

# **MANGOES OF GOAN ORIGIN**

*with*

## **Propagation and Culture**



**ICAR RESEARCH COMPLEX FOR GOA**

(Indian Council of Agricultural Research)

**ELA OLD GOA - 403 402  
GOA INDIA**

# **MANGOES OF GOAN ORIGIN**

**with**

## **PROPAGATION AND CULTURE**

Editors

**D. G. DHANDAR**

**P. A. MATHEW**

**S. SUBRAMANIAN**



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(Indian Council of Agricultural Research)

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## FOREWORD

I am happy to know that a Technical Bulletin on "Mangoes of Goan origin with Propagation and Culture" is being brought out by the ICAR Research Complex for Goa located at Old Goa. It is indeed a landmark in the horticultural history of Goa because no comprehensive publication on the Goan mango varieties was available so far. A brief history and the present status of mango varieties have been given with a separate chapter on description of varieties with magnificent photographs which will enable even a layman to identify the local varieties. The guide on propagation and culture including plant protection aspects will be of great help and value to all mango growers and farmers. Combining the varietal and cultural aspects in one publication will be appreciated by the public and will be helpful for greater mango production in Goa on scientific lines. The job has been done splendidly and the efforts made are appreciated. This publication will also go a long way in introducing the Goan mangoes to the tourists especially to the foreigners who throng Goa to enjoy its natural bounty since very little is known about the mango wealth existing in this small state to the outside world. I am sure that the publication may trigger a renewed interest in the Goan mangoes for developing local tourism and export of mangoes for benefitting the economy of the state.

A handwritten signature in black ink, appearing to read "D. G. Narvekar".

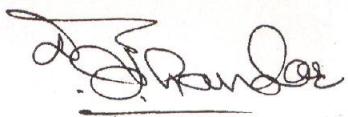
(D. G. Narvekar)

September, 1995

Minister for Agriculture  
Government of Goa

## PREFACE

A need has been felt for a long time to have a publication describing the various mango varieties of Goa with a package of practices for cultivation. It is hoped that the present bulletin will fulfil the need to a larger extent. Efforts have been made to collect as much information as possible to present a comprehensive idea of the varieties of Goa. Probably this may be the first book of its kind ever published in Goa on mangoes. The work is, nevertheless, incomplete as several varieties are yet to be located. Therefore, suggestions and information on other varieties or desirable variations of known varieties are welcome to bring out a more refined edition later on based on information collected after detailed studies. Due to high variation in vegetative and fruit characters even in the same clones and the ambiguity in the names, some overlapping is likely to occur and suggestions for future improvement of the present edition are welcomed. Chapters on cultivation practices, propagation and pests and diseases will be helpful to orchardists and home garden owners to cultivate mango on scientific lines. It is hoped that this publication will help to boost mango production in the state of Goa.



(D. G. Dhandar)  
Director

## **ACKNOWLEDGEMENT**

The authors are indebted to several people in different walks of life for their invaluable help in locating and identifying the varieties; for supply of fruit samples for the studies and shoots for grafting these varieties. Many helped us in soliciting the cooperation of mango contractors and reluctant owners of trees which made this task easier. We owe immense gratitude and appreciation to two outstanding progressive farmers, Mr. Mariano Monteiro Menezes, Assolna and Mr. Prabhakar M. Keni, Cuncolim, both from Salcete *taluka*, for their assistance, interest in our work and even sparing their own vehicle and time for the survey work several times.

We acknowledge the warm friendship, help and cooperation extended in our endeavour by Dr. A. B. Cardozo, Mapusa in whose compound the improved Mankurad seedling was located and he was kind enough to spare enough fruits for studies and exhibition; Professor Kamat Dalal, Mairna, Siolim; Mr. Tito Figueirodo, Asst. engineer (Electricity Department), Benaulim; Mr. Cruz Fernandes, Benaulim; Mr. A. A. Barreto, Margao; Dr. Inacio Pais, Assolna; Mr. Alvito D'Silva, Pomburpa; Mr. Proto M. Soares, Verna; Mr. Miranda, Margao; Mr. Pinto, Calangute; Mr. Lobo, Siolim; apart from other individuals.

