EDUZONE: International Peer Reviewed/Refereed Multidisciplinary Journal (EIPRMJ), ISSN: 2319-5045
Volume 12, Issue 1, January-June, 2023, Available online at: www.eduzonejournal.com

Rice Production Prediction in India by Multiple Regression Model

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ABSTRACT

India is world second largest populated country. Day by day growing population makes pressure on feedstock. Majority of Indian population survives depends directly or indirectly on agricultural segment. India's agrarian sector is well known for its diversity. The enhanced earnings from cultivation would possible due to transformation in technology, usage of fertilizers & pesticides etc. Rice is symbol of honour in food in Asia and the subcontinent, therefore, the insignificant harvest of the rice crop in not only an economic loss but can also made a famine-like condition. The present research find out the influence of MSP and Area utilized for cultivation of rice in India on production and its yield. MSP and area utilized for cultivation are independent factors whereas production and yield depends on both. Window 2007 Microsoft Excel is used to calculated regression analysis in the study. The study found that minimum support price has found lessor impact on rice crop production while area under cultivated land has significant.

Key words: Production, Minimum Support Price, Cultivation, Multiple Regression line

INTRODUCTION

India is world second largest populated country. Day by day growing population makes pressure on feedstock. Majority of Indian population survives depends directly or indirectly on agricultural segment. India's agrarian sector is well known for its diversity. The enhanced earnings from cultivation would possible due to transformation in technology, usage of fertilizers & pesticides etc. (Yadav and Anand, 2019). The green revolution strategy /schemes were applied in the country to achieve the targets of self-sufficiency in food grains (especially wheat and rice) production. The Green Revolution focused on numerous constituents for instance improving irrigation facilities with usage of fertilisers / pesticides / insecticides, adoption of high yielding seeds varieties, advanced technology and other reforms so on. In India, rice is one of the major consumable food grains with high nourished contents after wheat. On the globe, rice species varieties are more than forty thousand. The origin and discovery of rice was as long as civilization of human being (Jena, 2015). Rice journey around the world has been slow, however once it cultivated it remained and became stable agrarian and commercial food grains for the publics. In India, rice is essential part of majority of daily meal of the population. Rice is symbol of honour in food in Asia and the subcontinent, therefore, the insignificant harvest of the rice crop in not only an economic loss but can also made a famine-like condition (Jena, 2015).

REVIEW OF LITERATURE

Jena (2015) studied and analysed the existing factors to predict the future production of rice. The total land utilized for cultivation was main factor taken into consideration for prediction of rice cultivation whereas irrigation is others. The author has analysed data from the period 1950 to 2012 to determine the rice production. This study shows how the mathematical methods such as Multivariate Correlation Analysis and Time Series Analysis are utilized to give an idea about the forthcoming production of rice in India.

Gandhi et. al. (2016) tried to determine factors influencing the production of rice and also analysis the possible rice production in upcoming periods. The various determinants which have been taken into consideration are rainfall, latitude, earlier harvest quantity of rice, availability of field for agronomy and evapotranspiration etc. The statistics used for analysis in this study is precisely taken from state Maharashtra (27 districts) from the period of 1998-2002. The important findings are drawn with the help of WEKA tool. The aim of the study is to explore the significance of machine learning strategy for the forecast of crop harvest under diverse climatic conditions.

Sellam and Poovammal (2016) in their study analysed the influence of diverse ecological elements or factors on the harvest of crops. Their study also determines correlation between factors influence harvest of crops. The various components that are taken into consideration are field under Agronomy, Yearly Precipitation, and FPI (Food Price Index). The Regression Analysis Model was used to predict the harvest quantity of crops. The prime focus of the

study is to find out the components that are considered as main affecting conditions, and to point out the correlation among these components with the help of Regression Analysis

Objective of the study
To analysis the impact of various constituents affecting the rice production and its yield in India

