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THE FRUITS OF PAKISTAN: DIVERSITY, DISTRIBUTION, TRENDS OF PRODUCTION AND USE

D. Khan[1] and S.S. Shaukat[2]

[1]*Department of Botany, Govt. National College, Karachi - 74800, Pakistan.*
[2]*Department of Botany, University of Karachi, Karachi -75270, Pakistan.*

ABSTRACT

In all, some 144 types of fruits of Pakistan, belonging to 49 families and 78 genera, which are sold on shops or by the hawkers, or eaten locally or elsewhere as fun or famine food or are under research trial are described with reference to their distribution, trends of production and use. Citrus, mango, apple, banana, dates, melons, apricot, pear, peach, plum, guava, papaya and grape are the major fruits. Rosaceae, Rutaceae, and Moraceae are the three top families contributing 27, 12, and 12 types of fruits, respectively. Representative to these families, *Citrus, Prunus,* and *Ficus* are three top genera contributing 12, 10 and 7 types of fruits, respectively. Most of the genera (52) were represented by single fruit type. Some 22 genera were those, which represented 2-4 types of fruits.

Key Words: Pakistan, Fruit diversity, distribution, production, economic use.

INTRODUCTION

The word fruit comes from the Latin word *frui*, meaning *enjoy*. It commonly refers to "the juicy, sweet or tart kinds [of structures produced by plants sexually or parthenocarpically, and] that people enjoy as desserts or snacks" (Janick, 1993). Horticulturists define fruit as an edible seed-bearing structure that consists of fleshy tissue and is produced by a perennial plant. This definition, therefore, excludes many nuts and vegetables because nuts are firm and not fleshy and vegetables are annuals. It also conflicts with botanical definition of fruit (*a ripened ovary (or ovaries) of a flower*). For example, watermelons and muskmelons are botanically fruit and most people consider them so but as they grow on vines, horticulturists regard them vegetables. Many vegetables we use are fruits in strict botanical sense.

Fruit use and domestication have been occurring in our region from ancient times (Sharma, 1979). Citriculture is known from Indus valley for some 4000 years (Solley, 1997). The Proto-Australoids who displaced the Negritos (the earliest inhabitants of India) started crude form of cultivation in this region. It is said that they used fruits such as Kadali (Banana), Narikela (Coconut), Jambu (Jamun, *Syzygium*), Dadima (Pomegranate) and Bhavya (Calta, *Dillenia indica* L.), etc. in their diet (Sharma, 1979).

Fruits are not only nutritious; they are refreshing and appetizing also. They have high sugar content but they are low in protein. Fruits have little fat and no cholesterol. Olive is exception - it is oily. The fruits provide vitamins. For example, oranges and strawberry are rich in Vit. C. Water Chestnut has Vit. A, B, and C. However, over-ripe fruits can ferment resulting in enough alcohol production to trigger an allergic reaction in many cases. According to a survey carried out in January 2002, by Gallup Pakistan, an affiliate of Gallup International, the most preferred winter fruit in Pakistan are oranges and Kinnows (39%) followed by apple (25%). Amongst summer fruits, mango is the most preferred fruit (59%) followed by watermelon (12%) (http://www.gallup.com.pk or http://www. etaleem. com/ news/ gallup25jan.asp).

The climatic diversity of Pakistan is such that it allows cultivation of nearly all types of fruits- temperate, tropical and subtropical. Apple, apricot, cherry, peach, pear, plum, grape, strawberry and currant are temperate fruits; banana, mango, guava, papaya and tamarind are tropical fruits (that cannot stand even light frost) and date, fig, orange and pomegranates are subtropical fruits. The southern part of the country has tropical climate suitable for tropical fruits. The plains and plateau of the Indus basin in Sindh and Punjab are most suited for sub-tropical fruits. The mountainous areas in NWFP and Balochistan are favorable for all types of temperate fruits (Laghari, 1998). In temperate areas the elevation is important. Anwar (1999) reports that even in temperate areas, with increasing elevation the climate varies from subtropical in the foothills to warm temperate, to temperate, to alpine and arctic. For every 1000m increase in elevation, the mean temperature decreases as much as 6°C. Thus, within a relatively limited geographic region, there are widely varying temperature differences due to local site differences in elevation, exposure, slope, vegetation cover, and wind patterns. Generally, temperate fruit crops are grown from about 1000m to 2900m with the less hardy, lower chilling requiring species such as Oriental plums, Asian pears, and persimmons at the lower elevations and apples, walnuts and apricots to the highest elevations. Walnuts and apricots are grown from about 900m to 2800m but fruits have better quality at the higher elevations. Grapes and almonds are successful

to about 2150m; above this elevation there is insufficient heat to mature fruit satisfactorily.

FLORISTICS:

Some 144 types of fleshy and dry fruits were recorded from Pakistan belonging to 49 families and 78 genera. Rosaceae, Rutaceae, and Moraceae are the three top families contributing 27, 12, and 12 types of fruits, respectively. Representative to these families, *Citrus, Prunus,* and *Ficus* are three top genera contributing 10, 12 and 7 types of fruits, respectively (Table 1)**.** Most of the genera (52) were represented by single fruit type. Some 22 genera were those, which represented 2-4 types of fruits. Major fruit species are few - citrus, mango, apple, banana, dates, melons, apricot, pear, peach, plum, guava, papaya and grape.

Table 1. Families and genera of fruits with two or more than two kinds of fruits.

S.No.	Family	Number of fruits	S.No.	Genus	Number of Fruits
1.	Rosaceae	27	1.	*Prunus*	12
2.	Rutaceae	12	2.	*Citrus*	10
3.	Moraceae	12	3.	*Ficus*	07
4.	Palmae	05	4.	*Grewia*	04
5.	Rhamnaceae	05	5.	*Ziziphus*	04
6.	Anacardiaceae	05	6.	*Elaeagnus*	04
7.	Elaeagnaceae	05	7.	*Annona*	03
8.	Tiliaceae	04	8.	*Cordia*	03
9.	Sapotaceae	04	9.	*Morus*	03
10.	Cucurbitaceae	03	10.	*Pyrus*	03
11.	Boraginaceae	03	11.	*Solanum*	03
12.	Capparidaceae	03	12.	*Capparis*	02
13.	Annonaceae	03	13.	*Phoenix*	02
14.	Myrtaceae	03	14.	*Manilkara*	02
15.	Grossaluriaceae	03	15	*Ribes*	02
16.	Solanaceae	03	16	*Artocarpus*	02
17.	Ebenaceae	02	17.	*Diospyros*	02
18.	Vitaceae	02	18.	*Salvadora*	02
19.	Trapaceae	02	19.	*Cucumis*	02
20.	Euphorbiaceae	02	20.	*Phyllanthus*	02
21.	Lordizabalaceae	02	21.	Syzygium	02

AREA UNDER FRUIT CULTIVATION AND FRUIT YIELD AND PRODUCTION:

The area under fruit cultivation in Pakistan has increased almost steadily (**Fig. 1**). The cultivation of fruits in Pakistan occupied some 0.1997 million Ha of land in 1970-71, 0.6724 million Ha in 2000-01 and 0.6518 million Ha in 2002-03. Likewise the production of "all fruits" has increased from 1601.6 thousand tonnes in 1970-71 to 5741.7 thousand tonnes in 2002-03 (FBS, 2002; Govt. Pakistan, 2004). The yield / Ha of "all fruits" during last 33 years fluctuated by 5.82% only and averaged to 8.648 ± 0.0889 tonnes / Ha. Yield, since 1970-71, has been more or less asymptotic until 1995-96 and then after an increase for a short period (1996-97 to 1998-99), declined in recent years. One-way ANOVA of yield of "all fruits" for last 33 years and partitioned into three cultivation periods viz. i) 1970-71 to 1982-83, ii) 1983-84 to 1992-93 and iii) 1993-94 to 2002-03, indicated statistically significant promotion of yield only during the third (last) cultivation period (1993-94 to 2002-03) (Table 2) when it reached to 9.199 ± 0.145 tonnes / Ha. The yield remained highly consistent during the second period of cultivation (1983-84 to 1992-93 - CV: 2.51%).

The increase in "all fruits" production in Pakistan appears to be the function of both - the area of cultivation (r = 0.9909) as well as fruit-yield / Ha (r = 0.7302). The later variable, in spite of its statistical significance, is definitely less conspicuous in determining the total fruit production, as is evident from the following statistical equations. Including yield into regression analysis in addition to the area of cultivation accounts for merely 1.6% more variation in fruit production. It appears to be attributable to statistically significant but relatively low increase in yield (Range: 7.6517 to 9.8346 tonnes / Ha; averaging 8.648 tonnes / Ha; max. / min. ratio =1.285; CV = 5.82 %) compared to the increment in area under cultivation (Range: 199.7 to 672.4 thousand Ha; averaging 426.13 thousand

Ha; max. / min. ratio = 3.367; CV = 37.14 %). Compared to many countries of the world, we still produce much less fruits per unit area of land. A great deal of improvement in pomi-cultural practices, on more scientific ground, is needed to further enhance fruit production in Pakistan, to which there exists a great potential.

"All Fruits" Production (000 tonnes) = - 4212 + 8.65 Area (000 Ha) + 492 .76 Yield (tonnes / Ha) ± 75.62
t = 15.8 t = 78.7 t = 14.5
F = 6652.8, R^2 = 0.9977, adj. R^2 = 0.9975

"All Fruits" Production (000 tonnes) = - 383.12 + 9.6663 Area (000 Ha) ± 210.19
t = 3.59 t = 41.18
F = 1695.4 R^2 = 0.9820, adj. R^2 = 0.9814

Historically speaking, the year 1998-99 has been the year of maximum fruit production in Pakistan (6343.6 thousand tonnes *in toto*). Province-wise apportionment of the produce for this year is portrayed in **Fig. 2a**. Around 54% of the total produce came from the Punjab, 26.7% from Balochistan, 11.0% from Sindh and 8.4% from NWFP, which was more or less reflective to the proportionate magnitude of areas under fruit cultivation in the four provinces, respectively, during that year (**Fig. 2b**).

The yield (tonnes / Ha) of "all fruits" for last 33 (1970-71 to 2002-03) years of cultivation in the four provinces of Pakistan has shown a fluctuating trend (**Fig. 3**). One-way ANOVA of this data (Table 3) partitioned into three periods viz. i) 1970-71 to 1982-83 ii) 1983-84 to 1992-93 and iii) 1993-94 to 2002-03, indicated that yield of "all fruits" in Punjab increased statistically significantly only during third period of cultivation (1993-94 to 2002-03). During this period it averaged to 9.912 ± 0.1019 tonnes / Ha. On the other hand, during this period, the yield of "all fruits" in Sindh declined significantly (from 7.128 tonnes / Ha during second cultivation period to 6.08 tonnes / Ha in the third period). Promotion of yield in NWFP which took place during second period of cultivation could not statistically further increase during the last decade. The fruit yield in Balochistan, which increased during second period of cultivation (1980's), apparently continued to rise in the third period (1990's) as well but third period's yield could not differ significantly from the yield of the previous decade due to its sharp decline during 1999-2000 and later years presumably due to intense drought during recent years 1998-2000, particularly (Ahmed *et al*., 2003, 2004).

Irrespective of the kind of fruits, the average yield of "all fruits" for last 33 years has been maximum in NWFP (10.841 ± 0.0863 tonnes / Ha, CV: 4.5%)) followed by Punjab (8.954 ± 0.1370 tonnes / Ha; CV: 8.857%) and Balochistan (8.765 ± 0.2874 tonnes/ Ha; CV: 18.55%). It was minimum for Sindh (7.050 ± 0.1749 tonnes / Ha; CV: 14.03%). It follows from Table 4 that most of the Citrus (95%) and guava (86.6%) is produced in the Punjab. Apple, apricot, grape and Pomegranate are almost exclusively produced in Balochistan. Mangoes come from Punjab and Sindh and peaches come from Balochistan and NWFP. Dates are largely produced in Balochistan and substantially in Sindh (29.85%). Pears are almost exclusively produced in NWFP.

During recent years the area of cultivation under various kinds of fruits has declined substantially due to drought. However, the largest crop area, as per 2002-03 data, is occupied by *Citrus* (181.6 Th. Ha) followed by mango (102.8 thousand hectare), dates (77.9 thousand hectare), guava (62.7 thousand hectare) and apple (47.7 thousand hectare). Grape and apricot occupy crop area of 12700 and 13800 Ha, respectively (Govt. of Pakistan, 2004a).

The production estimates of some important fruits since 1957-58 to 2002-03 with 10-year interlude are presented in Fig. 4. Gradual increase in production with time is obvious but sharper for Citrus and mango. The production of these fruits was almost comparable until 1977-78. During next decade production of Citrus became almost double to that of mango, which is more or less maintained at present as well. This increase has been the result of increased area of Citrus cultivation in Punjab. The ratio of Citrus to mango cultivation, at present, is 1.8: 1 and likewise the production ratio of 1702.4: 1034.6 Th. tonnes is 1.65: 1. Their yields are almost comparable (Citrus: 9.374 and Mango: 10.06 tonnes / Ha). Apple, guava and dates had shown increase but at reduced level. The increase in apricot production became noticeably visible since late 1990's and in case of banana and apple since 1980's.

Pakistan in general and Balochistan in particular is in a state of drought since 1998 and a general trend of decline in fruit production is obvious through various years in available data.

However, in contrast to other provinces where promotion in fruit production in case of several fruits has taken place, production of most of the fruits in Balochistan has undergone substantial decline. This reduction in "all fruit" category amounted to 47% in 2002-03 over the production in 1998-99 (Table 5). It obviously necessitates to develop ways and means of irrigation in this hyper-arid province on priority basis in order to enhance and exploit

the fruit-producing-potential of the province to its fullest. The day the water constraints of Balochistan are removed, it should emerge as a big fruit basket of Pakistan.

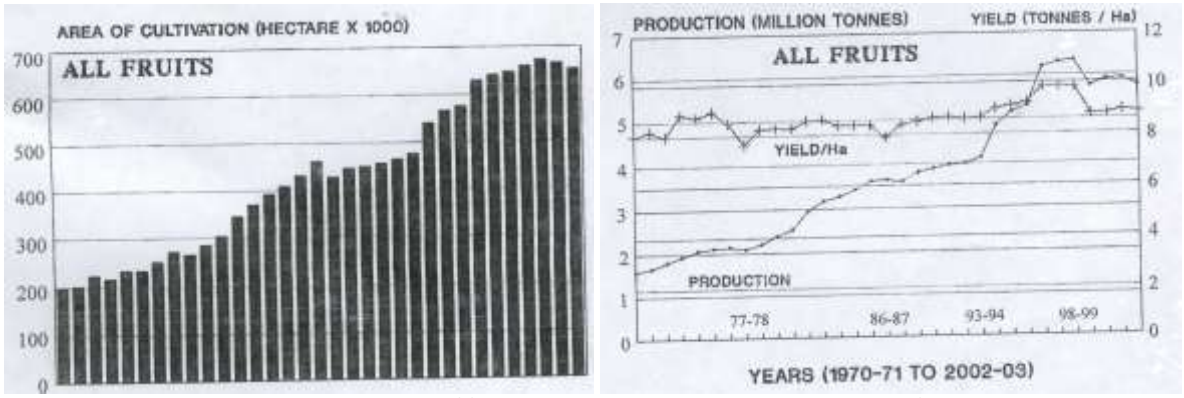

Fig.1. Area under cultivation, production and yield of fruits in Pakistan through 1970-71 to 2002-03. Data from FBS (1998 a & b and 2002, Govt. of Pakistan, 2004) . All Fruits category includes production of almonds since 1971-72 and melons, srda and garma from 1995-96 onward as well..

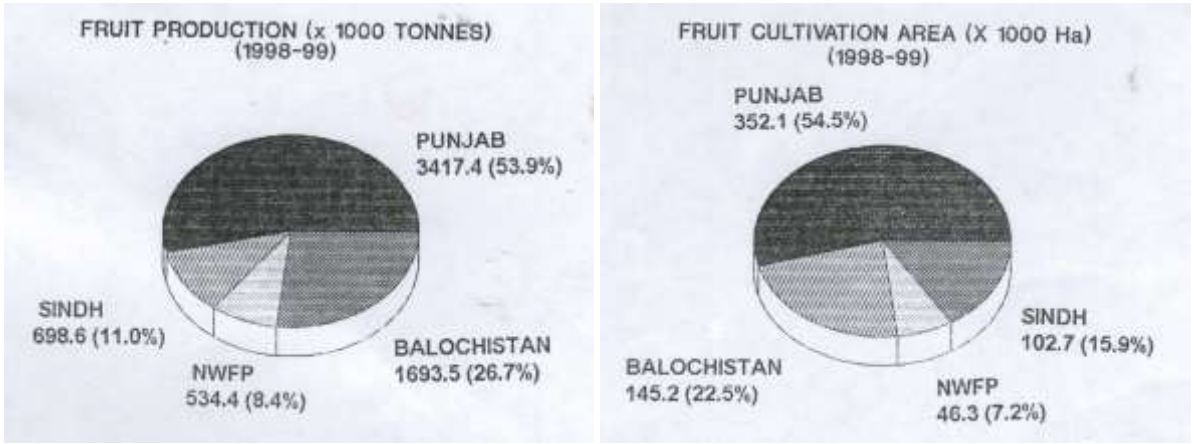

Fig.2. a=.Province-wise apportionment of total fruit production (6.3436 million tones) for the year of 1998-99, historically the year of the maximum fruit production in Pakistan. Data adopted from Federal Bureau of Statistics, Govt. of Pakistan.
b= Provinvce-wise apportionment of total area of fruit cultivation in Pakistan for the year 1998-99. Data from FBS (2002).

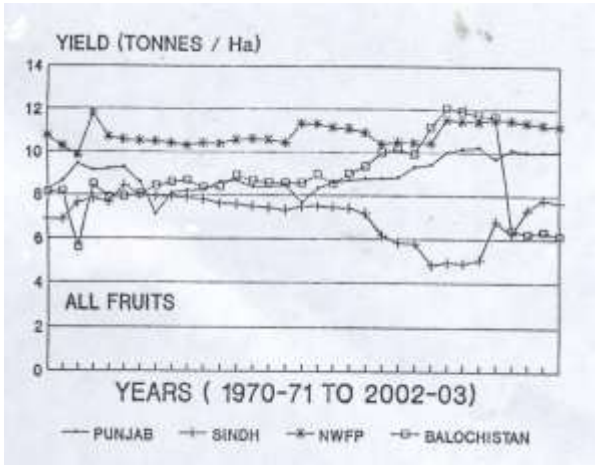

Fig.3. Yield (tones / ha) of All Fruits for the four provinces of Pakistan For the last 33 years of cultivation i.e., from 1970-71 to 2002-03.

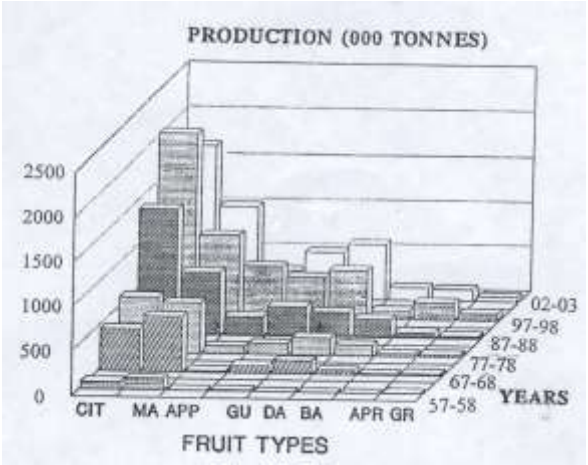

Fig.4. Trends of fruit development in Pakistan. Key to the acronyms: CIT=citrus; MA=mango; APP=apple; GU=guava; DA=dates; BA=banana; APR=apricot; GR=grapes. Data adapted From FBS (1998,2002) and Govt. of Pakistan (2004).

