VOL. 6, NO. 12, DECEMBER 2011 ISSN 1990-6145
ARPN Journal of Agricultural and Biological Science


www.arpnjournals.com

TRENDS, GROWTH AND VARIABILITY OF MAJOR FRUIT CROPS IN BALOCHISTAN – PAKISTAN: 1989-2009

Mohammad Pervez Wasim
Applied Economics Research Centre, University of Karachi, Karachi, Pakistan
E-Mail: mpwasim@live.com

ABSTRACT

The present study was undertaken with a view to analyze trends, growth and variability of major fruit crops in two different periods of Balochistan, Period I (1989-90 to 1998-99) and Period II (1999-00 to 2008-09). Major fruit crops were apple, grapes, pomegranate, dates, apricot, peach, plums and almonds. The study reveals that in period I, the increase in production growth in majority of fruit crops, is mostly due to its area growth rather than productivity growth. Productivity growth contributed to some extent for apple, pomegranate, dates, apricot and almonds. It means that the farmers of these fruits were utilizing new farm technologies mainly because of profitability in growing these fruit crops due to its favorable price incentives, good irrigation facilities and good quality of trees and favorable climatic conditions. The study also reveals that the productivity growth of all the fruits except plums, recorded negative and significant growth in period II compared to period I. The decline in production and productivity growth in period II were mainly due to drought from 2000 onward, and lack of marketing infrastructure and facilities like farm-to-market roads and sale centres. The study also confirms the magnitude of variability in production of apple, grapes, dates, apricot and plums declined in period II relative to period I. The synchronized movements in area and productivity both were responsible for low instability/variability in apple, grapes, dates, apricot and plums production in period II compared to I.

Keywords: fruit crops, growth rates, instability, production, cuddy-della, valle index, Balochistan.

INTRODUCTION

Perennial crops such as shrubs and trees generally remain as grossly under exploited potential resources in hill agriculture. Some of the perennials are well suited to marginal lands with steep slopes or those of low fertility. Amongst these, fruits are usually grown by Balochistan farmers and these crops afford them few advantages. Therefore, the farmers should adopt a particular mix of crops, and the eventual balance between annuals and perennials should be based on connected factors. As the attention of development planners is focused on the total welfare of farm family rather than only on the productivity/yield of major cereals, the potential importance of the horticultural crops in mixed farming system deserves careful assessment, particularly in hill areas.

Fruits play a unique role in developing countries like Pakistan, both in economic and social sphere for improving income and nutritional status, particularly of rural masses. Along with these, orchards help in maintaining ecological balance. Further, horticulture being a labor intensive crop, production of these commodities should be encouraged in a labor abundant and capital scarce country like ours.

Nature has bestowed Balochistan with so many natural resources and its favorable climatic and various plateau of land further enhanced its importance by producing apple, grapes, pomegranate, dates, apricot, peach, plums and almonds. The distinctive climatic conditions in the province provide a great diversity and variety for fruit production. Export of fruits is considered a big source of foreign exchange today. The province produces million of tones of fruits annually. That is why Balochistan is rightly considered fruit basket of Pakistan.

Water resources are extremely limited and scare as compared to other parts of the country. There is dearth of water for irrigation. Main dependence of people has always been on nature and indigenous sources such as springs, streams and karez a permanent source of water for drinking and irrigation purposes in highland of the province. In Balochistan the drought from 2000 onward not only declined the water Table low and karez almost totally dried up, the fruits production also gone down.

The area under fruit is extensively grown in Balochistan in the highlands due to installation of tube-wells and this has changed the life style and standard of living of the people. The dry temperature climate is ideal for growing deciduous fruits in the uplands of Balochistan. Arable land is, however, very limited, the net sown area being only 3.08% of its geographical area (2008-09). Fruit area is 15.35% of net sown area in Balochistan (2008-09). The average size of holding is 9.6 hectares which cannot be considered economical by any standard, particularly when the fields are terraced, small, floppy, stony, and scattered. Under such natural constraints, the majority of farmers cannot hope to improve their level of living by exclusive dependence on field crops. Even the new technology is likely to have little impact in the non-valley areas. This is so particularly because here not only the proportion of area suitable for crop farming is limited but also the state's capacity to intensify land use through traditional crop-mix is more severely handicapped. Thus, the only alternative is to utilize its natural endowments for other high pay-off vocations, and fruit cultivation is one such enterprise.

Besides nutritional advantages, there are other compelling reasons also for which fruit production in hilly areas deserves preference. These include: (i) Given the

terrain and agro climatic features, horticulture is the only vocation through which higher income per unit of land can be generated. (ii) Fruit farming helps in profitable utilization of areas not so well suited for growing cereals and other field crops and in soil conservation as well. (iii) Fruit cultivation allows optimum utilization of the gift of nature in making it possible to upgrade inferior fruit trees into superior ones by top working and by adopting other techniques of vegetative propagation. (iv) Given suitable combination, fruit farming can even be taken as a complementary occupation in hills to a set of other business propositions.

