

## The Guava (*Psidium guajava*)

By

T. B. DASARATHY

Assistant in Fruits, Fruit Research Station, Kodur

**Introduction:** The guava is a sub-tropical, hardy, ever-green fruit-tree grown all over Uttar Pradesh, and Madras. It is grown in parts of Sindh, and also in places like Dharwar in Bombay. It can withstand a maximum temperature of 114° F., even with scanty rainfall of less than 10". In Madras it grows to perfection in the alluvial areas of the Godavari, Krishna and Sarada, where there is an adequate admixture of sand in the soil. In Bombay it has been reported to thrive quite well even on rocky soils. It is known to thrive even upto an altitude of 3,000 feet in the hill zones of South India. It is clear that it is a plant that is adaptable to a variety of conditions.

By careful cultural practices and irrigation, the guava can be made to yield almost throughout the year. The cheapness of the fruit, with the superior quality of the seedless types, make them the ideal dessert fruit of the common man.

The guava is particularly rich in vitamin C., with 280-580 mg. per 100 grams in different varieties. The white-fleshed varieties have generally more vitamin than the red-fleshed ones. The guava is also found to contain adequate pectin, which makes it suitable for preparation of jellies.

Due to its hardiness and ability to withstand climatic vicissitudes, its cheapness, and its usefulness as dessert and preserved fruit, it can have an important place in our fruit industry, but the fruit is not as popular as it can be, mainly because the superior, seedless varieties are not in extensive cultivation and also due to a lack of appreciation of the various guava products.

In spite of the ease with which it is grown the crop has not received so far much attention from research workers. The Bulletin of the Bombay Department of Agriculture by Cheema and Deshmukh (1927) forms the major reference work. A survey of guava cultivation in the Circars was done by Ibrahim (1948) wherein the practices and varieties were described at length.

**Materials and Methods:** The existing guava collection at the Fruit Research Station, Kodur, formed the bulk of the material. The methods adopted for determination of the viability of the pollen and

receptivity of the stigma had necessarily to be limited to field observations. These studies could not be followed up in the laboratory by examining sections at different stages to see whether fertilization took place or not. The existing branches and shoots in the Guava 49 were observed to note the nature of growth and flowering.

**Presentation of Data and Discussion:** The guava is a native of tropical America and belongs to the family *Myrtaceae* and the genus *Psidium*. The leaves are opposite, exstipulate and entire. The flowers are in cymes or in singles on current season's growth only. The receptacle is hollow and is united to the ovary and the flower is in consequence epigynous. The first layer of perianth leaves enclose the flower bud and are generally seen to crack slightly a day in advance of opening of flowers and expose the petals slightly. The calyx is not separable into any definite number of sepals. On the full emergence of the flower the calyx is thrown off bodily as a cap or torn into 2—4 unequal lobes which may subsequently drop away. The corolla consists of white, circular or oval, unequal sized petals varying in number from 5—12, though most have 7 or 8 only. The androecium consists of several thin filaments with bilobed anthers at the top. In some cases the filaments bear miniature petal-like structures, instead of anthers. The stamens are of different sizes and are arranged in the receptacle over the ovary. The gynoecium consists of an inferior ovary and is syncarpous with axile placentation. The style is longer than the filaments and is bent over the stamens in the bud stage. In rare cases the stigma has been noted to be bilobed.

**Opening of Flowers:** It takes 30 days from the visible differentiation of the flower bud to the opening of the flower. The flower buds that open the next morning show a cracking of the calyx on the previous day, nearly 24 hours in advance. The buds increase in size by the evening and the sepals get separated by 3 A. M. and the flowers open completely between 5 and 5-30 A. M. The petals drop off by noon. In the case of the seedless types the opening of flowers is similar except that the flowers open between 8-9 A. M. and in many cases the petals do not unfold themselves but are bodily thrown off as a cap. In a few cases it was noticed that the petal cap remains so for a day even after the opening of the flower.

**Anthesis:** The anthers commence dehiscing 15 minutes prior to the opening of petals and reach the peak dehiscence in about 45 minutes after the opening of flowers. By 7 A. M. 80% of the anthers shed their pollen, though a few may continue till about 9-0 A. M. The anthers thereafter gradually fade away and turn brown by the evening. Many of the filaments drop away by the evening or the next day, though a few might remain till the fruit matures.

**Viability of Pollen:** Pollen collected and kept at room temperature, when used the next day on freshly opened flowers did not result in fruiting in any of the varieties tried, namely, Red-fleshed Guava No. 46, Smooth Green and Nagpur Seedless. (The pollen is used on the same tree.) It may be presumed that the pollen loses its viability under field conditions by the next day.

