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Economics, resource use efficiency in groundnut and contribution of important input in production

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Abstract
In this study an attempt has been made to study the economics and Resource use efficiency in Groundnut production in Amravati district of Maharashtra state. The study revealed that at overall level, the per hectare cost of cultivation of summer groundnut was worked out to Rs.73737.76. It increased with increase in size of holdings from Rs.71720.4 on small to Rs.75588.97 on medium sized farms. The study also revealed that, at overall level the output-input ratio which indicates the profitability of investment was observed to be 2.37 at Cost A, 1.48 at Cost B and 1.39 at Cost C. In this study, it was observed that the explanatory variables included in the production process have explained 73, 63, 70, and 65 percent in small, medium, large and overall level respectively. It can be seen that the contribution of human labour was highest compare to the other (i.e. 105.56 percent), this indicated excess use of input because all the values of the variables are less than one hence there should be reduction in these input for efficient groundnut production.

Keywords: Cost, returns, groundnut, resource use efficiency

Introduction
Groundnut (*Arachis hypogea* L.) is believed to be a native of Brazil (South America). It was introduced in India during first half of the sixteenth century from one of the pacific islands of China, where it was introduced earlier either from Central America or South America. In the world, area under groundnut stood at 23.95 million hectare and production at 36.45 million tonnes during 2009-10 and average yield of 1520 kg/ha in 2009-10. India has produced around 5.43 million tonnes of groundnut with area of 5.4 million ha and productivity 991 kg/ha. during 2009 - 2010. India is second largest producing country after China. (Directorate of Agriculture and Statistics, 2012) The Gujarat State is major producer of groundnut (55 lakh ha area) followed by Andhra Pradesh, Karnataka, Tamil Nadu & Maharashtra.
Amravati is one of the important district of growing groundnut in Maharashtra with area under summer groundnut cultivation 1464 ha in 2011-12. The cultivation carried in areas like Chandur Railway (85 ha. area), Tiwasa (305 ha. area), Anjangaon Surji (110 ha. area) and Achalpur (30 ha. area) are major growing areas compared to other tahsils in Amravati district. The summer cultivation area was about 900 ha. and its production was 1700 tonnes and productivity 1936 kg/ha during 2009-10. (Directorate of Agriculture and Statistics, 2012).
Regarding these implication presents study on economic of production of summer groundnut in Amravati district is undertaken with the following objectives.

Objectives
1. To study the economics of groundnut production.
2. To study the Resource productivity and Resource use efficiency in groundnut production.
3. To examine contribution of important input in production.

Methodology
The data on the cultivation of groundnut crop for the 100 farmers pertaining to 2011-2012 was collected from four selected tahsils (i.e. Tiwsa, Anjangaon Surji, Chandur railway and Achalpur) of Amravati district.
The data were collected through personal interviews, using pre-tested schedules.
The data, thus collected were subjected to tabular analysis and statistical technique like, standard cost concept, Cobb-Douglas production function and linear production function analysis.

a) Standard cost concept

Cost A: It is actual paid out cost by the cultivators in the form of cash and kind.

Cost B = Cost 'A' + rental value of land + interest on fixed capital @10 percent.

Cost C = cost 'B' + imputed value of family labour

i) Cobb-Douglas production function

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

ii) Linear production function

$$Y = a + b_1x_1 + b_2x_2 + \ldots b_nx_n$$

Where,

Y = Yield in quintals per ha.

a = Intercept

b_i (i.e. i = 1, 2, 3, 4, 5, 6, 7, 8) = Regression coefficient of respective factor as follows.

X_1 = Area in ha.

X_2 = Seed kg/ha.

X_3 = Human labour days/ha.

X_4 = Bullock pair days/ha.

X_5 = Manure in qt/ha.

X_6 = Fertilizer kg/ha.

X_7 = Plant protection charges Rs/ha.

X_8 = Irrigation charges Rs/ha.

Cobb-Douglas production function as given above was estimated for input-output data to study the combination of variables and resource productivity.

2.2 Estimation of resource used efficiency

To calculate resource use efficiency of various inputs, the marginal physical product (MPP) of these inputs was obtained by taking derivatives of production function.

The estimate production function underlying crop production enable us to evaluate the efficiency of prevent factor proportions.

The MVP is computed by multiplying the coefficients of the given resource with the ratio of the geometric means of the output to the geometric mean of given resource.

$$MVP\ (Xi) = bi\ \frac{\bar{Y}\ (Geometric\ Mean)}{\bar{Xi}\ (Geometric\ Mean)}$$

Where,

MVP = Marginal Value of Product

bi = Corresponding elasticity of Xi.

