

## Production and Productivity of Rice in India: An Economic Analysis

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### Abstract:

*Present study was based on secondary data in which multiple linear regression model was used to find out the impact of area and time on the production of rice, the results have indicated the coefficient of determination ( $R^2$ ) for area and time was calculated as 77.9% which is statistically significant. To prove the hypothesis T test was used to find out the impact of both the variables on the production of rice as both the variables were proved statistically significant at 95 % level of significance which gives the idea that production of rice dependent on time and area. Data used in the study has shown continuous fluctuation in the production and productivity which at many a times has hit export industry of rice in India.*

**Key words:** production of rice, productivity of rice, industry of rice, India.

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## **Introduction:**

India's socio economic history and development have been very closely tied to its agricultural sector, as the country is blessed by the nature with varying climatic conditions, natural resources and has the potential for producing, marketing and exporting different agricultural commodities. Over 50 years since independence, India has made immense progress towards the production of some major crops and food security, with growing population India has made an immense progress towards food security and there is sustainable increase in available food grain per capita. Despite there are structural changes taking place and the shift of traditional practices, agricultural is still considered as the back bone of Indian economy as 68% of the people gets livelihood from this sector and it absorbs 50% of the total workforce of the country. However the contribution of agricultural towards the national economy is declining since the economic reforms were introduced in India during 1990-91 as less attention is being drawn on this sector. The contribution of agricultural and allied sectors towards the gross domestic product (GDP) which was 51.9% in 1950-51 has come down to 13.7% in 2012-13 at 2004-05 prices<sup>2</sup>. But still India is considered as the world's largest producer of many important agricultural commodities like sugarcane, fresh fruits, spices, jute etc, and is the 2<sup>nd</sup> largest producer of wheat and rice as the world's most stable food. Among all the agricultural commodities Rice occupies a prime place in the world and is being considered as the world's largest staple food. India is considered as the world's 2<sup>nd</sup> largest rice growers and has devoted its maximum area 29.20% towards the said crop. Indian share in the global rice production is continuously increasing as it was 18.90% in 2002-03 to 22.88% in 2011-12.

The states like West Bengal, Punjab, Uttar Pradesh,

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<sup>2</sup> Central Statistics Office (CSO) New Delhi (2012-13)

Andhra Pradesh, Tamil Nadu, and Orissa are contributing to the extreme. Over the years it has been shown that production of rice is continuously increasing and the area under rice is also increasing. The major rice producing states of the country had made an immense progress with the passage of time as the government has initiated some major policies by exploring new strategies in marketing, export promotion minimum support price etc. which has made interest in the minds of people towards the crop. Research institutes have been established so that the people will get benefits from them to increase the production and productivity of rice in the country.

### **Objectives of the Study:**

1. To find out the impact of time and Area in the production of Rice in India from last twenty two (22) years.
2. To find out the problems faced by rice growers in the cultivation of rice and also to find out the possible solutions of those problems.

### **Hypothesis of the study:**

#### **Hypothesis 1.**

$H_0$  = There is no relationship between production of rice and time.

$H_a$  = There exists a relationship between production of rice and time.

#### **Hypothesis 2.**

$H_0$  = There is no relationship between production of rice and area.

$H_a$  = There exists a relationship between production of Rice and area.

## Methodology:

Present study is based on the secondary data which has been collected from Directorate of Economics and Statistics Government of India and Central statistical office (CSO) New Delhi (2012-13) to obtain the data of area and production of rice in India. The data of last twenty two years was brought under study in which Linear multiple regression models was used to find out the impact of area and time on the production of rice in India though normal equations. Since time plays an important role in explaining the production and area as decision making so this element was also brought under study in explaining the model. Also multiple linear regression of model was used to make the future predictions in the production of rice in India. For the testing of hypothesis T' test was used to prove weather there exists any relationship between production, area and time.

