Forecasting of Millet Area and Production in Pakistan

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Abstract

The present study was planned to check the trend analysis of area and production of millet in Pakistan. The findings of the study are based on millet area and production data during the years (1984-85 to 2011-12). Three models of trend analysis were applied but most appropriate model for trend analysis of the present study was quadratic model. Forecasting was also done up to 2016-17. Forecast values are very close to actual values.

Key Words: Millet; Area; Production; Quadratic model; Pakistan

Introduction

Millet [Pennisetum glaucum (L.) R.Br.] locally known as "Bajra" is a nutritious course grain cereal. Globally, it is grown on an area of 34.6 million ha with annual production of 28.8 million tons (FAO, 2005). The millets are a group of highly variable small-seeded grasses, extensively grown around the world as cereal crops or grains for both human food and fodder. Millet is grown as food and fodder in arid and semi-arid tropical environments. It is an essential source of fodder in many countries of the world (Bhatnagar et al.1998).

It has a high nutritional value as nourish for poultry and livestock. Its cultivation in crop rotation has been shown to reduce nematode problems in wheat, soybean and potato. Alternative uses of pearl millet grains show its potential for health foods, bakery products, and poultry feed and brewing. Millet is the third important cereal in livestock feed in Pakistan. It is a major contributor in the feeding of rural cattle and poultry. In Pakistan millet is the most popular bird seed commodity fed to pet birds (Chughtai et al. 2004). The stover of millet after the harvest of grains is used as a dry fodder, particularly during winter months when feeds are usually scarce. Stover represents up to 50% of the total value of the crop and its value and consumption increases in drought years. In addition, pearl millet is especially grown for its production of green fodder and it serves as an important kharif fodder. Pearl millet grains are not only nutritionally comparable but are also superior to major cereals with respect to protein, energy, vitamins and minerals (Malleshi and Desikachar,1985).

Millet is an important coarse grain crop in Pakistan specially in areas where drought is common, despite its economic importance this crop has received little attention compared with wheat, rice and millet. It is grown in most districts south of latitude 34 ^{0}N, but is particularly important in: Gujrat, Gujranwala, Chakwal, Mianwali, Bahawalnagar, Bahawalpur, Rawalpindi, Attock and Jhelum in Punjab; Hyderabad, Khairpur, Dadu, Nawabshah and Sanghar in Sindh; Lorali, Khuzdar and Sibbi in Balochistan; and Bunnu, Karak, D.I.Khan in NWFP. About 90% of the grain produced is used on the farm as food and as seed. The little surplus is sold mainly as seed for the fodder crop in the irrigated areas where farmers do not keep their own seed. Since the crop is grown for grain as well as for fodder production from February to August, it is difficult to assess the cropped area and production accurately. However, according to the economic survey of Pakistan (2012-13), the average area under millet during was about 458 (000) hectares and production 304 ton (000). An objective of the study was to forecast millet area and production in Pakistan using the best fitted model of trend analysis.

Methodology

The study was conducted by using time series data of millet's area and production during the years 1984-85 to 2011-12 (28 years) of Pakistan.

The data was collected from the various issues of Agriculture Statistics and Economic Surveys of Pakistan, published by Government of Pakistan. Data was analyzed by using MINITAB software. In this study Linear, The linear trend Model was also used by Finger (2007), Boken *et al.*, (2000) and Rimi *et al.*, (2011), Exponential, Quadratic and S-Curve Models of trend analysis were applied for this study. The best model was selected on the basis of three accuracy measures. These accuracy measures were Mean Absolute Percentage Error (MAPE), Mean Absolute Deviation (MAD) and Mean Squared Deviation (MSD). Smaller values of all these measures indicate a good fitted model with minimum forecasting errors (Karim et al., 2010); this model was also applied by Finger (2007). The best fitted model for this study was Quadratic model and applied for forecasting the area and yield of mung pulse in Pakistan for the years 2012-13 to 2016-17.

Results and Discussion

This section presents the analysis and discussion of results in the light of the objectives of the study.

