

SITAPHAL AND OTHER ANNONA FRUITS IN INDIA



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SITAPHAL

SITAPHAL or *sharifa* is known by different names such as sugar-apple, sweet-sop and custard-apple. The fruit belongs to the Annonaceae family. Though this family contains more than 40 genera, only a few of them produce edible fruits. The genus *Annona* contains more than 70 species. Of these, only five produce fruits of some importance.

Several species of *Annona* are found growing in Brazil, Peru and other parts of South America. In Peru, cherimoyer was being grown even before the discovery of America by the Europeans. From its occurrence in the sculptural designs at Ellora and Ajanta, and its mention in Sanskrit literature, *sitaphal* appears to be indigenous to India. This fruit must have spread rapidly to other parts of the world after the discovery of the New World.

The Annonaceous fruits, believed to have originated in the Tropical America, are now widely distributed throughout the tropics and sub-tropics. These have not succeeded in the Mediterranean countries or in the temperate regions where the winter temperature falls to the freezing point. Most of the *Annona* species are found growing wild in many parts of India which possess a tropical climate.

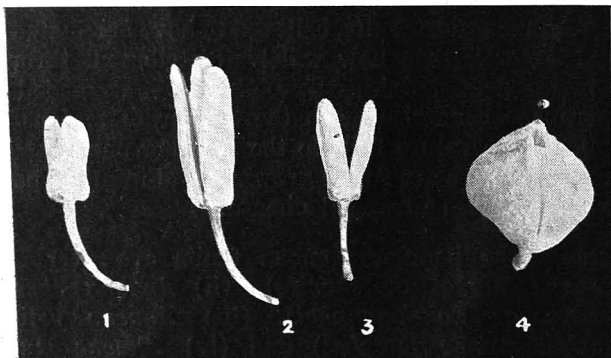
Some of the popular *Annona* fruits are : (i) *Annona squamosa* (*sitaphal* or *sharifa*), (ii) *Annona cherimola* (cherimoya or *Lakshmanphal*), (iii) *Annona reticulata* (Bullock's Heart or *Ramphal*) and (iv) *Annona muricata* (soursop or *Mundla sitaphal* in Telugu).

Apart from these fruits, *Annona glabra* or 'pond-apple' is also found in a few places. *Rollinia orthopetala* is another species of this family, possessing large, fleshy fruits with a delicious flavour. The biriba (*Rollinia deliciosa*) is popular in Brazil. The papaw (*Asimina triloba*) is a wild fruit of the temperate region in the United States.

The other Annonaceous species have some value as root-stocks in breeding. The popular *asoka* tree or *Polyalthia longifolia* and *Artabotrys odoratissimus* (*champaka*) are other commonly known Annonaceous plants found in India.

Annona amplexicaulis and *Annona grandiflora* occur in the islands of Mauritius and Madagâscar. *Annona purpurea* or Negro Head is common in the Isthmus of Panama. *Annona glabra* is known by such names as pond-apple, alligator-apple or monkey-apple. It is a medium-sized tree growing in swampy places. The fruit is smooth, and possesses a leathery skin with a cream-coloured pulp. It looks like young, under-developed mango, but is not edible. It has been found to be a dwarfing root-stock.

Flowers of different *Annona* fruits : (1) *sitaphal*,
(2) *Bullock's Heart*, (3) *cherimoya* and (4) *soursop*





Fruits of pond-apple (*Annona glabra*)

Annona montana known as 'mountain soursop', is found in Central America, and *Annona longiflora*, known as wild cherimoya of Jalisco, is found in Mexico. The latter is a small shrub, and is not known in other parts of the world. Another Annonaceous plant is Ilama (*Annona diversifolia*), the fruits of which are said to be similar to those of the *sitaphal*. It is common in Mexico and Central America, but is entirely unknown in India.

DISTRIBUTION

Tropical America is considered to be the home of Annonaceous fruits. A few are also found in Africa. Some are grown to a limited extent in Egypt, Ceylon and Java. Some species have been introduced into southern California and Florida in the U.S.A. In India, Annonaceous species occur commonly in the Deccan plateau and in some parts of central India. Annonaceous fruits prefer a dry climate, but do not withstand a severe low temperature. Most of these fruits are found to flourish under very dry conditions in a semi-wild state, withstanding drought very well.



A *sitaphal* plantation in Andhra Pradesh

The acreage under *sitaphal* in India is estimated as follows.

State	Acres
Andhra Pradesh	1,01,000
Madhya Pradesh	500
Madras	200
Uttar Pradesh	300
Bihar	200
Bombay	500
Other States	1,000
Total	1,03,700

CLIMATE

Sitaphal and other Annonaceous fruits grow under semi-wild conditions in the Deccan plateau. *Sitaphal* especially prefers a warm, dry climate, with a moderate winter. The tree goes to dormancy from December to February and sheds its leaves. New growth emerges with the commencement of spring; flowering starts later.

A rainfall of 20 to 30 inches is considered optimum. But in some places like Ceylon, it is found to thrive both at the sea-level and at elevations up to 3,000 feet, with a rainfall of about 100 inches. The tree suffers if there is water-logging or alkalinity in the soil, though it is tolerant to drought to a great extent. *Sitaphal* tolerates extremes of heat. But when the summer temperature rises above 103°F, the tree sheds its flowers badly. Thus, under such a condition, its yield goes down correspondingly. In years of mild summer, with a fair distribution of rainfall, there have been bumper harvests of *sitaphal*.

