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**Ravindra Singh**  
Directorate of Research,  
N.D.U.A.T Kumarganj,  
Faizabad, Uttar Pradesh, India

**Sadhna Singh**  
Department of Food Science &  
Nutrition, College of Home  
Science N.D.U.A.T Kumarganj,  
Faizabad, Uttar Pradesh, India

**Sandeep**  
Agril. Economics, N.D.U.A.T  
Kumarganj, Faizabad, Uttar  
Pradesh, India

## Economic analysis of maize cultivation in Lucknow district of Uttar Pradesh

**Ravindra Singh, Sadhna Singh and Sandeep**

### Abstract

Maize is the third most important crop in India next to wheat and rice. It is one of the most miracle cereal crops in the world. It has very high yield potential. In the country, maize is considered and consumed as nutritious and tasty human food. Several food dishes including chapattis are prepared from maize flour and grain. District Lucknow was selected purposively and block Moll was selected randomly. Finally, 100 farmers were selected following the proportionate random sampling technique from five selected villages. The study period pertains to agricultural year 2015-16. Overall, average cost of production was Rs 778.46 /qt. and gross income reflects direct relationship with the farm size. Average yield was found 48.41 q/ha. Major portion of cost of cultivation were accounted on human labour, seed cost, manures & fertilizers and irrigation. Return to scale in all farm size was found less than unit (that is 0.948572 in small, 0.915736 in marginal, and 0.883402 in medium farms) indicates that production of maize was characterized by decreasing return to scale in case of all categories of farms. Some new maize based products were prepared like maize infant food, maize sev, maize upma, maize flour halwa etc popularize maize among modern consumers.

**Keywords:** Maize, wheat, rice, agricultural

### Introduction

Maize is grown in almost all the states of India and occupies an area of about 6 million hectares which accounts for about 25 per cent of the total area of the continent. In the country, maize is considered and consumed as nutritious and tasty human food. Maize is one of the world's leading crops cultivated over an area of about 139 million hectares with a production of about 600 million tones of grain. Maize is the third most important food grain crop in India next to wheat and rice. In India, about 28 per cent of maize produced is used for food purpose, about 11 per cent as livestock feed, 48 per cent as poultry feed, 12 per cent in milling industry and 1 per cent as seed for maize (AICRP, 2007). Like other cereals, maize contains a large proportion of carbohydrates (60 to 65%) and thus provides bulk of energy in diets based on it. Apart from carbohydrates it is also a good source of protein (10 to 12%), fat (3.5 to 5.5%) and crude fibre (2.0 to 2.5%). It is also rich in vitamins and minerals (magnesium 139 mg, zinc 2.8 mg, potassium 286 mg, niacin 1.8 mg and carotene 90 µg), ICAR-NAIP(2011). To popularize maize among new generation new products were standardized using fresh maize (corns) and flour etc.

Keeping in view, the present study entitled "Economic analysis of maize cultivation in Lucknow District of U.P." was carried out with the following objectives.

1. To workout cost of cultivation of maize crop in the study area.
2. To workout input- output relationship and various profit measures of maize cultivation and
3. To workout resource-use efficiency of maize cultivation.
4. To standardized some new maize based value added products.

### Research Methodology

Three stage stratified random sampling technique was used to select the sample farmers. Lucknow district of Uttar Pradesh was selected purposively to avoid the operation inconvenience of the investigator. The one block namely Mall was selected randomly for the study. The cultivators were classified into three categories viz, below 1hectare (marginal ), 1-2 hectare (small) and 2-4 hectare (medium ).Finally hundred farmers were selected randomly from five selected villages. The study period pertains to agricultural year 2015-16.

### Analytical Tools

Both tabular and functional analysis of data were used.

