Hand weeding	14.51 (23.77)	16.45 (26.39)	15.03 (24.48)	8.51(13.23)	10.42 (16.64)	9.02 (14.12)
Plant protection	2.51 (4.11)	1.32 (2.12)	2.19 (3.57)	1.53 (2.38)	3.21 (5.13)	1.98 (3.10)
Harvesting/picking	15.40 (25.23)	16.45 (26.39)	15.68 (25.54)	15.41(23.95)	11.22 (17.91)	14.29 (22.38)
Bullock labour (in pair days*/ha)	6.28	5.45	6.06	5.64	3.13	4.97
Tractor/Power tiller (in hours/ha)	5.09	5.85	5.29	5.31	4.46	5.08

Note: *1 day is equal to 8 hrs; Figures in parentheses indicate percentages to the total human labour in each category.

Table 3. Cost of cultivation of organic kidney beans and black gram (Rs./ha)

Particulars	Kidney beans			Black gram		
	Marginal	Small	Overall	Marginal	Small	Overall
Interest on total fixed investment	2339 (12.41)	2243 (12.28)	2313 (12.38)	2339 (12.41)	2243 (12.28)	2313 (12.38)
Depreciation	3003 (15.94)	2520 (13.80)	2875 (15.38)	3003 (15.94)	2520 (13.80)	2875 (15.38)
Land rent	13500 (71.65)	13500 (73.92)	13500 (72.24)	13500 (71.65)	13500 (73.92)	13500 (72.24)
Total fixed cost	18842 (47.72)	18263 (46.23)	18688 (47.32)	18842 (54.01)	18263 (53.56)	18688 (53.89)
Seed	6559 (31.78)	6681 (31.45)	6592 (31.68)	1763 (10.99)	1861 (11.75)	1789 (11.19)
FYM	3332 (16.14)	3806 (17.91)	3451 (16.59)	3592 (22.39)	3363 (21.23)	3525 (22.05)
Vermi-compost	260 (1.26)	234 (1.10)	254 (1.22)	203 (1.26)	319 (2.02)	231 (1.45)
Liquid organic inputs	426 (2.07)	408 (1.92)	423 (2.03)	303 (1.89)	331 (2.09)	311 (1.95)
Biopesticides measures	681 (3.30)	533 (2.51)	651 (3.13)	410 (2.56)	442 (2.79)	424 (2.65)
Labour cost	9158 (44.37)	9351 (44.01)	9209 (44.26)	9650 (60.13)	9395 (59.32)	9582 (59.93)
Interest on working capital	225 (1.09)	233 (1.10)	227 (1.09)	125 (0.78)	126 (0.80)	126 (0.79)
Total variable cost	20641 (52.28)	21245 (53.77)	20806 (52.68)	16047 (45.99)	15837 (46.44)	15988 (46.11)
Total cost (A + B)	39483	39508	39494	34889	34100	34676

Note: Figures in parentheses indicate percentages of the total cost in each category.

proportion of total variable and the total fixed cost was about 53 and 47 per cent of the total cost of cultivation on the overall farm situation, respectively. The share of the total variable cost was found to be highest on small farms than marginal farms, i.e. about 54 and 52 per cent of the total cost of cultivation, respectively. Among the variable cost constituents, the cost of human labour was highest (Rs. 9,209/ha), accounting for about 44 per cent of the total cost of cultivation, followed by seed (31.68%) and FYM (16.59%) on the overall farm situation. The contribution of other variable cost inputs ranged from 1.09 to 3.13 per cent of the total cost of cultivation on the overall farm situation.

As far as black gram was concerned, the total cost of cultivation was estimated at Rs. 34,676 per hectare on overall farm situation, whereas it was relatively higher on marginal farms (Rs. 34,888/ha) than small farms (Rs. 34,084/ha). The share of human labour in the total cost

Table 4. Return of organic kidney beans and black gram (Rs./ha)

Particulars	Kidney beans			Black gram		
	Marginal	Small	Overall	Marginal	Small	Overall
Total fixed cost	18842	18263	18688	18842	18263	18688
Total variable cost	20641	21245	20806	16047	15837	15988
Total cost	39483	39508	39494	34889	34100	34676
Gross returns	68906	67421	68510	39682	38234	39296
Net returns over variable cost	48265	46176	47704	23635	22397	23308
Output-input ratio	1.75	1.71	1.73	1.14	1.12	1.13

