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Resource use efficiency of maize in Telangana state

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Abstract
Agriculture is an important sector to fuel in economic growth and it needs to be made more attractive. The present study will help farmers to improve economically profitable eventually leading to more inclusive development. Enabling policies for access to inputs, credit, markets and innovations will result in increased productivity, profitability and growth. Telangana is one of the large maize producing states in India; the maize production in the state has been largely influenced by increasing demand from the feed industries and various industrial uses, by calculating recourse use efficiency farmers can understand where he can improve his expenditure as well as efficiency to increase productivity, the present study explains regression coefficients with relation to various explanatory variables, geometric mean of inputs, marginal products, marginal value product, price of input, MVP to price ratio, and optimum recourse efficiency were calculated in present study. Cobb-Douglas type of Production Function was used to find the results. The results in elasticity of maize productivity examines that coefficient of multiple determination (R^2) was 0.908 which indicated that 90.80 percent effect of all independent variables together in maize productivity, and Return scale was 1.00 which indicated constant return to scale of maize farming of Telangana state. Some critical resources like Manure, Plant protection chemical and Nitrogen fertilizer are not used properly and there is a greater chance to increase these inputs in maize farming.

Keywords: MVP, regression coefficients, geometric mean, marginal products, marginal value product, optimum recourse efficiency

Introduction
Agriculture is an important sector in economic growth and it needs to be made more remunerative, by creating necessary framework for strengthening the entire agriculture value chain, the present study will help farmers to improve economically profitable eventually leading to more inclusive development. Enabling policies for access to inputs, credit, markets and innovations will result in increased productivity, profitability and growth.

With the globalization, the agricultural sector is opened up with new avenues, especially for agricultural enterprises. The cereals are of significant importance not only in providing nutritional support but also in earning additional income. Among the cereals, maize is a multifarious crop used as food and industrial crop globally grown extensively throughout the world and has the highest production role among all the cereal crops throughout the India and world.

The importance of maize lies in its wide industrial applications besides serving as human food and animal feed. As the demand for maize is growing globally due to its multiple uses for food, feed, and industrial sectors, Among cereals and millets, oil is extracted only from maize; a strong demand for ethanol production has resulted in increased maize prices and has provided incentives to increase maize acreage, Every part of the maize plant has economic value; the grains, leaves, stalk, tassel, and cob can all be used to produce a variety of food and non-food products

Methodology
The study was undertaken on a macro framework based on primary data collected from personal interview, multi stage sampling design was adopted for selection of districts, mandals, and villages and selected 120 maize growers from major maize growing districts of state.

To examine the resource use efficiency in the production of maize was achieved by Cobb Douglas and functional analysis.

The production function approach was used to examine the productivity of resources used in the cultivation of Maize. For this purpose, the Cobb-Douglas production function was employed.

The single most advantage of this production function has been that the input coefficients constituted the respective elasticity.
The Cobb-Douglas type of Production Function was used and is usually defined as follows.

$Y = a X_1^{b1} X_2^{b2} X_3^{b3}$-----------$X_n^{bn} e^u$ ………………. (1)

Where,
Y = Output of Maize crop including main produce and by-products (qts./ha).
a = Intercept.
X_1, X_2, X_3,-----------X_n = Different variables used or independent variables.
e^u = Error term.
b_n = regression coefficient of the respective resource variables.

The function given in equation (1) can be expressed as,

$\text{Log } \hat{Y} = \text{Log } a + b_1 \text{ Log } X_1 + b_2 \text{ Log } X_2 \ldots b_n \text{ Log } X_n + u \text{ log } e$ .....(2).

For fitting the production function in the Maize crop, eleven input variables were considered as important factors by considering the problem of multicollinearity in estimating production function. Multicollinearity refers to a situation where because of storing interrelationship among the independent variables, it becomes difficult to disentangle their separate effects on the dependent variables. Some of the independent variables are not important just because the standard errors are high. It might be due to the presence of multicollinearity.
The main consequences of multicollinearity are (a) the sampling variances of the estimate coefficients increase as the degree of collinearity increase between the explanatory variables, (b) estimated coefficients may become very sensitive to small changes in some of the estimates of the coefficients. This results in the non-significance of regression coefficients. Sometimes it happens that more of the regression coefficients are significant but the value of R^2 is very high.
The equation fitted was of the following formula.