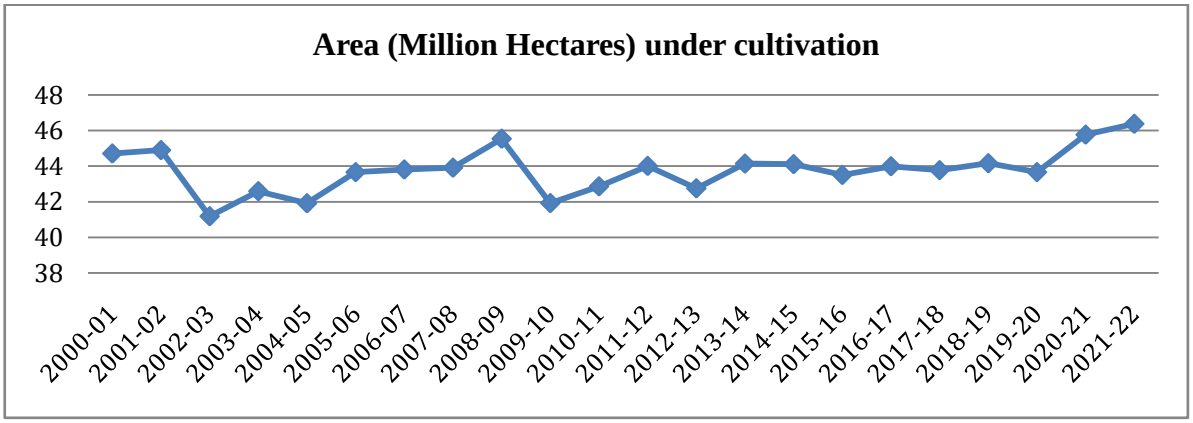
RESEARCH METHODOLOGY

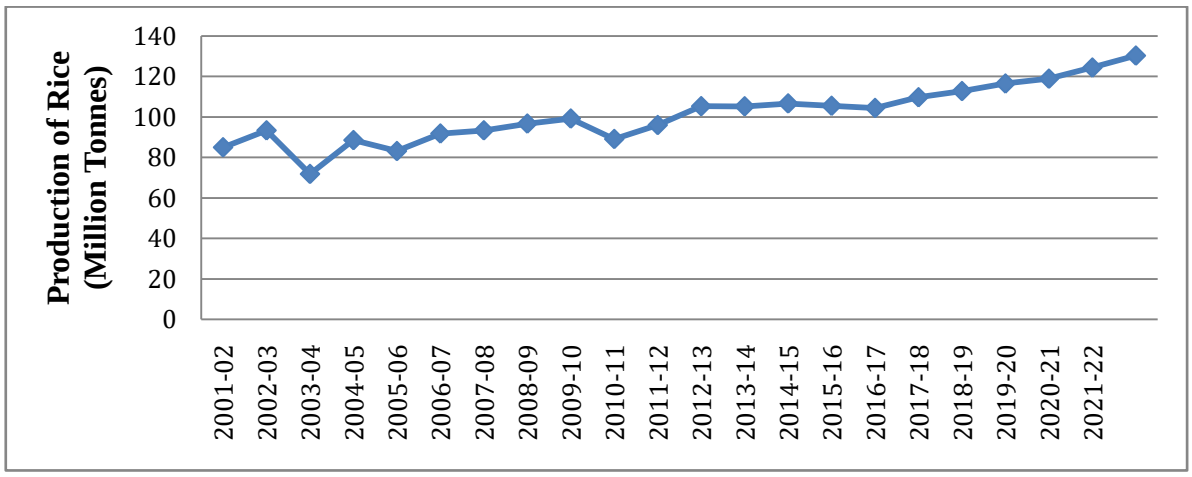
The present study based on secondary data and collection technique was adopted. In this study twenty one year's from 2000-01 to 2021-22 is collected regarding area, production and yield of rice in India (Million Tonnes & Kg/ Hectare) are collected from www.farmer.gov.in and Government of India Ministry of Agriculture & Farmers Welfare Department of Agriculture & Farmers Welfare Economics & Statistics Division). The MSP data (in Rupees) is taken from Reserve bank of India website. The present research find out the influence of MSP and Area utilized for cultivation of rice in India on production and its yield. MSP and area utilized for cultivation are independent factors whereas production and yield depends on both. Window 2007 Microsoft Excel is used to calculated regression analysis in the study.