A majority of fruits are grown in the province of Balochistan. The province has been divided into two major zones, Upland Zone and Coastal Zone. The main districts included in Upland Zone are Quetta, Pishin, Qilla Saifullah, Qillah Abdullah, Zhob, Loralai, Ziarat, Kalat, Khuzdar and Mastung. The common fruits grown in these districts are apple, apricot, peach, plums, grapes, cherry, almonds, pear, pomegranate and melons. Coastal zone consist the districts of Turbat, Panjgoor and Kharan. These districts boast of many varieties of dates. In these districts the staple food is dates. Great attention is paid to the cultivation and care of the date-tree and the dates of Panjgur are declared by Arabs to excel those of Basra. Fresh trees are raised from offsets and they produce fruit after two to eight years and continue to do so for three generations. Apple particularly from Ziarat Valley is famous for their Red delicious and golden varieties. Table-1 indicates that apple, grapes, pomegranate, dates, apricot, peach, plums and almonds accounts for 91.08 percent, 98.43 percent, 81.68 percent, 56.09 percent, 92.55 percent, 60.22 percent, 53.61 percent, and 96.88 percent of area and 96.88 and 69.49 percent, 98.24 percent, 71.37 percent, 43.94 percent, 91.87 percent, 30.31 percent, 52.52 percent and 96.60 percent of production, respectively in Pakistan's total area and production of fruits (2008-09). The contribution of Balochistan in all fruits is 29.71 percent of area and 16.67 percent of production in Pakistan's total area and production. The contribution of Balochistan in area and production of the above-mentioned fruits is very high, 78.82 and 69.29 percent, respectively as compared to other provinces.

Table-1. Major growing districts and percentage of area and production of major fruit crops of Balochistan in Pakistan's total area and production of fruits, 2008-09.

Fruits	Percentage area	Percentage production	Percentage of area contribution of major districts of Balochistan in descending order		
Apple	91.08	69.49	Kila Saifullah (66.5%)	Mastung (7.5%)	Zhob (6.3%)
			Kila Abdullah (4.6%)		
Grapes	98.43	98.24	Pishin (54.9%)	Quetta (10.4%)	Mastung (9.5%)
			Kharan (9.5%)		
Pomegranate	81.68	71.37	Kila Saifullah (64.4%)	Loralai (10.9%)	Zhob (6.2%)
			Panjgoor (4.3%)	Gwadar (3.7%)	
Dates	56.09	43.94	Turbat (47.1%)	Panjgoor (39.6%)	Kharan (7.5%)
Apricot	92.55	91.87	Kila Saifullah (61.9%)	Mastung (9.6%)	Loralai (9.0%)
			Zhob (7.1%)		
Peach	60.22	30.31	Kila Saifullah (62.5%)	Kalat (11.1%)	Mastung (11.0%)
			Quetta (5.6%)		
Plums	53.61	52.52	Mastung (24.6%)	Kalat (22.7%)	Quetta (15.6%)
			Pishin (12.3%)		
Almonds	96.88	96.60	Loralai (41.9%)	Zhob (20.8%)	Kila Saifullah (19.4%)
			Barkhan (4.3%)		
All Fruits	29.71	16.67	Kila Saifullah (40.2%)	Turbat (9.5%)	Panjgoor (8.5%)
			Pishin (7.0%)		

Source: Crops Area and Production (by districts) 2008-09, Government of Pakistan.

Instability/variability is one of the important decision parameters in development dynamics and more so in the context of agricultural production. An analysis of fluctuations in crop/fruit output, apart from growth, is of importance for understanding the nature of food security and income stability. Wide fluctuations in crop/fruit output not only affect prices and bring about sharp fluctuation in them but also result in wide variations in disposable income of the farmers. The magnitude of fluctuations depends on the nature of fruit production technology, its

sensitivity to weather, economic environment, availability of material inputs and many other factors.

High growth in production accompanied by low level of instability for any crop is desired for sustainable development of agriculture. There is a growing concern that rapid technological change in agriculture has increased variability in crop production. Several studies conducted in different countries analyzed the instability in cereal production responding this concern. Until now no empirical studies have been able to settle the debate. Some studies show that production instability has increased due to the expansion of modern technology while some other studies showed that production instability has decreased with the expansion of modern technology.

A link between growth in agricultural production and instability was first addressed by Sen (1967). He concluded that variability in production increases due to expansion of cultivation to the marginal land and the increased use of purchased inputs. Rao (1975), however, held that since variability in yield tends to be far greater than variability in area, shifting from growth based on expanding area to growth based on increasing yields, automatically led to a tendency toward increased variability in production.