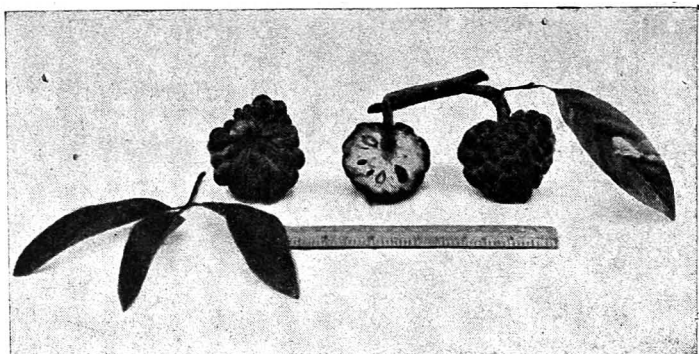
Of the different fruits of the Annonaceous family planted under identical conditions at the Fruit Research Station, Sangareddy, *Ramphal* (Bullock's Heart) did not thrive under a severe summer. *Sitaphal* and cherimoya alone are found to be hardy among all the Annonaceous fruits in the Deccan plateau.

SOIL

Sitaphal grows well in red sandy or gravelly soils, known as *chalka* in Andhra Pradesh. In fact, *sitaphal* is found to grow in a rocky soil and in-between crevices of rocks under natural conditions. Although stony ground or gravelly soil is suitable for its growth, *sitaphal* thrives in sandy to medium loams as much as in heavy soils and in pure sandy soils. Heavy black soils which crack in summer are unsuitable for the cultivation of *sitaphal*. Generally, shallow and poor classes of soil are preferred for the cultivation of these fruits.

VARIETIES

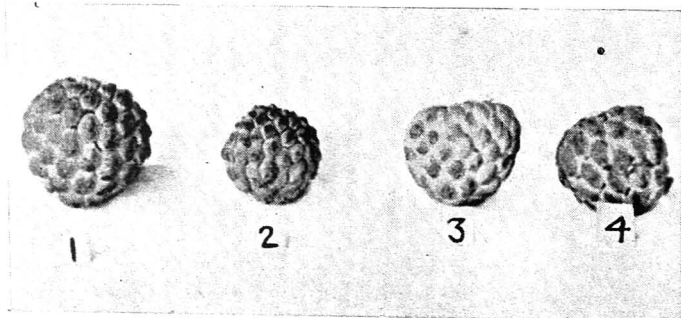
There are no standard varieties of *sitaphal*. The fruits vary in size, colour, quality and the number of seeds in them. The colour of the outer skin varies from green to cream yellow.



Fruits of Red Sitaphal

There is a distinct variety of *sitaphal* which bears light reddish purple-coloured fruits which look attractive. The plant is dwarf, with the leaves having a purplish mid-rib.

Some of the promising selections of sitaphal: (1) *Balanagar*,
(2) *Washington*, (3) *Barbados* and (4) *Mammoth*

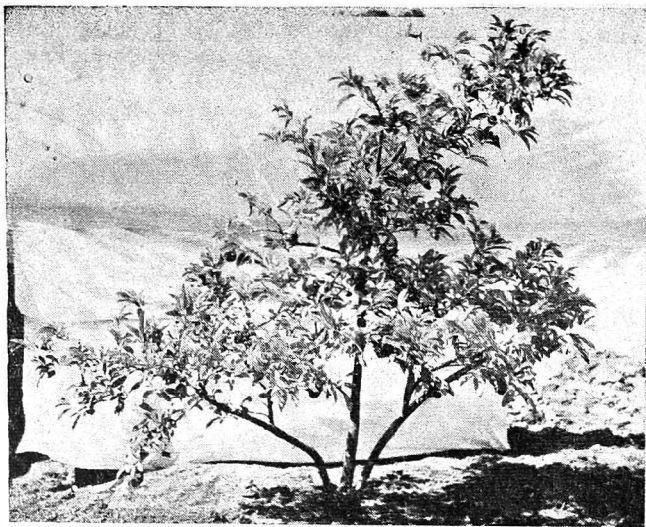


The fruit is similar to that of ordinary *sitaphal*, though containing more seeds. The plant seems to have occurred as a chance seedling, and breeds true, even by seed. The tree bears 40 to 50 fruits per year. The fruit is popularly known as *Lal Sitaphal* or *Red Sitaphal* (*Annona squamosa* var. *sangareddy*).



There is another distinct variety of *sitaphal*, known as *Mammoth*. Its fruit is ovoid. Its segments are very broad and round. This variety yields regularly, and is a dependable bearer. The yield varies from 60 to 80 fruits, the quality of the fruit being somewhat better than that of ordinary *sitaphal*.

Other promising selections are *Washington PI 107005* and *Balanagar*. A survey of *sitaphal*-growing regions has



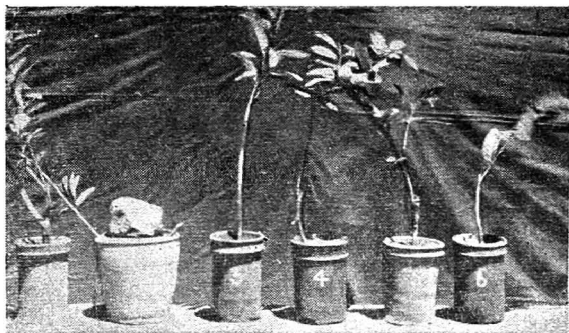
A tree of *Balanagar Sitaphal*.

been made in this country, and several outstanding, heavy-yielding plants have been perpetuated by budding at the Fruit Research Station, Sangareddy. The progenies of these plants are likely to come to bearing in a few years.

PROPAGATION

Sitaphal is propagated by seed. Normally, the seeds are sown *in situ*. Its propagation is also helped in nature by birds, squirrels and other agencies. The seedlings grow about a foot high in a year's time, and afterwards can stand transplantation.

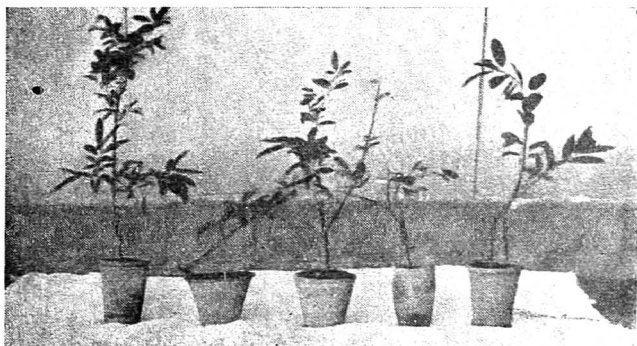
Propagation by root cuttings does not give more than a two to five per cent success. Budding and grafting, however, are more successful. Among all the methods of propagation tried in India, shield-budding of *sitaphal* on its own root-stock and on *atemoya* has given a 60 to 80 per cent success.