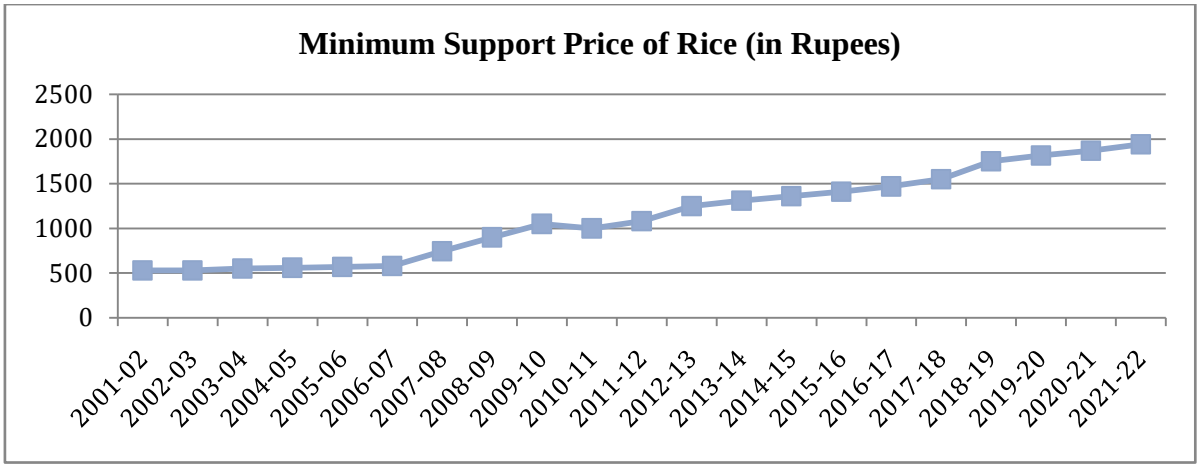
RESULTS AND DISCUSSION

Since inception Indian economic system is generally known as agrarian economy system. India's international trade constituent basically depends on agriculture produce. Agro business export constituents are wheat, rice, spices, tea, Jute, food grains etc. Rice is essential part of majority of daily meal of our population. Rice is symbol of honour in food in Asia and the subcontinent, therefore, the insignificant harvest of the rice crop in not only an economic loss but can also made a famine-like condition. The present study discusses the impacts of independent factors on production and yield of rice crop in India.

The following Charts showing Area, Production and Minimum Support Price of Rice crop for a period of 21 years in India.







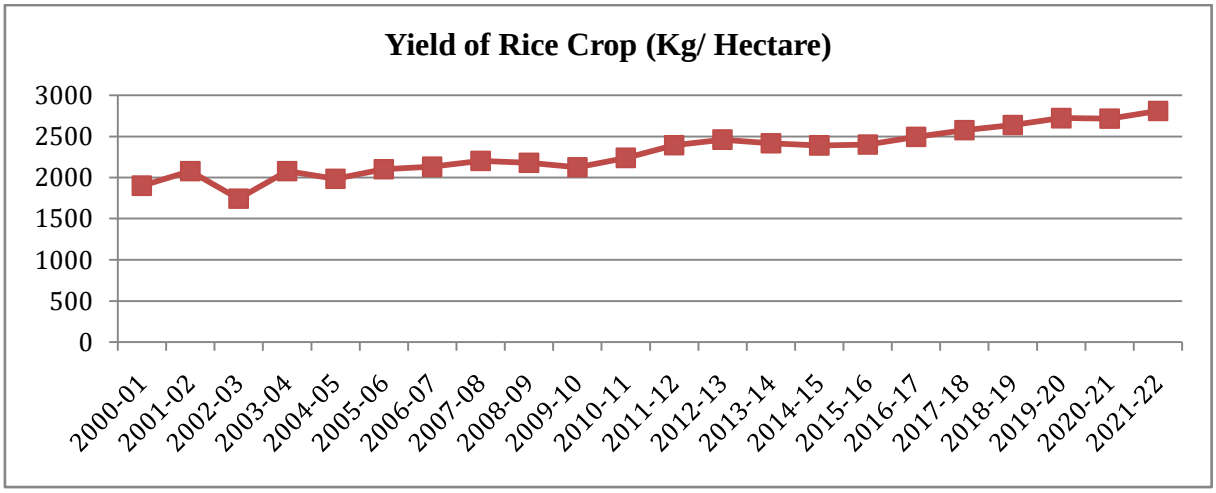


Table 1.1: Regression Model Summary

Multiple R	R square	Adjusted R Square	standard error of estimates
0.742717	0.551628	0.52803	9.68187

a. Dependent Variable: Rice Production
b. Independent Variable: Area under Cultivation

Table 1.2: ANOVA Table

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	1291.19	1	2191.19	23.375	0.00012
Residual	1781.03	19	93.7386		
Total	3972.23	20			

a. Dependent Variable: Rice Production
b. Independent Variable: Area under Cultivation

Table 1.3: Coefficient Table

Model	Coefficients	Standard Error	t stat	P Value
a	-256.121	74.105	-3.456	0.002645
Area under cultivation	8.1881	1.6935	4.8348	0.000115

c. Dependent Variable: Rice Production
d. Independent Variable: Area under Cultivation

In above said tables area under cultivation in India is taken as independent variable whereas rice production as dependent one. Therefore regression line Y=A+BX has been fitted. It is shows that the value of p for area under cultivation is 0.0001, which is lesser than 0.01 so, the study found that it has high impact in regression line. The value of R Square is found 0.55 that shows moderate degree of positive correlation between both variables. The value of standard error of estimates is 9.68 and it indicates 10 percent level of significance. The F value in Anova table is greater than 2.5 that show rejection of null hypothesis. It means there is not significant relation between both variables.