Hazell (1982 and 1989), observed that production variability in world cereal and Indian foodgrains production increased due to the adoption of modern technology. Mehra (1981) also argues that instability in India's total food grain production has increased due to the widespread adoption of the improved seed-fertilizer intensive technologies since the mid 1960's. Wasim (2001), based on secondary data from Pakistan for the period 1970-71 to 1997-98, analyzed production variability of major crops in the provinces of Pakistan for two periods - period I (1970-71 to 1983-84) and period II (1984-85 to 1997-98) to clearly bring out the trends in more recent period. He finds that the variability in production increases in more recent period due to higher adoption of new farm technologies and HYVs in most of the crops in Sindh. Wasim (1999), in his another study concludes that the improvement in productivity in most of the crops of Sindh during phase II was higher as compared to the improvement in crops during phase III. Similar arguments are also put forward by Rao (1975), Ray (1983), Parthasarathy (1984), Barker, Gabler and Winckelmann (1981), Mitra (1990) and Griffin (1988). Mclntire and Fussell (1985) estimated sources of variation in millet grain yield from farm level data in India. The results showed that improved technology did not generally contribute to increased relative or absolute variability if accompanied by appropriate package of inputs. Carlson (1985) examined the causes of rice yield variability using panel data from 13 Asian countries. He concluded that the coefficients of variation of both rice yields and total production decreased significantly with higher adoption of modern varieties and irrigation development. Singh and Byerlee (1990), based on 57 wheat producing countries of the world, showed that relative variability in wheat yield declined over time and expansion of modern wheat varieties have positive contribution to the decrease in variability in wheat yield. Deb, Mandal and Day (1991), based on secondary data from Bangladesh for the period 1947-48 to 1986-87, analyzed production variability for six crops for two periods - modern technology period (1968-69 to 1986-87) and pre-modern technology period (1947-48 to 1967-68). They found that both the absolute and relative variability in production reduced during the modern technology period as compared to the pre-modern technology period. In Pakistan no study is available relating to this topic on fruit.

Pakistan though exports fruits but the exported quantity is very small. We know that Pakistan has a deficit in its trade, so by increasing the production of fruits its export can be increased and Pakistan can earn a lot of foreign exchange which can be used to reduce trade deficit. Balochistan has enormous potential for boosting fruit production. Fruit production also determines the progress of industry because most of the industries depends not on its production only but also on its raw materials. Thus, if fruit crop performs well, both the level and composition of trade favour fruit industry growth. The converse is weak if fruit crop is weak.

Information about the growth performance and instability situation in major fruit crops production would help the policy makers of Pakistan to implement policy measures such as export-import policy for different fruit crops.

Examination of the issues stated above is expected to throw light on the nature of variability in fruit production, following from this, on how far the current measures as economical and better water usage, farmer education through extension services, producing varieties consistent with the taste and demand of foreign markets, grading and certainty of delivery, construction of check/delay action dams in suitable areas and development and dissemination of new technologies like trickle irrigation system, high yielding and drought and disease resistance varieties of fruits could be said to be instrumental in bringing about increase in area and productivity. Balochistan has nearly about 921 thousand (2008-09) hectare current fallow land mainly due to shortage of water there. The net sown area under fruit crops can be increased through better water usage, installation of tube wells and construction of dams.

The present study is undertaken with a view to analyze trend, growth and variability, of major fruit crops in two different period of Balochistan. The study has the following specific objectives:

a) to discuss the trends in average area, production and productivity.
b) to examine the period wise growth rates of area, production and productivity.
c) to estimate the period-wise level of variability/instability in major fruit crops area, production and productivity.

d) to represent concluding remarks and possible inferences for policy.

DATA SOURCE

The analysis is based on secondary data of major fruit crops area, production and productivity for 20 years, collected from various issues of Agricultural statistics of Pakistan, published by Ministry of Food, Agriculture and Livestock, Government of Pakistan, Agricultural Statistics of Balochistan, published by Directorate General Agriculture, Government of Balochistan, Fruit, vegetables and condiments statistics of Pakistan, Government of Pakistan. The analysis of growth and instability in major fruit crops area, production and productivity is done for two different periods, Period I (1989-90 to 1998-99), and period II (1999-00 to 2008-09). The major reasons for dividing it into two periods is to bring out the trends in more recent period because day by day the agricultural technology is improving.

METHODOLOGY

The compound growth rates are estimated by using log linear functions on the time series data on area, production and productivity of the major fruit crops. The equation fitted to analyze the trend growth rate is semi log exponential form.

$$\text{Log}Y = a + bt \quad (1)$$

where

Y = area/production/ productivity of major fruit crops
t = time variable in year (1, 2, ….. n)
a = constant
b = rate of change and when multiplied by 100 gives the percentage growth rate in area, production and productivity of major fruit crops.

The measurement of instability in time series data requires an explicit assumption of what constitutes the acceptable and unacceptable components. A systematic component which can be predicted does not constitute instability and hence, it should be eliminated from the data. The remaining unpredictable component represents the variability.

There are a number of techniques available to measure the index of instability. Such techniques are found in Coppock (1962), Mac-Bean (1966), Weber and Sievers (1985), Massel (1970), Singh and Byerlee (1990) and Cuddy-Della Valle (1978). In this study the instability in area, production and productivity of major fruit crops is measured in relative terms by the Cuddy-Della Valle index which is used in recent years by a number of researchers as a measure of variability in time series data. The simple coefficient of variation over estimates the level of variability in time-series data characterized by long-term trends whereas the Cuddy-Della Valle index corrects the coefficient of variation.

The instability index IX, is given by the expression:

$$IX = CV (1 - R^2)^{½} \quad (2)$$

where

CV = coefficient of variation (in percent)
R^2 = coefficient of determination from a time-trend regression adjusted by the number of degrees of freedom.