(1) Seedling, (2) layer, (3) air-layer,
(4) inarched plant, (5) side-graft and
(6) budded plant

VEGETATIVE PROPAGATION OF *SITAPHAL*

(1) Air-layer, (2) layer, (3) side-graft,
(4) inarched plant and (5) budded plant



Of the several different species, atemoya has proved to be the most vigorous and satisfactory root-stock for *sitaphal* in Andhra Pradesh. The method of budding practised is essentially the same as that in citrus. The bud is collected and used immediately, and is protected by covering it with a bandage of alkathene or banana fibre for a fortnight, which is the time needed for the bud to unite with the stock. The root-stock is then lopped back by three to six inches and the bandage at the bud-joint unwound. It is rewound later, keeping the bud exposed. This facilitates the sprouting of the bud.



A four-year old grafted *sitaphal* plant

Other root-stocks like *Annona glabra* and *Annona muricata* have not promoted a vigorous growth of *sitaphal*. Grafting by inarching on these root-stocks has not been successful. But *sitaphal* shows a delayed incompatibility on soursop (*A. muricata*) and pond-apple (*A. glabra*). Yet, surprisingly enough, buds of *sitaphal* on soursop have been found compatible so far.

At the Government gardens in Agra, budding and inarching are practised. In Java, the modified Forkert Method of budding is preferred, while in Florida and Ceylon, shield-budding is practised. Bud-wood about a year old gives best

results. Inarching is in vogue in Madras State. Work at Sangareddy shows that cuttings from the basal portions of the branches from the middle of the trees can be rooted. A fat bed is best suited for their planting. But the percentage of success obtained by cuttings is 5.3 as compared to a cent per cent success with grafting in July. Air-layering and layering are less preferred to grafting.

Soursop is used successfully as a root-stock in Ceylon. But in Java, Bullock's Heart has proved better. In Israel, it was found better on its own seedlings. At Kallar (Madras State), inarched plants on Bullock's Heart flowered within four months of planting. Grafting on Bullock's Heart and *Annona glabra* is found successful.

In growing seedlings for root-stock purposes or as trees, Hayes recommends the use of fresh seed; Ahmed, however, recommends that the seed be exposed for a week. Seed-germination can be hastened by scarification or soaking for three days in water.

Because *sitaphal* is propagated by seed, it varies very greatly in production as well as in the size, colour, form, texture, and quality of fruit. Best results, according to Ahmed, are obtained if budding is done at the end of the dormant period. In Egypt, budding in July-August and March has given over 60 per cent success as compared to the other months. In the Deccan plateau, February-June and September-October are the ideal months for budding.

CULTIVATION

There are no commercial plantations of the *sitaphal* or any other Annonaceous fruit in India. No grower has paid serious attention to this class of fruits or tried any scientific methods of cultivation. Hence, very little information is available about the optimum cultivation practices for the *sitaphal*.

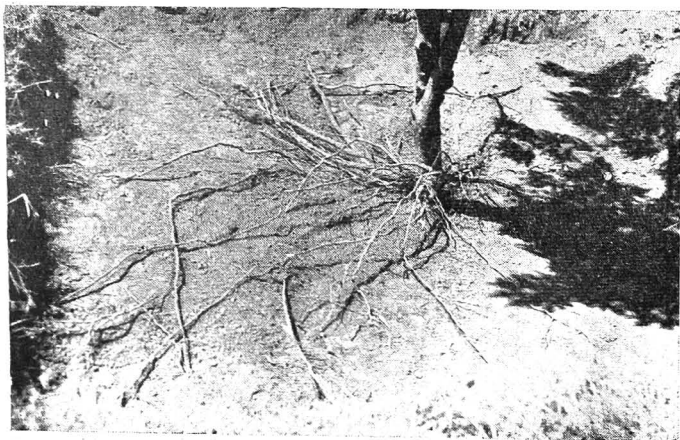
The fruit tree is universally grown by seed. But the success achieved by shield-budding on atemoya shows that

it is possible to perpetuate desirable forms of the fruit by vegetative propagation.

It is generally believed that the *sitaphal* comes best when left to itself. In fact, there is a prevalent opinion in the Deccan that the *sitaphal* is likely to deteriorate by cultivation. The *sitaphal* grows very slowly and never attains a good size if planted in very poor soils or if not given sufficient attention. In natural conditions, it lives for about 15 to 20 years.

The seedling plantation of *sitaphal* raised in 1933 at the Fruit Research Station, Sangareddy, and kept under natural conditions has declined in two decades. A survey of the *sitaphal* plantations in the Deccan has indicated that about one to two per cent of the trees perish every year due to unfavourable conditions. In nature, the tree population is kept

Root system of a bearing *sitaphal* plant



up, and remains constant in semi-wild forests due to the continuous seed-propagation. In some regions of Telangana, the area under the *sitaphal* is gradually declining due to the spread of shrub weeds like *Lantana* and *Randia*.

The *sitaphal* forms a small bush with a large number of branches of various sizes and ages. In about five to six years' time, seedling plantations come to bearing. *Sitaphal* plants budded on atemoya have come to bearing in the second year itself. Most of the crop that comes to the market is from the semi-wild forests in the Deccan plateau. There are hardly a few plantations which are grown under protected conditions. Under cultivated conditions, the performance of the *sitaphal* has been found to be very satisfactory. This proves that there is a need for proper cultivation and maintenance of the trees.