**Receptivity of the Stigma:** Flowers pollinated one day before the opening flowers did not result in fruit-set in any of the varieties. Flowers that were artificially pollinated immediately after the opening of the flower i. e., 6—6-30 A. M. did not set appreciably in Smooth Green, Red-Fleshed and Smooth White. Flowers pollinated on the next day immediately after the opening of flowers did not result in fruit set, except in a few, rare cases in Smooth White. In very stray cases flowers pollinated on the third day have also set fruit. Flowers that were pollinated at about 8 A. M. in red-fleshed set fruits to the extent of 50%.

It is believed that the receptivity of the stigma commences only after the anthesis is nearly over, by about 8 A. M. and may in rare cases go upto the third day, if not pollinated and bagged. Under natural conditions the receptivity may not extend beyond the opening day of the flower. The stigma of the guava does not show any secretion denoting its receptivity unlike as in some other fruit plants. The stigma before the opening of the flower looks very green and on opening turns pale. By the evening on the day of the opening by 4 P. M. it turns slightly brown in withering up. The stigma is quite prominent in the case of the Nagpur Seedless and the Sharanpur Seedless and is darker than in seeded varieties. The stigma remains fresh for four or five days even after pollination, when kept bagged, in nature though it withers by the next day. The freshness of the stigma does not seem to give any clue as to its receptivity, as apparently such non-withered stigmas when pollinated after three days of the opening of the flower did not yield any fruit set. The style and the stigma are generally not persistent.

/ In nature cross-pollination is the rule as none of the flowers selfed and bagged set any fruit in Guava 49, Smooth Green and Nagpur Seedless.

The flowers are slightly protandrous and attempts were made to trace the agents of pollination. The following insects have been observed on the flowers at the time of anthesis.

1. *Apis dorsata*.
2. *Apis indica*.
3. *Andrena sp.*



Pollination by wind may also be possible as the pollen is very light and is produced in abundance in flowers of almost all varieties.

**Results of Fertilization:** After pollination the visible symptoms of fruit-set are manifest only after about 12 days. The ovary begins to swell slightly. If the flower is not fertilised it drops off between the 8th and 12th day of flower-opening, though in some cases it drops off earlier, by the 5th or 6th day. It is believed that fertilization takes place in about 7 to 10 days after the pollination, though it could not be confirmed by microscopic examination.

**Percentage of Fruit Set in Nature:** This was determined by selecting at random a few flowers and noting the number that had set. In Guava 49 only 12 out of 16 flowers had set. In Red-Fleshed 15 out of 22 had set i. e. 75% in the former and 66% in the latter, in this season.

**Flower Shedding:** Most of the flower shedding takes place between 5—12 days after opening of the flowers. In Nagpur Seedless and Sharanpur Seedless there is greater shedding of flowers and poorer set of fruits than in seeded varieties like Red-Fleshed and Smooth Green. Fruit shedding takes place only to a very limited extent, within a month from the opening of the flowers. The causes are believed to be physiological.

**Parthenocarpy:** Flowers emasculated and bagged in the following varieties did not result in fruit set, showing that parthenocarpy is not a common feature in the guava, even in the commercially seedless varieties.

Guava Red-Fleshed, Guava 46. Guava 49.

Nagpur Seedless, Sharanpur Seedless and Smooth White.

**Seedlessness in Guava:** The commercial seedless guavas are not entirely free from seeds, but do contain 9-20 seeds per fruit. These varieties differ markedly from the other seeded varieties in their leaf structure, opening time of flowers and method of opening and even in the production of pollen. The leaves of the seedless types are more roundish, while those of the seeded are elliptic. The Seedless produces pollen in abundance as the incomplete opening of the flower petals inhibits to some extent insect activity and also of wind which are the main agents of pollination. As already pointed out, the flower petals do not unfold completely in the case of seedless varieties while in the seeded ones they unfold completely. The seedless flowers shed their pollen between 8—9 A. M. while the seeded ones complete the anthesis by 7 A. M.

In guava the bearing is confined to the current season's growth only. The inflorescence is axillary and is in singles or in cymes of 2 or 3 flowers as in jasmine. A bearing twig yields one pair or two pairs and

very rarely two groups of three flowers. As the fruits grow the further growth of the twig comes to a close. The axillary flowers develop in the second and third pair of leaves. Normally the bearing twigs grow a few inches long, putting forth only four or five pairs of leaves. If meanwhile the flowers happen to set, the terminal bud does not grow any more but rests till the next growing season. After the fruits develop and mature, this twig generally dries up from the terminal bud backwards. In very rare cases when the tree and the branch are vigorous, further extension takes place in the next season but these growths do not bear flower or fruit directly.

