Economics of hybrid maize cultivation in Sarguja district of Chhattisgarh

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ABSTRACT

The present study was emphasized to study the cost and return of cultivation, the trend in area yield potential and resource use efficiency of hybrid maize of farm holdings sizes in Sarguja district of Chhattisgarh. A sample of eighty farmers was surveyed (forty five marginal, twenty five small and ten large) by three stage stratified random sampling method. The result indicated that cost of labour constituted largest component in total variable cost accounted about (46.89%) followed by manure and fertilizer cost (37.00 %), followed by seed cost (11.60%). Of all the components of the fixed cost, rental value of owned land and depreciation cost constituted the maximum share about (81.90%) and (16.50%) respectively. The total cost increased with the increase in size of holdings. The total costs of production of maize per hectare was highest for large farmer of Rs. 32079.54/ha followed by small farmer of Rs. 28794.74/ha followed by small farmers of Rs. 27334/ha. There is excess use of labour by marginal farms. The excess labour may be diverted for cultivation of other crops. Large farmers received higher income due to optimal application of fertilizer. Improvement of farm level efficiency relies on technical knowledge of crop as well as income diversification, institutional capacity building that can enhance assets ownership, extension and credit facility.

Key words: Economics, Maize cultivation.

INTRODUCTION

Maize is most potential, widely distributed cereal crop ranks third after rice and wheat in total food grain production in India. It is used for various purposes traditionally as a staple food in various regions, primarily for household consumption, feed for live stock and as a raw material for industry including biofuel production. About 50% of maize in India is used as animal feeds (Singh et al., 2003). The demand of maize for producing cattle and poultry feed and other valuable production for human consumption are increasing though its raw consumption among the elite population is declining (Badal and Singh, 2000 and Chauhan and Chhabra, 2005). Maize growing importance can be well amplified as it is used both in domestic and trading purpose among countries. Globally, maize is known as higher productive cereals because it has highest genetic yield potential among cereals. Maize ranks first (868 MT) followed by wheat (691 MT) and rice (461MT) in world production (GOI, 2013). Worldwide maize production was more than 960 MT and global maize production has grown at CAGR of 3.4 per cent over last ten years from 716 MT in 2004-05 to 967 MT in 2013-14 (FICCI, 2014). Though maize production has gone up high in recent years, need of higher productivity cannot be ignored due to high growth rate of population and their demand (Kumar, 1998). At present, two major ways to increase maize productivity with existing technology – first by growing high yielding varieties which comprises composites and hybrid maize and other is growing area of maize production. Appropriate government policies and institutions bust to grow hybrid maize in huge area in India is needed. High degree of hybrid maize adoption leads to better dietary intake in household use (Kumar, 1994).

Major maize growing states in India are Andhra Pradesh, Karnataka, Rajasthan, Maharashtra, Bihar, Uttar Pradesh, Madhya Pradesh, and Himachal Pradesh contributes more than 80 percent of total maize production (ICAR, 2014).

In Chhattisgarh, maize is replacing non-economic and non marketable crops in the upland. Maize is grown in an area of 116 thousand hectare, has a productivity of 1939 kg/ha. The total maize production in the state is 225 thousand metric tons. Maize is trading in the range of Rs. 1500-1600/ q across major spot markets, much above minimum support price , as MSP fixed by government was Rs.1310 (GOIC, 2012-13). Though the state is favorable for maize production with better input delivery system, price stabilization, favorable market condition, good institutional support system, hybrid and composite seeds utilization, but less crop yield due to high cost of production, lack of appropriate incentive, inefficient input utilization, lack of technical knowledge and awareness. The study has been done to find out the production lacuna of maize production and getting the better option for higher productivity. Thus, the present study has been made with the special objectives,

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• To estimate cost and return of maize cultivation in different farm sizes,
• To find out the trend of maize cultivation in the study area, and
• To examine the resource use efficiency of different farm Sizes.

MATERIALS AND METHODS

Primary data has been collected from Northern hills of Chhattisgarh state which consists of three zones namely Chhattisgarh plains, Northern Hills and Bastar plateau. Most of area of northern hills is used for maize production and Sarguja district comes under that zone with higher production. A three stage stratified random sampling procedure has been followed to select the sample of eighty farmers of the total sample fourty five are marginal, twenty five are small and ten are large farmers. At the first stage Ambikapur block was randomly selected. Three villages namely Sakalo-sargawa, Digma and Nehru Nagar were selected randomly at next stage. At the third stage, farmers were selected randomly by their farm size proportionally. The information about sample villages and respondents were obtained through a pre tested schedules.

