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Export Forecasting of Major Fruit Crops of Pakistan

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Abstract: The present study has been designed to check the export trends of major fruits of Pakistan and determine future situation. It is based on time series data from 1999 to 2014. To forecast the export trends of fruits deterministic time series models are applied. Projections are made for the time period 2015-2019. It is found that quadratic trend model best fits to forecast the exports volume of selected fruit crops on the basis of minimum errors of MAPE, MAD and MSD. Results revealed that exports of citrus, mango and apple will have positive trend in the near future, however, exports of dates are expected to decline.

Key words: Forecast, exports, citrus, mango, dates, apple, quadratic trend, Pakistan.

INTRODUCTION

Horticultural sector has great potential for increasing export of premium quality horticultural produce and perhaps is the most cost-effective to all farming activities (Kondal, 2014). Nobody can deny the importance of horticultural crops in human diet. Pakistan is blessed with vast agricultural resources on account of its fertile land and it has central importance in the economy that the Government has identified agriculture as one of the four major drivers of growth. In the sixteen green revolution, high yield varieties of wheat and the adoption of production technology led towards food security. However, with the passage of time, it was realized that Pakistan's ecologies have natural climate zones, which are rich to produce horticultural crops and by adopting excellent methods of cultivation, farmers having small land can become self-sufficient (GoP, 2010).

Horticulture sector covers fruits, vegetables, floral and landscape plants. Fruit production has considerable position in Pakistan's economy. All fruits produced in Pakistan have a covered area of 776 thousand hectares and produce 6423.9 thousand tonnes total output (GoP, 2014a). Pakistan has primitive network, which involves six to seven intermediaries between growers to consumers. Due to lack of marketing structure, almost 30 to 40% of the product dumps to dustbin before reaching to the consumers (GoP, 2007).

Pakistan has great potential in fruit export, due to its taste. According to statistics, fruits, vegetables and condiments contribute to the economy up to US$ 2 billion, which is almost 26% of the total value of all crops. Only the export of fruits during 2013-14 contributed to the national economy about Rs. 2,366.5 billion. The production of horticulture crops is a signal of market demand of fruits and vegetable. According to FAO (2014), the fruits, like, mango, citrus, banana, grapes, guava, apple and date, are the major fruits of Pakistan, in terms of production and exports. Mango, citrus and dates contribute almost 78% of the total value of Pakistan's fruit export and in the world production ranking, Pakistan is having 6thposition in mango and dates and 20th position in apple production (Akhtar *et al.*, 2009).

Pakistan has a leading position in production of fruits and vegetables in the world market. According to statistics, more than 29 types of fruits were produced in the country and now Pakistan has become the 5th largest producer of dates in the world. During 2013-14, the production of mango reached at 1658.7 thousand tonnes, whereas, the total export of fruits have improved more than 10% between 2013 and 2014 (GoP, 2014b).

Decade-wise average annual growth of major fruits is presented in Table 1. As stated in Table 1 that by decreasing the area of fruits, the production also declined by decade. During 1970s, the growth in citrus area was witnessed 7.1%, which declined to 6.12%, 1.33% and -0.02%, during 1980s, 1990s and 2000s, respectively. The similar trend has been observed in growth production of citrus. Growth in area and production of mango is having upward and downward movement. In 2000s, mango growth of

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area and production was doubled than during 1980s. Dates growth by area and production showed major fluctuation during decades. In 1990s, dates growth was the highest in area (6.24%) and production (7.28%), whereas growth rate declined during 2000s, in area 1.43% and -1.41% in production. Situation of apple growth is not much different from other fruits. Its growth of area and production declined every decade and even growth of production becomes negative, i.e., -1.79% in 2000s.

Table 1. Decade wise average annual growth rate of major fruits (percent).

Fruits	Area/production	1971-80	1981-90	1991-00	2001-10
Citrus	Area	7.12	6.12	1.33	-0.02
	Production	6.93	5.46	1.9	1.26
Mango	Area	0.36	3.76	0.97	6
	Production	0.58	3.43	1.91	6.43
Date	Area	2.25	5.62	6.24	1.43
	Production	2.34	3.77	7.28	-1.41
Apple	Area	9.9	6.99	8.53	6.73
	Production	11.5	8.02	4.5	-1.79

Source: Author's calculation

Pakistani fruits are having demand in the world, due to their taste; however, there are still issues relating to international standards certification and sanitary and phytosanitary (SPS), etc. Thus keeping in mind, the value of exports of Pakistan's fruits, an attempt has been made to forecast the export of fruit crop for upcoming years (2015-2019).

