Trends and economics of cultivation of potato in Chhattisgarh

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Abstract
The present study deals with the Input wise cost of cultivation and compound growth rate in area, production and productivity of potato (2004-05 to 2015-16) in Chhattisgarh. Multi-stage sampling design was used for the ultimate selection of potato growing farmers. Bilaspur district was selected purposively based on maximum area of potato under Chhattisgarh plain region. 100 farmers were sampled from ten villages of Bilha and Masturi block (5 Villages each) of Bilaspur district. Status of potato crop has improved drastically among the farmers of Chhattisgarh over the last few years. Growth rate in area, production and productivity of potato in Chhattisgarh state was found 9.01, 10.93 and 1.76 per cent per annum respectively. Cost of cultivation showed increasing trend from marginal to large farmers. Average cost of cultivation of potato was found Rs 75839.72. The major share of cost among different cost items were found in seed which accounts 37.65 per cent to the total cost of cultivation. Overall input output ratio was found 1:1.89 in potato crop.

Keywords: cost of cultivation, potato, compound growth rate, cost concepts, input output ratio

Introduction
Potato (Solanum tuberosum L.) popularly known as ‘The king of vegetables’, is the staple food for most of the population of India after cereals. India is the second largest producer of potato after China in the world. It contributes 26.53 per cent to the total vegetable production and occupying 21.24 per cent to the total area of vegetables in India. Uttar Pradesh is the leading producer of potato’s followed by West Bengal and Bihar. It is an annual plant of Solanaceae family; grown for its starchy edible tubers. Potatoes are frequently served whole or mashed as a cooked vegetable and are also ground into potato flour, used in baking and as a thickener for sauces. The tubers are highly digestible and supply vitamin C, protein, thiamin, and niacin. Being a major vegetable, it has the huge importance to the processing industry as well. Many processed products of potato such as potato chips, French fries, potato flakes etc. are available in market.

Being a short duration crop, it produces more quantity of dry matter, edible energy and edible protein in lesser duration of time compared to cereals. So it is one the most important vegetable for food security and nutrition. Looking to the need of financial understanding of potato growing farmers and nutritional value of potato to the country, the present study is conducted with the following objectives.
1. To estimate the compound growth rate of area, production and productivity of potato in Bilaspur district, Chhattisgarh plains and Chhattisgarh state.
2. To work out the cost and returns of potato in the study area.

Methodology
A multi-stage sampling design was adopted for the ultimate selection of potato growing farmers and market functionaries. As Chhattisgarh plain zone with 304453 ha area under vegetables contributing 69.69 percentages to total area of vegetables in Chhattisgarh. Chhattisgarh plains have 16 districts, amongst which Bilaspur has highest area under potato contributing 23.43 percentages to the total area under vegetables in Chhattisgarh plains. So, Bilaspur district was selected purposively for the study. Bilaspur districts has seven blocks, amongst which Bilha and Masturi blocks contributing 16.15 and 15.49 area of potato in the district; ranks first and second in the area of potato respectively. So, five villages were selected from each block and ten farmers were interviewed from each village. In all, hundred farmers were interviewed from ten villages.

Growth rate
Annual Compound growth rates in area, production and productivity of potato from 2004-05
to 2015-16 were estimated in the study area by fitting an exponential function of the following form.

\[ Y = AB^t \]

Log \( y = \log A + t \log B \)

\( Y \) = area/ production/ productivity

A= constant.

B= regression coefficient.

t= time in year.

\[ \text{Compound growth rate} = \left( \text{Anti-log of B} - 1 \right) \times 100 \]

Cost of cultivation

To work out the cost of cultivation standard Cost concept were used which includes cost \( A_1 \), cost \( A_2 \), cost \( B_1 \), cost \( B_2 \), cost \( C_1 \), cost \( C_2 \) and cost \( C_3 \).

- **Cost \( A_1 \): Consist of following 16 items of costs**
  1. Value of hired human labour (permanent & casual)
  2. Value of hired and owned bullock labour
  3. Value of hired and owned machinery
  4. Value of seed (both farm-produced and purchased)
  5. Value of manure (produced on farm and purchased) and fertilizers
  7. Irrigation charges
  8. Land revenue and other taxes
  9. Depreciation
  10. Interest on the working capital.
  11. Miscellaneous expenses (wages of artisans, and repairs to small farm implements)

Cost \( A_2 \) = Cost \( A_1 \) + rent paid for Leased-in Land.

Cost \( B_1 \) = Cost \( A_1 \) + interest on value of Owned Capital assets (excluding land)

Cost \( B_2 \) = Cost \( B_1 \) + rental value of owned land + rent for leased in land

Cost \( C_1 \) = Cost \( B_1 \) + imputed value of Family Labour.

Cost \( C_2 \) = Cost \( B_2 \) + imputed value of Family labour.

