

## Comparative Economics of Maize Cultivation under conventional and mechanization

### ABSTRACT

**Aim:** To compare the cost and return analysis of conventional maize cultivation with mechanization.

**Place of study:** A field experiment on maize crop cultivation by conventional and mechanization was conducted at Agricultural Research Station, Karimnagar during Kharif, 2019-20.

**Methodology:** The cost concepts were used to estimate the cost of cultivation under conventional and Mechanization methods. The cost concepts viz., cost A1, cost A2 cost B1 cost B2 and cost C1, cost C2 and C3 were used in the present study.

**Results:** The total costs of cultivation under conventional and mechanization methods were Rs.117794.78 and Rs.104137.92 per hectare respectively indicating 12 % saving with mechanization. Similarly gross returns were Rs. 146064.00 in conventional method against Rs.146988.00 in mechanized method. Net returns recovered were 52% higher with mechanized method i.e Rs.42850.08 compared to conventional method Rs.28269.22. In the same way returns per rupee of investment in conventional method and mechanization were 1.23 and 1.41. Mechanization in cultivation also saves time, labour usage and reduces drudgery.

*Key words:* Maize, Mechanization, Cost of cultivation, Cost concepts, Comparative analysis

### 1. INTRODUCTION

Maize is an important cereal crop in India. Maize is known as queen of cereals because it has the highest genetic yield potential among the cereals. The demand for maize has been remarkable after introduction of sweet corn, baby corn, pop corn which have almost captured the Indian market [1]. Maize is a versatile crop, allowing it to grow across a range of agro-ecological zones. Every part of the maize plant has economic value, the grain, leaves, stalk, tassel, and cob can all be used to produce a large demand for food, feed, fuel and industrial raw material [2].

In the country maize is cultivated in an area of 95.69 lakh hectares with production of 28.766 thousand tons and productivity of 3006kg/ha [3]. In Telangana maize is cultivated in an area of 6.43 lakh hectares while in Northern Telangana zone maize is cultivated in an area of 1.98 lakh hectares. The maize production in the state has been largely influenced by increasing demand from the feed industries and various industrial uses like starch and bakery industries [4]. Major maize growing districts in Telangana include Siddipet, Nagarkurnool, Rangareddy, Vikarabad, Mahabubnagar, Kamareddy, Nizamabad, Karimnagar and Jagtial contributing nearly 85% of total maize production [5].

The local methods of maize cultivation are labour intensive. High demand for labour in each operation adversely affects the timeliness of operations, thereby reducing the crop yield and increases the cost of cultivation [6]. Mechanization helps in efficient and large scale production leading to commercialization in agriculture sector [7]. The extent of farm mechanization is considered to be the indicator of the quality of farm life. In general mechanization of farms helps in reduction of human drudgery besides ensuring the timeliness of operation and solving the problem of scarcity of labours during peak cropping season [8]. Mechanization can be used at every step of production from land preparation to harvesting and processing. The purpose of mechanization in maize is to replace manual labor for sowing to harvesting from fields in time with minimum loss while maize maintaining high quality as well. Mechanization can reduce labor cost, work load, time of operation and ultimately helps to increase production and productivity of farm [9]. Keeping this in view the present study was conducted to compare the cost of cultivation of maize under conventional and mechanized cultivation.

## **2. METHODOLOGY:**

### **2.1 Cost concepts:**

Primary data was collected from Agricultural Research Station, Karimnagar on conventional method and mechanization in maize during Kharif 2019-20.

The cost concepts were used to estimate the cost of cultivation. The cost concepts viz., cost A1, cost A2 cost B1 cost B2 and cost C1, cost C2 and C3 were used in the present study and these are derived as follows:

**Cost A1:** It includes all actual expenses in cash and kind in production by the owner farmer such as, value of hired human labour, owned and hired bullock labour, owned and hired machinery services, value of farm produced seed or purchased seed and FYM, value of fertilizers, plant protection chemicals, depreciation of implements and machinery, land revenue, interest on working capital and miscellaneous expenses.

