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Comparative economics of maize cultivation in major and minor maize producing districts of Karnataka – a study across farm size groups

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ABSTRACT: In India, maize is the third most important food grain which constitutes around 10 per cent of the total volume of cereals produced after rice and wheat. As per 2021 -22 data leading producer state of maize is Karnataka with 5.2 million MT (15.53 % of India), followed by Madhya Pradesh and Maharashtra. The present study aimed to study the cost of and returns from maize cultivation to know its profitability across the farm size groups in more maize producing (Devanagere district) and less maize producing (Tumkur district) districts of the state of Karnataka. The primary data was collected for the year 2017(kharif) by personally interviewing 160 sample farmers. CACP concept was used to estimate cost of cultivation in the study. The results revealed that large farms are mostly substituting machine power to conventional bullock power for performing different operations in maize cultivation. Large farmers of Devanagere district are having more access to owned machineries compare to Tumkur' large farmers, indicates Davanagere' large farms are economically better than Tumkur' large farms. As similar to Tumkur, the use of machine hour is highest at large farms, whereas use of bullock labour in marginal farm size group. The seed rate of Davanagere district is lesser than Tumkur but the overall cost of seed is higher in Davanagere (Rs. 3119). It may be due to use of high-quality seeds by marginal and small farms in Davanagere compared to same category in Tumkur. The net price received by farmer for main product sale in villages or mandis was lesser than MSP. This leads to negative returns at Cost C₂ and C₃ across the farm holdings. It indicates that the farmers are not getting any economic profit as it is not covering the costs incurred for providing managerial services by farmer himself. The return per rupee of investment at Cost C₃ in Devanagere district was Rs. 0.87 on overall basis, whereas Rs. 0.82 in Tumkur district. There is a need of creating awareness among the farmers in case of crop insurance to mitigate drought, about MSP to increase bargaining power, regarding co-operative benefits to save cost in marketing and other farm works and use of high-quality seeds along with other developed techniques in increasing productivity of maize.

Key words: Cost of cultivation, farm size group, input use, Karnataka, maize, returns

Maize, popularly known as Queen of Cereals and also called as corn is one of the most important cereal crops of the world. Among the maize growing countries, India rank fourth in area and seventh in production, representing around 4per cent of the world maize area and 2 per cent of total production. In India, maize is the third most important food grain which constitutes around 10 per cent of the total volume of cereals produced after rice and wheat. As per 2021 -22 data leading producer state of maize is Karnataka with 5.2 million MT (15.53 % of India), followed by Madhya Pradesh and Maharshtra (www.indiabudget.gov.in). During the period from 1980-81 to 2015-16 the area, production and the productivity of maize in India grew significantly at 1.46, 3.95 and 2.45 per cent per annum, respectively. All the major maize producing states registered significant growth rates in area, production and productivity except Uttar Pradesh, where it is observed negative growth in area and production remained stagnant (Geetha and Srivastava, 2019).

In India, most of the maize area is rain-fed. The maize yield is still lower than the world average. Farmers are not able to earn more due to low productivity as well as low production. Increasing productivity and thereby reducing costs will greatly enhance the competitiveness of maize both globally as well as in the domestic market. Cost concepts serves as a basis for decision making process i.e. to expand the size of the farm, requisite inputs in short run and capital assets in long run. The level of net profit decides the allocation of area under particular crop. Therefore, the study of cost and returns plays an important role in determining the level of profit and identifying the relative profitability in cultivation of various crops. To find whether there is profitability in maize production or not, estimation of cost and returns is a requisite. Therefore, this study was planned to compare among more and less maize producing districts across different farm size groups in the state of Karnataka, being the highest producing state of maize.

MATERIALS AND METHODS

The proposed study is based on primary data which was collected by personally interviewing the sample farmers with the help of pre-tested schedule specifically designed for the purpose. Thereafter, two districts were selected randomly from the state each out of 5 maximum and 5 minimum maize producing districts. In this regard Davanagere and Tumkur districts were selected to represent high and low maize producing districts, respectively. Then, two blocks were selected randomly from each district i.e., Madhugiri and Koratagere blocks from Tumkur district and Honnali and Harihara blocks from Davanagere district. In the next step, one village was randomly selected from each block and 2-3 villages adjacent to this selected village were selected to form a cluster. From the selected cluster, list of farmers cultivating maize was prepared and 40 farmers were selected randomly from each cluster comprising 10 each of marginal, small, medium and large farmers. Thus, a total of 160 farmers were selected for the study.

Estimation of Cost of Cultivation

To estimate the cost of maize cultivation, CACP (Commission for Agricultural Costs and Prices) cost concepts have been used. The total cost is classified into operational cost, material cost and other costs. Operational cost includes cost on hired human labour, owned human labour, machine power and hired machine power. The material cost includes cost of seeds, manures and fertilizers, irrigation and plant protection chemicals. Other costs include land revenue, depreciation on farm buildings, interest on working capital, interest on owned capital assets and rental value of owned land etc. The cost concepts, in brief, are Cost A_1 , Cost A_2 , Cost B_1 , Cost B_2 , Cost C_1 , Cost C_2 , Cost C_2^* and Cost C_3 . (Mishra *et al.*,

2012; Pant and Srivastava, 2013; Pant and Srivastava, 2014; Geetha and Srivastava, 2018; Tiwari and Srivastava, 2023). The different components that are included under each cost concept are detailed below.