EXPORT:

During 1998-99, Pakistan exported fruits and vegetables of worth of Rs. 5407 million, which was substantially higher than that of the previous years. This export, however, amounted to only 1.385% of the total exports (FBS, 2000). Fruit culturing in Pakistan needs still a great deal of improvement. Fruits like almond, apricot, grape, peach, pear, plum and pomegranate are under-exploited and loquat, mulberry, olive, persimmon, etc. need special attention for their fullest commercial exploitation (cf. Khattak, 1998; Laghari, 1998).

Table 2. One-way ANOVA of yield (tones / Ha) of "All fruits" in Pakistan for last 33 years of cultivation* partitioned into three periods viz. Period I, 1970-71 to 1980-81; Period II, 1981-82 to 1991-92; Period III, 1992-93 to 2002-2003. Figures followed by the same letter are not significantly different from each other at least at $p < 0.05$ as determined by the t-test. Note the change in period-width in Table 1- B.

(A) ALL FRUITS

Period	Mean	SE	N	CV (%)
I	8.346 a	0.11880	11	4.50
II	8.452 a	0.06880	11	2.45
III	9.147 b	0.15997	11	5.24
G. Mean: 8.648			33	5.819

Range: 7.6517 – 9.8352 tonnes per Hectare

Source	SS	df	MS	F	p
Between	4.165	2	2.082	14.902	0.001
Within	4.192	30	0.140		
Total	8.357	32			

(B) ALL FRUITS

Period	Mean	SE	N	CV (%)
I	8.381 a	0.10265	13	4.243
II	8.446 a	0.07081	10	2.515
III	9.199 b	0.14511	10	4.732
G. Mean: 8.648		0.088961	33	5.819

Range: 7.6517 – 9.8352 tonnes per Hectare

Source	SS	df	MS	F	p
Between	4.367	2	2.183	16.414	0.001
Within	3.990	30	0.133		
Total	8.357	32			

*, Data for the period 1957-58 to 1969-70 not available.

DIVERSITY, DISTRIBUTION AND USE:

In the following pages the fruits produced in Pakistan are briefly enlisted. It includes fruits sold on fruit shops or by the hawkers, or wild fruits eaten locally or elsewhere as fun or famine food and those grown by the enthusiasts or are under research trial. The distribution and taxonomic data cited here are from Flora of Pakistan (e.g., Abdulla, 1973; Abedin, 1972, 1973; Akhtar, 1985; Ali, 1973a and b; Ghafoor, 1974, 1985; Ghazanfar, 1976; 1982; Grohman, 1974; Hassanuddin and Ghazanfar, 1980; Jafri, 1973, 1974 a & b; Khatoon, 1985; Malik, 1984 a & b; Nasir, 1970, 1971, 1973, 1975 a & b, 1983, 1985, 1989; Nazimuddin, 1978; Nazimuddin and Qaiser, 1982, 1983; Nazimuddin and Naqvi, 1984; Qaiser and Qaiser, 1978; Qureshi, 1972; Redcliffe-Smith, 1986; Siddiqi, 1972, Stewart, 1972, etc.). Nuts of Pakistan require to be described separately, however, some of them being sold on fruit shops and treated with fruits by FBS (Pakistan) are included here for convenience and in the botanical interest.

Family Actinidiaceae:

1. *Actinidia chinensis* Planch., Kiwi fruit, Chinese gooseberry, golden kiwi, *Actinidia chinensis* Planch. Indigenous to China where it is called Yangtao. It was named Chinese gooseberry when its cultivation started in New Zealand in 1906. It reached USA in 1960's. Fruit, which is up to 10 cm long, is edible while fresh. It has sweet taste with a touch of tartness. It contains high amount of Vit. C – more than any Citrus fruit contains. Fruit survives long after picking. After reaching full size, it takes c 2 months to ripe, which may be speeded up by ethylene. It can be stored in cold storage up to 4-6 months (Saver, 1993). Propagation of kiwi fruit using stem cuttings has been studied by Rashid *et al.* (1993) at HRI, PARC, Islamabad and it is under research for its possible cultivation in Pakistan. Kiwi fruit cultivation is stepping up in Himachal Pradesh and attracting farmers of Arunachal Pradesh, India. Fruit is useful as meat tenderizer due to the presence of actinidin - a proteolytic enzyme. It is a salad ingredient and a good source of Vit. E and K and fiber. It is sodium and cholesterol free. Its popularity is increasing world over (www.foodreference.com/html/fkiwifruit.html). A word of caution is, however, necessary.

Hydroalcoholic extract from kiwi fruit has been found to decrease testosterone and sperm count in groups of rats treated with it. The estradiol level has also been found to decrease with kiwi fruit extract. It is, therefore, recommended to use it with caution if there is a reproductive problem (Panjey-Shahin *et al.*, 2005). Anti-tumor activity of *A. chine*nsis polysaccharide from roots on murine tumor is indicated by Lin (1988). The fruit is also known to cause life-threatening allergies in some children under five (http://news.bbc.co.uk/ 2/low/health/ 2997292.stm-June 2003) - the symptoms in adults being mild. Although allergenic properties of kiwi fruit are known for last 20 years or so, it has been specifically investigated as possible allergen recently. The kiwi fruit allergies shows symptoms such as breathing difficulty, wheezing and collapse in children, besides rash, vomiting, abdominal pain, swelling of lips, tongue and face, unpleasant itching and soreness of mouth. Actinidin is the major allergen (Pastorello *et al*., 1998).

Table 3. One-way ANOVA of yield (tonnes / Ha) of "all fruits" for four provinces of Pakistan for last 33 years of cultivation partitioned into three periods viz. Period I, 1970-71 to 1982-83 (13 years); Period II, 1983-84 to 1992-93 (10 years); Period III, 1993-94 to 2002-2003 (10 years). Figures followed by the same letter are not significantly different from each other at least at $p < 0.05$ as determined by the t-test.

PUNJAB (Range: 7.1304 – 10.2318 tonnes / Ha)

Period	Mean	SE	N	CV (%)
I	8.575 a	0.17190	13	6.944
II	8.489 a	0.10965	10	3.875
III	9.912 b	0.10191	10	3.084
G. Mean:	8.954	0.13704	33	8.657

Source	SS	df	MS	F	p
Between	13.204	2	6.602	29.890	0.001
Within	6.627	30	0.221		
Total	19.831	32			

SINDH (Range: 4.8168 – 8.4264 tonnes / Ha)

Period	Mean	SE	N	CV (%)
I	7.695 a	0.11657	13	5.247
II	7.128 a	0.19030	10	8.009
III	6.134 b	0.39087	10	18.626
G. Mean:	7.050	0.17486	10	14.030

Source	SS	df	MS	F	p
Between	13.855	2	6.927	11.273	0.001
Within	18.435	30	0.615		
Total	32.290	32			

NWFP (Range: 9.8487- 11.8033 tonnes / Ha)

Period	Mean	SE	N	CV (%)
I	10.545 a	0.12248	13	4.023
II	10.837 ab	0.11922	10	3.300
III	11.229 b	0.13333	10	3.562
G. Mean:	10.841	0.08631	33	4.504

Source	SS	df	MS	F	p
Between	2.646	2	1.323	7.606	0.001
Within	5.219	30	0.174		
Total	7.866	32			

BALOCHISTAN (Range: 5.5810-12.0427 tonnes /Ha)

Period	Mean	SE	N	CV (%)
I	8.113 a	0.22695	13	9.690
II	9.026 b	0.19321	10	6.422
III	9.351 b	0.85745	10	27.509
G. Mean:	8.765	0.28737	33	18.547

Source	SS	df	MS	F	p
Between	9.642	2	4.821	1.865	0.1725
Within	77.565	30	2.586		
Total	87.207	32			

Family Anacardiaceae:

1. *Mangifera indica* L., Mango**,** Aam, "the king of the tropical fruits". Large-scale cultivation in plains and lower foothills of Pakistan. Cultivated in the Indo-Pak sub-continent for last 4000-6000 years. In 327 BC, Alexander of Macedonia is said to have spotted a mango garden in the Indus Valley during his invasion of this area (Nazri, 2003). There are around 1000 cultivars of mango the world over (Usher, 1984). Chadha (1995) reports 1000 mango cultivars alone in India. There is more cultivated diversity in areas where monoembryonic forms are grown. There are three types of mango cultivars: 1) unimproved cultivars (high disease susceptibility, high fibre content,

undesirable external colour, poor shelf life, and turpentine flavour), 2) improved tropical cultivars and 3) improved subtropical cultivars (fibreless fruit, outstanding eating qualities and no turpentine flavour). Some 250 varieties of mango are said to be grown in Pakistan. Mango may be of two types: a) Tukhmi (grown by seeds) and b) Qalmi (grafted). Sindhri, Chowssa, Siroli (Bombay), Langra, Anwar Rittol, Sonnaro Dasheri, Safeda, Samar Bahisht Fazli**,** and Neelam are some of the best varieties of qalmi mango in Pakistan. Other varieties are Baiganphali, Totapari, Gopal Bhog, Alfonso, and Pari of Bombay (Khan, 1998), which are less popular. Zafran, Swarnreca, salehbahi, Chotai, Chota Padam are some less known varieties. There are 70 grafted varieties grown in Sindh. It is surprising that Pakistani mango was introduced in European countries such as Romania, Holland, West Germany, France, Italy, Denmark and Norway as late as 1983 (Nazri, 2003).

Table 4. Per cent provincial contribution to total national production of various fruits for the year 1998-99, the year of maximum fruit production in Pakistan.

FRUITS	Punjab	Sindh	NWFP	Balochistan
Citrus	95.04	1.89	2.12	0.95
Mango	63.60	34.33	0.25	1.81
Banana	17.34	67.23	13.11	2.33
Apple	0.44	0.03	16.95	82.69
Guava	86.63	5.68	6.51	1.17
Apricot	0.26	-	10.35	89.41
Peach	2.48	-	27.54	69.98
Pears	5.87	-	91.73	2.40
Plums	0.74	-	47.58	51.67
Grapes	-	-*	2.64	97.36
Pomegranate	14.70	-	2.54	82.75
Dates	13.22	29.85	0.90	56.03
All fruits	53.87	11.01	8.42	26.70

*, Excluded for being less than 0.5 tonne.

Mango is used in several ways - eaten ripe in hand, as pickles, chutnies, drinks, jam, jellies, nectar, etc. Dehydrated slice of mango are called amchur. The nutritional value of mango is high. Hundred gram of ripe mango pulp contains protein: 0.36 - 0.40g, fat: 0.3 – 0.53g, carbohydrate: 16.2 - 17.2g, fiber: 0.85 - 1.06g, Ca: 6.1-12.8 mg, P: 5.5 – 17.9 mg, Fe: 0.20 - 0.63 mg, etc. Ascorbic acid content may vary from 7.8 to 172.0 mg. The peel constitutes around 20 –25% of the total fruit. Peel can be utilized as source of pectin – average yield being c 13% on dry weight basis (Morton, 1987).

Mango kernel consists of a number of aminoacids – alanine, arginine, aspartic acid, cystine, glutamic acid, glycine, histidine, isoleucine, lysine, methionine, phenylalanine, proline, serine, threonine, tyrosine and valine – but at level lower than wheat. Kernel flour contains protein: 5.56%, fat: 16.17%, carbohydrate: 69.2% and ash: 0.35%. Kernel flour value, when tannins are absent, is nearly equal to that of rice (Morton, 1987).

Yellowish resinous exudates from base of stalk of fruit are potent skin irritant capable of blistering skin. During blooming of mango trees, itching around eyes and facial swelling, and respiratory difficulty even in absence of pollens is attributed to vapouriozed essential oil of the flowers, which contains the sesquiterpene, alcohol, mangiferol and the ketone, mangiferone.

Most diseases of mango are due to fungi and bacteria. Prakash (2003) have discussed in detail some 25 diseases of mango caused by algae, fungi lichens and bacteria. According to M. Mithal Jiskani, Asstt. Professor, Dept. Pathology, Sindh Agriculture University, Tandojam (2005), all mango varieties have been released between 1949-1965. These varieties are more susceptible to diseases. According to Jiskani (2005) following diseases of mango have been recorded in Pakistan (www.pakissan.com).

Powdery Mildew:	*Oidium mangiferae*
Sooty Mould:	*Capnodium romatum or Tripospermum aconum*
Fruit Rot:	*Aspergillus niger*
Leaf blight:	*Pestaloptiopsis mangifeare*
Anthracnose:	*Glomerella cingulata- Colletotrichum gloeosporiodes*

Stem blight or Die Back:	*Diplodia spp.*
Root Rot:	*Rhizoctonia and Fusarium spp*.
Tip die disease:	*Fusarium equiseta*
	Alternaria alternate
	Aspergillus niger
	Rhizopsis nigricans
Leaf blight:	*Erwinia mangiferae*
Malformation:	Cause not known [*Fusaium subglutinans- see www.nationalpak.com*]

Table 5. Percent promotion or reduction in production of various fruits in the four provinces of Pakistan for the year 2002-2003 over 1998-99, the year of maximum production of fruits in Pakistan.

FRUITS	Punjab	Sindh	NWFP	Balochistan
Citrus	- 8.23	- 21.31	- 3.55	- 25.99
Mango	+ 17.39	+ 6.77	+ 39.13	- 31.93
Banana	- 10.37	+ 77.52	- 1.61	+ 40.09
Apple	+ 38.46	- 50.00	+ 10.99	- 58.63
Guava	+ 7.74	+ 115.41	+ 9.51	- 30.90
Apricot	- 20.00	-	+ 23.35	- 38.51
Peach	+ 8.33	-	+ 352.63	- 55.62
Pears	- 9.09	-	- 12.79	- 44.44
Plums	- 16.66	-	- 1.82	- 36.21
Grapes	-	-*	+ 15.00	- 31.84
Pomegranate	- 7.14	-	+ 59.25	- 21.52
Dates	- 34.91	+ 47.21	+ 24.62	- 41.21
All fruits Excluding almonds	-	-	- 6.21	- 47.46
All Fruits Including almonds	+ 0.05	+ 29.96	- 5.54	- 46.27

*, Excluded for being less than 0.5 tonne. "All Fruits" category from 1995-96 onwards includes melons, sarda, and garma as well. FBS includes almonds in "all fruits" category since 1971-72, the production of which varied from 4.0 to 50.1 (x 000 tonnes) a year (average yield / Ha = 3.9078 ± 0.1441 tonnes).

Mango diseases in Pakistan cause loss of worth of rupees one billion. According to Haji Khan Kerio, DG Agric. Res. Sindh, around 0.30 million trees of mango on 0.1 million acre of land are sick i.e., approximately 3 trees per acre are suffering due to one or more diseases (www.onlypunjab.com). A new disease "sudden death of mango tree" has recently appeared in Sindh, which is, however, rated as the combined attack of anthracnose, stem blight or die back, root rot, tip die back leaf blight bacterial leaf spot and malformation (Jiskani, 2005). It necessitates use of healthy seeds; avoidance of intercroppinmg and mix cropoping, irrigarion at required time, use of proper and balanced fertilizers and avoidance of high nutrient doses, proper sanitation, treatment with broad spectrum fungicides in combination with insecticides in consultation of pathologists and entomologists (Jiskani, 2005). Mango needs genetic breeding.

Mango is the second largest fruit crop of Pakistan. Its cultivation has consistently increased since 1957-58 and likely the production of fruit reached to 1702.4 thousand tonnes in 2002-03 from merely132.1 thousand tonnes in 1957-58. The yield of mango has fluctuated around 28.96% in early years of its cultivation (until 1968-69). Then it became progressively consistent. During last 46 years the yield averaged to 9.311 ± 0.2178 tonnes / Ha **(Table 6)**. As indicated by one-way ANOVA of the yield, no appreciable improvement in mango yield has, however, taken place since late sixties when it had attained a value of 10.08 ± 0.212 tonnes / Ha with an increase of 31.83% over earlier decade's average yield (7.646 ± 0.7382 tonnes / Ha). Mango production (1957-58 to 2002-03) related more closely with the area of cultivation (r = 0.9679) than yield /Ha (r = 0. 6781).

Mango Production (000 tonnes) = - 402.798 + 9.476 Area (000 Ha) + 43.575 Yield (tonnes / Ha) ± 20.50

t = 20.4 t = 56.05 t = 18.14

$F = 2626.5$, $R^2 = 0.9927$, adj. $R^2 = 0.9924$

2. ***Pistacia vera*** L., **Pistachio**, Pistache, Pista, Green Almond, a tree cultivated in Queetta, Zhob, and Kalat Divisions of Balochistan. It grows well above 900m.

Pistachio tree begins bearing in 5-8 years, but full bearing is not attained until the 15th or 20th year. According to Statistical Wing, Balochistan's Agricultural Directorate (1988-89) pistachio yield in Balochistan amounts to c. 3.9 tonnes/Ha. A hard gray shell that is either bleached white or dyed red for commercial purpose covers each nut. Under the shell a thin purple skin covers the nut. Pista kernel is finely textured and very delicious. It has mild flavour and is used in ice creams and confectionaries. Also eaten salted and roasted as dessert. It is considered to be digestive, sedative and tonic. It contains 53.5% fat, 19.8% protein and 16.2% carbohydrates. Pista oil turns rancid easily (NISC, 1998b). *Alternaria, aspergillus, Botrytis, Phomopsis, Phytophthora*, and *Rhizoctonia* are disease-causing fungi in Pistachio.

3. *Rhus javanica* L., Titar, grows in Himalayan ranges from 762 - 1981m. The acidic pulp of the fruit (drupe) is medicinal and also eaten (in Nepal and Sikkim).

4. *Rhus typhina* L., Staghorn Sumac or Sumac, velvet Sumac, Sparingly cultivated in NWFP and Punjab (Nasir, 1983). Fruit used to make beverage – "Sumac-ade" or "Indian lemonade" or "Rhus Juice" in Eastern North America (www.biologydaily.com).

5**.** *Spondias mangifera* Willd. (syn. S. pinnata Kurz.), Ambara, Ambra, Amra, Hog Plum, Indian Mombin and Andman mombin, in salt range and sub-Himalayan tract (Stewart, 1972). Drupe delicious, juicy with highly acidic flesh used in sweets or eaten fresh or pickled (www. cresentbloom.com/plants/specimen/SO/spondias%20pinnata. Htm). Rated to be under-exploited (http;//bodd.ef.ac.uk/BotDermFodder/BotDermA/ANAC.html). It is rich in vit. A. (Arora and Pandey, 1996).

Table 6. One-way ANOVA of yield (tonnes / Ha) of various fruits in Pakistan for last 46 years of cultivation partitioned into five periods viz. Period I, 1957-58 to 1966-67; Period II, 1967-68 to 1976-77; Period III, 1977-78 to 1986-1987; Period IV, 1987-88 to 1996-97; and Period V, 1997-98 to 2002-03. Mean figures followed by the same letter are not significantly different from each other at least at $p < 0.05$ as determined by the t-test.

