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Factors affecting cost of cultivation of Jowar in India

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Abstract

This study aims to look at the factors that affect cost of cultivation of Jowar. The study based on the secondary data collected for the period 2001-2002 to 2020-21 years and spilt into sub-periods i.e. period I: 2001-02 to 2010-11 and period II: 2011-12 to 2020-21 and overall: 2001-02 to 2020-21. Factors affecting cost of cultivation of Jowar was analyzed by using multiple linear regression analysis. The study revealed that, all the factors were found be important in cost of cultivation of jowar. However, the regression coefficients indicated that a seeds (X_1), fertilizers (X_2), manures (X_3), human labour (X_4) and animal labour (X_5) had a significant influence on cost of cultivation of jowar. Consequently, it is apparent that more focus should be directed to seeds and human labour.

Keywords: Cost of cultivation, jowar, regression, factor

Introduction

During the past five decades, Indian agriculture has witnessed a significant change in input-use away from traditional inputs like human labour, bullock labour, farm-grown seeds, manure and traditional methods of irrigation towards modern inputs like improved seeds, chemical fertilizers, farm machine and large-scale use of tube wells for irrigation. It is pertinent to evaluate the effect of such transitions on crop production cost and profitability of crop enterprise. It is also important to ascertain whether the change in cost of cultivation, if any, is due to the changes in level of input-use or its prices. The changing relative price of the factors of cultivation prompts farmers to partially substitute the related factors (e.g., farm labour with machinery) in order to maximize their profits. The evaluation of effect of factor substitution on crop cultivation cost is useful in devising suitable strategies for controlling the cost inflation in the country.

Materials and Methods

This study was conducted on secondary data (Indiaagristat.com) from 2001-02 to 2020-21 (20 years) comprises of three periods i.e. period I: 2001-02 to 2010-11, period II: 2011-12 to 2020-21 and overall: 2001-02 to 2020-21. Factors affecting cost of cultivation was analyzed by using multiple linear regression analysis. Multiple linear regression analysis is a statistical technique used to understand the relationship between multiple independent variables and a dependent variable. In the context of calculating the cost of cultivation, it can be employed to predict the costs based on various factors that influence cultivation expenses. The equation for multiple linear regressions can be represented as

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \epsilon$$

Where

Y = the dependent variable (cost of cultivation).

β_0 = intercept or constant term.

$\beta_1, \beta_2, \dots, \beta_5$ = Coefficients associated with independent variables

X_1, X_2, \dots, X_5 .

X_1 = Seeds, X_2 = Fertilizers, X_3 = Manures, X_4 = Human labour, X_5 = Animal labour

ϵ = error term, representing the unexplained variability in the model.

Results and Discussions

The study was conducted to analyze the factors affecting the cost of cultivation of jowar crop in the states of India. The major jowar growing states are Maharashtra, Karnataka, Rajasthan, and Tamil Nadu. These four major states were selected for the analysis. The individual states were divided into two sub periods and overall period also calculated: period I (2001-02 to 2010-11), period II (2011-12 to 2020-21), and overall period (2001-02 to 2020-21). The results of the analysis of the cost of cultivation factors, such as seeds, fertilizers, manures, human labour, and animal labour on jowar cultivation data were analyzed using multiple linear regression analysis.

Factors affecting cost of cultivation of Jowar in Maharashtra: The multiple linear regressions were carried out between the independent variables and dependent

variable. The independent variables that represent seeds, fertilizers, manures, human labour and animal labour, while dependent variable represent cost of cultivation of jowar in Maharashtra for the period I (2001-02 to 2010-11), period II (2011-12 to 2020-21), and overall Period (2001-02 to 2020-21).

Table 1 show that, the coefficient of determination (R^2) is used to measure how much the ability of the independent variable in explaining the bound variation. During period I, the coefficient of determination (R^2) obtained was 0.99. This coefficient of determination shows that jowar cost of cultivation (Y) can be explained by seeds (X_1), fertilizers (X_2), manures (X_3), human labour (X_4) and animal labour (X_5) by 99 per cent while the remaining 1 per cent is influenced by other variables and human labour is significant at the 5 per cent level.

