

GROWTH AND VARIABILITY IN AREA PRODUCTION AND YIELD OF SELECTED FRUIT CROPS IN KHYBER PAKHTUNKHWA

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ABSTRACT:- Growth in agricultural production along with low variability is highly desirable. The objective of this study was to investigate growth and variability in area, production and yield of selected fruit crops including apple, peach, pear, and plum in Khyber Pakhtunkhwa province. The study is based on secondary data from 1975-76 to 2011-12 which is further bifurcated into three periods; period-I (from 1975-76 to 1990-91), period-II (from 1991-92 to 2011-12), and period-III (from 1975-76 to 2011-12). Cuddy-Della Valle index has been used for variability analysis. The findings of the study revealed that growth in production of selected fruit remained positive with area under fruit as a major contributor during period-I. Period-II witnessed either low or negative growth in fruit production except peach. Variability in fruit production was higher in period-II as compared to period-I. Main contributor to fluctuations in fruit production during period-I was variability in area under fruit, whereas, both area and yield variability were mainly responsible for variability in fruit production during period-II.

Key Words: Apple; Peach; Pear; Plum; Growth; Variability; Cuddy-Della Valle Index; Production; Yield; Yield Components; Pakistan.

INTRODUCTION

In developing countries, fruits and vegetables are one of the fastest growing agricultural markets, with production increasing by 3.6% a year for fruits and 5.5% for vegetables over 1980-2004 (World Bank, 2008). Despite substantial progress in irrigation and other technologies, the agricultural production in general and fruit production in particular are subject to year-to-year fluctuations, thereby, disturbing farmers' livelihood and negatively affecting their investment decisions in farming. Furthermore, these fluctuations also challenge agricultural sector's viability and its potential to contribute to the country's economic

growth as well as food and nutritional security.

Trend and variability analysis for fruit production and yield is of great importance to understand the nature of food and nutrition security as well as income stability of farmers in the country. Fluctuations in fruit production and yield substantially affect its prices and consequently farmers' disposable income. Magnitude being dependent upon various factors like weather condition, availability of inputs, nature of production technology, and economic environment in the country. Higher growth in fruit production and yield along with lower level of instability are highly desirable for food security as well as for

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sustainable agricultural development in the country.

It is generally argued that variability in agricultural production has increased due to technological progress in agriculture. However, studies proved that instability in agricultural production has decreased due to expansion of modern technology. Sen (1967) showed that marginal land cultivation and increased use of inputs were responsible for higher production variability in India. Rao (1975), on the other hand, concluded that increased yield variability was the main source of production variability in Indian agriculture. Hazell (1982) found that variability in foodgrains production increased with the adoption of modern technology. Wasim (2011) showed that production variability of major crops increased in recent period due to higher adoption of modern technology in Pakistan. On the other hand, McIntire and Fussell (1985) found modern technology did not contribute to increased variability if it was accompanied with proper inputs package. Similarly, Singh and Byerlee (1990) also concluded that

wheat yield variability decreased with the expansion of modern technology across countries.

Khyber Pakhtunkhwa is the major fruit producing province of Pakistan. The important fruit of the province include peach, plum, guava, pear, apple, apricot, pomegranate, dates, mango, and grapes. Since long time, fruit farming has been an important business of Khyber Pakhtunkhwa. Total area under fruit was 43,108 ha while total fruit production remained 414,458 t during 2011-12 in Khyber Pakhtunkhwa (Table 1). This study estimates not only growth in area, production and yield of selected fruit but also estimates its measure of instability in Khyber Pakhtunkhwa. These fruit were selected as they have considerable contributions both in total area and production of the country.

MATERIALS AND METHOD

This study used time series data related to area, production, and yield of selected fruit crops namely apple, peach, pear and plum from 1975-76 to 2011-12. Data have been taken

Table 1. Percentage area and production of selected fruits grown in Khyber Pakhtunkhwa with major fruit growing districts

Fruit	Area	Production	Major growing districts by area and production in Khyber Pakhtunkhwa
Apple	8.6	29.7	Swat (42.6, 37.8), SWA (36.1, 49.3), Mansehra (6.8, 4.0), Abbotabad (5.8, 3.5)
Peach	39.2	69.1	Swat (67.8, 76.0), SWA (13.0, 2.8), Mardan (6.1, 6.3)
Pear	91.5	96.3	Swat (21.7, 32.0), Peshawar (15.3, 16.7), Mardan (13.9, 13.2)
Plum	45.9	47.0	Swat (20.1, 21.0), Peshawar (11.6, 14.0), SWA (8.7, 1.6), Nowshera (7.6, 9.4)

Source: GoP (2013a; b)

from various issues of Fruit, Vegetables and Condiments Statistics of Pakistan. The time span is further bifurcated into three periods i.e., from 1975-76 to 1990-91 the period-I, which is close to Green revolution and where agriculture sector was more protected in terms of input subsidies on fertilizers, pesticides etc., from 1991-92 to 2011-12 the period-II where structural reforms took place and majority of subsidies were abolished and the period-III from 1975-76 to 2011-12.

Growth rates of area, production, and yield for each fruit crop have been estimated by the following regression;

$$\text{Log}Y_t = a + bT \dots \dots \dots (1)$$

where,

Y_t = Area, production or yield of selected fruit crop

a = Constant

T = Time variable

b = Parameter of interest called growth rate.