**Correspondence**  
**Ravindra Singh**  
Directorate of Research,  
N.D.U.A.T Kumarganj,  
Faizabad, Uttar Pradesh, India

For tabular analysis percentages, simple and weighted averages were used. The formula for weighted average is as follows:

$$W.A. = \frac{\sum Wi Xi}{\sum Wi}$$

where,

W. A. = Weighted average  
 Xi = Variable  
 W = Weights of Xi

#### Cropping Intensity : (CI)

$$CI = \frac{\text{Total cropped area}}{\text{Net sown area}} \times 100$$

#### Regression analysis:

The mathematical form of Cobb-Douglas production function is given below:

$$Y = aX_1^{b_1} \cdot X_2^{b_2} \cdot X_3^{b_3} \cdot X_4^{b_4} \cdot e^u$$

Where,

Y = per hect. output (Rs.)  
 A = constant  
 X<sub>1</sub> = per hectare cost of seed (Rs.)  
 X<sub>2</sub> = per hectare cost of manure & fertilizer (Rs.)  
 X<sub>3</sub> = per hectare Irrigation charges (Rs.)  
 X<sub>4</sub> = per hectare cost on human labour (Rs.)  
 e<sup>u</sup> = error term

This can be expressed in log form as follows:

$$\log Y = \log a + b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 + b_4 \log x_4 + u$$

This formula was used for estimating the parameter of the function based on sample data.

The marginal value productivity of (MVP) inputs were estimated by following formula:

$$(MVP)_{bi} = \frac{b_i y}{x_i}$$

Where,

B<sub>i</sub> = production elasticity with respect to X<sub>i</sub>  
 Y = Geometric mean of Y (output values in Rs/ha.)  
 $\bar{X}_I$  = Geometric mean of x<sub>i</sub> (input values in Rs/ha.)  
 MVP<sub>i</sub> = marginal value product of 1st input

#### Results and Discussion

The per hectare cost on various input factors in maize production was worked out and its details are presented in the Table 1. This Table indicates that on an average per hectare cost of cultivation of maize was Rs. 41407.20. The cost of cultivation was observed higher on medium farm (Rs. 43304.75) followed by small farm (Rs. 41721.36) and marginal farm (Rs. 39904.99), respectively.

The total cost on medium farm was maximum due to heavy expenditure use on rental value of owned land. The study further revealed that in case of marginal farm, cost incurred on rental value of owned land (30.07) per cent followed by human labour (24.24) per cent, managerial cost (9.09) per cent, tractor charge (8.40) per cent, irrigation (8.25) per cent, and manures & fertilizers (7.64) per cent.

Further, distribution of the costs on over all farm average showed the maximum expenditure on rental value of owned land (28.98 per cent. The costs on human labour, irrigation, manure, tractor charges and interest on fixed capital were 21.59, 8.90, 8.37, 8.27 and 6.46 per cent, respectively.

#### Measures of costs and returns of maize crop

Per hectare costs and income from the cultivation of maize crop on different categories of farms were worked out and presented in Table 2. It is depicted from the table that on an average the total cost of cultivation (C<sub>2</sub>) came to Rs. 37642.91 per hectare which was maximum Rs. 39367.96 on medium farm followed by small, and marginal farms corresponding to Rs. 37928.51 and Rs. 36277.27, per hect. respectively.

As for as the income measures are concerned, it is observed from the table that the gross income per hectare was maximum Rs. 56340.11 on medium farm followed by small and marginal farms corresponding to Rs. 54985.35 and Rs. 52150.25, respectively. Where as the average gross income on over all farms came to Rs. 54248.91 per hect. Other income measures like net income, farm income and family labour income were also worked out and presented in the table showing same trend as in the case of gross income (as size of farm increases the various measures of income decreases).

It is displayed in the table that cost of production per quintal on the basis of cost C<sub>2</sub> was highest to Rs. 800.46 on marginal farm followed by small and medium farms corresponding to Rs. 772.16 and Rs. 753.88, respectively whereas it was Rs. 778.46 per quintal on over all farms.

The input-output analysis was also done on the basis of cost A<sub>1</sub> to cost C<sub>3</sub>. It varies from 1:3.41 to 1:1.30 in case of marginal farm size group, 1: 2.86 to 1:1.31 on small farm and 1:2.56 to 1:1.30 on medium farm size groups. The overall average of the input: output ratio on the basis of various costs varies from 1:2.99 to 1:1.31.

#### Resource use efficiency

The Cobb-Douglas production function was applied to find out the efficiency of various resources used in the production of maize.

