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Cost, return and resources use efficiency of okra crop: A case study

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Abstract
The evaluation of production of okra crop primary data for the year 2015-16 were collected from randomly selected 100 farmers of okra growers in Meerut district of Western Utter Pradesh. The objective of the study were to identify the cost of cultivation and resource use efficiency of the cultivators in using input resources and to access the impact of geographical factors on okra production. The analysis revealed that the major item of cost incurred by the farmers was the expenditure made on labour (23.61%), the gross income increased with an increased in the farm size and net income per hectare of okra cultivation increased with an increased in the farm size except small farm. Resource use efficiency were found statically significant in case of human labours in all size of farms MVP of manure & fertilizer on small and medium farms were found less than unity indicated excess investment on this variable and return to scale is observed less than unity in all farms of Okra production.

Keywords: Okra crop, production, cost

Introduction
Vegetables may be described as those plants, which are consumed in relatively small quantities as a side dish with the staple food. Okra is one of the vegetable grown in the world in different countries like India, Nigeria, Sudan and Iran others. In the world production of okra around 62% share of okra produced in India (Horticulture at a glance 2018). Vegetable growing has assumed increased interest by the farmers during the last few decades with the commercialization of agriculture okra is cultivated throughout India for its immature fruits which are generally cooked as vegetable. Okra soups and stews are also popular dishes. When ripe, the black or brown white eyed seeds are sometimes roasted and used as substitute for coffee. The crop is used for the extraction of the fibre. The fruits also have some medicinal value. Okra crop is grown all over India. Among the most important states only four U.P., Maharashtra, M.P. and Tamil Nadu account three fourth of total area 544 M Ha and production 6494 MT with the productivity of 12 t/ha. An attempt was made here to collect primary data and analyse it to find out certain special features which would reveal a broad picture of cost of production, profit, income and resource use efficiency from okra and put forth suggestion to overcome them (Agriculture statistics at a glance 2022).

Methodology
The paper is mainly based on primary data collection for the study (Sangwan and Gagandeep 2015). Study is conducted Meerut district of Uttar Pradesh. The simple random technique used for selection of block, villages and respondents. From the 12 blocks of selected district, one block namely Kharkhoda having highest area under Okra crop was selected purposively and a list of all the villages falling under selected block was prepared and arranged in ascending order according to area covered by okra crop and 5 villages were selected randomly from the list and 100 respondent were selected randomly by the surveyor, a separate list of okra growers of selected five villages were prepared along with their size of holdings. Thus the farm holding categorized into three size groups. i.e. (1) Marginal: Below 1.0-hectare, (2) Small: 1.0 to below 2.0 ha and (3) Medium: 2.0 to 4.0 ha.

Analytical tool

Cost of cultivation and returns from okra cultivation were estimated using standardized CACP cost concept.

Costs concepts

Costs A1

1. Value of hired labour
2. Value of bullock labour (hired + owned)
3. Machinery charges
4. Value of seed
5. Value of FYM and fertilizer
6. Irrigation charges
7. Plant protection
8. Interest on working capital

Cost B_1: cost A_1 + imputed on value of owned fixed capital assets (excluding land).

Cost B_2: cost B_1 + rental value of owned land less land revenue

Cost C_1: cost B_1 + imputed value of family labour.

Cost C_2: cost B_2 + imputed value of family labour.

Cost C_3: cost C_2 + 10% of cost C_2 (managerial cost).

Cobb-Douglas Production Function

To study the effect of various independent variables on the dependent variables, various forms of production function were explored. However, Cobb-Douglas production function, elasticity of production and return to scale, was found to be best fit for the analysis of data.

The mathematical form of Cobb-Douglas function (power function) is as follows:

$$Y = ax_1^{b_1}.x_2^{b_2}.....Xn^{bn}$$

Where,

Y = Dependent variable (output value in rupees/hectare)

X_1 = i^{th} independent variable (input value rupees/hectare)

a = Constant

b_1 = Production elasticity with respect to $X_{i's}$

The value of the constant (a) and coefficient (bi) in respect of independent variable in the function have been estimated by using the method of least square. The Cobb-Douglas production function in log form is as follows:

$$\text{Log } Y = \log a + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + \ldots\ldots + u \log e$$

Where,

Y = Value of gross returns of crops (Rs./ha)

X_1 =Expenditure on human labour (Rs./ha)

X_2 =Expenditure on seed (Rs./ha)

X_3 =Expenditure on manures and fertilizers (Rs./ha)

X_4 =Expenditure on plant protection (Rs./ha)

a = Intercept

b_i: (j = 1, 2……4) are the elasticity coefficient of the j^{th}

Marginal Value Product (MVP)

The marginal value of product Inputs were estimated by following formula:

$$(MVP)\ X_j = b_j \frac{\overline{Y}}{\overline{X}_j}$$

Where,

b_j = Production elasticity with respect to X_j

Y = Geometric mean of the dependent variable Y

X_j = Geometric mean value of X_j

MVP = Marginal value product of j^{th} input, significance test of the simple regression coefficient.

