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Economic analysis of black gram in Washim district

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Abstract
The present study entitled "Economic Analysis of Black gram in Washim district" was undertaken in three tehsils of Washim district i.e. Mangrulpir, Karanja and Washim. The primary data were collected from selected farmers by personal interview. The information was collected regarding socio-economic characteristics of farmers, cost and returns of black gram cultivation. The data pertained for the year 2021-22. Per hectare total cost of cultivation of black gram i.e. cost 'C_3' at overall level was Rs./ha 38610.56 and it was highest in large size group i.e. Rs./ha 41428.6. Net returns at cost 'C_3' at overall level was Rs./ha 17967.84 and it was highest in large size group i.e. Rs./ha 19872.17. Input output ratio of black gram cultivation at cost 'C_3' at overall level was 1.46 and it was highest in small size group i.e. 1.50.

In case of Resource use efficiency of black gram production, at overall level, the regression coefficient of human labour (-0.2923), machine charges (0.1262), manure (-0.0340) was found to be significant. The value of coefficient of multiple determination (R^2) of estimated production function was 0.66, which indicated that about 66 percent variation in per hectare productivity of Black gram is being explained by the explanatory variables included in the function. In case of small, medium, large size groups and at overall level, human labour, bullock labour, machine hours, manures were over utilized. at overall level marginal value of product to the factor cost ratio of bullock labour, machine charges, nitrogen, phosphorous was positive and less than one whereas of human labour, manure and plant protection was negative and less than one. This indicates over utilization of these resources. Hence, there should be reduction in utilization of these resources to optimize black gram returns.

Keywords: Economic analysis, black gram, farmers

Introduction
Pulses are the important crops grown in India. The different pulses grown in the country are an integral part of subsistence farming. The different pulses play an important role in sustainable production system and household nutritional security. Pulses are edible dry seeds of plants belonging to the Leguminosae family. They are consumed in the form of whole seed, split grain, dehulled split grain and flour. Many different types of pulses are grown over the world, of these the major ones in terms of global production and consumption quantities, are the common bean, chickpea, dry pea, lentil, cowpea, mung bean, urd bean and pigeon pea. In addition, there are a large number of minor pulses that are grown and consumed in different parts of the world. They are rich in proteins and minerals, have high fibre content and low fat content, and no cholesterol. The carbohydrates in pulses are absorbed and digested slowly and thus help control diabetes and obesity. The nutritional benefits of pulses make them a valuable component of healthy food systems.

Black gram (*Vigna mungo* (L.) Hepper) is one of the important pulse crop of kharif season in our country. It belongs to the family Leguminosae and sub-family Papilionaceae. The earlier name of black gram was phaseolus mungo that has now been changed to *Vigna mungo*. Black gram is used in the form of 'dal' (whole or split, husked, and un-husked) or perched .It is used as supplementary nutritive fodder specially for milch animals. High content of lysine in urdbean makes it as a excellent complement to other food grain in terms of balanced nutrition. The protein content in black gram is about 24 percent, 1.4 percent fat, 3.2 percent mineral, 0.9 percent fiber and 59.6 percent carbohydrates.

India is the world's largest producer as well as consumer of black gram. In India during year 2020-21 the area under black gram was 4.6 million hectares while the production accounts for 24.5 lakh tonnes of Urad with an average productivity of 533 Kg per hectare (agricoop.nic.in) as compared to other pulses i.e. chickpea (813 kg/ha), pigeon pea (564 Kg/ha), lentil (625 Kg/ha), peas (895 Kg/ha), lathyrus (627 Kg/ha), and total pulses (572 Kg /ha) was low i.e. 432 Kg/ha.

North Indian plains are most preferred areas for the crop however, it may be grown from mean sea level upto an attitude of about 2000 meters.

Methodology

1. **Selection of Area:** The present study was undertaken in Washim district of Vidarbha region.
2. **Selection of tehsils:** Out of six tehsils of Washim district three tehsils were selected on the basis of highest area of black gram concentrated in last five years.
3. **Selection of villages and farmers:** In third stage, from each selected tehsil, three villages were selected randomly for the present study.
4. **Cost and returns of Black gram:** The standard cost concept i.e. cost A_1, cost A_2, cost B_1, cost B_2, cost C_1, cost C_2 and cost C_3 were used in present analysis.
5. **Gross and net returns:** Gross returns of the farmers under the present study was estimated from returns obtained by the sale of main produce and by produce.
6. **Net returns:** Net returns was computed at different costs i.e. cost A_1, cost A_2, cost B_1, cost B_2, cost C_1, cost C_2 and cost C_3 by deducting respective costs from the gross returns.
7. **Input Output ratio:** It is a ratio between the value of gross output and the cost of cultivation at different cost concepts.
8. **Resource use efficiency:** The transformation of inputs into output is described by the production function. The production function can be specified as follows,

