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Resource Use Efficiency in Ginger Production in the West Garo Hills District of Meghalaya

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ABSTRACT

India is a predominantly agricultural economy. More than 70% of its population is directly or indirectly involved in agricultural activities. India is one of the foremost producers of spices in the world. According to the Bureau of Indian Standards (BIS), 63 spices are grown in India. Ginger is one of the main spices and plays a vital role in the production and export of the country. Meghalaya's economy is predominantly agriculture-based with 81% of its population depending on agriculture, though agricultural productivity in Meghalaya is very low. This paper analyzes resource use efficiency in ginger production in Meghalaya's West Garo Hills district. The study is based on primary data. The multi-stage random sampling technique was used to select 300 ginger farmers. To estimate resource use efficiency in ginger production, the Cobb-Douglas type of production function was best fitted to the data. Independent variables identified were land (X_1), seed (X_2), labour (X_3), harvesting cost (X_4), marketing cost (X_5) and others include hoe, dao (wait), digging spades (X_6) and dependent variables as production of ginger(Y). Among the inputs used for the production of ginger which had positive and significant influences at the overall level, the MVP to PX ratio was less than one for land (0.07), seed (0.26), human labor (0.08), harvesting cost (0.08), marketing cost (0.13) and others (0.09) indicated under-utilization of these resources in the cultivation of ginger.

Keywords Ginger, Resource-use efficiency, Cobb-Douglas production function, Marginal value product, Marginal input cost.

INTRODUCTION

India is not only the largest producer but also the major consumer and exporter of spices in the world (FAOSTAT 2015). The English term 'ginger' originated from the Sanskrit word 'Sringavera'. Botanically known as 'Zingiber officinale,' it is the most popular hot spice in the world. Ginger is a valuable spice crop commercially grown in Meghalaya, India. In 2017-18, the total area dedicated to ginger cultivation was 224,000 hectares, and the production yield was 1,107,000 metric tonnes (Spice Board of India 2018). Although ginger is grown in all 12 districts of Meghalaya, it is considered one of the most important cash crops in the West Garo Hills district due to the unique soil and climate conditions in that area. In 2013-14, the West Garo Hills district had 1,992 hectares under

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ginger cultivation and produced 11,006 tonnes of ginger. Some popular indigenous ginger cultivars are Maran, Nadia, Khasi local, Tura, and Rio-de-Janeiro (GoM 2019).

The notion of efficiency concerns the relative performance of the processes that transform given inputs into outputs. Economic theory identifies at least three significant types of efficiency. These include: Technical, allocative and economic efficiencies. Technical efficiency measures a firm's success in producing maximum output from a given set of inputs. Allocative efficiency refers to choosing an optimum combination of inputs consistent with the relative factor prices. Economic efficiency is the product of technical and allocative efficiencies. Efficiency is a significant factor of productivity growth, especially in developing agricultural economies where resources are meager, and opportunities for developing and adopting better technologies are dwindling (Adhiana and Riani 2018). To increase ginger production, it is crucial to assess the existing level of resource utilization. Therefore, the present study aims to evaluate the efficiency of ginger production in terms of resource use.

MATERIALS AND METHODS

A multistage sampling technique was used to select ginger cultivators in this study. The West Garo Hills district was chosen purposively due to its high potential for ginger production. Specifically, three blocks - Rongram, Dadenggre and Selsela - was also selected purposively from this district. From each block, a random selection of 100 farmers was made, resulting in a total sample size of 300 ginger cultivators. Data for the study was collected from the selected ginger growers in October 2021 of the agricultural year 2021-22.

Resource-use analysis

The Cobb-Douglas production function was used to determine the contribution and efficiency of different variable production inputs on a ginger production system. Gross income was used as a dependent variable and cost of variable input as an independent variable in this study. Cobb-Douglas's production function was considered to determine resource productivity, efficiency and return to scale. The input-output relationship was established by applying the Cobb-Douglas production function which has been used by (Mathew *et al.* 2017, Holida *et al.* 2019).

The study employed production function analysis to analyze resource productivity and efficiency using the logarithmic form of the Cobb-Douglas production function.

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

$$Y = AX_1b_1.\ X_2b_2.\ X_3b_3.\ X_4b_4.\ X_5b_5.\ X_6b_6. \qquad (1)$$

The above equation is presented in a log-linear form to analyze the data:

$$\text{Log } Y = a + b1\log X1 + b2\log X2 + b3\log X3 + b4\log X4 + b5\log X5 + b6 \log X6$$

Where,
Y is the yield of ginger (in quintals),
X_1 is the land (ha),
X_2 is the seed (in Kgs),
X_3 is the labor (in days),
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.