Normal equations used under study are as:

$$\sum Y = n\hat{\beta}_1 + \hat{\beta}_2 \sum X_2 + \hat{\beta}_3 \sum X_3 \quad 1.1$$

$$\sum X_2 Y = \hat{\beta}_1 \sum X_2 + \hat{\beta}_2 \sum X_2^2 + \hat{\beta}_3 \sum X_2 X_3 \quad 1.2$$

$$\sum X_3 Y = \hat{\beta}_1 \sum X_3 + \hat{\beta}_2 \sum X_2 X_3 + \hat{\beta}_3 \sum X_3^2 \quad 1.3$$

## Production of Rice in India:

India is the world's second (2<sup>nd</sup>) largest producer of Rice after china and has devoted its maximum area towards this crop, as a matter of fact rice is considered as the most stable food of more than 60% of the country's population. It occupies maximum area in the food grains production of about 28.3% of the gross cropped area in the country and contributes around 43% of the total food grain production and 46% of the total cereal production of the country. The percentage share of agricultural export to total national export was 4.5% during the

year 1998-99 which has now increased to 6.95% in 2011-12 whereas the percentage share of rice export in total agricultural in total agricultural export were 24.62 during 1998-99 which has now increased to 35.23%. Thus rice export contributes around 29% of the total agricultural export from the country. Over the years it has been shown that the production of rice in India has increased beyond expectations as the government has taken some keen steps by exploring new market strategies that enable the producers the reap the better benefits from the crop.

As per the 2010 FAQ world agricultural statistics India's population is growing faster than its ability to produce rice, other studies claim that India can easily feed its growing population as well as it can globally export rice, but the latter is possible only when India can reduce food staple spoilage, improve its infrastructure and raise its farm productivity to those achieved by other developing countries. The main theme of this paper is to find out the impact of area on the production of rice i.e. with the passage of time weather production has increased with area so we employed data of last twenty two (22) years in order to achieve our goal for which we employed multiple linear regressions Model.

Production is the function of = (area and time)

**P = f (Area, Time) OR P= f (A, T).** The variables that were brought under study were Production of Rice is the function of Area and time.

**The equation becomes  $Y = \beta_1 + \beta_2X_2 + \beta_3X_3 + U_i$**  where  **$\beta_1$ ,  $\beta_2$ , and  $\beta_3$**  constants and  **$X_2, X_3$**  are the variables as area and time. In order to estimate  **$\beta_1, \beta_2, \beta_3$**  we apply least square criteria to obtain the estimates of  **$\hat{\beta}_1, \hat{\beta}_2$  and  $\hat{\beta}_3$** .

After summing up from 1 to n the multiple regression equations produces three normal equations the three normal equations are as under:

$$\hat{\beta}_1 = \bar{Y} - \hat{\beta}_2 \bar{X}_2 - \hat{\beta}_3 \bar{X}_3 \quad 2.1$$

$$\hat{\beta}_2 = \frac{\sum X_2 Y \cdot \sum X_3^2 - \sum X_2 X_3 \cdot \sum X_3 \cdot Y}{\sum X_2^2 \cdot \sum X_3^2 - (\sum X_2 X_3)^2} \quad 2.2$$

$$\hat{\beta}_3 = \frac{\sum X_3 Y \cdot \sum X_2^2 - \sum X_2 X_3 \sum X_2 Y}{\sum X_2^2 \sum X_3^2 - (\sum X_2 X_3)^2} \quad 2.3$$

$$\hat{\beta}_2 = \frac{[(25.2163 \times 891) - (-120.58 \times 669.26)]}{[(100.8943 \times 891) - (-120.58)^2]} = \hat{\beta}_2 = 0.986044$$

$$\hat{\beta}_3 = \frac{[(669.26 \times 100.8943) - (-120.58 \times 25.2163)]}{[(100.8943 \times 891) - (-120.58)^2]} \quad \hat{\beta}_3 = 1.41928$$

$$\hat{\beta}_1 = \bar{Y} - \hat{\beta}_2 \bar{X}_2 - \hat{\beta}_3 \bar{X}_3$$

$$\hat{\beta}_1 = 84.48772727 - 0.986044 \times 42.63954545 - 1.41928 \times 11.5 \text{ so} \quad \hat{\beta}_1 = 26.12149$$

$$R^2 = \frac{\hat{\beta}_2 \sum X_2 Y_i + \hat{\beta}_3 \sum X_3 Y_i}{\sum Y_i}$$

$$R^2 = \frac{0.986044 \times 25.2163 + 1.41928 \times 669.26}{1250.4777} \quad R^2 = 0.779$$

