

The use of biotechnology in Sindh, Pakistan to improve Agriculture, its growth and bring Sustainable Development in the country.

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Abstract.

Sindh has Sub-tropical climate, which is extremely suitable for large number of crops, but the farmers of Sindh are illiterate and they raise crops just by copying each other and do not take a risk with their investment. Due to this practice the local market is full with conventional fruits and vegetable raised here namely: mangoes, guava, grapefruit, lemon, lime, sapodilla, cherimoya, dates, lychee, papaya, melons and zizyphus mauritania. The net result is a few varieties of each fruit growing over short season and a glut of one or another fruit crops, throughout the year, and consequently low prices. Due to mono-culture all diseases, infection, and viral attacks are frequent, due to cover large area under same crop, and its control become difficult.

The solution lies in diversification of crops, with extension of harvest season and new cultivars, especially evolved by breeding, tissue culture, genetic engineering and bio-technology. These would be extremely beneficial, to bring sustainability locally and globally.

Agriculture is the backbone of our economy as well as of our foreign trade. To strengthen the economy of Pakistan, one should first of all take necessary steps to reform the agricultural system of the country. This can only be done by educating the farmers in the latest method of cultivation, new developments in agricultural inputs and day to day changes in Agricultural Research arena.

If we improve the agricultural sector in Sindh, and improve its economic growth and conditions, this alone can bring the sustainability locally and globally.

Introduction.

Pakistan lies between longitudes of 60°-70°East and latitudes 40°N to 37°N. It is located in the north-western sector of the South Asia. On its north it has boundary with China, and the Central Asian State in west Afghanistan and Iran. In the south-west is the Arabian sea and Persian Gulf. The south and south-east are connected with India. On north-east and east have Jammu and Kashmir States.

The population of Pakistan in the year 2003 was 149.1 millions. Projected population in the year 2025 will be 249.9 millions and by the year 2050 the population will be 348.6 millions. It cover an area of 307.375 square miles, while it contains 485 population per square miles (Ref. A)

In the year 2000 Pakistan had population 137.8 millions, it increases at the rate of 2.8%. Its projected population by the year 2025 will be 232.9 millions. Its annual renewable freshwater per capita available for the year 1990 was 3,838 cubic meters, while for the year 2025 it will be 1,643 cubic meters, while 74% population from the year 1990-95 having access to safe water. For the same period only 47% population was having adequate sanitation. The crop land available per capita in the year 1990 was 0.17 hectares, which in the year 2025 will be 0.07 hectares. In the year 1992 the CO₂ emissions per capita was 0.6 metric tonnes (Ref. B)

In the year 2003-2004 the actual shortage of river and canal water in Sindh has resulted in drop water table of aquifers from 15 feet to 50 feet. According to Government of Sindh's estimates around 1.4 million people and more than 5.6 million livestock heads have been adversely affected due to drought condition, harsh climate, and pollution caused by above conditions.

In the year 1998 the extent of water-logging and salinity at the depth of 0-5 feet or 152 cm water table depth in Sindh affected 3796000 hectares, while in Pakistan it was 4942000 hectares but water table at 0-10 feet or 305 cm water table depth for the same year total in Pakistan was 9120000 hectares out of which in Sindh it was 5198000 hectares. (Ref. C)

In the year 1998 the extent of saline/ sodic soil total land in Pakistan was 6173500 hectares out of which Sindh had 2109600 hectares. For the same year this saline/sodic land in Pakistan, were 2803800 hectares in which Sindh has 1151000 hectares. (Ref. .D)

In the year 1997-98, the total area under afforestation in Pakistan was 21400, out of which Sindh has 2800 hectares (Ref. .D)

General

The Province of Sindh lies between 23°40' to 28° 30'N and 66°40' to 71° 30' E. The region has sub-tropical climate receiving 100-550 chill units and 3700-4500 heat units. Soil is sandy loam having pH over 7.8.

The major crops growing in Pakistan are rice, sugarcane, wheat, gram, maize, accounting for 35.9% of agricultural value added crops. Area under cotton crop has declined by 10.3%. The minor crops are bajra, jawar, sesames, rape, mustard, tobacco and pulses like, moong and masoor. The production of wheat in the year 2002-2003 was 1.92 million tonnes. The wheat crop shows poor production due to high temperature stress at the grain formation stage, which shrivel the grain and reduces its weight causes attack of aphids in large wheat growing area. The production of rice for the same year was 4.5 million tonnes, the production of sugarcane was 52.1 million tonnes. Cotton production was 10.2 million bales, it suffered badly due to short supply of canal irrigation water. There is also attack of new and serious pest and diseases including viral diseases. The production of maize in 1999-00 was 1565800 tonnes. Grain production was 582100 tonnes.

The production of potatoes and onion was 1996 thousand tonnes. The growth rate of major crop was 5.8% while the growth rate for minor crops was 0.4%. The live stock sector shows growth rate of 2.9%. Due to effect of draught on availability of fodder and feed, results in to decline animal production. The growth rate of fisheries was 16.6% (Ref. E)

In the year 1990-00 the total cropping area in Pakistan was 22.76 million hectares, there distribution was.