Our thanks are due to Shri P. K. Desai, Director and several Agricultural Officers of the Directorate of Agriculture, Goa such as Mr. Olavio Fernandes, Mrs. Freeda Barreto, Mr. Joaquim D'Souza, Mr. Miguel Braganza, Mr. Satish Tendulkar, Mr. Girish Kenkre, Mr. Kazi, Mr. Nelson Figueirodo, Mr. Ali Ahmed, Mr. P. A. Jamble, etc.

The authors express their appreciation of the hard work put in by Mr. B. Dharmapala, Mr. K. Manikandan and Mr. Ashok Desai for the scion collection, grafting, nursery care and maintenance of these collections. The senior author especially thanks the assistance rendered by Mr. K. Manikandan (Tech. Officer, KVK) for photographic work. But for their dedicated service, the entire task of collection of the varieties could have been difficult. We also thank Dr. R.N.S. Sundaram (Scientist SG, A.N.) and Dr. Mani Chellappan (Scientist, Ento.) for helping in preparation of photographs, Dr. S. Modak for wordprocessing of the manuscript, Dr. JR. Faleiro (Scientist, Ento.) and Mrs. Sunetra Talaulikar (Trg. Assoc., KVK) for the help in collecting several varieties from Bardez *taluka*. Sri S. Nagabhushanam, retired Principal Scientist (Hort.) has assisted the senior author in preparing the descriptive blank used in the text for describing the varieties. The authors express their gratitude for his service. The authors are thankful to Dr. Subramanian (Sr. Scientist) and Shri B L Manjunath (Scientist, Agronomy) for the help rendered in proof reading, editing and printing arrangements.

The authors are grateful to Dr. K. L Chadha DDG (Hort.) for his constant encouragement and continued interest in the preparation of this technical bulletin. The authors are also thankful to Dr. P. Rethinam, ADG (PC) who mooted the idea of bringing out the bulletin on Goan mangoes in one of the SRC meetings of the Institute and for his continued support in bringing out this publication.

Lastly, the authors thank all those who cooperated with us in this stupendous task which has helped us to put out a comprehensive volume on most of the mangoes of Goa origin. This publication will be the door to the world of innumerable mango varieties of Goa to the people of India and abroad since little is known about them outside Goa.

**P. A. Mathew**  
**D. G. Dhandar**  
**V. Y. Gaonkar**  
**S. Chander Rao**

Old Goa,  
September, 1995

# MANGOES OF GOAN ORIGIN

with

## PROPAGATION AND CULTURE

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## CHAPTER - 1

### PRESENT SCENARIO

*D. G. Dhandar and P. A. Mathew*

*ICAR Research Complex for Goa, Old Goa - 403 402, Goa*

Goa state, an erstwhile Portuguese colony, lies between 14° 19" N latitude and 73°38" E longitude and is situated on the West Coast of India in the Konkan tract, bound by Arabian Sea on the West, Maharashtra on the North and Karnataka on East and South. It has two districts (North and South Goa) and 11 talukas. The state covers an area of 3,701 Sq. Km. which is 0.16% of the land area of India. Goa enjoys a warm humid climate without any extremes in weather parameters. The temperature ranges between 18°C and 35°C; rainfall is about 2,500 to 4,000 mm per annum distributed in about 120 days confined mostly to June to September; the severity of dry weather increases from December onwards reaching a peak in May and plenty of sunshine is available during most part of the year. Soils are predominantly laterite and lateritic (73.40%) followed by alluvial and marshy soils (11.70%), sandy soils (10.11%) and saline soils (4.79%).

The favourable soil and climatic conditions are ideal for growing a variety of horticultural and plantation crops. Goa is, therefore, unique in having 53.22% (76,201 ha) of its net cropped area of 1,43,181 ha under horticultural crops. Among plantation crops, cashew, coconut and arecanut account for major part of the cultivated area. Among fruits, mango occupies the premier position.