In poor soils, a spacing of 14 to 15 feet is adequate, whereas in soils of moderate fertility, it should be 20 feet. Closer planting should be resorted to under rainfed conditions with a view to improving the pollination and raising the humidity of the atmosphere. Budded plants are planted in pits 1½ feet deep. The pits are first filled with tank silt and wood-ash. This promotes good growth in new plantations. In alluvial soils, it is not necessary to dig pits. One to two baskets of farmyard manure and wood-ash are added to the soil before planting.

Manuring is not practised for *sitaphal*, but it needs a proper application of manures, as the trees are found to decline gradually if not manured and cultivated. Firminger recommends the use of lime mortar or cow-dung as manure. A fertilizer containing three per cent nitrogen, ten per cent phosphoric acid and ten per cent potash has been recommended by Carle in Cuba. In Egypt, the application of organic fertilizers has improved the size and quality of the fruit.

Cultural trials on the *sitaphal* indicate that green manuring the orchard is a simple and economic practice to

follow. At the beginning of the kharif season, sannhemp, *mung* (green gram), cowpea or any other 'green manure' crop should be broadcast at 20 to 30 pounds per acre. The green-manure crop comes into flower in August-September. It should then be ploughed in and mixed with the soil. If done regularly, this improves the vigour of the tree. The bearing capacity gradually increases or, at least, is well maintained even in an advanced age of the tree. Even merely ploughing the orchard during the rainy season helps increase moisture in neglected plantations. In the Nalgonda and Medak Districts of Andhra Pradesh, crops like *jowar* and castor are grown under rainfed conditions in the wild *sitaphal* plantations.

In spite of these intercrops, the *sitaphal* trees are found to be better than those growing under uncultivated conditions. This is due to a frequent stirring of the soil by ploughing. Several intercrops like groundnut, *bajra* and *til* are grown in the *sitaphal* plantations in the Deccan. It is desirable to crop these plantations with sannhemp or *mung* in the *kharif* season. In the *rabi* season, horse-gram can be grown. The application of castor cake and bonemeal in the ratio 2:1 is found beneficial.

IRRIGATION

The *sitaphal* is grown normally without irrigation in India, as it is a fairly drought-resistant plant. The plant is able to produce a fair growth in the rainy season, taking advantage of the South-west monsoon. The fruit begins to set in the months of June-July, although flowering starts in two flushes from March to July. The fruit starts developing from July with the onset of monsoon, and ripens in September-October. The tree, therefore, naturally benefits by the rainfall that it receives during its bearing period. One or two irrigations at the time of the ripening of the fruit will improve the size and quality of the fruit. In Egypt, regular irrigations for the *sitaphal* are recommended.

Irrigated trees make luxuriant growth and come to bearing very early in the season. In humid tracts, the crop comes to harvest as early as August, and this extends to October-November in dry regions.

BAHAR TREATMENT

Hardly any treatment is given to induce the *sitaphal* to fruit. The *sitaphal* is a deciduous plant. The fruits are borne on old as well as new wood. Light pruning of old wood induces better branching. The *sitaphal*, being sensitive, does not recover from the shock of a severe pruning. Pruning is done to remove overcrowding of branches. In budded plants the growth is uniform, and there is very little need for any pruning.

From November to December normally the *sitaphal* goes into dormancy. The leaves gradually turn yellow and shed at the time of the harvest of fruit, when winter is at its peak. The plant remains without foliage for about two months. The new growth emerges with the onset of spring. The *sitaphal* thus makes a cyclic growth every year. Any fruiting or *bahar* treatment should, therefore, take into consideration these factors.

CROPPING

The seedling *sitaphal* plants come into bearing after about five years and the budded plants from the third year onwards. Flowering starts in March and extends up to July. In July, a second crop of flower clusters appears on the old as well as the new wood. A medium-sized tree bears about 1,000 to 1,500 flowers in the season. Most of these flowers drop away. Only about two per cent set and bear fruits.

The *sitaphal* is mostly cross-pollinated as the stamens and pistils in the same tree mature at different times.

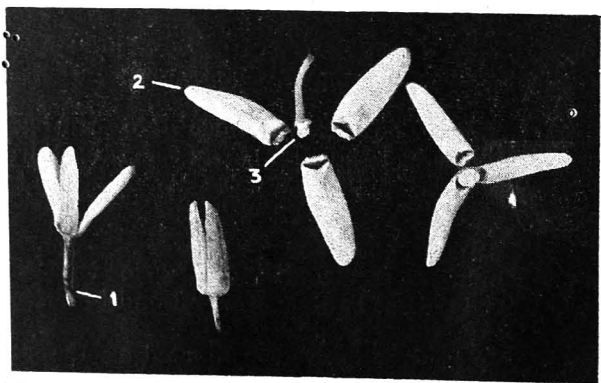
Within three days of opening of the flowers, petals drop out after pollination. Otherwise, the entire flower with the aggregate ovaries sheds. The period of fruit development, from flowering to harvest, covers about four months.

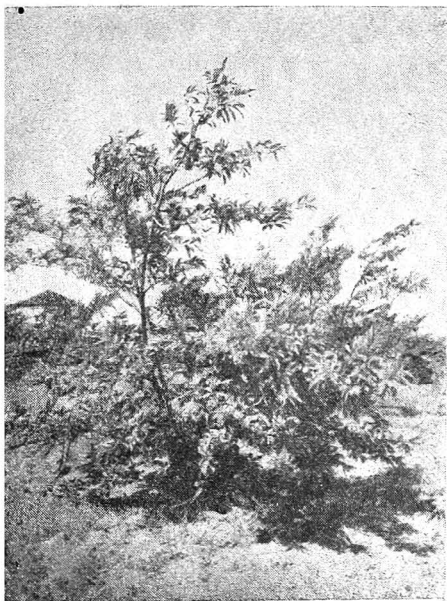
The *sitaphal* comes into bearing from the middle of August and continues up to the end of November. A few stray harvests are also made in December. The fruit goes out of the market in December, and cherimoya comes in at this period.