**Cost A2:** Cost A1 + rent paid for leased in land.

**Cost B1:** Cost A1 + interest on fixed capital.

**Cost B2:** Cost B1+rental value of own land + rental value for leased in land.

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

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

**Cost C3 =** Cost C2 + 10% of Managerial cost of C2

## 2.2 Farm income measures:

(a) **Gross income:** the income obtained from the sale of the main product and by-product. The actual amounts received from product marketed at the prevailing price were considered for arriving at gross income.

**Gross income=** Value of main product + Value of by-product

(b) **Net income:** This is the surplus over the gross costs i.e., commercial cost of cultivation (cost C2).

**Net income =** Gross income - Cost C2

## 3. RESULTS AND DISCUSSION:

**3.1 Comparative analysis of different operations in conventional method and mechanization in maize ( per ha)**

Comparative analysis of different operations in conventional and mechanized maize was presented in Table 1. Land preparation was done by cultivator, rotavator and levelling blade in conventional as well as mechanization methods. Sowing was done behind the plough in conventional method and with seed vacuum planter in mechanization method. Time taken to complete the sowing operation in conventional method was 15hrs and in mechanized method was 3.75 hrs. Earthing up operation was done by Tractor drawn ridger and Bullock drawn ridger in mechanized and conventional methods respectively. Spraying was done by Knapsack Sprayer in conventional method and through HTP Boom Sprayer in mechanized method where it took 15 hrs in conventional method and 30 minutes in mechanized method respectively. Harvesting done by manually in conventional method and with combined harvester in mechanized method. Harvesting includes cobs removal, de husking, drying, shelling, stalk cutting & bunding in both methods. Time taken to complete the harvesting operation in conventional method was 270 hrs and in mechanized method was 62.5 hrs. Labour used for sowing, spraying and harvesting operations in conventional method and mechanization was 13, 5, 63 mandays and 1, 1 and 5 mandays respectively. Sowing, spraying and harvesting operation showed that labour saving is 92, 80 and 92 percent respectively in mechanized method compared to Conventional method.

**Table:1 Comparative analysis of different operations in conventional method and mechanization in maize ( per ha)**

S.No	Name of the operation	Machine used		Time taken to complete the operation		Labour used (Mandays)	
		Conventional	Mechanization	Conventional	Mechanization	Conventional	Mechanization
1	Sowing (sowing & Thinning)	Behind the Plough	Seed vacume planter	15 hrs	3.75 hrs	13	1
2	Spraying	Knapsack Sprayer	HTP Boom Sprayer	10 hrs	30min	5	1

3	Harvesting (cobs removal, de husking, drying, Shelling, stalk cutting& bunding)	Manual	Combined Harvester	270 hrs	62.5 hrs	63	5
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### 3.2 Cost of cultivation

The cost and return have been summarized in this part of the study. The estimate of total costs on the basis of six cost concept i.e. Cost A1/A2, cost B1, cost B2, cost C1, C2 and cost C3, have been worked out for estimation of cost [10].

The cost of cultivation of maize is presented in Table 2 for conventional and mechanization methods. The human labour accounted about Rs.55875.00 (47.74 percent) in conventional method and Rs.35375.00 (33.96 percent) in mechanization [11]. The expenditure on conventional method was higher compared to mechanization. On examining the machine labour cost mechanization incurred Rs.27100.00 (23.15 percent) higher cost than conventional method Rs.14125.00 (12.07). The expenditure incurred on seed in conventional method is Rs.4500.00 (3.84 percent) compared to mechanization Rs.2340.00 (1.99 percent). Seed rate used in mechanization was less which reduces the costs. The reason for increased cost of cultivation in conventional method is the high usage of human labour for farm operations. The total variable costs incurred in conventional method is Rs. 97336.5 (83.87 percent) and in mechanization is 83680.42 (71.50 percent). 12.57 percent cost saving is observed in mechanization.

The total fixed costs incurred in conventional **method** and **mechanization** were Rs. 20457.50 (17.48 percent) where rental value of owned land occupied highest cost among all the fixed costs 15000.00 (12.81 percent) [12].