MATERIALS AND METHODS

This study is based on the secondary data to forecast the exports volume of citrus, mango, dates and apple. The export data of selected fruits have been taken from fruits, vegetables and condiments statistics of Pakistan. The time series data covered the period from 1993 to 2014. Various models have been used in the literature to forecast time series data. In this study, to estimate the data deterministic time series growth models have been applied, i.e., linear, exponential, quadratic and double exponential smoothing models.

According to Pindyck and Rubinfeld (1991), to measure the growth analysis and predict future value, usually deterministic growth models are used in practice. These models are very good in many situations for forecasting the growth pattern and future movement of a time series data. Effort has been made in Bangladesh to forecast the wheat production by employing the growth model (Karim *et al*., 2010). Rehman and Imam (2008) found out the appropriate models using latest model selection to forecast the pigeon pea, chickpea and field pea pulse production in Bangladesh. Other attempts were made, using the latest model selection criteria in various studies, such as, price estimation of major pulses in Pakistan (Rani and Raza, 2012), trend analysis for mung beans in Pakistan (Habib *et al*., 2013), to forecast maize production (Abid *et al*., 2014), and sugarcane area and yield for Pakistan (Batool *et al*., 2015).

Deterministic time series forecasting models:

Linear trend model

$$Y_t = a_\circ + \alpha_1 t + \varepsilon_t \text{.....} 1$$

Quadratic trend model

$$Y_t = \alpha_\circ + \alpha_1 t_1 + \alpha_2 t^2 + \varepsilon_t \text{.....} 2$$

Exponential Growth Model

$$Y_t = \alpha_0 \,.\, \alpha_1 \, t.\, e^t \text{.....} 3$$

where, Y = export of selected fruits

$\alpha_\circ$ = constant

t = time

ε_t = error term

α_1, α_2 = parameters of the models

Double exponential smoothing model …….4

This model helps to smooth the data and usually recommend for short-time projection (Brown, 1959). Bowerman and Connell (1993) also suggested this technique for forecasting.

The following general equation of the series in algebraic form when single exponential smoothing on S` is applied:

$$S``_t = \alpha S`_t + (1 - \alpha) S``_{t-1}$$

Finally, the forecast: $Y`_{t+1} = a_t + b_t$

Where, $a_t = 2S`_t - S``_t$ the expected level at time t

$b_t = \left(\frac{a}{1-\alpha}\right)(S`_t - S``_t)$ the anticipated trend at time t

Accuracy measures for selection of forecasted model: The deterministic time series models for forecasting have been compared on three points, i.e., Mean Absolute Percentage Point (MAPE), Mean Absolute Deviation (MAD) and Mean Squared Deviation (MSD). The best fitted model for forecasting was selected on the basis of the smallest amount of these errors (Gujarati and Porter, 2008).

RESULTS AND DISCUSSION

The trend of export of major fruits, i.e., citrus, mango, apple and dates, has been portrayed in Fig. 1.

The trend of citrus show a sharp decline in export during 2000 and afterwards it is now moving slightly upward. Export of mango is showing a smooth trend, while export of dates sudden declined in 2013 and 2014, however, the export volume of apple is the least.

