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Cost, returns and profitability analysis of maize in Madhya Pradesh

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Abstract

The study was carried out with objective to estimate cost and returns of maize in Madhya Pradesh. In this article, we have analysed absolute and relative change, variability and growth rate during the study period 2000-01 to 2018-19 of maize. The required data were collected from Directorate of Economics and Statistics, for estimation of cost of cultivation cost concept (cost A₁ A₂, B₁ B₂ C₁ C₂ and C₃) were used and profitability estimation, net income, family labour income, farm business income and B:C ratio were calculated. The cost of cultivation of maize (total cost C₂) was Rs. 42391.49 per hectare, variable cost percentage was 67.65 percent and fixed cost was 23.26 percent. The per hectare gross income was Rs. 40735.83 with B: C ratio of 0.96 which showed not profitable but nearer to profitable of crop. On the basis of finding of study, it is recommended that the study area efforts should be made to find out the reasons behind decreasing net return in this state and adopt the govt. policies (like. National Food Security Mission for coarse cereal).

Keywords: Cost and returns, maize, profitability, Madhya Pradesh

Introduction

Maize (*Zea mays* L.) is the most widely distributed crop of the world being grown in tropical, subtropical and temperate regions under irrigated to semi-arid conditions. Being a versatile crop, it adapts easily to a wide range of production environments. In India, maize is the third most important food crops after rice and wheat. Maize crop furnishes huge quantities of green fodder for cattle. Maize is a major source of cooking oil (corn oil), gluten and starch which is used as a major ingredient in home cooking and in many industrialized food products. It also serves as a source of basic raw material for the number of industrial products such as protein, alcoholic beverages, food sweeteners, cosmetics, etc. The unprecedented growth of maize in India has been attributed to its increasing use in poultry as feed, increasing interest of the consumers in nutri-rich products. It is a miracle crop having high yield potential. There is no cereal on the earth which has so immense potentiality and that is why it is also called 'Queen of Cereals'. Maize is the only cereal which can be grown throughout the year in all three seasons of kharif, rabi and zaid. It is cultivated in an area of 1537.09 thousand ha with an average production of 4489.58 thousand tons and productivity of 2.92 tons/ha (2019-20). (Madhya Pradesh Economic Survey, 2020-21). It is predominantly cultivated as Kharif crop in Chhindwara, Seoni, Betul, Barwani and Dhar districts of Madhya Pradesh. These districts contributed more than 60 percent and 70 percent of area and production respectively of maize for the state. The cultivation of maize has assumed critical importance due to its diversified use as food, feed and fodder. The high carotene content of yellow maize is considered to be very useful in importing yellow colour to egg yolk and yellow tinge to the milk. No other concentrate is yet known to substitute maize in this respect. The present study has highlighted the cost of cultivation of maize in Madhya Pradesh with the various income measures received from the maize cultivation in the study area.

Objectives

- To estimate the cost and returns of maize production of Madhya Pradesh.
- To estimate the dynamics of profitability of maize production of Madhya Pradesh.

Materials and Methods

Data sources

The present study's required time series data were collected from the Directorate of Economics and Statistics to address the stated objectives.

Period of the study

The data were collected from the period 2000-01 to 2018-19.

Method of analysis

Absolute change (AC): Current year- Base year

Relative change (RC)

$$\text{Relative change (\%)} = \frac{(\text{Current year} - \text{Base year})}{(\text{Base year})} \times 100$$

where, Current year (CY) = Triennium average from 2016-17 to 2018-19

Base year (BY) = Triennium average from 2000- 01 to 2002-03.

Simple growth rate (SGR)

$$\text{Simple growth rate (\%)} = \frac{b}{\bar{y}} \times 100$$

where, b = Regression co-efficient.

$$\text{CV (\%)} = \frac{\text{Standard deviation}}{\bar{y}} \times 100$$

Where,

CV= Co-efficient of variation, Y = Dependent variable, X = Independent variable,

\bar{y} = Mean of Y, \bar{x} = Mean of X, a = Constant, b = Regression coefficient

Cost concepts

Cost A₁: All actual expenses in cash and kind incurred in production by the owner-operator.

Cost A₂: Cost A₁ + rent paid for lease in the land.

Cost B₁: Cost A₂ + interest on the value of owned fixed capital assets (excluding land)

Cost B₂: Cost B₁ + rental value of owned land + rent paid for

lease in the land.

Cost C₁: Cost B₁ + imputed value of family labour.

Cost C₂: Cost B₂ + imputed value of family labour.