Table 1: Factors affecting cost of cultivation of Jowar in Maharashtra

Sr. No	Variables	Period I	Period II	Overall
1.	Constant	-385.20 (2694.60)	-33220.47 (19039.61)	-4934.46 (5977.32)
2.	X_1 (Seeds)	6.809 (8.38)	-11.23 (22.67)	-5.657 (9.12)
3.	X_2 (Fertilizers)	6.650 (5.63)	-12.42 (6.92)	-9.370** (4.01)
4.	X_3 (Manures)	4.170 (4.53)	-13.13 (4.96)	-10.221** (3.90)
5.	X_4 (Human labour)	2.049** (0.28)	4.04** (1.42)	2.997** (0.64)
6.	X_5 (Animal labour)	-0.532 (1.67)	10.92** (3.34)	5.482** (3.56)
7.	R^2	0.99	0.90	0.94
8.	F	0.001	0.043	0.000

(Figures in parentheses indicates the standard error)

**Significant at 5% level

During period II, the coefficient of determination (R^2) obtained was 0.90. This coefficient of determination shows that jowar cost of cultivation (Y) can be explained by seeds (X_1), fertilizers (X_2), manures (X_3), human labour (X_4) and animal labour (X_5) by 90 per cent while the remaining 10 per cent is influenced by another variable. Animal labour and human labour factors are shows significant at 5 per cent level. At the overall level, the coefficient of determination (R^2) obtained was 0.941. This coefficient of determination shows that jowar cost of cultivation (Y) can be explained by seeds (X_1), fertilizers (X_2), manures (X_3), human labour (X_4) and animal labour (X_5) by 94 per cent while the remaining 6 per cent is influenced by other variables. From the resulting

model, fertilizers, manures, human labour and animal labour were found to be statistically significant at 5 per cent confidence level.

Factors affecting cost of cultivation of jowar in Karnataka

The multiple linear regressions were carried out between the independent variables and dependent variable. The independent variables that represent seeds, fertilizers, manures, human labour and animal labour, while dependent variable represent cost of cultivation of jowar in Karnataka for the period I (2001-02 to 2010-11), period II (2011-12 to 2020-21), and overall period (2001-02 to 2020-21).

Table 2: Factors affecting cost of cultivation of Jowar in Karnataka

Sr. No	Variables	Period I	Period II	Overall
1.	Constant	2465.73 (1014.16)	-7558.29 (4868.64)	-5965.35 (1216.06)
2.	X_1 (Seeds)	-0.257 (3.64)	17.986 (11.63)	16.095** (5.84)
3.	X_2 (Fertilizers)	-0.714 (0.97)	2.980 (1.69)	2.761** (1.11)
4.	X_3 (Manures)	1.771 (1.81)	-18.673 (8.98)	-16.770** (4.57)
5.	X_4 (Human labour)	1.921** (0.16)	0.286 (0.30)	0.348 (0.20)
6.	X_5 (Animal labour)	0.830 (0.56)	7.209** (1.01)	6.937** (0.74)
7.	R^2	0.994	0.966	0.99
8.	F	0.000	0.005	0.000

(Figures in parentheses indicates the standard error)

**Significant at 5% level

Table 2 shows that, the coefficient of determination (R^2) is used to measure how much the ability of the independent variable in explaining the bound variation. During period I, the coefficient of determination (R^2) obtained was 0.994. This coefficient of determination shows that jowar cost of cultivation (Y) can be explained by seeds (X_1), fertilizers (X_2), manures (X_3), human labour (X_4) and animal labour (X_5) by 99.4 per cent while the remaining 0.6 per cent is

influenced by other factors and human labour shows significant at 5 per cent.

During period II, the coefficient of determination (R^2) obtained was 0.966. This coefficient of determination shows that jowar cost of cultivation (Y) can be explained by seeds (X_1), fertilizers (X_2), manures (X_3), human labour (X_4) and animal labour (X_5) by 96.6 per cent while the remaining 3.4

per cent is influenced by other factors and animal labour variable shows significant at 5 per cent level.

At the overall period, the coefficient of determination (R^2) obtained was 0.966. This coefficient of determination shows that jowar cost of cultivation (Y) can be explained by seeds (X_1), fertilizers (X_2), manures (X_3), human labour (X_4) and animal labour (X_5) by 99 per cent while the remaining 1 per cent is influenced by other factors. From the resulting model seeds, fertilizers, manures, and animal labour were found to be statistically significant at 5 per cent confidence level.

Factors affecting cost of cultivation of Jowar in Rajasthan

The multiple linear regressions were carried out between the independent variables and dependent variable. The independent variables that represent seeds, fertilizers, manures, human labour and animal labour, while dependent variable represent cost of cultivation of jowar in Rajasthan for the period I (2001-02 to 2010-11), period II (2011-12 to 2020-21), and overall period (2001-02 to 2020-21).

