An Economic analysis of production of rainfed and irrigated maize in Ariyalur district of Tamil Nadu in India

Abstract

Maize is the most important cereal and it is mostly used as grain, feed, fodder, and industrial products. In the present study, an attempt was made to calculate the cost of cultivation and to evaluate the of maize conducted in Ariyalur district of Tamil Nadu. Totally 98 respondents were purposively selected and interviewed from the district to examine the cost and returns of maize among the farmers in the study area. The data was gathered in the form of pre-structured interview schedule. Random sampling technique was adopted for selection of respondents. The study shows cost and returns of rainfed maize and irrigated maize cultivation per hectare and benefit cost ratio in different farm size groups. The total cost of cultivation of rainfed maize was identified as Rs.58338.54 for marginal farmers with benefit cost ratio 1.03, Rs.56301.69 for small farmers with benefit cost ratio 1.08 and Rs.54090.75 for semi-medium farmers with benefit cost ratio 1.15. The total cost of cultivation of irrigated maize was identified as Rs.94442.74 with benefit cost ratio 1.35 for marginal farmers, Rs.92473.29 with benefit cost ratio 1.38 for small farmers and Rs.91857.83 with benefit cost ratio 1.43 for semi-medium farmers. Those cost of cultivation includes all the expenses like, plant protection chemicals, land preparation, harvesting and other intercultural operations. This study clearly shows cost of cultivation decrease with increase in farm size.

Key words: cost of cultivation, different size group farmers, rainfed maize, irrigated maize

Introduction

Maize is the third most important cereal in India after rice and wheat which contributes nearly 9 % in national food basket **(Kumar *et al.*, 2013)**. The primary source of protein in maize is the kernel. They have a three percent of hull made up of a rough, resilient, fibrous outer shell. 4.5% of all sperm is produced by the germ; the remainder is endosperm **(Prassana *et al.*, 2001).**

According to the conditions under which it was grown, the raw yellow kernel contains 10 to 15% water, 10% protein, 10% fiber, minerals, and lipids and 80% of carbs. Besides being high in potassium and calcium, maize is also a good source of phosphorus, magnesium, manganese, zinc, copper, iron, and selenium. (**Sharma *et al.*, 2005**).

Maize serves as a basic raw material for the manufacturing of starch, oil, and protein as well as alcoholic drinks, culinary sweeteners, and more recently fuel. It also supplies nutrition for people and animals. Worldwide, there is a rising need for maize. This will help to further increases in the demand for maize. The cost of maize on the global market might rise as a result. Maize has higher yield than other cereals, is simple to prepare and is less expensive. the study about

economic analysis of maize leads to boosting the yield of maize and the return on investment for farmers that grow maize. **(Karthika *et al.*, 2015).**

Regarding adaptability, types and application, maize (zea mays l.) is the most adaptable crops among cereals. It is the second most frequently cultivated crop in the world and is grown in variety of climates from sub-tropical to temperate, including field corn, sweet corn, popcorn, and baby corn. There are numerous different varieties if field corn including high oil, waxy and quality protein maize (QPM). Millions of people depend on maize as a food source, animal feed, and raw materials for industries. With an average productivity of 5.75 tons per hectare, about 1147.7 million tons of maize as currently produced globally by more than 170 nations on an area of 193.7 million hectares. **(Food and agricultural organization stat 2020)**

2. Methodology

To get replies from appropriate respondents, a random sampling method was adopted. The study was carried out in Ariyalur district, which was deliberately chosen since it offers the researcher a lot of convenience in terms of accessibility, familiarity with location, time, money, and effort quantatively. The research period covered the agricultural year 2022. Six blocks make up the district and Thirumanur block was purposefully chosen based on its area of output. 25 farmers from Melapalur, 24 farmers from Melavannam, 25 farmers from Angiyanur, 25 farmers from Venganur were from those blocks. Among those respondents, 86 of the farmers are men, 12 are women. Four members are up to age of 30 then, there are 19 members in the group of people betweenthe ages of 31 and 40, 29 members in the group of people between the ages of 41 and 50 and 46 farmers in the group of people over the age of 60 when the topic of age is brought up.

3. Analytical tools

Cost of cultivation

It includes all the costs incurred to produce the maize. The production cost is divided into fixed and variable cost. Fixed cost includes land revenue, rental value of land and depreciation whereas variable cost includes seed, nutrients, farmyard manure, plant protection chemicals, weeding, irrigation, labour cost for various operations.

Units of Measurement: The methods of measurements and valuation of variables are presented below:

A. Labour cost

Machine labour: It was measured in terms of machine hours. Machine power was valued using the prevailing market rates of custom hiring in the selected villages. The hiring charge ranges from Rs.1000-1300/ hour.