Coefficient of variation (CV) has been widely used as measure of instability index. It has an easy interpretation. However, CV is suitable when data has no trend as it does not account for the time trend. In time series data, there is always some trend; therefore, one has to be very careful to use CV as measure of instability. The instability index is estimated by the following formula called Cuddy-Della Valle index (Cuddy and Della Valle, 1978);

$$CD = CV * (1 - R^2)^{1/2}$$

where,

CD = Cuddy-Della Valle index

CV = Coefficient of variation (%) and is equal to standard deviation/mean

R^2 = Coefficient of determination

adjusted for number of degree of freedom obtained from trend regression in equation (1)

RESULTS AND DISCUSSION

Use of high yielding seed varieties, pesticides, fertilizers, and farm mechanization were among the main features associated with green revolution that started in the early sixties. All these features contributed considerably to agricultural growth in Pakistan. Moreover, generous subsidies on agricultural inputs along with higher price incentives motivated farmers to adopt new technology packages. Consequently, the average annual growth rate of agricultural sector jumped to 3.8% during the second five year plan (1960-65) as compared to only 1.8% during the first five year plan and further boosted to 6% during the third five year plan. However, growth rate of agricultural sector slowed down in seventies due to many reasons including neglecting development of support services like agricultural extension, education and training, and research (Wasim, 1999).

Growth and Fruit Production Variability

Period-I

All fruit witnessed positive growth in production during period-I (Table 2). The highest growth was recorded in apple (7.94%), followed by peach (7.68%), plum (3.75%) and pear (2.44%). Similarly, growth in area remained positive for all selected fruit crops. On the other hand, there was a slight positive yield growth for all fruit except plum during this period. This employs that production increase in all selected fruit crop was

Table 2. Comparison of growth rates of area, production and yield of selected fruits in Khyber Pakhtunkhwa across periods (%)

Fruit	Period-I			Period-II			Period-III		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
Apple	6.49	7.94	1.45	0.72	1.93	1.21	3.02	3.17	0.15
Peach	7.54	7.68	0.14	13.01	10.05	-2.96	10.86	11.45	0.59
Pear	2.21	2.44	0.23	-0.91	-2.57	-1.66	0.09	-0.18	-0.27
Plum	4.01	3.75	-0.26	-0.13	-1.08	-0.95	1.61	1.17	-0.44

Source: GoP (2013a; b)

due to area expansion under fruit crop during the period. These results are consistent with results obtained by Wasim (2011). This could be attributed to agricultural subsidies extended to farmers during the period. Higher the variability in agricultural production, less sustainable the agriculture sector will be. Highest variability (23.15) was witnessed in peach production followed by apple (10.22), pear (8.11), and plum (7.36) during period-I (Table 3). Almost similar variability was recorded for area under selected fruit crop. The yield variability was relatively low during the same period. These results signify that production variability was mainly due to variability in area under selected fruit crop.

Period-II

Growth rates in area and production of all fruit either slowed down or remained negative except peach fruit during period-II. Yield of all fruit witnessed negative growth except apple. The deceleration in area, production and yield of the selected fruit crops could be partly attributed to withdrawal of agricultural subsidies under initiation of structural reforms and partly to change in investment decision of farmers. Farmers have to wait for a long time to get returns from fruit crops as compared to other crops and vegetables. Farmers now prefer to grow cereal crops or mostly vegetables as compared to fruit due to its short term nature and better price

Table 3. Comparison of instability index in area, production and yield of selected fruit in Khyber Pakhtunkhwa across periods

Fruit	Period-I			Period-II			Period-III		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
Apple	7.47	10.22	7.02	6.64	11.87	6.05	13.98	16.47	9.84
Peach	15.82	23.15	11.57	27.96	38.52	13.37	28.49	31.95	22.56
Pear	9.08	8.11	1.65	10.93	10.77	10.89	12.60	16.12	10.06
Plum	8.23	7.36	1.23	5.08	8.10	4.12	11.36	14.22	3.99

Source: GoP (2013a; b)

return mainly due to change in consumer preferences.

Variability in area, production and yield of selected fruit crop during period-II was relatively higher than the corresponding variability witnessed during period-I. The same pattern of production variability has been observed in period-II like period-I i.e., variability in peach production remained highest followed by apple, pear and plum. Contrary to period-I, relatively higher variability was witnessed in fruit yield during period-II, therefore, both area and yield variability was responsible for production variability of fruit crops in the period.

CONCLUSION AND RECOMMENDATIONS

It is concluded that sustainability in fruit growth has been aggravated during recent years. This could be attributed to various factors including post-harvest losses, higher input and management costs, lack of knowledge regarding high yielding fruit varieties, pest attack, and poor post-harvest handling techniques. To control large variation in fruit production, the following recommendations are made.

- Capacity building of horticulturists and extension workers to help fruit growers in proper fruit orchard management, post-harvesting handling, packaging, transportation and marketing.
- Provide credit facilities on easy terms and conditions to fruit growers to procure necessary inputs at proper time.
- Develop high yielding fruit varieties by increasing expen-

diture on research activities both at federal and provincial level.

- Develop market infrastructure like cold storage, improved weighing and loading facilities, proper road links etc.
- Improve information system to provide latest information to all stakeholders through various means of communications.

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