Having estimates of the elasticity coefficients, it is desirable to ascertain the reliability of these estimates. The most commonly used 't' test was applied to ascertain whether the sample production elasticity coefficient; bj is significantly different from zero or not at some specified probability level.

't' cal = b_j/standard error of b_j

If cal. 't'is greater than table value of t-distribution at (n-k-1) degree of freedom and specified probability level of significance, b_j is said to be statistically significant from zero (K is number of independent variable and n is sample size).

Result and Discussion

Economics of costs incurred in the production of okra crop depict in Table 1, that the okra is a labour- intensive crop and generate employment for livelihood of land less rural labour or tenant farmers. In the cost of cultivation of okra production is in maximum share on an average of human labour is 23.61 percent, spend on inputs like plant protection and management is maximum 13.10 percent and total working capital share of cost of cultivation is 59.22, per cent, The situation of study area near to NCR and location of vegetable market is very easy to reach due to a very good facilities of transportation so rental value of land is very high (24600 Rs/ha) 21.21 percent, on an average cost of cultivation is 115973 Rs/ha for okra crop and the maximum rupees spent on the cultivation of okra crop is by the marginal farmers.

Table 1: Per hectare input cost on different size of sample farm of Okra (Rs./ha)

S. No.	Components of investment	Cost imputed to various components			
		Marginal below 1 ha	Small 1-2 ha	Medium 2-4 ha	Overall average
1.	Human labour	28458.00 (24.10)	27258.00 (23.95)	26346.00 (22.69)	27384.00 (23.61)
a.	Family labour	26152.00 (22.15)	17368.00 (15.26)	5092.00 (4.38)	16204.00 (13.97)
b.	Hired labour	2306.00 (1.95)	9890.00 (8.69)	21254.00 (18.31)	11150.00 (9.61)
2.	Bullock labour	452.00 (0.38)	254.00 (0.22)	161.00 (0.13)	289.00 (0.24)
3.	Machinery charges	2456.00 (2.08)	2315.00 (2.03)	2127.00 (1.83)	2299.00 (1.98)
4.	Seed	9478.00 (8.02)	10248.00 (9.00)	12158.00 (10.47)	10628.00 (9.16)
5.	Manure and fertilizer	8420.00 (7.13)	8386.00 (7.37)	9367.00 (8.06)	8724.00 (7.52)
6.	Irrigation	4658.00 (3.94)	4720.00 (4.14)	3210.00 (2.76)	4196.00 (3.61)
7.	Plant protection	14657.00 (12.41)	14982.00 (13.16)	15954.00 (13.74)	15198.00 (13.10)
8.	Total working capital	68579.00 (58.08)	68163.00 (59.90)	69323.00 (59.72)	68688.00 (59.22)
9.	Interest on working capital	1464.00 (1.23)	1454.00 (1.27)	1483.00 (1.27)	1467.00 (1.26)
10.	Rental value of land	24000.00 (20.32)	24500.00 (21.53)	25300.00 (21.79)	24600.00 (21.21)
11.	Interest on fixed capital	10439.00 (8.84)	6576.00 (5.77)	6613.00 (5.69)	7876.00 (6.79)
12.	Sub-total	104482.00 (88.49)	100693.00 (88.49)	102719.00 (88.49)	102631.00 (88.49)
13.	13% cost managerial of sub-total	13583.00 (10.50)	13090.00 (10.50)	13353.00 (10.50)	13342.00 (10.50)
14.	Grand total	118065.00 (100.00)	113783.00 (100.00)	116072.00 (100.00)	115973.00 (100.00)

Measure of costs and income of Okra

Table 2 shows return on marginal small and medium farms. Main product of okra yield was calculated as on average yield 84.70 quintal per hectare. Gross income was calculated as maximum in medium farms Rs. 219361.00 Per hectare due to higher investment on H.Y.V. of seeds resulted higher productivity, and observed gross return Rs.206159.00, net income per hectare over cost a + b + c was found highest in medium farms Rs. 1103289.00 net income over cost C_1 medium farm is Rs.141942.00, and net return over cost C_2 is highest medium farm Rs.116642.00. The B.C ratio found highest in lady finger crop medium farms 1: 1.88. Cost of production per quintal of okra was computed to be with an average of Rs. 1369.00. Average input-output ratio on cost A_1, cost B_1, cost B_2, cost C_1, cost C_2 and cost C_3 were worked out and came to 1:3.82, 1:3.33, 1:2.38, 1:2.64, 1:2.00 and 1:1.77. Input-output ratio related to cost C_3 was highest on medium farms (1:1.88) In respect of cost C_2 input-output ratio (1:2.13) was highest on medium farms, Cost C_1 input-output ratio (1:2.83) was highest medium farms In respect to input-output ratio (1:2.52) of B_2 was found highest on marginal farms whereas, in Cost B_1 the input-output ratio was highest on marginal farms (1:3.63) In respect to cost A_1, Input-output ratio cost A_1, was highest on marginal farms (1:4.50).