$\hat{Y} = a. X_1^{b1}. X_2^{b2}. X_3^{b3}. X_4^{b4}. X_5^{b5}. X_6^{b6}. X_7^{b7}. X_8^{b8}. X_9^{b9}. X_{10}^{b10}. X_{11}^{b11}. e^u$

Where,
Y = Yield of the crop in quintal per hectare
a = Intercept of production function
bi = Partial regression coefficients of the respective resource variable
(i = 1, 2, 3, ..., 11)
X_1 = Area of the crop in hectare
X_2 = Hired human labour in man day per farm
X_3 = Family human labour in man day per farm
X_4 = Bullock labour in pair day per farm
X_5 = Machine labour in hours per farm
X_6 = Seed kg per farm
X_7 = Manures in quintal per farm
X_8 = Nitrogen in kg per farm
X_9 = Phosphorus in kg per farm
X_{10} = Potassium in kg per farm
X_{11} = Plant protection in litre per farm
e^u = Error term

i. Elasticity of production (EP)
The elasticity's of the respective variables are equal to the regression coefficient of the resource in Cobb-Douglas production function. The elasticity of production can be calculated as follows.

$$EP = \{baX^{b-1}\} \frac{X}{Y} = \frac{baX^b}{X} . \frac{X}{Y} = \frac{bY}{X} . \frac{X}{Y} = b$$

ii. Testing of the regression coefficient
Partial regression coefficients are tested for significance by applying 't' test at n-k-1 degree of freedom as under:

$$t_{(n-k-1)} = \frac{bi}{SE(bi)}$$

Where,
bi = Partial regression coefficient of particular variable
SE = Standard error of bi
n = No. of observations
k = Dependent variables

iii. Marginal product (MP)
Cobb-Douglas production function allows either constant, increase or decrease marginal productivity. In other words, resource productivity refers to a marginal product for the added unit of input. The marginal product equation is as:

$$MP = \frac{dy}{dx} = bia\ X^{b-1} = \frac{biaX^b}{\bar{X}} = b \frac{\bar{X}}{\bar{Y}}$$

Where,
bi = Elasticity of production
$\bar{Y}$ = Geometric mean of output and
$\bar{X}$ = Geometric mean of the respective input

iv. Marginal value product (MVP)
It refers to the product of MP and Py, where MP is marginal productivity and Py is the price of Maize per quintal. The MVP for the input factor is worked out by the following formulae

$$MVP = bi \frac{\bar{Y}}{\bar{X}} Py$$

Where,
bi = Partial regression coefficient of a particular independent variable
$\bar{X}$ = Geometric mean of a particular independent variable
$\bar{Y}$ = Geometric mean of the dependent variable
Py = Price of the dependent variable

v. Optimum resource use efficiency
Optimum resource use efficiency was calculated by the following formula

$$\text{Optimum resource use} = \frac{bi.\bar{Y}.Py}{Px}$$

Where,
bi = Partial regression coefficient of a particular independent variable
$\bar{Y}$ = Geometric mean of the dependent variable
Py = Price of the dependent variable
Px = Price of an independent variable

vi. Returns to Scale

It refers to the summation of bi values.

Return to scale = ∑bi

If ∑bi = 1, constant return to scale

If ∑bi < 1, decreasing return to scale

If ∑bi > 1 increasing return to scale

Its significance is tested by ‘F’ test as

$$F = \frac{(\sum bi - 1)(n - k)}{[\sum var\ (bi)](k - 1)}$$

Results and Discussion

Regression coefficients with relation to various explanatory variables, geometric mean of inputs, marginal products, marginal value product, price of input, MVP to price ratio, and optimum recourse efficiency were calculated and presented in Table: 1.