Mango is the major fruit of Goa and is highly esteemed, covering the largest area under fruit crops. Its cultivation is scattered. Well spaced and systematically planted orchards are few. Of

late, good gardens are coming up with commercial cultivars. One can see mangoes being grown among coconut and arecanut palms, other fruit trees or miscellaneous trees, on roadsides, bunds of fields or bhandaras, playgrounds, parks, office premises, etc. Many of these trees are very old and senile, ravaged by neglect, pests and diseases and heavy infestation of *loranthus* parasite. No systematic cultural practices are followed for these trees except for the new plantings. The trees are leased out to contractors or tenants based on old customs prevalent from Portuguese times and the owners evince little interest in the upkeep of these trees as the returns they get are not in tune with the market rates. Social factors like *Communidades*, fluidity in land reforms, developmental activities, etc., also complicate the mango scenario of Goa. Nevertheless, mango is slowly emerging as a cash crop after cashew, especially for export.

The scattered nature of the fruit has made it difficult to estimate the area and production in Goa. The present data available are only estimates based on the number of trees. According to the Directorate of Agriculture, Goa, the area under mango in Goa is 3,700 ha with an annual production of 37,000 tonnes. The estimated average production per hectare is 10.0 t/ha which is more than the national average of 8.41 t/ha (Chadha and Pareek, 1993).

The history of mango cultivation in Goa is long and steeped in antiquity. The existence of relatively large number of varieties in Goa, considering the small area of the state, indicates the patronage extended to the mango by the

Portuguese. It is believed that the grafting technique in mango was introduced to Goa by the Portuguese in the 16th century (Rego and Kazi, 1979). It was a form of side grafting of seedling mango trees as rootstocks and is still prevalent in Goa and quite often is resorted to by the older generation, though more efficient methods have become available. The technique involves side grafting of scions on the collar region of the stems of mango seedlings and the union is covered with heaps of soil as a protection against drying. Hence, the success rate was quite low and only expert grafters could get good success, which was often kept as a secret skill. The Jesuit priests were especially credited with introduction of grafting technique in Goa. Scions of seedling mangoes possessing desirable characteristics were grafted to form new varieties. They have been observant enough to notice the peculiar inherent traits of each mango and thus varieties for dessert or table purpose, jam making or for pickles were developed and propagated resulting in a proliferation of varieties. The owner or the grafter gave fancy names such as Malcorado, Bemcorado, Udgo, Mussarat, etc. and sometimes the name suggested the character of the fruit. For example, Saccardin and Sakri are known for sweetness, Colaco Branca means white culas, Ball for 'ball shape', etc. Often mangoes are named after families such as Hilario, Fernandina, Costa, Carreira, Colaco, etc. Sometimes, the name indicated the use of the fruit as in the case of Dosi Ambo used for making mango candies (Manga da dos). Yet another case is 'Ananas', named after the flesh colour of the pineapple fruits. 'Bishop' is known for its fatness or big size. Indiscriminate grafting also has resulted in high variability among clones of each variety. Often good seedling progenies of popular varieties are also named; viz. Afonsina (seedling of Afonso), Salgadina (seedling of Salgad), Furtadina (seedling of Furtad), etc.

Rego and Kazi (1979) reported the existence of 77 named varieties. Many of these might have been lost due to inherent bad qualities

in course of time or may be existing in some garden as unknown isolated trees. This is because many of these varieties were protected from indiscriminate multiplication by the owners who originally grafted them. Most of the older generation of Portuguese who left Goa, especially after liberation in 1961, also carried with them information on most of these varieties. Many among the older generation living in Goa also have left the world along with the knowledge they had on these mangoes. Therefore, the task of locating and retrieving the varietal wealth has become stupendous. Rapid urbanization and developmental pressures also are causing loss by way of removal of old trees, many of which may belong to the list of varieties reported.

