Plant Archives Vol. 20, Supplement 2, 2020 pp. 2522-2526 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

A STUDY ON ECONOMICS OF GINGER CULTIVATION IN ASSAM- A CASE STUDY OF TINSUKIA DISTRICT

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Abstract

Ginger being a major cash crop of Assam has a unique place in its production in the state. The crop has immense potentiality towards generating farm income as well as employment thereby improving the standards of living of the farmers. On account of a very limited research on the production aspect of ginger cultivation in the state, an in depth analysis of the economics of ginger cultivation assumes importance with the objective of determining the various cost and returns pattern of ginger production. The study under consideration was undertaken in 2013 in Tinsukia district of Assam, the district being known for its extensive production of the crop. Multistage stratified random sampling was utilized for the purpose of collecting primary data. Hence the data required was gathered from Chapakhowa block of Tinsukia district. The sample data comprised ginger growers categorized as 12 small, 30 medium and 18 large farmers, classified on the basis of probability proportion to class sizes. The study revealed that the variable costs varied inversely to the class sizes meaning that it was highest for the small farms and least for the large farms. The same pattern was found to be true for the total costs of ginger cultivation whereas the fixed costs were found to be directly proportional to the farm sizes. Moreover the study also revealed that seeds occupied a larger share in the variable costs for all the farm sizes whereas rental value of owned land had the largest share (74-78 %) in the total fixed cost. Data analysis revealed that the large sized farms were highly efficient with the highest net returns from ginger cultivation. Cobb Douglas production function analysis of indicated that human labour, bullock labour, plant protection, fertilizer and seed were significant at various levels of significance for different farm categories. Besides this a higher R^2 value indicating the fit of the regression equation represented the acceptability of the Cobb Douglas form of production function analysis.

Key words: Variable costs, fixed costs, Cobb Douglas production function

Introduction

India is referred to as "the world's spice bowl" owing to its production of a variety of superior quality spices. It has been a witness for growing spices for different purposes since the ancient times. A total of sixty three spices are grown extensively in India according to the Bureau of Indian Standards. India has the world's highest number of varieties of spices ((Kumar, P., Dwivedi, P. (2018a), Kumar, P., Kumar S. *et al.* (2018b), Kumar, P., Misao, L., *et al.*, 2018c, Kumar P, Dwivedi, P. 2018d, Kumar, P. and Purnima *et al.*, 2018e, Kumar, P. Pathak, S. 2019f, Kumar, P. Siddique, A. *et al.*, 2019g, Siddique, A. Kumar, P. 2018h, Siddique, A., Kandpal, G., Kumar P. 2018i). According to the International Spice Group definition, spices are referred to as flavored substances of vegetable origin which are mostly used as condiments or for various purposes owing to their fragrance, and medicinal qualities". Ginger is one of the cornerstones of Indian spice account, used for flavoring and medicinal purposes. It is an important commercial spice crop of the country tracing its cultivation since ancient times. Although the place of origin of the crop has not been established with conformity, yet Indo-China region is presumed to be the home of this unique spice. Depending upon the variety, the colour of the ginger rhizome may vary from yellow to red (Pathak, S., Kumar, P., P.K Mishra, M. Kumar, M. 2017j, Prakash, A., P. Kumar, 2017k., Kumar, P., Mandal, B., 2014L, Kumar, P., Mandal, B., Dwivedi P., 2014m., Kumar, P., Kumar, P.K., Singh, S. 2014n, Kumar, P. 2013o., Kumar, P., Dwivedi, P. 2015p, Gogia, N., Kumar, P., Singh, J., Rani, A. Sirohi, Kumar, P. 2014q, Kumar, P., 2014r. Kumar, P., Dwivedi, P., Singh, P., 2012s.).

Ginger is widely grown in various countries of the world with its production distributed over countries namely India, China, Nigeria, Nepal, Indonesia, Thailand, etc during the year 2018 was accounted to an amount of 3,038,120 metric tonnes. The crop is mainly imported by UK, USA and Saudi Arabia. Nigeria has the highest area under ginger (56.23% of total world ginger area) which is followed by countries like followed by India, China, Indonesia and Bangladesh having about 23.6, 4.7 and 3.4 per cent of the world ginger area respectively. During the same year, India stood first with respect to production of ginger (11, 19,596 tones) and second in terms of area under ginger (1, 60,000 hectares). However it is necessary to be mentioned that, USA ranks first with respect to ginger productivity (47,925kg/ha) and India's ginger productivity (4900 kg/ha) is more than the world's ginger productivity (3856 kg/ha).