Elasticity of productivity

The result revealed that coefficient of multiple determinations (R^2) was 0.908 which indicated 90.80 per cent effect of all independent variables together in maize productivity. ‘F’ value was highly significant that was 97.59. Return to scale was 1.003 which indicated constant return to scale. It was clear that partial regression coefficient of area under maize was 0.68 which was positive and highly significant at 1 per cent level of significance. It inferred that one per cent increased in area under maize crop over its geometric mean it would lead to increase the Maize production by 0.68 per cent. Similarly, partial regression coefficient of plant protection was 0.22 which also positive and significant at 5 per cent level. It inferred that 1 per cent increased in plant protection over its geometric mean it would lead to increase the Maize production by 0.22 per cent. Further, with respect to manure (0.02) is positive and significant at 5 per cent level it shows one increased in manure over its geometric mean it would lead to increase the maize production by 0.02 percent and regression coefficient of nitrogen was 0.25 which was positive and significant at 5 percent level. It inferred that one percent increased in nitrogen over its geometric mean it would lead to increase maize production by 0.25 percent. On the contrary partial regression coefficient of hired labour, family labour, bullock labour, machinery, total seed, phosphorus and potash was -0.04, -0.01, 0.03, -0.03, -0.09, -0.04 and 0.003 respectively having negative and non-significant.

Marginal productivity

It was observed that marginal product with respect to area under maize was 35.26 which means that in addition of one hectare of land to geometric mean which resulted to give 35.26 quintals of yield. Marginal product of manure was 0.22 it indicated that when there was addition use of one quintal of manure which resulted to give additional product of maize by 0.22 quintals. Marginal product of plant protection used was 4.85 liters which mean that when there was addition of one litre used of plant protection chemical it gives additional product by 4.85 quintals respectively. Similarly marginal product of nitrogen was 0.124 kg. It was clear that when there was additional use of one kg nitrogen, it could give additional product of maize by 0.124 quintals. On the contrary the negative marginal product observed in hired labour, family human labour machinery, phosphorous and seed i.e. -0.14, -0.17, -0.70, -0.01 and -0.23 quintals which indicated that due to addition of one man day of hired labour and family human labour caused to reduce the product of maize up to 0.14 and 0.17 quintals, Similarly the marginal product of machinery, phosphorous and seed caused to reduce the product, potash was positive which inferred that with every one kg use of and potash caused to increase the product up to 0.002 quintals. It can be concluded that hired labour, family human labour, machinery, phosphorous and seed were used excess in maize production. Thus marginal product of potash shows that there was a positive increasing production of maize. Thus manure, nitrogen, Plant protection and potash were underutilized resources in maze production.

Resource use efficiency

Results revealed that marginal value product (MVP) due to area under maize were found to be Rs. 50042.13 and price of input of land under maize was Rs. 16450.37 per hectare hence MVP to price ratio was 3.04. MVP to price ratio of Nitrogen was found to be 14.01 followed by plant protection (13.25), and bullock labour (1.86). MVP to price ratio of hired human labour, family human labour, machinery, phosphorus and total used was negative. It was cleared that higher the MVP to price ratio there was greater chance to increase these resources. So the results inferred that there was greater chance to increase plant protection, nitrogen and bullock labour. When MVP to price ratio tends to unity at that point, there would be efficient utilization of resource.

Optimum resource use

Results showed that optimum resource use of production under maize area was found to be 3.07 hectares which inferred that there was good chance to increase production under maize area up to 3.07 hectares. With respect to production there was chance to increase manure to 0.29 quintals, plant protection to 9.93 liters and nitrogen to 515.87 kg per hectare.

Work out resource use efficiency in maize productivity

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Table 1: Estimates of Cobb Douglas productivity function in maize production