A good bearing tree of *sitaphal* gives about 60 to 70 fruits. Each fruit weighs, on an average, four to eight ounces and contains 60 to 70 seeds.

The low yields in plantations are due to poor nutrition and lack of pollination. Most of the flowers drop down primarily due to lack of pollination. Crop yields can be improved considerably by hand-pollination. But this being a tedious job, is not undertaken by growers. Hiving of bee colonies and keeping them in the orchard would help increase fruit-set and crop yields.

Different parts of a *sitaphal* flower : (1) petiole,
(2) petals and (3) stamens





A ten-year old *sitaphal* tree

Fruit thinning is never a problem in the *sitaphal*, as the tree rarely bears more than a 100 fruits. The fruits mature at different times corresponding to the crop of flowers, which occurs at regular intervals. If the fruits are left on the tree, they split open and decay rather than get soft and be ready for eating. Fruits are, therefore, harvested when firm and plumpy. It is difficult to assess the correct stage of maturity of the fruit, but it is considered to have fully matured when the skin between the segments turns light yellow.

STONE FORMATION

The *sitaphal* plants become dormant immediately after the crop is harvested. In neglected trees, however, the

dormancy starts very early. At this juncture, the fruits on the tree suddenly turn brown. Such fruits are known as stone fruits. The occurrence of stone fruits is very common during November and December. These fruits continue to stay on the tree even after the leaves have shed, and do not drop down even when the new growth commences.

The formation of the stone fruits is due to some physiological factors and malnutrition. In green-manured or well-manured plantations, stone fruits are not very common. When the trees are properly cultivated and attended to, the fruits reach harvest before the dormancy period starts and thus escape the development of stone.

The *sitaphal* fruit is very delicate and requires careful handling. It ripens within a week of its harvest. On ripening, it cracks and splits into segments. It is, therefore, difficult to transport the fruit to long distances. If on the other hand, the fruit is harvested before it reaches maturity, the segments hold together, the pulp inside ferments and the quality is lost. The fruit also becomes hard and stone-like, and gradually ferments inside. The application of superphosphate and bone-meal to the plantation improves fruit yields and reduces stone formation.

•• HARVESTING AND MARKETING

The *sitaphal* is harvested mostly in one stretch. This is due to the fact that there are no commercial plantations of *sitaphal* apart from semi-wild seedling plantations in forests. In the Telangana districts of Andhra Pradesh, all the plantations are auctioned very early in the season by the Government to fruit merchants. The merchants employ labour from the surrounding villages, collect harvest, and transport the fruit to a place nearest to the road. The harvested fruit is transported in bullock carts or trucks to the wholesale market. About 300 wagonloads of the *sitaphal* fruit are exported every year from Hyderabad to cities like Bombay, Delhi and Calcutta.

There are no co-operative organizations marketing this fruit. The biggest market of *sitaphal* is found in Hyderabad. In the market, the fruit is sold in wholesale lots either in truckloads or cartloads by public auction. No grading of fruit is done, as huge quantities of *sitaphal* arrive in the market during a short period. The fruit is then sold in baskets by the retail merchants. The fruit is transported without any packing. At the bottom of the baskets, paddy straw and *sitaphal* leaves are commonly used. The fruit is generally kept in straw for ripening. It becomes dark during storage at ordinary temperature. At low temperatures, this dark colour or discolouration increases. Such a fruit although possessing good quality is not liked because of its appearance. Even during the normal ripening, segments in the fruit develop mild black patches on their outer skin. These patches are sometimes mistaken for blemishes or damaged spots. As such, cold storage of this fruit is not feasible.

There are a few merchants who grade and sell fruit according to its size. But these fruits are used primarily for keeping on the topmost layer of the basket so that the buyer pays a good price. All medium and small-sized fruits are generally kept at the bottom, with the better-sized fruits at the top.

There is no systematic method of marketing this fruit. There is a considerable demand for this fruit because of its cheapness and good quality. With improvement in the marketing and grading of this fruit, there is a vast scope for expanding the demand for this fruit, even in villages.

USES

Sitaphal is eaten as a dessert fruit. Its pulp is sweet and can be mixed with milk or ice-cream to form a good beverage. The pulp has a pleasant texture with a mild flavour. There is very little acidity in the fruit. *Sitaphal* is considered to be the best of the Annonaceous fruits and is

popular with all classes of people, especially with the poorer sections. Most of the villagers in Telangana take this fruit as part of their daily diet during the cropping season. When the fruit is in abundance it is heated directly over fire by burning some trash. The baked fruit is eaten. Several products like jelly, jam, syrup, fermented liquid and drinks are prepared from *sitaphal*.

The calorific value of *sitaphal* is 105 per 100 grams of the fruit pulp. The following Table illustrates the nutritive value of the pulp of *sitaphal*.

	Per cent
Moisture	73.5
Carbohydrates	23.9
Protein	1.6
Fat	0.3
Calcium	0.02
Phosphorus	0.04
Iron	Traces
Vitamin C	Traces
Carotene	Traces

The unripe fruit, seed, leaf and root have medicinal value, and are used for destroying insects and lice. An alkaloid ancorin extracted from *sitaphal*, possesses insecticidal properties. Due to the presence of *annonaine*, the leaves, stem and other portions of the plant are also bitter. Hence, the *sitaphal* plant is not attacked by goats or cattle. This is one of the main reasons for its spontaneous spread in nature. Its seeds are also abortifacient. The root is a drastic purgative. The leaves are used as a poultice to produce suppuration. The dried kernels of the seed have about 30 per cent oil-content, having 0.9126 specific gravity and iodine value 86. This oil is a very useful paint and has high insecticidal properties. Traces of hydrocyanic acid have been found in the leaves, bark, root and seeds. The wood is used for village carts. The *sitaphal* wood is not attacked

by white ants. Hence, roof thatching of all village dwellings in some places is done with the brush wood of *sitaphal*.

