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TREND ANALYSIS OF RICE AREA AND YIELD IN PUNJAB

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ABSTRACT:- The present paper to estimated the situation of rice regarding its area and yield in Punjab, the estimation is based on time series data from 1980 to 2011. On the basis of minimum errors of accuracy measure quadratic model was selected. The estimated results revealed that there is an increasing trend in the area and yield of rice in Punjab. The area of rice was 276800 ha in 2012 and would be 2934280 ha in 2016. Likewise results about yield indicated that it was 2438kg ha^{-1} in 2012 and would be 2678kg ha^{-1} in 2016. This increasing trend will provide a great opportunity for rice export from the country.

Key Words: Rice; Area; Yield; Quadratic Trend Model; Pakistan.

INTRODUCTION

Agriculture is the major source of economic activity in Pakistan both at micro and macro levels. At macro level it is supporting the country's manufacturing industry, trade (particularly when imports are outweighing the exports) and custodian of national food security. At micro level, the livelihood of majority of the rural population is directly and of urban population indirectly associated with agricultural prosperity of the country. Pakistan has a rich and vast natural resource base, spread over many ecological and climatic zones, which allows production of large number of field and horticultural crops. Agriculture part is providing employment to nearly 44% of the working manpower that generate their own food requirements and ensures accessibility of food for remaining part of the nation and value additional activities (GoP, 2014).

Rice is the most vital food in the world. In developing countries almost half of the world population relies on rice to fulfill their food needs. In Asia rice is not only a food or staple crop it also contribute in economic activity for income generation of the rural poor population with employment generation. Almost, 250 million farming families cultivating rice on their fields in Asia (Fischer and Cordova, 1998). Rice is a staple crop in Pakistan and its production has to be enhanced to meet the food requirement of an over populated country where the size of the population is still growing fast. It is therefore, important to investigate the trend of production of rice in Pakistan. Rice being one of the richest starchy foods is a principal food crop of about half the world's population (Martin et al., 1986).

Keeping in view the importance of rice in Pakistan it is necessary to estimate logically the upcoming production picture of this crop found on past tendency. Estimated procedure in agriculture includes projection of production and area. Reliable and suitable forecast offers crucial input for correct, prescience and updated setting in agriculture. Different policy

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decisions regarding storage, marketing and pricing required forecasting for obtaining yield (Agrawal, 2005). Nazli et al. (2012) has estimated the future prediction of two significant cereals in Pakistan. Punjab is at the top of the list in the production and area of rice that is 66.67% and 53.19%, respectively (Mahmood et al.,1991).

There is a lot of work done on forecasting studies for different crops in Pakistan (Habib et al., 2013; Rani and Raza., 2012; Tahir and Habib, 2013) but forecasting of rice specifically in Punjab has not been done. That's why this study has prior importance for the rice growing farmers and policy makers in Pakistan to take future decisions regarding the promotion of rice keeping in view the future yield level and area of rice in Punjab which is the major rice producing province in the country. This study aims to overlook the previous trends and on the basis of these results estimate upcoming scenario of rice area and yield in Pakistan by applying suitable model.

MATERIALS AND METHOD

In this study time series data from 1980 to 2011 for rice area and yield of Punjab has been used, data were collected from different secondary sources. MINITAB software was used for analysis and quadratic, linear and exponential models were employed. Many researchers have also applied these models in their different studies like Karim et al. (2010), Finger (2007), Boken et al. (2000) and Rimi et al. (2011). On the basis of accuracy measures the best model has been selected. The accuracy measures were Mean Absolute Deviation (MAD), Mean Absolute Percentage Error (MAPE), and Mean Squared Deviation (MSD). Minimum errors of accuracy measures are selected as superior fitted model by Karim et al. (2010).

Linear Model

The linear trend model that is suggested by Finger (2007) and Boken et al. (2000) is used in this study for analysis and expressed as:

$$Y_t = \beta_o + \beta_1 t + et$$

where,

Y_t = Expected value
t = Time index
β_0 = Model intercept
β_1 = Annual area and yield

Quadratic Model

Quadratic model was used in this study as this model was also applied by Rimi et al (2011), the model equation is as follow:

$$Y_t = \beta_0 + \beta_1 * t + \beta_2 t_2 + et$$

where,

Y_t = Predicted area and yield
t = Time index
β_0 = Model intercept
β_1 = Annual area and yield change

Exponential Model

The exponential growth trend model financial records for exponential growth and the equation of the model is as follows:

$$Y_t = \beta_0 * \beta_1 t * et$$

where,

Y_t = e forecasted area and yield
t = Time index
β_0 = Model intercept
β_1 = Annual area and yield change

RESULTS AND DISCUSSION

Selection of Forecasting Model for Rice Area

It is exposed from the estimated results that minimum values of

accuracy measures are lying in the quadratic trend model (Table 1) so, it is suggested to pick this model for projecting coming trends of rice area in Pakistan, instead other two models namely linear trend and exponential trend (Karim et al., 2010).

