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Research Article

RESOURCE USE EFFICIENCY OF MAJOR GROUNDNUT BASED CROPPING SYSTEMS IN PAVAGADA TALUK OF TUMKUR DISTRICT IN KARNATAKA

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Abstract- The present study was undertaken with an overall objective to evaluate the Resource use efficiency of Groundnut based Cropping Systems in Pavagada Taluk of Tumkur District in Karnataka. For the study 96 Farmers were selected by Multistage stratified random sampling method, data was collected with pretested interview schedule through personal interview method. (Cropping system)CS-I (Groundnut+Redgram+Greengram+Cowpea), CS-II (Groundnut+Redgram) and CS-III (Groundnut sole), were the Three important Groundnut based Cropping Systems (CS) followed in the study area underrainfed condition. The Cobb-Douglas type of production function was fitted to study the resource use efficiency in major cropping systems identified in the study area. The results of the Cobb-Douglas production functionanalysis revealed that the ratio of MVP to MFC was greater than one for Human labour, Bullock labour and FYM under different Cropping System, indicating further scope for using additional units of these inputs to increase net income. The result of the study through light on and enable the farmers and extension agencies to plan for the appropriate Cropping System to utilize farm resources rationally and to enhance productivity and profitability.

Keywords- Groundnut, Cropping System and Cobb-Douglas production function

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Introduction

Groundnut (*Arachis hypogea L.*) crop assumes significant importance in terms of food and income shares of the households cultivating this crop. It provides livelihood security to farmers of the Groundnut cultivating regions in the country[3].India second largest producer of Groundnut in the world next to China. Groundnut predominantly cultivated as a dry land crop in the Districts of Tumkur, chitradurga and Kolar. Productivity of Groundnut in Karnataka state is low as compared to other Groundnut growing states. Pavagada is major Groundnut growing taluk in the Tumkur district the average productivity of crop is only 450 kg per acre. Cropping system refers to the principle and practices of cropping and interaction with farm resources, environment. It is one of the very important tool to augment the Agricultural production and stabilize the farm income [2,4,5].

Materials and Methods

For the present study, Pavagada taluk of Tumkur district was selected purposively as it is one of the major groundnut intercrop-growing taluk in Tumkur district. In Pavagada, Groundnut is grown as a major field crop by majority of the farmers on dry land during kharif season. Pavagadataluk consist of four Hoblies *viz*., Nagalamadike, Y.N. Hosakote, Nidagal and Kasaba, for the selection of the villages and sample respondents Multi stage stratified random sampling technique was fallowed for collection of information required for the study.

Among the different Groundnut based intercropping systems identified by conducting a pilot survey in the study area, three major Groundnut based intercropping systems were selected. Based on the highest area under Groundnut intercrop cultivation. From each Hobli 4 villages were selected randomly, from each village 6 farmers totalling the Sample size to 96 farmers. It constitute 32 Marginal (up to 2.5 acres), 32 small (>2.5 to 5 acres) and 32 large (>5 acre) farmers respectively.

Three major cropping systems identified in the study area were

1. Cropping system-I Groundnut + Red gram +green gram + cowpea
2. Cropping system-II Groundnut + Red gram and
3. Cropping system-III Groundnut sole crop

The Cobb-Douglas type of production function was fitted to study the resource use efficiency in major cropping systems identified in the study area

Functions of the following form were fitted for different cropping Systems.

$$Y = ax_1^{b1} . x_2^{b2} . x_3^{b3} \ldots\ldots\ldots\ldots\ldots x_n^{bn}$$

On linearization, it becomes

$$\log Y = \log a + b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 + \ldots\ldots\ldots\ldots\ldots + b_n \log x_n$$

Production function employed for cropping system as a whole is given below.

$$\text{Log } (Y) = \log (a) + b_1 \log (x_1) + b_2 \log (x_2) + b_3 \log (x_3) + b_4 \log (x_4) + b_5 \log (x_5) + b_6 \log (x_6) + e$$

Where,

Y = Gross returns in rupees/ acre
a = Intercept
x_1 = Bullock labour (rupees/acre)
x_2 = Machine labour (rupees/acre)
x_3 = Human labour (rupees/acre)

x_4 = Seed (rupees/acre)
x_5 = FYM (rupees/acre)
x_6 = Fertilizer (rupees/acre)
bi = Elasticities of production (i = 1 to 6)
e = Error term

Result

On processing the data, it was ascertained that factors like, human labour, bullock labour, machine labour, seeds, FYM and Fertilizer are important variables bearing on the production activity. These are considered as independent variables and gross income as dependent variable. A Cobb- Douglas production function was fitted to the data in order to estimate the functional relationship between the dependent variable and independent variables. The Marginal Value Product (MVP) of each explanatory variable was also computed and compared with its Marginal Factor Cost (MFC) to know the allocative efficiency of farmers.