Cost A_1 = it includes the value of Hired human labour; Owned and hired bullock labour; Hired machine power; Value of owned machine power; Value of seeds (owned or purchased); Value of manures and fertilizers; Value of plant protection chemicals ;Irrigation charges; Interest on working capital; Depreciation; Land revenue

 $\operatorname{Cost} A_2 = \operatorname{Cost} A_1 + \operatorname{Rent}$ paid for leased in land, if any

Cost $B_1 = Cost A_1 + Imputed interest on value of$ owned capital assets excluding the value of land $Cost <math>B_2 = Cost B_1 + Imputed$ rental value of owned land less land revenue + rent paid 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 $C_2^* = Cost C_2$ is estimated by taking into account statutory minimum wage rate or actual wage rate, whichever is higher

Cost $C_3 = \text{Cost } C_2^* + 10\%$ of Cost C_2^* on account of managerial functions performed by the farmer

Estimation of returns

Total returns from cultivated crop are calculated by valuing the total output at prices received by the framers for both main product and by-products of the crop (Raghav and Srivastava, 2016). As maize is a joint product produced on the farm, gross returns include returns from main product and by product. The average farm harvest price of product is obtained after deducting transportation and other miscellaneous charges incurred by the farmer in sale of the product. Net returns have been estimated by taking the difference from gross return and respective cost concept. The functional form of gross return and net return are as follows:

$$GR = P_m^* Q_m + P_b^* Q_b$$
$$NR_i = GR - C_i$$

Where, GR = Gross return in Rs/ha ; P_m = Average price of maize (Rs/Qt); Q_m = Quantity produced of maize (Qt/ha) ; P_b = Average of price of maize by product (Rs/Qt); Q_b = Quantity produced of maize by product (Qt/ha); NR_i = Net return over ith cost concept per hectare; C_i = ith cost concept

Cost of production of maize i.e. COP_{M} (Rs/Qt) at cost C₃ is worked out as follows: $COP_{m} = COC_{m} / Q_{m}$

Where, $COC_m = Cost$ of cultivation of main product (Rs/ha) i.e. maize grain; $Q_m = Quantity$ produced of maize (Qt/ha) i.e. maize grain $COC_m = COC_m * PV_m GR$

Apart from CACP cost concepts farm business income, family labour income and farm investment income have (Reddy *et al.*, 2011) also been worked out as follows,

Farm business income = Gross income – $Cost A_1$

Family labour income = Gross income - Cost B_2

Farm investment income = Farm business income - imputed value of family labour

RESULTS AND DISCUSSION

The costs of and returns from maize cultivation in Tumkur district (less maize producing district), Devangere district (more maize producing district) and Karnataka state as a whole, based on these two districts has been explained separately. Cost figures are rounded off to their nearest integers

Cost of and returns from maize cultivation in Tumkur district

The cost of and returns from maize in the district has been explained using Tables 1, 2, and 3 representing per hectare input utilisation in maize cultivation, cost of cultivation of maize and returns from maize cultivation in Tumkur district, respectively.

i) Input use

Per hectare input utilization in maize cultivation in

 Table 1: Per hectare input utilization in maize cultivation in Tumkur district during the year 2017

| Particulars | | Farm size group | | | | | |
|------------------------------|--------|-----------------|-------|--------|-------|---------|--|
| | | Marginal | Small | Medium | Large | Overall | |
| A. Human Labour (Days) | | | | | | | |
| Hired labour | Male | 13.60 | 13.97 | 15.45 | 17.55 | 15.47 | |
| | Female | 38.16 | 38.66 | 35.82 | 33.22 | 36.04 | |
| Owned labour | Male | 13.97 | 13.84 | 12.86 | 11.99 | 12.99 | |
| | Female | 13.71 | 13.21 | 13.46 | 11.86 | 12.93 | |
| Total Labour | Male | 27.57 | 27.81 | 28.31 | 29.54 | 28.46 | |
| | Female | 51.87 | 51.87 | 49.28 | 45.08 | 48.97 | |
| Total man days | | 62.32 | 62.56 | 61.33 | 59.74 | 61.28 | |
| B. Bullock power (Pair days) | | | | | | | |
| Hired | | 1.48 | 0.99 | 0 | 0 | 0.47 | |
| Owned | | 3.46 | 2.47 | 1.48 | 0.49 | 1.72 | |
| Total | | 4.94 | 3.46 | 1.48 | 0.49 | 2.19 | |
| C. Machine power in hrs | | | | | | | |
| Hired | | 4.94 | 5.43 | 5.93 | 6.05 | 5.69 | |
| Owned | | 0 | 0.99 | 2.47 | 3.58 | 2.07 | |
| Total | | 4.94 | 6.42 | 8.40 | 9.63 | 7.77 | |
| D. Seed (Kg) | | 19.51 | 20.01 | 18.90 | 18.40 | 19.10 | |
| E. Manure (Cart load) | | 1.88 | 2.19 | 2.50 | 2.50 | 2.33 | |
| F. Fertilizers (Kg) | | | | | | | |
| Urea | | 141.25 | 140 | 141.25 | 142.5 | 141.35 | |
| DAP/Complex | | 123.75 | 126.5 | 136.25 | 137.5 | 132.33 | |
| Potash | | 32.5 | 45 | 50 | 50 | 46.00 | |

Tumkur district during 2017 is presented in the Table 1. The table reveals that more labour employment was found to be at marginal farms i.e., 62.32 man days while on overall basis labour use in maize cultivation in Tumkur district was 61.28 man days. It is observed from the table that marginal farmers solely dependent on hired machine power as they were not having access to owned machineries. Large farmers were mostly substituting machine power to

conventional bullock power for performing different operations in maize cultivation.

The table further reveals that highest seed rate applied at small farms (20.01 kg/ha) which was more than overall seed rate i e 19.10 kg in maize cultivation in Tumkur district. Manure applied was found to be same at medium and large farms (2.50 cart load). While highest fertilisers application in