- Food grains- wheat, rice, jowar, maize, bajra, and barley about 56% of total cropping area.
- Cash crops- sugarcane, cotton, tobacco, sugar beet and jute was 18% of total cropping area.
- Pulses- Gram, mung, mash, masoor, mattar, other pulses was 6% of total cropping area.
- Oil-Seeds- Rape-seed, mustard seed, sesamum, ground nut, linseed, castor seed and other oil seed was 3% of the total cropping area.
- Vegetables- Covering an area of 1% of the total cropping area.
- Condiments- Citrus, mangoes, banana, apple, guava, peach, pear, plum, grapes, pomegranate, dates, almonds, all kinds of melons, strawberries, cherries and sapodilla was 3% of the total cropping area.
- Others- Cover about 12% of the total cropping area.
- (Ref. Provincial Agricultural Department)

The above statistics show that in the future we have a great difficulty to feed the growing population needs. The productivity of land is affected due to urbanisation, green revolution, modernisation, industrialisation and human and natural activities. Which could not be able to provide enough feeding material unless we have to use biotechnology, advanced technologies and genetic engineering, which helps in producing feed with better quality, better appearance, enhanced nutritional values, better processing abilities, long shelf life, produce crops having ability of insects, pest and diseases resistance, high yielding, dwarf varieties, more yield per acre, less time for maturation, better colour, better taste and flavour, resistance to stress, drought and salinity.

Rice crop (Scientific name : *Oryza Sativa*.L)

In the year 1990-00 the total area 2333800 hectares in Pakistan was under rice cultivation, out of which Sindh contains 685600 hectares. For the same year its production in Pakistan was 4486700 tonnes out of which Sindh production was 1910600 tonnes (Ref. D).

Varieties.

The rice varieties Shadab Showa-92, and Sarchar are developed recently accordingly Sindh climate but following varieties are developed under special conditions.

* Summer Paddies: TTB. As.35, TTB.As.48;TTB.As.86;D1.3;D1.4; SLO.16; MTU.9; MTU;15,CO,13 and PTB,10

- Flood resistant varieties- Kmj, Ar, 108-1, Km,Ar.G.353-148; Kmg,Ar,G,614-25B,BR-14 and BR-15; FR-13A,FR,43-B;MTU,16; PTB,15,Dudhalchi and Jaisuria.
- Salt resistant and drought tolerance varieties- Sr-26-B and Orissa.
- Early maturing varieties- Ch.2-mature in 85 days, Ch.45- mature in 105 days. Ch.62-mature in 110 days and ch.63-mature in 110 days (Ref. F)

*Rice with enhanced nutritional values.

Bio-technologically rice varieties are developed, which have Vitamin-A in it. Also scientists have re-programmed rice, so it has 5-10% soluble prolamines, while the human digestive system absorbs 70-80% insoluble gluten, this re-programmed rice has more protein in it, and it can easily be absorbed by the intestine.

The future lies in using newly developed varieties, which give high production per acre, less immune to attacks of infection, diseases, insects, pest and are able to adjust under harsh climatic conditions.

Maize. (Scientific name *Zea mays* Linn)

In the year 1999-00 the total area under maize production in Pakistan was 944600 hectares, while in Sindh it was 10100 hectares. For the same year its production in Pakistan was 1565800 tonnes, while in Sindh its production was 5300 tonnes (Ref. D)

Varieties.

Its varieties run in to large numbers. Its varieties produce grain colour predominately either white, red or yellow. In Sindh the yellow varieties is more popular. The varieties T.41 and T.4.111 are considered as good varieties. The future lies to bring more high yielding hybrids of flint maize according to our climatic conditions.

Genetically evolved maize.

Maize genetically modified for tolerance to the European corn borer (*Ostrinia Nubilalis*) main insect pest for maize. The genetic modified maize contain bacterial gene, which confers resistance to European corn borer, also contains select -able marker gene for tolerance to herbicide glufosinate ammonium and antibiotic ampicillin. The ampicillin resistance gene has bacterial regulatory sequences and not express in maize. The herbicide resistance gene product was not present in freshly harvested grain from the genetic modified maize.

The insecticidal activity was detected in the fresh grain, but disappeared after drying, and dehydration of the grain. The grain bacterial regulatory sequences on the gene could allow the gene to become function if it were transferred from the genetic modified maize to a bacterium, and allow many copy of gene to be generated in a cell, which could lead high level of production of gene product. The chances of such a transfer occurring in very low but infinite , so it is safe to eat. Since the insects and pest are the biggest source of damage maize crop in Sindh. This genetically evolved maize crops have a great future.

Potato (Scientific name : *Solanum tuberosum.L*)

In the year 1999-00 the area under potato was 97900 hectares in Pakistan out of which Sindh have only 0700 hectares. For the same year the production of potatoes in Pakistan was 1426300 tonnes, out of which Sindh production of potato was 7400 tonnes (Ref. .D)

Varieties.

- Early varieties- Up-to- Date, Magnum-Bonum, Military special, Great Scot, Hybrid 19, Kheera, Gola.
- Mid season varieties- Darjeeling Red Round (Surkha), Italian white, Hybrid-9.
- Late season varieties- Phalwa (Patna White)
- Sweet Potato varieties- White Star, C.L.44 (Ref. .F)

Genetically evolved potatoes.

Genetically evolved potatoes name is New leaf. This varieties can be kept for longer time without sprouting. While other varieties produced by this technology showing resistance to insecticide, pesticide, fungicide and nematocide resistance.

The genetically evolved potatoes have great market potential due to non- sprouting characteristic and more nutritional values.

Squash.

In the year 1990-00 there were 218000 hectares in Pakistan was under vegetable out of which 34700 hectares were in Sindh. for the same year vegetable production in Pakistan was 2889300 tonnes, while in Sindh it was 211900 hectares (Ref.. D)

Varieties.

The genetically developed varieties are resistance to three different types of viruses and its name is Freedom II, The newly variety of Cook-neck squash called ZW-20. These varieties have great future in Sindh, because having better keeping quality and long shelf life.

