

---

# **Genetically evolved guava (*Psidium gaajava*) and its future in Pakistan**

Farzana Panhwar, May 2005

---

**Author:** Mrs. Farzana Panhwar

**Address:** 157-C, Unit No.2, Latifabad, Hyderabad  
(Sindh), Pakistan

**E-mail:** farzanapanhwar@hotmail.com  
farzanapanhwar@yahoo.com

**Fax:** 92-21-5830826 and 92-221-860410

**Publisher:** Digitalverlag GmbH, Germany  
www.ChemLin.com

© 2005 Digitalverlag GmbH, Germany

Edition ChemLin

www.ChemLin.com

## Genetically evolved guava (*Psidium gaajava*) and its future in Pakistan

### Abstract.

The province of Sindh lies between 23° 40" to 40" to 29° 38'N and 66° 40' to 71° 30'E. This region has sub-tropical climate, having chill units between 100-550 units and 3700-4500 heat units. Soil is silty-loam, having pH 7.8 to 8.3.

In the year 1994-95 the area under guava cultivation in Pakistan was 54,400 hectares, while in Sindh it was 3500 hectares. For the same year the total production of guava in Pakistan was 420,300 tonnes, while in Sindh it was 20,700 tonnes.

In order to meet the food requirement of the growing population, we have to take help of advance technologies, to develop better cultivars, produce more fruit per tree, so genetic engineering is used for this purpose.

### Introduction.

Its name derived from Haitian name guayaba. It have two common species called common guava (*Psidium guajava*), and cattley guava (*Psidium cattleianum*). The cherry or cattley guava is red in colour, fruit is acidic, good for processing. Genus *psidium* (X=II) includes about 150 species, belong to family, Myrtaceae. Its scientific name is *Psidium aromaticum*, and its two species pear guava *P. pyriferum* and apple-guava *P. pomiferum*, are important. In Pakistan the common variety of guava is *psidium guajava*, which produce 100-300 fruits/tree. Five species of *psidium*, which are economically important are, *psidium guinase*, *P. cattleianum*, *P. chinese*, *P. friedrichsthalia*, *P. guajava*, *P. aromaticum*.

### Varieties.

Glom Toon Klav, Glom Um-porn, Kampuchea, Thai Maroon, Waiakea, Etheridge Selection, Oakey pink, Red Indian, Beaumont Donrom, Allabad Safeeda, Lucknow 49, Hong Kong pink, Blitch Hart, Ruby X Supreme, Mulherbe Saxon, Vanzyl, Fanretief, Patillo, Rolf, *P. littorale* (Brazil), *P. guineense* (West Indies), *P. montanum* (Jamaica), Nasik *P. microphyllum* (Puerto Rico), *P. friedrichsthalium* (Malaya). Chittidar, Nasik 88, Ka Hua Kula, Tathen white, Shahidi, Karella, Parker, Dhola 7, Dhanwar 34, Sindh 63, Kothrud 19, 11-56 (T3), Miami Red, Miami white, Homestead, Indonesian Seedless, Pink Acid 25, Feets, Redland, Keerweeder, Patnagola, Pirassunga (Vermetha e Branco), 1AC-4, Pirassunga, Brune, Saoise Rice, Paluma, Paraca, EEF-3, Banarsi, Rojo, Affricano, Agrio, Keerweeder, *Psidium littorale* Raddi var. *longipes*. Fosb and *P. littorale* Raddi var. *littorale* was formed known as *psidium cattleianum* sab. and *p. cattleianum* var. *lucidum* (Degner) Fosb. Variety *longpies* is cattled purple strawberry guava or cattley guava, the var *littorate* known as yellow strawberry guava or yellow cattley and pineappele guava (*Feijoa Sellowiana*).

### Vernacular names.

Guava, Goyavier (Fr), Brunei, Jambu batu, Jambu biji (Malay), Biyabas (Indonesia), Jambu Klutuk (Javanese) Malaysia: Jmbu biji, Jambu Kampuchia, Jambu berase (north), Philippines: guava, bayabas (Taga log), guyabas (Iloko), Burma: malakapen. Cambodia: trapaek sruk, Laos: si da. Thailand: farang (central), ma-kuai, man-man (north, Vietnam: oi.

