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Research Note

Resource Use and Allocative Efficiency in Ginger Production in Wayanad District of Kerala§

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Abstract

The study has determined the resource-use and allocative efficiency in ginger production in Wayanad district of Kerala. The multi-stage random sampling technique was used to select 80 ginger farmers. The results of the Cobb-Douglas production function show that seeds, fertilizers and manures on small farms, fertilizers and manures on large farms, and seeds, plant protection chemicals and manures on overall pool of farms can contribute to increase the yield of ginger. The results of allocative efficiency have highlighted that the MVP/MFC ratios are more than unity for seeds, fertilizers and manures on small farms, and seeds and plant protection chemicals on pooled farms. The study has suggested some measures also to enhance yield and hence farmers' income in ginger production.

Key words: Resource-use efficiency, allocative efficiency, Cobb- Douglas production function, marginal value product, marginal input cost, ginger production, Kerala

JEL Classification: Q10, Q12, D61, Q00, E23

Introduction

The ginger is cultivated in all the 14 districts of Kerala and is one of the important cash crops grown in the Wayanad district. Due to the peculiar nature of soil and climate, the area under ginger cultivation has been concentrated in this district. The Wayanad district had highest area under ginger, 1,992 hectares in 2013-14 with a production of 11,006 tonnes. The district of Wayanad contributes more than 50 per cent to the total state production of ginger. Some of the prominent indigenous cultivars are: Maran, Kuruppampadi, Ernad, Wayanad, Himachal and Naida. The exotic cultivar Rio-de-Janeiro has also become very popular among cultivators.

The ginger crop has a great significance in the rural economy of Wayanad since approximately 15 per cent of the income from agricultural crops is contributed by the ginger alone. For enhancing the production of ginger efficient utilization of available resource is a pre-requisite. Therefore, assessing resource-use and allocative efficiency in ginger production assumes paramount importance. Hence, the present study has been conducted with the specific objectives of estimating resource-use and allocative efficiency in ginger production; identifying the constraints in ginger production and marketing, and suggesting measures for improvements.

Data and Methodology

Data

The area selected for the study was Wayanad district, which is one of the major ginger growing

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districts in Kerala. It accounts for more than 40 per cent of the total area and total production of ginger in the state. Based on the criterion of highest area under ginger, four villages, each from two blocks were selected. The farmers were stratified into small (possessing ≤ 2 ha dry land) and large (possessing > 2 ha dry land) groups. From each of the selected villages, 10 farmers in each farm size group were selected at random. Thus, the sample had 80 farmers for the study.

To study the resource productivity and resource-use efficiency, production function analysis was used. Among different types of production functions, Cobb-Douglas production function in its logarithmic form [Equation (1)] was used.

The Cobb-Douglas production function is specified in the following power form.

$$Y = a X_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} X_5^{b_5} X_6^{b_5} \ldots e^{\mu} \quad \ldots(1)$$

where, Y is the yield (in quintals), X_1 is the human labour (in mandays), X_2 is the machine power (in hours), X_3 is the seeds (in kg), X_4 is the fertilizers (in kg), X_5 is the plant protection chemicals (in liters), X_6 is the farm yard manure (in tonnes), a is the intercept, m is the stochastic disturbance-term, and b_1 to b_6 are partial elasticity coefficients of X_1 to X_6 inputs.

Marginal Value Product

Equality of marginal value product (MVP) to factor cost is the basic condition that must be satisfied to assess resource-use efficiency. In Cobb-Douglas production function, marginal physical product of X_j, the j^{th} input factor is given by Equation (3).

$$Y_i = AX_{1i}^{b_1} . X_{2i}^{b_2} \ldots\ldots\ldots\ldots X_{ji}^{b_j} . e^{\mu_i}$$

for i = 1,...,n farms and j = 1,…,k inputs …(3)

$$\text{MPP of Xj input} = \frac{b_j \bar{Y}}{\bar{X}_j}$$

where,

MPP = Marginal physical product of the j^{th} input,

b_j = Partial elasiticity coefficient of the j^{th} input,

$\bar{Y}$ = Output of the crop at its geometric mean level, and

$\bar{X}_j$ = The j^{th} independent variable at its geometric mean level.

The marginal value product for each factor can be obtained by multiplying the MPP of each factor with unit price of output i.e.

$$MVP = MPP_x P_y$$

To study resource-use efficiency, the marginal value productivities are compared with the acquisition costs. An input is said to be efficiently used when its MVP = MFC.

Results and Discussion

Resource-use Efficiency

The farmers have limited access to inputs and their goal is to maximize output from the resources available with them. Hence, they make some adjustments in allocation of their resources. The study examined the input-output relationship and the resource-use efficiency in the ginger production. The regression coefficients of different inputs used in the production function [Equation (1)] were estimated separately for each farm size group and results are presented in Table 1.