Diagnostic Measures for the Selection of Best Forecasting Method for Area and Production In Pakistan

This study applied Quadratic Model for trend analysis of millet area and production in Pakistan on the basis of smaller values of accuracy measures (Karim et al., 2010).

Table 1 revealed that all the values of accuracy measures for millet area in Pakistan are smaller in Quadratic Model. So this Model best fitted to forecast the future values for Millet area in Pakistan for next Six years.

Table 1: Best Fitted Model Selection Criteria for Area

Measures of Accuracy	Criteria		
	MAPE	MAD	MSD
Linear Trend Model	15.48	61.84	5325.37
Quadratic Trend Model	14.92	59.78	4880.28
Exponential Trend Model	15.29	62.13	5328.16
S-Curve Model	16.79	71.91	7699.09

Table 2 revealed that all the values of accuracy measures for millet Production in Pakistan are smaller in Quadratic Model. So this Model best fitted to forecast the future values for Millet area in Pakistan for next Six years.

Table 2: Best Fitted Model Selection Criteria for Production

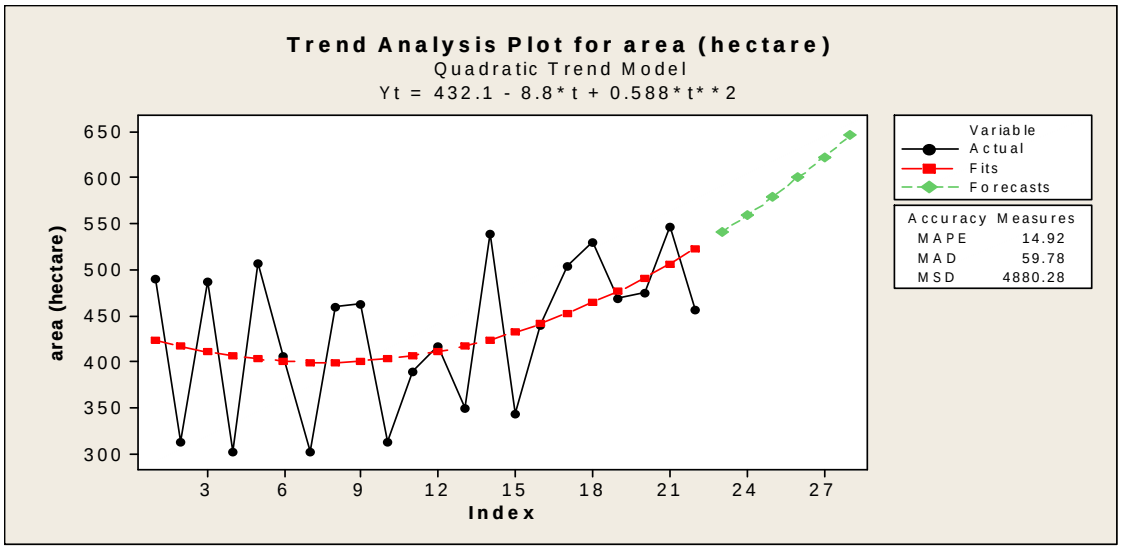
Measures of Accuracy	Criteria		
	MAPE	MAD	MSD
Linear Trend Model	15.08	30.73	1222.88
Quadratic Trend Model	13.324	27.029	901.951
Exponential Trend Model	14.21	29.21	1105.70
S-Curve Model	13.21	27.95	1033.43

Forecasted Millet Area

The area growth rate has positive trend in Pakistan. As figure 3 exposed the trend analysis plot for millet area in Pakistan by using Quadratic Trend Model. The black line shows actual values, red fitted values and green line is for forecasted values of millet area at 95% prediction interval. As in table 3 results showed that if the present growth rates of millet area remain the same then area of millet in Pakistan would be 540, 559, 579, 600, 623 and 646 thousands ha respectively for the years 2012, 2013, 2014, 2015, 2016 and 2017.

Forecasted values of area under millet in Pakistan has slightly increasing trend in coming Six years in Pakistan, But with slow growth as shown in figure 3, it can be due to ignorance of government and policy makers as a minor crop. Farmers giving more importance to cash and major crops, as they earn more from other crops so they show less intention to this crop. Similarly table 3, is also explaining the same type of future trends of millet area in Pakistan.