Xi (G.M.) = G.M. of ith resource

Y (G.M.) = Computed value of Y at G.M. levels of resources.

By comparing the respective input prices with their marginal values is increase or decrease the levels of use of that, particular input of products.

$$MPP = \frac{\text{Change in total physical product}}{\text{change in input level}}$$

$$MPP = \frac{\Delta Y}{\Delta X}$$

Where

ΔY = change in total physical product

ΔX = change in i^{th} input level

Results and Discussion

Per hectare cost of cultivation of summer groundnut

The cost of cultivation of summer groundnut includes the fixed cost, working cost and the cost of production mainly influenced by the relationship between outputs and inputs. The per hectare cost of cultivation of summer groundnut was worked out by using standard cost concepts. The information on item wise cost of cultivation of summer groundnut for different size groups of holding represented in Table 1.

Table 1 depicts the information regarding per hectare cost of cultivation of summer groundnut. For this different cost concepts such as cost A, cost B, and cost C are worked out and are presented in Table 1.

Table 1: Per hectare cost of cultivation of summer groundnut (Rs/ha)

Sr. No.	Particulars	Small	Medium	Large	Overall
1	Hired labour				
	Male	1704.56 (2.376)	3174.213 (4.19)	3112.77 (4.21)	2663.85 (3.61)
	Female	5483.25 (7.65)	6586.312 (8.72)	6727.15 (9.10)	6265.57 (8.50)
2	Bullock labour				
	Hired	314.845 (0.44)	94.1358 (0.12)	0.00 (0.00)	136.327 (0.18
	Owned	671.948 (0.94)	1612.114 (2.13)	1488.88 (2.01)	1257.65 (1.71)
3	Machine labour				
	Hired	3107.78 (4.33)	1533.873 (2.03)	2000.83 (2.71)	2214.16 (3.00)
	Owned	118.314 (0.16)	700 (0.93)	966.61 (1.31)	594.975 (0.81)
4	Seeds	14662.9 (20.44)	15125.46 (20.61)	15788.57 (21.36)	15192.3 (20.60)
5	FYM	3709.69 (5.17)	6337.19 (8.38)	6108.33 (8.27)	5385.07 (7.30)
6	Fertilizer				
	N	412.356 (0.57)	318.9514 (0.42)	458.981 (0.62)	396.763 (0.54)
	P	3058.97 (0.27)	2770.854 (3.67)	3575.03 (4.84)	3134.95 (4.25)
	K	130.17 (0.18)	169.3614 (0.22)	386.93 (0.52)	228.824 (0.31)
7	Irrigation charges	551.676 (0.77)	475.29 (0.63)	378.32 (0.51)	468.431 (0.64)
8	Plant protection	516.453 (0.72)	615.309 (0.81)	386.93 (0.88)	592.749 (0.80)
9	Land revenue	25 (0.003)	25 (0.003)	25 (0.03)	25 (0.03)
10	Incidental charges	237.578 (0.33)	213.67 (0.31)	183.83 (0.25)	217.695 (0.30)
11	Repairing charge	265.38 (0.37)	268.27 (0.35)	226.61 (0.31)	253.424 (0.34)
12	Interest on working capital	2159.5 (3.01)	2568.83 (3.40)	2615.21 (3.54)	2447.85 (3.32)
13	Depreciation	1125.66 (1.57)	2794.214 (3.70)	1512.194 (2.05)	1810.69 (2.46)

	Cost A	38256 (53.34)	45382.79 (60.04)	46202.06 (65.52)	43280.3 (58.69)
14	Rental value of land	16544.7 (23.07)	16370.91 (21.66)	16553.3 (22.40)	16489.6 (22.36)
15	Interest on fixed capital	10837.1 (15.11)	8958.215 (11.85)	7841.12 (10.61)	9212.15 (12.49)
	Cost B	65637.8 (91.52)	70711.92 (93.55)	70596.48 (95.52)	68982.1 (93.55)
16	Family labour charges				
	Male	4924.72 (6.87)	4202.88 (5.56)	2929.72 (3.96)	4019.11 (5.45)
	Female	1157.87 (1.61)	674.16 (0.89)	377.70 (0.51)	736.58 (1.00)
	Cost C	71720.4 (100.00)	75588.97 (100.00)	73903.91 (100.00)	73737.8 (100.00)

It could be seen from the Table 1 that at the overall level, per hectare cost of cultivation of summer groundnut i.e. cost C worked out was Rs.73737.8. At the overall level, amongst the different items of cost, the rental value of land was Rs.16489.6 (22.36 percent).