Table 2: Cost of maize cultivation in Tumkur district during the year 2017 (Rs/ha)

| Particulars | Farm size groups | | | | | | | |
|--|------------------|-------|--------|-------|---------|--|--|--|
| - | Marginal | Small | Medium | Large | Overall | | | |
| A. Operational costs | | | | | | | | |
| 1. Human labour | | | | | | | | |
| a. Hired | 9804 | 9989 | 10007 | 10248 | 10047 | | | |
| b. owned | 6247 | 6134 | 5877 | 5375 | 5838 | | | |
| Total | 16051 | 16123 | 15884 | 15623 | 15884 | | | |
| 2. Bullock labour | | | | | | | | |
| a. Hired | 740 | 495 | 0 | 0 | 236 | | | |
| b. Owned | 1730 | 1235 | 740 | 245 | 859 | | | |
| Total | 2470 | 1730 | 740 | 245 | 1095 | | | |
| 3. Machine labour | | | | | | | | |
| a. Hired | 3211 | 3530 | 3855 | 3933 | 3699 | | | |
| b. Owned | 0 | 644 | 1606 | 2327 | 1349 | | | |
| Total | 3211 | 4174 | 5461 | 6260 | 5048 | | | |
| Sub Total (1+2+3) | 21732 | 22027 | 22085 | 22128 | 22028 | | | |
| B. Material costs | | | | | | | | |
| 1. Seed | 1936 | 2421 | 3241 | 3818 | 3020 | | | |
| 2. Manure and Fertilizers | 5990 | 6539 | 7109 | 7148 | 6806 | | | |
| 3. Plant Protection Chemicals | 20 | 70 | 120 | 130 | 95 | | | |
| 4. Irrigation | 0 | 315 | 585 | 900 | 527 | | | |
| Sub Total (1+2+3+4) | 7946 | 9345 | 11055 | 11996 | 10449 | | | |
| Total working capital | 23431 | 25238 | 27263 | 28749 | 26639 | | | |
| C. Other costs | | | | | | | | |
| 1. Rental Value of Owned Land | 4178 | 6513 | 8406 | 10074 | 7807 | | | |
| 2. Rental Value of Leased Land | 1156 | 891 | 581 | 0 | 562 | | | |
| 3. Land Revenue | 15 | 30 | 41 | 48 | 36 | | | |
| 4. Depreciation | 237 | 521 | 749 | 609 | 568 | | | |
| 5. Interest on Working Capital @ 7% | 410 | 442 | 477 | 503 | 466 | | | |
| 6. Interest on the Value of Fixed Assets @ 10% | 538 | 1552 | 2708 | 2251 | 1940 | | | |
| 7. Threshing / shelling charges | 1003 | 1112 | 1255 | 1265 | 1184 | | | |
| Sub Total (1+2+3+4+5+6) | 7537 | 11061 | 14217 | 14750 | 12564 | | | |
| Grand Total (A+B+C) | 37215 | 42433 | 47357 | 48874 | 45041 | | | |
| a. Cost A, | 25096 | 27343 | 29785 | 31174 | 28894 | | | |
| b. Cost A_2^{1} | 26252 | 28234 | 30366 | 31174 | 29456 | | | |
| c. Cost B, | 25634 | 28895 | 32493 | 33425 | 30833 | | | |
| d. Cost B_2^{1} | 30953 | 36269 | 41439 | 43451 | 39167 | | | |
| e Cost C, ² | 31881 | 35029 | 38370 | 38800 | 36671 | | | |
| f. Cost C | 37200 | 42403 | 47316 | 48826 | 45004 | | | |
| g. Cost $\tilde{C_2}^*$ | 37200 | 42403 | 47316 | 48826 | 45004 | | | |
| $h. Cost C_2$ | 40920 | 46643 | 52048 | 53709 | 49505 | | | |
| Cost of Cultivation of Main Product at Cost C, | 37131 | 42550 | 47612 | 48943 | 45149 | | | |
| Cost of production of Main Product at Cost C_2^3 | 1481 | 1531 | 1518 | 1548 | 1525 | | | |

large farms especially urea and DAP/ complex.

ii) Cost of cultivation/production

Table 2 comprises of component wise various costs

| able 3: Returns from maize cultivation i | 1 Tumkur district | during the year 2017 | (Rs/ha) |
|--|-------------------|----------------------|---------|
|--|-------------------|----------------------|---------|

| Particulars | Farm size group | | | | | | |
|--|-----------------|----------|----------|----------|----------|--|--|
| | Marginal | Small | Medium | Large | Overall | | |
| Yield of Main Product (Qt) | 25.07 | 27.79 | 31.37 | 31.62 | 29.59 | | |
| Price of Main Product (Rs/Qt) | 1215 | 1231 | 1266 | 1289 | 1257 | | |
| Yield of By-product (Qt) | 25.90 | 27.20 | 29.60 | 31.50 | 29.04 | | |
| Price of By-product (Rs/Qt) | 120 | 121 | 125 | 126 | 124 | | |
| Returns from Main Product | 30460 | 34209 | 39714 | 40758 | 37253 | | |
| Returns from By-product | 3108 | 3291 | 3700 | 3969 | 3593 | | |
| Gross return | 33568 | 37500 | 43414 | 44727 | 40847 | | |
| Net return over | | | | | | | |
| Cost A ₁ | 8472 | 10157 | 13629 | 13553 | 11953 | | |
| $\operatorname{Cost} A_2$ | 7316 | 9266 | 13048 | 13553 | 11391 | | |
| $\operatorname{Cost} \operatorname{B}_{1}^{2}$ | 7934 | 8605 | 10921 | 11302 | 10013 | | |
| Cost B ₂ | 2615 | 1231 | 1975 | 1276 | 1680 | | |
| $\operatorname{Cost} C_1$ | 1687 | 2471 | 5044 | 5927 | 4175 | | |
| $\operatorname{Cost} \operatorname{C}_2$ | (-) 3632 | (-) 4903 | (-) 3902 | (-) 4099 | (-) 4158 | | |
| $\operatorname{Cost} \operatorname{C}_{2}^{\tilde{*}}$ | (-) 3632 | (-) 4903 | (-) 3902 | (-) 4099 | (-) 4158 | | |
| $\operatorname{Cost} C_3^2$ | (-) 7352 | (-) 9143 | (-) 8634 | (-) 8982 | (-) 8658 | | |
| Farm business income | 8472 | 10157 | 13629 | 13553 | 11953 | | |
| Family labour income | 2615 | 1232 | 1975 | 1276 | 1680 | | |
| Owned farm business income | 7316 | 9266 | 13048 | 13553 | 11391 | | |
| Farm investment income | 2225 | 4023 | 7752 | 8178 | 6115 | | |
| Returns per rupee of investment | | | | | | | |
| At Cost A ₁ | 1.34 | 1.37 | 1.46 | 1.43 | 1.41 | | |
| At Cost C_3 | 0.82 | 0.80 | 0.83 | 0.83 | 0.82 | | |