Cost \( C_3 \) = Cost \( C_2 \) + 10 percent of cost \( C_2 \) as managerial cost

- **Interest on working capital**
  It was calculated @ 4% per annum for half of the crop period.

- **Interest on fixed capital**
  It was calculated @ 10% per annum for the crop period.

- **Rental value of owned land**
  It was calculated based on the prevailing rates in the sampled villages.

- **Depreciation**
  It represents the value by which a farm resource decreased in value as a result of cause other than a change in general price of the item. Straight line method was used for calculating the depreciation:

  \[ \text{Depreciation} = \frac{\text{Purchase value of the asset} - \text{Junk value}}{\text{No. of useful years of life (expected life)}} \]

Input: output ratio:

It is ratio between input and output and computed by dividing value of total output by value of total input.

\[ \text{Input output ratio} = \frac{O}{I} \]

Where,

\( I = \text{Total input} \)

\( O = \text{Total output} \)

Results and Discussion

Growth rate in area, production and productivity of potato

Growth rate in area, production and productivity of potato in Bilaspur district, different agro climatic zones and Chhattisgarh state is presented in table. It can be clearly seen from the table that compound growth rate in area and production of potato was found significantly positive in all the three agro climatic zones as well as Chhattisgarh state. Compound growth rate in area of potato in Bilaspur district was also found positive and significant. Being 39.92 and 34.19 percentage growth rate in area and production of potato respectively; Bastar plateau shown a drastic increase in compound growth rate of potato. Growth rate in area, production and productivity of potato in Chhattisgarh state was found positive being 9.01, 10.93 and 1.76 per cent per annum.

Table 1: Compound growth rate in area, production and productivity of potato

<table>
<thead>
<tr>
<th>S. No</th>
<th>Region</th>
<th>Compound growth rate</th>
<th>Area</th>
<th>Production</th>
<th>Productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bilaspur District</td>
<td>19.48**</td>
<td>12.20</td>
<td>-6.09</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Chhattisgarh Plains</td>
<td>13.76**</td>
<td>13.85</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Bastar Plateu</td>
<td>39.92**</td>
<td>34.19</td>
<td>-4.09</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Northern hills</td>
<td>4.04*</td>
<td>7.93*</td>
<td>3.74</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Chhattisgarh state</td>
<td>9.01**</td>
<td>10.93</td>
<td>1.76</td>
<td></td>
</tr>
</tbody>
</table>

Note: ** Significant at 1% level of significance
* Significant at 5% level of significance

Fig 1: Trend in area of potato in Chhattisgarh

\[ y = 4445x \\
R^2 = 0.097 \]
Input wise cost of cultivation of potato

Table 2 clearly shows input wise cost of cultivation of potato per hectare which is highest in case of large farms and lowest in case of small farms. Cost of cultivation showed increasing trend from marginal to large farmers. It is due to the fact that large farmers could incur more expenditure on modern farm inputs like quality seed, fertilizers, plant protection chemicals, hired labours etc. Average cost of cultivation of potato was found Rs 75839.72. The major share of cost among different cost items were found in seed which accounts 37.65 per cent to the total cost of cultivation. Rental value of owned land contributed 23.73 and total labour cost (human, machine and bullock) contributed 23.22 percent to the total cost of cultivation. Contribution of variable cost and fixed cost in the total cost of cultivation was found 73.98 and 26.02 per cent respectively.

Table 2: Input wise cost of cultivation of potato (Rs/ha.)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Particulars</th>
<th>Marginal Farms</th>
<th>Small Farms</th>
<th>Medium farms</th>
<th>Large farms</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Input Cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Human labour</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>Family</td>
<td>8303.98(12.42)</td>
<td>7414.74(9.88)</td>
<td>4834.83(6.01)</td>
<td>2045.88(2.38)</td>
<td>5992.00(7.90)</td>
</tr>
<tr>
<td>b)</td>
<td>Hired</td>
<td>2711.03(4.05)</td>
<td>5055.45(6.74)</td>
<td>8599.77(10.69)</td>
<td>11896.44(13.84)</td>
<td>6457.58(8.51)</td>
</tr>
<tr>
<td>Total</td>
<td>human labour</td>
<td>11015.01(16.47)</td>
<td>12470.19(16.62)</td>
<td>13434.60(16.69)</td>
<td>13942.32(16.22)</td>
<td>12449.59(16.42)</td>
</tr>
<tr>
<td>B</td>
<td>Fixed Cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Land revenue &amp; taxes</td>
<td>12.00(0.02)</td>
<td>12.00(0.02)</td>
<td>12.00(0.01)</td>
<td>12.00(0.01)</td>
<td>12.00(0.02)</td>
</tr>
<tr>
<td>11</td>
<td>Interest on fixed capital</td>
<td>906.98(1.36)</td>
<td>921.33(1.23)</td>
<td>954.49(1.19)</td>
<td>1002.84(1.17)</td>
<td>939.80(1.24)</td>
</tr>
<tr>
<td>12</td>
<td>Depreciation</td>
<td>127.52(0.19)</td>
<td>414.66(0.55)</td>
<td>1077.71(1.34)</td>
<td>2044.83(2.38)</td>
<td>783.95(1.03)</td>
</tr>
<tr>
<td>13</td>
<td>Rental value of land</td>
<td>18000.00(26.92)</td>
<td>18000.00(23.99)</td>
<td>18000.00(22.37)</td>
<td>18000.00(20.94)</td>
<td>18000.00(23.73)</td>
</tr>
<tr>
<td>Sub total</td>
<td></td>
<td>19046.49(28.49)</td>
<td>19347.99(25.79)</td>
<td>20044.19(24.91)</td>
<td>21059.68(24.50)</td>
<td>19735.75(26.02)</td>
</tr>
<tr>
<td>C</td>
<td>Total cost (A+B)</td>
<td>66864.33(100.00)</td>
<td>75028.94(100.00)</td>
<td>80477.35(100.00)</td>
<td>85950.85(100.00)</td>
<td>75839.72(100.00)</td>
</tr>
</tbody>
</table>