Considering the imperative need to collect the existing gene pool of mango in Goa, the ICAR Research Complex existing at Old Goa has been carrying out surveys, making grafts of identified varieties and maintains a germplasm at its farm at Old Goa. All the efforts made so far has resulted in the collection of 74 distinct varieties of yore as clonal material. Besides, an excellent seedling selection from Mankurad, the leading variety, has also been made.

#### Varieties collected so far :

Out of the 77 varieties reported, three names appear to be synonymous. They are Afonsa (Goa Alfonso or Appus), Afonsa de Portugal and Afonsinha. So one may presume that 75 varieties existed. Afonsina might have been a seedling of Afonsa as seedlings of a variety were named after it. Out of 75, the following 47 varieties have been located and collected.

1. AFONSA
2. BABIO
3. BARRETO
4. BEM-CORADA (Type I)
5. BEM-CORADA (Type II)
6. BISHOP

7.	BAN
8.	BRI
9.	CAB
10.	CAB
11.	CUC
12.	COO
13.	COO
14.	DOO
15.	DUD
16.	FEE
17.	FUN
18.	GOD
19.	HIL
20.	JAM
21.	JEI
22.	JOM
23.	KAB
24.	MAB
25.	MAB
26.	MAB
27.	MAB
28.	MAB
29.	MAB
30.	NAB
31.	OAB
32.	PAB
33.	PAB
34.	RAB
35.	RAB
36.	RAB
37.	RAB
38.	SAB
39.	SAB
40.	SAB
41.	SAB
42.	SAB
43.	TAB

- |                          |   |
|--------------------------|---|
| 7. BALL                  | 44. TORANJA                                       |
| 8. BRINDAO               | 45. CHIMUT  |
| 9. CARREIRA              | 46. UDGO  |
| 10. CARREIRA BRANCA      | 47. XAVIER  |
| 11. CULAS                | Several surveys have been carried out to          |
| 12. COLACO BRANCA        | locate the local varieties reported. However, the |
| 13. COSTA                | following varieties are yet to be located.        |
| 14. DOURADA              | 1. ABREU  |
| 15. DURBATE              | 2. ARECA  |
| 16. FERNANDIN            | 3. ARUDA  |
| 17. FURTAD               | 4. AUREA  |
| 18. GODGO                | 5. BASTARDA                                       |
| 19. HILARIO              | 6. BOMBIO   |
| 20. JAPAO                | 7. CAMOES   |
| 21. JERONIMO             | 8. CIDRAO   |
| 22. JOSE                 | 9. DERRUBADA                                      |
| 23. KAPRI                | 10. DOM-BERNADO                                   |
| 24. MADAME               | 11. DOM-FERNANDO                                  |
| 25. MANKURAD             | 12. DOM-PHILIPPE                                  |
| 26. MALGESH              | 13. FERRAO  |
| 27. MUSSARRAT BARDEZ     | 14. FIGEIRODO                                     |
| 28. MUSSARRAT SALCETE    | 15. FILIPINA                                      |
| 29. MAIGOA               | 16. FOTTIO  |
| 30. NICOLAU AFONSA       | 17. FRIAS   |
| 31. OLIVEIRA             | 18. MATEUS  |
| 32. PAPEL                | 19. MATUTINA                                      |
| 33. PAPEL BRANCO         | 20. MIRIO   |
| 34. REBELLO              | 21. MOGRY   |
| 35. REYNOLD              | 22. PAPAJI  |
| 36. ROSA (Type I)        | 23. PIRES   |
| 37. ROSA (Type II)       | 24. REARIO  |
| 38. SECRETIN             | 25. REMEDIOS                                      |
| 39. ST. ANTONY (Type I)  | 26. ROSARIO                                       |
| 40. ST. ANTONY (Type II) | 27. SANTANA                                       |
| 41. SALGADA              | 28. SANTIAGO                                      |
| 42. SALGADIN             | 29. SONAR   |
| 43. TANQUE               | 30. TEMUDA  |
|                          | 31. UNDURLI                                       |

During the survey, several unreported but cultivated varieties were recognized including seedling selections. These are as follows :