Table 4: Input utilization in maize cultivation in Davanagere district during the year 2017 (Per hectare)

| Particulars | | Farm size group | | | | | |
|------------------------------|--------|-----------------|--------|--------|--------|---------|--|
| | | Marginal | Small | Medium | Large | Overall | |
| A. Human Labour (Days) | | | | | | | |
| Hired labour | Male | 12.73 | 13.35 | 13.60 | 16.31 | 14.07 | |
| | Female | 38.90 | 39.15 | 40.51 | 38.66 | 39.38 | |
| Owned labour | Male | 13.97 | 14.09 | 13.47 | 11.87 | 13.32 | |
| | Female | 13.46 | 13.71 | 11.98 | 11.36 | 12.56 | |
| Total Labour | Male | 26.70 | 27.44 | 27.07 | 28.18 | 27.40 | |
| | Female | 52.36 | 52.86 | 52.49 | 50.02 | 51.94 | |
| Total man days | | 61.78 | 62.85 | 62.24 | 61.69 | 62.20 | |
| B. Bullock power (Pair days) | | | | | | | |
| Hired | | 1.48 | 1.48 | 0 | 0 | 0.67 | |
| Owned | | 2.96 | 2.47 | 0.99 | 0.49 | 1.61 | |
| Total | | 4.44 | 3.95 | 0.99 | 0.49 | 2.28 | |
| C. Machine power in hrs | | | | | | | |
| Hired | | 5.43 | 4.94 | 5.93 | 4.94 | 5.31 | |
| Owned | | 0 | 0.99 | 2.96 | 4.45 | 2.29 | |
| Total | | 5.43 | 5.93 | 8.89 | 9.39 | 7.60 | |
| D. Seed (Kg) | | 18.40 | 18.28 | 18.77 | 18.03 | 18.38 | |
| E. Manure (Cart load) | | 1.88 | 1.88 | 2.5 | 2.5 | 2.22 | |
| F. Fertilizers (Kg) | | | | | | | |
| Urea | | 132.5 | 137.5 | 138.75 | 138.75 | 137.35 | |
| DAP/Complex | | 113.75 | 123.75 | 127.5 | 128.75 | 124.45 | |
| Potash | | 40 | 40 | 45 | 47.5 | 43.38 | |

incurred in cultivation of maize by different farm size groups in Tumkur district. The table reveals that cost of human labour constituted the most important component of operational cost. Out of total human labour cost, the cost of hired labour (Rs. 10248) was found to be highest at large farms group, whereas that of imputed family labour cost (Rs. 6247) at marginal farms. The overall labour cost per hectare was found Rs. 15884 (32.09 per cent of total cost, Cost C_3). The second important component of operational cost is machine hour which has been classified into owned and hired machine hour. The overall cost of machine hour was Rs. 5048.

The table reveals that marginal farms don't have much access to machinery. The usage of machine

Table 5: Cost of maize cultivation in Davanagere district during the year 2017 (Rs/ha)

| Particulars | Farm size groups | | | | |
|--|------------------|-------|--------|-------|---------|
| | Marginal | Small | Medium | Large | Overall |
| A. Operational costs | | | | | |
| 1. Human labour | | | | | |
| a. Hired | 11600 | 11835 | 12182 | 12624 | 12099 |
| b. owned | 6883 | 6969 | 6437 | 5833 | 6508 |
| Total | 18483 | 18804 | 18619 | 18457 | 18607 |
| 2. Bullock labour | | | | | |
| a. Hired | 740 | 740 | 0 | 0 | 334 |
| b. Owned | 1480 | 1235 | 495 | 245 | 806 |
| Total | 2220 | 1975 | 495 | 245 | 1139 |
| 3. Machine labour | | | | | |
| a. Hired | 3530 | 3211 | 3855 | 3211 | 3454 |
| b. Owned | 0 | 644 | 1924 | 2893 | 1486 |
| Total | 3530 | 3855 | 5779 | 6104 | 4940 |
| Sub Total (1+2+3) | 24233 | 24634 | 24893 | 24806 | 24687 |
| B. Material costs | | | | | |
| 1. Seed | 2512 | 2830 | 3172 | 3777 | 3119 |
| 2. Manure and Fertilizers | 5854 | 6129 | 6771 | 6856 | 6457 |
| 3. Plant Protection Chemicals | 50 | 90 | 110 | 150 | 104 |
| 4. Irrigation | 0 | 225 | 480 | 750 | 396 |
| Sub Total (1+2+3+4) | 8416 | 9274 | 10533 | 11533 | 10077 |
| Total working capital | 25766 | 26939 | 28989 | 30506 | 28255 |
| C. Other costs | | | | | |
| 1. Rental Value of Owned Land | 4495 | 6103 | 7963 | 10416 | 7481 |
| 2. Rental Value of Leased Land | 1772 | 1976 | 1272 | 0 | 1231 |
| 3. Land Revenue | 18 | 29 | 37 | 45 | 34 |
| 4. Depreciation | 252 | 551 | 666 | 536 | 531 |
| 5. Interest on Working Capital (@ 7%) | 451 | 471 | 507 | 534 | 494 |
| 6. Interest on the Value of Fixed Assets (@ 10%) | 459 | 1569 | 2464 | 2085 | 1778 |
| 7. Threshing /shelling charges | 1606 | 1649 | 1779 | 1803 | 1719 |
| Sub Total (1+2+3+4+5+6) | 9052 | 12348 | 14688 | 15419 | 13267 |
| Grand Total (A+B+C) | 41701 | 46256 | 50114 | 51758 | 48031 |
| a. Cost A ₁ | 28092 | 29639 | 31978 | 33424 | 31033 |
| b. Cost A_2 | 29864 | 31615 | 33250 | 33424 | 32264 |
| c. Cost B ₁ | 28551 | 31208 | 34442 | 35509 | 32811 |
| d. Cost \mathbf{B}_2 | 34800 | 39258 | 43640 | 45880 | 41489 |
| $e \operatorname{Cost} C_1^2$ | 35434 | 38177 | 40879 | 41342 | 39320 |
| f. Cost C, | 41683 | 46227 | 50077 | 51713 | 47997 |
| g. Cost $\tilde{C_2}^*$ | 41683 | 46227 | 50077 | 51713 | 47997 |
| h. Cost C_3 | 45851 | 50850 | 55085 | 56884 | 52797 |
| Cost of Cultivation of Main Product at Cost C ₃ | 42293 | 46896 | 50880 | 52488 | 48723 |
| Cost of production of Main Product at Cost C_3 | 1398 | 1422 | 1430 | 1456 | 1429 |