PESTS AND DISEASES

The *sitaphal* is virtually free from pests and diseases. The entire family of *Annona* consists of hardy trees or shrubs which are least susceptible to diseases. Recently, a sudden decline of trees has been noticed in sandy and rocky soils during severe rains or when there is a temporary stagnation of water in the soil. This disease is similar to the die-back disease. Often, the old trees decline suddenly as all the branches shrivel up and dry. Such die-back symptoms are noticed in very old plantations also.

The occurrence of the die-back disease in cultivated plantations, similar to the gummosis disease in *mosambi* orange and the collar-rot disease, has been noticed in Australia. No such disease has been reported in India.

The stone formation in fruits is mainly due to malnutrition, as this is not noticed in manured plantations. Occasionally, due to a severe drought, such stone formation is also noticed in a few plantations. Irrigation, manuring and good cultivation reduce considerably the stone formation in fruits.

The only important pest in the *sitaphal* is the mealy-bug. This bug develops on the fruit skin. It is harboured by the fruit in-between its segments. Although this mealy-bug does not cause a serious damage to the fruit, it spoils its appearance and lowers its marketing value. The bug is controlled by spraying fish oil soap at one ounce in two gallons of water. Nicotine sulphate, 'Endrin' or other insecticides can also be used.

NUTRITIVE VALUE

The nutritive value of all the different varieties of *sitaphal* and that of cherimoya and *Annona glabra* is given in the Table on the next page.

CHEMICAL ANALYSIS OF ANNONACEOUS FRUITS

VARIETY	PERCENTAGES OVER PULP					PERCENTAGE ON WHOLE FRUIT			
	Total Reduc- aci- ing dity sugars	Non- reduc- ing sugars	Pro- tein	CaO	P ₂ O ₅	Fat	Ash	Mois- ture	Seed
A. squamosa									
<i>Local Hyderabad</i>	2.95	20.20	0.10	1.100	0.05046	0.0752	0.0136	1.2212	71.00
<i>Mammoth</i>	2.15	17.39	2.11	0.981	0.06070	0.0757	0.0535	0.7864	72.60
<i>Washington</i>	3.36	20.00	nil	1.031	0.05242	0.0733	0.0232	1.0624	81.80
<i>Red Variety</i>	2.95	15.62	3.89	1.112	0.07482	0.0748	0.0080	0.7896	75.00
A. cherimola									
<i>Cherimoya</i>	4.59	18.52	0.31	0.844	0.04393	0.0707	0.0092	0.8696	73.60
A. glabra	4.97	6.54	nil	1.006	0.0601	0.0418	0.9920	—	11.83
									67.51
									20.65

* 1 = Rich in reducing sugars

* 2 = Minimum acidity

* 3 = Maximum non-reducing sugars

* 4 = Maximum acidity and minimum reducing sugars

CHERIMOYA

CHERIMOYA, the choicest fruit of the Annonaceous family, is grown on a very limited scale in India. It is cultivated especially at high elevations or at the foot of the hills. Many consider that it will thrive only on high altitudes ranging between 3,000 and 7,000 feet. The fruit is of South American origin and is considered to be one of the finest among the sub-tropical fruits. It has been in cultivation for several centuries. There are several distinct varieties of this fruit. Cherimoya was introduced into Jamaica in 1786. In Madeira, it is grown as a crop, and is found in many of the estates on the warm southern slopes of the Island. It has been successfully introduced into southern California, Florida, Ceylon, Costa Rica and Africa. Cherimoya is also known as cherimoyer or cherimola. Cherimoya in Quichua language of Peru signifies cold seeds.

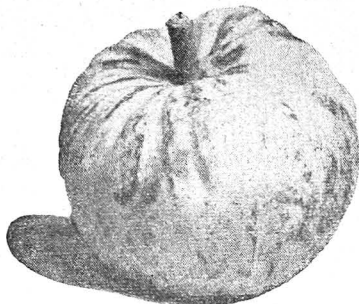
In India, cherimoya is found growing in the hill slopes of the Nilgiris, the Nandi Hills in Mysore, and in the Deccan plateau. Cherimoya is propagated by seed. Although it is stated to come up well in warm, humid conditions at high altitudes, cherimoya has established itself successfully in the Deccan plateau.

VARIETIES

The cherimoya is a medium-sized tree, growing up to a height of 15 to 20 feet. It develops into an unattractive tree with a straggling growth. But there are several forms of cherimoya, with moderately dense and compact foliage suitable for planting in home gardens. There are five distinct varieties of cherimoya. Each variety has been classified according to the nature of the tubercles on the fruit.

Fingerprint cherimoya. This is one of the best varieties with juicy pulp and a good flavour, and possesses relatively fewer seeds.

Smooth cherimoya. The fruit of this variety has a



A smooth
cherimoya

smooth skin and is heart-shaped. It is often mistaken for *Ammona glabra*.

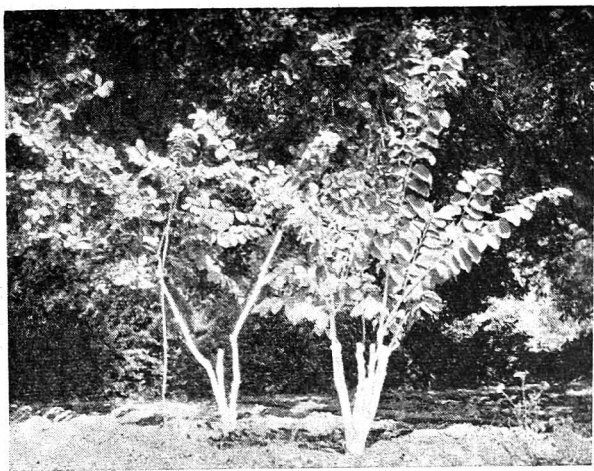
Tuberculate cherimoya. It is commonly found in Peru. The fruit is heart-shaped and bears small wood-like tubercles round the apex. The *Golden Russet cherimoya* of California belongs to this group.