Estimation of cost ratios

$$\text{Cost of production ((q/ha)} = \frac{\text{Total cost} - \text{Value of by product}}{\text{yield (q/ha)}}$$

$$\text{Total cost (Rs./q)} = \frac{\text{Total cost (Rs./ha)}}{\text{Actual yield (q/ha)}}$$

$$\text{Benefit - Cost ratio} = \frac{\text{Gross income}}{\text{Cost } C_2}$$

Estimation of income measures

1. Gross income (Rs/ha) = (quantity of main product x price per unit) + (quantity of by-product x price per unit)
2. Net income (Rs/ha) = Gross income – Cost C₂
3. Farm business income = Gross income – Cost A₂
4. Farm invest income = Farm business income – Imputed value of family labour
5. Family labour income = Gross income – Cost B₂

Results and Discussion

Per hectare physical inputs used in maize production

Table 1 indicates the Per hectare physical inputs used in maize production. Triennium average of the base year to current year, absolute change, relative change, variability and simple growth rate for the same during the study period were calculated and presented in Table 1. It was revealed that, the use of bullock labour (pair hrs.) and seed (kg/ha) were found to be decreased by -51.75 and -9.37 percent, while the irrigation (numbers) (128.64%), human labour (4.50%), fertilizer (258.26%), manure (87.54%) was found to be increased in the current year as compared to the base year during the study period. The quantity of human labour (hrs.), bullock labour (hrs.) and seed (kg) were found to be decreased with the growth rate of -0.70, -4.51 and 0.76 percent per year, while the quantity of machine labour (hrs.), fertilizer, manure, plant protection chemicals and irrigation was found to increase with 18.32, 3.23, 22.68 and 6.22 percent/year during the period under study in Madhya Pradesh.

Table 1: Per hectare physical inputs used in maize production

| Particulars | Base Year | Current Year | AC | RC (%) | CV (%) | Growth (%) |
|----------------------------|-----------|--------------|--------|---------|--------|------------|
| Human labour (man hrs.) | 396.86 | 414.72 | 17.86 | 4.50 | 12.71 | -0.70 |
| Bullock labour (pair hrs.) | 65.50 | 31.60 | -33.89 | -51.75 | 32.00 | -4.51** |
| Machine labour (hrs.) | 0.35 | 9.57 | 9.22 | 2672.14 | 117.41 | 18.32** |
| Seed (Kg) | 21.74 | 19.70 | -2.04 | -9.37 | 6.19 | -0.75** |
| Fertilizer (Kg) | 25.66 | 91.93 | 66.27 | 258.26 | 41.86 | 6.63** |
| Manure (q) | 4.57 | 8.58 | 4.00 | 87.54 | 44.88 | 3.23 |
| PPC (L) | 0.00 | 7.82 | 7.82 | - | 188.05 | 22.68** |
| Irrigation (No.) | 0.02 | 0.04 | 0.02 | 128.64 | 217.89 | 5.22 |

Source: Directorate of Economics and Statistics

(PPC: Plant protection chemicals, hrs. =hour)

* and ** indicate significance of values at P=0.05 and 0.01, respectively

Change in expenditure on variable cost and fixed cost use in maize production

Table 2 represents the cost structure analysis of maize production from 2000-01 to 2018-19. Relative change, variability and simple growth rate were calculated and

presented in Table 2. The relative change in variable cost (568.19%) was found to be more as compared to fixed cost (427.94%), while in absolute term the change in variable cost (Rs. 26824.33 /ha) was found to be more as compared to fixed cost (Rs. 8791.69 /ha) cost of cultivation of maize during the

study period. This was only due to 2850.00 percent (Rs. 5563.48 /ha) increased in machine labour in the current year (Rs. 5758.69 /ha) from the base year (Rs. 195.21 /ha) in cultivation of maize in Madhya Pradesh. Among, the various components of variable cost of cultivation of maize expenditure on machine labour (2850.00%) was found to be highest followed by seed (1613.97%), manure (830.52%), fertilizer (544.22%), human labour (452.31%), bullock labour (172.48%) and irrigation (91.72%). The growth rate of expenditure in machine labour (17.17% per annum) was also found maximum as compared to seed (15.25% per annum), manure (12.27% per annum), fertilizer (10.35% per annum), human labour (9.88% per annum), bullock labour (5.93% per annum) and irrigation (1.19% per annum) with the highly significant growth rate except irrigation during the period under study.

Fixed cost in maize production was increased by 427.94

percent from base year to current year. The highest expenditure of fixed cost was found on rental value of land with 591.07 percent followed by depreciation 199.33 percent, interest on fixed capital 169.49 percent and negative expenditure on land revenue -57.02 percent. The growth rate of expenditure in rental value of land (11.49% per annum) was also found highest as compared to interest on fixed capital (6.32% per annum), depreciation (4.69% per annum) with the positive and highly significant growth rate except land revenue during the study period in Madhya Pradesh.