Forecasting Model Selection for Rice Yield

The estimated results showed that all figures of accuracy measure for rice yield are smaller in quadratic model as compared to other models (Table 1). Therefore quadratic trend model was found suitable for estimating future aspects for rice yield in Pakistan.

Previous Trends of Area and Yield of Rice in Pakistan

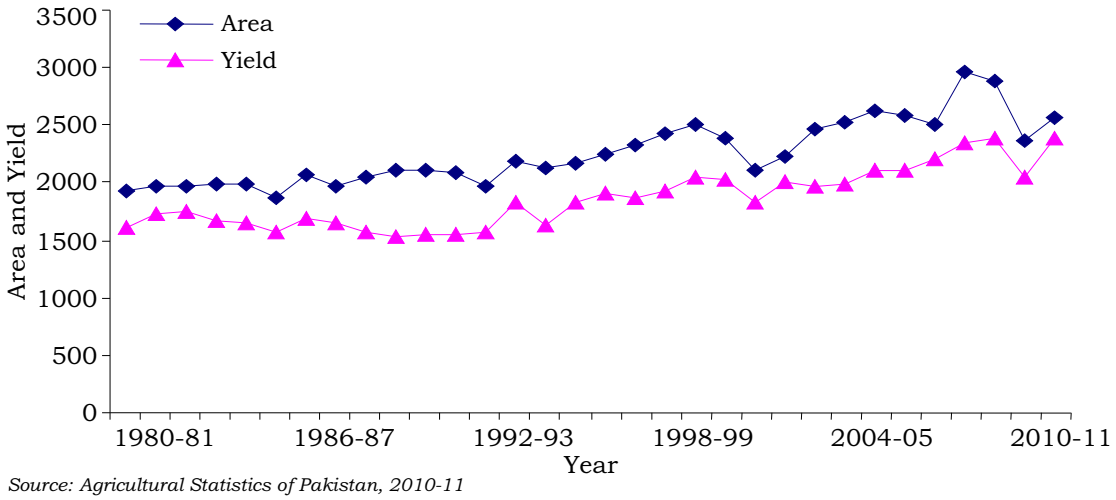
The time series parameter that are estimated for rice area and yield in Pakistan during 1980-2011 showed that area has upward and downward trend while yield has increasing trend (Figure 1). There was little fluctuation in the rice area. In 1980 rice area was 1933300 ha while in 2011 area was 2365000 ha, however in 2010 the rice sown area was estimated at 2365000 ha, which was 17.9% less than the last year that was 2883000 ha. The crop production is estimated at 4,823000 t which was 29.9% less than the last year. The reason behind the decrease in production is that the area under this crop has decreased significantly. In 1980 the yield of rice was 1616 kg ha^{-1} and increased gradually in 2011 (2396 kg ha^{-1}) in Pakistan.

Table 1. Model selection for rice yield and rice yield in Pakistan

Accuracy measure	Criteria		
	MAPE	MAD	MSD
Rice area			
Linear model	5.8	103.9	16274.4
Quadratic model	4.7	085.8	10663.6
Exponential model	5.6	100.3	14835.0
Rice yield			
Linear model	4.2	097.8	18322.1
Quadratic model	4.0	093.5	17316.0
Exponential model	4.1	095.7	17796.9

Forecasting of Rice Area

After the selection of suitable model; forecasted values for rice area and yield in Punjab were estimated to project future values with minimum errors.