Mammillate cherimoya. This variety has prominent tubercles, and is commonly found in the Nilgiri Hills in India and in the Island of Madeira.

Umbonate cherimoya. The fruit of this variety has a thick skin and more acidic pulp, and has numerous seeds. It has the flavour of pineapple, and is used in the preparation of cold drinks and *sherbats*. The fruit is oblong-conical in shape, with protuberances. *Horton cherimoya* in Pasadena, California, belongs to this group. The fruit contains 18.4 per cent sugar, 1.8 per cent proteins and 0.1 per cent fat.

PROPAGATION

The cherimoya is usually propagated by seed or by budding and grafting on *sitaphal*, Bullock's Heart,

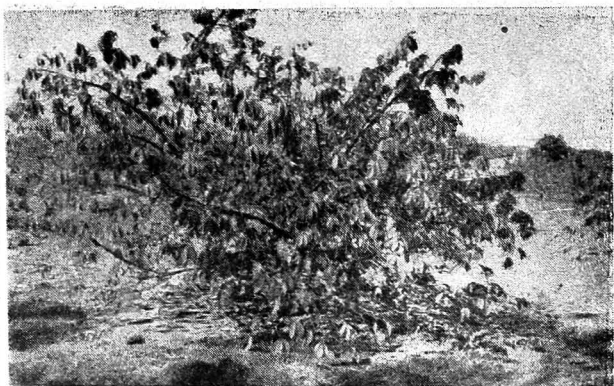


A six-month old cherimoya plant top-worked on *sitaphal*

etc. Cherimoya budded on *sitaphal* is found to be very vigorous. Budded cherimoya plants on the *sitaphal* rootstocks, acclimatized for growing in the plains, are now available for large-scale plantings.

A year old cherimoya plant top-worked on *sitaphal*





A five-year old cherimoya plant

The cultivation of the cherimoya is similar to that of the *sitaphal*. It requires a spacing of about 20 feet. Seedlings come into bearing in the fourth year, and budded plants even from the third year. The average yield of a six-year old budded plantation of the cherimoya has been over 100 fruits per tree, weighing about 40 pounds.

Manuring is not commonly practised. In Queensland (Australia), application of one to three pounds of superphosphate, two to six pounds of meat-meal or dried blood-meal, and one to two pounds of potassium sulphate has given beneficial results.

CROPPING

The tree flowers during May to June and July to September. The anthesis takes place between 4 p.m. and 8 p.m. The fruit comes to maturity in December and January. It comes to the market when the harvests of *sitaphal* are over. Cherimoya is liked more than the *sitaphal* as an edible fruit because of its characteristic delicate flavour, its buttery consistency of flesh, and low seed-content. The pulp is mildly acidic. The fruit contains ten to 15

seeds as against 60 to 80 in *sitaphal*. The segments of cherimoya are almost fused, and are not distinct as in *sitaphal*. On account of this, the fruit does not crack into segments and, therefore, is able to stand transport better.

The crop yields of cherimoya are generally lower than those of *sitaphal*. But as a result of careful selection, a few varieties with fine flavour, comparatively fewer seeds and good size have been evolved at the Ganeshkind Botanic Gardens, Poona, and at the Fruit Research Station, Sangareddy. There are cherimoya fruits which weigh anything from 12 to 16 pounds. Fruits weighing three to eight pounds have been sold at Rs. 10 to 15 each in the London market. Due to the lack of pollination, over 90 per cent of the flowers fail to set fruits; ordinarily, only two per cent of the flowers set fruit. Due to its protogynous nature, there is cross-pollination. The pistils are receptive before the pollen grains mature, and in nature, cross-pollination is the only means of fruit-set. The yields can, therefore, be increased by hand-pollination or by hiving bee colonies and keeping them in the orchard.

NUTRITIVE VALUE

This fruit is very delicious. The food value of the principal Annonaceous fruits is considered higher than that of mango, fig and grape in their content of protein, fat and sugar. Their calorific value is 822 per kg., as compared to 741 of mango. According to Popenoe, cherimoya contains the following ingredients :

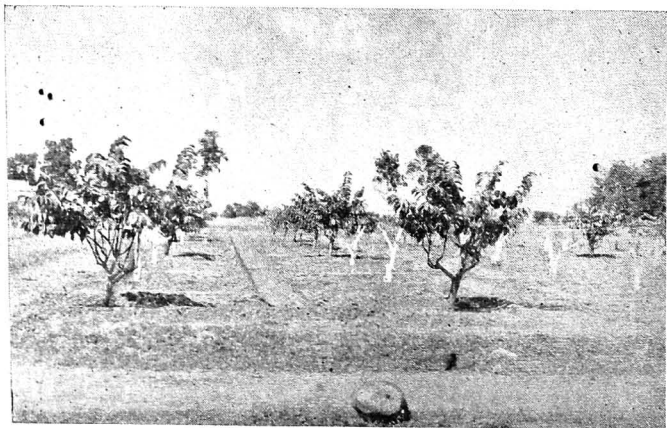
	Per cent.
Sugar	18.4
Protein	1.8
Fat	0.1
Total solids	33.31
Ash	0.66
Fibre	4.29

ATEMOYA

THE fruit is a cross between *sitaphal* and cherimoya. This fruit resembles cherimoya, but the plant is able to thrive like the *sitaphal* in dry, warm regions. As this is a hybrid, the seedlings do not give true to type plants. It has been successfully budded on the *sitaphal* root-stock. In Florida, it bears good crops of fruits of excellent quality. The leaves of this plant are very broad and resemble those of the cherimoya. But they are glabrous like those of the *sitaphal*.

