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Resource productivities and their optimum utilization pattern in chilli-based mixed cropping system – an economic analysis

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INTRODUCTION

Chilli (*Capsicum annuum*) is generally grown as a mixed and sole crop under rainfed and irrigated conditions respectively. Mixed cropping of chilli and cotton is very popular in Karnataka and Maharashtra. Intercropping cotton with chilli in transitional tract of Dharwad in Karnataka was viewed as a well established and remunerative cropping system followed on a large scale, occupying an area of 60,000 ha (Hosmani, 2). Therefore, an attempt was made to analyse the resource productivities and their optimality in their usage.

MATERIAL AND METHODS

Time of planting of mixed crops in chilli is a prerequisite to adjust in such a way that the companion crop (cotton) growth is not affected due to the possibility of overlapping. Chilli is transplanted during June-July under drizzling and cloudy weather conditions in the format as shown in the Fig. 1. The cotton (Jayadhar) seeds were dibbled during August - September. Chilli is a shallow-rooted (0.2 cm depth) while cotton is deep-rooted (1.5-2.0m depth) depending on soil and its moisture status. Hence, no competition exists amongst both main (chilli) and companion crop (cotton) for soil moisture, light and space as root system in the peak period of growth differs.

To analyse the resource productivities of the system, the data were collected from 30 farmers spread over in 5 villages in Kundgol taluk in Dharwad, a leading district in chilli production in Karnataka. All the farmers were interviewed randomly with the help of well-structured schedules to elicit the information on cash inputs in intercropping of chilli with cotton with respect to yield, extent of resource use and price realized for 1997-98. For evaluating the resource productivities, Cobb-Douglas type of production function was employed to the farm level data to determine the extent to which the resources explains the variability in its yield to determine the extent to which the resources are optimally used. The production function fitted for the system was specified as below :

$$Y = a.\ X_1^{b1}.\ X_2^{b2}.\ X_3^{b3}.\ X_4^{b4}.\ X_5^{b5}.\ X_6^{b6}.\ X_7^{b7}.\ X_8^{b8}.\ e^{u}$$

The function was converted into linear form by making logarithmic transformations of all the variables.

$$\text{Log}Y = \text{Log}\ a + {}_{b1}\text{Log}\ X_1 + {}_{b2}\text{Log}\ X_2 + {}_{b3}\text{Log}\ X_3 + {}_{b4}\text{Log}\ X_4 + {}_{b5}\text{Log}\ X_5 + {}_{b6}\text{Log}\ X_6 + {}_{b7}\text{Log}\ X_7 + {}_{b8}\text{Log}\ X_8 + u\ \text{Log}\ e$$

where,

Y = Gross returns from the system (Rs), A = intercept term, X_1 = area under the system (ha), X_2 = seeds value, X_3 = nitrogenous fertilizers value, X_4 = phosphatic fertilizers value, X_5 = potassic fertilizers, X_6 = farmyard manure, X_7 = human labour, X_8

= bullock labour, u = error term, b_i = regression coefficients of the independent variables (i=1 to 8) and Σ bi = returns to scale. The coefficient of multiple determination (R^2) was worked out to test the goodness of fit of the model. Marginal Value Product with refernece to Xi resource cash

$$\text{inputs} = bi \frac{\bar{Y}}{Xi}$$

where,

Y = Geometric mean of gross returns of system

Xi = Geometric mean of i^{th} independent variable

b_i = Regression coefficient of i independent variable

After estimating the marginal value product (MVP) of each cash input was compared with its marginal factor cost. The marginal factor cost (MFC) of all the inputs except land (ha) was taken in value terms (Rs). Hence, MFC for land was taken as its rental value while for other inputs considered as one rupee. The regression function is run for the farm level data with an average size of the farm being 7.568 ha of the total sample size obtained. To arrive at a decision of an optimum level of output from the system, a comparative mean level of the existing and optimum use of resources included in the function is drawn out (Govardhan Rao, 1).

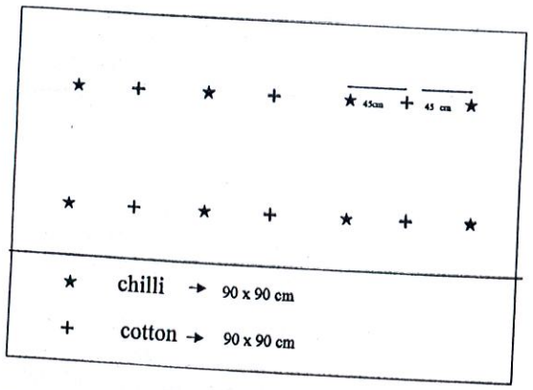

Fig. 1. Planting pattern of mixed cropping of chilli + cotton system.