The regression coefficients of various resources in each system were computed and the results are presented in [Tables-1] [Tables-2] and [Tables-3] the cropping system wise results are summarized below.

Table-1 *Cobb-Douglas production function estimates and MVP to MFC ratios for Cropping System-I*

Sl. No	Particulars	Parameter	Regression coefficients	MVP: MFC Ratios
1	Intercept	A	10.097	
2	Bullock labour	b1	0.691* (0.069)	1.108
3	Machine labour	b2	0.057 (0.014)	0.483
4	Human labour	b3	0.192* (0.112)	2.833
5	FYM	b4	0.091 (0.011)	1.473
6	Seed	b5	-0.025 (0.080)	-0.199
7	Fertilizer	b6	0.113* (0.027)	3.981
		R^2	0.76	
		Return to scale	1.119	

Note: Figures in parenthesis indicates their respective standard error
* Significant at 5% level

The regression coefficients of various resources of CS-I are presented in [Table-1] from the results, it was found that the regression coefficients of all resources used by farmers were positive except for seed. The coefficients for Fertilizer, Human labour and bullock labour were statistically significant at five per cent level and other resources were non-significant. The coefficient of multiple determination (R^2) was 0.76 and the sum of elasticities was 1.119.

The ratios of MVP to MFC were greater than unity for the resources like, Fertilizer (3.981), Human labour (2.833), FYM (1.473), Bullock labour (1.108), The MVP to MFC ratio was less than unity for the resources like machine labour (0.483), whereas, the ratio was negative for seed (-0.199).

Table-2 *Cobb-Douglas production function estimates and MVP to MFC ratios for Cropping System-II*

Sl.No	Particulars	Parameter	Regression coefficients	MVP: MFC Ratios
1	Intercept	A	11.7149	
2	Bullock labour	b1	0.1783*(0.123)	1.667
3	Machine labour	b2	0.0208*(0.014)	5.437
4	Human labour	b3	0.0278 (0.163)	0.204
5	FYM	b4	0.4194*(0.016)	1.200
6	Seed	b5	0.0759 (0.227)	0.363
7	Fertilizer	b6	-0.0004 (0.018)	-0.020
		R^2	0.71	
		Return to scale	0.722	

Note: Figures in parenthesis indicates their respective standard error
* Significant at 5% level

Table-3 *Cobb-Douglas production function estimates and MVP to MFC ratios for Cropping System-III*

Sl.No	Particulars	Parameter	Regression coefficients	MVP: MFC Ratios
1	Intercept	A	11.938	
2	Bullock labour	b1	0.085(0.094)	0.972
3	Machine labour	b2	-0.013 (0.012)	-2.094
4	Human labour	b3	0.367* (0.137)	3.120
5	FYM	b4	0.005 (0.009)	1.055
6	Seed	b5	0.034 (0.249)	0.199
7	Fertilizer	b6	-0.015 (0.016)	-0.611
		R^2	0.79	
		Return to scale	0.463	

Note: Figures in parenthesis indicates their respective standard error
* Significant at 5% level

The regression coefficients for the resources in CS-II are presented in the [Table-2], which shows that the regression coefficients were positive for all resources except fertilizer. Among these variables, the coefficients for Bullock labour, machine labour and FYM were significant at 5 per cent level and all other resources were Non-significant. The coefficient of multiple determination was 0.71. The sum of elasticities was 0.722.

The MVP: MFC ratios were greater than unity for machine labour (5.437), Bullock labour (1.667) and FYM (1.200). The MVP to MFC ratio was less than unity for Seeds (0.363) and Human labour (0.204) whereas, Fertilizer (-0.020) recorded negative MVP: MFC ratios.

The regression coefficients of the resources in the CS-III are presented in [Table-3] it was observed from the [Table-3] that, the regression coefficients for machine labour and fertilizer were negative and regression coefficients for all other resources are positive. Among these variables, the coefficient for Human labour was significant at 5 per cent level and all other resources were non-significant. The coefficient of multiple determination was 0.64. And the sum of elasticities was 0.463

The ratios of MVP to MFC were greater than unity for Human labour (3.120), FYM (1.055), The MVP to MFC ratio was less than unity for the resources like Bullock labour (0.972) and seed (0.199). Whereas, machine labour (-2.094) and Fertilizer (-0.611) showed negative MVP: MFC ratio.