For estimation of the standard errors of  $\hat{\beta}_2$  and  $\hat{\beta}_3$  we need an estimate of  $\sigma_u^2$

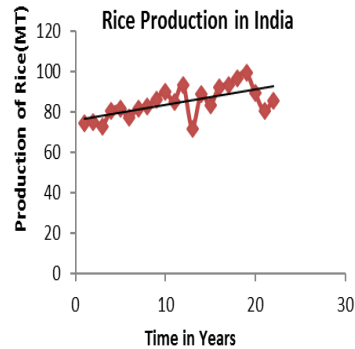
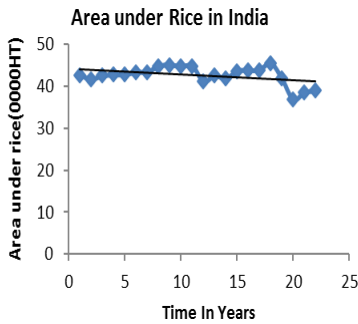
$$\hat{\sigma}_u^2 = \frac{\sum e_i^2}{n-k} = \sum y_i^2 - \hat{\beta}_2 \sum X_2 Y_i - \hat{\beta}_3 \sum X_3 Y_i$$

$$\frac{1250.4777 - 0.986044 \times 25.2163 - 1.41928 \times 669.26}{22 - 3} \quad \text{So the calculated } \sigma_u^2 = 14.51295$$

The variance of  $\hat{\beta}_2$  and  $\hat{\beta}_3$  was calculated by the following formula:

$$\text{Var}(\hat{\beta}_2) = \frac{\sigma_u^2 \sum X_3^2}{[\sum X_2^2 \sum X_3^2 - (\sum X_2 \sum X_3)^2]} = \text{Var}(\hat{\beta}_2) = 0.014368$$

$$\text{Var}(\hat{\beta}_3) = \frac{\sigma_u^2 \sum X_2^2}{\sum X_2^2 \sum X_3^2 - (\sum X_2 X_3)^2} = \text{Var}(\hat{\beta}_3) = 0.016288$$



In order to test the hypotheses no 1 we employ T test at 95% level of confidence  $t^* = \frac{\hat{\beta}_2}{SE(\hat{\beta}_2)}$

**Hypothesis no 1.** If  $t^* < t_t$  null hypothesis is accepted and if  $t^* > t_t$  null hypothesis is rejected.

$t^* = \frac{0.986044}{0.1198665} = 8.226$  whereas tabulated  $t_t = 1.729$ . The calculated  $t^*$  is greater than  $T_t$  at  $(n-k=22-3)$  we reject null hypothesis and conclude that production of rice is dependent on area.

For **hypothesis No.2**  $t^* = \frac{\hat{\beta}_3}{SE(\hat{\beta}_3)} = \frac{1.41928}{0.1276244} = 11.120820$  again it is seen that  $t^* > t_t$  so null

hypothesis is again rejected, it may be conclude that production of rice is dependent on time at 95% level of confidence.

Hence both the variables plays an important role in the production of rice in country and both variables were statistically proved significant and play a commanding role in the influence on the production of rice.

## Problems faced by rice growers faced in the country:

Despite the fact that India have made great strides in the development of agricultural since independence, growth rate in the agricultural has been increased but still there are lot of problems that have become hindrance in the production of agricultural. Rice production in the country is continuously increasing but at the same time there are lots of problems that are faced by rice growers in the country that have become the barriers in front of the rice growers to reap the rich dividends

from the crop which are discussed as under.