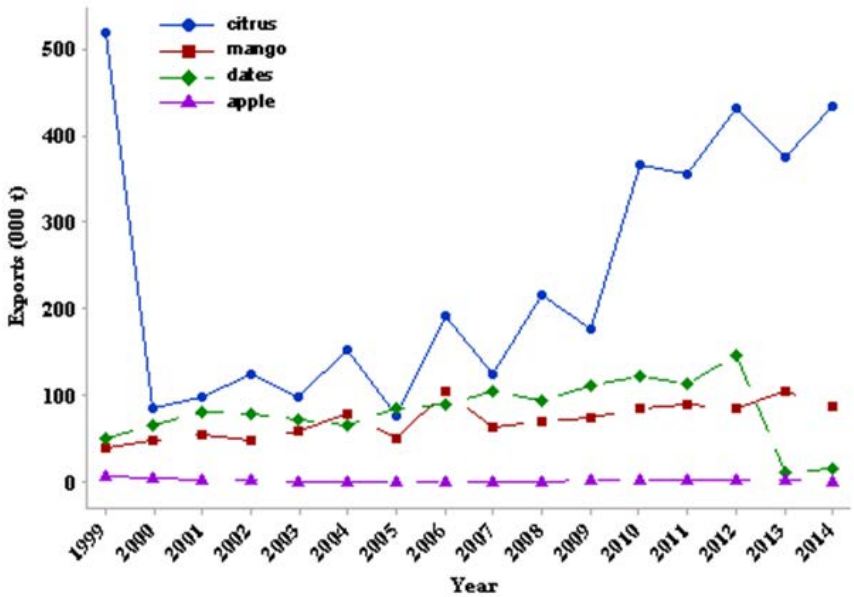

Fig. 1: Trends of export of major fruit crops of Pakistan.

Table 2: Diagnostic measure for the selection of best fitted model for export of major fruit crops in Pakistan.

Model	Citrus export (000 t)			Mango export (000 t)		
	MAPE	MAD	MSD	MAPE	MAD	MSD
Linear	51.2	91.9	15583.1	12.3	8.7	149.6
Quadratic trend	**34.7**	**72.9**	**8161.0**	**12.2**	**8.7**	**144.6**
Exponential growth	41.4	75.7	14549.5	12.3	8.9	162.3
Double exponential	37.1	75.7	11990.6	17.6	11.4	201.1
	Dates export (000 t)			**Apple export (000 t)**		
	MAPE	MAD	MSD	MAPE	MAD	MSD
Linear	96.0	25.9	1214.0	656.9	1.1	1.7
Quadratic trend	**64.9**	**20.5**	**790.8**	**237.4**	**0.7**	**0.6**
Exponential growth	72.2	32.6	1610.9	309.8	1.0	2.4
Double exponential	105.4	21.7	1251.9	613.8	0.8	0.9

Source: Author's calculation

The value of MAPE for quadratic model was lowest for all the selected fruits, i.e., 34.7 for citrus export, 12.2 export of mango, 64.9 for the export of dates and apple export was 237.4, respectively. Quadratic model also attained the smallest values of MAD for citrus export (72.9), mango export (8.7), dates export (20.5) and apple export (0.7) in contrast to the values of linear, exponential growth and double exponential. In the same way smallest value of MSD was found for citrus exports (8161), mango export (144.6), dates export (790.8) and apple export (0.6) as compare linear, exponential and double exponential models (Table 2).

Forecasting exports of major fruits, using quadratic model: The forecasted values of exports of citrus, mango, dates and apple with 95% forecasted interval showed that if the momentum of growth rate remains static for the projected years then the export of citrus, mango and apple will remain positive, only export of dates will have declining trend. Till 2019, the export of citrus and mango will be increased to 1049 thousand tonnes and 97.9 thousand tonnes, respectively. However, exports of dates will decline to 58.1 thousand tonnes, while export of apple will remain positive and will gain the export volume 6.1 thousand tonnes (Table 3). Quadratic trend for exports of citrus, mango, dates and apple of Pakistan is plotted against time period 1999 to 2019 in Fig. 2 (a-d) at 95% predicted interval.

Table 3: Five years 95% forecasted exports of fruits (000 t).

Forecasted years	Citrus export	Mango export	Dates export	Apple export
2014-15	603.6	94	30.8	2.7
2015-16	701.3	95.3	11.8	3.4
2016-17	808.1	96.4	-9.3	4.2
2017-18	924.0	97.3	-32.6	5.1
2018-19	1049.0	97.9	-58.1	6.1