hour was highest in case of large farms, whereas use of bullock labour at marginal farm group. This

clearly shows that the large farms were paving way towards more mechanised farming. The cost incurred

| Table 6: Returns fro | om maize cultivation in | Davanagere district | during the year 2017 (Rs/h | a) |
|----------------------|-------------------------|---------------------|----------------------------|----|
|----------------------|-------------------------|---------------------|----------------------------|----|

| Particulars | Farm size group | | | | | | | |
|--|-----------------|----------|----------|----------|----------|--|--|--|
| | Marginal | Small | Medium | Large | Overall | | | |
| Yield of Main Product (Qt) | 30.25 | 32.97 | 35.57 | 36.06 | 34.07 | | | |
| Price of Main Product (Rs/Qt) | 1210 | 1234 | 1255 | 1282 | 1248 | | | |
| Yield of By-product (Qt) | 30.20 | 33.30 | 34.80 | 35.20 | 33.71 | | | |
| Price of By-product (Rs/Qt) | 102 | 103 | 106 | 110 | 106 | | | |
| Returns from Main Product | 36603 | 40685 | 44640 | 46229 | 42578 | | | |
| Returns from By-product | 3080 | 3430 | 3689 | 3872 | 3560 | | | |
| Gross return | 39683 | 44115 | 48329 | 50101 | 46139 | | | |
| Net return over | | | | | | | | |
| Cost A ₁ | 11591 | 14476 | 16351 | 16677 | 15105 | | | |
| Cost A ₂ | 9819 | 12500 | 15079 | 16677 | 13874 | | | |
| Cost B ₁ | 11132 | 12907 | 13887 | 14592 | 13327 | | | |
| Cost B ₂ | 4883 | 4857 | 4689 | 4221 | 4649 | | | |
| $\operatorname{Cost} C_1$ | 4249 | 5938 | 7450 | 8759 | 6819 | | | |
| $\operatorname{Cost} \operatorname{C}_2^{-}$ | (-) 2000 | (-) 2112 | (-) 1748 | (-) 1612 | (-) 1859 | | | |
| $\operatorname{Cost} \operatorname{C}_2^*$ | (-) 2000 | (-) 2112 | (-) 1748 | (-) 1612 | (-) 1859 | | | |
| $\operatorname{Cost} \overline{C_3}$ | (-) 6168 | (-) 6735 | (-) 6756 | (-) 6783 | (-) 6658 | | | |
| Farm business income | 11591 | 14476 | 16351 | 16677 | 15105 | | | |
| Family labour income | 4882 | 4857 | 4689 | 4221 | 4649 | | | |
| Owned farm business income | 9819 | 12500 | 15079 | 16677 | 13875 | | | |
| Farm investment income | 4708 | 7507 | 9914 | 10844 | 8597 | | | |
| Returns per rupee of investment | | | | | | | | |
| At Cost A ₁ | 1.41 | 1.49 | 1.51 | 1.50 | 1.49 | | | |
| At Cost C ₃ | 0.87 | 0.87 | 0.88 | 0.88 | 0.87 | | | |

Table 7: Input utilization in maize cultivation in Karnataka during the year 2017 (Per hectare)

| Particulars | | | Farm size group | | | |
|------------------------------|--------|----------|-----------------|--------|--------|---------|
| | | Marginal | Small | Medium | Large | Overall |
| A. Human labour (Days) | | | | | | |
| Hired labour | Male | 13.17 | 13.66 | 14.53 | 16.93 | 14.88 |
| | Female | 38.53 | 38.90 | 38.16 | 35.94 | 37.69 |
| Owned labour | Male | 13.97 | 13.97 | 13.17 | 11.93 | 13.09 |
| | Female | 13.59 | 13.46 | 12.72 | 11.61 | 12.68 |
| Total labour | Male | 27.14 | 27.63 | 27.69 | 28.86 | 27.97 |
| | Female | 52.12 | 52.36 | 50.88 | 47.55 | 50.37 |
| Total man days | | 62.05 | 62.71 | 61.78 | 60.72 | 61.71 |
| B. Bullock power (Pair days) | | | | | | |
| Hired | | 1.48 | 1.24 | 0.00 | 0.00 | 0.53 |
| Owned | | 3.21 | 2.47 | 1.24 | 0.49 | 1.60 |
| Total | | 4.69 | 3.71 | 1.24 | 0.49 | 2.13 |
| C. Machine power in hours | | | | | | |
| Hired | | 5.19 | 5.19 | 5.93 | 5.50 | 5.49 |
| Owned | | 0.00 | 0.99 | 2.72 | 4.02 | 2.29 |
| Total | | 5.19 | 6.18 | 8.65 | 9.51 | 7.78 |
| D. Seed (Kg) | | 18.96 | 19.15 | 18.84 | 18.22 | 18.73 |
| E. Manure (Qt) | | 13.16 | 14.28 | 17.5 | 17.5 | 16.03 |
| F. Fertilizers (Kg) | | | | | | |
| Urea | | 136.88 | 138.75 | 140.00 | 140.63 | 139.42 |
| DAP/Complex | | 118.75 | 125.13 | 131.88 | 133.13 | 128.61 |
| Potash | | 36.25 | 42.50 | 47.50 | 48.75 | 44.95 |

on manures and fertilizers constituted around 14 per cent of total cost in given farms. The fertilizer cost was found highest on large farms because of high usage of complex and potash fertilizers compared to other category of farms which fetch high cost compared to nitrogenous fertilizers. It is observed that even though the usage of seed by large farms was less (18.40 kg/ha), the cost incurred (Rs. 3818) was more due to usage of high-quality seeds which brings cost differential across farm size groups. The cost was found negligible for components of irrigation and plant protection chemicals as majority