Total cost in maize was found to be increased Rs. 35616.02 per ha (525.66%) in the current year (Rs. 42391.49/ha) from the base year (Rs. 6775.47/ha) with the variability of 64.07 percent during the study period. It was found to be positive and highly significant with the growth rate of 10.90 percent per annum.

Table 2: Composition of variable cost and fixed cost of maize cultivation in Madhya Pradesh

| Particulars | (Rs./ha) | | | | | |
|----------------------------|-----------|--------------|----------|---------|--------|------------|
| | Base Year | Current Year | AC | RC (%) | CV (%) | Growth (%) |
| Human labour (Man hrs.) | 2411.43 | 13318.48 | 10907.06 | 452.31 | 57.57 | 9.88** |
| Bullock labour (pair hrs.) | 1341.36 | 3654.86 | 2313.51 | 172.48 | 40.25 | 5.93** |
| Machine labour (hrs.) | 195.21 | 5758.69 | 5563.48 | 2850.00 | 106.12 | 17.17** |
| Total labour cost | 3948.00 | 22732.03 | 18784.05 | 475.79 | 61.22 | 10.44** |
| Seed (kg) | 198.38 | 3400.22 | 3201.84 | 1613.97 | 92.31 | 15.25** |
| Fertilizer (kg) | 312.41 | 2012.60 | 1700.19 | 544.22 | 64.53 | 10.35** |
| Manure (q) | 165.65 | 1541.44 | 1375.78 | 830.52 | 90.04 | 12.27** |
| PPC (L) | 0.00 | 1042.84 | 1042.84 | - | 184.95 | 22.40** |
| Irrigation (no.) | 3.90 | 7.48 | 3.58 | 91.72 | 236.45 | 1.19 |
| Miscellaneous Expenditure | 0.00 | 57.30 | 57.30 | - | 202.08 | 22.56** |
| Interest on WC | 92.72 | 751.19 | 658.47 | 710.20 | 74.05 | 12.28** |
| Total input cost | 773.06 | 8813.07 | 8040.00 | 1040.01 | 80.32 | 13.35** |
| Variable cost | 4721.03 | 31545.36 | 26824.33 | 568.19 | 65.89 | 11.18** |
| Rental Value | 1248.98 | 8631.37 | 7382.39 | 591.07 | 69.61 | 11.49** |
| Land Revenue | 5.77 | 2.48 | -3.29 | -57.02 | 44.84 | -4.00* |
| Depreciation | 191.66 | 573.69 | 382.03 | 199.33 | 34.95 | 4.69** |
| Interest on FC | 608.03 | 1638.59 | 1030.56 | 169.49 | 46.42 | 6.32** |
| Fixed costs | 2054.44 | 10846.13 | 8791.69 | 427.94 | 61.19 | 10.20** |
| Total cost | 6775.47 | 42391.49 | 35616.02 | 525.66 | 64.07 | 10.90** |

Source: Directorate of Economics and Statistics

(PPC: Plant protection chemicals)

* and ** indicate significance of values at P=0.05 and 0.01, respectively

Cost of cultivation of maize

Table 3 Indicates the cost of cultivation of maize according to cost concepts. The cost A₁ and cost A₂ were found to be identical and same in cultivation of maize reveals that none of cultivator was found to cultivate maize in leased land in Madhya Pradesh. The cost A₁/cost A₂ was found to be increased 675.50 percent (Rs. 22108.62 /ha) from Rs. 3257.00 /ha (the base year) to Rs. 25365.62 /ha (the current year) with a highly significant growth rate of 12.02 percent per annum. The cost C₂ which is also known as total cost was found to be

increased Rs. 35616.02 from base year to current year. The cost C₃ which includes managerial cost was Rs. 39177.62 per ha (from base year to current year). The relative change showed overall percent increase from the base year to the current year. It was found that all the cost concepts in maize production were increased by around 550 percent. Simple growth rates of all the cost concepts during the study period were positive and highly significant at a 1 percent level of significance. They were found to be increased by around 10 to 12 percent per annum.