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7)$$

$$Y = ax_1^{b_1} \times x_2^{b_2} \times x_3^{b_3} \times x_4^{b_4} \times x_5^{b_5} \times x_6^{b_6} \times x_7^{b_7}$$

Where,
Y = Yield in quintals per hectare
a = Intercept
b_1, b_2, b_3, b_4, b_5, b_6, b_7 = Partial Regression Coefficient of respective factor as follows.
X_1 = Human labour in Rs/ha.
X_2 = Bullock labour in Rs/ha.
X_3 = Machinery in Rs/ha.
X_4 = Manure in Rs/ha.
X_5 = Nitrogen in Rs/ha.
X_6 = Phosphorous in Rs/ha.
X_7 = Plant protection in Rs/ha.

Marginal value product

Marginal value product of particular resources represented the "expected addition of one unit of that resources while other inputs are held constant" to the marginal factor cost.

$$MVP = b_1 \frac{GM\ (Y_i)}{GM\ (X_i)}$$

Where,
b_1 = Elasticity of output with respect to X_i
GM (Y_i) = Geometric mean of output Y_i
GM (X_i) = Geometric mean of input X_i

Results and Discussion

Cost and returns of Black gram

Table 1: Per hectare cost of cultivation of Black gram for overall farmers (Rs./ha)

Particulars		Unit/ha	Input	Cost per input	Total cost (Rs.)	Percentage To total cost
Hired Human Labour	Male	DAYS	9.36	250.06	2340.56	4.83
	Female	DAYS	31.46	158.83	4996.79	9.51
	Total	DAYS	40.82	171.95	7019.11	14.34
Bullock Labour	Hired	DAYS	2.12	521.14	1104.81	2.86
	Owned	DAYS	2.54	456.99	1160.75	3.00
	Total	DAYS	4.66		2265.57	5.86
Machine Charges	Hired	HOURS	8.43	536.89	4525.98	11.72
	Owned	HOURS	0.00	0.00	0.00	0.00
	Total	HOURS	8.43	536.89	4525.98	12.72
Manure		TONNS.	12.06	113.10	1363.98	4.83
Fertilizer	N	Kg.	25.34	24.40	618.29	1.60
	P	Kg.	36.43	40.15	1462.66	3.76
	K	Kg.	8.79	22.98	201.99	0.52
	Total				2282.94	5.89
Seed	Cost	Kg/Rs.	14.86	93.43	1388.37	3.59
Insecticide (Plant Protection)	Cost	RS.			1495.33	3.87
Incidental charges	Cost	RS.			108.92	0.28
Repairing charges	Cost	RS.			120.26	0.31
Working capital	Cost	RS.			20563.20	53.25
Int. on working capital @ 6%	Cost	RS.			308.44	0.79
Depreciation		RS.			865.70	2.24
Land Rev. cess & other taxes		RS.			80.15	0.20
COST A_1		RS.			21817.49	56.50
Rent paid for leased land		RS.			0.00	0.00
COST A_2		RS.			21817.49	56.50
Int. on Fix. Cap. @ 10%/annum		RS.			1045.92	2.70
COST B_1		RS.			22863.41	59.21
Rental value of land		RS.			9349.59	24.91
COST B_2		RS.			32213.11	83.43
Family Human Labour	Male	DAYS	5.80	250.06	1450.34	3.45
	Female	DAYS	10.29	158.83	1437.16	4.40

	Total	DAYS	16.09	179.45	2887.50	7.85
COST C_1					25750.91	
COST C_2					35100.51	90.91
10% of Cost C2 (Managerial cost)					3510.051	9.09
COST C3					38610.56	100
Yield Per hectare	Main	QTLS.	9.06	6132.48	55560.27	
	By produce	QTLS.	2.32	438.85	1018.13	
Value Of Total Produce		RS.	11.38		56578.40	
Per qtl. Cost of main produce at Cost C3					4149.27	