Table 8: Cost of cultivation of maize in Karnataka during the year 2017 (Rs/ ha)

| Particulars | | | Particulars Farm size group | | | | |
|--|----------|-------|-----------------------------|-------|---------|--|--|
| | Marginal | Small | Medium | Large | Overall | | |
| A. Operational costs | | | | | | | |
| 1. Human labour | | | | | | | |
| a. Hired | 10702 | 10912 | 11095 | 11436 | 11099 | | |
| b. owned | 6565 | 6552 | 6157 | 5604 | 6139 | | |
| Total | 17267 | 17464 | 17252 | 17040 | 17239 | | |
| 2. Bullock labour | | | | | | | |
| a. Hired | 740 | 618 | 0 | 0 | 266 | | |
| b. Owned | 1605 | 1235 | 618 | 245 | 801 | | |
| Total | 2345 | 1853 | 618 | 245 | 1067 | | |
| 3. Machine labour | | | | | | | |
| a. Hired | 3371 | 3371 | 3855 | 3572 | 3570 | | |
| b. Owned | 0 | 644 | 1765 | 2610 | 1490 | | |
| Total | 3371 | 4015 | 5620 | 6182 | 5060 | | |
| Sub Total (1+2+3) | 22983 | 23331 | 23489 | 23467 | 23366 | | |
| B. Material costs | | | | | | | |
| 1. Seed | 2224 | 2626 | 3207 | 3798 | 3103 | | |
| 2. Manure and fertilizers | 5922 | 6334 | 6940 | 7002 | 6655 | | |
| 3. Plant protection chemicals | 35 | 80 | 115 | 140 | 102 | | |
| 4. Irrigation | 0 | 270 | 533 | 825 | 480 | | |
| Sub Total (1+2+3+4) | 8181 | 9310 | 10794 | 11765 | 10340 | | |
| Total working capital | 24599 | 26089 | 28126 | 29628 | 27567 | | |
| C. Other costs | | | | | | | |
| 1. Imputed rental value of owned land | 4337 | 6308 | 8185 | 10245 | 7796 | | |
| 2. Rental value of leased land | 1464 | 1434 | 927 | 0 | 837 | | |
| 3. Land revenue | 17 | 30 | 39 | 47 | 36 | | |
| 4. Depreciation | 245 | 536 | 708 | 573 | 551 | | |
| 5. Interest on working capital (@ 7%) | 430 | 457 | 492 | 518 | 482 | | |
| 6. Interest on the value of fixed assets (@ 10%) | 499 | 1561 | 2586 | 2168 | 1880 | | |
| 7. Threshing / shelling charges | 1304 | 1381 | 1517 | 1534 | 1456 | | |
| Sub Total (1+2+3+4+5+6+7) | 8295 | 11705 | 14453 | 15084 | 13038 | | |
| Grand Total (A+B+C) | 39458 | 44345 | 48736 | 50316 | 46744 | | |
| a. Cost A, | 26594 | 28491 | 30882 | 32299 | 30092 | | |
| b. Cost A ₂ | 28058 | 29925 | 31808 | 32299 | 30929 | | |
| c. Cost B_1 | 27093 | 30052 | 33468 | 34467 | 31972 | | |
| d. Cost B ₂ | 32877 | 37764 | 42540 | 44665 | 40569 | | |
| e Cost C ₁ | 33658 | 36603 | 39625 | 40071 | 38112 | | |
| f. Cost C ₂ | 39442 | 44315 | 48697 | 50269 | 46708 | | |
| g. Cost $\tilde{C_2}^*$ | 39442 | 44315 | 48697 | 50270 | 46708 | | |
| h. Cost C_3 | 43386 | 48747 | 53566 | 55296 | 51379 | | |
| Cost of cultivation of main product at Cost C, | 39712 | 44723 | 49246 | 50715 | 47147 | | |
| Cost of production of main product at Cost $\vec{C_{2}}$ | 1440 | 1477 | 1474 | 1502 | 1478 | | |

Figures are rounded off to their nearest integers

of crop area is rainfed.

As the study is confined to single crop i.e., maize, annual depreciation and interest on fixed assets is dealt out in proportion to cropped area occupied by maize in proportion to gross cropped area of farm during the study year. The fixed items are imputed rental value of owned and leased in land, depreciation and interest on the value of farm assets and land revenue paid to the government. The imputed rental value of owned land found highest for large farms (Rs. 10074), whereas, Rs. 7807 in overall. The other costs accounted for 25.38 per cent of total cost in overall. The fixed costs have been found highest in case of medium farms (Rs 2708) due to high depreciation value and interest amount on fixed assets. In overall, the total cost of cultivation of maize (Cost C₃) was Rs. 49505. The highest cost of cultivation was observed at large farms (Rs. 53709), followed by medium farms (Rs. 52048) this may be due to use of high-quality seeds, machine power usage and more rental value of land, interest value on fixed assets as well as depreciation amount. Results also indicates that cost of production of main product at Cost C₃ was highest in large farms i.e. Rs 1548 per quintal, whereas, Rs 1525 per quintal in overall. The table further reveals that cost A₁ which was also defined as operational cost is found to be highest at large farms and on overall basis it is Rs. 28894. It is observed from the table that cost A1 increased with increase in size of holding.

iii) Yield and returns

The yield of main product has been found to be 29.59 Qt/ha on an overall basis. It was observed from the Table 3 that the maize yield was highest at large farm (31.62 Qt/ha) and lowest in case of marginal farms (25.07 Qt/ha). The gross return of Rs. 40847 was obtained by farms on overall basis, whereas, large farms are getting highest i.e. Rs 44727 among all the farm sizes. The net returns over $cost A_1$ which is also referred as farm business income showed that medium farms are getting highest farm business income than others.