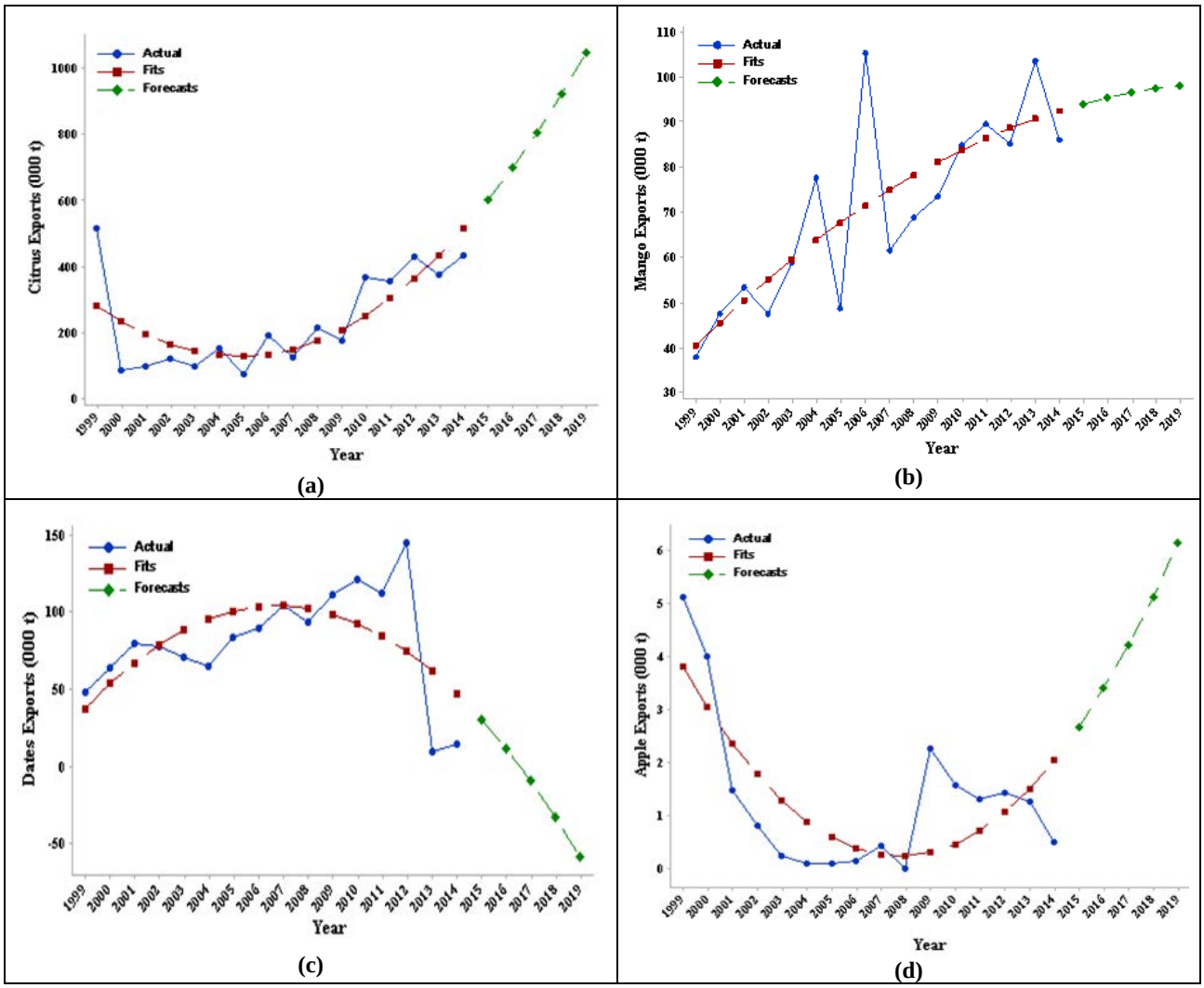

Fig. 2: Forecasted trend for major fruit crops in Pakistan.

CONCLUSION

The study in hand presents the export situation of Pakistan's major fruits, i.e., citrus, mango, dates and apple. The analysis of data showed that Pakistani fruits are facing fluctuation in exports market. Currently, Pakistan is the 5th largest producer of dates and from 2013 its production is declining which result sudden lessening in exports. A forecasted value of dates also shows the situation that 2015 to 2019 exports of dates will shrink. On the other hand exports of citrus, mango and apple will remain stable and follow the increasing trend. According to the results, citrus exports will reach in 2018-19 to 1049 thousand tonnes, mango export will be 97.9 and 6.1 thousand tonnes will be export of apple. Thus, there is need to bring the attention of policy makers to promote the exports of surplus fruits and introduce the new markets.

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