It is revealed from the Table 1 that, the per hectare cost of cultivation at cost 'A_1' and 'A_2' is Rs. 21817.49, cost 'B_1' is Rs. 22863.41 and cost 'B_2' is Rs. 32213.11 whereas cost 'C_1' is Rs. 25750.91, cost 'C_2' is Rs. 35100.51 and cost 'C_3' is Rs. 38610.56 which indicates the 10 percent as a managerial cost. The major share of cost of cultivation goes towards cost 'A_1' and cost 'A_2' (56.50 percent). In cost 'A_1' and 'A_2', major share was of hired human labour i.e. 14.34 percent followed by machine charges (12.72 percent), bullock labour (5.86 percent), fertilizer (5.89 percent), manure (4.83 percent), plant protection (3.87 percent), and seed (3.59 percent). All the above inputs are cash inputs for which farmers required to pay immediately from his pocket. Cost 'B_1' contributes to 59.21 percent, cost 'B_2' contributes to 83.43 percent to the total cost i.e. cost 'C_3'. The share of family labour was 7.85 percent. Per hectare yield obtained by overall farmers was 9.06 quintal main produce with gross return of Rs. 55560.27 and by produce 2.32 quintal of value 1018.13. In case of overall size group per quintal cost of production was Rs. 4149.27.

Per hectare cost and returns of Black gram cultivation

Table 2: Per hectare cost and returns from Black gram cultivation (Rs./ha)

Sr. No.	Particulars		Size group			
			Small	Medium	Large	Overall
1	Yield (qtl./ha)	Main Produce	8.70	8.90	9.60	9.06
		By Produce	1.95	2.05	2.98	2.32
2	Price/ qtl.	Main Produce	6003.70	6163.31	6230.43	6132.48
		By Produce	398.62	418.35	499.56	438.85
3	Value of main produce		52232.19	54853.45	59812.12	55560.26
4	Value of by-produce		777.30	857.61	1488.68	1018.13
5	Total produce		53009.49	55711.07	61300.81	56578.40
6	**Cost of cultivation at**					
a)	Cost 'A_1'		20065.39	21437.93	23651.03	21817.49
b)	Cost 'A_2'		20065.39	21437.93	23651.03	21817.49
c)	Cost 'B_1'		21032.85	22478.09	24781.18	22863.41
d)	Cost 'B_2'		29287.20	31684.86	34959.26	32213.11
e)	Cost 'C_1 '		23830.16	25630.88	27484.31	25750.91
f)	Cost'C_2'		32084.52	34837.65	37662.40	35100.51
g)	Cost'C_3'		35292.97	38321.42	41428.64	38610.56
7	**Net return over**					
a)	Cost 'A_1'		32944.10	34273.14	37649.78	34760.91
b)	Cost 'A_2'		32944.10	34273.14	37649.78	34760.91
c)	Cost 'B_1'		31976.64	33232.98	36519.63	33714.99
d)	Cost 'B_2'		23722.29	24026.21	26341.55	24365.29
e)	Cost 'C_1'		29179.33	30080.19	33816.50	30827.49
f)	Cost 'C_2'		20924.97	20873.42	23638.41	21477.89
g)	Cost 'C_3'		17716.52	17389.65	19872.17	17967.84
8	**Benefit-cost ratio at**					
a)	Cost 'A_1'		2.64	2.59	2.59	2.59
b)	Cost 'A_2'		2.64	2.59	2.59	2.59
c)	Cost 'B_1'		2.52	2.47	2.47	2.47
d)	Cost 'B_2'		1.80	1.75	1.75	1.75
e)	Cost 'C_1'		2.22	2.17	2.23	2.19
f)	Cost 'C_2'		1.65	1.59	1.62	1.61
g)	Cost 'C_3'		1.50	1.45	1.47	1.46

It is revealed from the Table 2 that, at overall level average gross returns worked out to Rs. 56578.40. The net returns obtain at overall level at various costs were Rs. 34760.91 at cost 'A_1' and cost 'A_2', Rs. 33714.99 at cost 'B_1', Rs. 24365.29 at cost 'B_2', Rs. 30827.49 at cost 'C_1', Rs. 21477.89 at cost 'C_2' and Rs. 17967.84 at cost 'C_3'. This means Black gram crop appeared to be good for monitory benefits. The highest input-output ratio at cost 'C_3' was recorded in small size group i.e. 1:1.50 followed by large size group i.e. 1:1.47 and medium size group i.e. 1:1.45. At overall level the input-output ratio at cost 'C_3' was 1:1.46.