Tools and techniques used

Farm business analysis: This includes the detailed analysis of the costs and returns of the individual crop enterprises as well as the farm as a whole. The various measures used for the analysis included:-

Estimation of working capital

Seeds: The seed cost comprised of cost of subsidized seed purchased from agricultural cooperative society and also seed purchased from seed companies and dealers.

Fertilizer and manure: Comprises of cost of subsidized fertilizer purchased from the agricultural cooperative society and also from retail shop. Manure is mostly purchased from other farmers and it includes purchase price and transportation cost to the farm.

Human labour: This is determined by hired labours and imputed value of family labours. The prevailing market price is i.e. Rs.200 for male and Rs. 150 for female labour per day. Machine labour: Both owned and hired machine are charged differently according to area. Tractor is charged at the rate of Rs. 500 per hour for field preparation of one acre area. Interest on working capital: it was calculated at the rate of 7 % per annum for half of the crop period.

Estimation of fixed capital

Land revenue: The actual amount which the farmers pay to the government. For marginal farmers (up to 1 ha) it is less than Rs. 20, for small farmers (1-2 ha) it is Rs. 20 to Rs. 40 and for large farmers (more than 2 ha) it is more than Rs. 40.

Valuation of tools and implements: The farm tool and implements were evaluated at the cost minus depreciation.

Estimation of fixed costs

Depreciation: It was calculated by straight line method taking life period of the implement and it’s cost at the time of purchasing.

Interest on fixed capital: Interest on fixed capital, excluding land, was charged at the rate of ten % per annum.

Rental value of land: It is taken as Rs.1000 per acre.

Statistical tools used: For testing statistical significance of regression co-efficient or production elasticity,’t’ values were calculated using the formula:

\[
 t = \frac{b_1}{S.E.(b_1)}
\]

Where,

\[
 t = \text{Calculated ‘} b_1’ = \text{regression coefficient of input X1}
\]

\[
 S.E. = \text{standard error of } b_1
\]

To find statistical significance of gross income between two farm sizes, ‘t’ test is used.

Resource use efficiency: Resource use efficiency has been examined by computing marginal value product (MVP) at the geometric mean level and this has been compared with the acquisition or opportunity cost of resource. The significance difference between MVP of resource and their acquisition cost were tested using following ‘t’ test.

\[
 t = \frac{(MVP_i - P_i)}{S.E.(MVP_i)}
\]

\[
 S.E. = \sqrt{\frac{Y}{X_i}}
\]

RESULTS AND DISCUSSION

Cost structure and return on maize cultivation in the sample farms: Production cost plays an important role in the process of decision making by the farmers. The analysis of cost and return indicates the profitability of the farm business. The concept of cost and return used in the present discussion are the same as generally adopted in the farm management studies conducted in the country. This section provided the cost structure prevailing in the study area. The costs were determined keeping into account the inputs that the farmers in the study area used in the maize cultivation. Table 1 below illustrated the composition of variable cost while Table 2 illustrated the composition of fixed cost per hectare in each farm category.

Variable cost: The variable cost is such cost which varies with the level of production. These costs include the cost of inputs responsible for production such as labour (human and machinery), seed, manure, fertilizer, pesticides and interest on working capital. It was observed from the Table 1 that average variable cost was Rs. 25,629.60/ha in sample farms. Variable cost increased with the increase in farm size. The per hectare expenditure on labour is Rs.12018 which accounted highest among all the costs i.e. 46.89 % of
the TVC. As the study area is hilly, less scope is for farm mechanization, people are mostly tribal, almost engaged in working, labour cost accounted highest among all the expenditure. The next important component is expenditure on Manure and fertilizer accounting for 37.19 % of TVC. Total expenditure on seed was 11.60 % of TVC. Total expenditure on plant chemical and interest on working capital was Rs. 2255.48/ha (81.90%) and Rs. 808.94/ha (3.15%) of total variable costs respectively. Kumar and Grover., 2014 reported that seed cost accounted about 11.8 %, manure fertilizer about 13.7 %, chemicals about 0.01%, interest on working capital about 1.60% respectively of total variable costs.