**General description.**

Guava also called amrood, guayaba, piyara. The largest producing countries are: India, South Africa, Brazil, Columbia, Dominican Republic, Haiti, Cuba, Venezuela, Philippines, New Zealand, Australia, Mexico, Peru, Hawaii, China, Malaysia, Florida and California (USA), Zimbabwe, Kenya and Pakistan.

Guava belong to family Myrtaceae, which include many important species. small tree. Tree also produce suckers from the roots near the base of the trunk. Flowers are bisexual produce as single or in cluster of 2-3 flowers. Guava seedless cultivars are shy bearers Aneuploidy breeding is profitable.

In Pakistan guava give fruit throughout the year. The tree can get height up to 25 feet. Guava tree is evergreen tree, it is a shrub, height between 3 to 10 meters. Plant is drought resistant can stand high temperature good temperature is 80-90°F. It can stand water logging. Fruit have 153-664 seed/fruit. In Sindh distance rows 20'x15 between rows, 145 trees/acre, average yield of 38-75 tonnes/acre.

**Fertiliser.**

500g supper phosphate/tree, 1-5 years apply 100-250g nitrogen/tree, 2 kg of N:P:K/tree, but 200g mixed fertiliser N:P:K at 9:9:9 per centimetre of trunk diameter/year. Defoliation done by 25% urea + wetting agent spray add nitrogen helps to concentrate flower and harvesting period.

In Sindh, date of defoliation pruning 1-15<sup>th</sup> July: date of defoliation and 2<sup>nd</sup> pruning, 1<sup>st</sup> August, vegetative growth, 5<sup>th</sup> September, flower development along with vegetative growth 5<sup>th</sup> September to 31<sup>st</sup> October, fruit pollinate 15<sup>th</sup> October to 10<sup>th</sup> November, 1<sup>st</sup> stage fruit development 5<sup>th</sup> December, 2<sup>nd</sup> stage fruit development 20<sup>th</sup> February, 3<sup>rd</sup> stage fruit development 25<sup>th</sup> March, harvest 1<sup>st</sup> March - 1<sup>st</sup> April. Total time defoliation to harvest 15<sup>th</sup> July to 31<sup>st</sup> March (8 months).

After defoliation with urea and pruning the flowers comes which bear fruit. Crop cycle usually takes 7-9 months. Foliar application of N .1.65%, P. 0.26%, K .1.4%, Ca .1.25% and Mg .0.3% gives good results. Thinning of flowers, produce fruits of large size. Fruit is harvest when its colour change from pale green to first sign of yellowing. Fruit storage at 5°C extend its storage life to 2 weeks.

**Flowers.**

Flowers are borne in clusters of 2 - 3 in the axils of the leaves. Fruit ripen after 3 months of flowering. The fruits are of various shapes like spherical, oblong, ellipsoid, pear-shaped. Size varies from 1 - 5 inches long. Flesh may be white ,yellow or reddish. Seeds are usually triangular in shape. Flowers are hermaphrodite. Calyx lobes are 4-6, 1 - 1.5 cm long, irregular, persistent, petals 4 - 5, white 1 - 2 cm long, stamens numerous, 1 - 2 cm long, ovary 4 - 5 locular; stylus 1.5 - 2 cm long, stigma captivate. Fruit berry, globose, ovoid or pyriform 4 - 12 cm long. Pollen remain variable up-to 42 hours, while stigma is receptive for 2 days Seedling give fruit within 2 years, while colonial propagated fruits gives fruit in one year.

**Fruit.**

Fruits are pendulous and highly variable in size, shape and colour. It is observe that during ripening wall polysaccharides changes by the help of enzymes poly-galacturonase, pectinesterase and cellulose. The standard selection guava weights ,160-300grms , seeds 1-2%, dark-pink colour, fruit with pleasant, palatable, characteristic guava flavour, soluble solids 9-12%, vitamin C 300mg, flesh with few stone calls.

On the basis of specific gravity, guava is divided into 3 groups. Group I, (<1.0), Group II (1.0 - 1.02), Group III (>1.02).

- The group-I have highest content of vitamin C - shelf-life is 6 days.
- The group-II have shelf-life up-to 8 days.
- The group-III, have lowest in vitamin C content, poor colour and shelf-life.