**Table 2: Cost of cultivation of maize in conventional method and mechanization (per ha)**

S.No.	Cost components	Conventional method	Mechanization
1	Total human labour	55875.00 (47.74)	35375.00 (33.96)
2	Total bullock labour	7875.00 (6.72)	3750.00 (3.20)
3	Total machinery labour	14125.00 (12.07)	27100.00 (23.15)
4	Seeds	4500.00 (3.84)	2340.00 (1.99)
5	Fertilizers	7200.00 (6.15)	7200.00 (6.15)
6	Plant protection chemicals	5775.00 (4.93)	5775.00 (4.93)
7	Interest on working capital @ 12.5%	1986.45 (1.90)	2140.42 (1.89)
<b>8</b>	<b>Total variable costs</b>	<b>97336.5 (83.87)</b>	<b>83680.42 (71.50)</b>
9	Depreciation	2375.00 (2.02)	2375.00 (2.02)
10	Land revenue	0 (0)	0 (0)
11	Rental value of owned land	15000.00 (12.81)	15000.00 (12.81)
	Rent paid for leased in land	0 (0.00)	0 (0.00)
12	Interest on fixed capital @ 10%	3083.00 (2.63)	<b>3083.00</b> (2.63)
<b>13</b>	<b>Total fixed costs</b>	<b>20457.50 (17.48)</b>	<b>20457.50 (17.48)</b>
	<b>Total cost (8+13)</b>	<b>117794.78 (100.00)</b>	<b>104137.92 (100.00)</b>

Note: Figures in parentheses are percentages to total cost.

### 3.3 Cost concepts

The cost of cultivation is presented according to cost concepts in Table 3. In conventional method Cost A1 worked out to be Rs.99711.45 against Rs.86055.42 for mechanized method. Cost A2 for conventional method was Rs.99711.45 as against Rs.86055.42 for mechanized method. Cost B1 for conventional method was Rs.102794.78 while it was Rs.89137.92 for mechanized method. Cost B2 for conventional method was Rs.117794.78 against Rs.104137.92 for mechanized method. Cost C1 for conventional method was Rs.102794.78 as against Rs.89137.92 for mechanization. Cost C2 for conventional method was Rs.117794.78 as against Rs.104137.92 for mechanization. **These results were in accordance with Harendra PSC *et al* [10].**

**Table 3: Cost of cultivation according to cost concepts in maize- conventional method and mechanization (per ha)**

S.No	Cost components	Conventional method	Mechanization
1	Total human labour	55875.00	35375.00
2	Total bullock labour	7875.00	3750.00
3	Total machinery labour	14125.00	27100.00
4	Seeds	4500.00	2340.00
5	fertilizers	7200.00	7200.00
6	Plant protection	5775.00	5775.00
7	Land revenue	0	0
8	Interest on working capital @ 12.5%	1986.45	2140.42
9	Depreciation	2375.00	2375.00
<b>10</b>	<b>Total of Cost A1</b>	99711.45	86055.42
11	Rent paid for leased in land	0	0
<b>12</b>	<b>Cost A2 (Cost A1+11)</b>	99711.45	86055.42
13	Interest on fixed capital @ 10%	<b>3083.00</b>	<b>3083.00</b>
<b>14</b>	<b>Cost B1 (Cost A2+13)</b>	102794.78	89137.92
15	Rental value of owned land	15000.00	15000.00
<b>16</b>	<b>Cost B2 Cost B1+15)</b>	117794.78	104137.92
17	Family labour	0	0
<b>18</b>	<b>Cost C1 (Cost B1+17)</b>	102794.78	89137.92
<b>19</b>	<b>Cost C2 (Cost B2+17)</b>	<b>117794.78</b>	<b>104137.92</b>

20	Cost C3 = Cost C2 + 10% of Managerial cost of C2	129574.25	114551.71
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### 3.4 Returns per rupee of investment

A return per rupee of investment was presented in Table 4. The total cost of cultivation in conventional method was Rs.117794.78 as against Rs.104137.92 for mechanized method. Gross returns per hectare were Rs.146064.00 in conventional method against Rs.146988.00 for mechanized method. These findings were almost similar to the results reported by Vasanth P *et al* [13]. Net returns were Rs.28269.22 per hectare in conventional method while it was Rs.42850.08 in mechanized method. 52 percent higher net returns were obtained in mechanization. Returns per rupee of investment in conventional and mechanized methods were 1.23 and 1.41 respectively.