It may be mentioned here that some authors have estimated the CV around trend as the standard error of regression divided by mean, after estimating in both ways from the same set of data. Singh and Byerlee (1990) found that the results are almost identical whichever method is used. Since both methods provide same results, we decided to estimate instability index using Cuddy Della Valle index.

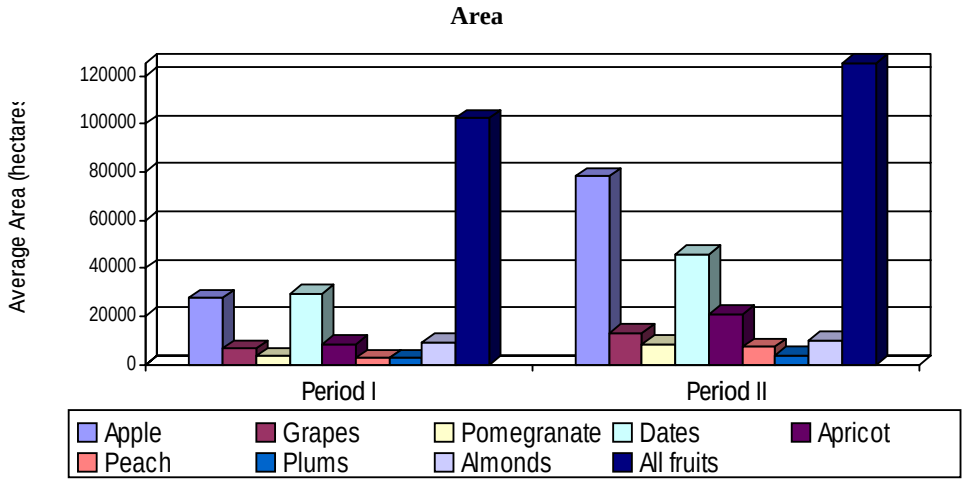
Trends in average area, production and productivity of major fruit crops in two different periods

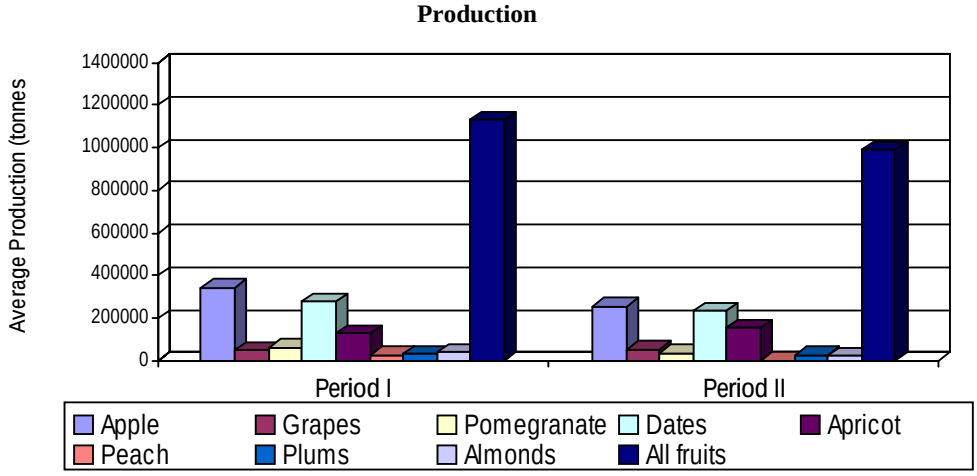
During Period I, the average apple area was 27573 hectares, grapes 6344 hectares, pomegranate 3286 hectares, dates 29351 hectares, apricot 8291 hectares, peach 2408 hectares, plums 2484 hectares, almonds 9252 hectares and all fruits 102115 hectares (Table-2 and Figure-1). In Period II, the area of all the fruits increased. Apple increased by 183.58 percent, grapes by 104.19 percent, pomegranate by 147.87 percent, dates by 56.55 percent, apricot by 150.86 percent, peach by 197.23 percent, plums by 53.70 percent, almonds by 8.67 percent and all fruits by 105.03 percent. The highest increase in area was recorded in peach (197.23%) while lowest in almonds (8.67%). The average production of all the fruits decreased except grapes in Period II as compared to Period I. Almonds recorded highest decrease in production (-41.22%) while lowest decrease was in all fruits (12.50%). The average productivity of all the fruit crops negatively decreased in Period II as compared to positive productivity in Period I. Though the percentage area of all the fruits increased in Period II compared to Period I, their average production (except grapes) and productivity negatively decreased. The major factor which caused decline in production and productivity of fruits was drought from 2000 onward, which declined the water Table low and karez almost totally dried and unfavorable price and climatic conditions.

Table-2. Percentage change in area, production and productivity of major fruit crops in Balochistan, 1989-90 to 2008-09.