**a. New Varieties (unreported) :**

1. AKNO MALGESH
2. ANANAS
3. ARAUJO
4. AQUA ROSEA
5. BLACK CULAS
6. COTA
7. DOSI AMBO
8. ELAVAYANGAN
9. IRMAO XAVIER
10. JESUIT
11. KOITA
12. KALA ALFONSO
13. MANGLECH
14. MAXIMA
15. MANCHERON
16. MONTEIRO
17. MOZAMBIQUE
18. MIRANDA
19. MATEKIN
20. OVAL APPUS
21. SAKRI
22. SALDAD
23. SAKAR AMBO
24. SEVERINA
25. TIMOZ
26. TOKIO
27. ROTTO

**b. Seedling selections :**

1. IMPROVED MANKURAD (CARDOZ MANKURAD)
  2. KHUTE (one selection with small fruits)
- Even though such large number of varieties

exist, only a few varieties are marketed being of commercial value. Among these, the most important is Mankurad. The other varieties of importance are Hilario, Salcete Mussarrat, Bardez Mussarrat, Malgesh, Nicolau Afonso, Xavier, Udgo, Culas, Fernandin, Goa Alfonso, Karel, Furtad, Costa, Sakri, Rosa, and Bishop. A lot of variation exists among the clones of the same variety. Some good clonal variations in Mankurad, Hilario, Goa Alfonso, Udgo, Fernandin, Mussarrat and Culas have been collected and are under evaluation. Varieties such as Barreto, Reynold, Oval Appus, Mozambique and Salgadin need wider popularization owing to the excellent fruit quality. The juice making qualities of Udgo, Xavier, Reynold etc. need to be evaluated and exploited. The good colour of many varieties will be useful in breeding programmes. So far only one polyembryonic type (i.e., Mozambique) has been located among the varieties collected. Elavayangan may be useful as a dwarfing rootstock or breeding material for dwarfness. The new entries viz., Improved Mankurad and Black Culas have good commercial potential.

Most of the local varieties are late bearers. The earliest and the most popular variety is Mankurad with excellent flavour, taste and sweetness but lacks good keeping quality. There is a need to identify superior clones in this variety.

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## CHAPTER - 2

# DESCRIPTION OF GOAN VARIETIES OF MANGO

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*ICAR Research Complex for Goa, Old Goa 403 402, Goa*

The descriptions are mainly derived from the guidelines followed by earlier workers on mango (Gangolly, et. al. 1957; Naik and Gangolly 1950 and Singh, 1960).

### 1. AFONSA

*Syn :* Goa Appus, Goa Alfonso

This variety was quite popular before Ratnagiri Alfonso became commonly known. Quality is poor compared to Ratnagiri Alfonso especially the keeping quality. It is used as a table fruit and finds a place in all home gardens of olden days. At present, Ratnagiri Alfonso is preferred over this variety and hence it is fast disappearing. It is known for its big size. Variation exists in this variety. A clone from Assolna has been collected with good quality fruits that used to get first prizes during Portuguese times in Goa. Now the fruit comes to the market only occasionally.

**Tree :** Large; vigorous; canopy round and spreading; shoots thick without any waxy bloom or pigmentation; trunk stocky.

**Leaves :** Big to medium (Length-25.5 cm); upheld; base obtuse; tip subacute; shape ovate; lamina slightly recurved and not folded (Length - 23.2cm, Breadth - 6.7cm); margin smooth; tender leaves pale green; mid rib and veins devoid of any pigmentation; waxy bloom on petiole sinus.

**Bearing :** Alternate; yield medium.

**Season :** Mid season (April-May).

**Inflorescence :** Large (Length - 38.0cm, Breadth - 28.0cm); conical; rachis and rachilla slightly pubescent with out any pigmentation; stamens equal and parallel to pistil; staminodes developed.

**Fruit :** Big, weighs 472.0g, 11.2cm long, 9.0cm broad, 8.2cm thick, L/B = 1.24; asymmetric; oblique; base obliquely flattened; stalk insertion oblique; stalk thick; cavity deep; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder; back curved; sinus deep; beak a point; apex round.