In overall, the cost of production (Cost C_3) of main

| Particulars | Farm size group | | | | |
|--|-----------------|----------|----------|----------|----------|
| | Marginal | Small | Medium | Large | Overall |
| Yield of main product (Qt) | 27.66 | 30.38 | 33.47 | 33.84 | 31.94 |
| Price of main product (Rs/Qt) | 1212.27 | 1232.63 | 1260.15 | 1285.27 | 1255.90 |
| Yield of by-product (Qt) | 28.05 | 30.25 | 32.20 | 33.35 | 31.45 |
| Price of by-product (Rs/Qt) | 110.30 | 111.09 | 114.74 | 117.56 | 114.06 |
| Returns from main product | 33531 | 37447 | 42177 | 43494 | 40113 |
| Returns from by-product | 3094 | 3361 | 3695 | 3921 | 3593 |
| Gross return | 36625 | 40808 | 45872 | 47414 | 43706 |
| Net returns over | | | | | |
| Cost A ₁ | 10031 | 12316 | 14990 | 15115 | 13613 |
| Cost A ₂ | 8567 | 10883 | 14063 | 15115 | 12777 |
| Cost B ₁ | 9533 | 10756 | 12404 | 12947 | 11733 |
| Cost B ₂ | 3749 | 3044 | 3332 | 2749 | 3137 |
| Cost C ₁ | 2968 | 4204 | 6247 | 7343 | 5594 |
| $\operatorname{Cost} \operatorname{C}_2^1$ | (-) 2816 | (-) 3508 | (-) 2825 | (-) 2855 | (-) 3003 |
| $\operatorname{Cost} C_2^{*}$ | (-) 2816 | (-) 3508 | (-) 2825 | (-)2856 | (-) 3003 |
| $\operatorname{Cost} C_3$ | (-) 6760 | (-) 7939 | (-) 7695 | (-) 7882 | (-) 7673 |
| Farm business income | 10032 | 12317 | 14990 | 15115 | 13613 |
| Family labour income | 3749 | 3044 | 3332 | 2749 | 3137 |
| Farm investment income | 3467 | 5765 | 8833 | 9511 | 7474 |
| Returns per rupee of investment | | | | | |
| At Cost A ₁ | 1.38 | 1.43 | 1.49 | 1.47 | 1.45 |
| At Cost C ₃ | 0.85 | 0.84 | 0.86 | 0.86 | 0.85 |

 Table 9: Returns from maize cultivation in Karnataka during the year 2017 (Rs/ha)

Cost figures are rounded off to their nearest integers.

product of maize observed to be more than current MSP of Rs. 1425 per quintal and the net price received by farmer for main product sale in villages or mandi was lesser than MSP. This leads to higher negative returns at Cost C2 and Cost C3. It indicates that the farmers are not getting any economic profit but they are continuing farming business as it covers all explicit costs and part of implicit costs which pave a way for the farmer to continue the farming business. The ratio of overall gross returns to the Cost C_3 was found to be 0.82 indicating the loss of Rs. 0.18 for every rupee of investment. It is observed from the table that yield and returns are increasing with increase in size of holding. Even though the price received by small farmer (Rs. 1231) was more than that of marginal farmer (Rs. 1215), the returns per rupee of investment at Cost C₃ for small farmers was low (1: 0.80) in comparison to that of marginal farmers (1:0.82) indicates that they are incurring more loss compare to other farm size group

Costs of and returns from maize cultivation in Davanagere district

The cost of and returns from maize in the district has been explained using Tables 4, 5, and 6 representing per hectare input utilisation in maize cultivation, cost of cultivation of maize and returns from maize cultivation in Devangere district, respectively.

i) Input use

Per hectare input utilization in maize cultivation in Davanagere district during the year 2017 is presented in the Table 4. The table reveals that more labour employment was found to be at small farms i.e., 62.85 man days while on overall labour use in maize cultivation in Tumkur district is 62.20 man days which is more than that of Tumkur. It is observed from the table that marginal farms solely dependent on hired machine power as they are not having access to owned machineries like that of Tumkur. Large farms are mostly substituting machine power to conventional bullock power for performing different operations in maize cultivation. Large farms are having more access to owned machineries compare to Tumkur' large farms, indicates Davanagere' large farms are economically better than Tumkur' large farms.

The table further reveals that highest seed rate in case of medium farms (18.77 kg/ha) while overall seed rate i. e., 18.34 kg and it is lesser than seed rate in maize cultivation in Tumkur district (19.10 kg/ha). While in fertilisers, urea application in medium farms was at par with that of large farms. The overall fertiliser's use by Davanagere farms was less compared to that of Tumkur farms.

ii) Costs of cultivation/production

The component wise various costs incurred in cultivation of maize by different farm size groups in Davanagere district has been presented in Table 5.

The results show that the overall group, farms' operational cost accounted for 46.76 per cent to total cost. The cost of human labour (Rs. 18607) was found to be higher in Davanagere district compared to Tumkur (Rs. 15884) because of higher wage rate of woman labour in Davanagere. As similar to Tumkur, the use of machine hour was highest at large farms, whereas use of bullock labour in marginal farm size group. The overall cost of machine hour and bullock labour was Rs. 4940 and Rs. 1139. The cost on manure and fertilizers was an important component of material cost and it was around 12 per cent to total cost across different farm size groups. The seed rate of Davanagere district was lesser than Tumkur but the overall cost of seed was higher in Davanagere (Rs. 3119). It may be due to use of high-quality seeds by marginal and small farms in Davanagere compared to same category in Tumkur. The farms incur negligible cost on plant protection chemicals because of no major incidence of insect and pest in the study area.