Note: Figures in the parenthesis represent percentage to the total cost.
Cost concepts in potato among various categories of farms

Table 3 portrays the cost concept of potato among different farm categories. Cost A1 and Cost A2 are same among all the farm categories because no respondent was found cultivating leased in land. On an average cost A1, cost A2, cost B1, cost B2, cost C1, cost C2 and cost C3 was found Rs 50907.92, 51847.72, 69847.72, 57839.72, 75839.72 and 83423.69 respectively. It was noted that Rs 18000 was the prevailing rental value of land in the study area. Cost A1 is showing increasing trend from marginal to large farms because of more use of hired labour, plant protection chemicals, improved varieties, manure and fertilizers etc.

<table>
<thead>
<tr>
<th>S.N.</th>
<th>Category</th>
<th>Marginal</th>
<th>Small</th>
<th>Medium</th>
<th>Large</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cost A1</td>
<td>39653.38</td>
<td>48692.87</td>
<td>56688.03</td>
<td>64902.13</td>
<td>50907.92</td>
</tr>
<tr>
<td>2</td>
<td>Cost A2</td>
<td>39653.38</td>
<td>48692.87</td>
<td>56688.03</td>
<td>64902.13</td>
<td>50907.92</td>
</tr>
<tr>
<td>3</td>
<td>Cost B1</td>
<td>40560.35</td>
<td>49614.2</td>
<td>57642.51</td>
<td>65904.97</td>
<td>51847.72</td>
</tr>
<tr>
<td>4</td>
<td>Cost B2</td>
<td>58560.35</td>
<td>67614.2</td>
<td>75642.51</td>
<td>83904.97</td>
<td>69847.72</td>
</tr>
<tr>
<td>5</td>
<td>Cost C1</td>
<td>48864.33</td>
<td>57028.94</td>
<td>62477.35</td>
<td>68180.25</td>
<td>57839.72</td>
</tr>
<tr>
<td>6</td>
<td>Cost C2</td>
<td>66864.33</td>
<td>75028.94</td>
<td>80477.35</td>
<td>85950.85</td>
<td>75839.72</td>
</tr>
<tr>
<td>7</td>
<td>Cost C3</td>
<td>73550.76</td>
<td>82531.84</td>
<td>88525.08</td>
<td>94545.94</td>
<td>83423.69</td>
</tr>
</tbody>
</table>

Net returns per rupee of the investment

Net returns per rupee of the investment for each category have been presented in table 4. Net returns per rupee of the investment for each category have been presented in table 4. Input output ratio was 1:1.59 in case of medium farmers which was highest among all the categories of farms. Input output ratio in marginal small and large farms was found 1:1.58, 1:1.56 and 1:1.54 respectively. Overall input output ratio was found 1:1.57 in potato crop.

<table>
<thead>
<tr>
<th>S. No</th>
<th>Category</th>
<th>Input (Rs)</th>
<th>Output (Rs)</th>
<th>Input : Output Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Marginal farms</td>
<td>66864.33</td>
<td>105778.79</td>
<td>1.58</td>
</tr>
<tr>
<td>2</td>
<td>Small farms</td>
<td>75028.94</td>
<td>116758.17</td>
<td>1.56</td>
</tr>
<tr>
<td>3</td>
<td>Medium farms</td>
<td>80477.35</td>
<td>127765.13</td>
<td>1.59</td>
</tr>
<tr>
<td>4</td>
<td>Large farms</td>
<td>85950.85</td>
<td>132471.72</td>
<td>1.54</td>
</tr>
<tr>
<td>5</td>
<td>Overall</td>
<td>75839.72</td>
<td>119044.26</td>
<td>1.57</td>
</tr>
</tbody>
</table>

References