The value of elasticity of production, standard error, coefficient of multiple determination and return to scale for maize production on different size group of farms are presented in Table 3. The high value of R<sup>2</sup> of the fitted function indicated that sufficient and large proportion of the total variation in the depended variable is explained by the input included in the function. The table further indicated that four variables viz. seed, manures & fertilizers, irrigation charges and plant protection explained 93.77, 96.08 and 94.38 per cent variation of the dependent variable on marginal, small and medium farms, respectively.

**Table 1:** Per hectare cost of different inputs used in maize crop on different size group of sample farms

S. No.	Particulars	Size group of sample farms			Overall
		Marginal	Small	Medium	
1.	Family labour	6450.25 (16.16)	4025.35 (9.64)	3535.51 (8.16)	4382.49 (10.58)
2.	Hired labour	3225.40 (8.08)	4580.40 (10.97)	5825.51 (13.45)	4360.14 (10.53)
3.	Total human labour	9675.65 (24.24)	8605.75 (20.62)	8361.02 (19.30)	8942.64 (21.59)
4.	Tractor charges	3050.08 (8.40)	3588.10 (8.60)	3750.35 (8.66)	3427.33 (8.27)
5.	Seed	1580.25 (3.96)	2085.35 (4.99)	2575.22 (5.94)	2008.92 (4.85)
6.	Manures & fertilizers	3050.25 (7.64)	3585.11 (8.59)	3940.65 (9.09)	3468.16 (8.37)
7.	Irrigation	3295.15 (8.25)	3825.22 (9.16)	4085.92 (9.43)	3689.09 (8.90)
8.	Plant Protection	680.25 (1.70)	945.58 (2.26)	1143.29 (2.64)	892.27 (2.15)
9.	Interest on working capital	395.53 (0.99)	598.28 (1.43)	652.32 (1.50)	536.12 (1.29)
10.	Rental value of owned land	12000 (30.07)	12000 (28.76)	12000 (27.71)	12000 (28.98)
11.	Interest on fixed capital	2550.11 (6.39)	2695.12 (6.45)	2859.19 (6.60)	2678.35 (6.46)
12.	Managerial cost	3627.72 (9.09)	3792.85 (9.09)	3936.79 (9.09)	3764.29 (9.09)
Grand total		39904.99 (100)	41721.36 (100)	43304.75 (100)	41407.2 (100)

**Table 2:** Per hectare costs and returns from the production of maize on the basis at various costs concepts (in Rs)

S.No.	Item	Size group of farms			Overall
		Marginal	Small	Medium	
1.	Cost A <sub>1</sub> /A <sub>2</sub>	15276.91	19208.04	21973.26	18382.06
2.	Cost B <sub>1</sub>	17827.02	21903.16	24832.45	21060.41
3.	Cost B <sub>2</sub>	29827.02	33903.16	36832.45	33061.41
4.	Cost C <sub>1</sub>	24277.27	25928.51	27367.96	25642.91
5.	Cost C <sub>2</sub>	36277.27	37928.51	39367.96	37642.91
6.	Cost C <sub>3</sub>	39904.99	41721.36	43304.75	41407.2
7.	Gross income	52150.25	54985.35	56340.11	54248.91
8.	Net income	15872.98	17056.84	16972.15	16605.60
9.	Family labour income	22323.23	21082.19	19507.66	21188.10
10.	Farm business income	36873.34	35777.31	34366.85	35866.45
Cost of production/q					
a.	Yield qt./ha	45.32	49.12	52.22	48.41
b.	Cost of production (Rs./q.)	800.46	772.16	753.88	778.46
12.	Input-output ratio				
I.	A <sub>1</sub> /A <sub>2</sub> basis	1:3.41	1:2.86	1:2.56	1:2.99
II.	B <sub>1</sub> basis	1:2.92	1:2.51	1:2.26	1:2.60
III.	B <sub>2</sub> basis	1:1.75	1:1.62	1:1.52	1:1.64
IV.	C <sub>1</sub> basis	1:2.14	1:2.12	1:2.05	1:2.11
V.	C <sub>2</sub> basis	1:1.43	1:1.44	1:1.43	1:1.43
VI.	C <sub>3</sub> basis	1:1.30	1:1.31	1:1.30	1:1.31

**Marginal value productivity (MVP)**

Table 4 indicates that all these categories of farms and all the variables are positive value of M.V.P. to factor costs,

therefore, there is further scope to increase the investment on all the factors to realize more return than the costs.