Human labour: The total number of male and female labour used for various operations in Maize cultivation was taking in to account prevailing wage rate. Wage rate for male was Rs.400-600 and for female was Rs.200-300 in the district.

B. Material costs:

Seeds: The cost of seeds was the value arrived at by multiplying the quantity of seeds used by the sample farmers multiplied by the market prices prevailed.

Manures: The farmyard manure produced at the farm was valued at the market price prevailing at the village.
Fertilizers: It was the total quantity of N, P, K, and other organic and inorganic fertilizers used for maize cultivation and it was expressed in kilograms.
Plant protection chemicals: Plant protection chemicals used by the farmers were valued at their respective market prices to calculate the cost and it was expressed in kilograms.
Irrigation: Irrigation cost includes cost pertaining to operation and maintenance of pump sets used by the sample farmers.

C. Interest on working capital

The working capital was charged at the interest rate of seven per cent per annum, since this is the interest rate charged by commercial banks for short – term credit

D. Land revenue

Land revenue was taken at the rates levied by the government. Land revenue paid by the farmers during the current year was considered for this study.

E. Rental value of Land

The cost of the land was computed based on the prevalent rent if it was leased. In the case of owned land, the rental value prevailed in the area for the similar type of land was the rent equivalent, was considered.

F. Interest on fixed capital

Interest on fixed capital was computed at 12 per cent rate which was the interest charged for investment loans sanctioned by commercial banks in the study area.

G. Depreciation

It was worked out by straight line method that is at the rate of five per cent for farm buildings, and ten per cent for farm equipment and implements.

Measures of cost concept

Cost A: It includes,

Value of hired human labour, Value of hired bullock labour, Value of owned bullock labour, 4Value of tractor charges, Value of seed/seedlings (farm produced and/ or purchase) Value of manure and cakes owned (farm and/or purchased) Value of fertilizers, Value of fertilizers, Irrigation Charges, Depreciation on farm buildings. Interest on working capital, Other paid out expenses, if any

Cost B: Cost A + Rental Value of owned land + interest on value of owned fixed capital (Excluding Land).
Cost C1: Cost B + imputed value of family labour.
Cost C2: Cost 1 + 10 per cent of cost C1. as managerial charges.
Return: Gross income is the total value of main and by products at the prevailing market price.
Net income: It is estimated by deducting total cost from gross income.
Benefit - Cost Ratio: The benefit cost ratio (BCR) will be worked out by using following formulation

BC ratio = $(present\ worth\ of\ benefit)$ / $(present\ worth\ of\ cost)$

4. Result and discussion

Economics of Maize

The total cost required for cultivation of maize in rainfed and irrigated conditions were identified and mentioned below separately.

4.1. Cost of cultivation for irrigated maize:

From the below table 1, overall cost of cultivation of irrigated maize crop was Rs/ha 94442.74 in marginal which is the highest followed by Rs.92473.29 in small and Rs.91857.83 in semi medium which is the least. The large contribution has been observed in human labour use with Rs 7450.51 and shared of 7.88 percent to the total cost in marginal. The seed cost, fertilizer & plant protection chemicals was contributed the maximum share in marginal which is Rs8287.87, Rs12676.99, Rs3982.12 which shared 8.77, 13.42, 4.21 percent respectively. The input value of family labour use was noticed to be, Rs.7450.51(marginal), Rs.4457.22(small), Rs.2426.6(semi medium). The cost of cultivation of irrigated maize per hectare in marginal, small, semi-medium and farm groups is Rs.94442.74, Rs.92473.29, Rs.91857.83 respectively the table clearly indicates that, the cost of cultivation of irrigated maize per hectare in marginal size group is higher than small and semi-medium farm groups of cultivation of rainfed maize. A similar study conducted by **(Murthy *et al.*, 2015)** showed that the share of fixed cost of maize was 22.06 percent, 22.91 percent, and 23.59 percent for medium small and large farmers and the variable cost share of human labour was highest followed by cost of fertilizers.