CITRUS (Range: 6.051 – 12.025 tonnes / Ha)

Period	Mean	SE	N	CV (%)
I	9.375 a	0.71345	10	22.85
II	10.546 a	0.25050	10	7.13
III	9.588 a	0.21156	10	6.62
IV	9.584 a	0.15888	10	4.97
V	9.685 a	0.17293	6	3.99
G. Mean:	9.762	0.17923	46	12.40

Source	SS	df	MS	F	p
Between	8.376	4	2.092	1.464	0.231
Within	58.575	41	1.429		
Total	66.942	45			

MANGO (Range: 5.524 – 12.072 tonnes / Ha)

Period	Mean	SE	N	CV (%)
I	7.646 a	0.73820	10	28.96
II	10.087 b	0.22730	10	8.21
III	9.588 b	0.21156	10	3.26
IV	9.555 b	0.14640	10	4.59
V	10.006 b	0.14042	6	3.14
G. Mean:	9.311	0.21775	46	15.687

Source	SS	df	MS	F	p
Between	37.476	4	9.438	6.406	0.001
Within	60.402	41	1.473		
Total	98.153	46			

BANANA (Range: 1.8180 – 13.7060 tonnes / Ha)

Period	Mean	SE	N	CV (%)
I	6.933 ab	1.40210	10	60.66
II	9.041 ab	0.18260	10	6.06
III	8.730 ab	0.03911	10	1.34
IV	5.786 abc	0.8522	10	44.18
V	4.229 abc	0.21116	6	11.17
G. Mean:	7.299	0.42711	46	39.91

GUAVA (Range: 5.782 – 10.336 tonnes / Ha)

Period	Mean	SE	N	CV (%)
I	7.775 a	0.53276	10	20.58
II	6.649 a	0.23740	10	10.71
III	7.255 ab	0.05771	10	2.39
IV	7.626 abc	0.07099	10	2.79
V	8.228 abcd	0.07868	6	2.14
G. Mean:	7.444	0.14773	46	13.049

Source	SS	df	MS	F	p
Between	130.945	4	32.736	5.441	0.0013
Within	246.678	41	6.017		
Total	377.624	45			

Source	SS	df	MS	F	p
Between	11.800	4	2.150	3.883	0.009
Within	31.557	41	0.770		
Total	43.357	45			

APPLE (Range: 2.143 – 13.242 tonnes / Ha)

Period	Mean	SE	N	CV (%)
I	6.038 a	1.03300	10	51.33
II	7.692 a	0.24872	10	9.70
III	9.574 b	0.14329	10	4.49
IV	11.415 cd	0.40072	10	10.53
V	9.116 abc	1.2404	6	30.40
G. Mean:	8.739	0.39766	46	30.48

APRICOT (Range: 1.909 – 16.431 tonnes / Ha)

Period	Mean	SE	N	CV (%)
I	5.605 a	0.83089	9	41.928
II	9.376 b	0.83430	10	26.69
III	11.362 c	0.14550	10	3.840
IV	13.698 d	0.55060	10	12.060
V	11.607 bcd	1.27294	6	24.529
G. Mean:	10.321	0.51935	45	33.378

Source	SS	df	MS	F	p
Between	163.413	4	40.853	10.41	0.001
Within	160.968	41	3.926		
Total	324.381	45			

Source	SS	df	MS	F	p
Between	343.886	4	85.972	18.084	0.001
Within	190.161	40	4.754		
Total	534.047	44			

PEARS (Range: 5.25 – 18.333 tonnes / Ha)

Period	Mean	SE	N	CV (%)
I	12.639 a	1.54085	9	34.482
II	8.999 b	0.68950	10	22.990
III	11.081 a	0.21584	10	5.85
IV	12.403 a	0.11652	10	2.82
V	12.716 a	0.07639	6	1.343
G. Mean:	11.442	0.39708	45	23.0205

POMEGRANATE (Range: 6.591 – 16.492 tonnes / Ha)

Period	Mean	SE	N	CV (%)
I	9.004 a	0.37821	10	12.60
II	12.425 b	0.63138	10	15.25
III	11.508 b	0.51776	10	13.54
IV	12.845 b	0.79815	10	18.64
V	11.999 ab	1.5903	6	29.65
G. Mean:	11.519	0.37846	46	22.040

Source	SS	df	MS	F	p
Between	92.873	4	23.218	4.2345	0.006
Within	219.320	40	5.483		
Total	312.193	45			

Source	SS	df	MS	F	p
Between	90.397	4	22.599	4.496	0.004
Within	206.089	41	5.027		
Total	296.485	45			

Family Annonaceae:

1. *Annona muricata* L., Soarsop, Graviola, native of tropical America and W. Indies. Introduced in Sindh. Highly valuable plant. It is the largest fruit of all the *Annona* species - sometime weighing up to 4.5 Kg. The pulp is pleasantly sour and aromatic. Fruits are used for making sherbets. Seeds are insecticidal. Whole plant is medicinal. Seeds' annonaceous acetogenins are well documented to be anti-tumorous, antiparasitic, insecticidal, and anti-microbial (www.raintree.com/index.html ; tropical Plant Database). Studies have shown that these acetogenins are superb inhibitors of enzyme processes that are only found in membranes of cancerous tumour cells. That is they are toxic to cancer cells only and have no activity on healthy cells (Sesaki *et al*. 1998; Alali, *et al*. 1999; Yuan, *et al*. 2003; Ancuceanu and Istudor, 2004).

2. *Annona reticulata* L., Bullock's heart (custard Apple in W. Indies), occasionally cultivated in Sindh. The fruit

is inferior in taste. The unripe fruits are anthelmintic. Seeds and leaves are insecticidal.

3. *Annona squamosa* L., Sharifa, Custard Apple (Sugar Apple or Sweet Sop), cultivated in Sindh and the Punjab. Morton (1987) reported 88.9 –95.7 calories / 100g fresh wt. of edible part of fruit. The pulp contains carbohydrates 19.16 – 25.19%, protein 1.53 – 2.38 and fat 0.26-1.10 % of fresh weight. It is a good container plant

PLUMS (Range: 7.727 – 19.703 tonnes / Ha)

Period	Mean	SE	N	CV (%)
I	17.409 a	1.96090	5	22.53
II	12.115 b	0.84867	10	21.01
III	11.432 b	0.30953	10	8.12
IV	11.387 b	0.18852	10	4.97
V	9.537 b	0.68596	6	16.08
G. Mean:	12.039	0.46684	41	24.524

Source	SS	df	MS	F	p
Between	189.753	4	47.438	10.186	0.001
Within	167.664	36	4.657		
Total	357.416	40			

GRAPES (Range: 3.429 – 11.875 tonnes / Ha)

Period	Mean	SE	N	CV (%)
I	7.355 a	0.77869	7	25.932
II	10.555 b	0.31854	10	9.054
III	10.452 b	0.27542	10	7.905
IV	8.802 a	0.l64710	10	22.056
V	5.659 c	0.91608	6	36.200
G. Mean:	8.919	0.36118	43	26.243

Source	SS	df	MS	F	p
Between	131.301	4	32.825	11.961	0.001
Within	104.290	38	2.744		
Total	235.591	42			

PEACH (Range: 4.50 – 13.08 tonnes / Ha)

Period	Mean	SE	N	CV (%)
I	8.131 a	0.89780	10	33.13
II	8.079 a	0.38526	10	14.31
III	8.598 a	0.24009	10	8.38
IV	10.115 a	0.33093	10	9.82
V	8.136 a	0.81864	06	22.50
G. Mean:.718		0.26927	46	20.875

Source	SS	df	MS	F	p
Between	29.036	4	7.259	2.459	0.0605
Within	121.056	41	2.953		
Total	150.092	45			

DATES (Range: 4.50 – 9.558 tonnes / Ha)

Period	Mean	SE	N	CV (%)
I	7.246 a	0.45678	9	17.83
II	7.798 a	0.13805	10	5.31
III	7.700 a	0.23762	10	9.26
IV	7.039 a	0.11398	10	4.86
V	8.028 a	0.33648	6	9.37
G. Mean: 7.528		0.12716	45	11.205

Source	SS	df	MS	F	p
Between	5.629	4	1.407	2.133	0.944
Within	26.385	40	0.660		
Total	32.014	44			

NOTE: 1957-58 data for apricot, date and pear being zero was excluded from ANOVA);
In case of grapes three-year data for 1957-58, 1958-59, 1959-60 excluded from ANOVA due to zero value in 1959 60.

and may be grown in 10-15 gallon tub and still gives good number of delicious fruit (www.tradewindsfruit.com/ sugar_apple.htm). Seeds are effective against cules larvae (Prasad *et al*., 1995).
Annonas are regarded as valuable but neglected crops by Mahdeem (1994) on account of their diversity and degree of adaptation to different environment and valuable material for hybridization, selection and propagation studies.

Family Apocynaceae:

1. *Carissa carandus* L., Karanda, Kakronda or Karaunda or Garna, wild and sometimes cultivated in gardens for its fruits sold at few fruit and vegetable shops occasionally. The unripe fruits are sour and astringent and used for making pickles. The ripe fruits are sweet, edible (Nazimuddin and Qaiser, 1983) and suit for tarts, puddings and jellies.

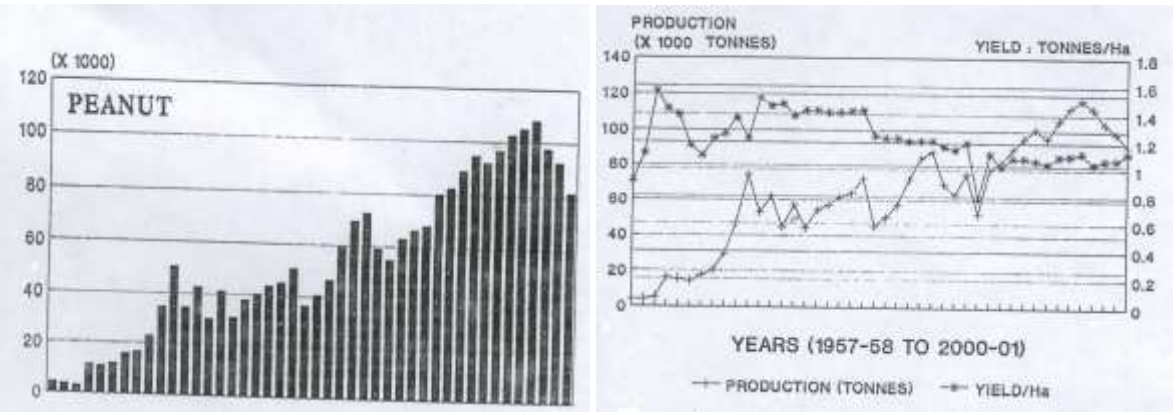

Fig.5. Area under cultivation, total production and yield/ha of peanut in Pakistan through 1957-58 t 2000-01. Data adapted from FBS (1998 a and b and 2002).

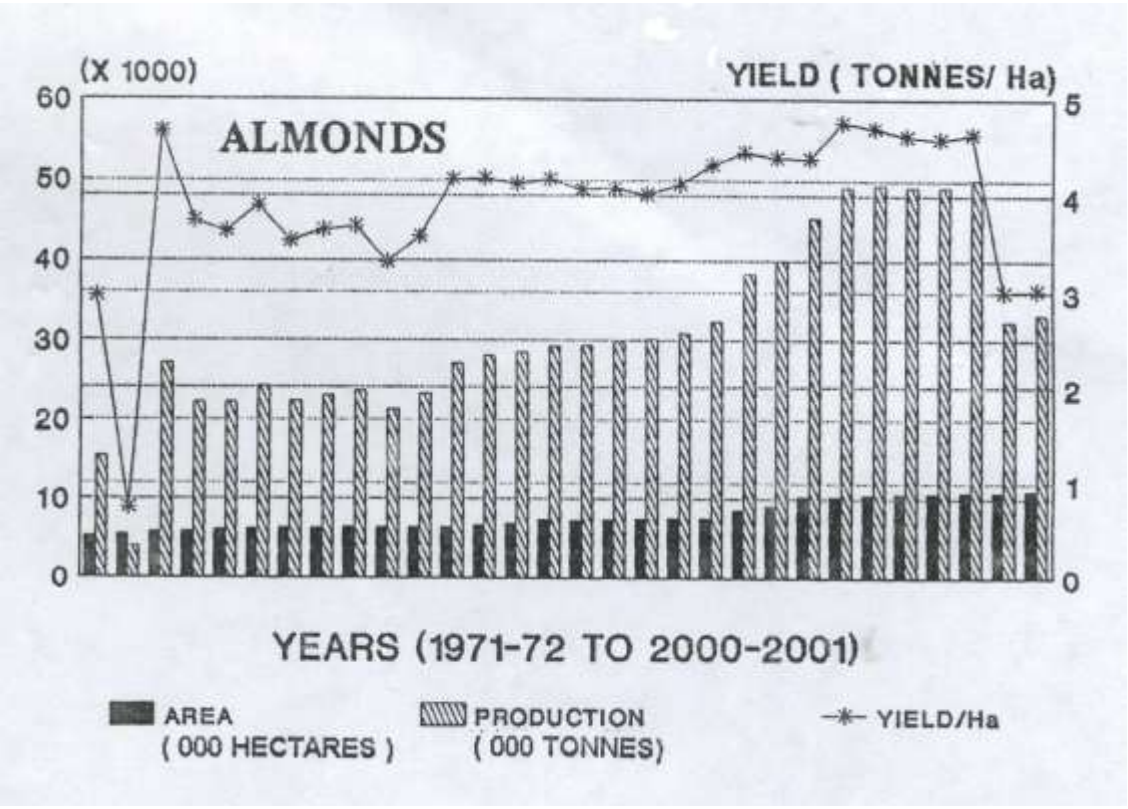

Fig.6. Area under cultivation, total production and yield/ha of almonds in Paksiatn through 1971-72 to 2000-01. Data adapted from FBS (19998a & b and 2002).

Family Averrhoaceae:

1. *Averrhoa carambola* L., Kamrukh, Kamaranga (India), Carambola, Star fruit, cultivated in some Sindh and the Punjab gardens. Fruit oblong, 5-6 angled, around 6-12 cm long and 6 cm wide. It is bright golden in colour and has sweet, estery, and fruity odour. It tastes crunchy, acidulate and tangy. Two types of varieties are there. One with small fruits, which are acidulate and contain high concentration of oxalic acid. Other variety gives larger fruits, which are sweet and contain low amounts of oxalic acid. The fruit is used in salads, jam and jellies. Good source of Vit. A & C. The juice yield of fruit is 76%. The fruit contains 50% reducing sugars on dry wt. basis (www.dessert tropicals.com/plants/oxalidaceae/ Averrhoa_Carambola.html). The fruit juice is rated suitable as substrate for wine fermentation if properly modified because fruit juice is highly acidic (pH: 2.20) and its sugar content is around 2.55%. Most brewers' yeasts require pH range of 4-6 and sugar content about 10% for adequate alcohol production

(Anim and Tano-Debrah, 2004) (www.ajol.info/ viewerside.php?id=19855&jid=110&layout=abstract). High concentration of oxalic acid in fruit juice involves health risks and necessitates further research. The fruit is said to be laxative, antiscorbutic, febrifuge, antidysenteric and antiphlogistic. The fruit juice is good remedy for bleeding piles and is useful in relieving thirst and febrile excitement (PID, 1985). Maximum diversity of species found in Malaysia.

Family Berberidaceae:

1. *Berberis brandisiana* Ahrendt., Shugloo, Pallas valley. Fruit is edible**.** **(**www.siu.edu/~ebl/leaflets/zafeer/.htm).

2. *Berberis lycium* Royale**,** Kwaray, Common in Dir Chitral, Gilgit, Murree, Gokand valley (Buner district), poonch. Up to 2300m. Fruit collected for sale by locals. There are three varieties found in Kasmir – viz. var. lycium, var. virescens, and var. fascicularis. Fruit edible (Stewart, 1972; Khan *et. al*., 2003).

Family Boraginaceae:

1**.** *Cordia gharaf* (Forssk.) Ehrenb. ex Asch. Gondni, Gondi, Cordia, Grows in Sindh, Balochistan and the Punjab. Fruits are eaten locally.

2. *Cordia myxa* L. Sebestan plum, Assyrian plum, Sapistan (Lasora), wild and cultivated in gardens and along roadsides in Sindh and Punjab. Fruits are eaten locally and as medicine. Fruits show anti-inflammatory and antioxidant activity and effectiveness in colitis (Al-Wadi *et al*., 2001).

3. *Cordia sebestena* L., Geiger tree fruit, sparingly cultivated for its attractive cyme or large showy flowers. The fruits are edible.

Family Bromeliaceae:

1. *Ananas comosus* Merr., Ananas, Pine-apple**,** Fruit is Juicy, sweet and fragrant. Eaten as dessert or in salads. Generally imported from Bangladesh and Sri Lanka. Some people grow it in pots in Karachi. Mr. Humayun, a graduate student of Govt. National College, Karachi, grew it successfully in pots on roof of his house.

Family Burseraceae:

1. *Garuga pinnata* Roxb., Kharpat, Mandvi, Introduced and cultivated in Lahore. The fruit is a drupe - eaten raw, pickled or cooked. Young shoots and leaves are used as fodder. Famine plant (www.hort.purdue.edu/newcrop/faminefoods/ff_ families/BURSERACEAE.html)

Family Cactaceae:

1. Opuntia ficus-indica (L.) Mill., Prickly Pear, Barbary Pear, Cacrus pear, Indian Pear, Indian Fig, Tuna fig, Mission Cactus, Nopal, Nopalito, Anar Phali, Chittarthohar, Nag Phani, is native to Mexico. It is distributed in arid areas of Pakistan. Fruit juicy and sour in taste and eaten fresh. In Pakistan, fruits are collected from Northern areas and available in market from October to January (Mirza and Bukhari, 1996). It is a hardy multipurpose plant reaching to 2m in height – tolerant to intense drought, and heat on poor soils. Mexicans have used it for long as food, fodder and medicine. *O. ficus-indica* var. *inermis* is spineless. Cladodes or pads are reported highly palatable to livestock when cut into small pieces. It is nutritionally good when mixed with straw of cereals (IFAD. www. ifad.org/Irkm/tans/6.htm). Fruit extract is powerful anti-oxidant and radical scavanging, helpful in gastric ulcer prevention, exhibits blood lipid and cholesterol lowering potential and ease hangover. Nopal fruit contains a number of flavinoids such as Kaempferol, quercetin, kaempferol 3-methyl ether, narcissin, (+)-dihydroxykaempferol (aromadenrin), (+)-dihydroxyquercetin (taxifolin), and eriodictyol – strong antioxidants. Fruits' chemical components are also considered to act in the bowel to prevent fat and excessive sugars from entering the bloodstream (www.saysahelian.com/pricklypear.html). Piga (2004) has reviewed the nutraceutical and functional importanbce of this fruit, which contains protein 0.2 – 1.6%, fat 0.09-0.7%, and total sugars 10-17% of the pulp and Vitamin C 1-41 mg per 100g of fruit. It contains a number of aminoacids but proline (1768.7 mg / L of fruit juice), glutamine (574.6) turine (572.1), serine (217.5), and alanine (96.6) in major quantities. Some betacyanins and betaxanthins also occur.

Family Caeselpiniaceae:

1**.** *Tamarindus indica* L., Tamarind, Imli, cultivated in Sindh and the Punjab. Plant is highly medicinal. Ripe fruit pulp contains proteins (3.1%), carbohydrates (67.4%) and fat (0.10%). It has calcium (35 –170 mg/100g fresh wt) and Phosphorus (54 – 110 mg/100g fresh wt) (Morton, 1987).

Family Capparidaceae:

1**.** *Capparis decidua* Edgew., Karil, Wild Caper, Delha, , Karir, Grows wild throughout dry and hot regions of Pakistan. Fruit edible and pickled (Mirza and Bokhari, 1996).

2**.** *Capparis spinosa* L., Kabar, Khawarg, Panetro, grows wild. Fruits and buds are sometimes pickled.

3**.** *Crataeva adansonii* Dc. ssp. *odoro* (Ham.) Jacobs., Barna, Cultivated. Pallas valley. The fruit is edible.

Family Caprofoliaceae:

1. V*iburnum cotinifolium* D. Don., Aoon, Pallas valley. In Gokand valley (district Buner), it is called chamayarddi (Khan *et al*., 2003). Fruit edible (www.siu.edu/~ebl/ leaflets/zafeer.htm); Khan *et al.,* 2003).

2. *Viburnum nervosum* D. Don., Juglote, Jhal, Shrub up to 2 m tall (www.esveld.nl/htmldiaen/v/ vinerve.htm). Fruit edible (www.siu.edu/~ebl/leaflets/zafeer.htm).

Family Caricaceae:

1. *Carica papaya L.*, Papita, Papaya, cultivated in Sindh and the Punjab. It does not stand frost. Papain, a proteolytic enzyme is prepared from latex of the immature fruit. fruit contains 7-9% sugar and good amount of Vit.C.

Family Caryophyllaceae:

1. *Silene conoidea* L., Manghotay, Common weed in grain fields from plains to 3500m (Stewart, 1972). Manghotay fruit edible (Khan *et al*., 2003).

Family Combretaceae:

1. *Terminalia catappa* L., Tropical almond, Myrobalan, Demerara, Desi Badam, A large deciduous tree cultivated in Karachi. Fruit is edible. The kernel resembles almond or fresh filbert in flavour. The air-dried kernel has fat around 52%, protein 25.4% and sugar 5.9% (PID, 1989).