**Table 4: Returns per rupee of investment (per ha)**

S.No.	Output and Returns	Conventional method	Mechanization
1.	Total cost of cultivation	117794.78	104137.92
2.	Gross returns	146064.00	146988.00
3.	Net returns	28269.22	42850.08
4.	Returns per rupee of investment	1.23	1.41

### 4.CONCLUSION

Through mechanization time and labour saving as well as reduction in costs was observed in the present study. The variable costs are high in Conventional method compare to mechanization. The net income in mechanization was higher than that of the conventional method farm because the farm got higher yield per ha and also reduction in cost of cultivation. This may be due to timely operations, better tillage practices, even depth of sowing and harvesting through combined harvester etc, in the mechanization. The labour requirement in conventional method was higher than that of the mechanized method which increases costs. The mechanization can thus help in the increase in output and hence income.

## REFERENCES

1. Sagar MS, Shankar T, Manasa P, Sairam M. Present status and future prospects of maize cultivation in South Odisha. *International Journal of Bio Resource Science* 2019; 6(1):27-33.
2. Kathirvel N and Karthika R. Cost and returns of maize cultivation in Tirupur district. *Global Journal for Research Analysis*. 2015; 4(5):36-40.
3. India stat focused on facts. <https://www.indiastat.com>.
4. Ranjit Kumar, Srinivas K. Boiroju NK and Gedam PC. Production performance of maize in India: Approaching an inflection point, *International Journal of Agricultural and Statistical Science*. 2014; 10 (1):241-248.
5. Anonymous, Kharif 2019-20 pre-harvest price forecast of maize, Market Intelligence Scheme, PJTSAU, Hyderabad. 2019.
6. Dixit J, Khan JN and Rohitashw K. Maize mechanization for hill agriculture to enhance productivity and profitability. *SKUAST Journal of Research*. 2017; 19(1): 83-91.
7. Barman S, Deka N and Deka P. Factors affecting farm mechanization-A case study in Assam, India. *Asian Journal of Agricultural Extension, Economics & Sociology*, 2019; 32(1): 1-7
8. Thakur SS, Chandel R, Narang MK. Joint farm machinery ownership in Indian agriculture-need of the time. *SKUAST J. of Res*. 2016; 18:1-11.
9. Santosh K, Rakshya P, Min Thapa S and Tulsi P. Status of farm mechanization and its impact on maize production in Jhapa District, Nepal. *Archives of Agriculture and Environmental Science*. 2021; 6(3): 290-294
10. Harendra PSC, Singh GP, Rajeev S, Punam K, Rajeev K and Ashutosh KR. Costs and income analysis of maize cultivation in Bahraich district of Uttar Pradesh, India. *International Journal of Current Microbiology and Applied Sciences* 2018; 7(2): 1060-1065.

11. Suvashree R. Prusty, Upasana Mohaptra and Sudhakar Tripathy. Economics of hybrid maize cultivation in Sarguja district of Chhattisgarh .Agricultural Science Digest.2017;(37):56-59.
12. Srikanth B, Kausadikar HH , Jondhale RN and Gandhi N. Economic analysis of maize production and marketing in Khammam District, Telangana. Asian Journal of Agricultural Extension, Economics & Sociology. 2017; 20(4):1-13.
13. Vasanth P, Suryavanshi, Sachin S K and Rohit Y K. Yield and Economics of Maize (*Zea mays L.*) under Various Resource Constraints. International Journal of Current Microbiology and Applied Sciences. 2020; 9(11): 3618-3624.

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