The table of cost of cultivation of rainfed maize was described below;

Table 1. Cost of cultivation of irrigated maize (Rupees per quintal)

S.No.	Particulars	Marginal	Small	Semi-medium
1.	Land prepared by machinery	9787.87 (10.36)	8668.33 (9.37)	7516.96 (8.18)
2.	Hired labour	17214.94 (18.22)	19503.01 (21.09)	19721.32 (21.46)
3.	Machine labour	6125.25 (6.48)	5997.18 (6.48)	5632.55 (6.13)
4.	Seed cost	8287.87 (8.77)	7768.33 (8.40)	7089.21 (7.71)
5.	Manures and fertilizers	12676.99 (13.42)	12084.69 (13.06)	11916.75 (12.97)
6.	Plant protection chemicals	3982.12 (4.21)	3806.59 (4.11)	2552.77 (2.77)
7.	Irrigation cost	3362.5 (3.56)	2236.36 (2.41)	1000 (1.08)
8.	Transportation charges	2562.5 (2.71)	2090.90 (2.226)	1934.38 (2.10)
9.	Total working cost	64000.04	62155.39	57363.94
10.	Interest on working capital	4480.00 (4.74)	4350.87 (4.70)	4015.47 (4.37)
11.	Depreciation	1009.33 (1.06)	3376.2 (3.65)	5002.54 (5.44)
12.	Land revenue	87.5	87.5	87.5

		(0.09)	(0.09)	(0.09)
	Cost A	**69576.87**	**69969.96**	**66469.72**
13.	Rental value of owned land	7766.11 (8.22)	8235.54 (8.90)	12500 (13.60)
14.	Interest on fixed capital	1063.55 (1.12)	1403.9 (1.51)	2110.80 (2.29)
	Cost B	**78406.53**	**79609.41**	**81080.52**
15.	Imputed value of family labour	7450.51 (7.88)	4457.22 (4.82)	2426.6 (2.64)
	Cost C1	**85857.04**	**84066.63**	**83507.12**
	10 per cent of Cost C1. as managerial charges	8585.704 (9.09)	8406.66 (9.09)	8350.71 (9.09)
	Cost C2	**94442.74**	**92473.29**	**91857.83**
	Total cost of cultivation of irrigated maize per ha.	**94442.74 (100.00)**	**92473.29 (100.00)**	**91857.83 (100.00)**

(Figures in parenthesis indicates percent to total)

4.1.1. Cost and returns of irrigated maize

From the below table 2, the cost and returns of irrigated system farmers are denoted. It is revealed that the total cost of cultivation increases with decrease in farm size. For marginal farmers, the total cost of cultivation was 94442.74 in this 10.89 percent was fixed cost and 89.11 percent was variable cost. The gross income which was 127757.57 per hectare for marginal farmers. Net income was 33314.83 and output input ratio was 1.35. For small farmers the total cost of cultivation was 92473.29. In this 14.63 percentwas total fixed cost and 85.37 percent was variable cost. Gross income per hectare for small farmers was 128416.66. Net income and input output ratio of small farmers were 35943.37 and 1.38 respectively. For semi medium farmers the total cost of cultivation was 91857.83 In this 22.58percent was total fixed cost and 77.42 percent was variable cost. Gross income per hectare for semi medium farmers was 131834.84. Net income and input output ratio of small farmers were 39977.01 and 1.43 respectively. A similar study by **(Navadkar *et al.*, 2012)** showed output input ratio for kharif maize was found 1.06 that indicated maize as the profitable enterprise.

Table 2. cost and returns of maize in irrigated conditions

S.No.	Particulars	Marginal	small	Semi-medium
1.	Total cost of cultivation	**94442.74**	**92473.29**	**91857.83**
2.	Gross income	127757.57	128416.66	131834.84
3.	Net income	33314.83	35943.37	39977.01
4.	Output- Input ratio	**1.35**	**1.38**	**1.43**

4.2. Cost of cultivation for rainfed maize:

From the table 3, It reveals that overall cost of cultivation of maize crop was Rs/ha 58338.54 in marginal which is the highest. The large contribution has been observed in human labour use

with Rs 11056.22 and shared of 20.44 percent to the total cost in semi medium. The seed cost, fertilizer & plant protection chemicals was contributed the minimum share in semi medium which is Rs5730.35, Rs4357.13, Rs1138.41 which shared 10.59, 8.05, 2.10 percent respectively. The input value of family labour use was noticed to be, Rs.4385.32(marginal), Rs.3642.55(small), Rs.1503.21(semi medium). The cost of cultivation of rainfed maize per hectare in marginal, small, semi-medium and farm groups is Rs.58338.54, Rs.56301.69, Rs.54090.75 respectively. The table clearly indicates that, the cost of cultivation of maize per hectare in marginal size group is higher than small and semi-medium farm groups. Similar study conducted by **(Devi *et al.*, 2016)** revealed that, increase in cost of production mainly due to increase in prices of labour and inputs used.