Family Cucurbitaceae:

1. *Citrullus lanatus* (Thumb.) Mats. & Nakai, Tarbuz, Watermelon, Hindvana, Mattira, widely cultivated up to around 5000 feet, besides being escape sometimes. Fruit containd mostly water (93-95%), carbohydrate 5% and protein 0.5 –1.0% (www.mpiz-kaeln.mpg.de/pr /garten/schan/citrullus lanatus/Water_Melon.html)

2. *Cucumis melo* L. var. *melo*, Khurbuza, Muskmelon, sweet melon, , widely cultivated in Sindh, Balochistan and up to 2400m in Baltistan. 'Sarda', commonly cultivated in Balochistan for its luscious fruits, is treated as a variety of *C. melo* L. (CSIR, 1950), which is also grown up to 2000m in Himachal Pradesh, India (NISC, 2001). The variety 'Garma' closely resembles sarda. There are several compounds, which provide aroma to muskmelon. Esters, alcohols and a sulphur-containing compound (ethyl 3-(methylthio) propionate) appear to be the most important contributors to the essence aroma. Aromatic profile of the fruit of *C. melo* var. Athena cultivar indicated some 38 components in puree of fresh fruit and 53 components in the aqueous essence (Jordon *et al.,* 2001).

Temperature is reported to play important role in yield, fruit appearance and fruit quality characters of *C. melo*. In 23 cultivars investigated by Ventura and Mendlinger (1999), treatment of plants with lower night temperature significantly affected them. Plants grown under low temperature showed extended fruiting-period, more fruit, higher total yield, but smaller and lighter fruits than those plants, which were grown under high temperature in heated green house with temperature around what is employed in commercial cultivation in Israel. Suboptimal low temperature when used appropriately may aid in improving fruit quality as fruits under low night temperature had significantly more netting and higher amounts of total soluble sugars, sucrose and fructose.

Irrigation with saline water (EC: 4 $dS.m^{-1}$) is reported to bring 16% fruit yield reduction when applied from 14 DAT (days after transplantation). This water caused merely 9% reduction in fruit yield when applied from 71 DAT. At salinity of 8 $dS.m^{-1}$, reductions were 56 and 16%, with treatment insuing 14 and 71 DAT, respectively. Early salinity treatment reduced number of fruits and later commencing treatment reduced the individual fruit mean weight (del Amor *et al.* Yield response of soilless melon and tomato to different irrigation water qualities. Int. Soc. Hortic. Sci. Acta Horticulture 559. Int. Symp.on protected cultivation in mild winter climaters: Current Trends for Sustainable Techniques. http:// www.actahort.org) (seen Oct. 2005).

2. *Cucumis melo L. ssp. Agrestis* var. *momordica* (Roxb.) Cogn., Phunt, Wild melon, phut, phoot, Wild in Khrif crops and cultivated in Sindh and Punjab.

According to Bureau of Statistics of Punjab (2000) production of melon in the Punjab amounted to 376,000 tonnes. According to agricultural statistics, Balochistan produced 175180 tonnes of melons (watermelon, sarda & garma) in 1988-89 corresponding to a yield of 15.028 tonnes / Ha. Garma and Sarda produced in Quetta, Zhob and

Kallat divisions amounted to 28530 and 21450 tonnes with respective yields of 13.326 and 13.857 tonnes / Ha. Yield of melons was always much higher in irrigated areas compared to that in un-irrigated areas (Agric. Stat., 1988-89).

Family Dilleniaceae:

1. *Dillenia indica* L., Chalta, Ramphal, Handapara, Native of tropical Asia. Being dispersed by elephant so also called elephant Apple. Stewart (1972) recorded it to be cultivated in Lahore. The fleshy sepals have an agreeable taste and are eaten raw, cooked to make pickles or chutnies or in curries (www.tropical.com). The fruit has similar taste and flavour to unripe apple. It is said to have tonic and laxative properties and is used for abdominal pains (CSIR, 1952). It can survive short burst of frost to 28-32 ^{o}F. It is rated as under-exploited.

Family Ebenaceae:

1. *Diospyros kaki* (syn. *D. chinensis)*, Ziar Amlok, Date plum**,** (The Japanese Persimmon or Chinese date plum or Chinese Ki-kwe), Amlok, cultivated near Lahore and Kulu. It is fine only when fully ripe but unfortunately it looks ripe before it is (Stewart, 1972). NWFP Fruit and Vegetable Development Board distributed some 52758 saplings of persimmon to the farmers from 1992-93 to 1995-96. During 1997-99 some 10381 saplings of persimmon were produced in NWFP (Bureau of Stat., NWFP, 2000).

2. *Diospyros lotus* L., Amlok, Date plum, Tor Amlok, found planted or self-sown about villages in the hills from 800 to 1800m. Distributed in Balochistan, Kurram, Chitral, Murree Hills and apparently wild in Poonch and Mirpur (Stewart, 1972). Large cherry-sized fruit contains protein 1.9%, fat 0.2% and carbohydrates 47.7% (Reid, 1977 and www.gardenbed. com/source/24/2341_edi.asp)

Family Elaeagnaceae:

1**.** *Elaeagnus angustifolia* L. var. *angustifolia*, Russian Olive, Oleaster mostly cultivated and also found wild in Kashmir and trans-Indus from 100 - 3500 m. Flowers have pleasant odour. The acid fruit is astringent and can be eaten. Fruit sweet when ripe.

2. *Elaeagnus latifolia* L., Bastard Oleaster, occasionally cultivated and indigenous in swampy areas. The fruit is edible. Fruits make excellent tarts and jelllies (CSIR, 1952).

3. *Elaeagnus parviflora* Wall., Ghowein, Ripe fruit is c 8mm in diamter and a rich source of Vit.A, C, E (www.ibibliograpgy/pfaf/cgi-bin/arr-html?Elaeagnus+parviflora&CA=LATIND).

4. *Elaeagnus umbellata*Thumb. Ghanum Ranga, Wild in Kurram**,** Swat, Gokand valley (Buner district), Gilgit, Shnagla, Mansera, Kaghan, poonch, Jhellum valley, Mirpur (Kashmir) (Stewart, 1972; Khan *et al*., 2003). Up to 3500m. Fruit edible (Khan *et al*., 2003).

5. *Hippophae rhamnoides* L. ssp. *Turkestanica* Rousi., Kalabisa, Seabuck Thorn**,** Climbing shrub throughout Himalaya (Murree). Berries are acidic and edible when made into a jelly with sugar. Fruit of *H. rhamnoides* is a rich source of Vit. C (ascorbic acid 13.5 – 60mg / 100g; dehydroascorbic acid, 30 mg/ 100g). Mature fruit is also rich in carotene (6 mg/100g) - almost half that of carrots (NISC, 1997). The economic importance of seabuckthorn has generated interest in research on this plant in many countries. It is a source of oil. It contains flavinoids effective in cardiac function. It has biologically active principles with pharmacological effects on cardiovascular, immune system, besides antisanilism, anti-inflammation, and anti-radiation effects (Wang Bingwan *et al*. (1998) and Xu Mingyu *et al.* (1998) in Seabuckthorn Research Journal 1(1). 1998. (Interrnational Center for Research & Training on Seabuckthorn (ICRTS). In Pakistan, it is being developed to address problems of environmental degradation. A germplasm evaluation nursery has been established and plantations in Balochistan are being raised by National Arid land Development & Research Institute (NADRI) to exploit the plant for juice and oil and other food and health products. Research work on improved variety of *H. rhamnoides* ssp. s*inensis* from China is underway (http://www.icrts.org/publications/publications.htm)

Family Euphorbiaceae:

1. *Phyllanthus acidus* (L.) Skeels, Harfaruri, Chalmeri, Star gooseberry, Otaheite gooseberry, small tree widely cultivated for its fruits. Acid fruit eaten raw, cooked and as a preserve (RedCliffe-Smith, 1986; Baqar, 1995).

2. *Phyllanthus emblica* L., Amla, Aonla, Ambla, Emblic Myrobalan, Indian Gooseberry, Wild in foothills of Himalaya and cultivated in the plains (610m - 1370m). The fruit is often eaten raw- very acidic. It is also used in making pickles, preserves and jellies (www.tradewindsfruit.com/emblic.htm). The fruit is the richest known source of Vit. C (nearly 20 times in concentration comparing to that in citrus fruit). It is used in fever, liver disorder, indigestion, anemia, heart complaints and urinary problems, treating scrubby, pulmonary tuberculosis due to lack of Vit. C. It is major ingredient in Chayanprash, a popular Ayurvedic tonic (www.haryana-online.com). In Indonesia,

pulp of the fruit is smeared on the head to dispel headache and dizziness due to heat (Perry, 1980). The fruit contains a variety of compounds – alkaloids (phyllantine, ziatin nucleotide alkaloid), banzenoids (phenols – amlaic acid, ellagic acid, corilagin, 3-6-dio-O-galloyl-glucose, ethyl-gallate B-glucogallin, phyllembic acid, emblicol, music = gallactric acid), flavinoids (phenols – kaempherol-3-O-β-D-glucoside, quercitin-3-O-β-D-glucoside), furanolactone (ascorbic acid), triterpenes (lupcol), neutral and acidic polysaccharides, etc. The fruit is considered to be anti-inflammatory, antipyretic, anti-oxidant, chemoprotective; hypolipidaemic and anti-HIV-1 (Human Immunodeficiency Virus 1) Simple benzenoids present in fruit are cytoprotective and have possible inhibitory properties against carcinogenesis, mutagenesis and tumorigenesis (Summanen, 1999). The high potency fruit as anti-oxidant is not only due to its richness in Vit. C alone but also due to polyphenols present in the fruit (Khopde *et al.*, 2001).

Family Flacourtiaceae:

1. *Flacourtia indica* (Burm.) Merrill., Kokoh, Governor's plum, Madagascar plum, Distributed in sub-Himalayan zone (600 - 1000 m). Cherry-sized red or purple berries with orange yellow flesh having flavour of plum are edible and used in making jellies. Fruits mature after 1-2 months of flowering. Tree medicinal (www.tradewindsfruit.com/goushors_plum.htm).

Family Grossulariaceae:

1. *Ribes himalense* Decne. Karan, Black Currant, Common in Himalaya from 2400 to 4000m. Berries edible and sold as currant for making jams, puddings and cakes.
2. *Ribes nigrum* L., Black Currant, wild in Chitral, Astor, Chilam, Gilgit, Kargil, and Kashmir. Berries black, edible and used for making desserts, jams and cakes. Seed oil is rich in both gamma linolenic acid and alpha-linolenic acid (Wu *et al*., 1999).
3. *Ribes orientale* Derf. Lhil, Hargul, Pallas valley. Fruit edible (Saqib, Z. & A. Sultan- www.sui. edu/~ebl/leaflets/zafeer.html).

Family Juglandaceae:

1. *Carya illinoensis Koch.,* Pecan, introduced in Pakistan in 1972 from North America. Out of the nine varieties of pecan tested in Pakistan, variety Wichita is reported to give the highest yield of 13 Kg nuts per tree followed by Mohan, 12 Kg nuts per tree (not indicating whether on shelled or unshelled pecan basis (Rehman and Jan, 1998). Pecan trees are known to produce up to 230 Kg nuts each year. But trees do not bear nuts until 5 or 6 years old. For another five years they do not bear enough nuts to be profitable. Only after the trees are 20 years old, they fully bloom (Jaynes, 1993). However, varieties such as Wichita and Mohan have been approved for commercial cultivation in the plains of NWFP (Charsada, Mardan, Nowshera, Peshawar, and Swabi) as this tree requires less number of cold hours, around 400 hours below 7 ^{o}C per year (Rehman and Jan, 1998).

Pecan nuts are eaten raw or cooked or used in confectionary, cakes, etc. Pecan oil extracted from seeds is edible but is used mainly in the manufacture of cosmetics, and some drugs. Pecan is greatly consumed in the USA. The production estimate of pecan in shell in the USA for the year 2000 is reported to be around 72,824 tonnes with shelled to unshelled pecan ratio around 2.50: 1.0 (USDA-NASS, 2002).

2. *Juglans regia* L., Akhrot, Walnut (Persian walnut), a beautiful tree wild and cultivated in Hazara, Murree, Gilgit, Chitral, etc. up to c. 3000m.

Walnut tree yields good quality edible nuts and wood, which is strong, hard, and even-textured. The best-cultivated variety is 'Kaghzi Akhrot', a large nut with easily breakable thin shell and whitish kernel of good taste. It is used in ice creams and confectionaries. Walnut kernel contains 15.6% protein, 11.0% carbohydrates and high amounts of fat. It contains Vit. A, B and C. Juglansin is the protein present in the kernel. The immature fruit is the richest source of Vit.C. Walnut oil is a pale greenish drying oil, which is edible and also used in printing inks, varnishes and for making soap. Oil cake is rich in protein and used as cattle feed. Shell is used as flour in moulded plastics and as an extender in resin adhesive. Bark is sold in the market by name 'Dundasa' used to clean teeth and chewed for reddening lips (NISC, 1997). Walnut leaf and hull, broadly used in traditional medicine, have several pharmacological effects. Girzu *et al*. (1998) have reported its sedative activity due to juglone, an active constituent.

Family Lordizabalaceae:

1. *Akebia quinata* (Houtt.) Dacne., Chocolate Vine, Five-leaf Akebia, Tall graceful deciduous to semi-evergreen climber cultivated in Islamabad and Rawalpindi. Male flowers chocolate brown and male flowers pink in colour (www.ces.ncsu.edu/depts/hort/consumer/factsheets/vines/akebia _quinata.html). Fruits produced rarely under cultivation. Fruits purple violet with pulpy white core are edible.

2. *Holboellia latifolia* Wall., Holboellia, Climbing shrub of Murree (throughout Himalaya). Highly scented flowers in bunch in spring *(www.beehive. Thisisstaffordshireco. uk/defaultasp?WCl=csv&ID =9908&pageID = 62 933)*. Berries generally 3-6 cm long, 2 - 4 cm broad. Fruit length may reach up to 10 cm (Kankel, 1984). Fruit with mealy texture and eaten raw (Polunin and Stainton, 1984). Easily propagated by seeds.

Family Malpighiaceae:

1. *Malpighia glabra* L., Barbados cherry, Cultivated in Lahore. Dark red drupe with thin epicarp is acid and fine-flavoured. It is eaten raw or cooked. Fruit is rich in ascorbic acid (1000 - 4000 mg//100g of edible pulp). Green fruits are richer in Vitamin content. Fruit may be used in Jams, preserves, sherbats, jellies, punch, and beverages. Canned juice of the fruit may be used to enrich the ascorbic acid content of other products such as pear and apricot nectar and grape juice (NISC, 1998).

Family Mimosaceae:

1. *Pithecelobium dulce* (Roxb.) Benth., Jangal Jalebi, (Chaguay & Mongollano in central America), widely cultivated in Punjab and Sindh. The fleshy pulp of the fruit is eaten or may be turned into drinks. Fruit contains proteins (2.7%) and phosphorus 40 mg/100g fresh fruit (Pradheep *et al*. 2003). Fruit is taken to stop blood in case of haemoptysis. Seeds contain greenish oil (20%) which can be refined and bleached and may used as substitute to ground nut oil or in soap making (www.worlddagroforestry.org /sea/products /AFDbases /AF/asp/speciesInfo.asp?SpID=1314)

Family Moraceae:

1. *Artocarpus lakucha* Buch.-Ham., Barhal, Monkey Jack, Kathal, Cultivated in Sialkot & Lahore. Confined to Indo-Pak sub-continent. Fruit is yellow-orange in colour and edible. It is rich in Vit. A (Arora and Pandey, 1996).

2**.** *Artocarpus heterophyllum Lam.*, Jackfruit, Kathal, Cultivated in Sindh. It originated in Western Ghats of India. Several products have been developed from ripe as well as raw jackfruit, seeds and rind in Mysore (India) (PID, 1985). Jackfruit is the biggest and weightiest fruit in existence (18 - 23 (-45) Kg). Latex is bacteriolytic. The brown seeds called jack nuts are roasted or boiled and eaten. They are starchy, have little sugar and about 5% protein. They have a flavour of chestnut. The jack is said to be indigestible fruit, but if the roasted seeds are eaten immediately after they counteract any tendency towards indigestion (Norris, 1960). Several products from ripe as well as raw jackfruit, seeds and rind have been developed in Mysore, India (PID, 1985). About 50 species of *Artocarpus* are reported from Asia.

3. *Ficus auriculata* Lour., Dhusi, Trembel, Timal, Grows in Rawalpindi, Hazara and Kashmir (up to 2000 m) in Pakistan and elsewhere. Fruits are eaten raw or cooked.

4. *Ficus carica* L., Fig, Injir, Enzar, cultivated up to c. 1500m in Baluchistan and 1220 m in Hazara. All figs in cultivation are said to be the subspecies, *F. carica* ssp. *carica (*Huxley *et. al.*, 1992). Ghafoor (1985), however, reports *Ficus carica* L. ssp. *rupestris* (Haussekn. ex Boiss.) Borowicz also to be in cultivation in Balochistan and NWFP, which is also called Anjir or injir locally. Fresh figs contain 17% carbohydrates. They provide vitamins also (CSIR, 1956).

5**.** *Ficus hispida* L., Dagurin, Katgularia, Daduri, Occurs in sub-Himalayan zone. The fruits are edible and considered tonic, lactagogue, and emetic.

6. *Ficus palmata* Forssk. ssp. *virgata* (Roxb.) Browicz, Phagwara, Anjir, Phatguleri, Phagoi (Pallas Valley), cultivated and wild fig occurring in N.W. hills up to 2500 m on dry slopes in clay-loam soils in Balochistan, Punjab, NWFP and Kashmir. Often confused with *F. Carica*. Fruits edible, demulcent, laxative and used in diseases of lungs and the bladder.

7**.** *Ficus recemosa* L., Cluster Fig, Gular, Redwooded Fig, Country Fig, Rumbal, Umbar, Cultivated in the Punjab and Sindh for shade in Gardens. Fruits eaten by locals.

8. *Ficus sarmentosa* Buch.-Ham ex J.E. Smith, Dodabel, wild in N.W.Hills and Kashmir up to 2300 m. creeping on rocks or in crevices or climbing on trees. The orange-red figs are said to be edible.

9. *Ficus semicordata* Buch.-Ham. ex J.E. Smith, Kandrol, Joharphali, Khenan, occurs in sub-Himalayan tract; in Rawalpindi and Kashmir in Pakistan. The fruits often ripen underground (geocarpic) and are eaten.

10. *Morus alba* L., Tutri, White Mulberry, Tut, tut kishmishmi, Cultivated and sub spontaneous in all parts of Pakistan from sea level to 3500m. Collected, dried and used as winter food by the Kalash tribes of the Bumboret and Ayun valley in Chitral (Ghafoor, 1985).

11. *Morus nigra* L., Shahtoot, Tortoot, Black Mulberry**,** Cultivated in Balochistan, NWFP and other areas. Punjab produced 2100 tonnes of mulberry in 1999-2000 (Punjab Bureau Stat., 2000). Fruit are laxative.

12. *Morus serrata* Roxb. Karum, Kimmu, Kartut, Confined to Indo-Pakistan sub-continent from 1200 to 2700 m. Frequently cultivated. Ripe fruits are edible.

Family Musaceae:

1. *Musa paradisica* L., Banana, Kela, Cultivated in Sindh and Punjab. *Musa sapientum* (syn. *M. paradisica* var. *sapientum*) has been reported by Stewart (1972) to be grown in Sindh, Punjab and N.W.F.P. and sometimes along the foothills from Hazara eastward to around 1400m to be poor in quality. Quality of banana of Pakistan has now greatly improved. Edible bananas are of hybrid origin valued for seedless fruit. They are mainly hybrid of *M. acuminata* and *M. balbisiana* (NISC, 1998). Cultivars grown in Pakistan are China, Champa, and Chitri. A good quality banana 'Sindhi' is extensively cultivated in Sindh (Ghazanfar, 1982). Banana fruit contains 75% water, 22% carbohydrates, 1.3% protein, 0.6% fat and minerals around 0.8%. It contains serotonin and norepinephrine, two physiologically very important compounds in large amounts, which probably make banana therapeutically useful in colic diseases, constipation, peptic ulcer, etc. (NISC, 1998).