**Table 3:** Resource use efficiency in maize crop in different size of sample farms

Size group of sample farms	Production elasticities				Sum of elasticities	R <sup>2</sup>
	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>		
Marginal	0.217444* (0.666)	0.394828** (0.034121)	0.112312 (0.336767)	0.067233 (0.154071)	0.791818	0.915736
Small	0.267076* (0.11327)	0.362095** (0.062352)	0.174634 (0.396016)	0.063619 (0.04651)	0.867424	0.948572
Medium	0.229765 (0.403851)	0.480668* (0.14784)	0.118202 (0.889215)	0.02215 (0.08837)	0.850787	0.883402

(Note: Figures in parenthesis denotes standard error of respective variables)

\*\* Significant at 1 percents level

\*Significant at 5 percents level

X<sub>1</sub>, X<sub>2</sub>, X<sub>3</sub>, X<sub>4</sub> denotes for seed, manures & fertilizers, irrigation charges and plant protection cost, respectively.

**Table 4:** Marginal value productivity (MVP) of included factors in production process of maize crop

Size group of farms	MVP			
	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>
Marginal	1.760018	2.012161	1.153298	5.256387
Small	2.269237	1.915086	1.910219	5.215333
Medium	1.844255	2.481516	1.277334	1.585772

## **Standardization of maize based products:**

### **1. Maize infant food**

#### **Ingredients**

Maize 150g, Green gram 75g, Groundnut 20g, Sesame seeds 20g

#### **Method**

Washed and soaked gram dal for four hours and sun dried. Roasted dried gram dal, maize, groundnut and sesame seeds separately till its typical roasted flavor come. Ground all the roasted items and kept in air tight container. At the time of feeding the infant, mixed desired amount of this powdered mixture with milk or luke warm water and sugar.

### **2. Maize sev**

#### **Ingredients**

Maize flour 75g, Bengal gram flour 25g, Salt according to taste, Turmeric a pinch, Asafoetida a pinch, Baking soda a pinch Red chilli powder according to taste, Oil for frying

#### **Method**

Sieved maize flour and Bengal gram flour. Added salt, red chilli powder, asafoetida, salt and baking soda. Added little oil and rubbed with both hands. Added water and made soft dough using required amount of water, passed through sev machine and deep fried.

### **3. Maize upma**

#### **Ingredients**

Fresh maize (corns) 5 no., Grated Carrot 2, Capsicum 2 no., Cabbage 1 small, Grated coconut 1/3 cup, Onion 2 no., Ginger paste 1 teaspoon, Green chillies 4-5, Lemon juice 1 tsp, Coriander leaves few springs, Salt according to taste, Refined oil 1 tbs, Curry leaves few

#### **Method**

Boiled fresh maize corns in a pressure cooker using little water. Cooled and took out grains. Coarsely ground in a mixer. Heated oil in a pan. Cut onion in small pieces and added in the oil and sauté for 2 min. Added cut capsicum, shredded cabbage and grated carrots in it and cooked till soft. Then added coarsely ground maize in it. Added salt and cooked for 5 min. sprinkled grated coconut, lemon juice and cut coriander leaves and ready to serve.

### **4. Maize ghughani**

#### **Ingredients**

Fresh maize (corns) 5 no., Garlic 4-8, Cloves 3-4, Green chillies 3-4, Black pepper powder ¼ tsp, Desi ghee 1 tsp, Salt according to taste

#### **Method**

Put maize (corns) in a pressure cooker and boiled using little water. Cooled and removed the grains. Heated ghee in a pan. Added cut garlic and green chillies. Added boiled maize and salt in it and cooked covered for 5 minutes. Sprinkled black pepper powder and served hot.

### **5. Maize flour halwa**

#### **Ingredients**

Maize flour 100g, Sugar 100g, Desi ghee 20g, Coconut 10g, Water 400ml

## **Method**

Heated ghee in a pan. Added maize flour and roasted till colour turned little golden brown. Added sugar and water. Cooked till excess water evaporated and halwa leaved sides of the pan. Garnished with coconut and served hot.

## **References**

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