Soy Bean.(Scientific name : Glycine max)

In Pakistan the soy bean comes under Non -Traditional Oil-seeds. In the year 1999-00 there were about 1364000 hectares in Pakistan, out of which 123000 hectares comes under Sindh. For the same year its production in Pakistan was 1537000 tonnes, out of which Sindh produced 131000 tonnes (Ref. .D)

Varieties

It has varieties resistant to bacterial diseases (*Xanthomonas Phaseoli Sojense*); downy mildew (*Perono spora spp.*); root-rot (*Macrophomina phaseoli*); and leaf Spot (*Cerospora Sojina*). (Ref. .F)

The varieties resistance to herbicide glufosinate, are used to control weeds. The genetically evolved soybean have better nutritional abilities, which is developed by the transfer of Brazilian protein nut to the soy bean. Some people show allergy to Brazillian nut. Scientist still continued their research to control these allergies. It is possible that in future varieties not showing any allergic problem are developed. The genetically soy bean have great potential in Sindh.

Canola or Rape seed (Scientific name : Brassica Species)

In the year 1999-00 in Pakistan 333400 hectares were under rape seed crop, out of which Sindh have 92700 hectares. For the same year in Pakistan its production have 281700 tonnes, out of which Sindh's production was 72500 tonnes; while in Pakistan it yield was 845 Kg per hectare, while in Sindh its was is 782 Kg per hectare. (Ref. .D)

Varieties.

The genetically evolved canola varieties have resistance to herbicide glufosinate, which can control weeds, and varieties having resistance to herbicide gluphosate, which also can control weeds. Some varieties have sterility, this helps in facilitating plant breeding. The canola variety Laurical, has altered oil composition. This variety produce high amount of Lauric acid, and can boost soap market. The genetically evolved canola with high protein is used a source of animal feed industry. The Brassica species normally contain toxic glycosinolate and Euric Acid. But genetically evolved varieties are free from this toxicity. Genetically evolved canola variety Topas is used in manufacturing process and production of bio-degradable plastic.

Pakistan is spending huge foreign exchange to import canola oil. This crop can bring revolution and remove the important burden on agriculture, make the country self-sufficient in canola-oil and its production.

Alfalfa or Lucerne (Scientific name : Medicago Sativa)

In the year 1999-00 in Pakistan 2649900 hectares were under fodder crop , out of which Sindh had 365700 hectares. For the same year its production in Pakistan was 60215100 tonnes, out of which Sindh had 9131100 tonnes. In Pakistan fodder yield was 22700 tonnes per hectare , of which Sindh 's yield was 25000 tonnes per hectares (Ref. D)

Varieties.

Its varieties Kandahar or Quetta, Persian or Arabian and Meerut. The cold resistant variety's name is Lucerne No-9. The genetically evolved varieties give yield up to 36 tonnes . of green forage per acre in 8-10 cutting annually. The genetically evolved varieties under work are; varieties resistant to bacterial diseases (Xanthomonas alfalfae); common leaf spot (Pseudopeziza medicaginea); crown wart (Physoderma alfalfae); downy mildew (Peronospora Aestivalis); dry rot (Macrophoomina Phaseoli) and rust (Uromyces Striatus), (Ref. F)

New varieties.

The genetically evolved varieties is programmed by adding nif A gene, this gene is responsible to enhance the activity of enzyme, which help in nitrogen fixation activities. since the genetically evolved strain produce more alfalfa forage in per acre than its respective parent strain, that is why genetically evolved alfalfa have very good future in Sindh.

Palm oil.

In Sindh only very few farmers have attempted grow palm oil, but it is used to extract fatty easters, glycerol mostly used in soap, candle, lubricants, plastic-idser for PVC, cosmetics industries. It has a great future in Sindh but in very limited area, near the coast in Jati Shah Bander and Ghorabari Talukas. . Palm oil can be used as a substitute of coca butter.

Tomato (Scientific name : Lycopersicum esculentum)

In the year 1999-00 tomato in Pakistan was grown on 29300 hectares out of which Sindh cover an area of 6300 hectares. For the same year its production in Pakistan was 311600 tonnes, while in Sindh its production was 32000 tonnes. Its yield in Pakistan was 10600 tonnes per hectare in Sindh , its yield was 5100 tonnes per hectares (Ref. .D)

Genetically improved tomatoes varieties.

- The genetically improve varieties produce fruits, having controlled and reduced pectin degrading enzyme, but its nutritional values are similar to that of conventionally bred counter part, but this variety have longer shelf life.
- The tomato (Cherry variety) having altered ripening process. It can keep long as fresh for long time . It helps in fresh market value.
- The tomato variety name Flvr Saver, has delayed ripening gene. This variety has large demand in fresh vegetable market.
- Tomato variety have altered pectin enzyme activities and produce thick skin, having better processing qualities is under process.

- Tomato Lycopersicon Chilense has drought resistant qualities.
- The tomato variety Lycopersicon Chimielewskii. Shows improved colour intensity, with more sugar content in it.
- The tomato variety Lycopersicon Esculentum Cerasi Fomr, can stand high temperature and humidity.
- The tomato variety Lycopersicon Hirsutum and for high altitude growing abilities is resistant to many diseases.
- The tomato variety Lycopersicon Parviflorum has better colour with increase soluble solid concentration.
- Tomato variety Lycopersicon Pennellii, shows drought resistance abilities, enhances Vitamin C contents and has more sugar content in it.
- The tomato variety Lycopersicon Peruvianum has pest resistant abilities with rich source of Vitamin C.
- Tomato variety Lycopersicon Pimpinellifolium shows resistance to many diseases, has low acidity but high concentration of Vitamin C in it.

All Fruit Crops.

In the year 1999-00 the area under all fruit crops in Pakistan was 639000 hectares, while in Sindh it was 101200 hectares, for the same year all fruits production in Pakistan was 6152600 tonnes, while in Sindh all fruit production was 587100 tonnes (Ref. .D)

All Fruit Crops in Sindh .Pakistan.