Compared to 1957-58, banana cultivation in Pakistan has substantially increased. It is now cultivated on nearly 30×10^3 Hectares of land, largely in the province of Sindh. Its cultivation area declined by c 50% during 1986-87 to 1990-91, as a result of its *en masse* die out. Thus yield as well as banana production both fluctuated considerably through years but more particularly in initial years of cultivation until 1968-69. Its yield during last 46 years varied from 1.82 to 13.71 tonnes / Ha (CV: 39.9%). Its yield remained stable from 1967-68 to 1990-91; being around 9.0 tonnes / Ha. It then declined and fluctuated greatly among years and at present we are producing banana with a rate (4.23 tonnes / Ha) almost half or even less than that we produced during 1970's and 1980's (Table 6). The average yield of banana in Pakistan for the last 46 years amounts to 7.3 ± 0.427 tonnes / Ha), which is merely 43 % of banana yield in Hawaii (USA) (17.08 ± 0.804 tonnes / Ha for growth period ranging from 1992 to 2000 (USDA-NASS, 2002). Banana production in Pakistan is more closely related with area of cultivation (r = 0.7488) than yield (r = 0.3111).

Banana Production (000 tonnes) = - 54.75 + 5.5503 Area (000 Ha) + 10.1371Yield (tonnes / Ha) ± 26.36
t = 4.02 t = 12.43 t = 7.282
$F = 87.79$, $R^2 = 0.8033$, adj. $R^2 = 0.7941$

Owing to its genetic poverty, a number of pathogens like nematodes, fungi, bacteria and viruses are active against banana. In Pakistan, Sindh province is the major center of banana cultivation. A disease of unknown etiology was observed in 1989 in coastal areas of Sindh that caused some 50% loss in yield within two years of disease epidemic during 1990-92. The disease was identified as Banana Bunchy Top Virus Disease (BBTV) in 1991 (Khalid *et al*., 1993), which is spreading slowly from southern part of the country towards north (Yasmin, 2001). This "nanavirus" disease is characterized by chlorosis, dark green streaks on leaf petiole, midrib and pseudostem and bunchy appearance (Smith *et al.* 1998; Yasmin, 2001). The Pakistani BBTV isolate is reported to be identical to South Pacific group and closely related to Egyptian and very closely related to Australian isolates but does not resemble to any of the Asian isolates. It appears that BBTV was introduced to Pakistan through Australian suckers importation (Yasmin *et al*., 2005). According to a Belgian plant pathologist banana lacks genetic diversity to fight off diseases and pests plaguing plantations and without scientific help the sterile, seedless fruit could disappear within ten years. In spite of the fact that a number of new varieties are becoming available, improvement of banana against diseases and abiotic pressures and inclusion of better agronomical traits is still the need of time on global as well as regional basis. Breeding is time consuming, induced mutations and biotechnology should be an ideal approach to improve banana. Genetic improvement and pest and disease resistance must be the two basic priorities of science in banana today besides attention to nutrition, genomics, genetic mapping, low cost micropropagation and somatic embryogenesis. Farmers should accept developed banana varieties and minimally use the chemical pesticides (Escalant and Jain – FAO Corporate Document Repository- www.fao.org/docrep/007/ ae216e/ae216e00.HTM ; seen on 27-07-2005).

Family Myricaceae:

1. *Myrica esculenta* Buch.-Ham. (syn. *M. sapida* Wall., *M. nagi* Hook. f.), Kaiphal, Kaephal, Box Myrtle, pleasant sourish sweet cherry-sized drupe is edible. Found in subtropical Himalaya at altitude of 900 - 2100 m. Fruit is medicinal also. It makes refreshing drink (Baqar, 1995; NISC, 1998a).

Family Myrtaceae:

1**.** *Psidium juajava* L., Amrud, Guava, Zaitoon in Sindhi, Widely cultivated in plains. There are two varieties of

guava grown in Pakistan - Allahabadi and Larkana. Protein content of the fresh ripe fruit is 0.9 to 1.0 % and carbohydrate around 9.5 to 10%. It contains Ca: 9.1-17 mg, P: 17.8 to 30 mg, Fe: 0.3 to 0.7 mg per 100g of fresh ripe fruit. Several vitamins such as Vit A, Riboflavin, Niacin, VitB3, and Vit G4 are present besides ascorbic acid in fairly good amount. Ascorbic acid may vary from 56 to 600 mg, which is mainly in the skin. It may range from 350 to 450 mg in nearly ripe fruit. It declines to 50 to 100 mg in fully ripe and soft fruit and is further destroyed in vanning and other processes by a quantum as large as 50%. Ascorbic acid is high in fruit skin, than in the firm flesh and little in central pulp. The odour of the fruit is due to carbonyl compounds (Morton, 1987).

Guava cultivation in Pakistan remained below 20,000 Ha until 1980-81. Then it increased steadily and remarkably reaching more than three-fold in the year 2002-03 (62.7×10^3 Ha). Production replicated the same trend and reached to a quantum of more than 531.6 thousand tones in 2002-03. The yield of guava during last 46 years varied from 5.78 (1968-69) to 10.34 tonnes / Ha (1962-63) averaging around 7.4 ± 0.1477 tonnes / Ha, CV: 13.05 %). Yield's fluctuation, which was on higher side during initial years (CV: 20.58%) lessened gradually through years being least (2.14% only) during the last six years (1997-98 to 2002-03) (Table 6). Although statistically significant increase in yield of guava has taken place in recent years, a great room for its improvement still exists if we compare it with the guava yield in Hawaii (USA) for a period of 1992-2000 (23.44 ± 0.91 tonnes / Ha), which is nearly three times to that of ours guava (USDA-NASS, 2002).

2. *Syzygium jambos* (L.), Gulab Jamun, Rose apple, Alston. Sometimes grown in the Punjab. Fruits are reported to give nice jams and jellies (www.tradewindsfruit.com/roseapple.htm).

3. *Syzygium cumini* (L.) Skeels, Jamun, Jambolan, jambul, Java Plum, Black berry, black plum, frequently cultivated in the plains of Pakistan. The fruit is astringent, stomachic, carminative, and anti-scorbutic and diuretic. Fruits contain up to 0.7% protein, 14% carbohydrate, fat 0.15 – 0.30%. Vit. A, B, and C ane present with good amount of P (15-16 mg per 100g). The seeds lower blood pressure perhaps due to ellagic acid content. The dried alcoholic extract of seeds is reported to reduce blood sugar and glycosuria. Seeds are used in ayurvedic, Unani, and Chinese system of medicines. Plant is valued in apiculture (Morton, 1987 and www. emea.eu.int/pdfs/vet/mrls/067999en.pdf).

Family Oleaceae:

1**.** Olive**,** *Olea europaea* L., Zaitoon, a mediterranean tree, known for olive oil and pickled fruits, has been introduced in Pakistan. Drupe is blackish violet when ripe. Pulp and seed oily. The olive is the oldeset known cultivated tree in history. It was first cultivated in Africa, and then Phoenicians spread it to Algiers and Tunisia. It was first cultivated in Crete and Syria over 5000 years ago. Earlier introduction in Pakistan grew well but gave hardly any fruits as most of the varieties are self-sterile and no proper pollinator was present. Different varieties were then planted together with some proper pollinators and the results were quite satisfactory (Grohman, 1974). Now there are some reports of its successful cultivation in Balochistan. There are three plants of olive at Medinat-al-Hikmah, Karachi, which are doing well. They are still to reach maturity. Tree needs pruning to produce more fruits. As the oil content of fruit increases, it changes colour from green to violet to nearly black (www.blueplanetbiomass .org/olive_tree.htm). Boron application is found to improve flowering and fruitset (PARC Annual Reoprt, 2003-2004- www.parc.gov.pk).

Limited but not conclusive scientific evidence suggest that eating about two tablespoon (23g) of olive oil daily may reduce the risk of coronary heart disease due to monosaturated fats in oil. Morello *et al* (2005) have shown the antioxidant characteristics of phenolic compounds in olive pulp and oil. The delicate flovour of quality virgin olive oil is related to the presence of a large number of chemical compounds. Over 100 such compounds have been identified. The taste and fragrance is derived mainly from compounds like hexanal (green, grassy), trans-2 hexanal (green bitter), 1-hexanol and 3-methylbutan-1-ol - major volatile compounds. There is good correlation between aroma and flavour of olive oil and its polyphenol content (www.oliveoilsource.com/ olive_chemistry_flavor.htm).

Family Palmaceae (Palmae):

1. *Borassus flabellifer* L., Tar, Palmyra Palm, rarely cultivated in Karachi. Plant is a source of toddy. The endosperm of young fruit is juicy and edible.

2 *Cocos nucifera L.,* Coconut, Narial (Khopra), cultivated in coastal areas of Pakistan mainly for its nuts. The kernel (endosperm) is oily and edible. The copra contains 60-65 % oil suitable for manufacture of quick lathering soaps, margarine, cosmetics, and synthetic rubber. The kernel is also eaten raw. Coconut water is a delicacy. Since coconut production is not sufficient in Pakistan, coconut and its oil are imported from southeastern countries.

3. *Nannorrhops ritichiana* (Griff.) Aitchinson, Mazri, Patha, Fees, wild in Sindh, Punjab, Makran, Peshawar valley, Kohat, and trans-Indus territory. Inflorescence and fruits are used as food (Malik, 1984 a). The seeds are used as beads. The yield of seeds per tree varies from 3 – 4 lbs. per annum, which contain 10.6% oil and 7% proteins

(Ihsan-ul-Haque *et al* 1962).

4. *Phoenix dactylifera L.*, Khajoor, Date (date palm), widely cultivated in Punjab, Sindh, Balochistan and N.W.F.P. Pakistan is the fifth largest date producing country in the world. Hillawi, Khardrawi, Zaidi, Aseel, Dhaki, Berni, Begun, Jungi, are some well-known varieties of Khajoor in Pakistan *(www.telmedpak.com /agricultures/Datepalm.html*). Khairpur district in upper Sindh has an ideal climate for date production. As per a conservative estimate, date palm acreage in the district is around 100,000 acres comprising four million trees. Since 2000, it is under attack of black -headed caterpillar, which has so far killed some 8,000 trees of various ages (Bhambhro, 2003).

5. *Phoenix sylvestris (L.) Roxb*., Khajji, Date (wild date palm), cultivated in Sindh and the Punjab. Date palm cultivation in Pakistan increased slowly to reach up to 20,000 Ha of land in 1971-72 from merely 3600 Ha in 1957-58. It reached to 30,000 Ha in 1981-82 and fluctuated around 40,000 Ha from 1986-87 to 1992-93. Presently, we cultivate date palm on c. 78 thousand hectares of land and produce 625 thousand tonnes of date fruit (FBS, 2002; Govt. Pak, 2004). During last 46 years, yield of dates varied from 4.50 tonnes / Ha in 1958-59 to 9.56 tonnes / Ha in 1998-99, averaging to 7.53 ± 0.1272 tonnes / Ha, varying around 11.21%. One-way ANOVA of yield data partitioned into five cultivation periods indicated 17.8% variation in yield during early cultivation period, which substantially lessened in later years. The yield did not vary significantly within and between the years of cultivation-periods (Table 6). The yield of our date palm orchards is, however, significantly lower (t = 4.81) than that of California date palm orchards (9.901 ± 0.491 tonnes / Ha) reported by USDA-NASS (2002) for the growth period - 1992-2000). Date production in Pakistan related significantly with area of cultivation (r = 0.9847) but exhibited no correlation with yield (r = 0.2455).

Date Production (000 tonnes) = - 7.2235 + 7.7461 Area (000 Ha) ± 32.78

t = 37.14

$F = 1379.81$, $R^2 = 0.9697$, adj. $R^2 = 0.9691$

Date Production (000 tonnes) = - 176.025 + 7.624 Area (000 Ha) + 23.199 Yield (tonnes / Ha) ± 22.12

t = 7.31 t = 53.81 t = 7.24

$F = 1542.2$, $R^2 = 0.9866$, adj. $R^2 = 0.9959$

Dates are known to lower the ketone bodies in the blood and are regarded as better energy source for patients of high blood pressure, heart disease and cancer. It has sugar (72%), protein (1.9%), fat (0.5), and fiber (2.3%). It is a good source of potassium, Vit. A, B1& B2 and zinc and copper (www.telmedpak.com).

Family Papilionaceae:

1. *Arachis hypogaea* L., Mungphali, Peanut (Groundnut), Goober, Pindar, cultivated in Sindh and Punjab and NWFP.

Although some decline has taken place in recent years, the area of cultivation as well as the production of peanut have gradually increased in Pakistan (Fig. 5). In 1997-98, total peanut production amounted to 112.3 thousand tonnes; nearly double to that in 1980-81 (57.4 thousand tonnes) and only slightly lower than that in 1996-97 (117.4 thousand tonnes; ever maximum). However, this rise in peanut production appears to be largely the function of the increase in the area under peanut crop. Average production per hectare for 44 years of peanut cultivation since 1957-58 until 2000-01, has been quite low averaging to 1.223 ± 0.0262 tonnes/Ha; range: 0.78 - 1.563; CV, 14.04%). The data of Federal Bureau of Statistics (FBS, 1998a & b and 2002) indicates that peanut yield/Ha has been much higher in Sindh and NWFP than that in the Punjab. Peanut cultivation in Pakistan needs more judicious and scientific approach so that its yield may increase to its fullest potential. Yield/Ha of peanuts for nuts in USA for the period of 1992 - 2000 has averaged around 2.796 ± 0.084 tonnes/Ha (CV = 9.01%), which is much higher, comparatively (USDA-NASS, 2002).

The peanuts are roasted and eaten as snacks. The pale yellow oil of peanuts is a non-drying oil belonging to the oleo-linolein group. It has nutty odour and bland taste and is completely digestible. It is hydrogenated to produce 'Vanaspati Ghee'. It contains fats (47.5%) and protein (28.5%). Arachin is the dominant protein in its kernel. It is a good source of Vit. C. Germ of groundnut, however, contains bitter principles, the saponins. At least four saponins are reported to be present. Groundnut is used in multiple ways e.g., in desserts, confectionary products and preparation of edible groundnut flour, which is used in some formulations of food for infants and adults. Groundnut milk is reported to be as good as Cow's milk. Groundnut oil cake is extensively used in livestock feed and also as fertilizer, in preparation of glues for binding plywood. Wool like fibers (Ardil in UK and Sarelon in USA) has been prepared from protein extracted from groundnut oil cake. The fiber is said to be light cream in colour with soft

handle and warmth similar to that of wool. The shells of fruit form low-grade fertilizer (PID, 1985). George Washington Carver of USA (1864 - 1943) extensively studied peanut and he is credited with having found more than 300 uses for peanut plant and its seeds (Kitchens, 1993).

Family Pinaceae:

1. *Pinus gerardiana* Wall. ex Lamb., Pine nut, Chilghoza**,** Neosia Pine, Cultivated in Balochistan, Kurram valley, Chitral, upper Swat, Astor, Naga Parbat and Kishtwar areas. Roasted seeds are eaten in winter. The kernel of the seeds is oleaginous and possesses a delicate terebinthine flavour. It is carminative, stimulant and expectorant. The kernel has 15.9% protein, 49.9% fat, 21.6% carbohydrates and fair amount of calcium and phosphorus (NISC, 1998b).

Family Podophyllaceae:

1. *Podophyllum emodi* Wall. ex Royale., Indian podophyllum, Bankakri, Papra, Banwangan, Perennial herb throughout Himalaya-Gilgit, Astor, Hazara, Muzaffarabad, Kashmir, Murree, Fruits are edible when ripe. Unripe fruits are bitter. It is a source of bioactive podophyllotoxin (Moraes *et al*., 2002).

Family Punicaceae:

1. *Punica granatum L.*, Anar, Pomegranate, Shu (Balti), Danu (Shinah), both wild and cultivated. It is wild in the Salt Range, Balochistan, Waziristan, Kurram, N.W.F.P., Dir Chitral, Hazara and Kashmir, up to 6000 feet (Stewart, 1972). Generally cultivated variety is "Kandhari" for its large deep red and acid- sweet pomegranates. Anar is a good source of Vit. C. It has fair amount of iron but is poor in calcium. Tannins occur in all parts of plant but particularly in rind (around 26% of dried rind). Dried seeds (Anardana) are used to add taste to food and used medicinally (NISC, 1998).

A number of nematodes have been reported to be associated with pomegranate rhizosphere but chiefly *Melidogyne incognita* and *Xiphinema basiri* in lower southern Sindh (Khan and Shaukat, 2005).

At present, pomegranate is cultivated on 6600 Ha of land. The total pomegranate produce, which was merely 9.1 thousand tonnes in 1957-58, increased more than ten-fold in 1998-99 (106.1 thousand tonnes). However, being largely the produce of Balochistan, its yield has greatly reduced in recent years due to drought. Its yield during last 46 years of cultivation exhibited a fluctuating trend and ranged from 6.59 tonnes / Ha during 2000-01 to 16.49 tonnes / Ha in 1996-97 with an overall variation of around 22%. It averaged to 11.52 ± 0.3784 tonnes / Ha. One-way ANOVA of the data **(Table 6)** partitioned into five cultivation periods since 1957-58, indicated significant increase in yield in late 1960's, which could not improve subsequently.

Family Rhamnaceae:

1. *Rhammnella gilgitica* Mansf. & Melch. Fruits Edible (Saqib, Z. & A. Sultan-www.sui.edu/~ebl/leaflets/zafeer.html).
2. *Ziziphus jujuba* Mill., Unnab, Jujube Berries, grow wild. Fruit edible and medicinal.
3. *Ziziphus mauritiana* Lamk., Ber, Indian Jujube Berries, , desert apple, Indian plum, cultivated in all provinces of Pakistan – mostly in Sindh and the Puinjab. It is most ancient fruit of Pakistan. Fruit eaten fresh or dried. The pulp has 86% moisture, 11-13.5 carbohydrates, some minerals and Vit. C (Mirza and Bukhari, 1996). Large number of varieties known which vary in taste, size and amount of pulp and shape of fruit. Ber plant is fairly salt tolerant and gives fruit, fodder and fuel in seemingly harsh infertile desert ecosystem (www.winrock.org/forestry/factnet.htm).
4. *Ziziphus nummularia* (Burm.) f. W. & Arn., Jar Beri, Jujube Berries, Malla, , Karkanda, grows wild. Fruit edible.
5. *Ziziphus oxyphylla* Edgew. Sezen, Pallas valley. Fruits edible (Saqib, Z. & A. Sultan-www.sui.edu/~ebl/leaflets/zafeer.html).

Family Rosaceae:

1. *Crategus songorica* C. Koch., Chochina or Cocina in Swat (Kalam valley) and Shogran valley, Howthorn Sheteel. Wild on sandy banks and hills in dry areas in valleys, Northern Areas. Fruit purple black or red – edible. The plant is used for grafting of apple. Fruit contains 4 -11 % of sugar- mainly fructose, ascorbic acid 31-108 mg/ 100 g fruit and vit. A 380-680 mg/100 g fruit (Dzhangaliev *et al*., 2003).
2. *Crotoneaster bacillaris* Wall ex lindl. Loni, loin (Swat), Fruit edible.
3. *Cydonia oblonga* Mill., Quince, Bihi, grown on limited scale in Quetta, Kashmir and Kohat. Fruit flesh is eaten or used in preserve making. It is medicinal also.