The other important items of cost were the seeds Rs.15192.3 (20.60 percent) followed by bullock labour charges Rs.1393.977 (1.89 percent), interest on fixed capital Rs.9212.15 (12.49 percent), hired human female labour charges Rs.6265.57 (8.50 percent), interest on working capital Rs.2447.85 (3.32 percent), manure Rs.8385.07 (7.30 percent), irrigation charges Rs.468.431 (0.64 percent). Machine labour, fertilizers, plant protection, land revenue and taxes, depreciation, had negligible contribution towards the cost of cultivation.

Per hectare, costs, return and input-output ratio of summer groundnut

Table 2 depicts the information regarding per hectare costs, return and Input-output ratio obtain from Groundnut cultivation by different group of farmer.

It can be seen from the table 2 at overall level the output-input ratio which indicates the profitability of investment was observed to be 2.39 at cost A. 1.50 at cost B, 1.40 at cost C. At cost C the output-input ratio was more than unity indicating thereby that the cultivation of summer groundnut was profitable when both direct and imputed costs were taken into account. Among, the size group of holdings, the output ratio at cost C was highest in small size group of holdings than that of in medium and large size group of holdings.

Table 2: Per hectare, costs, return and input-output ratio of summer groundnut

Sr. No.	Particulars	Small	Medium	Large	Overall
1	Yield				
	Main Produce (Qtl)	26.13	25.29	24.52	25.31
	By Produce (Qtl)	7.28	6.54	6.85	6.89
2	Price				
	Main Produce (Rs/qtl)	3852.91	3914.13	4066.04	3944.56
	By Produce (Rs/qtl)	555.23	574.07	563.22	564.17
3	Value of Main Produce (Rs)	100676.53	98988.34	99699.30	99836.81
	Value of by Produce (Rs)	4042.07	3754.41	3858.05	3887.13
4	Gross return (Rs)	104718.60	102742.75	103557.35	103723.94
5	Cost A (Rs)	38256.00	45382.79	46202.06	43280.28
6	Cost B (Rs)	65637.80	70711.92	70596.48	68982.06
7	Cost C (Rs)	71720.40	75588.97	73903.91	73737.70
8	Net return				
	Cost A (Rs)	66462.60	57359.96	57355.29	60443.66
	Cost B (Rs)	39080.80	32030.83	32960.87	34741.88
	Cost C (Rs)	32998.20	27153.78	29653.44	29986.24
6	Input-output ratio at				
	Cost A	2.73	2.26	2.24	2.39
	Cost B	1.59	1.45	1.46	1.50
	Cost C	1.46	1.35	1.40	1.40

Resource use efficiency in groundnut production

One of the objectives of the present investigation was to study the resource use efficiency in summer groundnut. This objective was accomplished through the production function analysis. The production function framework is often used to determine optional quantities of inputs that the cultivators use in the production process.

Cobb-Douglas production function and linear production function was estimated on per farm basis for small, medium, large and overall size group. The elasticity of the production and related parameter are presented in the Table 3.

Out of these two model on the basis of highest R^2 value and more number of significant variables, Cobb-Douglas production function was fitted for the data.

It is observed from the table that the explanatory variable included in the production process have explained almost the variation in input for small, medium, large and overall for the sample as a whole that is 73 percent, 63 percent, 70 percent and 65 percent respectively. In small size group the regression coefficient of seed, human labour and plant protection is significant at 10 percent level of significant.

Table 3: Resource use efficiency in groundnut production

Particulars	Size group				Contribution of important input in production
	Small	Medium	Large	Overall	
Intercept	5.320 (11.52)	45.29 (7.57)	15.36 (7.22)	18.35 (4.80)	
Area	0.210 (5.14)	-5.72** (2.78)	0.913 (0.741)	0.032 (0.952)	0.40983

Seeds	0.078* (0.13)	-0.093** (0.0407)	0.034* (0.0188)	0.0036** (0.0132)	6.005
Human labour	0.113* (0.193)	0.073* (0.037)	0.030** (0.0120)	0.074** (0.0303)	105.569
Bullock pair	-0.194 (0.296)	-0.198 (0.166)	-0.060 (0.199)	-0.2803* (0.1476)	-18.499
Manure	0.031 (0.027)	-0.047*** (0.015)	0.020 (0.016)	-0.0016 (0.0133)	-0.912
Fertilizer	-0.007 (0.017)	-0.0082 (0.0158)	-0.015 (0.012)	-0.0081 (0.0095)	-12.284
Plant Projection	0.0039* (0.00223)	0.0022* (0.0011)	-5.137 (0.0011)	0.0019* (0.0010)	16.494
Irrigation charges	-0.0019 (0.0073)	-0.0198** (0.0091)	0.0052 (0.016)	0.00048 (0.0038)	3.217
R^2 (Coefficient of multiple determination)	0.73	0.63	0.70	0.65	

Figures in the parentheses are standard errors of respective regression coefficient. Note: ***, **, * denotes significant at 1%, 5% and 10% level of significance.