Table 3: Factors affecting cost of cultivation of Jowar in Rajasthan

Sr. No	Variables	Period I	Period II	Overall
1.	Constant	2969.22 (860.46)	4576.80 (529.59)	1815.85 (684.93)
2.	X_1 (Seeds)	1.625 (1.29)	3.224** (0.45)	3.261** (1.08)
3.	X_2 (Fertilizers)	-0.014 (4.56)	12.909** (0.92)	8.161** (2.87)
4.	X_3 (Manures)	2.133 (2.61)	5.925** (0.49)	2.764** (1.40)
5.	X_4 (Human labour)	1.230** (0.35)	0.790** (0.05)	1.012 (0.19)
6.	X_5 (Animal labour)	2.168 (1.39)	-17.497** (1.77)	0.248** (1.89)
7.	R^2	0.96	0.99	0.99
8.	F	0.007	0.00	0.00

(Figures in parentheses indicates the standard error)

**Significant at 5% level

At the overall, the coefficient of determination (R^2) obtained was 0.99. This coefficient of determination shows that jowar cost of cultivation (Y) can be explained by seeds (X_1), fertilizers (X_2), manures (X_3), human labour (X_4) and animal labour (X_5) by 99 per cent while the remaining 1 per cent is influenced by other factors. From the resulting model seeds, fertilizers, manures, and human labour were found to be statistically significant at 5 per cent confidence level.

Table 3 shows that the coefficient of determination (R^2) is used to measure how much the ability of the independent variable in explaining the bound variation. During period I, the coefficient of determination (R^2) obtained was 0.966. This coefficient of determination shows that jowar cost of cultivation (Y) can be explained by seeds (X_1), fertilizers (X_2), manures (X_3), human labour (X_4) and animal labour (X_5) by 96 per cent while the remaining 4 per cent is influenced by other factors and human labour variable shows significant at 5 per cent level.

During period II, the coefficient of determination (R^2) obtained was 0.99. This coefficient of determination shows that jowar cost of cultivation (Y) can be explained by seeds (X_1), fertilizers (X_2), manures (X_3), human labour (X_4) and animal labour (X_5) by 99 per cent while the remaining 1 per cent is influenced by other factors. From the resulting model seeds, fertilizers, manures, human labour and animal labour were found to be statistically significant at 5 per cent confidence level.

Factors affecting cost of cultivation of Jowar in Tamil Nadu

The multiple linear regressions were carried out between the independent variables and dependent variable. The independent variables that represent seeds, fertilizers, manures, human labour and animal labour, while dependent variable represent cost of cultivation of jowar in Tamil Nadu for the period I (2001-02 to 2010-11), period II (2011-12 to 2020-21), and overall period (2001-02 to 2020-21).

Table 4: Factors affecting cost of cultivation of Jowar in Tamil Nadu

Sr. No	Variables	Period I	Period II	Overall
1.	Constant	4236.11 (1663.28)	-199.78 (18068.19)	-2518.41 (2246.26)
2.	X_1 (Seeds)	12.417** (4.27)	-7.946 (3.60)	-7.988** (1.84)
3.	X_2 (Fertilizers)	-7.048** (1.99)	0.649 (7.63)	0.513 (2.82)
4.	X_3 (Manures)	-4.204 (2.02)	3.052 (3.00)	2.926 (1.43)
5.	X_4 (Human labour)	0.929 (0.407)	2.979 (1.66)	3.123** (0.41)
6.	X_5 (Animal labour)	1.761** (0.58)	-5.462 (63.61)	3.199 (1.78)
7.	R^2	0.92	0.95	0.98
8.	F	0.023	0.01	0.00

(Figures in parentheses indicates the standard error)

**Significant at 5% level

Table 4 shows that, the coefficient of determination (R^2) is used to measure how much the ability of the independent variable in explaining the bound variation. During period I, the coefficient of determination (R^2) obtained was 0.92. This coefficient of determination shows that jowar cost of cultivation (Y) can be explained by seeds (X_1), fertilizers (X_2), manures (X_3), human labour (X_4) and animal labour (X_5) by 92 per cent while the remaining 8 per cent is influenced by other factors. From the resulting model seeds, fertilizers and

animal labour were found to be statistically significant at 5 per cent confidence level.

During period II, the coefficient of determination (R^2) obtained was 0.95. This coefficient of determination shows that jowar cost of cultivation (Y) can be explained by seeds (X_1), fertilizers (X_2), manures (X_3), human labour (X_4) and animal labour (X_5) by 95 per cent while the remaining 5 per cent is influenced by other factors. From the resulting model seeds, fertilizers, manures, human labour and animal labour

were found to be statistically insignificant at 5 per cent confidence level.

At the overall, the coefficient of determination (R^2) obtained was 0.98. This coefficient of determination shows that jowar cost of cultivation (Y) can be explained by seeds (X_1), fertilizers (X_2), manures (X_3), human labour (X_4) and animal labour (X_5) by 98 per cent while the remaining 2 per cent is influenced by other factors. From the resulting model manures, fertilizers and animal labour were found to be statistically significant at 5 per cent confidence level.

Conclusion

The study revealed that, all the factors were found be important in cost of cultivation of jowar. However, the regression coefficients indicated that a seeds (X_1), fertilizers (X_2), manures (X_3), human labour (X_4) and animal labour (X_5) had a significant influence on cost of cultivation of jowar. Consequently, it is apparent that more focus should be directed to seeds and human labour.

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