4. *Eriobotrya japonica* (Thunb.) Lindley, Loquat, lokat, cultivated widely in sub-Himalyan zones and adjacent plains. As per available data Balochistan produced 145 tonnes of Loquat (yield = 7.632 tonnes / Ha) in 1988-89 (Baloch. Stat. Wing., 1988-89) and the Punjab produced 3100 tonnes of Loquat in 1999-2000 (Punjab Bureau Stat., 2000). Fruit contains protein 1.4%, fat 0.7%, carbohydrates (43.3%). It is rich source of calcium (70 mg/100g fresh wt.) and P (126 mg / 100g fresh wt.). There are reports of poisoning due to ingestion of seeds (in poultry). The seeds contain amygdalin, which is converted into HCN. There is also amygdalin in fruit peel. Fruit is sedative (Morton, 1987). First grafted variety, "Tanaka" was introduced by I. Khan (Drub House, 20 Chinar Rd. Univ. Town, Peshawar) in 1965, which came to bearing after four years and gave big, excellent and tasty fruits. Some 1000Ha of Tanaka variety are said to be present now in orchards of NWFP producing some 16,000 tonnes of fruits. Mr. I. Khan reports to be experimenting with 30 varieties of loquat imported from Japan, Morocco, Italy and Egypt, in his private experimental station (Khan, I. The history of loquat growing and future prospects of its commercial cultivation and marketing in Pakistan - http://ressources. ciheam.org/om/pdf / 058/ 03600130.pdf - seen 2005).

5. *Fragaria indica* Andr., Kikoloh mukbursa, Bright red fruit is poor in quality but edible. Fruit juice contains sugar 3.4 g per 100 ml and Vit.C 6.29 mg per 100 ml (www.hort.purdue.edu/newcrop/parmar/11.html).

6. *Fragaria nubicola* Lindl. ex Lacoita (syn. *F. vesca* var. *nubicola)*, Mukbursa, Wild Asian strawberry, is wild and very common in the temperate and sub alpine zones; fruit often gathered for sale by shepherd children.

7. *Fragaria vesca* L., Toot-e-Zamini, Strawberry, Woodland strawberry, grown in high altitude regions of Pakistan such as Murree Hills, Hazara, Kashmir, etc. Strawberry is now raised in Murree, Rawalpindi, Islamabad, and also Karachi (Khan, 1998). Mrs. Sultan Anwar Ali, a florist, grew strawberries successfully in Karachi. It is potentially capable of widespread cultivation (Pers. Comm. A.K. Khan, President Hortic. Soc. Pakistan).

8. *Malus pumilla Mill.*, Apple, Seb, Kushu (Balti), Balt (Brushuski), Mar (Wakhi), Cultivated in N.W.F.P., Northern areas and Baluchistan. About 6500 horticultural forms of *M. pumilla* are reported to be under cultivation in various parts of the world (NISC, 1998). There are some 32 varieties of apple grown in Pakistan. Some 16 of them are grown in Hunza valley (www.maep-pk.org/bap.pdf). Golden Delicious, Kulu, Amberi Kashmiri, Red Chief, Sheena are some of the best apple varieties of Pakistan. Apples are good source of potassium, calcium and some iron.

Apple cultivation in Pakistan, which until 1977-78 could not exceed 10,000 Ha, increased to slightly more than 20,000 Ha in 1988-89. From this time, it increased exponentially and reached to 58200 Ha in 2000-01 (47700 Ha in 2002-2003) and 110784 Ha in 2003-04 (Govt. Pak., 2004b). The production also exhibited similar trends but it abruptly declined since 1999-2000 due to reduction of apple yield during recent years. Apple yield exhibited high fluctuation during early years of cultivation (51.33%). Later, the yield fluctuation lessened. During last 46 years the apple yield ranged from 2.14 tonnes / Ha in 1960-61 to 13.24 tonnes / Ha in 1995-96 (CV: 30.5%) - averaging to 8.734 ± 0.3976 tonnes /Ha. One-way ANOVA of this data partitioned into five cultivation periods since 1957-58, indicated significant variation between and within the cultivation periods. There was progressive increase in apple yield from 6.04 ± 1.033 tonnes / Ha in initial cultivation period to 11.42 ± 0.4007 tonnes / Ha in 1990's (Table 6). During late 1990's its yield was around 12-13 tonnes/ Ha. The success in apple cultivation during these years was said to be the result of adoption of new technology, timely irrigation and application of fertilizers. The drought in recent years has, however, significantly affected apple yield resulting in substantial decline to around 7.5 tonnes / Ha in 2001-2002, and 6.612 tonnes / Ha in 2002 –2003. Still apple production in Pakistan is more related with the area of cultivation (r = 0.9414) than yield/ Ha (r = 0.6389).

Apple Production (000 tonnes) = - 135.084 + 8.91 Area (000 Ha) + 17.61 Yield (tonnes / Ha) ± 46.58

t = 5.70 t = 19.30 t = 6.08

$F = 329.62$, $R^2 = 0.9388$, adj. $R^2 = 0.9359$

Apple suffers from a number of diseases caused by fungi and bacteria. *Aphis pomi* (green apple aphid, *Dysaphis plantagenia* (rose apple aphid) and black aphid (*Aphis* sp.) are common (www.balochistan.org.pk/pdf/azrc.pdf). Shah *et al.* (2002) conducted studies on post harvest and cold storage losses in apple in Balochistan and reported damages to apples up to 17% in wooden crates due to uneven grading and tight packaging as farmers put large and bold apples on the top and small and infected ones at the bottom or in the middle of the crate. This loss is in addition to that occurring in field or due to poor communication and infrastructure development in the province.

9. *Prunus amygdalus* Batsch.,, Almond, Badam, Cultivated and wild in Balochistan, Chitral, Gilgit and Astor. It does not do well in the Punjab. The area under almond cultivation in Pakistan is little more than 9000 Ha at present (Fig. 6) and average yield per hectare, for 30 years since 1971-72 until 2000-01, amounts to 3.908 ± 0.144 tonnes/Ha (FBS, 2002).

It is said that this species has three varieties, viz. var. *amygdalus*, var. *amara* (DC.) Focke and var. *sativa* (Ludw.) Focke. The first one includes wild types found in West Asia, Greece and N. Africa; the second and third varieties include a large number of types; var. *amara* comprises mostly the Bitter Almond and var. *sativa* the Sweet

Almond**.** The drupe has tough fibrous rind surrounding a hard oval-shaped pit that contains the edible seed. It is most widely used of all nuts. It is eaten ripe, dried, or green and even salted or roasted. Almond is added in desserts and pressed to obtain oil, Badam oil. The sweet almond kernel contains around 58% fat, 20.8% protein, and 10.5% carbohydrates besides calcium, phosphorus, iron, thiamine, nicotinic acid, riboflavin, folic acid, and tocopherols. Almond is lacking Vit. A and C. The chief protein of almond is a globulin, amandin, which has high arginine content. Albumin is also present. The inedible bitter almond is used only for oil. The sweet almond oil (Oleum Amygdalae Expressum**)** is non-drying oil and used to soften tissues and relieve congestion. The bitter almond oil (Oleum Amygdalae Amarae) is also non-drying oil but it contains a glucoside that form hydrocyanic (prussic) acid, a poison. Under the influence of the enzyme emulsin, which is present in the kernels and freed by crushing of the kernels, the glucoside gets hydrolysed into benzaldehyde, hydrocyanic acid and glucose. With Prussic acid removed, the oil is used in making cough syrups and other medicines and for making almond extract, a flavoring for food. The crushed material remaining after the oil has been extracted is used for soaps, cosmetics, and bases for perfumes. Badam oil is a mild laxative (NISC, 1998; Usher, 1984).

10. *Prunus domestica* L., Aloocha, Plum, Alubukhara, Grown in the plains of the Punjab. Stewart (1972) distinguishes *Prunus domestica* L., commonly cultivated plum with stone flattened and sharply rigid and usually free from flesh, from *P. insititia* L. (syn. *P. domestica* L. ssp. *institita* (L.) Poir) (Bullace and Domson plums), which are blue black or purple in colour with flesh adhering to the bluntly angled stones; and also from *P. domestica* ssp. *italica* (Borkh.) Hegi (green gage plum), which are large with flesh adhering to the stone. Plums in Pakistan are cultivated on c. 7700 Ha of land. Since 1962-63, plum yield ranged from 7.73 tonnes / Ha in 1968-69 to 19.70 tonnes / Ha in 1963-64, varying around 24.5%. It averaged to 12.22 ± 0.4739 tonnes / Ha. One-way ANOVA of yield data for last 41 years partitioned into five cultivation periods indicated significant decline in plum yield in late sixties, which could never improve in later years at all. It further declined in last cultivation period probably due to drought (Table 6).

11. *Prunus armeniaca* L. *(Thunb),* Apricot, Khubani, Apricot, Khurbani, Zardalu, cultivated in Kurram, Hunza, Gilgit, and Chitral but mostly in the mountainous region of Balochistan. Wild Hunza apricots are greatly delicious. There are fifty varieties of apricots available in Pakistan (Laghari, 1998). Some 30 varieties of apricot are grown in Hunza valley alone (www.maep-pk.org/bap.pdf). Apricots are good source of sugars and Vit. A. It contains appreciable amounts of thiamine and iron. Apricots are suitable for growing in cities because they tolerate pollution more than other woody plants (*http://www.botany-prunus.htm*). Apricot-nut-kernel is used as substitute of almond or eaten raw along the fruit pulp. Locals opine that eating kernel along the pulp saves from gastric upset, which may occur on eating the pulp alone. The oil extracted from the kernels is used for cooking and burning and as substitute of almond oil. Apricots are good source of sugars and Vit. A. A number of products are prepared from apricots. (NISC, 1998). Dried apricots are also sold in the market.

In Gilgit, Kilaoo, a delicious sweet snacks, is prepared by layering the apricot, almond or walnut kernels with thick mulberry or grape juice and then drying.

The cultivation area under apricot in Pakistan increased regularly since 1957-58 but sharp increment took place after 1992-93. At present, it is cultivated on >12,000 Ha of land. Its maximum production was recorded in 1998-99 (190800 tonnes). According to Agricultural Census of 1990 reported by Statistical Section of Azad Kashmir (Azad Kashmir Statistical yearbook 1998), there were some 175310 fruit-bearing and non-fruit-bearing trees of apricot in Azad Kashmir alone.

Apricot yield, during last 46 years, ranged from 1.91 tonnes / Ha in 1960-61 to 16.43 tonnes / Ha in 1995-96 averaging around 10.32 ± 0.5194 tonnes /Ha with a variation of around 33.4%. One-way ANOVA of this data partitioned into five cultivation periods, since 1958-59, indicated significant increase in yield regularly from 5.61 ± 0.831 tonnes / Ha in early cultivation period to 13.7 ± 0.5506 tonnes / Ha in the fourth period (1986-87 to 1996-97). Some decline in yield although occurred in recent years, the yield of 11.61 ± 1.273 tonnes / Ha in the fifth period was double to that of initial decade (Table 6), which is reported to be the result of application of new technology, irrigation and fertilizers (Rahman and Jan, 1998). Apricot is a greatly promising fruit crop of Pakistan. Culturing of the plant and processing of the produce, however, needs more improvement. Diseases caused by bacteria and fungi are common. *Lachnus persicae* and *Mazus persicae* are major aphids infecting apricots in Balochistan (www.balochistan.org.pk/pdf/azrc.pdf). At present, it is said that 60% of the fruits go in waste during apricot season. According to PCSIR (www.pcsir.gov.pk/fruit_lab_skardu.html), Baltistan produces apricot worth of Rs. 400 million but nearly 70% are wasted because people use outdated techniques, and roads and other logistics infrastructure is primitive. It is imperative that some simple and appropriate technology, which may easily be assimilated by the farmers, should be made available to them. Moreover, collection and conservation of local germplasm is required since emphasis on apricot improvement has mainly been restricted to the selection of exotic germplasm so far (Laghari, 1998).

12. *Prunus persica* (L.) Batsch., Peach, Aru, Gardalu (Pushto), Gilgalu (Chitrali), Takashu (Balti), cultivated in Balochistan , N.W.F.P. and Punjab. Fruit juicy and delicious and usually the fine ones are cultivated near Peshawar.

Peach cultivation in Pakistan remained below 2000 Ha until 1987-88. Since then it increased rapidly and reached to 5500 Ha in 2000-01 and 9200 Ha in 2002-03. Production also exhibited a similar trend and was recorded to be the maximum in 1998-99 (48300 tonnes) (FBS, 2002; Govt. Pak., 2004). The yield of peach for last 46 years ranged from 4.5 tonnes / Ha in 1958-59 to 11.49 tonnes /Ha in 1995-96 - averaging to 8.718 ± 0.2693 tonnes / Ha with a variation of 20.9%. One-way ANOVA for this data partitioned into five cultivation periods, since 1957-58, indicated no significant variation in yield between or within the cultivation periods (Table 6) although some promotion was suggestive during IV period of cultivation (1987-88 to 1996-97).

13**.** *Prunus cerasifera* Ehr., Myrobalan Plum, or Cherry Plum, alucha, Dildaru (Shinnah), According to Anwar (1999) in many instances in Pakistan, the names 'alucha' and 'alubokhara' are used interchangeably for any type of plum, i.e., for *P. cerasifera* or for *P. salicina* cultivars, More commonly, 'alubokhara' was reserved for the larger-fruited *P. salicina* types and 'alucha' for the smaller-fruited *P. cerasifera.* This species is thought to have originated in W. Asia, in the Caucasus Mts. It has naturalized in parts of Europe and it is reported in 'The Flora of The USSR' to be growing wild from the Caucasus to Central Asia. Anwar (1999) asserts that widespread occurrence of *P. cerasifera* in Pakistan suggests that this species has been here for a very long period. Because of its relatively small fruit size and poor quality (as compared to European plum cultivars) he believes that it was not introduced by the British, but rather, that it had moved with humans from Central Asia sometime in the past. He views that the similar common names in both Pakistan [alucha] and the USSR [alycha] support his belief. In Pakistan, it is grown in all temperate regions from about 500m to at least 2300m. Fruit subglobose, about 2-2.5cm diam., clingstone, green, yellow, bright red to dark purple-red. Fruit flesh is soft and the skin tough. Stewart (1972) has described two var. of *P. cerasifera* – *P. cerasifera* Ehr. var. *divaricata* (Ledeb.) Bailey and *P. cerasifera* Ehr. var. *pissardii* Koehne. The former taxon with round or elliptic yellow plum and the later with purple leaves and dark, wine red fruit. It is little cultivated for fruits but is highly prized as a stock upon which to grow other stone fruits, particularly *P. domestica*.

14. *Prunus jacquemontii* Hk.f., Jikhin (Kohistani), Makheen (Shinah), Occurs in Baluchistan and the Kurram valley, as well as in the inner Himalayan semi-arid regions of Chitral, Swat, Gilgit, Astore, and Kaghan valley at elevations of 1250 to 3700m. Common in Naltar valley, Gilgit Dt., at 2400m to 2600m associated with *Fraxinus xanthoxyloides*, *Daphne oleoides*, *Hippophae rhamnoides*, *Juniperus excelsa*, *Artemmesia* and *Ribes orientale* growing on rocky scree slopes in full sun. Fruit is bright red, sub-globose, 1 to 1.5mm diameter, juicy and, although tart, is edible. This shrub would make an attractive ornamental shrub with pink flowers in spring and bright red fruit in summer. Possible value as a dwarfing rootstock for cherries should be considered (Anwar, 1999).

15. *Prunus mahaleb* L., Mahaleb cherry or St. Lucie cherry, English cherry, Rock cherry, cultivated in Chitral and Balochistan. Soft interior of the fruit, kernel, and embryo is used (www.uni-graz.at/~katzer/eng/Prun_mah.html).

16. *Prunus prostrata* Labill (syn. Cerasus prostrata (Labill.) Ser., Mountain Cherry, Swat, Kalam, Gilgit, up to 1500 m on rocky slopes and crevices. Fruit edible.

17. *Prunus eburnea* Aitch., Zarga, wild almond (www.rms..nau.edu/publications /ciesla_bal /chapter4.html), Mash Monk (www.un.org.pk/profiles/mastung.htm), Distributed in Musakhel, Ziarat wild life sanctuary (http://sea.unep-wcmc.org/sites/pa/a852v.htm), Sibi District and Herboi rangeland of Kalat, Balochistan. Fruit edible (Durrani and Husain, 2005).

18. *Prunus avium* L., Sweet cherry, Originally cherries are from Transcaucasia, Asia Minor and Persia. Sometimes cultivated at higher altitudes up to 3000m of Himalaya and higher regions of Balochistan. Cherries are fairly high in sugars and ascorbic acid and Vit. A. Carbonated cherry juice is a very pleasing beverage. A liquor of high alcohol content (kirschwasser) is distilled from fermented sweet cherries (NISC, 1998).

During 1988-89, Balochistan produced 628 tonnes of cherry with yield of 4.988 tonnes / Ha (Agric. Stat. Balochistan, 1988-89).

19. *Prunus cerasus* L., Red sour cherry, wild cherry, Ulchi, grown in Hazara, Chitral and Azad Kashmir. Fruit red to black, 1.5 to 2 cm across, acidic and edible (www.cnr,vt.edu/dendro/dendrology/syllabus2/Prunus cerasus and http://diet.die.net/prunus%20cerasus/).

20. *Prunus cerasioides* D. Don., Wild Cherry or Carmine Cherry, Rare in Pakistan. It occurs naturally in the outer Himalaya from Pakistan to W. China at elevations as low as 800m in the western edge of its distribution to a reported 2400m in more southeasterly regions as, for example, in Burma. In Pakistan, botanists at the National Herbarium had records of only 2 locations for this species in the country -one collection from Murree, and the other from the Margalla Hills at about 800m. Fruits are small (1-1.5cm long), ovoid, red or yellow, acid flavor, and mature in spring (April-May) (Anwar, 1999). Fruits produced in abundance have scanty pulp. They are used to make a well-known cherry brandy in India (NISC, 1998).

21. *Pyrus pashia* (Ham. ex D. Don), Batanji, Tanchi, Tangai, Tangay or Bantangay (all names meaning 'very small-fruited pears'), tangore, occurs naturally at elevations between 750 and 2500m all along the front slopes of the Himalayan range from N.W. Pakistan (Dir District) to W.China. Also reported from Gokand valley, Buner district (Khan *et al*., 2003). It is also found south of Dir in the Sufaid Koh and Suleiman mountains ranges in regions where the summer monsoon rains reach. Fruit is brown with conspicuous white, raised lenticels, and very small in size (1-2 cm). It is harvested in November, at which time it is hard and inedible. Before it can be eaten it is stored and allowed to soften and turn dark brown (Anwar, 1999). Fruit edible, astringent, febrifuge, sadative and laxative (M. Humayun- Ethnobotanical studies of some useful shrubs and trees of District Buner, NWFP, Pakistan- www.sin.edu/~ebl/leaflets/buner.htm).

22. *Pyrus lindleyi* Rehder, Nakh, Sand pear, grown from plains to some 3350 m.

23. *Pyrus communis* L., Pear, Nashpati, peso or fesho (Brushuski), ayai (Chitrali), batang or batangay (Pushto), neuri or muri (Balti), Pear, grow well above 1400m in the Punjab, N.W.F.P., and Balochistan.

Pear cultivation in Pakistan has only seldom exceeded 3000 Ha of land. It generally remained below this level. During last 45 years of cultivation, yield of pear has been lowest in 1968-69 (5.25 tonnes /Ha) and the highest in 1963-64 (18.33 tonnes /Ha). It averaged to 11.44 ± 0.3971 tonnes / Ha varying around 23.02%. One-way ANOVA of the data partitioned into five cultivation periods indicated no significant variation in yield within or between the periods (Table 6) except significant decline in second cultivation period (1966-67 to 1976-77).

Pear cultivars are grown both in regions with summer rainfall (Swat, Hazara, and Muzaffarabad) and in the arid interior valleys (Gilgit, Baltistan and Chitral) where there is irrigation (Anwar. 1999). According to him, the greatest diversity of pears is in the Swat valley and adjacent tributary valleys, especially on the eastern side of the valley. Because cultivars in Swat are not suitable for storage and shipping, it is not economical to plant large orchards in this region. In Gilgit and Chitral Districts, there is a very good Asian pear cultivar, 'Shoghori' (which means it came from the village of Shoghor in Chitral). In Peshawar District, which is at the lowest elevation region for pears (estimated chilling is about 400 hours), 'LeConte' and 'Kieffer' are the main cultivars because of their low chilling requirements. In Muzaffarabad, important cultivars are 1) Nak Batang', said to be "an ancient" cultivar and to have large, juicy fruit, fairly firm texture, and to be a good keeper (few months) and 2) 'Bagugosha' has the largest, juicy, sweet, and tender-skinned fruits ripening in late August. It stores only a few weeks (Anwar, 1999).

