Production economics of Ginger (*Zingiber officinale* Rose.) in Salyan district of Nepal

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**ABSTRACT**

This study investigates the economics of ginger (*Zingiber officinale* Rose.) production in the Salyan district of Nepal. The production economics was assessed by the household survey in purposively selected Sharada municipality and Siddhakumakh Rural Municipalities. The semi-structured interview schedule was administered to interview randomly selected forty-three producers from Sharada Municipality and thirty-one producers from Siddhakumakh Rural Municipality. The results indicated that the ginger production was found to be a profitable enterprise in the study area with an average B:C ratio of 1.55. The overall productivity of ginger in the study area was found to be 16.28 MT/ha. The Cobb-Douglas production function indicates that ginger production exhibited increasing returns to scale at a decreasing rate. The regression function of 0.784 implies that if all the inputs specified in the production function are increased by 100%, the gross return will increase by about 78.4%.

**INTRODUCTION**

Ginger (*Zingiber officinale* Rose.) is a widely grown spice crop of mid-hills of Nepal with a huge export value (ITC, 2007). Ginger as a high-value spice crop can contribute more to improve the socioeconomic status of rural people by raising their income (NSCDP, 2007). It is one of the nineteen commodities of Nepal that has significant export potential (NTIS, 2017). Globally, Nepal is fourth in ginger production after India, China, and Nigeria with about 9.2% of the world’s share (FAO, 2017). About 99% of Nepal’s ginger export is to India, about three fourth of which is fresh ginger rhizome while remaining is in dried form locally known as ‘sutho’ (TEPC, 2017). The total area under cultivation of ginger in Nepal was 22649 hector (ha) with the production of 279504 Metric Ton (MT) in fiscal year 2016/17 (MoAD, 2018). Salyan is the second most important district of Nepal after the Ilam district in ginger production. The total area under ginger production in Salyan district in 2016/2017 was 2000 ha with a total production of 25006 MT (DADO, 2018). Salyan district shares 8.95% of total national ginger production and shares 8.83% of total cultivated land area (MoAD, 2018).

Agricultural development is the key factor of poverty reduction in Nepal and commercialization of the Nepalese agriculture sector can be brought about through increased market research and product development (ADS, 2015). Despite this humongous potential of ginger to alleviate rural poverty, the studies that investigate the profitability of ginger production are lacking. Ginger production is basically a family farm enterprise of small-holder farmers who are facing multi-faceted challenges like increased cost of production, lack of production, sub-optimal level of resource use, lack of market information and inefficient marketing channels (Khanal, 2018). However, studies on economic aspects of ginger production are limited. To fill this gap, this study was conducted to investigate the economics of ginger production in the major ginger-producing pocket of the country. It also explores the level of resource used by the ginger...
producers and identifies the scale of production.

MATERIALS AND METHODS

Selection of study area
Among all the districts of Nepal, Salyan district ranks second, after the Ilam district, both in terms of area under ginger farming and total production (MoAD, 2018). Salyan district, famous for its fibreless ginger, has a promising scope of improving the ginger sub-sector which can lead to employment generation and poverty alleviation if problems of marketing could be solved (FNCCI, 2012). Malneta of Sharada Municipality and Chande of Siddhakumakh Rural Municipality were selected purposively as they were major ginger producing areas in Salyan District (PMAMP, 2018).

Sources of data
Primary data was collected by conducting a household survey using a semi-structured, pre-tested interview schedule while the secondary sources of data were reports of government authorities, NGOs and INGOs along with research articles on national and international journals and proceedings. The collected information was further verified through a focus group discussion conducted within the study area.

Sample size and sampling techniques
For the samples of producers, an inventory of farmers of the research study areas was prepared to consult farmers groups/ cooperatives, Project Implementation Unit of Prime Minister Agriculture Modernization Project (PMAMP) and District Agriculture Development Office (DADO). Random sampling technique was used to select 43 producers from Sharada Municipality and 31 from Siddhakumakh Rural municipality.

Data analysis
The collected data was analyzed using the statistical packages like Microsoft Excel and Statistical Package for Social Science (SPSS version 16). Cobb-Douglas production function was used for the assessment of production economics.

Economic analysis

Cost of production: Only variable cost items were considered and the total variable cost of production was calculated by adding all the expenditure on variable inputs.