Skin smooth; yellowish orange; blush absent; medium tough; leathery; thick; easily peeled; nonbitter; dots medium, moderately close, in flush with skin, same colour as skin.

Pulp firm, melting or tends to softness; yellowish orange with orange centre; weakly aromatic; fibre scanty; juice medium; taste sweet; flavour pleasant; T.S.S. 21° Brix; flesh - 75.61%.

Quality good, shelf life poor.

**Stone :** Oblong, full and plump, big (40.0g), heavy, 7.9cm long, 3.7 cm broad, 2.3 cm thick; veins grooved and forked; fibres sparse, soft, short, concentrated on ventral ridge; endocarp thick, woody; monoembryonic.

**General :** Susceptible to hoppers, shoot borer, fruit flies, pink disease.

## 2. ANANAS

*Syn :* Mang Ananas

A very rare variety located in Cansaulim of South Goa used as table fruit. According to the owner, the name was given due to the flesh colour of the fruit that resembles the flesh of pineapple. A fully matured and properly ripened fruit tastes excellent. But the fruit leaves a disagreeable after taste quite often in the mouth. Only one tree is existing at present in Goa. A comparatively slow grower.

**Tree :** Medium; less vigorous; canopy is conical and semi spreading; shoots thin without any pigmentation or waxy bloom; trunk slender.

**Leaves :** Medium to small (Length - 26.1 cm); upheld; base attenuate; tip acuminate, shape lanceolate; lamina slightly twisted, recurved, not folded, (Length - 23.5 cm, Breadth - 3.7 cm); margin smooth; tender leaf brownish green; mid rib and veins without any pigmentation; no waxy bloom on petiole sinus.

**Bearing :** Regular; medium yielder.

**Season :** Mid (April - May).

**Inflorescence :** Medium (Length - 33.1 cm, Breadth - 23.2 cm), loose; rachis and rachilla glabrous with pinkish brown pigmentation; stamens neither equal nor parallel to pistil; staminodes developed.

**Fruit :** Medium, weighs 218.0g, 8.87 cm long, 6.93 cm broad; 6.6 cm thick, L/B = 1.28; asymmetric; oblong; base obliquely flattened; stalk insertion oblique; stalk moderately thick; cavity shallow; dorsal shoulder narrow, abruptly falling; ventral shoulder rising, rounded, broader than dorsal shoulder; back curved; sinus absent; beak just a point; apex round.

Skin smooth; deep orange; crimson blush on both shoulders; less tough; leathery; thick; easily peeled; non bitter; dots small, very close, in flush with skin, same colour as skin.

Pulp firm, melting, deep yellow with deep orange centre; non aromatic; fibre scanty; juice medium; taste sweet; flavour pleasant; T.S.S. 22° Brix; flesh - 68.76%.

Quality good, shelf life fair.

**Stone :** Oblong; full, plump; medium (23.7 g), 6.73 cm long, 3.27 cm broad, 1.97 cm thick; veins raised, parallel; fibres sparse, soft, short mostly on ventral ridge; endocarp moderately thick, woody; monoembryonic.

**General :** Susceptible to fruit flies. Needs to be promoted as a home garden variety due to its slow growth and regular bearing.

## 3. AKNO MALGESHI

This is a variant form of Malgeshi having smaller fruits of better quality prevalent in some places of North Goa. The fruit is used for table purpose.