According to Rashid Anwar (1999), the diversity of pears found in Pakistan appears to be due to at least three, and possibly more species involved in the origin of various cultivars. Fruit size ranges from small, round (2 cm diameter) to large, pyriform (8cm width x 11 cm length, or larger) and Shape varies from oblate to long, pyriform. Fruit colour varies from light green, yellow, to brown, and some had a red blush. Fruit texture varies from soft and smooth to very hard and gritty. In relation to fruit size, pedicel length varies from very short to very long (5-25mm). Detailed taxonomic studies are needed.

24. *Rubus fruticosus* Hk. f., Kharawari, Distributed in Gokand Valley, Buner district (Khan *et al*. 2003) and Malakand agency (Begum *et al.* 2005). Fruit edible (Khan et al., 2003). Stewart (1972) describes *Rubus fruticosus* Hk. f. to be synonymous to *Rubus ulmifolius* Schott).

25. *Rubus rivens* Hk.f., Zakeeny, Pallas valley. Fruit edible (Saqib, Z. & A. Sultan – www. siu. edu /~ebl/leaflets/zafeer.htm).

26. *Rubus ulmifolius* Schott., Gouraj, Distributed in Kurram, Chitral, lower Swat, Gilgit, Hunza, Murree, Gokand valley (Buner district) Kashmir and Balochistan. Up to 2000m. Very common in hedges and on field borders (Stewart, 1972, Khan *et al*, 2003)). Fruit edible (Khan *et al.*, 2003).

27. *Sorbus lanata* (D.Don) S. Schauer., Gurtu, Wild in Kalam valley of Swat. Fruit edible.

Family Rutaceae:

1. *Aegle marmalos (L.) Correa*, Wood apple, Bel, Bil, Bael, Bela, Bengal Quince, Golden apple, Holy fruit, Stone apple, Sirphal, Marcado, wild in the foothills from the Jhelum eastward and cultivated in plains and in the lower Balochistan and Karachi. Fruit is more prized for medicinal value than its edible value. Fruit is eaten fresh or processed for squash and sherbat with milk and sugar and marmalade. Pulp is also pickled and made into toffees. Fruit contains protein around 1.8 – 2.6 % and carbohydrate 28.1 – 31.8%. Bark of the plant is a fish poison and leaves may cause abortion and sterility in women (Morton, 1987).

2. *Citrus aurantium* L., Seville orange, seldom cultivated in the plains. Ripe and nearly ripe fruits are used as expectorant and antitussive in traditional Chinese medicine. They contain synephrine and N-methyltyramine, which raise blood pressure, increase blood flow, and enhance the contractive strength of heart muscle and anti-shock effects (Kusu *et. al.*, 1992, Chem Pharm Bull., 40: 3284; seen in NISC, 2000). An ethanolic extract of dried peels of *C. aurantium* and *C. limon* is used in India as one of the ingredients of a herbal vanishing cream having antibacterial activity against *Bacillus aureus, B. subtilis, and Escherichia coli* (Venkatanarayan *et. al.* 1989. Indian Med. 1(2): 6).

3. *Citrus aurantifolia* (Christmann) Swingle (syn. *C. acida)*, Lime, Kaghzi Nimbu, cultivated on the plains and sometimes in lower hills of Pakistan.

4. *Citrus grandis* (L.) Osbeck (syn. *C. decumana)*, Pumello (Shaddock), Chakotra, cultivated in the plains of Pakistan. The essential oil from the fresh leaves exhibits anti-dermatophytic activity. It shows fungicidal and fungistatic activity against ringworm fungi- *Trichophyton mentagrophytes* and *Microsporum audouini.* It is superior to many synthetic antifungal agents (Yadav and Dubey, 1994, Ind. J. Pharm Sc. 56: 227; seen in NISC, 2000).

5. *Citrus limon* (L.) Burm. f., Gulgul, Lemon, Jatti Khatti, Jhambheri, cultivated in the plains of Sindh, Balochistan and the Punjab.

6. Citrus limelta Risso (syn. *C. medica* var. *limelta*), Sweet Lime, Mitha, much cultivated in the Punjab.

7. *Citrus madurensis* Lour. Calamondrin Orange, It is usually cultivated in pots and its small hesperidia are used instead of lime. The diluted fruit juice is reported to relieve sore throat.

8. *Citrus medica L.*, Turunj, Citron, sometimes cultivated in Balochistan and plains. The most common cultivar is *C. medica* L. var. *acida* Brandis.

9. *Citrus paradisi Macf.,* Gilgil, Grapefruit, cultivated in the Punjab. Common variety in Pakistan is "Marsh", which is seedless and pulp not too acid. Other varieties are Duncan and Shamber. The fruit is used to develop resistance against colds and influenza (Holdsworth, 1987. Int. J Crude drug Res. 25: 103; seen in NISC, 2000). Grapefruit has highly revitalizing and elevating effect on the emotion. It is also very detoxifying and has a sharp, zesty fragrance. Grapefruit is processed to prepare marmalade in Australia. (Morton, 1987). Aromatherapy oil is prepared from grape fruit in Europe. The fruit juice is said to be very good in heart problems. Naringin, limonin and Nomilin are said to contribute to bitterness of grapefruit juice. Many people are especially sensitive to limonin bitterness (down as low as 1 ppm) (Tsen and Yu. 1991. J. Food Sci. 56:31; Orme & Hasegawa. 1987. J. Agric. Food Chem. 35: 512 – both seen in NISC, 2000). Citrus is said to boost absorption of non-heme iron (iron found in plants not meat) due to the presence of Vit. C, which is a non-heme absorption booster (health.allrefer.com/alternative-medicine/iron-6.html).

10. *Citrus reticulata* Blanco, Mandarins, Kid-glove Oranges, Loose-skinned Orange, Santara, great favourite, cultivated in the Punjab. Mandarins constitute a complex group of oranges called mandarins, tangerines, and satsumas (Emerald tangerines) (Morton, 1987). In the United States mandarins are commonly called tangerines. Usher (1993) called *C. reticulata* var. *deliciosa* to be tangerine. *C. reticulata* is a good source of ascorbic acid, pectin, and citric acid, peel oil and minerals like calcium and phosphorus. The peel contains more than twice the amount of ascorbic acid than the fruit juice (Riaz *et al*., 1989. Pak. J. Sci. Ind. Res. 32: 574 – seen in NISC, 2000).. Citrus fruits (*C. limon, C. reticulata, and C. media*) are reported to be beneficial in heart diseases (Barde *et. al.*, 1992. Deerghayu Int. 9(4): 11).

Kinnow is a hybrid variety of mandarain orange, which is most widely grown in Pakistan. It is a cross between tangerine and an orange (Wordowski, 1993 & http://myeplaza.net/ovb/1.asp). Kinnow is a creation of the University of California, USA. Parental cross was made in 1915 by H.B. Frost between King mandarin and Willowleaf (Mediterranean Common mandarin) (www.telmedpak.com and www.citrusvariety.ueredu/index2.php? content/mandarins.html). It was released as a new variety in 1935 and was successfully adapted in Pakistan during 1950s and 1960s (Khan, 2003). It is a prolific variety and gives some 800 fruits per tree (Ali, 2005). Early Feutrall is another common cultivar of Pakistan. Kinnow was introduced from N. America and Early Feutrall from Australia (Hassanuddin and Ghazanfar, 1980). All orangres are the great source of Vit.C and essential oils. NISC (2000) may be seen for chemical composition of various *Citrus* species. Bocco *et al.* (1998) have reported antioxidant property of citrus peel and seed. According to Mitchell and Rock (1979), oil of fruit peel of Citrus spp. (*C. aurantium, C. limon, C. sinensis*, etc.) causes photodermatitis / dermititis.

11. *Citrus sinensis (L.) Osbeck.*, Sweet Orange, Malta. Parker, a renowned botanist, opines that Malta orange of Punjab is the best citrus in the world. Many varieties are cultivated in Pakistan. The commonest ones are Mosambi (*C. sinensis cv. Mosambi*), (Mozambique), Blood red and Washington Navel (Bahia Navel). Gujranwala district is famous for Blood red oranges. Succri, Jaffa and Ruby Red are other delicious varieties. The orange juice in rat diet is reported to induce a protective effect on the blood vessel wall and gastric mucosa. It also exhibits an immuno-stimulatory effect (Saija *et. al.*, 1992. Essenze Deriv Agrum 62 (1): 74, seen in NISC, 2000). Orange peel is the richest source of uronic acid oxidase (NISC, 2000).

12. *Limonia acidissima* L., Kaint, Kainth bel, Elephant apple, wood apple, wild as well as cultivated in the plains. Also grown in the gardens of Sindh.

Citrus is the largest fruit crop of Pakistan, which is ranked among top 10 citrus producing countries. Around 80% of the citrus produce comes from Kinnow and Feutrall. Kinnow is the major citrus cultivar of Punjab and sweet orange (red-blood) is mainly grown in NWFP. The area under citriculture has progressively increased substantially since 1950s and so the citrus production. Its yield has, however, fluctuated considerably particularly during early

years of cultivation but it became more consistent in later years. During last 46 years citrus yield ranged from 6.051 tonnes / Ha (in 1958-59) to 12.03 tonnes / Ha (in 1964-65) - averaging to 9.76 ± 0.1792 tonnes / Ha with a variation of 12.4%. One-way ANOVA of yield from 1957-58 to 2002-03 partitioned into five cultivation periods indicated no statistically significant variation in yield within and between the periods. The yield has been, of course, more consistent during last 36 years (Table 6). Citrus production related positively significantly with area of cultivation (r = 0.9942) and exhibited no correlation with yield (r = 0.0366).

Citrus Production (000 tonnes) = 17.5910 + 9.5666 Area (000 Ha) ± 68.4895

$t = 61.52$

$F = 3785.22$ $R^2 = 0.9885$, adj. $R^2 = 0.9882$

In 1988, a preliminary survey of citrus undertaken by a group of Pakistani and Italian experts disclosed infection of our citrus crops in Punjab and NWFP with a number of virus and virus-like diseases (Catara *et al*. 1988). Since then the situation is reported to deteriorate to an extent that almost 100% of citrus trees in Paklistan are infected with one or more virus and virus-like diseases resulting in high economic losses (Arif, *et al*., 2005a). Major diseases of citrus so far reported are tristeza (caused by CTV- Citrus Tristeza Closterovirus)), infectious variegation (CCV- Citrus Variegation ilarivirus)), exocortis (CEVd – Citrus exocortis viroid)), cachexia-xyloporosis (CXVd - cachexia-xyloporosis viroid), greening (FPEB – a endocellular bacterium transmitted by Diaphorina citri, a psyllid vector) and stubborn due to *Spiroplasma citri* (Arif *et al*., 2005a). These diseases are not only a deadly threat to Citriculture in Pakistan but all over world where citrus is cultivated. The control of viruses infecting citrus crop is a challenge. The average incidence of CTV is reported to be 27%, CVV 31%, CEVd 16%, CCVd 4%, citrus greening (*Liberobacter* sp.) 4% and stubborn 2%. There is an urgent need to take action so that citrus industry could be saved from total collapse. Once a tree is infected with a virus it remains infected and after certain period of time the tree is killed. There is no direct method of control like chemotherapy. Some thermotherapic methods of producing virus-free-bud-wood are available to establish healthy clones. Arif *et al.* (2005b) have recently reported that like many other viruses, CTV may successfully be eliminated from citrus bud-wood by incubating citrus germplasm at 35/30 ^{o}C (day/night) for two weeks, followed by 40/35 ^{o}C for one week and then same germplasm incubated at higher temperature, 50/40 ^{o}C for one week in temperature controlled chamber.

Other important diseases of citrus in Pakistan include citrus canker (*Xanthomonas campestris* pv. Citri), citrus wither tip (*Colletotrichum gleoesporoiodes*), citrus slow decline (*Tylenchulus semipenetrans*- a nematode) and citrus quicvk decline (*Fusarium solani* (Matrt.) Sacc.) (See details in Anjum and Javaid, 2005). Most of the citrus orchards of Punjab are reported to be infested with *T. semipenetrans*.

Citrus cultivation is not only suffering due to poor cultivation methods and diseases. Monem Farooqi has reported that country is losing $44.5 million yearly in Kinnow export due to the absence of basic infra structure, transportation facilities, deficiency in storage, scarcity of farm inputs credit system, advance sales specialized research, dearth of cold store chain, scarcity in cargo space, insufficiency in processing and packing, keen international competition, shortage of irrigated water, infections, poor cultivation methodology, unavailability of specialized research (http://nation.com.pk /daily/jan_2005/11/bnews5.php). Moreover, a seedless citrus may be looked upon to substantially enhance its export (Ali, 2005). Seedless citrus should be more attractive to the foreign consumers. Satter *et al.* (2000) have reported successful induction of seedlessness in *Citrus reticulata* Blanco due to bud modification through gamma irradiation at NIAB, Faisalabad. The mutant citrus is slightly more acidic but there appears no significant change in Vit. C content. The mutant is also not significantly different from the wild type in characters such as fruit size, juice yield or peel thickness. Seed count in mutant has reduced appreciably from around 20-24 in the wild type to 2 to 8 only. It will still take some years to commercialize this seedless citrus.

Hussain *et al.* (2004) have investigated the effects of uni-packaging on the post harvest behaviour of Citrus fruits. According to them, oranges packed with individual polythene packing reduced the weight loss, maintained its acidity and ascorbic acid content and significantly preserved appearance, texture and taste of the fruit in an experiment carried out up to 45-day storage. Thick packaging (0.0508 mm polythene sheet) was more effective and prolonged the shelf life of the fruit.

'Waxing of Kinnow' is reported to improve shine, reduce weight loss and maintain the fresh look of the fruit during storage. Waxing also reduced production of carbon dioxide and ethylene. Waxing decreased acidity and increased sugar contents as storage prolonged. The taste and flavour of waxed fruits were, however, impaired and negative correlation between external appearance and flavour was observed (Farooqi *et al*., 1988. Pak. J. Sci. Ind. Res. 31: 142, seen in NISC, 2000). Potash application is reported to significantly improve growth and fruit quality of citrus (PARC Annual Report, 2003-2004).

Family Salvadoraceae:

1. *Salvadora oleiodes* Decne. Common Perun (Jal), Fruit of Pilu, Jhal, Jal, Khabbar, Mithajal (India), grape of the desert, arid region plant. Sweet fruits are eaten. Pulp contains glucose, fructose, and sucrose. Fat content in seeds is around 45%, and carbohydrates 23.48%. Seeds give green oil (Karandi, Pilufat, Kakan fat) (NISC, 1999).

2. *Salvadora persica* L. Perun (Kharajal), pilu fruit, Jal, Kharajal (India), grape of the desert, fruits eaten when ripe and used medicinally also. Fruits possess deobstruent, carminative, diuretic, lithotripic, stomachic properties. Seeds, bitter sharp in taste, are purgative, diuretic and tonic (NISC, 1999). Seeds rich in oil that may be used in making soap and candles and may be used as substitute for coconut oil (FAO, 1986). (www.hort.purdue. edu/newcrops /aminefruits /ft_families/ Salvadoraceae.html - Robert freedman, 1998.)

Family Sapindaceae:

1. *Litchi chinensis* Sonn., Litchi (Leechee, licche. lichi, litchee, lychee), leechi. Litchi cultivation started in in Pakistan in early 1970's (see Abdulla, 1973). Now it is grown in upper Punjab and NWFP – Charsada, Malakand Agency, Malakand Division and Hazara for last few years.

Not much published statistics on production of Litchi plants is available. However, some 247 saplings of Litchi were produced in Haripur and 20 in D.I. Khan in 1997-98 as per NWFP Bureau of Statistics (2000). Litchi fruit may be eaten fresh or dried like raisins. When dried they are called Litchi nuts (Ito, 1993). The seed kernel is, however, not eaten.

2. *Nephelium longana (Lam.) Cam* Longan, longyen, lenkeng, dragon's eye. A tree from South –East Asia. Under utilized fruit. It looks like lychee, is much sweeter and yields twice as much as the best lychee tree. Its fruit is smaller than lychee, and has brown smooth skin and therefore called "Little Brother of Lychee". Following account regarding its general characteristics and cultivation in Pakistan is from M.H. Panwar, (2003/2004). Longan: a new exportable fruit. Pakistan Horticulture Developnment & Export Board (http://phjdeb.org.pk /articles /article_detail.php?id=26).

There are a few trees of longan at the Ayub Agriculture Research Institute at Faisalabad., Some six new varieties are being grown at M.H. Panwar's farm, for nearly past eight years. The first commercial crop was sold in 2003. It can be grown in Sindh possibly up to Rahim Yar Khan as per climatic data available. May be it can be extended up to Khanpur but not further. The climatic requirements are that young trees are killed at -1C and frosts being common above Sadiqabad, losses during the first three years will be heavy. Mature plants can be killed at -4^{o}C and so once established there is little chance of their being killed. It flowers after 200 hours of chill and flowers early in January in the Punjab but its flowers are also killed at 0^{o}C, and freezes do occur at end of January and early February and therefore it does not fruit there. One favourable factor for southern Sindh is the resistant of tree to normal summer wind velocities sometimes reaching 40km daily, but most of time these are below 30km i.e., from April 15 to September 15. However, cyclone winds can cause splitting of branches, fruit drop and even tree loss, especially in morcotts with small shallow roots. Windbreaks, therefore, will be essential in lower Sindh from Sakrand-Nawabshah down south to the coast. They need full sunlight for maximum yield and fruit does not show sunburns or sunscald. Cloudy weather leads to 50 per cent reduction in yield. Since flowering is spread to 6-8 weeks, bad weather i.e., winter rains which cause flower drop, spare at least half of crop even in bad years. It does not stand drought and weekly irrigation in summer, 10-day interval in autumn and spring, and 15-day in winter is essential. Its moisture requirement is same as of sugarcane and lychee, more than that of mango. Fruiting in Sindh is from mid-July to mid August. In the rainy season, over-cast weather prior to harvest causes fruit drop. However rainfall occurs only on average of seven days in July-August in Sindh and so the losses are limited. Problem is severe in areas north of Rahim Yar Khan. Its chill requirements are lower than lychee and needs only 2-3 months of temperatures less than 15-22^{o}C. Even mild coastal areas of Sindh have temperatures lower than this from December to February. Low temperatures less than 10^{o}C for eight weeks or more produce no flowering, which is the main hurdle in its expansion in Punjab. As Sindh have low temperatures than needed for flowering, such temperature produce higher percentage of female flowers in longan and therefore a better crop and high yield. Soils of irrigated areas of Sindh and Punjab are suitable for this crop, except that high water table is counter-productive and therefore in rice area it is grown on mounds of about 0.5m high along the tree rows. Excess water can kill the trees. It can tolerate medium saline soils and second-class ground water, which lychee and mango do not. Fruits are smaller than lychee about 1.5 to 3cm in diameter, globes to round in shape. It is less acidic than lychee has more sugar and mild flavour. Propagation by seed is possible, but it would yield first crop after seven to eight years and commercial crop two years later. Grafts are successful but only on own rootstock. Propagation by grafting is successful, but all attempts to graft except approach grafting have failed in Pakistan due to lack of experience among the nurserymen. These factors have come in the way of large-scale propagation in South-Asia though it is common fruit tree in many countries. Different varieties have different sized trees. Dwarf varieties can be planted to about 218 trees per acre.

Fruiting age is 2-4 years for asexual, 2-3 years for marcotts, 3-4 years for grafts and 7-8 years for seedlings. A yield of 10 tons/acre is possible. Under good management, yield in Pakistan can be 15-30kg in year five. It can be used as fresh fruit for table use or dried in 20 days and moisture reduced by 66 per cent. Dried longan is considered highly delicious. Even seeds are used as shampoo. It can be canned and is superior to canned lychee. It can easily be frozen in airtight containers and on thawing it can be used as freshly picked fruit during the season. For export hydrocooled at 5^{o}C and stored, it can last for 40-45 days and at 10^{o}C for 20 days, but relative humidity of 85-90 per cent is needed. At ambient temperature of 25-31^{o}C in August in Karachi, its life will be 4-5 days. For export, of 15-20 gram size is preferred.