1. Indian agricultural is based on the natural climatic conditions and same is the case with rice in India. Inadequate supplies of the variables at time influence the production of rice in India. And at many time the soil is going to lost its moisture due to variability in the climatic conditions, soil often loses its fertility due to soil erosion resulting in loss of plant nutrients and moisture which have compel the farmers to towards commenting suicides or the transformation to other crop.
2. About 79% farmers in the country are small are marginal farmers that means there is small size of land holding in which propagation of technology is almost impossible to reap the dividends from the crop which have make them poor in resources.
3. Still there are lots of farmers who are still dependent on the traditional practices of and there is the non availability of awareness camps of high yielding varieties that has compel them to go for traditional practices resulting in low production of rice in the country.
4. Due to increase in the cost of inputs used in the production of rice more than the Minimum Support Price (MSP), it becomes costlier for the growers to invest further in the crop as the government has not taken those steps that will act as safeguard for the interest of growers. At the same time rice is suffering in the export market of world as it is not able to stand against the countries like Thailand, Pakistan etc. as in these countries cost of production is low as compared to Indian costs.
5. There are lack of proper infrastructural facilities in the country which at many a times hit the exporters they are not able to find out godown or proper storage houses which creates problems in the minds of exporters to buy the rice in India and export industry of rice gets hit



which in turn influence the GDP of India.

6. The major rice producing nations have decreased the price to capture the international markets but an Indian rice price are inelastic due to relatively high cost of production and becomes uncompetitive in the international markets. Much of basmati rice export prospects have been lost in the recent part to other competing countries like Pakistan etc because of high prices.

In spite all this efforts are made to increase the productivity of rice in India which was 668gk/ha has reached to 2566kg/gram in 2009-10. The main cause behind this is the introduction of high yielding varieties with high doses of fertilizers coupled with improved packages of practices evolved by agricultural scientists for various regions. But still all the above mentioned problem needs to be addressed so the we can increase the production and productivity of rice in India and to ensure food security to the growing population.

### **Suggestions to increase the production and productivity of Rice in India:**

Indian is facing a very tough competition in the international market with Thailand occupying first position due to its quality and low price of rice followed by Vietnam and Pakistan and other major countries. Still there is a lot of scope in the international market for India to enhance their name in front of these nations. Following are some suggestions that need to be implemented so that we can image for a better exporting and self-sustaining country:

1. Emphasis should be given to cropping system rather than single crop so that so that it will benefit the farmers and the country as it will help in increasing the fertility of soil.

2. As we know that India is an agrarian country 50 % of the workforce is absorbed by this sector so there is a need of inclusive growth to make the country not only self sufficient but also exporting on for that there is the need of public sector for better investment. Keeping in view the interest of farmers Minimum Support Price (MPS) should be addressed more carefully as the cost of production has increased than the MPS.
3. Cyclical fluctuations always occur in the prices of rice as the prices are low in the harvesting season but at the time of sowing these prices are always high. This is again a very big problem coming in front of country which needs to be addressed against the supply response.
4. Encourage the farmers to sow the high yielding varieties and making seeds available to the farmers, for that awareness campus should be organized at the village level so that we can reap the rich dividends from the crop.
5. More emphasis should be given to the non monetary inputs like timely sowing, maintaining optimum plant population timely irrigation, efficient use of fertilizers, plant protection measures, timely irrigation and efficient use of fertilizers and timely harvesting of crop etc.
6. Marketing infrastructure should be encouraged by the public sector so that the growers do not face any problem in selling their food grains. The government should provide the availability of cheaply inputs at times and should eliminate the role of middle man to provide agricultural credit to the farmers.

## **Conclusion:**

In this paper we applied multiple regression model for explaining the production on the basis of area and time which

have statistically proved significant in explaining the dependence of both variables. The studies have revealed that production and productivity has shown a continuous fluctuation over the years. Still there is a lot of untapped area that should be exploited by the government to enhance the production of rice in the country. The major challenge is sustaining the supply of rice to meet rising demand in the valley and to cope up the problems timely inputs of irrigation, seeds manures and fertilizers to promote increasing productivity and more importantly ensuring food security for the people.