The fruit resembles cherimoya in form, with distinct protuberances, and possesses a glaucous bloom like that of the *sitaphal*. The seeds are distinct for both the species. They are larger than those of the *sitaphal* and much darker

**A *sitaphal* plantation top-worked with atemoya
in different stages**





A plant of the commercial seedless form of atemoya

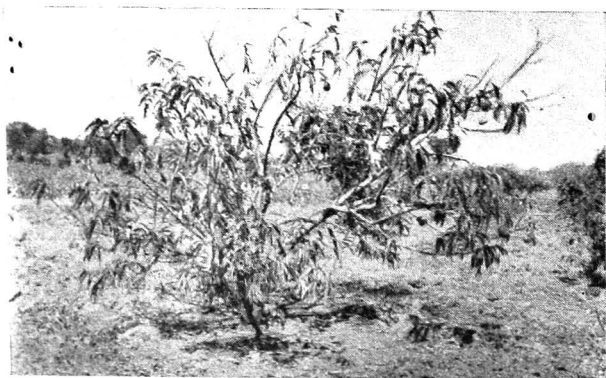
in colour than those of the cherimoya. The pulp is very juicy, with the fine, slightly acidic flavour of the cherimoya. By hybridization between different varieties of *sitaphal* and cherimoya, several promising hybrids have been evolved at the Fruit Research Station, Sangareddy. Atemoya strains containing five to ten seeds only have been selected at Sangareddy. *Selection No. 2/1* of atemoya has been named 'Pruthyphal' for its outstanding yield and quality, and a very low seed-content.

BULLOCK'S HEART

THE Bullock's Heart (*Annona reticulata*) is known as *Ramphal* in south India and *nona* in West Bengal. It is known by several names in South America. It is a deciduous tree, 20 to 25 feet in height, bearing heart-shaped, yellowish red fruits. The leaves are oblong lanceolate, with an acute apex. The fruit is harvested in April and May.

At the Fruit Research Station, Sangareddy, two varieties of this fruit have been located. One is the squamose form with heart-shaped fruit, and the other is the reticulate form which has distinct finger-prints on the surface. The reticulate form bears more than the squamose form. The flowers open during August to October, and the fruits ripen in eight months' time. The fruit is harvested from March to May. The yields range between 20 and 40 fruits per tree, each fruit weighing ten to 12 ounces.

A Bullock's Heart plant with fruits



•The fruit is edible. The white pulp has the consistency of tallow, and is somewhat insipid. It contains 72.3 per cent moisture, 12.5 per cent glucose and two per cent proteins. The Bullock's Heart has been budded successfully on the *sitaphal* and the *atemoya*. The budded plants are yet to come to their bearing stage. The Bullock's Heart is found compatible as a root-stock for the *sitaphal* and the *atemoya*. This fruit plant is somewhat less resistant to cold or heat, as compared to *sitaphal*. It comes up better in heavier types of soil. The Bullock's Heart is rarely grown on a commercial scale in any part of the country.

USES

It is used as a dessert fruit. The contents are sieved and eaten. It is used as an astringent and also as a blood complement. It also alleviates billiousness and thirst. In West Indies, it is used as an anti-dysenteric and a vermifuge. The dry, unripe fruit yields a black dye.

According to Aykroyd, the Bullock's Heart fruit has a calorific value of 90 per 100 grams. Its nutritive constituents are as stated below.

	Per cent.
Moisture	76.8
Carbohydrates	20.9
•Proteins	1.4
Fat	0.3
Mineral matter	0.7
Calcium	0.07
Phosphorus	0.01
Iron	0.6
Carotene	Trace

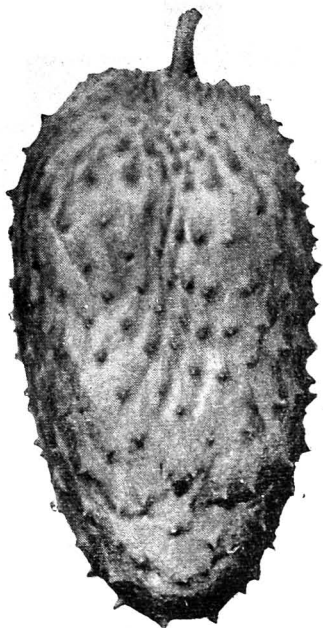
SOURSOP

THE soursop (*Annona muricata*), also known as *Mamphal*, is a small, evergreen tree, bearing the largest fruit among the Annonaceae family. It is found growing wild in Assam and lower Burma. The fruits are ovoid or heart-shaped and resemble a small jackfruit with spines on the surface. In the Telangana region, it is known as *Mundla Sitaphal* or thorny fruit due to the spines present on the fruit. The fruit weighs sometimes as much as five pounds. The pulp is white and juicy, pleasantly sub-acidic, with a slight mango-like flavour.

The fruit is of the Tropical American origin. It is propagated by seed. Attempts at propagation of the soursop by grafting on the *sitaphal*, cherimoya and other Annonaceous fruits have not been successful. The grafted plants die in a few years due to incompatibility. But surprisingly, buds of soursop have sprouted on the *sitaphal* and atemoya

A soursop plantation





• A soursop fruit

at the Fruit Research Station, Sangareddy. Their performance is yet to be seen.

A favourite drink is made from the juice. The pulp yields excellent jelly and preserves. The soursop thrives well in south India. The tree bears about 15 to 20 fruits. Its shy-bearing habit is attributed to insufficient pollination. The fruit comes into the market in July-August, after Bullock's Heart and before *sitaphal*. The fruit has an 11 to 14 per cent sugar-content.

Soursop is one of the best fruits of Java. The fruit is fibrous, and has juicy, aromatic flesh. It contains three to four times as much acid as *sitaphal*, but has somewhat less sugar. The tender fruit is used as a vegetable in Java, and is commonly considered an anti-scorbutic. The seeds are

used as a fish poison and possess insecticidal properties, and the leaves contain an essential oil.

In Cuba and other parts of America, it is used in ice or ice-cream, or mixed with milk to form an excellent drink. The pulp yields excellent jelly and preserves. The unripe fruit is dried and powdered, and is prescribed for chronic dysentery and for aphthae in the form of a decoction. The buds and flowers are considered to be an excellent remedy for cough.