In this functional form, 'Y' represents the dependent variable while 'X' represents the independent variable which is considered on a per-hectare basis. The regression coefficients obtained from this function are also called elasticities of production. The sum of regression co-efficient (b_1 to b_6) indicates the return to scale.

Estimation of marginal value product (MVP) and marginal physical product (MPP)

The Marginal Value Product (MVP) and Marginal Factor Cost (MFC) analysis approach was employed in the study to determine the resource-use efficiency of ginger production, as also used by (Aneani *et al.* 2011). The marginal value productivities are compared with the acquisition costs to study resource-use

Table 1. Co-efficient of regression of inputs for the production of ginger at an overall level.

Sl. No.	Variables	Co-efficient of regression
1	X_1 (Land)	0.106*
2	X_2 (Seed)	0.147*
3	X_3 (Labor)	0.107
4	X_4 (Harvesting cost)	0.001
5	X_5 (Marketing cost)	0.002
6	X_6(Others include hoe, dao (wait), digging spades)	0.003
7	Intercept	1.767
8	R-square (Adjusted co-efficient of multiple determination)	0.529
9	Returns to scale (Elasticity co-efficient)	0.368

*: Significance at a 5% level of probability.

efficiency. Equality of marginal value product (MVP) to factor cost is the essential condition that must be satisfied to assess resource-use efficiency (MVP = MFC).

$$MVP = MPPx. Py$$

Where,

MVP= Marginal value product
MPPx= Marginal physical product
Py= Price per unit of output

The Marginal value product for each factor was obtained by multiplying the Marginal physical product (MPP) of each factor with a unit price of output, i.e.

$$MPP_{Xi} = b_i \overline{Y} / \overline{X}_j$$

Where,

MPP = Marginal physical product of the i^{th} input,
bi= Partial elasticity coefficient of the i^{th} input,
$\overline{Y}$ = Output of the crop at its geometric mean level and
$\overline{X}$= The j^{th} independent variable at its geometric mean level.

After determining the marginal value product (MVP), resource utilization efficiency was evaluated using the MVP to factor in the cost ratio. The following criteria were used to assess resource use efficiency:

MVP/FC = 1 (optimal use of resources)
MVP/FC < 1 (under-utilization of resources)
MVP/FC > 1 (excessive utilization of resources)

RESULTS AND DISCUSSION

The farmers have limited access to inputs aiming to maximize output from the available resources. Hence, they make some adjustments in the allocation of their resources. The study examined the input-output relationship and the resource-use efficiency in ginger production. The regression coefficients of different inputs used in the production function [Equation (1)] was estimated and the results are presented in Table 1. The regression coefficient for land (0.106), seed (0.147) and labor (0.107) was positive and statistically significant at a 5% level. It was upbeat and non-significant for harvesting cost (0.001), marketing cost (0.002) and others. The co-efficient of determination (R^2) was observed to be 0.529. This indicated that about 53.00% of the variation in ginger production was explained by the identified input variable included in the function. The sum of the elasticity co-efficient was 0.368 which was less than one, indicating decreasing returns to scale.

From Table 2 it was seen that among the inputs

Table 2. Resource- use efficiency in ginger production.

Resources	MPP	MVP	MFC	MVP/MFC (Profitability ratio)	Level of resources used
Land	1.8	102.48	1500	0.06	Underutilized.
Seed	2	91.98	360	0.26	Underutilized
Labor	1.5	99.33	1200	0.08	Underutilized
Marketing cost	2	118.51	1500	0.08	Underutilized
Harvesting cost	2.3	119.91	900	0.13	Underutilized
Others	2	132.09	1500	0.09	Underutilized

(MPP: Marginal Physical Product, MVP: Marginal Value Product, MFC: Marginal Factor Cost).

used for the production of ginger, which was found to be positive and significant at the overall level, the MVP to PX ratio was less than one for land (0.06), seed (0.26), human labor (0.08), marketing cost (0.08), harvesting cost (0.13) and others(0.09) indicated under-utilization of these resources in the cultivation of ginger.

CONCLUSION

The study of resource use efficiency analysis showed that most resources such as land, seed, labor, are underutilized. Farmers are suggested to use these resources fully to achieve maximum profit. Efforts should be made to generate awareness of appropriate seeds, fertilizers and manures on small farms and seeds and plant protection chemicals on pooled farms. The respective department may be encouraged to give proper training for optimum utilization of existing resources.

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