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

Namami Gohain1, H.N. Atibudhi 2 and Avinash Kumar3

1 & 3 Department of Agricultural Economics and Extension/ School of Agriculture/ Lovely Professional University, Punjab, India
2 Former HOD, Department of Agricultural Economics/ College of Agriculture/ Orissa University of Agriculture and Technology, Odisha, India

*(e-mail : namami.25006@lpu.co.in; Mobile : 7973488946)

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 higher share in the total 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 R² 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., Misa, L., et al., 2018c, Kumar P, Dwivedi, P. 2018d, Kumar, P. and Purinima 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 cornerstone 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. 2017), 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 A1, A2, B1, B2, C1 and C2 were estimated according to CACP cost concepts.

Cost A1 = fixed + operating cost
Cost A2 = cost A1 + land rent (lease in)
Cost B1 = cost A1 + interest on fixed assets (excluding land).
Cost B2 = cost B1 + rental value of own land + land rent (lease in)
Cost C1 = cost B1 + family labour.
Cost C2 = cost B2 + 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

\[ Y = aX_1^{b_1}X_2^{b_2}X_3^{b_3}X_4^{b_4}X_5^{b_5}X_6^{b_6}U \]

where,

\[ Y = \text{Gross return (Rs/ha)} \]
\[ a = \text{constant} \]
\[ X_1 = \text{Human labour cost (Rs)} \]
\[ X_2 = \text{Seed cost (Rs)} \]
\[ X_3 = \text{Cost of bullock labour (Rs)} \]
\[ X_4 = \text{Cost of fertilizers (Rs)} \]
\[ X_5 = \text{Cost of plant protection chemicals (Rs)} \]
\[ b_1, b_2, ..., b_6 \text{ are regression coefficients.} \]
\[ U = \text{Error term.} \]

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

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

\[ t_{cal} = \frac{bi}{SE(bi)} \]

Where, \( bi = \text{regression coefficient} \)
\( SE(bi) = \text{standard error of } bi \)

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

\[ F = R^2 \frac{(n-k-1)}{K(1-R^2)} \]

Where, \( n = \text{sample size, } K=\text{Number of variables, } R^2=\text{Coefficients of multiple determination} \)

**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 1604.451). Hence it could be concluded that the fixed cost of ginger production varies proportionally to the size of farms. A similar trend was seen in case of cost A2 owing to a lack of leased in land. Similarly cost B1, B2, C1 and C2 were highest in small followed by medium and then by the large farm sizes. Costs C1 and C2 were observed to be higher in small farms primarily due to the fact that the utilization of family labour was more on small farms.

**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).

**Cost concepts**

The various cost concepts used in this study are cost A1, A2, B1, B2, C1 and C2 which are presented in tables 5. An assessment of various costs revealed that cost A1 was maximum on small followed by medium and then large farm categories. A similar trend was seen in case of cost A2 owing to a lack of leased in land. Similarly cost B1, B2, C1 and C2 were highest in small followed by medium and then by the large farm sizes.

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

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Small</th>
<th>Medium</th>
<th>Large</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rental value of owned land</td>
<td>12000</td>
<td>12000</td>
<td>12000</td>
</tr>
<tr>
<td>Land revenue</td>
<td>105</td>
<td>105</td>
<td>105</td>
</tr>
<tr>
<td>Interest on fixed capital</td>
<td>1550</td>
<td>1750</td>
<td>1750.22</td>
</tr>
<tr>
<td>Depreciation</td>
<td>1769.817</td>
<td>2317.837</td>
<td>2460.009</td>
</tr>
<tr>
<td>Total Fixed Costs</td>
<td>15424.82</td>
<td>16172.84</td>
<td>16315.23</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Small</th>
<th>Medium</th>
<th>Large</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total variable costs (TVC)</td>
<td>89173.52</td>
<td>65514.13</td>
<td>64840.02</td>
</tr>
<tr>
<td>Total fixed costs (TFC)</td>
<td>15424.82</td>
<td>16172.84</td>
<td>16315.23</td>
</tr>
<tr>
<td>Total costs (TVC + TFC)</td>
<td>104598.33</td>
<td>81686.96</td>
<td>81155.25</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Small</th>
<th>Medium</th>
<th>Large</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost A1</td>
<td>82736.96</td>
<td>62212.86</td>
<td>63278.99</td>
</tr>
<tr>
<td>Cost A2</td>
<td>82736.96</td>
<td>62212.86</td>
<td>63278.99</td>
</tr>
<tr>
<td>Cost B1</td>
<td>84286.96</td>
<td>63962.86</td>
<td>65029.21</td>
</tr>
<tr>
<td>Cost B2</td>
<td>96286.96</td>
<td>75962.86</td>
<td>77029.21</td>
</tr>
<tr>
<td>Cost C1</td>
<td>92493.34</td>
<td>69581.97</td>
<td>69050.25</td>
</tr>
<tr>
<td>Cost C2</td>
<td>104598.33</td>
<td>81686.96</td>
<td>81155.25</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Small</th>
<th>Medium</th>
<th>Large</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross return</td>
<td>118427.62</td>
<td>148539.76</td>
<td>153833.33</td>
</tr>
<tr>
<td>Cost</td>
<td>104598.33</td>
<td>81686.96</td>
<td>81155.25</td>
</tr>
<tr>
<td>Net return</td>
<td>13829.29</td>
<td>66852.8</td>
<td>72678.08</td>
</tr>
</tbody>
</table>
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 significance 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 $\beta$- 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

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Small</th>
<th>Medium</th>
<th>Large</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Labour ($X_1$)</td>
<td>0.4451**</td>
<td>0.2105**</td>
<td>0.2121**</td>
</tr>
<tr>
<td>Seeds ($X_2$)</td>
<td>0.1455**NS</td>
<td>0.1396*</td>
<td>0.2272**</td>
</tr>
<tr>
<td>Bullock labour ($X_3$)</td>
<td>0.2150**</td>
<td>0.2537**</td>
<td>0.6039***</td>
</tr>
<tr>
<td>Fertilizers ($X_4$)</td>
<td>0.3400*</td>
<td>0.4054**</td>
<td>0.0285*</td>
</tr>
<tr>
<td>Plant protection ($X_6$)</td>
<td>0.0334**</td>
<td>0.0416**</td>
<td>0.0717***</td>
</tr>
</tbody>
</table>

****, ***, & * 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, 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.

References


Kumar, P. Pathak, S. 2019f. “Responsiveness index of sorghum (Sorghum bicolor (L.) Moench) grown under cadmium contaminated soil treated with putrescine and mycorrhiza” Bangladesh J. Bot. vol.48 (1).


Kumar, P., Mandal, B., Dwivedi, P. 2011v. “Screening plant species for their capacity of scavenging heavy metals from soils and sludges. Journal of Applied Horticulture, 13 (2), 144-146.


Kumar, P., Yunnam, J. et al., 2018z. “Cadmium Induced Changes in Germination of Maize Seed Treated with Mycorrhiza” Annals of Agri-Bio Research, 23(2); 169-170.