Indian ginger is of very high significance in the global market owing to its characteristic lemon like flavour. Kerala is known for producing the premium quality ginger owing to the state's favourable climate and a soil type suitable for cultivation of the crop. Indian states of Kerala, Assam, Meghalaya, Arunachal Pradesh and Orissa combined account for over 60 per cent of the ginger produced in the country (Mishra, P.K., Maurya, B.R., Kumar, Pp. 2012t, Kumar, P., Mandal, B., Dwivedi, P. 2011u. Kumar, P., Mandal, B., Dwivedi, P. 2011v, Kumar, P., Pathak, S. 2016w. Pathak, S., Kumar, P., Mishra, P.K., Kumar, M. 2016x).

Ginger being a popular spice crop of the north eastern state of Assam is grown exclusively in the many districts of the state namely N.C. Hills, Cachar, Tinsukia, Darrang, Karbi-Anglong. Assam produced the largest volume of ginger in India during 2018 amounting to nearly 168 thousand metric tons, contributing about 17.5 percent to the country's ginger production, followed by Maharashtra ad West Bengal. In 2017-18, the area under ginger was 19,000 ha with an estimated production of 1, 68,980 metric tonnes. Five varieties (4 HYV and 1 local) of ginger are cultivated in the north-eastern state of Assam (Utpala *et al.,* 2006). Assam being very suitable for the crop accounts for more than 30% of the total ginger production in the country (Rahman *et al*., 2009). Tinsukia district of Assam grows ginger extensively producing a reasonably larger quantity of ginger owing to the favourable climate and soil of the district. Research on production aspects of ginger was found to be very limited in the state due to which a study on the same would prove to be useful. Hence a study entitled "A study on Economics of Ginger Cultivation in Assam- A case study of Tinsukia district" was undertaken with the objective to analyze the cost and returns structure of ginger production.

Materials and Methods

For the study under consideration, a specially designed schedule was prepared and pre tested in line with the objective of the study. Various information relating to the study about the farmers and the sample villages were collected through these set of schedules. The data pertaining to the aforementioned study was collected exclusively from ginger growers. The current study was undertaken in 2013. Tinsukia district of Assam was selected purposively for the collection of data and statement of the results. The sampling technique utilized for the study was multistage random sampling where Chapakhowa block was selected purposively. In the next step, a list of villages was prepared where ginger cultivation was carried out extensively. Out of all the villages listed, 5 villages namely Akhomia Borgora Gaon, Toribari, Jyotisnagar, Naharbari and Khanibari were selected randomly. Then the farm-households of these five villages were listed disjointedly to select a desired number of sampling units from each of these villages. Based on probability proportion to class sizes, a total of twelve small (< 2 ha), thirty medium (2- 4 ha) and eighteen large ginger growers (> 4 ha) were selected. Thus 60 respondents were interviewed from the above villages for the study (Kumar *et al*., 2018y; Kumar *et al*., 2018z; Kumar *et al*., 2018aa; Kumar *et al*., 2018bb; Kumar *et al*., 2018cc.).

The following cost concepts were used to find out the costs and returns in the production of Ginger.

a. Operational cost: It includes the cost labour (Family and hired), cattle labour, hired tractor charges, hired sprayer charges, seed cost, cost of manures & fertilizers, insecticides and pesticides (plant protection) cost, bagging and interest on working capital.

b. Fixed Cost: It includes land revenue, depreciation, rental value of owned land, interest on fixed capital (excluding land)

c. Total Cost: Fixed Cost + Operational Cost

Apart from the above mentioned cost concepts, other costs namely A_1, A_2, B_1, B_2, C_1 and C_2 were estimated according to CACP cost concepts.

Cost A_1 = fixed + operating cost

Cost A_2 = cost A_1 + land rent (lease in)

Cost B_1 = cost A_1 + interest on fixed assets (excluding land).

Cost B_2 = cost B_1 + rental value of own land + land rent (lease in)

Cost C_1 = cost B_1 + family labour.

Cost C_2 = cost B_2 + family labour.

Cobb-Douglas Production Function

In order to estimating the functional relationship between the farm inputs and outputs the model employed for the analysis was of the form

$$\mathbf{Y = aX_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} X_5^{b5} X_6^{b6} U}$$

where,

Y = Gross return (Rs/ha)

a = constant

X_1 = Human labour cost (Rs)

X_2 = Seed cost (Rs)

X_3 = Cost of bullock labour (Rs)

X_4 = Cost of fertilizers (Rs)

X_5 = Cost of plant protection chemicals (Rs)

$b_1, b_2 \ldots b_5$ are regression coefficients.