#### Post-harvest treatment.

- Guava without treatment can be stored for 20-25 days.
- Guava dipped for 5 minutes in a solution of NAA at 150 ppm and packed 150 gauge polythene bags increase shelf life to 10-12 days.
- Guava cooling and dip in 6% waxol, can be kept for 8 days at temperature of 27°C, and this will increase TSS + Ascorbic acid content.
- Guava treated 1000 ppm cycocel solution for 5 minutes, kept at ambient temperature 17-23°C for 14 days, increases shelf-life.
- Guava can be stored at 3.5-7°C for 12-14 weeks.
- Benomyl dip helps against fruit rots.
- When guava tree sprayed with aqueous solution of 1%, calcium nitrate + Teepol (0.5ml/litre) as wetting agent before harvesting of crop, this will help into production of fruit of better quality, and it increase shelf -life for 6 days.
- Fruit for juice production has soluble solids 10° Brix, good flavour and pink colour. Stone cells are removed from processing puree with fine screen finisher.

#### Propagation.

It can stand 15 - 45°C, at temperature 23 - 28°C gives high yield results. It require 1000 - 2000 mm of rain/year. Guava usually is propagated through seed. The 70% seedling have same characteristic as parent plant. At 8°C guava seed remain viable for one year. Environment affects on shoot growth, this should be study the effect of defoliation, and pruning effects on force the axillary buds to shoot. Long vigorous shoots dominate, which suppress the emergence of flowering side shoots. Parthenocarpy occurs in diploid as well as triploid cultivars.

It can be propagated by seeds, stooling, root and soft wood cuttings, veneer approach grafting, patch budding, inarching chip, budding and marcotting. These are treated with 2000 - 1000 ppm IBA, It also propagated through clonal propagation, air-layering, veneer grafting and stem cutting It needs the help of Auxin.

Germination can be hastened by:

- Boiling the seeds up-to 5 minutes.
- Soaking the seeds for 2 weeks before sowing.
- Brief treatment with strong sulphuric acid.
- Seed treated with fungicide as Thiram or Captan.

### Yield.

Its yield is 25 - 40 t/ha/year, while in experimental station it produce 100t/ha/year. Two year old clonal tree defoliated with 25% urea solution, yielded 61 kg fruit/tree. Three year old tree defoliated with ethephon-gibberlic acid-urea gives yield 97 kg fruits/tree. Mature tree yield 550 lb/tree or 1/4 ton i.e., 128 trees may have potential of 32 tons, pruning reduces its yield. For maximum yield ,soil must have pH 6-7 .It needs, K-120 - 15 mg/kg, Ca/Mg 25 - 4 mg/kg, Ca+Mg/K > 5.0 mg/kg, N - 0.30mg/kg. The guava tree remain productive up-to 15 years although the plant life is 40-50 years.

Nutritional value: in 100g edible portion contains.

- |                                     |                         |         |    |   |
|-------------------------------------|-------------------------|---------|----|---|
| ▪ Water                             | =                       | 83.3    | gm |   |
| ▪ Fat.                              | =                       | 0.4     | g  |   |
| ▪ Carbohydrates.                    | =                       | 6.8     | g  | In form of fructose 55.93%, sucrose<br>○ + inositol - small quantity. |
| ▪ Fibre.                            | =                       | 3.8     | g  |   |
| ▪ Ash.                              | =                       | 0.7     | g  |   |
| ▪ Vitamin C.                        | =                       | 337     | mg |   |
| ▪ Energy value.                     | =                       | 150-210 | KJ |   |
| ▪ Pectin.                           | =                       | 0.1-1.8 | %  |   |
| ▪ Glycollic, malic and fumaric acid | also present in traces. |         |    |   |
| ▪ Stearic and Palmitic acid.        | =                       | Traces. |    |   |
| ▪ Caloric value.                    | =                       | 38      |    |   |

### Uses.

Guava is used as table fruit juice, pleasantly aromatic jam, jellies and fruit butter. Guava powder is a good source of vitamin C, and pectin (total and soluble). The ripen fruit have low concentration of alcohol-insoluble solids, cellulose and hemi-cellulose. Guava wood used for engraving, spears, handles, chisels, rods, combs and activated carbon, whiles leaves and bark used for dye, tannin, medicine and seeds is used for oil, polishes, medicine and paints.