Fruits	Average area (hectares)		Percentage change in area	Average production (tonnes)		Percentage change in production	Average productivity (Per hectare in kgs.)		Percentage change in productivity
	Period I	Period II	Period II over I	Period I	Period II	Period II over I	Period I	Period II	Period II over I
Apple	27573	78193	183.58	344428	254422	-26.13	12491	3253	-73.96
Grapes	6344	12954	104.19	50489	52430	3.84	7958	4047	-49.14
Pomegranate	3286	8145	147.87	63942	39479	-38.26	19459	4847	-75.09
Dates	29351	45950	56.55	278407	235922	-15.26	9485	5134	-45.87
Apricot	8291	20799	150.86	129424	156436	20.87	15610	7521	-51.82
Peach	2408	7158	197.23	26252	18791	-28.42	10902	2625	-75.92
Plums	2484	3818	53.7	32448	27364	-15.67	13063	7167	-45.13
Almonds	9252	10054	8.67	40746	23951	-41.22	4404	2382	-45.91
All fruits	102115	209374	105.03	1131051	989701	-12.5	11076	4727	-57.32

Source: Agricultural Statistics of Pakistan (various issues), Government of Pakistan.
Note: Period-I (1989-81 to 1998-99); Period-II (1999-00 to 2008-09)





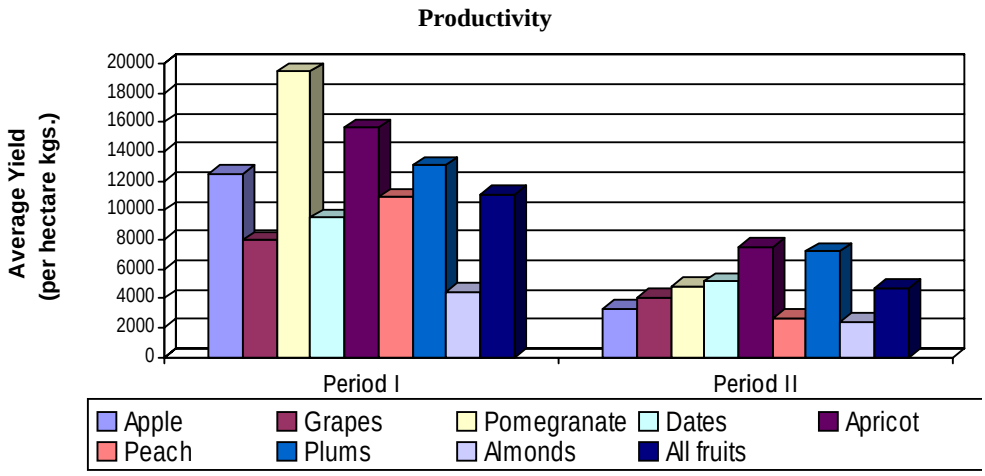


Figure-1. Bar-diagram showing average area, production and productivity of major fruit crops in two different periods of Balochistan.

RESULTS AND DISCUSSIONS

Growth rates in fruit crop production

Period-I (1989-90 to 1998-99)

As shown in Table-3, the growth of production of all fruits recorded a positive growth. Dates recorded highest growth rate of 21.84 percent per annum followed by all fruits, 18.26 percent, apple 16.52 percent, pomegranate 14.23 percent, apricot 12.58 percent, grapes 11.66 percent, plums 9.90 percent, peach 9.72 percent and almonds 5.41 percent. The increase in the production growth rate of apple, pomegranate, dates, apricot, almonds and all fruits was due to increase in both, area and productivity growth but area growth contributed more than productivity growth. For grapes, peach and plums production growth, only area growth is responsible. All the fruit crop production recorded positive and significant growth. The increase in productivity growth rate of apple, pomegranate, dates, apricot, almonds and all fruits was mostly due to increase in its production growth rate rather than area growth rate. Area growth rate contributed less than production growth rate. Conclusion that emerges from this period is that in the majority of the fruit crops, the increase in production growth is mostly due to its area growth rather than productivity growth. Productivity growth is also contributing for apple, pomegranate, dates, apricot and almonds. Apple, pomegranate, dates, apricot, almonds and all fruit growers are utilizing new farm technologies mainly because to grow these fruit crops are profitable to the farmers due to its favourable price incentives, HYVs, favourable climatic conditions, and good irrigation facilities.

Table-3. Period-wide compound growth rates of area, production and productivity of major fruit crops in Balochistan 1989-90 to 2008-09.

(Percent per annum)

Fruits	Period - I (1989-90 to 1998-99)			Period - II (1999-00 to 2008-09)		
	Area	Production	Productivity	Area	Production	Productivity
Apple	11.48 (7.02)*	16.52 (7.21)*	5.04 (5.99)*	12.86 (4.20*	0.37 (0.18)	-12.49 (3.21)**
Grapes	14.19 (5.68)*	11.66 (7.57)*	-2.53 (0.83)	3.34 (6.06)*	5.03 (2.97)**	1.68 (1.28)
Pomegranate	9.62 (6.71)*	14.23 (7.44)*	4.60 (7.31)*	14.23 (4.51)*	-1.36 (0.43)	-15.59 (2.85)**
Dates	21.27 (4.85)*	21.84 (4.83)*	0.57 (3.90*	2.32 (6.09)	-0.49 (0.37)	-2.81 (2.25)***
Apricot	9.09 (6.39)*	12.58 (7.01)*	3.49 (5.86)*	13.77 (5.47)*	9.65 (5.43)*	-4.11 (3.10**
Peach	9.71 (8.29)*	9.72 (8.65)*	0.01 (0.03)	14.13 (4.74)*	4.58 (3.43)*	-9.55 (2.90**
Plums	10.09 (7.68)*	9.90 (7.86)*	-0.18 (0.30)	1.01 (2.05)***	5.23 (4.53)*	4.21 (4.02)*