Total variable cost = Rhizome cost + labor cost (land preparation, planting, manure application, weeding, mulching, harvesting, and other post-harvest activities) + Farm Yard Manure (FYM) cost + fertilizer cost + insect-pest management cost

Benefit-cost analysis: The benefit-cost analysis was carried out after calculating the total variable cost and gross returns from ginger production (Poudel et al., 2016). The benefit-cost analysis was carried out by using the formula:

\[ \text{B: C Ratio} = \frac{\text{Gross returns}}{\text{Total variable cost}} \]

Where,

Gross return (in NRs) = total quantity of ginger marketed (kg) × price (per kg) of ginger + total quantity of sutho (kg) × price (per kg) of sutho + total quantity of seed rhizome (kg) × price (per kg) of seed rhizome

Empirical model
The extended Cobb-Douglas production function which was used as the empirical model in the study is given below:

\[ Y = AX_1^{b_1}X_2^{b_2}X_3^{b_3}X_4^{b_4}X_5^{b_5}e \]

Where,

\[ Y = \text{Gross returns}, A = \text{Intercept}, X_1 = \text{rhizome cost}, X_2 = \text{labor cost}, X_3 = \text{farmyard manure cost}, X_4 = \text{fertilizer cost}, X_5 = \text{insect pest management cost}, b_1 \text{ to } b_5 = \text{elasticity coefficients}, e = \text{Error term.} \]

When Cobb-Douglas production function was transferred into linear form, it was expressed as:

\[ \ln Y = \ln A + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + e \]

Returns to scale in Cobb-Douglas function is determined by the sum of the power coefficients i.e. b1 + b2 + ... + bn

If b1 + ... + bn = 1, we have constant return to scale.

If b1 + ... + bn < 1, we have decreasing return to scale.

If b1 + ... + bn > 1, we have increasing return to scale.

The values of the input coefficient imply their contribution to the production of ginger. Similarly, the Cobb-Douglas production frontier has been used to investigate the resource use analysis by Islam et al. (2012) and Poudel et al. (2016).

RESULTS AND DISCUSSION

Productivity and production of ginger
The overall productivity of ginger in the study site was found to be 16.28 MT/ha. It was recorded higher than the average productivity of the district (12.50 MT/ha) and the national average (12.34 MT/ha) (MoAD, 2018). The study area is identified as one of the most productive areas in the country for ginger and has huge climatic suitability for ginger production. Malneta (17.09 MT/ha) was found to be significantly superior to Chande (15.15 MT/ha) in terms of ginger productivity. The overall average production of ginger by each farm was found to be 2080.40 kg which statistically similar in both the villages (Table 1)

Quantity of ginger traded (rhizome, sutho and seed)
In the study area, ginger was found to be traded in three different forms. They were: mature rhizome, the dried form of rhizome (locally known as ‘sutho’) and seed rhizome. One kilogram of sutho can be obtained by drying about 6 kg of the
fresh mature rhizome. The overall average quantity of fresh ginger marketed on the per hectare basis was reported to be 11680.18 kg. The quantity of fresh mature rhizome sold was found to be more in Malneta (11534.88 kg) than Chande (11881.72 kg). The quantity of marketed sutho was significantly higher in Malneta (923.25 kg) compared to Chande (614.73 kg). Similarly, the quantity of seed rhizome marketed was found to be significantly more in Malneta (975.19 kg) than that in Chande (109.67 kg) (Table 2).

Table 1. Productivity and production of ginger in the study site.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Malneta (N=43)</th>
<th>Chande (N=31)</th>
<th>Overall</th>
<th>Mean difference</th>
<th>t value</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Productivity (MT/ha)</td>
<td>17.09</td>
<td>15.15</td>
<td>16.28</td>
<td>1.931***</td>
<td>3.936</td>
<td>0.000</td>
</tr>
<tr>
<td>Production of ginger(kg)</td>
<td>2176.75</td>
<td>1946.75</td>
<td>2080.40</td>
<td>229.969</td>
<td>0.656</td>
<td>0.514</td>
</tr>
</tbody>
</table>

Note: *** indicate level of significance at 1% level.

Table 2. Quantity of ginger sold (fresh mature rhizome, Sutho and Seed).

<table>
<thead>
<tr>
<th>Quantity (kg/ha)</th>
<th>Malneta (N=43)</th>
<th>Chande (N=31)</th>
<th>Overall</th>
<th>Mean difference</th>
<th>t value</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh rhizome</td>
<td>11534.88</td>
<td>11881.72</td>
<td>11680.18</td>
<td>346.836</td>
<td>-0.501</td>
<td>0.618</td>
</tr>
<tr>
<td>Dried form</td>
<td>923.25</td>
<td>614.73</td>
<td>794.00</td>
<td>308.52**</td>
<td>2.066</td>
<td>0.042</td>
</tr>
<tr>
<td>Seed rhizome</td>
<td>975.19</td>
<td>109.67</td>
<td>116.90</td>
<td>612.61**</td>
<td>3.208</td>
<td>0.002</td>
</tr>
</tbody>
</table>

** indicate level of significance at 5%.

Table 3. Cost of production per hectare, revenue and B:C ratio of ginger.