Total fixed cost: It was observed from Table 2 that of all the components of TFC, rental value of owned land and depreciation accounted for Rs. 2255.48/ha (81.90%) and Rs. 454.49/ha (16.50%). Rental value of own land was higher for large farms as compared to small and marginal farms. Depreciation cost was more for large and small farms as compared to marginal farmers because they use their own machinery like thresher and sprayer for operational farm business. The total fixed cost was found out to be Rs. 2753.78/ha.

Result of ‘t’ test of gross income: It was reported in Table 3 that gross income of large farmer was 13.93 % higher as compared to small farmers which were statistically significant at 5 %.

Similarly the large farmers received 14% higher gross income as compared to marginal farmers which was statistically significant at 5 %. Small farmers received about 0.30 % higher gross income as compared to marginal farmer which was not significant.

Farm efficiency measures in different farm sizes: Farm efficiency is the ratio of total expenses to gross income. It is a combined measure of profit making ability of the farm which expresses the percentage of the gross income consumed by the expenses and is therefore, indicative of absolute size of business. It represents profit margin for business as a whole. It was observed from Table 4 that gross ratio was highest for small farms followed by large and marginal farms. Fixed expenses remain same regardless of absolute size of business. Their relative importance in production can be expressed by a ratio determined by dividing TFC by gross income. It was higher for small farm followed by large and marginal farms. It indicates what proportion of gross income is spent in hiring labour, purchasing seeds, manure, fertilizer, pesticides. It is computed by dividing TVC by gross income. It was observed that small farms have higher operating cost ratio.

Resource use efficiency in different categories of farms: It was observed from the Table 5 that there was sub-optimal use of labour in marginal farms. In case of small and large farms there is optimal use of fertilizer and seed due to better mechanization.

Table 1: Composition of variable cost of maize production (rupees per ha) in different categories of farm holdings.

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Marginal farmers</th>
<th>Small farmer</th>
<th>Large farmer</th>
<th>All farms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed</td>
<td>2800(11.26%)</td>
<td>3186.75(12.37%)</td>
<td>3237.2(11.23%)</td>
<td>2975.50(11.60%)</td>
</tr>
<tr>
<td>Fertilizer and manure</td>
<td>9164.88(36.88%)</td>
<td>9591.95(37.23%)</td>
<td>11049.31(38.36%)</td>
<td>9533.89(37.19%)</td>
</tr>
<tr>
<td>Labour</td>
<td>11806.5(47.50%)</td>
<td>11903.97(46.21%)</td>
<td>13255.23(46.02%)</td>
<td>12018.05(46.89%)</td>
</tr>
<tr>
<td>Plant protection</td>
<td>296.10(1.19%)</td>
<td>259.80(1.00%)</td>
<td>349.82(1.21%)</td>
<td>291.47(1.13%)</td>
</tr>
<tr>
<td>Interest on working</td>
<td>784.62(3.16%)</td>
<td>812.43(3.15%)</td>
<td>909.70(3.16%)</td>
<td>808.94(3.15%)</td>
</tr>
<tr>
<td>Total variable costs</td>
<td>24852.39</td>
<td>25759.93</td>
<td>28801.27</td>
<td>25629.60</td>
</tr>
</tbody>
</table>

(Figures in parenthesis are percentage of total)

Table 2: Composition of fixed cost of maize production (rupees per ha) in different categories of farm holdings.

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Marginal farmers</th>
<th>Small farmers</th>
<th>Large farmers</th>
<th>All farms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rental value of land</td>
<td>2138.67(86.19%)</td>
<td>2379.96(78.39%)</td>
<td>2470(75.34%)</td>
<td>2255.48(81.90%)</td>
</tr>
<tr>
<td>Land revenue</td>
<td>20.42(0.82%)</td>
<td>21.72(0.71%)</td>
<td>27.2(0.83%)</td>
<td>21.67(0.79%)</td>
</tr>
<tr>
<td>Interest on fixed capital</td>
<td>15.09(0.60%)</td>
<td>31.25(1.02%)</td>
<td>30.97(0.94%)</td>
<td>22.12(0.80%)</td>
</tr>
<tr>
<td>Depreciation</td>
<td>306.93(12.37%)</td>
<td>601.88(19.83%)</td>
<td>750.10(22.89%)</td>
<td>454.49(16.50%)</td>
</tr>
<tr>
<td>Total fixed cost</td>
<td>2481.11</td>
<td>3034.81</td>
<td>3237.2(11.23%)</td>
<td>2963.10(11.17%)</td>
</tr>
</tbody>
</table>