Resource use efficiency in Black gram production

Table 3: Cobb-Douglas production function for Black gram

Sr. No.	Variable	Small	Medium	Large	Overall
1	Constant (Intercept)	3.6277 (0.8465)	1.5923 (1.5463)	3.72849 (1.0732)	1.2384 (0.4355)
2	Coefficient				
a	Human labour (X_1)	0.1836 (0.1723)	-0.6925** (0.4383)	-0.3586* (0.1136)	-0.2923** (0.1296)
b	Bullock labour (X_2)	-0.1203* (0.0584)	-0.1930 (0.0857)	0.0051 (0.0976)	0.0191 (0.0488)
c	Machine charges (X_3)	0.0008 (0.0576)	0.0623 (0.0845)	-0.0506** (0.0969)	0.1262** (0.0379)
d	Manures (X_4)	-0.0814** (0.0233)	0.0514** (0.0352)	0.0424 (0.0173)	-0.0340** (0.0235)
e	Nitrogen (X_5)	(0.1133)	(0.1852)	(0.7383)	(0.0941)
f	Phosphorous (X_6)	0.1572 (0.1193)	0.0569 (0.1402)	0.1974 (0.0978)	0.1364 (0.076)
g	Plant protection (X_7)	0.0254 (0.0482)	-0.1356 (0.0874)	-0.0260 (0.1436)	-0.0234 (0.0617)
3	Coefficient of Determination (R^2)	0.56	0.65	0.78	0.66

Note: Figures in parentheses indicates standard errors
* indicates significant at 10 percent level of significance.
** indicates significant at 5 percent level of significance.
*** indicates significant at 1 percent level of significance.

At overall level, the regression coefficient of human labour (0.2923) was negative and significant at 5 percent significance level. The regression coefficient of machine charges (0.1262) was positive and significant at 5 percent significance level. The regression coefficient of manures (-0.0340) was negative and significant at 5 percent significance level. Other remaining variables found non-significant. In Cobb-Douglas production function, the regression coefficient directly shows the production function elasticity hence, bullock labour, nitrogen, phosphorous and plant protection could not influence on black gram production significantly. The value of coefficient of multiple determination (R^2) of estimated production function was 0.66, which indicated that about 66 percent variation in per hectare productivity of black gram is being explained by the explanatory variables included in the function.

Marginal value of product to factor cost ratio

Table 4: Marginal value of product at factor cost

Sr. No.	Variable	Small	Medium	Large	Overall
1	Human labour (X_1)	0.1211	-0.8136	-0.3981	-0.4731
2	Bullock labour (X_2)	-0.1466	-0.3226	0.0178	0.0653
3	Machine charges (X_3)	0.0058	0.0824	-0.0902	0.1827
4	Manures (X_4)	-0.1248	-0.2327	-0.2474	-0.2035
5	Nitrogen (X_5)	0.2571	0.0267	0.0402	0.1628
6	Phosphorous (X_6)	0.2759	0.1143	0.2958	0.2928
7	Plant protection (X_7)	0.0628	-0.2107	-0.0583	-0.402

It is observed from Table 4 that, at overall level marginal value of product to the factor cost ratio of bullock labour, machine charges, nitrogen, phosphorous was positive and less than one whereas of human labour, manure and plant protection was negative and less than one. This indicates over utilization of these resources. Hence, there should be reduction in utilization of these resources to optimize black gram returns.

Conclusions

1. Per hectare total cost of cultivation of black gram i.e. cost 'C_3' at overall level was Rs./ha 38610.56 and it was highest in large size group i.e. Rs./ha 41428.64, followed by medium size group Rs./ha 38321.42 and small size group Rs./ha 35292.97, respectively.
2. Net returns at cost 'C_3' at overall level was Rs./ha 17967.84 and it was highest in large size group i.e. Rs./ha 19872.17, followed by small size group Rs./ha 17716.52 and medium size group Rs./ha 17389.65.
3. Input output ratio of black gram cultivation at cost 'C_3' at overall level was 1.46 and it was highest in small size group i.e. 1.50, followed by large size group 1.47 and medium size group 1.45.
4. The input-output ratio which is an indicator of economic efficiency in crop production for the crop and other discussion indicated that Black gram registered a good input output ratio 1:1.46 means this is a profitable crop.
5. At overall level, the regression coefficient of human labour (-0.2923), machine charges (0.1262), manure (-0.0340) was found to be significant. The value of coefficient of multiple determination (R^2) of estimated production function was 0.66, which indicated that about 66 percent variation in per hectare productivity of Black gram is being explained by the explanatory variables included in the function.
6. In case of small, medium, large size groups and at overall level, human labour, bullock labour, machine hours, manures were over utilized.

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