All genetically evolved fruit developed showing better qualities, long shelf-life, enhance nutritional values, attractive colour, uniform size, mature uniformly, long-harvest season, dwarf rootstock, rootstock resistant to adverse environmental condition, having pest resistant ability especially fruit fly and insect attacks, disease resistant against- powdery mildew, anthracnose various viral and bacterial infections, better physiological feature against malformation, internal fruit breakdown and softening of fruits, all fruits have early maturation, with good food processing qualities. Varieties resistant to salinity, acidity and drought conditions, produce high yield. Dwarf cultivars, produce more yield per acres and have better mechanical harvesting qualities.

The new cultivars in fruit crops, if introduced and propagated, will bring revolution in agriculture sector.

Citrus Fruits.

It has many varieties of which the following cover maximum are:

- Grape fruit (Citrus Paradisi Macfi)
- Lemon (Citrus limonia Osbeck)
- Lime (Citrus Aurantifolia Swingle)

In the year 1999-00 in Pakistan had 1958000 hectares were under citrus crop out of which Sindh had 4100 hectares. For the same year citrus production in Pakistan was 1960800 tonnes , out of which Sindh produce 34600 tonnes citrus fruit. (Ref. D)

Future varieties.(Grape Fruit)

Deeper Pink or Red Marsh or Thompson seedless, Ruby or Ruby Red (mutation of Thompson seedless), Red Blush, Shamber, Star Ruby, Ray Ruby, Flame seedless, Rio-Red or Real Red, Nelruby (Nelspruit Ruby), Foster, Chironia, Royal, Puma, Poorman's Orange, , Golden special, Wheeny, Melogold, and Pomelit (Shaddock-Hybrid 202) .(Ref. .I)

Lemon future varieties.

Eureka, Femminello, Hermosa, Limoni, Lisbon, Primofiori, Speciale, Verna, Meyor and Villa Franka Geneva . (Ref. I)

Lime future Varieties.

Keghazi, Nimbo, Mitha Nimbo and Thaitti lime or Persian lime Merican lime, Rangpur lime. (Ref. .I)

Mango (Scientific Name : Mangifera Indica)

In the year 1999-00 mango in Pakistan mangoes was produced on 92100 hectare out of which Sindh covered 41700 hectares of land . For the same year mango production in Pakistan was 918600 tonnes, while in Sindh production was 306500 tonnes of mangoes. (Ref. D)

Local Mangoes varieties.

Present varieties grown in Sindh are: Langra, Dusehri, Alphanso ,Bombay, Summer Bahisht, Rampur, Fajri, Kalan, Chaunsa, Anwar Retoul, Sindhri, Banganpali, Swarnareca, Neelum, Fazli and Zafran. (Ref. .J)

Future Mangoes Varieties.

Apple, Peach, Haden, Bourbon, Espada , Itamaraca, Tomy Atkins, Keitt, Tucpentine, No-11, Amarpali, Malika, Chancleto, Paloma , Hilaza, Mariquiteno, Sufaida, Albania, Papaya, Corazon, Kent , Biscochuclo, Reina de Mexico, Filipino ,combodiana, Irwin, Eidon, Glenn, Palmer, Ruby, Van Dyke, Carrie, Valencia Pride, jubilee, Lippens, Parvin, Sensation, Springfields , Sunset, Smith, FairChild, Brooks, Madome, Fracnis, Julie , Peter, Amelie, Manzanillo, Caroboa, Manila, Rapoza, Philot, Maomi-K, Ah-Ping, Paris No-1, Harders Gorvia, Tele Nene, Chulucanas, Chato de Ica, Rosado de Ica, Carne de Ica Rosica, Cariolle de Carne, Cariollo rosado, President, De Chupar, Co-pachito, Criollo, Smith , Golek, Arumanis, Mangalagi, Barido, Ngowe, Carabao, Pico, Pope , Ottis, Pahuton, Senora, Binoboy, Dudl, Manklar and RAD. (Ref. K)

Mango has very big future in Sindh, due to its climate is one month a- head than other provinces of Pakistan, so the mangoes will ripen and mature and come in the market early. This fetches good price in the market and will have a big demand of fresh mango market internationally.

Banana (Scientific Name : Musa spp. Family . Musaceae)

In the year 1999-00 in Pakistan , the area under banana cultivation was 26000 hectares, in which Sindh have 22400 hectares under banana cultivation. For the same year banana production in Pakistan was 95700 tonnes, while Sindh banana production was 63800 tonnes. (Ref. .D)

Banana Varieties in Sindh. (Ref. .L)

Sindh has two major banana varieties.

- Cavendish Dwarf (Basrai)
- Cavendish Giant (William Hybrid)

Future of Banana in Sindh.

In 1988 banana Bunchy Top Virus (BBT) was found by M .H. Panhwar in Sindh. It started near Sakro-Keti Bunder and gradually spread over to whole Sindh. In the year 1978 Sindh had 60,000 hectares under banana cultivation, with an average yield of 8 tonnes per acres and (BBT) virus devastated all the farms and destroyed all banana cultivated area . (Ref. M)

Apple (Scientific name : Malus Pumila Mill ; Syn. Pyrus Malus Linn)

In the year 1999-00 the area under apple crop in Pakistan was 45500 hectares, out of which Sindh have only 0100 hectare under apple. For the same year apple production in Pakistan was 532300 tonnes , while in Sindh only production was 0200 tonnes . (Ref. .D). Few farmers in Sindh grow apple, which is crab apple.

Apple fruit in Sindh.

Sindh have sub-tropical climate with 100-550 chill units. Only Panhwar Fruit Farm in Sindh have following low-chill apple varieties Anna, Dorset Goldern, Einshmer .Sindh has great potential of introducing the above cultivars.