Table 3: Per hectare Cost of cultivation of maize in Madhya Pradesh

| Particulars | (Rs./ha) | | | | | |
|---------------------|-----------|--------------|----------|--------|--------|------------|
| | Base Year | Current Year | AC | RC (%) | CV (%) | Growth (%) |
| Cost A ₁ | 3257.00 | 25365.62 | 22108.62 | 678.80 | 72.33 | 12.02** |
| Cost A ₂ | 3257.00 | 25365.62 | 22108.62 | 678.80 | 72.33 | 12.02** |
| Cost B ₁ | 3865.03 | 27004.21 | 23139.18 | 598.68 | 69.88 | 11.58** |
| Cost B ₂ | 5114.01 | 35635.58 | 30521.57 | 596.82 | 69.02 | 11.55** |
| Cost C ₁ | 5526.52 | 33868.90 | 28342.38 | 512.84 | 63.50 | 10.76** |
| Cost C ₂ | 6775.47 | 42391.49 | 35616.02 | 525.66 | 64.07 | 10.90** |
| Cost C ₃ | 7453.02 | 46630.64 | 39177.62 | 525.66 | 64.07 | 10.90** |

Table 4: Income measures from maize cultivation as per the different profitability concepts in Madhya Pradesh

| Particulars | Base Year | Current Year | AC | RC (%) | CV (%) | Growth (%) |
|--------------------------------|-----------|--------------|----------|----------|---------|------------|
| Yield (q/ha) | 7.60 | 28.26 | 20.66 | 271.96 | 49.80 | 7.77** |
| Main product (Rs./ha) | 3949.69 | 33754.74 | 29805.05 | 754.62 | 75.42 | 12.47** |
| Price (Rs./q) | 520.51 | 1201.56 | 681.06 | 130.85 | 36.63 | 6.10** |
| By product (Rs./ha) | 1046.24 | 6981.09 | 5934.84 | 567.25 | 69.76 | 11.35** |
| Gross Income | 4995.94 | 40735.83 | 35739.89 | 715.38 | 73.95 | 12.28** |
| Farm Business Income | 1738.94 | 15370.21 | 13631.27 | 783.89 | 82.32 | 12.66** |
| Farm Investment Income | 77.45 | 8614.30 | 8536.82 | 11018.66 | 138.58 | 17.65** |
| family Labour Income | -118.08 | 5100.24 | 5218.32 | -4419.43 | 137.22 | 17.55** |
| Net Income | -1779.57 | -1764.45 | 15.12 | -0.85 | -142.27 | -3.39 |
| Returns/rupee investment | 0.74 | 0.96 | 0.22 | 29.93 | 18.17 | 2.15** |
| Per quintal cost of production | 754.91 | 1268.75 | 513.83 | 68.06 | 27.84 | 3.71** |

Source: Directorate of Economics and Statistics

* and ** indicate significance of values at P=0.05 and 0.01, respectively

Profitability of maize production

Per hectare profitability in maize production was calculated and presented in table 3. The yield of maize was found to be increased 20.66 q/ha (271.96%) with the highly significant growth rate of 7.77 percent/annum in the study period. The results revealed that, per hectare increased in yield the gross income was found to be increased 715.38 percent (Rs. 35739.89 /ha) from Rs. 4995.94 (the base year) to Rs. 40735.83 per ha with highly significant growth of 12.28 percent/annum in maize production. It was clear that, farm business income, farm investment income and family labour income were found to be increased with the annual growth of 12.66, 17.65 and 17.55 percent/annum, respectively but the net income over total cost still found to be decreased by 0.85 percent (Rs. 15.12) in the current year (Rs. -1764.15/ha) from the base year (Rs. -1779.57 /ha) with the fluctuation of 142.27 percent. The net income from the cultivation of maize found to decreased with the magnitude of Rs. -61.71 /ha/annum and growth of -3.39 percent per annum. However, it was found non-significant during the period under study in Madhya Pradesh. It was clear that, output-input ratio was 0.74 to 0.96 from base year to current year with the growth rate of 2.15 percent per annum. It implied that, the cultivation of maize was found to be profitable business up to cost C_1 in the base year as well in current year. After cost C_1 it was found to be non-profitable as on the investment of Rs. 1.00 from the cultivation of maize in Madhya Pradesh. Per quintal cost of production of maize was also found to be increased Rs. 513.83 /q (68.06%) with the fluctuation of 27.84 percent from Rs. 754.91 /q (the base year) to Rs. 1268.75 /q (the current year) total cost C_2 during the period under study. It was found to be increased with a highly significant growth of 3.71 percent per annum. Net income of maize was found to negative. It was because total cost was higher than the gross income during the period under study of Madhya Pradesh.

Conclusion

In conclusion, use of machine labour was (Rs. 5563.48) with higher growth rate (17.17%), while human labour was (Rs. 10907.06) with lowest growth rate (9.88). This is huge variability and increase in variable cost in the current year from the base. Net income of maize was found to decreased and non-significant. Because total cost was higher than the gross income. It was clear that maize crop was nearer to profitable crop but not full profitable (investment of rupee 1 to found rupee 0.96). It is observed that, there is scope to increase in machine labour and high yielding seed variety for maize crop in Madhya Pradesh. Hence, efforts should be

made to find out the reasons behind decreasing net return in this state and adopt the govt. policies (like. National Food Security Mission for coarse cereal).

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