Almonds	4.44 (6.42)*	5.41 (6.99)*	0.97 (3.67)*	0.82 (1.15)	-1.29 (0.81)	-2.12 (2.07)***
All fruits	14.96 (7.73)*	8.26 (8.58)*	3.29 (6.93)*	7.38 (5.06)*	1.50 (1.62)	-5.87 (3.29)*

Note: *, **, *** Significant at 1, 5 and 10 percent level, respectively.
figures in parenthesis are t-values.

Period II (1999-00 to 2008-09)

Period II of Table-3 indicates that the growth of production of all the fruit crops (apple, grapes, pomegranate, dates, apricot, peach, plums and almonds) decelerated in period II compared to period I. In Period II the production growth in grapes, apricot, peach and plums were mainly due to increase in its area growth rather than productivity growth. The productivity growth of all the fruits except plums recorded negative and significant growth in period II compared to period I. The decline in production growth and negatively productivity growth in period II compared to period I was mainly due to drought from 2000 onward, unfavorable price and climatic conditions and non-availability of roads from fruit garden to markets.

For clear understanding of the growth scenario, we discuss the association between growth in major fruit crops area and productivity (Table-4). All crops under study were classified into four types of association on the basis of growth rates of area and productivity. AA- positive growth rate of area associated with positive growth rate of productivity. This would indicate that one fruit crop is either replacing other fruit crop or is grown in the newly cultivated area and the overall productivity of crop(s) increased. AB- positive growth rate of area associated with negative growth rate of productivity. BA- negative growth rate of area associated with positive growth rate of productivity. This would indicate that one major fruit crop area has been replaced by other major fruit crop or has gone out of cultivation and the productivity on the remaining area has increased. BB- negative growth rate of area associated with negative growth rate of productivity. It can be seen from Table-4 that 8 fruit crops fall in the AA category, 1 crop in AB category, and no crops in BA and BB category during period I. In period II, the number of fruits crop decreased to 6 in AA category and increased to 3 in AB category compared to period I. NIL crops in BA and BB category.

Table-4. Association between growth in major fruit crops area and productivity in Balochistan.

Types of Association	**Fruit crops under two different periods**	
	Period-I 1989-90 to 1998-99	**Period-II 1999-00 to 2008-09**
AA: Positive area positive productivity	Apple, pomegranate, dates, apricot, peach, almonds	Grapes, plums
AB: Positive area negative productivity	Grapes, plums	Apples, pomegranate, dates, apricot, peach, almonds
BA: Negative area positive productivity	Nil	Nil
BB: Negative area negative productivity	Nil	Nil

Source: Table-3.

Instability/variability in fruit crop production

The level of variability in major fruit crops production is very important for sustainable production. Therefore we have estimated the relative variability in major fruit crops production in Table-5 using equation (2). Variability in area, production and productivity are estimated for period I and II. It may be observed that in period I the production of grapes and dates recorded the highest degree of instability and that of apple, pomegranate, apricot, peach, almonds and plums the lowest. As the fluctuations in production are the compound result of fluctuations in crop acreage and crop productivity, area and productivity both contributed towards fluctuations in grapes in period II compared to I.

For dates fluctuation in production was mainly due to fluctuation in area. The low degree of production fluctuations in apple, pomegranate, apricot, peach, plums and almonds were due to fluctuations in both area and productivity fluctuations but low productivity fluctuations contributed more as compared to area. The magnitude of variability in production of apple, grapes, dates, apricot and plums declined in period II relative to period I. The synchronized movements in area and productivity both were responsible for low instability in apple, grapes, dates, apricot and plums production in period II. Production instability of apple, grapes, dates, apricot and plums decreased while that of pomegranate, peach and almonds increased in period II compared to period I.

Table-5. Instability in area, production and productivity of major fruit crops in Balochistan 1989-90 to 2008-09.

Fruits	Period-I (1989-90 to 1998-99)			Period-II (1999-00 to 2008-09)		
	Area	Production	Productivity	Area	Production	Productivity
Apple	1.36	1.57	0.75	2.31	1.37	4.06
Grapes	2.44	3.49	2.90	0.49	1.33	1.36
Pomegranate	1.49	1.47	0.54	3.03	2.53	5.44
Dates	3.69	3.11	0.13	0.30	0.90	1.25
Apricot	1.34	1.30	0.52	2.14	1.27	1.26
Peach	1.28	0.94	0.50	2.90	1.15	3.50
Plums	1.42	1.01	0.54	0.50	0.96	1.00
Almonds	0.64	0.61	0.27	0.65	1.35	1.11
All fruits	1.43	1.30	0.43	1.00	0.57	1.79

For better understanding of growth and variability in the production of major fruit crops we have presented Table-6. In period I all the fruit crops has high growth rate in production with low instability except grapes and dates as compared to period II. In period II the production growth rate of all the crops not only decreased (due to bad utilization of inputs and unfavorable climatic condition) but at the same time their instability has also declined except for pomegranate and almonds. Changes in production growth rate which cause instability can be due to a number of factors which include erratic availability of irrigation water, behavior of prices of competing crops and timely availability of agricultural inputs. These are true for period II.