Guava (Scientific name :Psidium Guajava L. Family.Myrtaceae)

In the year 1999-00 in Pakistan 57400 hectares were under guava crop, out of which Sindh have 4400 hectares. For the same year guava production in Pakistan was 461400 tonnes in Sindh it production was 26700 tonnes (Ref.. D)

Local guava varieties.

Local guava varieties are very inferior in production, taste and are attacked by large number of infections and diseases and its keeping quality is very low.

Future Guava Varieties. (Ref.-O)

Beaumont, Ka Hua Kula (097), Hong Kong Pink, Fan Relief, 11-56 (T3), Supreme (F1), Ruby, Miami Red, Weber, Rolf Hart, GAH- 5673, GA11-56 III, Bassateen, Rojo, Africano, Agrio, Fan Retief guava (Dual Purpose), Dimple Guava (Fredene, Weldheim, Jonelle), Psidium (Beaumont), Psodium cattleianum GPI-823, Psidium Guayjva, Pomoho Pink (Florida), Brazil white, Brazil Red, Red Decent, Pomho Pink, Munlingia Calabura, (Physalis Peruviana), Dovyalis bebecaipa, Solanum guifoense, Psidium guajava IPA-B-22.1, Psidium guajva IPA-B-14.2, Psidium guajava PIA-B-14.3, GOIABA-IAC-4.

Guava not only can have fresh fruit market in Sindh but it will have big demand for processed in food industry in Pakistan and Internationally as well.

Peach (Scientific Name : Prunus Persica Stocks. Family. Rosaceae.

In the year 1999-00 the area under peach was 4400 hectares, where these shares comes from Punjab and Balochistan. For the same year peach production in Pakistan was 43700 tonnes, while nobody except Mr .M .H.Panhwar and Mrs. Farzana Panhwar grow peaches at Panhwar Fruit Farm in Sindh , many varieties of peaches.(Ref. D)

Varieties.

Sindh have Sub-tropical climate, with 100-550 chill units. Under such condition only low chill peach varieties can grow in Sindh. The varieties grown in Sindh are. Florida beauty, Florida Prince, Tropical beauty, Rayon, Tropical sweet, Florida star, Tropical snow and Tropical Glo, are successfully grown by M.H.Panhwar and Mrs.Farzana Panhwar at Panhwar Fruit Farm at Tando Jam in .Pakistan. Peaches are in great demand as fresh fruit, because Sindh peaches comes in the month of May-July, when the peaches supply from other provinces not yet started. Peaches have very big future in Sindh.(Ref. .P)

Grapes (Scientific name : Vitis Vinifera .L., Ampelidaceae family. Vitaceae.

In the year 1999-00 the grapes in Pakistan was grown an 9000 hectares , while they are mostly grown in Balochistan and N.W.F.P There production in the year 1999-00 in Pakistan was 67300 tonnes . No one grow grapes in Sindh, except Mr .M.H.Panhwar and Mrs.Farzana Panhwar at Panhwar Fruit Farm in Sindh .(Ref. .D)

Future Varieties on grapes in Sindh

Most of these grapes varieties are already under cultivation by M.H.panhwar & Farzana Panhwar The various varieties of grapes grown , as well as future varieties are as under. (Ref. .Q)

- White grapes varieties - Emerald seedless, Fresno seedless and Sultana Muscata.
- Black grape varieties- Beauty seedless, Black Muscat of Hamberg, Alphonso lavelle, Monuka , Russian seedless.
- Red grapes varieties- Flame seedless, Ruby seedless, Red globe, Empeor seedless, King Ruby, Cardinal seedless.
- Golden grape varieties- Italia seedless, Thompson seedless, Regina (Waltam Cross) , Perlette seedless, Interlaken seedless, Himrood seedless and Fanta'sy seedless.
- Raisin varieties- Thomuscat, Moscata, Emerald seedless , Fresno 58-93, Russian seedless, Australian MS-23-7, CG-1481, Barlinka, Ribeir and Sultania.

Climate of Sindh is extremely suitable for grapes growing. It have very great future in Sindh.

Pomegranate (Scientific name : Punica Granatum Linn. Family Punicaceae.)

In the year 1999-00 the pomegranate in Pakistan was grown an area of 6500 hectares , it production was 96700 tonnes. Most of pomegranate comes from Balochistan and N.W.F.P. In Sindh only M.H.Panhwar and Farzana Panhwar grow pomegranate successfully at Panhwar Fruit Farm. (Ref. .D)

Varieties grown at Panhwar fruit farm are. Wonderful, Graneda, Ruby Red and Fleshman (Ref. .R)

Future varieties of pomegranate in Sindh.

Foot Hill, Gulosha Rosovayo, Vales, Shepands Red, Karan Seclation, Eliche, Jodhpuri, Ganesh, Poona, Paper Shell, Ras-el-Baghi, Roman Chakab Mallisi, Selimi, Yarquard, Ahmar , Asward, Halwa , Halu, Ragwani, Almasi, Teadril, Molar, Wonderrful, Sweet, Kabul, Red Lou Fani, Maliss Rasel Baghal, Publa, Man gualti, Granada de China, Granode Agria, Tehuacan, Basein, Ganeshi Kabuli, Dolka, Bedana , kalishirin, Glue-Shahi, Kozkai, Achikdona , Soni Bedana, Shirin, Schahvar Bala Myursal, Kara-Bela-Myursal, Gyuleisha -Azerbaijanskaya, Bashkalinskili, Al-Shin, Kai Achak Anor, Shrin Nor and Kazake Anor (Ref. .R)

Pomegranate have great demand both as a fresh fruit as well as processing and juice industry.