## REFERENCES:

- Ayoola, J.B, Dangbegnon, C., Daudu, K.C. 2010. "Socio Economic Factors influencing Rice Production among male and female farmers in Northern Guinea Savanna; Lessons for promoting Gender Equality in Action Research." *Agricultural and Biology Journal on Northern America* 5 (3): 154-159.
- Irfan, Maria, Irfan Muhammad, and Tahir Muhammad. 2011. "Modeling the province wise yield of rice crop in Pakistan GARCH Models." *International Journal of Science and Technology* 1(3): 224-228.
- Khurul, Islam. 2009. "Position of Rice Production in Assam." *IJCEAS Journal of Applied Social science* 6: 5-6.
- Mehmood, Y., Anjum, B., and Sabir, M. 2011. "Benefit cost ratio analysis of organic and inorganic Rice crop Production; Evidence from district Sheikhpura in Punjab Pakistan." *Pakistan Journal of Science* 63(3): 174-185.
- Munir, Ahmad, Rafiq Muhammad, Ali Sagar. 1999. "An analysis of technical efficiency of rice farmers in Pakistan Punjab." *Bangladesh Journal of Agricultural Economics* 2: 79-86.
- Nirmala, B., and Muthuraman, P. 2009. "Economic and

constraint analysis of Rice cultivation in kaithal District of Haryana.” *Indian Research Journal of Ext Education* 9 (1): 47-49.

Shanmugam, R.T. and R. Sendhil. 2006. “Quantification and Prioritization of Constraints causing yield loss in Rice.” *Agricultura Tropica ET Subtropica* 39(3): 194-201.

Singh, Devinder, M.S. Hansra, and Vishal Raina. 2011. “Trends in Non Basmati Rice and factors yielding gap in Jammu Region.” *Journal of community, mobilization and sustainable Development* 6(1):125-129.

**Table No.1 Rice production and Productivity in India:**

YEAR	PRODUCTION (MT)	AREA (0000)HA	PRODUCTIVITY	GROWTH RATE	Year	Production MT	Area (0000)Ha	Productivity	Growth rate
1990-91	74.29	42.65	1.7419	-----	2002-03	71.82	42.59	1.6864	23.05
1991-92	74.68	41.78	1.7875	0.66	2003-04	88.53	41.91	2.1124	23.26
1992-93	72.86	42.54	1.7127	-10.13	2004-05	83.13	43.66	1.9041	-6.099
1993-94	80.30	42.81	1.8758	10.22	2005-06	91.79	43.91	2.0956	10.41
1994-95	81.81	42.84	1.9097	1.881	2006-07	93.36	45.54	2.1262	1.710
1995-96	76.98	43.43	1.7726	-5.91	2007-08	96.36	41.85	2.1262	3.213
1996-97	81.74	43.45	1.8813	6.183	2008-09	96.69	36.95	2.1232	0.342
1997-98	82.53	44.80	1.8423	1.881	2009-10	99.18	38.60	2.3699	2.575
1998-99	86.08	45.16	1.9662	4.301	2010-11	89.13	39.00	2.4112	-10.13
1999-00	89.68	44.71	2.0056	4.182	2011-12	90.41	41.21	2.6832	1.436
2000-01	84.98	44.90	1.8926	-5024	2012-13	91.42	42.41	2.1902	1.117
2001-02	93.34	41.18	2.2667	9.84					

Source: Directorate of Economics and Statistics Government of India.

**Table No.2 Indian Rice Production in Global Context:**

Year	World prod.(MT)	Indian Share %	Year	World prod.(MT)	Indian Share %
2001-02	399	23.39	2007-08	438	22.08
2002-03	380	18.39	2008-09	459	21.61
2003-04	390	22.70	2009-10	457	19.49
2004-05	405	20.53	2010-11	449	21.38
2005-06	423	21.70	2011-12	456	21.88
2006-07	427	21.86	2012-13	463	22.25

Source: Central statistics office New Delhi