Table-6. Period-wise growth and instability in the production of major fruit crops in Balochistan.

Fruits crops	Period-I (1989-90 to 1998-99)		Period-II (1999-00 to 2008-09)	
	Growth (%)	Instability	Growth (%)	Instability
Apple	16.52*	1.57	0.37	1.37
Grapes	11.66*	3.49	5.03**	1.33
Pomegranate	14.23*	1.47	-1.36	2.53
Dates	21.84*	3.11	-0.49	0.91
Apricot	12.58*	1.30	9.65*	1.27
Peach	9.72*	0.94	4.58*	1.15
Plums	9.90*	1.01	5.23*	0.96
Almonds	5.41*	0.61	-1.29	1.35
All fruits	18.26*	1.30	1.50	0.57

Note: Taken from Tables 3 and 5
*, **, *** Significant at 1, 5 and 10 percent level, respectively.

A moderate and significant growth in production accompanied by a low level of instability for any fruit crop (almonds in period I and plums in period II) is desired for sustainable development of agriculture as compared to high growth in production and high level of instability (grapes in period I).

The association between productivity and variability in productivity of major fruit crops in Balochistan is presented in Table-7. Four different types of Association can be made. AA- increase in productivity associated with decrease in relative variability. AB- decrease in productivity associated with increase in relative variability. BA-decrease in productivity associated with decrease in relative variability. BB- decrease in productivity associated with increase in relative variability. From the development point of view, AA is the best situation whereas BB indicates the worst situation. AB would be preferred to BA. The distribution of fruit crops according to the types of association between productivity and relative variability in productivity shows that only grapes experienced an increase in productivity accompanied by decrease in variability while plums experienced increase in productivity associated with increase in variability in period II as compared to period I.

None of the fruit crops experienced decrease in productivity with decrease in variability. Apple, pomegranate, dates, apricots, peach and almonds recorded decrease in productivity with increase in variability.

Table-7. Association between productivity and variability in productivity of major fruit crops in Balochistan.

Types of Association	Fruit crops period II compared to period I
AA: Increase in productivity with decrease in variability	Grapes
AB: Increase in productivity with increase in variability	Plums
BA: Decrease in productivity with decrease in variability	Nil
BB: Decrease in productivity with increase in variability	Apple, pomegranate, dates, apricot, peach, almonds

Source: Tables 2 and 5.

CONCLUSIONS AND RECOMMENDATIONS

The present study was undertaken with a view to analyze trend, growth and variability of major fruit crops (apple, grapes, pomegranate, dates, apricot, peach, plums and almonds) in two different period of Balochistan. The study reveals that in period I in the majority of fruit crops, the increase in production growth is mostly due to its area growth rather than productivity growth. Productivity growth contributed to some extent for apple, pomegranate, dates, apricot and almonds. It means that the farmers of these fruits are utilizing new farm technologies mainly because of profitability in growing these fruit crops due to its favorable price incentives, good irrigation facilities, good quality of trees and favourable climatic conditions. The study also concludes that the growth of production of apple, grapes, pomegranate, dates, apricot, peach, plums and almonds decelerated in period II compared to period I. The study also reveals that the productivity growth of all the fruits except plums recorded negative and significant growth in period II compared to period I. The decline in production and productivity growth in period II compared to period I were mainly due to drought from 2000 onward, unfavorable price and climatic condition and non-availability of roads from fruit garden to markets. The magnitude of variability in production of apple, grapes, dates apricot and plums declined in period II relative to period I. The synchronized movements in area and productivity both were responsible for low instability in apple, grapes, dates, apricot and plums production in period II. The study also reveals that in a majority of fruit crops instability in production is lower than instability in productivity in period II, which indicated the importance of productivity instability. Changes in production growth rate which causes instability can be due to a number of factors which include erratic availability of irrigation water, behavior of prices of competing crops and timely availability of agricultural inputs.

In order to improve the growth in production and productivity with stability, some of the important steps needed are:

a) The result of the study indicates that in period II compared to I, the production and productivity growth decreased. Therefore in order to increase its productivity more its production growth rate is required to be increase more. The growth rate of production can be increased through favourable price incentives of these fruit crops, availability of groundwater in high land, good qualities of trees, rising level of chemical fertilizer application, farmers education through extension services, better marketing infrastructure and facilities like farm-to-market roads and sale centers and better utilization of skilled labor and technical knowledge.
b) The study also confirms high instability in production of pomegranate in period II compared to I. The instability can be declined through controlling the price of main fruit crop and its competing crops, timely availability of agricultural inputs (HYVs and fertilizer), farmer's education through extension services and economical and better water usage.
c) The study also confirms that per hectare productivity of most of the fruit crops are low. The productivity potential of high quality fruits can efficiently be tapped by establishing "crop specific zone" and "fruit processing units" in the province. The fruit farmers needed to be properly educated about the techniques of growing fruit crops, and pay attention toward zoning for growth of different fruit crops. Efficient crop management could increase the profit of local farmers by reducing the production cost.