(Figures in parenthesis are percentage of total)

Table 3: Result of ‘t’ test of gross income received by different categories of farms

<table>
<thead>
<tr>
<th>Categories of farmers</th>
<th>Percent increase in gross income</th>
<th>‘t’ value obtained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large- small farmers</td>
<td>13.93</td>
<td>2.20*</td>
</tr>
<tr>
<td>Large- marginal farmers</td>
<td>14</td>
<td>2.10*</td>
</tr>
<tr>
<td>Small- marginal farmers</td>
<td>0.30</td>
<td>1.66</td>
</tr>
</tbody>
</table>

*significant at 5% level of significance

Table 4: Gross ratio, fixed ratio, operating ratio of Maize in the sample holding of different categories of farms

<table>
<thead>
<tr>
<th>Size Group</th>
<th>Gross ratio</th>
<th>Fixed cost ratio</th>
<th>Operating cost ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marginal Farmers</td>
<td>0.526</td>
<td>0.047</td>
<td>0.478</td>
</tr>
<tr>
<td>Small Farmers</td>
<td>0.552</td>
<td>0.058</td>
<td>0.494</td>
</tr>
<tr>
<td>Large farmers</td>
<td>0.540</td>
<td>0.055</td>
<td>0.485</td>
</tr>
<tr>
<td>All farm</td>
<td>0.535</td>
<td>0.051</td>
<td>0.483</td>
</tr>
</tbody>
</table>
Table 5: Resource use efficiency in different categories of farms

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Marginal farmers</th>
<th>Small farmers</th>
<th>Large farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed</td>
<td>-</td>
<td>0.96</td>
<td>1.23</td>
</tr>
<tr>
<td>Labour</td>
<td>1.23</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Manure &amp; fertiliser</td>
<td>0.98</td>
<td>1.07</td>
<td>0.98</td>
</tr>
</tbody>
</table>

extension service. Other inputs like labour, plant protection chemicals were not optimally used in all the farm sizes of the study area.

CONCLUSION

Irrespective of the farm size the cost of seed, labour, manure and fertilizer and pesticides were important components of operational costs. Similarly rental value of owned land, interest on fixed capital and depreciation charges were major components of fixed cost. The result indicated that cost of labour constituted largest components in total variable cost accounting about 46.89 %. The total costs of production of maize were Rs. 27334/ha, Rs. 28794.74/ha and Rs. 32079.54/ha in marginal, small and large farms, respectively. The total cost increased with the increase in size of holdings. Manure and fertilizer accounted for 37 % of total variable cost and that of seed was 11.60 %. The share of plant protection chemical and interest on working capital were 1 % and 3 % respectively. Of all the components of fixed cost, rental value of owned land and depreciation cost constituted maximum share i.e. 81.90% and 16.50 % of total cost respectively. Large farms had spent 17.36 % higher expenditure for per hectare maize cultivation as compared to marginal farms. The gross ratio, fixed ratio and operating cost ratio were 0.53, 0.05 and 0.48 for all the farms,j indicating their financial solvency in maize production. The cost ratios in three categories of farm holdings remained relatively the same. It may be concluded from this observation that different farm holdings were not operating with equal efficiency in their employment of resources for production of maize. There is excess use of labour by marginal farms. The excess labour may be diverted for cultivation of other crops. Large farmers have received higher income due to optimal application of fertilizer. As there is higher use of labour in the study area, basically in case of poor marginal farmer due lack of sufficient fund, to purchase farm machinery, government should provide farm machineries in subsidized rate. The inputs viz seed and fertilizer provided by government at subsidized rate should aim at protecting the interest of the farmers. Institutional credit should be available to the farmers at their doorstep at right time and right quantity on liberal terms.

REFERENCES