<table>
<thead>
<tr>
<th>Cost (NRs)</th>
<th>Malneta (N=43)</th>
<th>Chande (N=31)</th>
<th>Overall</th>
<th>Mean difference</th>
<th>t value</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhizome cost</td>
<td>71534.88</td>
<td>72946.23</td>
<td>72126.126</td>
<td>-1411.352</td>
<td>-0.462</td>
<td>0.645</td>
</tr>
<tr>
<td>Labor cost</td>
<td>100279.06</td>
<td>77338.70</td>
<td>90668.918</td>
<td>22940.360</td>
<td>4.734***</td>
<td>0.000</td>
</tr>
<tr>
<td>FYM cost</td>
<td>22325.58</td>
<td>21045.69</td>
<td>21789.414</td>
<td>7395.452</td>
<td>3.484**</td>
<td>0.002</td>
</tr>
<tr>
<td>Fertilizer cost</td>
<td>372.09</td>
<td>0.00</td>
<td>372.09</td>
<td>372.09</td>
<td>1.992*</td>
<td>0.050</td>
</tr>
<tr>
<td>Insect-pest management cost</td>
<td>5174.80</td>
<td>7339.90</td>
<td>3349.774</td>
<td>3456.526</td>
<td>3.227**</td>
<td>0.002</td>
</tr>
<tr>
<td>Total cost of production/ha</td>
<td>199686.43</td>
<td>172148.92</td>
<td>188150.450</td>
<td>27537.509</td>
<td>4.705***</td>
<td>0.000</td>
</tr>
<tr>
<td>Return</td>
<td>330000.00</td>
<td>238899.99</td>
<td>291836.48</td>
<td>611111**</td>
<td>3.317***</td>
<td>0.001</td>
</tr>
<tr>
<td>B:C ratio</td>
<td>1.67</td>
<td>1.39</td>
<td>1.557</td>
<td>0.280</td>
<td>3.170***</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Note: ***, ** indicate level of significance at and 1%, 5% and 10% respectively.

Table 4. Cobb-Douglas production function of ginger production.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient</th>
<th>Standard error</th>
<th>t-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>6.760***</td>
<td>2.038</td>
<td>3.320</td>
<td>0.001</td>
</tr>
<tr>
<td>Rhizome cost</td>
<td>0.125</td>
<td>0.148</td>
<td>0.845</td>
<td>0.401</td>
</tr>
<tr>
<td>Total labor cost</td>
<td>0.220**</td>
<td>0.085</td>
<td>2.596</td>
<td>0.012</td>
</tr>
<tr>
<td>FYM cost</td>
<td>0.167</td>
<td>0.133</td>
<td>1.255</td>
<td>0.214</td>
</tr>
<tr>
<td>Fertilizer cost</td>
<td>0.012</td>
<td>0.013</td>
<td>0.989</td>
<td>0.326</td>
</tr>
<tr>
<td>Insect pest management cost</td>
<td>0.260***</td>
<td>0.007</td>
<td>3.818</td>
<td>0.000</td>
</tr>
<tr>
<td>F-value</td>
<td>12.920</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R square</td>
<td>0.487</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R-square</td>
<td>0.449</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Return to scale</td>
<td>0.784</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: ***, ** indicate level of significance at and 1% and 5%, respectively.
The estimated values of the coefficients and related statistics of Cobb-Douglas production functions are shown in Table 4. Out of five independent variables included in regression analysis, the costs on insect-pest management and labor were found significant while rhizome, farmyard manure, and fertilizer costs were not found significant in the study area. Poudel et al. (2016) also reported labor costs to be significant in ginger production. The regression coefficient of insect-pest management cost was 0.26 which indicates that increasing 100% cost in insect-pest management, the gross returns could be increased by 0.26. Similarly, a 100% increase in labor costs could increase the gross returns by 22%. The sum of all the regression coefficients of all the inputs considered in the regression function was estimated to be 0.784 which indicates that the production function exhibited an increasing return to scale at a decreasing rate. This implies that if all the inputs specified in the production function are increased by unity, the gross return will increase by about 0.784. The adjusted R-square value was estimated to be 0.449 which implies that the specified variables affect gross return by 44.9%.

**Conclusion**

Higher productivity indicates better suitability of ginger farming in the study area. Similarly, the benefit-cost ratio of 1.55 demonstrates the higher profitability of the ginger production enterprise. The Cobb-Douglas regression model revealed that ginger production exhibited an increasing return to scale at a decreasing rate. The regression coefficient of 0.784 implies that if the specified cost variables in the production function are increased by unity, the gross return will increase by 0.784 units. The costs on insect pest management and labor costs were identified to be significant for increasing the revenue. This implies that increasing labor and insect pest management costs will significantly increase the returns from ginger production.

**REFERENCES**