The imputed rental value of owned land is observed to be highest at large farms and lowest at marginal farms in consideration of irrigation and fertility aspect. Across farm groups, the rental value of owned land ranged from 9.80 to 18.31 per cent. In overall, other costs accounted for 25.13 per cent of total cost (Cost C_3). As similar to Tumkur, the fixed costs have been found highest at medium farms due to high imputed rental value of owned land, depreciation value and interest amount on fixed assets. In overall, Cost C₃ has been found Rs. 52797. The highest cost of cultivation is observed at large farms (Rs. 56884), followed by medium farms (Rs. 55085). The cost of production of main product at Cost C₃ was lowest in marginal farm (Rs. 1398/Qt) and highest in large farm group (Rs. 1456/Qt). The Cost A₁ was highest for large farm group and on overall basis it was Rs. 31033.

iii) Yield and returns

Yield of and returns from maize cultivation in Devangere district across farm size group is presented in the table No. 6 below. In overall, the yield of main product (34.07 Qt/ha) in Davanagere has been found higher than Tumkur (29.59 Qt/ha). Thus, there was yield difference of 4.48 Qt/ha between selected districts. The maize yield was highest in large category with 36.06 Qt/ha. The Table 6 reveals that gross return of Rs. 46139 was obtained by farmers in overall and large farmers are getting the highest of about Rs. 50101.

The net price received by farmer for main product sale in villages or mandis was lesser than MSP. This leads to negative returns at Cost C_2 and C_3 across the farm holdings. It indicates that the farmers are not getting any economic profit as it was not covering the costs incurred for providing managerial services by farmer himself. The return per rupee of investment at Cost C_3 was 0.87 on overall basis, whereas 0.82 in Tumkur.

Costs of and returns from maize cultivation in Karnataka as a whole

The cost of and returns from maize cultivation in the in the state as a whole has been explained using Tables 7, 8, and 9 representing per hectare input utilisation in maize cultivation, cost of cultivation of maize and returns from maize cultivation based on the information generated through the selected district, respectively.

i) Input use

The Table No. 7 reveals that more labour

employment is found on small farms i.e. 62.71 mandays, while, on overall farm size group labour use in maize cultivation in the state is found 61.71 man days. It is observed from the table that highest bullock power was utilised at marginal farms (4.69 pair days) and highest machine power used at large farms (9.51 hours) for performing different operations in maize cultivation.

The table further reveals that highest seed rate on small farms (19.15 kg/ha) which was more than the seed rate i e 18.73 kg used on an average across farm size groups. The highest application of fertilisers is found to be on large farms, while on overall basis fertiliser use is found 139.42 kg of urea, 128.61 kg of DAP/ complex and 44.95 kg of potash, respectively.

ii) Cost of Cultivation/production

Table 8 shows cost of cultivation incurred in maize cultivation by different farm size groups in Karnataka. From the table it is observed that the large farms are incurring higher cost of cultivation (Rs. 55296/ha) at Cost C₃ compared to other size of farms and on overall basis this is found Rs. 51379/ha. On overall basis, the most important cost determining factor was human labour which accounted for 33.55 per cent of total cost of cultivation (Cost C_2) followed by imputed rental value of owned land (15.17 %) and cost on manure and fertilizers (12.95 %). It is observed from the table that marginal farms are incurring the highest human labour cost which was about 39.88 per cent of total cost of cultivation (Cost C_{2}). The highest cost may be due to inefficient utilization of human labour as they are having segmented small land holdings. It is shown that large farms are incurring the highest machine hour cost (11.18 %) followed by medium farms with 10.49 per cent. It indicates that large and medium farmers are substituting machine hour for conventional bullock labour. The operation cost across farm groups ranged from 42.44 per cent to 52.97 per cent.

From the Table 7 it is observed that seed rate was the highest at small farm size group but the cost incurred was Rs. 2626 which was lower in comparison to seed cost incurred at large farms (Rs. 3798). It clearly indicates that the small farms are using low quality seeds which can be the major reason for low productivity at their farms. The perusal of table reveals that the highest operational costs incurred on medium farms, whereas, highest material and fixed costs by large farmers to bear more cost in comparison to other farm size groups. Cost A_1 was highest on large farms i.e. Rs.32299/ ha. The overall cost of production of main product is found Rs. 1478/qt, whereas, it is found highest on large farms to the tune of Rs. 1502/qt.

iii) Yield and returns

Per hectare overall yield and gross returns from maize cultivation in Karnataka, depicted in table 9, are found to be 31.94 qt and Rs. 43706, respectively. There was difference of 6.18 qt/ha and Rs. 10789 between yield and returns obtained on marginal and large farms. The Table 9 further reveals that medium and large farms are in better position with regard to different income measures like farm business income, farm labour income and farm investment income. If we consider Cost A₁, the overall return per rupee investment is found 1.45 and among different farm size group, medium farms are getting more profit (1.49).

If $\cot C_3$ is taken into account then returns per rupee of investment gives 0.86 on overall basis. It indicates that the farmers in Karnataka are incurring loss of 0.14 rupees for every one-rupee investment. It is observed from the table that loss incurred by medium farmers was at par with large farmers. In overall, there was a difference of Rs. 169 between net price received by farmers in sale of main product at villages or mandi and MSP.

CONCLUSION

The perusal of cost of and returns from maize cultivation across farm size groups in both the districts reveals variation therein among all the components of various costs. In both the districts and in the state as a whole $Cost A_1$ and yield returns were increasing with increasing size of holding. This indicates that marginal maize growers are more economically deprived off, when compared to other

farm size groups in terms of returns obtained from maize cultivation for the Karnataka. This may be due to segmented land holdings, lack of irrigation, maize cultivation under rain fed condition. It is also observed from the study that majority of marginal and small farmers sell their produce to village traders, while medium and large farmers in mandis. There is a need of creating awareness among the farmers in case of crop insurance to mitigate drought, about MSP to increase bargaining power, regarding co-operative benefits to save cost in transportation and other farm works and use of high-quality seeds along with other developed techniques in increasing productivity of maize.

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