S.NO	Variables	partial regression coefficient (bi)	Standard Error (SE)	t' value	Geo-mean	MP	MVP	Price(X)	MVP to Price ratio	Optimum resource use efficiency
1	Land ha	0.683	0.211	3.240**	1.144	35.266	50042.135	16450.368	3.042	3.071
2	Total hired Labour	-0.036	0.034	-1.037	14.975	-0.141	-199.406	350.000	-0.570	0.393
3	Family labour	-0.007	0.036	-0.186	2.237	-0.176	-250.292	350.000	-0.715	0.014
4	Bullock labour	0.032	0.053	0.615	3.025	0.630	894.599	478.580	1.869	0.236
5	Machinery	-0.030	0.047	-0.642	2.527	-0.706	-1002.108	586.250	-1.709	0.169
6	Total Seed	-0.095	0.153	-0.618	23.649	-0.236	-335.532	240.250	-1.397	4.038
7	Manure	0.024	0.010	2.339*	6.214	0.226	320.809	208.500	1.539	0.294
8	Plant protection	0.218	0.086	2.535*	2.658	4.851	6883.345	519.200	13.258	9.938
9	N	0.245	0.096	2.564*	116.302	0.124	176.598	12.600	14.016	515.868
10	P	-0.035	0.099	-0.354	163.441	-0.013	-17.972	41.560	-0.432	3.199
11	K	0.003	0.192	0.015	84.119	0.002	2.787	19.330	0.144	0.044

Intercept (log a) ------------ 1.47

F value ---------------------- 97.59**

R^2 ---------------------------- 0.908

Return to scale (∑bi) ------1.003

* Significant at 5 per cent level

** Significant at 1 per cent level

Note: Geometric mean $(\bar{Y})$ of maize productivity was 59.06 q/farm and price was Rs. 1419/q

Summary

Statistically significant and positive values of the estimated coefficients which were having higher the MVP to price ratio indicated that farmers could increase per hectare yield by applying more units of these inputs. In elasticity of maize productivity examines that coefficient of multiple determination (R^2) was 0.908 which indicated that 90.80 percent effect of all independent variables together in maize productivity, F value is highly significant that was 97.59 and Return scale was 1.00 which indicated constant return to scale of maize farming of Telangana state. Some critical resources like Manure, Plant protection chemical and Nitrogen fertilizer are not used properly it indicated that bringing in more quantity of Manure, Plant protection chemical and Fertilizers results high yield in maize farming would bring out the economies of scale and would result in higher productivity. However, using less quantity of these resources under maize in the state has been used very low and highly fragmented in maize cultivation.

Conclusion

In elasticity of maize productivity examines that coefficient of multiple determination (R^2) was 0.908 which indicated that 90.80 percent effect of all independent variables together in maize productivity, and Return scale was 1.00 which indicated constant return to scale of maize farming of Telangana state. Some critical resources like Manure, Plant protection chemical and Nitrogen fertilizer are not used properly it indicated that bringing in more quantity of Manure, Plant protection chemical and Fertilizers results high yield in maize farming would bring out the economies of scale and would result in higher productivity. However, using less quantity of these resources under maize in the state has been used very low and highly fragmented in maize cultivation.

References

1. Pavankalyan V, Vasudev N. Maize Crop Production Elasticities and Returns to Scale of Tribal Agriculture in I.T.D. as of Telangana Region. International journal of pure and applied bio science ISSN: 2320 – 7051. 2017;5(4):1318-1321.
2. Hamsa KR, Srikantha Murthy PS, Gaddi GM. Comparison of Cost And Returns of Major Food Crops Under Central Dry Zone of Karnataka, IOSR Journal of Agriculture and Veterinary Science 2017. ISSN: 2319-2380.
3. Dadson Awunyo-Vitor, Camillus Abawiera wongnaa and Robert Aidoo. 2016. Resource use efficiency among maize farmers in Ghana. Agriculture & Food Security 2016;5:28.
4. Ochi JE, Sani RM, Idefoh FK. Economic Analysis of Resource Use Efficiency among Small Scale Cassava Farmers in Nasarawa State, Nigeria: Implications for Agricultural Transformation Agenda, International Journal of Research in Agriculture and Forestry 2015;2(2):14-21 ISSN 2394-5907.
5. Pawar BR, Vijaykumar N. Resource productivity and resource use efficiency in soybean production, International Journal of Commerce and Business Management 2012;5(2):262-264.
6. Faruq Hasan M. Economic Efficiency and Constraints of Maize Production in the Northern Region of Bangladesh. j. innov. dev. strategy 2008;1(1):18-32.