### Diseases and pests.

Anthrancnose and fruit fly, root-rot cause by phyto-phthora spp. blossom-end rot, Mucor rot caused by *Mucor hiemalis*, fruit canker caused by *Pestalotia psidii*, mealy bugs, thrips, leaf-eating-caterpillars and beetles. Soft green scale; Helmet scale; cottony cushion scale, and leaf blotch. Guava wilt is caused by *Fusarium solani*, wood rot caused by *Clitocybe tabescens*.

### Rootstocks.

- Safeda graft on *Psidium cattleianum* rootstock have more yield. Seedless varieties, like *P. cattleianum*, variety *lucidum* against wilt, *cattlei* guava for high quality fruit, *P. pumillum* is a dwarf rootstock, Chinese guava are resistant to *Meloidogyni incognita*, safeda on *Psidium pulmilum* rootstock show better sugar in fruits, graft on *Psidium cujavillii* rootstock have more ascorbic acid.

- 0.5% Zn + 0.5% boron + urea + single superphosphate spray helps; Gujvillus and straw are dwarf rootstock.
- Seedless cultivars show abnormal meiotic division, with univalent, bivalents and laggards, chromosomes bridge and hybrid origin.
- Haploids study was done to observe callus development and browning, which prevent callus culture, in this study food that cold treatment of anthers delay the browning of calli and enhanced the percentage of callusing anthers.
- Guava is a diploid, inter-specific crosses for combing a superior characters in a single genome is successful. Somatic cell genetic help to develop better cultivars.
- Guava is diploid ( $2n=22$ ), some are artificial triploid ( $2n=3x=33$ ) which produce seedless fruits. Guava mostly propagated by seeds.
- Some hybrid as Safeda Jam (Allahabad Safeda x Kohir), and Kohir Safeda (Kohir x Allahabad Safeda) are good commercial varieties
- Mature guava can be micro-propagated from shoot apices and nodal explants. Guava somatic embryos also germinated well.

### Genetic engineering.

- Genetic engineering is used to develop following characteristic. It is used to isolate 4 anti-microbial compounds - Two new flavonoid these are:
  - Glycosides, morin -3-0-fi-L-Lyxopyranoside.
  - Morin-3-0-fi-L-arabopyranoside.
  - Two known Flavonoids.
  - They are used against solmonella enteritidis and Bacillus cereus.
- It is used to develop aneuploid particularly trisomics and tetrasomics, in which dwarf plants are used as rootstock. Also *Psidium friedrichsthalianum* is resistant to guava wilt, is used as rootstock.
- Somatic cell produce good results.
- This technology is used to control tree size, bearing habit, yield, fruit size, shape, colour, quality, seedless, process cultivars having strong acidic fruits with coloured flesh, while table varieties produce less acidic fruits, while flush, having attractive skin colour, firm fruit and ripen slowly.

### Future.

Future research is needed in the following matters:

- It is needed to study the enzymatic activity of poly-phenol-oxidase results into low level of flavans, proanthocyanidin heteropolymer compound of (+) catechin and (+) gallic acid during ripening period.
- It is needed in vitro manipulation of somatic cells or tissues for regeneration of guava plant, with improved quality of crop.
- It is required to study isobutanol, and butanol sesquiterpenes, their role at immature fruit size and ethyl acetate, ethylcuproate, ethyl caprylate and cis-hexenyl acetate role in fruit maturation.
- It is needed to study morphactin chloroflurecol at concentration of 100u 1.1, effects on various textural, biochemical and physiological changes hence effect on shelf-life of fruit.
- It is needed to find out the effect of ethephon on softening and colour development of fruit.
- Future cultivar Bangkok Golden Apple, is produce as a result of Thai and Indonesian seedless cross. Future varieties should have better shelf life, should be resistant to fruit flies.

- It is needed to study the behaviour of cinnamyl derivatives, B-caryophyllene and C6-derivatives which are responsible for aroma development in guava.

### Conclusion.

Since the guava fruit contains lot of seeds. It is not accepted widely as a table variety. But is used in process industry. The seedless breeding culture is a shy bearer and genetic engineering work is needed to control the shy bearing in guava and ethylene production, which improve shelf-life, also need more work on the development of seedless varieties.