REFERENCES

Barker. R.E. E. Gabler and Winckelmann. D. 1981. Long-Term Consequences of Technological Change on Crop Yield Stability: The Case of Cereal Grains. In: A. Valdes (ed.). Food Security for Developing Countries. Boulder. West-View Press.

Coppock. J.D. 1962. International Economic Instability. McGraw-Hill. New York,USA.

Cuddy. J.D.A. and Della. V.P.A. 1978. Measuring of Instability of Time Series Data. Oxford Bulletin of Economics and Statistics. 40(1): 79-85.

Deb. U.K.. M.A.S. Mandal and M.M. Dey. 1991. Impact of New Technology on Production Variability in

Bangladesh Agriculture. Bangladesh Journal of Agricultural Economics. 15(2): 27-50.

Government of Pakistan. 1990-91, 1992-93, 1995-96, 2000-01 and 2002-03. Agricultural Statistics of Pakistan. Ministry of Food. Agriculture and Livestock. Food, Agriculture and Livestock Division. Economic Wing. Islamabad, Pakistan.

Government of Balochistan. 1992-93, 1996-97, 2001-02. 2006-07 and 2008-09. Agriculture Statistics of Balochistan. Planning and Development Department. Quetta, Pakistan.

Government of Pakistan. various issues. Crops Area and Production (By Districts). Ministry of Food and Agriculture (Economic Wing), Islamabad.

Government of Pakistan. 1998. Provincial Census Report of Balochistan. Population Census Organization, Statistics Division, Islamabad, Pakistan.

Government of Pakistan. 2008-09. Fruit, Vegetables and condiments Statistics of Pakistan. Ministry of Food and Agriculture (Economic Wing), Islamabad, Pakistan.

Griffin. K. 1988. Alternative Strategies for Economic Development. Organization for Economic Cooperation and Development. Paris, France.

Hazell. P.B.R. 1982. Instability in Indian Food grain Production. International Food Policy Research Institute. Research Report. 30. Washington, USA.

Hazell. P.B.R. 1989. Changing Patterns of Variability in World Cereal Production. In: J.R. Anderson and P.B.R. Hazell (Ed.). Variability in Grain Yield. Baltimore and London. The John Hopkins University Press. pp. 13-34.

MacBean. A.I. 1966. Export Instability and Economic Development. Harvard University Press, Cambridge, U.K.

Massell. B.F. 1970. Export Instability and Economic Structure. American Economic Review. 60: 618-630.

Mclntire. J. and Fussell. L.K. 1985. Sources of Millet Gram Yield Variation and their Research Implications. Paper Presented at the IFPR/DSE Workshop on Sources of Increased variability in Cereal Yields. Feldafing. Germany. November 26-29.

Mehra. S. 1981. Instability in Indian Agriculture in the Context of the New Technology. International Food Policy Research Institute. Research Report. 25. Washington, USA.

Mitra. A.K. 1990. Agricultural Production in Maharashtra: Growth and Instability in the Context of New Technology. Economic and Political Weekly. 25(52). A-146 to A-164.

Parthasarathy. G. 1984. Growth Rates and Fluctuations of Agricultural Production: A District-Wise Analysis in Andhra Pradesh. Economic and Political Weekly. 19(26: A-74 to A-84.

Raju. V.T.. D.V.S. Rao and Ravishankar. C. 1987. Spatio-Temporal Growth and Distributing of Fruit Crops in Andhra Pradesh. Indian Journal of Agricultural Economics. 42(3): 438-445.

Rao. C.H. 1975. Technical Change and Distribution of Gains in Indian Agriculture. Institute of Economic Growth. The MacMillan Co. Delhi, India.

Ray. S.K. 1983. An Empirical Investigation of the Nature and Causes for Growth and Instability in Indian Agriculture: 1950-80. Indian Journal of Agricultural Economics. 38(4): 459-474.

Sen. S.R. 1967. Growth and Instability in Indian Agriculture. Address to the 20th Annual Conference of the Indian Society of Agricultural Statistics. January. pp. 1-31.

Singh. A.J. and Byerlee. D. 1990. Relative Variability in Wheat Yields across Countries and Over Time. Journal of Agricultural Economics. 14(1): 21-32.

Urdu Science Board 1989. Encyclopedia of Agriculture and Allied Sciences. 299 Upper Mall. Lahore, Pakistan.

Wasim. M.P. 1999. Growth Rates and Fluctuations in Area. Production and Productivity: A Study of Major Crops in Sindh - Pakistan. Pakistan Economic and Social Review. 37(2): 155-168.

Wasim. M.P. 2001. Agricultural Growth and Instability in Major Crops Production: A Province Wise Analysis in Pakistan. The Asian Economic Review. 43(2): 294-314.

Weber. A. and Sievers. M. 1985. Observations on the Geography of Wheat Production Instability. Quarterly Journal of International Agriculture. 24(3): 201-211.