Discussion

Cropping System-I

The production function analysis for CS-I shows that [Table-1] 76 per cent of the variation in gross returns was explained by the variables included in the production function. The elasticity coefficients for Fertilizer, Human labour and bullock labour were statistically significant at 5 per cent level; In other words, every one per cent increase in Fertilizer, Human labour and bullock labour the gross returns increase to the tune of 0.113, 0.192 and 0.691 per cent, respectively. Similar results were also reported by [1] on Onion production and the study by [5] on different farming systems of three districts of north-eastern Karnataka,.

The increase in resources like machine labour and FYM increases the gross returns, but not significantly.

The elasticity coefficient for seed was negative, indicating over utilization of this resource. Hence curtailing certain units of seed in the production process would increase the gross returns. The sum of elasticities was greater than unity, which slows increasing returns to scale.

In the case of CS-I, the MVP: MFC ratio indicated that the ratio was greater than unity for Fertilizers, Human labour and Bullock labour. There was scope for increasing the use of these inputs to increase the gross income.

Cropping System-II

In the case of CS-II, fertilizer had negative elasticity coefficient [Table-2] indicated that decrease in gross income for every unit increased use of this resource.

Bullock labour, machine labour and FYM had a positive and significant influence on gross returns at 5 per cent level. Every per cent increase in Bullock labour, machine labour and FYM increased the gross returns to the tune of 0.1783 per cent, 0.0208 per cent and 0.4194 per cent respectively.

The resources, *viz*., Human labour and Seed had positive effect, indicating that gross returns could be increased by using increased quantities of any of these resources.

The coefficient of determination (R^2) value indicated that, 71 per cent of the variation in gross income was explained by the variables considered in the production function. The sum of elasticities of coefficients was less than unity, which showed decreasing returns to scale.

In the case of CS-II, the MVP:MFC ratio indicated that the ratio was greater than unity for machine labour, Bullock labour and FYM. There was scope for increasing the use of these inputs to increase the gross income.

Cropping System-III

The production function analysis in the case of CS-III indicated that about 79 per cent of the total variation in the gross income was explained by the variables included in the production function [Table-3].

It was observed that a coefficient for Human labour was positive and significant at 5per cent; every per cent increase in Human labour increased the gross income to the tune of 0.367 per cent.

The elasticity coefficients for machine labour and fertilizers were negative, indicating that there will be decrease in returns if these resource levels increase, keeping all other variables constant. These finding are contrary to the findings of the [6] on onion production.

The coefficients for Bullock labour; FYM and seed are observed to be positive, which had positive influence on the gross returns. The sum of elasticites of coefficients was less than unity, which showed decreasing returns to scale.

Regarding CS-III, MVP: MFC ratio indicated that, Human labour and FYM were under-utilized, indicating the scope to increase the use of these resources to increase the returns.

Conclusion

The results of the analysis in CS-I revealed that, the adjusted co-efficient of multiple determination (R^2) worked out to be 0.76. Returns to scale were 1.119 showed an increasing return to scale. The resources like Bullock labour, human labour, and fertilizer were significant and positive influence on gross returns. The resources *viz*., bullock labour, human labour, FYM and fertilizer were underutilized, whereas machine labour and seed were over utilized.

In the case of CS-II the results of MVP to MFC ratio revealed that Bullock labour Machine labour and FYM had positive and significant influence on gross returns whereas, the resources like Human labour, Seed are less than unity and fertilizers were negative indicating there over-utilization. The adjusted co-efficient of multiple determination was 0.71 and production function fitted showed a decreasing return to scale.

With respect to CS-III, the resource, which had positive and significant influence on gross returns, were bullock labour, machine labour, seed and fertilizer were over utilized whereas as the resource Human labour and FYM was underutilized. The adjusted co-efficient of multiple determination was 0.79 and production function fitted showed decreasing return to scale.

Based on the findings of the investigation, the following policies can be drawn to improve the cropping systems in order to stabilize the income of the farmers.

Among the different cropping systems followed by the farmers, CS-I (Groundnut+ Redgram+Greengram+Cowpea) was found to be most profitable under rainfed condition, followed by CS-II (Groundnut+Redgram), and CS-III (Groundnut sole crop). Efforts should be made through Raitha Samparka and Krishi Vigyana Kendras to popularize these cropping systems to utilize farm resources rationally and to enhance productivity and profitability.

The farmers growing Groundnut could be encouraged to go for intercrops in place of sole crop of Groundnut in order to minimize the production and marketing risk associated with the weather and market fluctuations.

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