Source: Agricultural Statistics of Pakistan, 2010-11

Figure 1. Rice yield and area in Pakistan

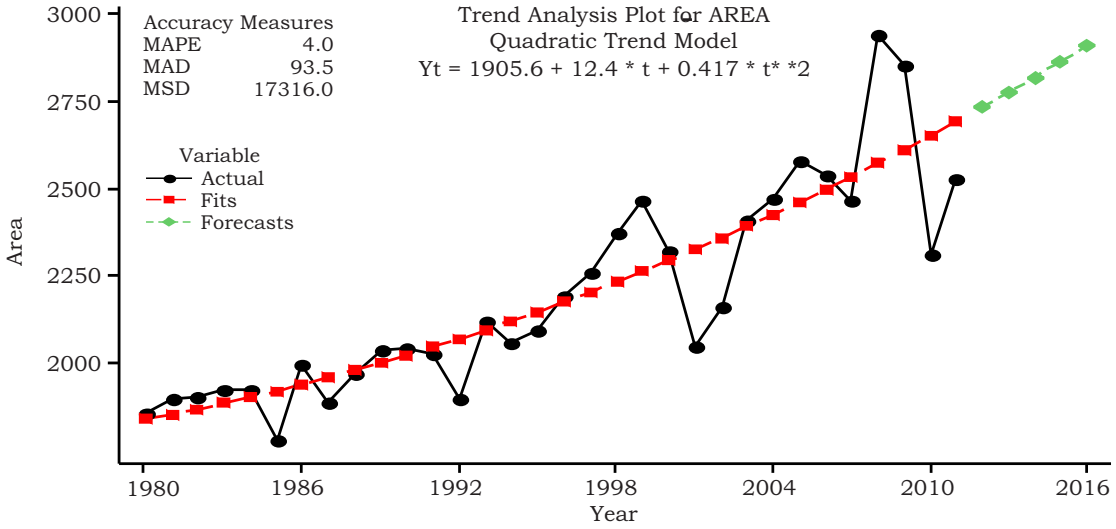


Figure 2. Trend analysis of rice area

The projected values for rice area and yield in Punjab, Pakistan. For 2012 was 2768.07 ha (Table 2). It shows that if present growth rate remains the same then area will increase up to 2934.28 in 2015-16 (Table 2). Therefore on the basis of above results, there is an increasing trend for the forecasted values of rice area in Punjab (Figure 2).

Forecasted Rice Yield

The forecasted value of rice yield in 2012 was 2438 kg ha^{-1}. It shows that if present growth rate remains the same then the yield will increase up to 2678 kg ha^{-1} in 2015-16.

Results also showed an increasing trend in the yield of rice in Punjab (Figure 3) depicting that if the growth rate remains the same then the projected value of rice yield in Punjab will be 2438, 2495, 2554, 2615 and 2678 kg ha^{-1} respectively with gradually increasing trend, during 2012 -2016 (Table 2).

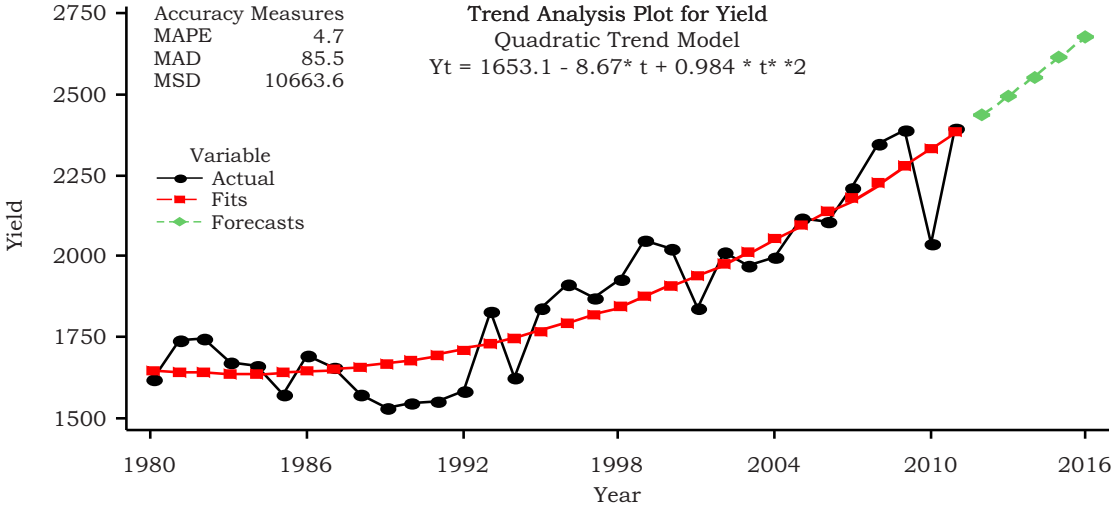


Figure 3. Trend analysis of rice yield

Table 2. Predicted rice area and yield

Year	Area (000 ha)	Yield (kg ha^{-1})
2012	2768.07	2438
2013	2808.38	2495
2014	2849.51	2554
2015	2891.48	2615
2016	2934.28	2678

The upcoming expansion in per acre yield was brought about because of the spreading out of high yielding varieties, appropriate and timely availability of agricultural inputs, good agronomic practices.

CONCLUSION

It is thus concluded that forecasted values for rice area and yield in Punjab has an increasing trend for the next five years. The results indicated that if the growth rates continue the same then the forecasted values of area would be 2768.07, 2808.38, 2849.51, 2891.48 and 2934.28 thousands ha, respectively, for the estimated years. the estimated figures illustrated that if the production of rice remain unchanged then yield values would be 2438, 2495, 2554, 2615 and 2678 kgha^{-1} accordingly during 2012-2016. The results proves that there is an increasing trend of rice area and yield for coming years in Punjab, that is a good sign for consumers. These estimated values would be helpful for researchers and policy makers as well.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

S. No	Author Name	Contribution to the paper
1.	Ms. Naheed Zahra	Main idea, Methodology and interpretation,
2.	Mr. Nadeem Akmal	Technical input at every step
3.	Ms. Sobia Naheed	Introduction
4.	Ms. Nusrat Habib	Abstract & results
5.	Ms. Sabeen Siddiqui	Data collection
6.	Ms. Irum Raza	Data analysis

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