Table 2: Measures of per hectare cost and profit of Okra (Rs. /ha)

S. No.	Particulars	Measure of farm profit			
		Marginal below 1 ha	Small 1-2 ha	Medium 2-4 ha	Overall Average
1.	Cost A_1	43891.00	52249.00	65714.00	53951.00
2.	Cost B_1	54330.00	58825.00	72327.00	61827.00
3.	Cost B_2	78330.00	83325.00	97627.00	86427.00
4.	Cost C_1	80482.00	76193.00	77419.00	78031.00
5.	Cost C_2	104482.00	100693.00	102719.00	102631.00
6.	Cost C_3	118065.00	113783.00	116072.00	115973.00
7.	Product (qt./ha)	79.21	83.05	91.86	84.70
A	Price of Product (qt./ha)	2496.00	2420.00	2388.00	2434.00
8.	Gross Income	197708.00	200981.00	219361.00	206159.00
9.	Net return over cost C_1	117226.00	124788.00	141942.00	128126.00
10	Net return over cost C_2	93226.00	100288.00	116642.00	103528.00
11.	Net income	79643.00	78198.00	103289.00	90186.00
12.	Family labour income	119378.00	117656.00	121734.00	119732.00
13.	Farm investment income	127665.00	131364.00	148555.00	136004.00
14	Farm Business Income	153817.00	148732.00	153647.00	152208.00
15.	Cost of production (Rs./q)	1491.00	1370.00	1264.00	1369.00
16	Input–Output Ratio				
A	On the basis of cost A_1	1:4.50	1:3.84	1:3.33	1:3.82
B	On the cost 'B_1' basis	1:3.63	1:3.41	1:3.03	1:3.33
C	On the cost 'B_2' basis	1:2.52	1:2.41	1:2.24	1:2.38
D	On the cost 'C_1' basis	1:2.45	1:2.63	1:2.83	1:2.64
E	On the cost 'C_2' basis	1:1.89	1:1.99	1:2.13	1:2.00
F	On the cost 'C_3' basis	1:1.67	1:1.76	1:1.88	1:1.77

Note: Figure in parentheses shows the percent to corresponding total.

Resource use efficiency

Table 3 reveals that coefficient of multiple determinations (R^2) on marginal farms accounted for 93. 25 per cent and indicating that all the explanatory variable contributing together. In the case of human labour all farms were statistically significant input factors contributed to the output significantly, and factors of production included in production process were found statistically non-significant. It can be inferred that there was no further scope for application of these input in production. Returns to scale was found to be less than unity. It is therefore, inferred that increasing all factors by one per cent simultaneously results increase of the returns by less than 1 per cent on each farm situation. marginal value productivities are positive in all size of farms and in case of manure & fertilizer on small and medium farms was found less than unity which indicated excess investment on this variable hence, there was need to decrease it, for increasing profitability of farms.

Table 4: Elasticity coefficient of the production function for Okra

Size group of farms	Production Elasticity's				Sum of elasticity's	R^2	Marginal value product of inputs /factors			
	Human Labour (X_1)	Seed (X_2)	Manure& Fertilizers (X_3)	Plant Protection (X_4)			Human Labour (X_1)	Seed (X_2)	Manure & fertilizers (X_3)	Plant Protection (X_4)
Marginal below 1 ha	0.249128** (0.076599)	0.016533 (0.046134)	0.2675* (0.0657)	0.2478 (0.2054)	0.89247	0.93254	4.28	1.54	1.57	4.24
Small 1-2 ha	0.184157** (0.073905)	0.1742* (0.0668	0.1079 (0.5590)	0.2395 (0.2481)	0.91587	0.88651	2.84	1.98	0.61	4.38
Medium 2-4 ha	0.0420527* (0.106934)	0.3898* (0.1578)	0.3955* (0.1588)	0.1292 (0.1199)	0.87624	0.81054	3.68	2.31	0.34	5.67

(Figures in parentheses show standard error of respective variable)
**1% level of significance.
*5% level of significance

Conclusion

The CACP cost concept to use calculation of cost of cultivation and Cobb-Douglas production function is used to work out the efficiencies of inputs in okra production. Primary data is collected from five villages in selected block of the Meerut district. The highest cost of cultivation in okra was observed under marginal size of sample farms mainly due to higher working capital. Overall average, cost of cultivation was worked out to be Rs. 115973.00. The gross income per hectare in okra was observed maximum under medium farms (Rs. 219361.00) Productivity on these farms was associated with better management by farmers, timely cultural operations through hired labours. On an average, gross income came to Rs. 206159.00 whereas net income was Rs. 90186.00 per hectare. Input-output ratio related to cost C_3 was highest on medium farms (1:1.88). Resources use efficiency and marginal value productivity is positively impact on the production and return to scale are observed less than unity in all cases.

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