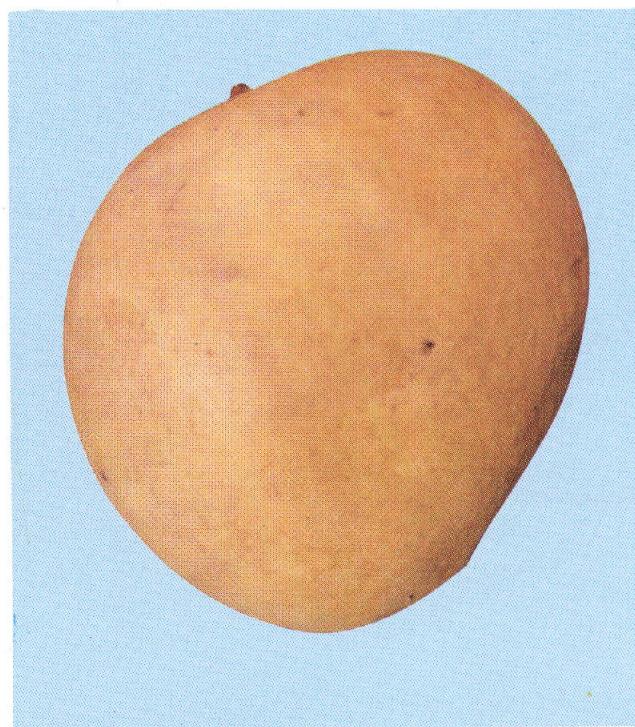
**Tree :** Large; vigorous; canopy round; spreading; shoots thick without any waxy bloom or pigmentation, trunk is stocky.

**Leaves :** Medium to big (Length - 34.0 cm); upheld; base cuneate; tip acuminate; lanceolate; lamina twisted, strongly recurved, not folded (Length 27.5 cm, Breadth - 4.0 cm); margin smooth; tender leaf pale brown; mid rib and veins devoid of any pigmentation; waxy bloom present on petiole sinus.

**Bearing :** Alternate; medium yielder.

**Season :** Mid (April - May).

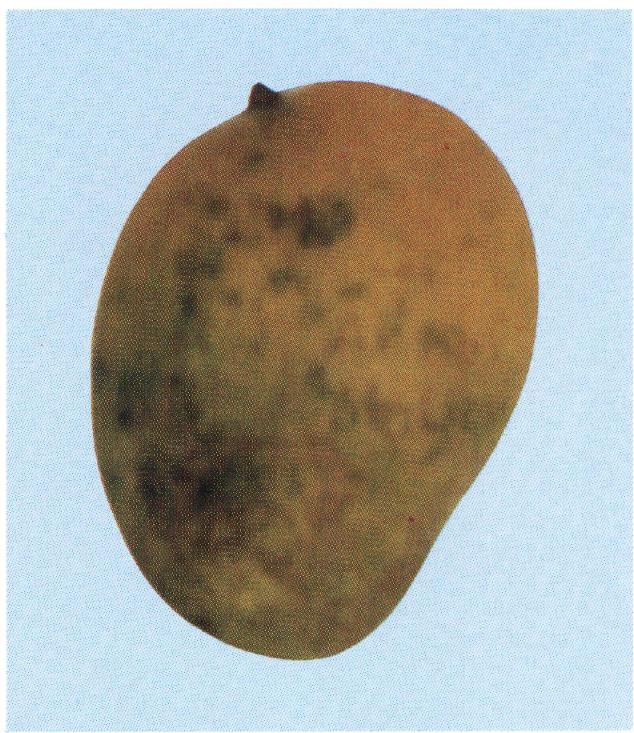
**Fruit :** Medium, weighs 302.0 g, 10.9 cm long, 7.4 cm broad, 6.68 cm thick, L/B = 1.47; asymmetric; oblong; base obliquely flattened; stalk insertion oblique; stalk medium thick; cavity slight; dorsal shoulder abruptly falling or moderately curved, narrow; ventral shoulder rising, rounded and broader than dorsal shoulder; back curved; sinus absent; beak just a point; apex pointed.