RESULTS AND DISCUSSION

It was observed that nitrogenous fertilizers could exert highly significant effect on yield and provide a further scope for increased use of the same enabling greater MVP/MFC(3.259) leading to optimal level of yield (Tables 1 and 2). Resources such as seeds and human labour were found to bear a significant but negative influence on the system reflecting excess use of the same as represented by the MVP/MFC ratios, -3.635 and -0.501 respectivly. Without any use of external inputs, the system was found to cede to an extent of Rs 11.98 as initial level of output which is represented in intercept. About 92% of the variation in the total yield of the system was explained by the variables included in the function. Remaining 8% of the variation in yield might be due to other variables like soil fertility status, natural calamities and management as a result diminishing returns was noticed (Σbi = returns to scale = 0.874 < 1) which was in confirmity to the statement by Maji (3). As more and more external inputs were used, profitability per unit resources used was less and less (Subba Rao 5). This stressess the need for including those variables which were not considered since there exists a scope for increasing the production of the system by increased use of nitrogenous and phosphatic fertilizers and also to cut down those resources which are in excess use to prevent the production process to continue in the third stage of production.

A comparative level of existing and optimum utilization of cash inputs was arrived at in the system (Table 2) so as to enable the farmers to reap optimum profits. As land was taken in physical terms (ha), the optimum size of the farm to go for practising the system was found to be 2.2 ha by reducing an area of 5.4 ha out of 7.57 ha, the present average size of the farm. This would enable to facilitate a portion of the land under other profitable crop rotations. The resources like seeds, potash fertilizers, farmyard manure and labour (human + bullock) were found to be in excess application in the system which implies irrational behaviour of farmers following the system. Hence,

Table 1. Production elasticities and marginal value product to marginal factor costs in chilli + cotton mixed cropping system.

Item		
n	30	
Intercept	11.98	
Inputs	Production elasticities	MVP/MFC
Land	1.108 (0.050)	0.039
Seed	-0.050** (0.260)	-3.635
Nitrogenous fertilizers	0.219** (0.611)	3.259
Phosphatic fertilizers	0.377 (0.367)	8.909
Potassic fertilizers	-0.251 (0.195)	-7.010
Farmyard manure	-0.123 (0.208)	-3.435
Human labour	-0.031** (0.274)	-0.501
Bullock labour	-0.375 (0.305)	-8.202
R^2	0.924**	
Σbi	0.874	

Note : * Significant at 5% level, ** Significant at 1% level, R^2, coefficient of multiple determination. Student 't' test was employed to test the significance of regression coefficients. 'F' test was employed to test the significance of coefficient of multiple determination. Values in parentheses indicate corresponding standard errors.

to necessiate an optimum level of output about Rs 498, Rs 3,199, Rs 1,831 and Rs 18,459 value of the respective resources use have to be cut down. On the contarary, nitrogenous and phosphatic fertilizers were found to excel the production by paving the way for increased use of the respective inputs to an extent of Rs 91,286 and Rs 1,882 (Table 2).

SUMMARY

Mixed cropping of chilli is practised generally with dry chilli crop than with green chilli. Hence, a study was conducted to evaluate the efficient utilization of cash input resources and made an attempt to draw optimality in the use of these resources in the chilli+cotton system in Dharwad district. A total sample size of 30 farmers following the system were selected and randomly interviewed through survey method using well-structered schedules. It revealed that there existed an indiscrimmate use of almost all cash external inputs except nitrogenous and phosphatic fertilizers of

Table 2. Optimality in use of resources in chilli + cotton mixed cropping system.

Input	Existing mean level of resource use	Optimum level or resource use	Difference in existing to optimum resource use
Land	7.56	2.21	-5.35
Seed	2,581.24	2,083.29	-497.95
Nitrogenous fertilizers	67,646.62	1,58,932.98	+91,286.36
Phosphatic fertilizers	13,153.99	15,036.02	+1,882.03
Potassic fertilizers	13,436.93	10,238.50	-3,198.63
Farmyard manure	8,204.53	6,373.50	-1,830.63
Human labour	51,896.55	34,709.52	-17,187.03
Bullock labour	11,807.41	10,535.05	-1,272.36

Note : Except land(ha) all other resources use are mentioned in Rupees per average farm size (7.568 ha) of the data collected.

which former found to bear a significant influence on the output, while seeds and human labour inspite of their excess utilization influenced significantly on the yeld indicating irrational behaviour of the farmers for the same. It was evident that about 92% of the variation in yield was explained by those variables which were included in the function representing a significant goodness in fitting the regression. This study drew importance of optimal utilization of the resource inputs thereby to realise optimum profits.

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