Table 5. The results of Cobb-Douglas production function on overall farms

Independent variables (in Rs.)	Kidney beans		Black gram	
	Coefficient	Standard error	Coefficient	Standard error
Constant (A)	3.5965*	0.0971	2.8429*	0.2470
Seed (X_1)	0.7535*	0.1499	0.0153	0.0247
FYM + Vermicompost (X_2)	0.0402	0.0369	0.0238	0.0396
Liquid manure (X_3)	0.1112	0.0575	-0.0097	0.0660
Bio-pesticides (X_4)	0.0761	0.0414	-0.0098	0.0474
Machine labour (X_5)	-0.0359	0.0416	-0.0607*	0.0215
Human labour (X_6)	-0.7593*	0.1373	0.3190*	0.0810
R^2	0.53		0.55	

Table 6. Production utilization of organic kidney beans and black gram (per cent)

Particulars	Kidney beans			Black gram		
	Marginal	Small	Overall	Marginal	Small	Overall
Family consumption	57.15	45.65	50.89	53.33	28.95	41.64
Kept for seed	7.14	10.87	9.17	6.67	5.26	5.99
Payment / gifts	-	4.35	2.37	6.67	7.90	7.26
Marketable surplus	35.71	39.13	37.57	33.33	57.89	45.11
Total production (qtl./farm)	0.14	0.46	0.23	0.15	0.38	0.21

of cultivation was highest, i.e. about 60 per cent of the total cost of cultivation, followed by FYM (about 22%) and seed (about 11%) on the overall farm situation. The proportion of the total fixed and total variable cost to the total cost of cultivation was estimated at 54 and 46 per cent, respectively, on the overall farm situation.

Return of organic kidney beans and black gram : The pattern of returns of organic kidney beans and black gram are presented in Table 4. It can be observed from the table that the gross returns were highest in the case of kidney beans Rs. 68,510 per hectare while Rs. 39,296 per hectare in case of a black gram on the overall farm situation. The analysis of data reveals that the net returns over variable cost for both crops (kidney beans and black gram) were found to be positive and was found to be highest in the case of kidney beans (Rs. 47,704/ha) while black gram was Rs. 23,308 per hectare on overall farm situation. Output-input ratio was highest in kidney beans (1.73), whereas in black gram (1.13). In marginal and small farms, almost similar results were observed in net return over variable cost and output-input ratio as compared to overall farm situations.

Regression analysis for organic Kidney beans cultivation : The coefficient of multiple determinations (R^2) was 0.53 for organic Kidney beans and 0.55 for black gram, indicating that 53 per cent of variations in the organic kidney beans yield and 55 per cent variation organic black gram was explained by the

independent variables taken together in the model. Table 2 further revealed that with one per cent increase in the expenditure of seed would increase the value productivity of organic kidney beans by 0.7535 per cent, showing a significant impact on value productivity. In contrast, human labour shows a significant but negative effect on value productivity. The regression coefficient of other variables, viz. FYM + Vermicompost, liquid manure, bio-pesticides, and machine labour has not shown any significant impact on the value productivity of the organic kidney beans.

In organic black gram, the analysis revealed that with a one per cent increase in expenditure, human labour would increase the value productivity of organic black gram by 0.3190 per cent, which shows a significant impact on value productivity, whereas machine labour leading significant but negative effect on value productivity. The regression coefficient of other variables, viz. seed, FYM + Vermicompost, liquid manures, and bio-pesticides, has not shown any significant effect on the value productivity of the organic kidney beans.

Production utilization of organic kidney beans and black gram : The production utilization of organic pulse crops on sample farms is depicted in Table 6. The results showed that the family consumption was higher in both crops (kidney beans and black gram) in the marginal farm category than in the small farm category. Family consumption percentage was high mainly due to low production than the national average per hectare. In pulse crops, the marketable surplus of kidney beans and black gram was relatively low, about 38 and 45 per cent, respectively, on the overall farm situation. The surplus pulse crops were sold in the local market.

CONCLUSION

The study examined the economic assessment and labour utilization of organic kidney beans and black gram. It revealed that the production of pulses is more profitable than from other field crops except vegetables in the study area. Seed and labour costs account for about 40 per cent and 33 per cent of the total cost of cultivation of organic kidney beans and black gram, respectively. The study also highlighted that the net returns over variable costs are double in the kidney beans as compared to the black gram. At the same time, human labour and tractor/power tiller utilization were almost similar in both crops. The input-output ratio of marginal and small farmers was 1.75 and 1.71 in kidney beans while 1.14 and 1.12 in black gram, respectively. Further, the regression analysis has shown that there is sufficient potential in spending on seed in kidney beans while human labour in black gram to enhance further the value productivity of these crops in the state. Therefore, government intervention should be improved to reduce seed costs and ensure the reasonable market price of organic produce. Besides, there is also a tremendous need to introduce labour-saving techniques to maximize productivity.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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