It is used to develop better genotypes of guava having better fruit size, fruit shape, less proportion of seeds, seeds are less hard, guava having better flavour, better texture of flesh, colour of flesh, aroma, ascorbic acid content, acidity, resistant to pest and diseases, tree dwarf, more vigorous, early fruit habits, response to defoliation, induced flowering and post-harvest qualities for processing and desert types guavas.

### References.

- Robert Mohlenbrock, (1988). You can grow tropical fruit trees, Great Outdoors Publishing Co., 77 p.
- Glenn Tankard, (1990). Tropical fruit an Australian, guide to growing and using exotic fruits; Viking O Neil, 152 p.
- Hammerschlag, F.A., and Litz, R.E., (1992). Biotechnology of perennial - fruit crops, C.A. B. International, 550 p.
- Verheij, E.W.M., and Coronel, r.e., (1991). Plant resources of south-east Asia, No.2, Edible fruits and nuts, Pudoc Wageningen, Netherlands, 446 p.
- Seymour, G.B., and others, (1993). Biochemistry of fruit ripening, Chapman and Hall, 454 p.
- Ginai, Muhammad Asghar, (1968). A treatise on horticulture, Bureau of Agriculture Information, Department of Agriculture, Government of West Pakistan, Lahore, 538 p.
- MacDonald, I., and Low, J., (1990). Fruit and vegetables, Evans Brothers Ltd, 137 p.
- Sunset Books and Sunset Magazine, (1984). How to grow fruits nuts and berries, Lane Publishing Co., 112 p.
- Alexander, D.McE., and others (1987). Some tree fruits for tropical Australia, common wealth scientific and industrial research organisation, Australia, 56 p.
- Popenoe, W., (1974). Manual of tropical and sub-tropical fruits, Hafner Press, 472 p.
- Nakasone, H.Y., and Paull, R.E., (1998). Tropical fruits, CAB International, 445 p.
- Hayes, W.B., (1957). Fruit growing in India, 501 p.
- Purseglove, J.W., (1977). Tropical crops, Dictyledous, Vol.1 and Vol.2, The English Language Book Society, 719 p.
- Janick, Jules, Simon, J.E., (1990). Advances in new crops, Timber Press, 560 p.
- Baxter, P., Tankard, G., (1987). Growing fruits in Australia, Nelson, 226 p.
- Page, P.E., (1984). Tropical tree fruits for Australia, Queensland Department of Primary Industries, 226 p.
- Brooks and Olmo, (1997). Register of fruit and nut varieties; 3rd edition, ASHS, Press, 743 p.
- Rice, R.P., and others, (1987). Fruits and vegetable production in Africa, MacMillian Publisherxs, 371 p.
- Kaul, G.L., (1989). Horticultural crops in India, Anmol Publication India, 248 p.
- Government of Pakistan, Ministry of Food, Agriculture and Livestock Economic Wing, Islamabad, Agricultural Statistics of Pakistan -1994-95, 290 p.
- Chundawat, B.S., (1990). Arid fruit culture, Oxford and IBH Publication, Co., Pvt, Ltd, 208 p.

- Singh, S.P., (1992). Fruit crops for wasteland, Scientific Publication, 227 p.
- Singh, V.B., (1990). Fruits of Ne-Region, Wiley Eastern Limited, 194 p.
- Nagh, Steven, and others, (1990). Fruits of tropical and subtropical origin, Florida Science Source, Inc., 391
- Chandra, Atul, and others, (1994). Arid fruit research, Scientific Publishers, India, 302 p.

---

**Author:** Farzana Panhwar (Mrs)  
**Address:** 157-C, Unit No.2, Latifabad, Hyderabad  
(Sindh), Pakistan.  
**E-mail:** farzanapanhwar@hotmail.com  
farzanapanhwar@yahoo.com  
**Fax:** 92-21-5830826 and 92-221-860410  
**Publisher:** ChemLin  
<http://www.ChemLin.com>  
**May 2005**

---

**More articles of Mrs. Farzana Panhwar see: <http://www.ChemLin.de/publications/index.htm>**

**To publish your research papers please contact [office@ChemLin.de](mailto:office@ChemLin.de)**