The results for small farmers show that out of six independent variables included in the model, three variables, viz. seed (X_3), fertilizer (X_4), and manures (X_6) are positively significant at 5 per cent level, indicating that an increase in the usage of seed, fertilizer and manures by 1 per cent from existing mean level, *ceteris paribus*, would increase the yield of ginger by 3.80 per cent, 2.15 per cent and 2.56 per cent, respectively. The coefficients of human labour (X_1) and machine power (X_2) are negative, but non-significant, and the coefficient of plant protection chemicals (X_5) is positive but non-significant. The adjusted coefficient of multiple determination (R^2) is quite high indicated that the variables included in the model could explain 91.94 per cent of variations in the production of ginger.

In large farms, the regression coefficient of manures (X_6) is positive and significant, indicating that, *ceteris paribus*, 1 per cent increases in use of manures (X_6) would result in an increase of 2.15 per cent in ginger yield. Fertilizer (X_4) use carries a negative sign, i.e., 1 per cent increase in fertilizer use would bring down the yield by 2.28 per cent. The other variables are not significant.

On overall basis, of the six variables included in the model, three variables viz. seed, plant protection chemicals and manures are found positively significant at 5 per cent level. This implies that keeping other variables constant, 1 per cent increase in use of seed, plant protection chemicals and manures would result

Table 1. Production elasticities of input factors in ginger cultivation in Kerala

Particulars	Small farms	Large farms	Pooled farms
No. of farmers	40	40	80
Constant	-0.5705	0.6967	-0.1502
Human labour (mandays) (X_1)	-0.0101 (-0.0476)	0.3337 (1.7094)	0.0828 (00.5231)
Machine power (hours) (X_2)	-0.3114 (-1.6131)	0.0185 (0.0960)	-0.0760 (-0.4913)
Seeds (kg) (X_3)	0.7381** (3.8004)	0.2942 (1.6579)	0.6167** (4.4777)
Fertilizers (kg) (X_4)	0.2006** (2.1559)	-0.2144** (-2.2758)	-0.0052 (-0.4913)
Plant protection chemicals (kg) (X_5)	0.0525 (1.6160)	0.1230 (1.4787)	0.1028** (3.5832)
Manures(tonnes) (X_6)	0.3145** (2.5676)	0.2471** (2.1478)	0.2284** (2.5089)
Adjusted coefficient of multiple determination (R^2)	0.9194	0.8830	0.9139

Note: Figures within the parentheses indicate 't' values
NS = Non significant; **Significant at 0.05 per cent level of probability

in an increase of 4.48 per cent, 3.58 per cent and 2.51 per cent respectively in the ginger yield. The other variables are not significant.

Thus, seeds, fertilizers and manures on small farms; fertilizers and manures on large farms; seed, plant protection chemicals and manures on overall pool of farms contribute to the increase in ginger yields. These results are in conformity with the earlier reports by Jagtap *et al.* (2014) and Karthick *et al.* (2013).

Allocative Efficiency

To examine the economic efficiency of resource use, the marginal value product (MVP) of each factor was compared with its acquisition cost. The MVP/MFC ratio indicates the potential for further use of inputs. The negative MVP/MFC ratio indicates over-use of inputs and suggests reduction in present level of their use. The resource is said to be allocated efficiently or optimally if the MVP=MFC. The ratios of MVP to their acquisition cost per unit are calculated only for the significant resources in the production of ginger and are presented in Table 2.

The variables seed, fertilizer and manures show significant potential for their further use as their MVP/MFC ratios are e greater than unity on small farms. On these farms every additional rupee spent on these inputs would add ₹ 17.7, ₹ 24.3 and ₹ 1.1 to the returns. This implies that these resources have been under-utilized. On large farms, MVP/MFC ratio is negative for fertilizers indicating their over-use. Manures, however,

Table 2. Comparison of marginal value products of inputs with their factor cost in ginger cultivation in Kerala.

Particulars	Small farms			Large farms			Pooled farms		
	MVP	MFC	MVP/MFC	MVP	MFC	MVP/MFC	MVP	MFC	MVP/MFC
Seeds	1165	66	17.5	NS	-	-	1030	66	15.6
Fertilizers	429	18	24.0	-500	18	-28.0	NS	-	-
Plant protection chemical	NS	-	-	NS	-	-	1559	512	3.0
Manures	2348	2159	1.1	1480	2160	0.7	1522	2160	0.7

Note: MVP = Marginal value product (₹); MFC = Marginal factor cost (₹); and NS = Non-significant

Table 3. Constraints in production and marketing of ginger crop

Problems	No. of farmers responded	Per cent of farmers responded	Rank
Production issues			
Diseases occurrence	80	100	I
Weed infestation	75	93.75	II
Lack of access to credit	64	80	III
High price of rhizomes	52	65	IV
Inadequate labour availability	51	63.75	V
High labour charge	48	60	VI
Lack of quality seeds	38	47.5	VII
Marketing issues			
Price fluctuations	67	83.75	I
Lack of storage facilities	66	82.5	II
Marketing through middleman	30	37.5	III

appear to be under-used. In the overall pool of farms, MVP/MFC ratio is greater than one for seeds and plant protection chemicals. Therefore, the potential exists for their further use as each extra unit of money spent on seeds and plant protection chemicals would add ₹ 15.6 and ₹ 3.0 to the income respectively. The MVP/ MFC ratio is found less than unity for manures on large and pooled farms.