Dates (Scientific name : Phonix Dactylifera-L, family Palmae.)

In the year 1999-00 in Pakistan the dates was covering an area 75200 hectares, while in Sindh it cover an area of 20700 hectares. For the same year its production in Pakistan was 581200 tonnes , while in Sindh its production was 111500 tonnes (Ref. .D)

Different forms of date fruit are used as source of food these are.

- Khasiyun
- Kimri.
- Doka or Khalal.
- Looni KharKoon.
- Dang (Rutab)
- Pind or tree ripened (Van Pakal) or Tamar or Kharak.

Local varieties of dates in Sindh are as under.

DegletNoor, Asel, Halawi , Khudrawy, Zahidi, Zari, Shamran, Jowan, Bcrni, Kahrba, Kalud, and Begum Jangi.

Future varieties for Sindh.

Barhi, Dayri, Hayany, khastawi, Maktoom, Medjool, Saidy. ,Sayer, Thoory, Amir Haji, Iteema, Migraf, Manakhir, Agnioua, Chars, Murzaban, Khanezi, Angal, Haiyani, Saidy, Zagloul, Samani, Hamraiya, Irzeiz, Ustaumran, Bikraari, Taasfirt, Murzabad, Sucotari , Succari, Mabsaly, Fardh, Tingerguel, Bufaguns, Barakaavi, Misharig-Khatiba, Fatumi, Mozawati, and Dhakki.

Dates have very big future. The local varieties had shown failure due to low yield, poor harvest abilities, rain and humidity susceptibility. attacks by large number of pest and diseases. The tissue culture and genetically evolved varieties have very big future in Pakistan.

Papaya (Scientific name : Carica Papaya. Family, Caricaceae.)

Local varieties are Honeydew (Malhubindu), Singapore, Ceylon and Washington.

Future varieties.

Solo , Bluestem, Graham, Fairchild, Betty and Kissimmee, Sun-Rise Hava, Waimanalo , Maroochy, Sunybank Coorg Honey-2, CO-1B, Honey-Dew-2, CO-2 and CO-5, Kapoho, Masumoto Solo, Honey Gold, Singapore, PR.8-65, Pink flesh, Puer to Rico, Blue Solo, Brazilian-3, Mexico-2, Campo Grande, Tocaimera, Zapote, Bettina, 43-A-3, Pusa Giant, Pusa Dwarf, Norton, Purplesten, Bluestem, PR-6-65 and PR.7-65.(Ref. S)

Papaya fruit have very big future in Sindh, both as fresh fruit market as well as Papain industry.

Litchi (Scientific name : Litchi Chinensis Sonn. Family. Sapindaceae.)

In Sindh only three small farmer grows litchi. Local varieties Bedana , Surahi and Gola. But M.H.Panhwar and Farzana Panhwar they grows large number of selected from seedlings varieties at Panhwar Fruit Farm.

Future varieties.

Wai Chee, Hakk Yip, Sum Yee , Hong, kwai, May, No Mai Chee, Souey Tung, Taiso, Brewster, Shah Keng, Chony , Young Ong, Chang yum Hong, Tai So, Baidum, Pink, Salathiel, Kaimana, Brewster Sweet Cliff, pink, Maritius, Kohala , Groff, Emperor, Ambonia, Grove Special, Hak Ip, Hanging Green, Kwaluk, Late Glob, Souey Tung, Peerless, Garnets, Shanchi, Yellow Red, Sneathil, Acekce, Kau lu, Kwai Wei, Hsiang Li, Hsi Chio Tsu, Hei yeh , Fei Tsuhsiano, T'ang Po, Shang shou Huai Ch'umatsu, Tatsao, , , Huai Chin, San Yuch Hung, Pai La Li Chin, Shan Chih, Fay Zee Siu. (Ref. T)

Litchi has a great potential as a table varieties as well as canned fruit, and processed industry.

Longan (Scientific name: Euphoria Longana)

In Sindh longan is only grown by M.H.Panhwar and Farzana Panhwar at Panhwar Fruit Farm.

Future Varieties.

Kohala, Daw, Dang, Chompoo, Haew, Biew Kiew, Badium, Homes tead, Ponai Kay Sweeney, Black ball, Fukho No-2, liao , Wai, Carambo , Sweeney, Saig Geeb, Shek Yip, Fa Hakk, Fa Hok Chai, Duanyu , Chien Leiu, Yeng Tau Yeh, Chau on diao, Chiu Yeun Wu, and Xixia. (Ref. U)

Longan have a great future as fresh table fruit in Sindh.

Chiku (Scientific name: Sapodilla or Sapota, family. Sapotaceae)

In Sindh we have only two local varieties called gola and egg.

Future Varieties.

Brown Sugar , Prolific, Russell, and Tikal, Kalipatti, Calcutta Special (Ref.B3)
Pilipatti, Ju-makhia , Mohana Gooti, Kittubarti, Cricket Ball, Dwarapudi, Bangalore, Jonnava-losa-I, Jonnava-losa-II, Jonnavalosa Round, Gauranga, Ayyangar , Thagarammudi, Badam Bhuri, Calcutta Round , CO-I, Dhola Diwani, Fingar, Gavarayya , Guthi, Kali, Vanjet, Pot, Sawo betewi, Sawo Koolon, Sawo apel Kalpa, SCH-02, SCH-03, SCH-07, SCH-08, SCH-28, Modello, Seedless, Boetzberg, Larsen, Morning Star, Jamica '8, Jamica '10, Tikal, Addley, Adelaide, Big Pine Key, Black, Jamica N0-4, Jamica N0-5 , Martin, Saunders, Ponderosa, Java, Sao Manila , Native, Formosa, Rangel . (Ref. .Y)

The local chicku varieties are low in yielding. The improved varieties have very big market potential due to big in size, uniform ripening , large size, and better shelf life.