Figure 1: Forecasted Millet Area



Forecasted Millet Production

The production growth rate is relatively higher than the area growth rate of millet in Pakistan. As figure 3 exposed the trend analysis plot for production of millet in Pakistan by using Quadratic Trend Model. The black line shows actual values, red fitted values and green line is for forecasted values of Millet production at 95% prediction interval. As in table 3 results showed that if the present growth rates of millet remain the same then production of millet in Pakistan would be 350, 370, 390, 411, 434 and 457 thousands ton respectively for the years 2012, 2013, 2014, 2015, 2016 and 2017. Forecasted values of production under millet in Pakistan has positive increasing trend in coming six years in Pakistan. Positive increase in production is due to availability of high yielding varieties, proper use of inputs and in time availability of inputs for millet in Pakistan. Similarly table 3 is also explaining the future trends of millet production in Pakistan. These trends show that instead of an incentive for farmers in form of high yielding from millet and there is also country demand available.

Figure 2: Forecasted Millet Production

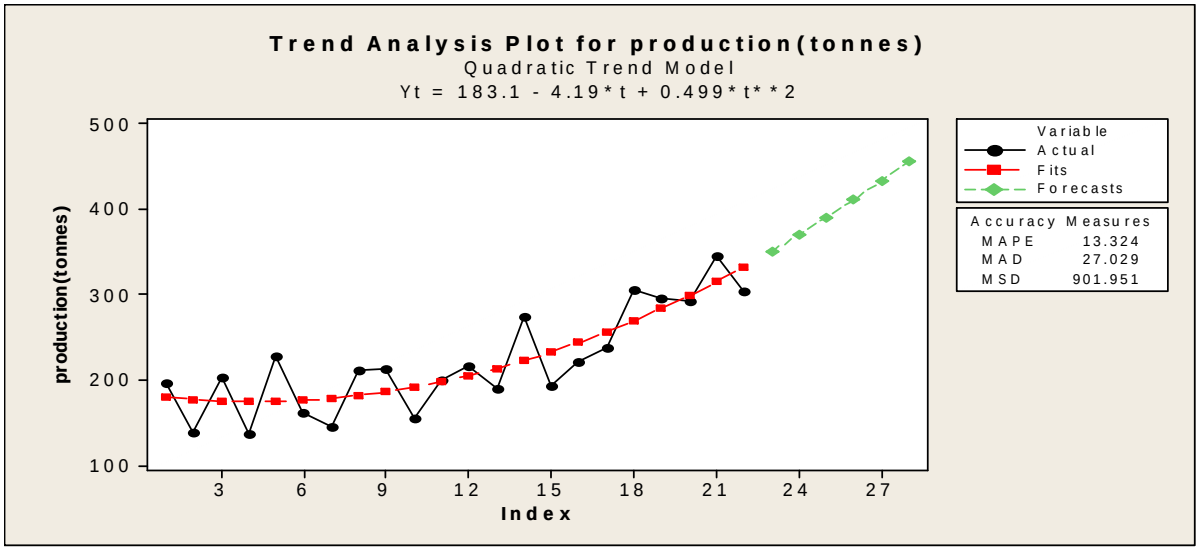


Table 3: Six years 95% forecasted Area and Production

Forecast Years	Area (000 Hectares)	Production (000, ton)
2012	540	350
2013	559	370
2014	579	390
2015	600	411
2016	623	434
2017	646	457

Table 3 results clearly revealed that there is positive increasing trend for area and production in Pakistan. Instead of supportive positive increase, area has slower growth or not much increased as production.

Conclusion and Recommendations

Quadratic Model provides good technique for predicting the magnitude of any variable. In this study developed Model was Quadratic Trend Model on the basis of best accuracy measures techniques. From the forecast available by using the developed model, it can be seen that forecasted area and production has increasing trend for the coming six years 2013 to 2017 respectively.

But area is slower growth comparative to increase in production of millet in Pakistan. The model can be used by researchers for forecasting of millet yield in Pakistan. However, it should be updated from time to time with inclusion of current data.

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