Thus, it is clear that there is under-utilization of seeds, fertilizers and manures on small farms, and of manures on the large farms. These results are in conformity with the findings of Sharma *et al*. (2008) and Amaranth and Sridhar (2012).

Constraints in the Production and Marketing of Ginger

Although ginger is a profitable crop, there are several constraints to its higher production (Table 3). On production issues, all farmers have reported the incidence of diseases like root rot and mahali. The problem of weed infestation is reported by 90 per cent of the farmers and 80 per cent also reported lack of adequate credit facility. About 65 per cent indicated higher price of seed material. Other major issues in ginger production are lack of labour, higher wages and poor quality seed material. Price fluctuations and lack of storage facilities have been identified as the major marketing constraints in ginger production.

The following measures are suggested based on farmer perception to overcome the production and marketing constraints.

- Emphasis on release of new high yielding, diseases resistant varieties.
- Development of cold storage facilities in the district.
- Establishment of grading facilities and processing centers at the village level.
- Access to credit from public financial institutions at lower interest rates.

Policy Implications

- Effort should be made on awareness generation for appropriate seeds, fertilizers, and manures on small farms, and seeds and plant protection chemicals on pooled farms.
- Incidence of diseases like root rot and mahali being a major problem in ginger cultivation, there is an urgent need to evolve an integrated pest- diseases management programme, besides strengthening the extension system in imparting knowledge about prevention and control of these diseases.
- Development of storage facilities at production sites.
- Better access to credit at lower/ subsidized ratios of interest from the financial institutions.

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Appendix Table 1. Cost of cultivation of ginger according to farm size and component-wise

(₹/ha)

Sl. no.	Particulars	Small farms	Large farms	Pooled farms
1.	**Operational costs**			
a.	Human labour	1,46,396.80 (32.18)	1,70,561.60 (34.49)	1,63,055.20 (33.83)
	Owned	10,942.80 (2.41)	2,032.80 (0.41)	4,800.40 (1.00)
	Hired	1,35,454.00 (29.77)	1,68,528.80 (34.08)	1,58,254.80 (32.84)
b.	Machine use	41,928.00 (9.22)	35,928.00 (7.27)	37,856.00 (7.85)
c.	Seeds	1,57,827.00 (34.69)	1,73,652.00 (35.12)	1,68,740.46 (35.01)
d.	Manures			
	i) FYM	17,786.56 (3.91)	18,195.76 (3.68)	18,059.36 (3.75)
	ii) Dry leaves	17,493.60 (3.84)	15,543.30 (3.14)	16,193.40 (3.36)
	iii) Seed cakes	781.44 (0.17)	1,940.40 (0.39)	1,580.04 (0.33)
e.	Fertilizers	8,915.00 (1.96)	9,238.60 (1.87)	9,289.31 (1.93)
f.	Plant protection chemicals	2,450.94 (0.54)	3,381.35 (0.68)	3,099.84 (0.64)
g.	Repairs and maintenance charges	472.00 (0.10)	1,370.00 (0.28)	921.00 (0.19)
h.	Interest on working capital	19,948.85 (4.38)	21,759.18 (4.40)	21,201.48 (4.40)
	Total operational costs	4,14,000.19 (90.99)	4,51,570.19 (91.32)	4,39,996.09 (91.29)
2.	**Fixed costs**			
a.	Land revenue	550 (0.12)	550 (0.11)	550 (0.11)
b.	Rental value of owned land	36,250 (7.97)	37,500 (7.58)	36,875 (7.65)
c.	Depreciation	2,062.89 (0.45)	2,333.86 (0.47)	2,198.38 (0.46)
d.	Interest on fixed capital	2,128 (0.47)	2,546.98 (0.52)	2,337.76 (0.49)
	Total fixed costs	40,991.43 (9.01)	42,930.84 (8.68)	41,961.14 (8.71)
	Total costs	4,54,991.62 (100)	4,94,501.03 (100)	4,81,957.23 (100)

Note: Figures within the parentheses indicate percentage to the total

Appendix Table 2. Output and returns per hectare of ginger

Sl. no.	Particulars	Small	Large	Pooled
1.	**Yield in physical units (quintals)**			
a.	Ginger	253	285	275
		(94.18)	(94.86)	(94.66)
b.	Seed purpose	16	16	16
		(5.82)	(5.14)	(5.34)
	Total output	269	300	291
		(100)	(100)	(100)
2.	**Yield in monetary terms (₹)**			
a.	Ginger	6,41,261	7,42,196	7,02,321
b.	Seed purpose	86,031	85,140	85,404
	Gross returns	7,27,281	8,27,336	7,87,736
	Cost of cultivation	4,54,991	4,94,501	4,81,957
	Net returns	2,72,289	3,32,834	3,05,778

Note: Figures within the parentheses indicate percentage to the total output.