A medium size group the regression coefficient of manures and irrigation are significant of 1 percent and 5 percent level of significance.

In large size group the contributing factor that is human labour and seeds both significant at 5 percent and 10 percent level.

In overall group seeds and human labour are significant at 5 percent whereas bullock pair and plant protection are significant at 10 percent level.

The area (X_1), seeds (X_2), Human labour (X_3), Bullock pair (X_4), manures (X_5), fertilizers (X_6), plant protection (X_7) and irrigation charges (X_8) were positive and significant, indicates the use these inputs to increase the yield. While were negative and non-significant indicate that these was need to decrease the use of these inputs.

Contribution of important input in production

In case of contribution of important input in summer groundnut production. It can be seen that the Table 3 contribution of human labour was highest compare to the other input that is 105.56 percent.

The contribution of important input in production *viz*. area (0.40 percent), seeds (6.00 percent), bullock pair (-18.49 percent), manures (-0.912 percent), fertilizers (-12.284 percent), plant protection (16.49 percent) and irrigation charges (3.21 percent).

Marginal value product to factor cost ratio

Marginal value of product to factor cost ratio is the measure of resource use efficiency. The ratio of marginal value product to factor cost indicate the optimum resource use efficiency of particular input. The marginal value product of each input factor was worked out and compared with prices of respective input in care of small, medium, large and overall group.

Table 4: Marginal value of product to factor cost ratio

Particulars	Small	Medium	Large	Overall
Area	0.0050	-0.1617	0.040	0.010
Seeds	0.3549	-0.4283	0.1725	0.017
Human labour	0.4295	0.314	0.1195	0.293
Bullock pair	-0.020	-0.04	-0.0077	-0.036
Manure	0.0098	-0.0321	0.021	0.0009
Fertilizer	-0.025	-0.027	-0.073	0.031
Plant Protection	0.015	0.020	-0.00038	0.011
Irrigation charges	-0.04	-0.37	-0.080	0.009

Table 4 reveals that the marginal value product to the factor cost ratio of all the input selected are less than one or negative.

This indicated excess use of input because all the values of the variables are less than one hence there should be reduction in these input for efficient groundnut production. The level use of these variables should be reducing so as to maximize the return.

Marginal physical product

Marginal physical product means change in output per unit change in input.

Marginal physical product to calculate resource use efficiency of various inputs the marginal physical product of these input was obtained by taking derivatives of production function.

Table 5: Marginal physical product

Particulars	Small	Medium	Large	Overall
Area	18.75	13.0208	3.125	6.907
Seeds	0.45	0.3125	0.135	0.315
Human labour	0.25	0.1549	0.122	0.2195
Bullock pair	1.85	1.1718	0.5869	1.3695
Manure	0.14	0.1048	0.064	0.1466
Fertilizer	0.091	0.1	0.061	0.09051
Plant Projection	0.013	0.0096	0.0051	0.01204
Irrigation charges	0.028	0.027	0.033	0.0266

It can be seen from Table 5 that marginal physical product for change in area contribute to more change in production in all three categories that small, medium, large and overall.

Marginal physical product of area for small farmer was 18.75, medium 13.02, large 3.12 and overall 6.90 respectively, among these marginal physical product of area is highest for

small farmer.

Marginal physical product of seeds, human labour, bullock pair, manures, fertilizers, plant protection and irrigation charges of marginal physical product was very low compared to area.

Thus, it can be stated that change in the level of input used changes the level of output.

Conclusion

In this study an attempt has been made to study the economics and resource use efficiency of summer Groundnut production in Amravati district of Maharashtra. The result showed that the large size group proved to be better and more remunerative than either the small and medium size group in respect of net return per hectare of groundnut production. The output-input ratios were greater than unity which indicates that the groundnut is a profitable crop in selected area. The study also concluded that, the selected variables explained 73, 63, 70 and 65 percent variation in yield of groundnut for small, medium, large and at overall level respectively. The contribution of important input of human labour (105.57%) was highest in summer groundnut production compare to other input. From the ratio of marginal value product to the factor cost ratio, it revealed that the marginal value product to the factor cost ratio of all the input were less than one or negative. While studying marginal physical product in groundnut production it was observed that in case of small, medium, large and overall size group the contribution of area was change in production compare to other inputs.

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