Jaman (Scientific name: Syzigium Cumini. Family. Myrtaceae)

In Sindh we have only two local varieties, Tall and Dwarf.

Future varieties .

- Syzigium Jambos (Rose apple or Safed jamun)
- Syzigium Fruitecosum, Syzigium Javanica.
- Syzigium densiflora, Syzigium Uniflora and syzigium Zeylanica.
- (Ref. A1)

Early Wild, Late Wild, Pharenda, Small Jaman and Dabaka (Ref-B3)

Jaman have big future as agro-forest tree in Sindh. Its wood, leaves and bark is used in large number of medicines and industries. The jaman fruit is the only fruit advised by the doctor to be given to diabetic patients. Its fruit contain Insulin, which helps in lowering the blood sugar level, but lot of research is needed to improve its keeping qualities and extraction of very useful medicines out of it.

Phalsa (scientific name : Grcwia Asiatica Linn. Family, Tiliaceae)

The Species Grewia Vestita Wall: are divided into two groups.

- Grewia Tilliacfolia.
- Grewia Sapinda.
- (Ref. .J)

In Sindh only Grewia Tilliacfolia is found. The local varieties Sharbati Tall and Sharbati Dwarf are commonly found (Ref. A1)

The tall variety produce fruit which is more acidic, while the dwarf produce fruit with small fruit , having small seeds.

Phalsa have great potential both as fresh fruit as well as processing , juice, jam and jelly making. It is a good source of Vitamin C and used as a quick source of as a relief agent against high summer heat in Sindh.

Custard Apple (Scientific name : Anona Squamosa Linn. Family. Anonaceae)

Although more than 50 species are present in the World, in Sindh we have only Anona Squamosa (Sitaphal Syn. Sarifa) and Anona Reticulata (Ramphal) as local varieties.

Future varieties.

Loma , Mc.Pherson , Ott, Ryerson and Sallmon. (Ref.Z)

Lisa, Impresa , Umbonada, Papilonado, Tetilaolo, Tuberculada, #1, # 2, Chaeuz, Namas, RioNegro, Bronceada, Concha Picuda, Terciopelo, Pinchua, Basta, Bays, Whaley, Deliciosa, Booth, ,Carter, Ryerson, White , Chaffey, Horton , Golden Russet, Mira Vista and Salmn. (Ref. B3)

Although the local varieties are heavy bearers and drought and salinity resistant, but are severely attacked by powdery mildew. The genetically evolved insects, pest and diseases resistant varieties have great future in Sindh.

Jujube (Scientific name : Zizyphus Jujube Lam. Family.Rhamnaceae)

Many local grafted varieties, are very successful in Sindh.

Future varieties.

Banarasi, Pewandi, Dandan, Kaithli, Muria Maharara, Narikelee, Nazuk, Sanauri -1, Sanauri-5, Thornless, Umran, Banarsi, Karaka Kaithli, Katha Phal, Gular Bashi, Kheera, Nazuk, Seober, Var. 1, Var.2, Var.3, Var.4 and Var.5 (Ref.B3)

Zizyphus.Vulgaris, Z.Sativa , Z.rotundifolia, Z.oncoplia, Z.xylocarnus, Z.rugosa, Z.iuiculosa, Z.spina, Z.glabrata, Z. oxyphylla , Z.mucronata, Z.Joazeiro, Z.mistol, Z.lotus, Z.chrisi, Lang, Mushing Hong, Shui Men, So Tu, Tigertooth, Leon Burk, Intermis, and Chico (Ref. V)

Gola is the common variety grown throughout Sindh, it can stand drought and salinity, produce good crop, but the its potential to export in the International market is limited due to severe attacks of infection and diseases, so the future of new varieties in Sindh is extremely good .Due to recent drought many rear plantation of Z.mauritanisa have come and rate are falling. Unless it is exported on large scale, the plantation may have to be removed.

Fig (Scientific name: Ficus Carica L. family.moraceae)

In Sindh only M.H.Panhwar and Farzana Panhwar grow Italian Everbearer and Brown Turkey, fig at Panhwar Fruit Farm.

Future varieties.

Celeste, Brunswick, Marseilles, Adriatic, Genoa, Purple Genoa, Black Ischia and Poona. (Ref.B3)

Cape white, Preston Prolific, White Genoa, Black Genoa, Brown Turkey, white Adriatic, Excel, Flanders, Adriatic, Calimyrna, Kadota, Mission, Conadria, King and Diredo and Brown Turkey. (Ref. W)

In Sindh M.H.Panhwar Mrs.Farzana Panhwar they grow Brown Turkey, which have big market as a fresh fruit. It is very uncommon in Pakistan, because here Pakistan has only dried fig varieties, which are grown in Northern areas of Pakistan. Fig fruit not only is used as a fresh fruit but it is used in fudge making. In Sindh its plant is used as a hedge, it can stand drought, high temperature and salinity conditions up to some extent.

Melon (Scientific name: Citrullus Lanatus)

The Musk melon, Honey dew melon and water melon are common varieties in Sindh (Ref. X). Pine-melon is considered to be future variety in Sindh (Ref.B1)

Major future varieties.