U = Error term.

ii) Significance of the regression co-efficient ('t' test):

't' test was employed to analyze the significance of regression coefficients using the following formula.

$$t_{cal} = bi / SE(bi)$$

Where, bi =regression coefficient

SE(bi)= standard error of bi

Furthermore the significance of the regression equation is determined from the value of R^2 using 'F' test.

$$F = R^2 (n-k-1) / K (1-R^2)$$

Where, n = sample size, K=Number of variables, R^2=Coefficients of multiple determination

Results and Discussion

Cost structure in the production of ginger

Costs and returns study assumes importance in determining the comparative profitability and economic viability of one enterprise over the other. Ginger cultivation has provided greater potentiality in generating higher farm income and employment. Owing to the capital intensive nature of ginger production, a detailed study on its costs and returns is of great significance in enhancing the profit level of the farmers. It is of general parlance that farmers do fail to keep records in relation to the costs of production of crops, which do provide a hindrance in determining the profitability of any crop production. The average land holding of and average areas under ginger cultivation for different categories of farms are presented in table 1. The categorization of farm households was done on the basis of operational area.

The values of average operational areas and average areas under ginger was 1.46 ha and 0.601 ha for small farmers; 3.28 ha and 1.119 ha for medium whereas it was 8.02 ha and 3.234 ha for large farmers as shown in table 1.

Variable costs

The variable costs of production of ginger per hectare for different farm categories are presented in table 2. An analysis of the table revealed that per hectare variable cost was maximum for small farms (Rs 89173.52) followed by the medium (Rs 65514.13) and the large farms (Rs 64840.02). The above findings coincided with the findings of Padmaja, G. (2004). Besides it was also observed that in all the farm categories, seeds contributed the major share (37% to 51%) of the total variable costs followed by human labour accounting for 27 per cent of the variable costs in all farm categories.

Fixed costs

The details of fixed cost of ginger cultivation as shown in the table 3 revealed that the large farms incurred the highest fixed costs per hectare (Rs 16315.23) followed by the medium (Rs 16172.84) and then the small farms (Rs 15424.82). Hence it could be concluded that the fixed cost of ginger production varies proportionally to the size of farms. The above findings were supported by the findings of Rath, J.R. (2010). Furthermore it was observed that for all farm categories, rental value of owned land alone accounted for a major (74 to 78 per cent) share of the fixed costs followed by depreciation (11 to 15 per cent).

Total costs

The per hectare total costs of ginger cultivation is shown in table 4. The variable costs accounted for 80 - 86 per cent whereas the contribution of fixed cost range from 13 - 20 per cent for different farm sizes. Furthermore, total cost per hectare was maximum for small farms (Rs. 104598.33) followed by medium (Rs 81686.96) and large (Rs. 81155.25) farms. Hence an inverse relationship was observed between the total costs of cultivation and farm size which was supported by the findings of Padmaja, G. (2004).

Table 1: Operational holding and area under ginger for different farm categories

Farm categories	Number of farms	Size of operational holding (ha)	Average area under ginger (ha)
Small	12	1.46	0.601 (41.16)
Medium	30	3.28	1.119 (34.11)
Large	18	8.02	3.234 (40.32)
Total	60	4.512	1.65 (36.58)

Figures in parentheses indicate percentage area under ginger

Table 2: Variable costs of Ginger for farm categories (Rs/ha)

Particulars	Small	Medium	Large
Human Labour	16938.72	16524.3	16999.23
a. Family labour	8206.374	5619.111	4021.046
b. Hired labour	8732.346	10905.19	12978.19
Cattle labour (owned)	2484.422	2135.143	2084.049
Tractor Charges (hired)	0	2800	2305.88
Sprayer Charges (hired)	490	101.379	0
Seeds	51162.26	24715.79	25027.47
Manures	4269.199	4189.756	4193.325
Fertilizers	2	1253.461	1990.351
Plant protection chemicals	6119.968	6661.899	5153.13
Bagging	5676.52	5640.68	5610.21
Interest on working capital	2160.755	1619.573	1604.451
Total Variable Costs	89173.52	65514.13	64840.02

Table 3: Composition of fixed costs of Ginger in the sample holdings (Rs/ ha)

Particulars	Small	Medium	Large
Rental value of owned land	12000	12000	12000
Land revenue	105	105	105
Interest on fixed capital	1550	1750	1750.22
Depreciation	1769.817	2317.837	2460.009
Total Fixed Costs	15424.82	16172.84	16315.23

Cost concepts

The various cost concepts used in this study are cost A_1, A_2, B_1, B_2, C_1 and C_2 which are presented in tables 5. An assessment of various costs revealed that cost A_1 was maximum on small followed by medium and then large farm categories. A similar trend was seen in case of cost A_2 owing to a lack of leased in land. Similarly cost B_1, B_2, C_1 and C_2 were highest in small followed by medium and then by the large farm sizes. Costs C_1 and C_2 were observed to be higher in small farms primarily due to the fact that the utilization of family labour was more on small farms.