The fruit has 18-24 per cent sugar, in edible portion of 66-78 per cent, seed and skin accounting for the rest. It is rich in vitamins A, B1, B2, Niacin and C with iron as mineral. As leaves contain quercetin and quercetrin, they are used in medicines, flowers as herbs and seeds for shampoos. In brief, it has very high economic potential.

Family Sapotaceae:

1. *Mimusops elangi* L., Molsari, Bakul, Sometimes cultivated. Fruit is eaten and sometimes used for making preserves and pickles. The caducuous corollas are used for making fragrant garlands.

2. *Manilkara hexandra* Roxb., Khirni**,** Rajan, Cultivated in gardens in Karachi for its very sweet edible fruits (Berries).

3. *Manilkara zapota* (L.) Royen, Sapodilla, Chikoo, cultivated in lower Sindh and Punjab. Data available from Balochistan reports production of 820 tonnes of Chikoo (yield: 13.44 tonnes / Ha) during 1988-89 mainly from Lasbella (810 tonnes) and little from Gwadar (10 tonnes) (Agric. Stat. Baloch., 1988-89). Being salt tolerant, it is a greatly potential fruit crop for coastal areas of Pakistan but not being fully exploited at present. Fruit is shown to contain two invertases (I and II) (Dahot and Numrio, 1996).

4. *Reptonia buxifolia* (Falc.) A.Dc., Gurgura, Occurs in Sindh, Balochistan (Kohat), Salt Range, Thal, Chitral, Drosh etc. Collected for local use. Fruit sold by boys (FAO- Country Report of Pakistan).

Family Solanaceae:

1. *Physalis pruviana L., Cape* Goose berry, Rasberry, Rasbhary, Often cultivated in the plains and up to 1830m (Nasir, 1985). Also reported growing wild and from Drosh in Chitral. The inflated membranous calyx is persistent and hides the orange berry, which is edible.

2. *Solanum surattense* Burm. F., Kundiari, Momoli, Buiringi, Maraghone (Malakand – Begum *et al.* 2005), Distributed nearly throught country. Unripe fruit is eaten in India. Plant parts medicinal. Famine food. (www.hort.purdue.edu/newcrop/ faminefoods/ff_families/SOLANACEAE.html - Robert freedman, 1998).

3. *Solanum nigrum* L. Makoh, Common Night Shade, Kachmachoo or Karmachoo (Malakand – Begum *et al.* 2005),) Black Night Shade, Distributed throught country. Ripe berries edible. Plant parts medicinal. Fruit contains 5.66% carbohydrates. Famine food. (www.hort.purdue.edu/newcrop/faminefoods/ff_families /SOLANACEAE.html - Robert Freedman, 1998).

Family Tiliaceae:

1. *Grewia asiatica* L., Parusha, Phalsa, cultivated in Sindh, Balochistan and Punjab gardens for its fruits, which are eaten fresh or used to prepare squash from the pulp. For being medicinal, its cultivation has been undertaken by Hamdard at Madinat al Hikmah, Karachi. It may yield fruits, on an average, around 9-11 Kg per plant in a season (Morton, 1987). Khan (1998) has mentioned its two varieties - "Sharbati" and "Shakri". Some 2700 tonnes of Phalsa were produced in Punjab in 1999-2000 (Punjab Bureau Stat., 2000). It can tolerate light frost (Morton, 1987). Being a salt tolerant plant, it may be a success in coastal areas of Pakistan. The fruit contains protein 1.58%, fat 1.82% and sugar 10.27%. It is astringent, and stomachic. When unripe it alleviates inflammation and is administered in respiratory, cardiac, and blood disorders. Its juice is delicacy but ferments easily so sodium benzoate must be added as preservative. The seeds yield bright yellow oil containing palmitic acid 11%, stearic acid 13.4%, oleic acid 13.4 5 and linoleic acid 64.5% (Morton, 1987).

2. *Grewia damine* Gaertn. Bihul, Nikki, Bekhar, garges, bather, *Grewia damine* Gaertn. Common in the dry arid plains and low hills between 500 and 1500 m. Local people eat the subacidic slightly succulent fruit.

3. *Grewia tenax* (Forsk.) Fiori, Kango, Gwangi, (Gangeran, Gangara, India), , small drupes are eaten. Sudan sample of fruit contains protein (6.3%), fat (0.4%), carbohydrates (15.1%) and crude fibre (8.1%). Famine fruit. (Robert Freedman - www.hort.purdue. edu/newcrops /FamineFoods/ff_families).

4. *Grewia villosa* Willd. Common Jalidar, Dohan, Kashkasri (Punjabi), Insarra, Pastuwanne (Pushto), Gangeti (Rajasthan), in dry hot plains and low hills. The fruit is eaten in Punjab and Sindh and it is delicious. Famine fruit. (Robert Freedman - www.hort.purdue.edu/newcrops/FamineFoods/ff_families).

Family Thymelaeaceae:

1. *Daphne oleoides Schreb. (D. muricata* Royale, *D. angustifolia* C. Koch.). Kutilal, Kanthan, Laghonai, Distributed in Murree, Gokand valley, Buner district (NWFP), and Pallas valley. The orange red scarlet berries may be eaten (Khan *et al*., 2003; M. Humayun- Ethnobotanical studies of some useful shrubs and trees of District Buner, NWFP, Pakistan- www.siu.edu/~ebl/leaflets/buner.htm and Saqib and Sultan – www.siu.edu/~ebl/ leaflets/ zafeer.htm). The fruit is also the source of dye for leather.

Family Trapaceae:

1. *Trapa bispinosa* Roxb., Singhara, Water Chestnut**,** Wild and cultivated in permanent and rain-fed ponds. Fresh kernel of fruit has 20% carbohydrates, 5% protein, and fair amounts of Vit. A, B, and C (Mirza and Bokhari, 1996). *T. natans* L. is a four-spined singhara of Kashmir lakes (Stewart, 1972).

Family Ulmaceae:

1. *Celtis australis* L., Tagha (?), Harnai-Loralai, Chitral, Swat, Bishigram, Kaghan, Gokand valley (Buner district), Murree, Hazara, Poonch, Kashmir. Up to 1200 – 3000m (Stewart, 1972; Khan *et al*., 2003). Fruit edible (Khan *et al*., 2003). Akhtar (1985) has, however, reported three species of *Celtis* from Pakistan: *C. caucasica* Willd., *C. erioptera* L. and *C. tetrandra* Roxb. *C. caucasica* is much similar to and often confused with *C. australis*, which is a typical Mediterranean species. *C. caucasica* differs from *C. australis* in having more ovate leaves without a long acuminate tip, distinctly glaucous and much less hairy below. It is perhaps *C. caucasica* Willd., which is called tagha locally.

Family Vitaceae:

1. *Vitis jacquemontii* Parker, Magrath, Ghedar Kuwar, wild edible grape. Perennial climber in Skradu region of Himalaya and Malam jabba (Saqib, Z. and A. Sultan - www.siu.edu/~ebl/leaflets/zafeer.htm and Iqbal, I and M. Humayun -www.siu.edu/~ebl/leaflets/ jabba.htm).

2. *Vitis vinifera* L. Grape, Angoor. Md. Asghar Ginai mentions about 36 varieties of grapes in Pakistan (Nazimuddin and Qaiser, 1982). Several types of grapes with seeds or without are largely cultivated in Balochistan (97.4%). Some grape is also produced in Chitral, Swat, Baltistan, Astor, and Kashmir. Black Corinth grape is dried and exported from Skardu. A green seedless, a white, and a purple grape are cultivated in Kurram. "Sunder Khwani" and "Haita" are the best seedless grapes of Pakistan (Khan, 1998). A popular variety "Gulabi" grape is reported to thrive well in Karachi (Khan, 1998) but it is not cultivated in Karachi now. Anab-e-Shahi, Bokhri, and Kandhari are other good varieties of grape in Pakistan. A few varieties containing seeds are used in making "Munaqqa". Small seedless raisins are called "Kishmish". Grapes contain malic, tartaric, and racemic acid. Oxalic acid is present in unripe fruit. Fresh ripe grapes contain protein (0.5%), fat (0.3%), carbohydrates (12.8%) and ash (0.4%). It is good source of potassium and vitamins. (Duke, 1983).

The area under viticulture in Pakistan remained under 3000 Ha until 1987-88. It could hardly climb to 3800 Ha in 1992-93. However, it has found some impetus in later years and at present it is cultivated on 12700 Ha of land (FBS, 2002; Govt. Pak. 2004). The production trend of grape closely mimics its cultivation trend. Grape production, which was 9600 tonnes in 1957-58, increased to 52600 tonnes in 2001-02 (MINFAL, 2003) but it somewhat declined in 2002-2003 (51800 tonnes). The maximum grape production was recorded in 1998-99 (75800 tonnes). Yield of grapes ranged from 3.43 tonnes / Ha in 1960-61 to 11.88 tonnes / Ha in 1976-77 averaging to 8.919 ± 0.3612 tonnes / Ha with a variation as high as 26.24%. One-way ANOVA of yield for last 43 years indicated that the improvement of yield that took place in mid 1970's could not hold up and production decline took place in late 1990's (Table 6). The yield presently is very low (5.66 tonnes / Ha), which at least may partly be attributed to the climatic adversity prevailing in Balochistan for last few years. Grape production related significantly with area under its cultivation (r = 0.7651). Production exhibited no correlation with yield / Ha (r = 0.0237).

Grape Production (000 tonnes) = 15.9486 + 4.40584 Area (000 Ha) ± 11.34

t = 5.81 t = 7.79

F = 60.70, R^2 = 0.5853, adj. R^2 = 0.5757

GENERAL DISCUSSION

Fruit crops occupy only 2% of Paklistan's agricultural area. In spite of great diversity of climate and the fruit types, production of fruits is far below the obvious potential. Increase in fruit production, since Pakistan came into

being, is generally the function of increase of the area under fruit cultivation. There is little or no improvement in yield / Ha of most types of fruits in cultivation, which appears to presumably be related to deficient agricultural system, poor cultivation methodology, shortage of irrigation water (more especially in Balochistan & NA), and unavailability of specialized research. The absence of infrastructure, transportation facilities (at least in NA and Balochistan in particular), deficiency of storage facilities, poor packaging, and infections are the major causes of losses in harvested produce. Our pre- and post harvest pomo-cultural techniques are outdated. Our existing orchards are diseased and need proper ameliorative attention.

Northern areas (NA) and Balochistan are rich in fruits and other resources, yet poor in material terms. Being close to two centers of fruit diversity – Central Asia and China, Northern Areas, being bestowed with unique horticultural resource, are well suited to several fruit crops. The fruit potential of these areas has not been practically realized so far. The upland areas are characterized with low productivity of fruit crops, great variability in production, high rate of off-grade fruits, small and fragmented land holdings, poor connectivity with market and high post harvest loss up to 50% (Ahmad and Zaif, 2005). The fruit resource of Pakistan in general and that of NA and Balochsitan awaits both *in-situ* and *ex-situ* conservation, which has received very little attention so far. No detailed studies have been undertaken to document varietal diversity of fruits in Pakistan in general and NA (www.northern areas.org.pk/nassd/soed_pdf/biodiversity6.pdf) and Balochistan in particular. It is feared that many traditional varieties are at risk of extinction. There is a need of systematic research and extensive germ-plasm collection throughout country. Preservation and improvement of germplasm needs to be undertaken on priority basis. The germplasm should also be catalogued using standard descriptors and comprehensive database prepared. There is paucity of water in NA and Balochistan. The period of 1998-2002 had been the period of worst drought in these areas, when the total flow of water in major rivers of Pakistan declined to 109 billion m^3 against an average of 162 billion m^3. In Balochistan, as a whole, during this period, the winter rains were reduced by 60-73% in some years, which reduced the fruit yield significantly (Ahmad *et al*., 2003, 2004). Long-term measures obviously require construction of several small-scale storage reservoirs in the country.

Possibilitries of broadening plant wealth of fruit crops should be evaluated because many wild edible fruit species, which are rich in micronutrients and vitamins to help alleviate malnutrition and under-nutrition, are part of its biodiversity. Several under-utilized or neglected species include *Aegle marmalos, Artocarpus lakucha, Averrhoea carambola, Annona spp., Cocos nucifera, Cordia myxa, Dillenia indica, Eriobotrya japonica, Ficus carica, Flacourtia indica, Ficus carica, Grewia asiatica, Mimusops elangi, Morus alba, M. nigra, Litchi sinensis, Pithecelobium dulce, Spondias mangifera, Syzygium cumini, Tamarindus indica, Ziziphus spp.* etc. Many of these species may be grown, at least on marginal lands, to bring furtherance in diversification in agriculture and combat pathogen virulence as a result of diverse ecological cropping. It will diversify the income of farmers and the related sector. It will also diversify diet and contribute to better quality of life (Pradeep *et al*., 2003). Any broad based fruit development programme with integrated multidisciplinary approach like genetic improvement, breeding and screening exotics for possible introduction, etc. shall, of course, be time-consuming, so some appropriate technologies are needed to be developed as an immediate remedy. Such technologies, of course, should be simple enough to be assimilated by farmers easily. Our pomocultural priorities should be: 1. Locating and collecting diversity in the target genepools. 2. Characterizing and evaluating diversity 3. Selection and improvement of native fruit diversity 4. Preparing Information documentation including development of descriptors. 5. Developing cost effective complementary conservation methods i.e. cryopreservation, *ex situ* genebanks, *in situ* conservation. 6. Use of improved diversity in local communities. 7. Human resources development and capacity building. 8. Exchange of information, technology and germplasm. 9. Regional and international collaboration. 10. Impetus and training to the local communities to grow fruits. Biotechnology is to play a great role in the conservation of fruit species, which have somehow been relatively neglected. Drew (2005) reports that in *vitro*, collecting and storage would facilitate conservation of many tropical fruit species that have recalcitrant seeds or are vulnerable in field conditions. Application of *in vitro* slow growth systems and cryopreservation for medium and long-term storage of tropical fruits species have much potential, although some refinements are needed. Until, then, micropropagation protocols are useful for medium term storage. Regeneration via embryogenesis has also been achieved from juvenile tissue in some tropical fruit species. Cases of gene transfer are limited but this technology has also important consequences for conservation as it provides novel method to access the use of genes from plants and other organisms.

The stabs taken towards pomocultural development by PARC are worthy of appreciation and their effects shall, of course, be more or less felt in future. Plant Genetic resource Institute (PGRI) / NARC has taken many expeditions to collect plant germplasm from different agro-ecological areas of Pakistan in collaboration with International Agricultural Research center (IARC) (Anwar, 1996). In 1992-93, under sponsorship of Japanese International Cooperation Agency (JICA) several labs for plant exploration, seed preservation, germplasm evaluation, *in vitro* preservation, data mangement, and plant introduction and seed health have been established at PGRI). This institute

has collected more than 15,000 land races of various crops and preserved them for future use of finding out desirable traits. Several entries have been evaluated. In 2002, besides other crops, PARC released 8 promising lines of groundnut (PARC Annual Report, 2002 – www.parc.gov/pk). Through continuous evaluation of germplasm cultivars of apple, peach, plum, grapes, olive have been selected and recommended for general cultivation (PARC Annual Report, 2003-2004).

Table 7. Area under cultivation, production and yield of various fruits of Pakistan for the year 2003-04.

Fruit Type	Area (x 1000 Ha)	Production (x 1000 tonnes)	Yield (Tonnes / Ha)	Yield Promotion / Reduction over the Year 2002-2003 (%)
Citrus	176.463	1760.346	9.976	+ 6.422
Mango	103.110	1055.987	10.241	+ 1.759
Banana	31.599	174.763	5.531	+ 28.299
Apple	110.784	333.741	3.013	- 46.320
Grapes	12.793	50.833	3.973	- 2.599
Pomegranate	13.209	55.627	4.211	- 69.119
Guava	61.608	549.599	8.921	+ 5.225
Dates	74.791	426.822	5.707	- 28.867
Apricot	28.389	210.882	7.428	- 20.903
Peach	14.746	76.223	5.169	- 37.670
Pear	2.410	30.679	12.730	- 1.471
Plum	7.228	64.273	8.892	+ 2.703
Almond	10.120	23.924	2.364	- 8.298
Fig	0.225	1.207	5.364	+ 39.651
Jaman	1.305	7.481	5.732	- 4.323
Litchy	0.406	2.627	6.315	+ 0.719
Phalsa	1.376	5.689	4.134	+ 1.448
Walnut	1.346	13.954	10.367	- 0.087
Jujube	2.927	16.744	5.721	- 2.105
Loquat	1.376	9.868	7.172	+ 4.624
Mulberry	0.858	4.710	5.490	+ 11.101
Chikoo	1.515	6.920	4.568	- 5. 307
Coconut	1.567	8.526	5.441	- 1.805
Cherry	1.168	1.965	1.682	- 0.119
Pistachio	0.733	3.425	4.673	+ 223.61
Papaya	1.896	9.707	5.120	- 41.645
Persimon	2.940	31.249	10.629	+ 0.577
Melons	42.666	643.431	15.081	- 7.656
Others	25.052	131.151	--------	----------
Total	**734. 616**	**5712. 353**	**7. 776**	**- 11. 727**

Source: Govt. of Pakistan (2004b).

Recently, Mal (2005) has reported significant accomplishments in terms of germplasm collecting, characterization and evaluation, documentation, identification of elite lines, *ex-situ* and *in situ* conservation, socio-economic analysis, human resource development etc. in case of such tropical fruit species as mango, citrus, rambutan, mangoesteen, jackfruits and litchi, as a result of cooperation among 10 Asian contries – Bangla Desh, China, India, Indonesia, Malaysia, Nepal, Philippines, Sri Lanka, Thialand and Vietnam under a comprehensive research project (2000 – 2003) – "Conservation & use of native tropical species biodiversity in Asia" funded by Asian Development Bank. Pakistan couldn't participate in the project.

The national endevour, at present, appears to be somewhat insufficient. Impetus, rather more impetus, is imperative in this multi-dimensional field of research. The production of fruits and their processing and export are a valuable industry. If taken on sound scientific ground, it is a profitable industry.

POST SCRIPT: Data on area of cultivation a nd production of fruits for the year 2003-04 became available by the

time this manuscript was almost complete. Compared to their yield in 2002-03 (Table 7) an overall reduction in all fruit category was found to be around 11.73%. In cases where promotion in yield occurred over 2002-03, it was generally low except banana, fig, and mulberry. Promotion in yield of pistachio was quite high – around 224% over last year yield (associated increase in area of its cultivation during 2003-04 over the past year cultivation area being around 442.96% only). Reduction in yield was found to be substantially high in case of apple, pomegranate, dates, apricot, and peach.

In a recent report of Govt. of Pakistan (2004b) export of mandarine & tangareens / mangosteens (*Garcinia mangostana* L. – Family Guttiferae) of worth of Rs. 1.511 million for the year 2003-2004 has been mentioned. This indicates that mangosteen is being cultivated at some place (s) in the country. We are not certain about the place of its cultivation at the moment. Dr. M. Banras Raja (PARC) may be consulted for mangosteen propagation techniques. He was sent for such training in Philippines sometime (PARC E-news.2000. vol. 20 (9) – www.parc.gov.pk.parcnews/sep2000/ newsseptember.html). Mangoesteen or Dodal is a plant of Far East and referred to as "Queen of the tropical fruits" (see details in Morton, 1987). Its fruit is about the size of small orange and known for its superb flavour. The plant takes years to establish due to poor root growth (Usher, 1971). The fruit has poor keeping qualities. The fruit contains powerful anti-oxidants - xanthones (www.mangosteen.ca/xanthones.htm). Recommended descriptors may be referred to at website - www.ipgri.cgiar.org/publications/pdf/911.pdf.

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