Nemta Dark (W42) F1, Black Lee (W24) F1, Black Ball (w22) F1, Sweet Black (T2-7) F1 ,Red Storm (2006) F1, Green Light (W6) F1, Celebration (W44) F1, Charles Grey (W18) F1, Legend Seedless, Trimander (55) seedless, Yellow baby (S4) seedless, Black babay (S2) seedless, Gold Kin (2002-20) seedless, Mankata-seedless, Beautiful Ball (S8), seedless, Desert Strim (2401), Black Diamond (W11) F1, Tender True (2301), Seedless, Yellow Inter ((24.2) seedless, Free Grower (W28) F1, New Visa (W27) F1, Merchant (B02-17) F1, Long Lamp (VS76)F1, Big Crina (W26) F1, Camanu (F1), Naukara (F1), Lee 1(W37) F1, Amena (F10), Black Sun (W9) F1, Yellow Show (2020) F1, Sweet Heat (w261) F1, Orang Sweet (W25) F1, Green Olive (2013) F1, Black Doll (W20) F1, Little Angel (w21) F1, Vita Star (W17) F1. (Ref.B2)

Hybrid Melon varieties.

Snow White 1(M13) F1, Snow White 11 (M14) F1, Kin Yellow (M18) F1, Honey Fen (M19) F1, Early Ha (M17) F1, Carvela (# 11) F1, Kin Fuhen (M26) F1, Honey Fen (M19) F1, Superman (M12) F1, Queen Kata (M2) F1, Tru Tala.F1, Goddess (M20) F1, Honey Cun (M22) F1, Nova F1, Kam Tam F1, Delicious (VM96) F1, Excellence (VM33) F1, Green Jade (M27) F1.

Sindh 's climate is extremely suitable for all kinds of melons, especially the seedless varieties, having more sugar to acid ratio, better post-harvest life, high yielding , more resistant to infections and diseases.

Sindh Special Fruit Crops.

The Statistics of peaches, grapes, pomegranate, papaya, litchi, longon, chicku, jamun, phalsa, custard apple, jujube, fig , musk melon, honey dew melon and water melons for Sindh are not available. The reason is due to non-functional activities of the Sindh Agriculture Department, Sindh Agriculture Research Institute, Sindh agriculture University, Sindh Agriculture Research Stations and Sindh Agriculture Extension work. All the above department have not helped the farmer or researcher to work and come forward, they have collected no data since 1950 , to improve the techniques and guidance of teaching and training the farmers , as a results the Pakistan Ministry of food ,Agriculture and livestock (Economic Wing) Islamabad is unable to get and add the statistic of above crops under Sindh., one can see the lack of knowledge in Agriculture Statistic of Pakistan 1999-00 book for the above crops in Sindh.

This further worsening the situation for Sindh is not getting any share of money for Agriculture Research and on-going agricultural activities in Sindh, due to not getting enough share of funds from the Federal Ministry, so the poor performance of agricultural sector in Sindh, pushed this province in to deep poverty, which has results in to corruption, stagnancy in progress and breakdown of law and order situation in Sindh.

Future suggestion for improving the Agriculture in Sindh.

The suggestion are as under:

- Government should take immediate steps to monitor Agriculture Departments, Agricultural Research Institute, Agricultural Universities and Agricultural Extension Units in Sindh.
- Government should provide Agriculture Extension service to the farmer, this service is non-existence right now.
- The proper Agricultural Research analysis laboratories with latest equipment and staff should be provided.
- The biotechnology, genetic engineering and tissue culture laboratories should be established in Sindh.
- In Sindh data collection, printing and dissemination Centre should be established.
- Proper soil testing and leaf analysis laboratories should be established.
- The library with latest research reports and journals and Internet facilities should be provided.
- The environmental protection Centre should be established.
- The hospital with facilities of occupational diseases should be established.
- Government should take drastically strong steps to eliminate and reduce the illiteracy rate in the province.
- The stock supplies of standard fertilisers and seeds should be supplied at the season.
- The hospital facilities with the hazard prevention and cure at the field, as well as the poison caused by the any insecticide, pesticide, weedicide and fungicide, medicines and first aid should be available in Sindh.
- All Federal Ministries should keep in touch with the Sindh Department.
- Post-harvest facilities, its processing and cold-storage should be established in Sindh.
- All farm to market road should be established, which are non-existence.
- Government should provide farmer market to sale their produce themselves.
- Government should revised present Agricultural commodities prices.
- Government should provide facilities for publishing Agricultural Research Reports, thesis, books, magazine and journals to bring awareness among the peoples.
- Government should provide an out-let of import and export facilities at farmer's door.
- Government should boost organic agriculture and sustainable agriculture to control environmental pollution.

Conclusion.

The climatic conditions and seasons in Sindh are such that all fruits and vegetable and agricultural crops mature nearly one month earlier than other Provinces of Pakistan. It is not able to provide fresh fruits and agricultural commodities due to lack of encouragement and education and training of farmers and also is not able to facilities in controlling pollution caused by the use of processed food, in which lot of chemicals additive, preservative and derivatives are used to keep them fresh and without any fungal, virus or bacterial attack. These things show negative effect on the health of the users.

Since Sindh has good soil, favourable temperature and enough water facilities, if little efforts are put in agriculture sector this province will bring revolution in agriculture and boost the country's economy and bring the sustainable development in the country and peace globally.

Reference.

Contact of Panhwar Fruit Farm in Sindh.Pakistan.

Panhwar Fruit farm is owned and run by Panhwar Trust.

Location.

The farm is located 25°30', 68°30'E. Panhwar Fruit Farm is located just 6 km from Tando Jam Agricultural University toward Mirpurkhas Road in Sindh. Pakistan.

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At Panhwar Fruit Farm, both Mrs.Farzana Panhwar and Mr.M.H.Panhwar had successfully introduced some 25 new fruit crops in Sindh, on a commercial Scale. Both are authors of some 13 manuals on fruit crops growing in Sindh and about 10 books on fruits post-harvest technology.

If any one needs information or interested in publication of our books, we feel too happy to share our experience and help in arranging Panhwar Fruit Farm Visit.

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