Costs and returns from ginger

The gross as well as net returns from ginger cultivation for different farm categories are presented in table 6. Maximum net return was calculated to be Rs 72678.08 obtained by the large farm sizes. This was followed by medium (Rs. 66852.8) and then by small (Rs. 13829.29) farm categories. Hence it could be stated that the large sized farms were the highly efficient as compared to medium and small farm sizes.

Table 4: Total cost of ginger cultivation in the sample holdings (Rs/ha)

Particulars	Small	Medium	Large
Total variable costs (TVC)	89173.52	65514.13	64840.02
Total fixed costs (TFC)	15424.82	16172.84	16315.23
Total costs (TVC + TFC)	104598.33	81686.96	81155.25

Table 5: Cost of cultivation of ginger as per cost concepts (Rs/ha)

Particulars	Small	Medium	Large
Cost A_1	82736.96	62212.86	63278.99
Cost A_2	82736.96	62212.86	63278.99
Cost B_1	84286.96	63962.86	65029.21
Cost B_2	96286.96	75962.86	77029.21
Cost C_1	92493.34	69581.97	69050.25
Cost C_2	104598.33	81686.96	81155.25

Table 6: Farm category wise gross and net returns from ginger (Rs/ha)

Particulars	Small	Medium	Large
Gross return	118427.62	148539.76	153833.33
Cost	104598.33	81686.96	81155.25
Net return	13829.29	66852.8	72678.08

Production function

With a view to establish a relationship between gross returns of ginger (dependent variable) and human labour, seeds, bullock labour, fertilizers and plant protection measures (independent variables), a production function (Cobb-Douglas) was employed. Production functions were estimated separately for different farm categories; the values of which are presented in table 7. The values of R^2 (co-efficient of multiple determinations) were found to be significantly high in all the cases thereby indicating that the acceptability of the selected form of production function. Analysis of table 7 revealed that for small farms the regression co-efficients of human labour and plant protection showed significance at 5 per cent whereas fertilizer at 10 per cent level of signifiance thereby indicating a positive impact towards the income from ginger. The R^2 value was estimated to be 0.936 which implied that 93 per cent variation in the income of the small farmers was explained by independent variables. In case of medium farmers, the β- values of human labour, bullock labour and fertilizers indicated significance at 5 per cent whereas seed at 10 per cent level. For large farmers, the co-efficients of bullock labour and plant protection were highly significant at one per cent, fertilizer at ten per cent level of human labour and seeds showed significance at 5 per cent level.

Table 7: Farm category wise results of regression

Particulars	Small	Medium	Large
Human Labour (X_1)	0.4451**	0.2105**	0.2121**
Seeds (X_2)	0.1455^{NS}	0.1396*	0.2272**
Bullock labour (X_3)	0.2150^{NS}	0.2537**	0.6039***
Fertilizers (X_5)	0.3400*	0.4054**	0.0285*
Plant protection (X_6)	0.0334**	0.0416^{NS}	0.0717***
□bi	1.179	1.051	1.143
R^2	0.936	0.684	0.861

'***', '**' & '*' indicate significance at 1%, 5% and 10% respectively and NS indicate non significant

Conclusions

The present study was undertaken to develop an understanding of the cost and return patterns of cultivating ginger in Assam with special reference to Tinsukia district. From the analysis it was observed that the variable cost for ginger cultivation was highest for small farms followed by the medium and then large farms. Furthermore it was also found that seeds contributed the major share in the total variable costs irrespective of farm sizes. On the other hand the fixed cost per hectare was maximum for large farms. For all farm size categories, the rental value of own land made up 74 to 78 per cent of the fixed costs. It was also observed that total costs and farm size varied inversely meaning that the total cost was highest for the small farms and the least for the large farms. Besides that for all farm categories, variable costs accounted for 80 - 86 per cent whereas the fixed costs contributed 13 - 20 per cent of the overall costs of ginger cultivation for different farm categories. Moreover return analysis of the data indicated that the large sized farms were highly efficient as indicated by the high values of net returns from ginger cultivation.

Production function analysis of the data indicated that for the variables namely human labour, plant protection and fertilizer were found to be significant at various levels of significance. Variables such as human labour, bullock labour and fertilizer, and seed exhibited positive impact on the gross returns from ginger as evident from their significance. For the large farmers, the input variables namely bullock labour, plant protection, human labour and seeds were found to be significant at various significance levels. High R^2 values indicated the goodness of fit of the regression equation.

Acknowledgement

The above study has been made possible due to the help and contribution of many persons notable among them are the farmer from whom the data has been collected, state agricultural department officers whose help was immense in going through the problem. Help and support lent by my family and friends without whom I could not have carried out the problem in hand. Apart from these, some of the references used for the study are listed as under.

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