The guava also puts forth another category of shoots every growing season, the vegetative shoots, as opposed to the flowering shoots described above. These shoots continue to grow, putting forth five to ten pairs of leaves in the growth period and rest for a while till the next growth period when it resumes growth again. The main difference between the two types of wood is that the fruiting wood generally dries up after the fruits are harvested while the vegetative wood merely rests for a while and continues to grow again. After a lapse of two or three seasons the axillary buds on the vegetative wood get activated and turn to be either fruiting wood or vegetative wood again. As the lateral buds get activated one by one the terminal growth comes to a close. In nature not all the buds get activated in one season and it takes several years to exhaust all the buds on such type of wood. The number that get activated depends on the vigour and age of the tree. Due to this peculiar phenomenon it is often found that the bearing region goes higher up with the age of the plantation though a few shoots that are activated on wood that is more than two or three years old remain at the lower reaches. This accounts for the patchy and irregular growth of the guava trees if left to themselves without sufficient care or attention.

To remedy the irregular activation and to keep down the bearing regions at a proper height to facilitate harvest, to increase the current season growths which are the ultimate bearers of the crop and to provide adequately for springing up of the vegetative wood, a proper system of pruning is essential.

The pruning removes the wood that bore the crop after the harvest as no longer useful to the plant, and cuts down to half the length, the vegetative type of shoots. This helps to activate the lower buds much earlier than in the normal course. It also helps in getting rid of unwanted wood, namely the shoots that bore the previous crop. It is essential to keep the tree in full vigour by adequately manuring and irrigating, as otherwise the response to pruning may not be impressive.

The Bombay method of pruning does not distinguish between the two types of wood but advises merely the pruning of fruiting wood to one or two buds unlike the system of pruning suggested above. By pruning closely to one or more buds the chances of getting more fruiting shoots are reduced, besides the risk of drying up of the entire twig. This might have been the reason why the pruned trees in their experiment have yielded only half that of unpruned trees. The quality of the fruits would have naturally improved as the total yield per unit plant decreased.

Pruning has to be done immediately after the harvest of the crop, that is once in January - February and again in August - September, if two crops are taken.

**Conclusions :** 1. Guava is a cross-pollinated crop.

2. Parthenocarpy is not a common feature in guava, at least in the varieties, Guava Red-fleshed, Guava 46, Guava 49, Nagpur Seedless, Sharanpur Seedless and Sooth White.

3. The crop is slightly protandrous.

4. The commercially seedless varieties differ in leaf shape, opening time of flowers, method of opening and anthesis, from the seeded varieties.

5. The guava throws out two distinct types of wood during the growth phase, a recognition of which is essential for understanding the bearing habits of guava.

6. Pruning of the vegetative wood to half the length and the removal of the fruiting wood after the harvest of the crop will lead to a proper manageable structure of the plant in addition to increased crop of better quality.

**Summary :** 1. The importance of the crop and its potentialities have been indicated.

2. The blossom biology of the crop has been presented and discussed.

3. The bearing habits have been analysed and a suitable method of pruning suggested.

#### **Acknowledgments**

My thanks are due to Sri C. Bhujanga Rao, B. Sc. (Ag.), Superintendent, for affording all facilities for the above work. My thanks are also due to the Government Entomologist for having identified the insect agents of pollination.

## BIBLIOGRAPHY

1. Cheema, G. S. and Deshmukh, (1927) ... Culture of the Guava and its improvements by selection in Western India. Bull. 148 of 1927 of Bombay Department of Agriculture.
2. Hayes, W. B., ... Fruit Growing in India.
3. Ibrahim, Syed, (1946) ... A survey of Guava cultivation in the Circars.
4. Lowson and Sahni, ... Text book of Botany for India, Pakistan and Ceylon, revised by Howart and Warne, London University Tutorial Press, Limited.
5. Naik, K. C. (1949) ... South Indian Fruits and their Culture, Varadachary & Co., Madras.

## A Note on the Five Year Plan

*Present Position:* A number of Agricultural Schemes have been in operation from 1949-'50 under the Three-Year Plan of intensive cultivation schemes listed below. The planning Commission's Five-Year Plan is a continuance of the Three-Year Plan already initiated.

*Provisions in the Plan:* The Planning Commission after studying the Development Schemes of the Central and State Governments suggested the formulation of the Five-year Plan. The States drew up a plan of development suited to their local conditions and fixed targets for each of the Schemes included under it. The available resources—financial, technical and administrative—have been concentrated in a limited number of schemes and targets, easy of attainment, have been fixed. Among agricultural schemes, schemes which go to increase the production of food grains in a relatively short period and subsidiary schemes which supply the necessary equipment as a complement to the main schemes, have been formulated.

The main agricultural schemes included under the Plan are (a) distribution of improved seeds of paddy and millets and green manure (b) distribution of fertilisers (c) preparation of rural compost (d) land reclamation by tractor cultivation (e) distribution of oil engine and electric motor pumpsets and accessories for lift irrigation (f) installation of river pumping units and (g) Plant Protection. The targets and the estimated cost of the schemes are indicated below :—

Name of Scheme	Total Cost	Estimated
		additional Production
	Rs.	(Tons)
Distribution of Improved Paddy Seed ...	2,27,86,594	2,33,992
Distribution Millet Seeds ...	43,61,701	1,01,104
„ Pulses Seed ...	2,88,901	2,760