Table 3. Cost of cultivation of rainfed maize (rupees per hectare)

S. No	Particulars	Marginal	Small	Semi-medium
1	Land preparation by machinery	10117.85 (19.07)	8250 (14.65)	7715.32 (14.26)
2	Hired labour	9603.5 (18.10)	10797.41 (19.17)	11056.22 (20.44)
3	Machine labour	5218.97 (9.84)	4996.42 (8.87)	4353.44 (8.04)
4	Seed cost	6193.43 (11.67)	5985.63 (10.63)	5730.35 (10.59)
5	Manures and fertilizers	5634.85 (9.65)	4959.14 (7.73)	4357.13 (8.05)
6	plant protection chemicals	1672.68 (2.86)	1432.14 (2.54)	1138.41 (2.10) `
7	Transportation charges	437.95 (0.75)	428.57 (0.76)	199.71 (0.36)
8	Total working cost	38879.23	36849.31	34550.58
9	Interest on working capital	2721.54 (4.66)	2579.45 (4.58)	2418.54 (4.47)
10	Depreciation	1218.71 (2.08)	2167.9 (3.85)	4479.59 (8.28)
11	Land revenue	75 (0.12)	75 (0.13)	75 (0.13)
	Cost A	**42894.48**	**41596.73**	**41523.71**
12	Rental value of owned land	5000 (8.57)	5000 (8.88)	5000 (9.24)
13	Interest on fixed capital	755.24 (1.29)	869.15 (1.54)	1146.55 (2.11)
	Cost B	**48649.72**	**47465.88**	**47670.26**
14	Imputed value of family labour	4385.32 (7.51)	3642.55 (6.46)	1503.21 (2.77)
	Cost C1	**53035.04**	**51183.36**	**49173.41**

15	10 per cent of Cost C1. as managerial charges	5303.50 (9.09)	5118.33 (9.09)	4917.34 (9.09)
	Cost C2	**58338.54**	**56301.69**	**54090.75**
	Total cost of cultivation of rainfed maize per ha.	**58338.54 (100.00)**	**56301.69 (100.00)**	**54090.75 (100.00)**

(Figures in parenthesis indicates percent to total)

4.2.1. Cost and returns of rainfed maize

From the above table 4, the cost and returns of rainfed system farmers are denoted. It is revealed that the total cost of cultivation increases with decrease in farm size. for marginal farmers, the total cost of cultivation was 58338.54 in this 12.35 percent was fixed cost and 87.65 percent was variable cost. The gross income which was 60401.45 per hectare for marginal farmers. Net income was 2062.91 and output input ratio was 1.03. For small farmers the total cost of cultivation was 56301.69.in this 14.51 percent was total fixed cost and 85.48 percent was variable cost. Gross income per hectare for small farmers was 61150. Net income and input output ratio of small farmers were 4848.31 and 1.08 respectively. For semi medium farmers the total cost of cultivation was 54090.75. In this21.69 percent was total fixed cost and 78.31 percent was variable cost. Gross income per hectare for small farmers was 62695.40. Net income and input output ratio of small farmers were 8604.65 and 1.15 respectively. Similar study conducted by **(Thulasiram *et al.*, 2017)** net returns obtained from maize were higher than groundnut. The benefit cost ratio of the maize and groundnut were1.75 and 1.45 respectively. Thus, it is concluded that maize is more profitable than groundnut.

Table 4. cost and returns of maize in rainfed conditions

S. No	Particulars	Marginal	small	Semi-medium
1.	Total cost of cultivation	58338.54	56301.69	54090.75
2.	Gross income	60401.45	61150	62695.40
.3.	Net income	2062.91	4848.31	8604.65
4.	Benefit – cost ratio	1.03	1.08	1.15

Conclusion and recommendations

Largescale farmers employed cuttingedge equipment like tractors, power sprayers, other agricult ural tools, as well as premium fertilizers, seeds, and pesticides.They will become more productiv e as a result of the economy and manufacturing efficiency.It is important to promote the use of su ccessful sophisticated technologies by small and mediumsized farmers as well.Small farmers are not aware of the best ways to use manures, insecticides, and fertilizers.Consequently, the Agricul tural University and local training programmes are needed.Small farmers should be educated on how to use resources efficiently.

Although research on crops like rice, cotton, bananas, and others has been done admirably by agr icultural universities and research institutes, there is a pressing need to make progress in the prod uction of maize.The absence of highquality seeds was cited by farmers as the main barrier.They b

elieved that there were seeds of various kinds mixed together, which causes poor germination an d decreased yield.Additionally, there is a lack of utilisation of high yielding varieties of maize, th us the extension agencies must be enhanced to reuggestion to use more high producing types and confidence in farmers regarding the quality of seeds.In order to boost the farmers' profitability, t he government may set a higher minimum support price for maize.This will increase their "stayin g power" and prevent a "distress sale" at the farm itself right after harvest.

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