Table 2.1: Regression Model Summary

Multiple R	R square	Adjusted R Square	standard error of estimates
0.6261	0.39204	0.360045	220.730

c. Dependent Variable: Rice yield
d. Independent Variable: Area under Cultivation

Table 2.2: ANOVA Table

Model	Sum of Square	df	Mean Square	F	Sig.
Regression	596952.4232	1	596952.4232	12.2522	0.002393
Residual	925718.5291	19	48722.02785		
Total	1522670.952	20			

e. Dependent Variable: Rice Yield
f. Independent Variable: Area under Cultivation

Table 2.3: Coefficient Table

Model	Coefficients	Standard Error	t stat	P Value
a	-3583.7262	1689.490	-2.1211	0.04728
Area under cultivation	135.1502	38.6108	3.5003	0.002393

g. Dependent Variable: Rice Yield
h. Independent Variable: Area under Cultivation

In above said tables area under cultivation in India is taken as independent variable whereas yield from rice production as dependent one. Therefore regression line Y=A+BX has been fitted. It is shows that the value of p for area under cultivation is 0.0001, which is lesser than 0.01 so, the study found that it has high impact in regression line. The value of R Square is found 0.392 that shows lower degree of positive correlation between both variables. The value of standard error of estimates is so high and indicates insignificance. The F value in Anova table is greater than 2.5 that show rejection of null hypothesis. It means there is not significant relation between both variables.

Table 3.1: Regression Model Summary

Multiple R	R square	Adjusted R Square	standard error of estimates
0.97676	0.95407	0.9489	3.183

a. Dependent Variable: Rice Production
b. Independent Variable: Area under Cultivation and MSP

Table 3.2: ANOVA Table

Model	Sum of Square	df	Mean Square	F	Sig.
Regression	3789.792964	2	1894.896482	186.9618274	9.09158E-13
Residual	182.4336933	18	10.13520518		
Total	3972.226657	20			

a. Dependent Variable: Rice Production
b. Independent Variable: Area under Cultivation and MSP

Table 3.3: Coefficient Table

Model	Coefficients	Standard Error	t stat	P Value
a	-103.33	27.23565184	-3.793930739	0.001329247
Area under cultivation	4.145	0.643227596	6.444637807	4.59276E-06
MSP on Rice	0.0211	0.001687496	12.5589601	2.41651E-10

c. Dependent Variable: Rice Production
d. Independent Variable: Area under Cultivation and MSP

In above said tables area under cultivation and Rice MSP in India are taken as independent variable whereas rice production as dependent one. Therefore regression line $Y=A+BX_1+CX_2$ has been fitted. It is shows that the values of p for area under cultivation and MSP have high impact in regression line. The value of R Square is found 0.9547 that shows higher degree of positive correlation between both variables. The value of standard error of estimates is also under 5 percent level of significance. The F value in Anova table is greater than 2.5 that show rejection of null hypothesis. It means there is not significant relation between both variables.

CONCLUSION

The built-in multiple regression line of rice production in India = -103.33 + 4.145 (Area under Cultivation) + 0.0211 (Minimum support Price) at ninety five percentage level of confidence. From above said regression equation taking two independent factors of rice production, MSP and Area under cultivation at zero, hence the rice crop production will be decrease by 103.22 million tonnes. The findings shows that taking cultivation land of rice crop at zero, therefore one rupees increase in minimum support price will leads to 0.0211 million tonnes increases. After that increase in one million hectare of cultivation land for rice crop, it would leads to 4.145 million tonnes increases in rice production.

Hence, minimum support price have found lessor impact on rice crop production while area under cultivated land have significant. Other independent factors of production such as irrigation, annual rainfall should also be studied for knowing the exact results of impacts on rice production in India.

Table 4: Yearly Area under cultivation, Production, Yield and MSP of Rice crop in India

Year	Area (Million Hectares)	Production (Million Tonnes)	Yield (Kg/ Hectare)	MSP (in Rupees)
2000-01	44.71	84.98	1901	510
2001-02	44.9	93.34	2079	530
2002-03	41.18	71.82	1744	530
2003-04	42.59	88.53	2079	550
2004-05	41.91	83.13	1984	560
2005-06	43.66	91.79	2102	570
2006-07	43.81	93.36	2131	580
2007-08	43.91	96.69	2202	745
2008-09	45.54	99.18	2178	900
2009-10	41.92	89.09	2125	1050
2010-11	42.86	95.98	2239	1000
2011-12	44.01	105.3	2393	1080
2012-13	42.75	105.23	2461	1250
2013-14	44.14	106.65	2416	1310
2014-15	44.11	105.48	2391	1360

2015-16	43.5	104.41	2400	1410
2016-17	43.99	109.7	2494	1470
2017-18	43.77	112.76	2576	1550
2018-19	44.16	116.48	2638	1750
2019-20	43.66	118.87	2722	1815
2020-21	45.77	124.37	2717	1868
2021-22	46.38	130.29	2809	1940

Source: Government of India Ministry of Agriculture & Farmers Welfare Department of Agriculture & Farmers Welfare Economics & Statistics Division, 2022 and RBI.

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