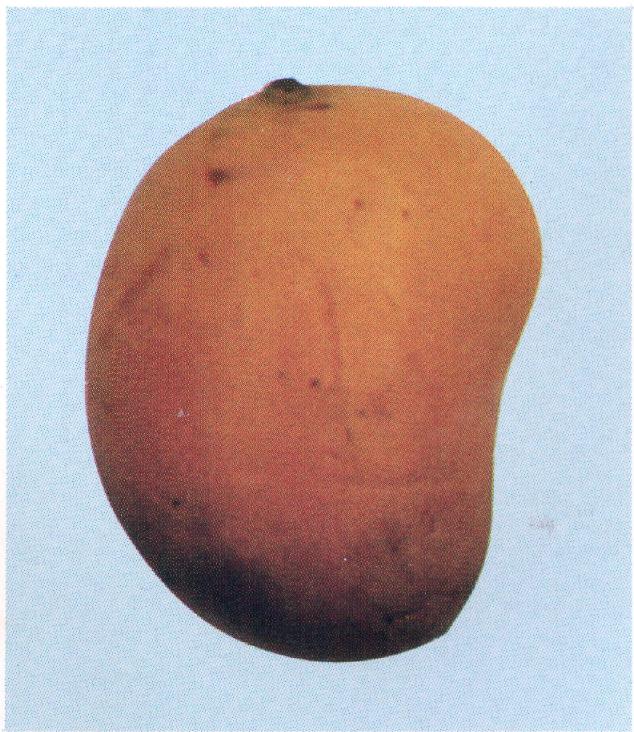
**Fig 1 : Afonso**



**Fig 2 : Ananas**



**Fig 3 : Akno Malgesh**



**Fig 4 : Araujo**

Skin smooth; yellowish orange; dark red blush on both shoulders; medium tough; leathery; thick; easily peeled; non bitter; dots small, very close, in flush with skin, same colour as skin.

Pulp firm, melting; orange; fibre scanty; strongly aromatic; juice medium; taste sweet; subacid; flavour pleasant; T.S.S. 14° Brix; flesh 66.05%.

Quality good; shelf life fair.

**Stone :** Oblong; full, plump; big (40.0 g), 8.6 cm long, 3.9 cm broad, 2.2 cm thick; heavy; veins grooved, parallel; fibre intermediate; short; concentrated on ventral ridge; endocarp thick and woody; monoembryonic.

#### 4. ARAUJO

A table fruit variety located in Margao of South Goa. A rare variety of local importance and fruits rarely come to market. Morphologically the tree resembles Fernandin.

**Tree :** Large; vigorous; canopy round and spreading; shoots moderately thick without any waxy bloom or pigmentation; trunk medium stocky.

**Leaves :** Medium (Length - 25.4 cm); upheld; base cuneate; tip acuminate; shape lanceolate; lamina slightly twisted, strongly recurved; not folded (Length 22.0 cm, Breadth - 4.6 cm); margin smooth; tender leaf light green; midrib and veins without any pigmentation; waxy bloom on petiole sinus.

**Bearing :** Regular; medium yielder.

**Season :** Late (May - June).

**Inflorescence :** Medium (Length - 35.4 cm, Breadth - 18.1 cm); conical; rachis and rachilla slightly pubescent with faintly pink pigmentation; stamens neither equal nor parallel to pistil; staminodes developed.

**Fruit :** Medium, weighs 211.0 g, 8.8 cm long,

6.5 cm broad, 6.55 cm thick, L/B = 1.35; asymmetric; oblong; base obliquely flattened; slightly necked; stalk insertion oblique; stalk moderately thick; cavity slight or absent; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder; back curved; sinus deep; beak absent or just a point; apex broadly pointed.

Skin smooth; yellowish orange with green tinge; blush absent; tough; leathery; thin; easily peeled; non bitter; dots medium, moderately closer, in flush with skin, same colour as skin.

Pulp firm, melting, deep orange; non aromatic; fibre none; juice scanty to medium; taste less sweet; flavour slightly turpentine; T.S.S. 16° Brix; flesh - 79.50%.

Quality fair; shelf life good.

**Stone :** Oblong; full, plump; medium (20.5 g), 6.89 cm long, 3.43 cm broad, 1.85 cm thick; veins raised, forked; fibres sparse, soft, short concentrated on ventral ridge; endocarp medium thick, woody; monoembryonic.

**General :** Susceptible to shoot borer, hoppers.

#### 5. AQUA ROSEA

*Syn : Aqua roseado*

A variety located at Benaulim of South Goa used as table fruit. It has very limited distribution and is very rare. Origin unknown.

**Tree :** Large; vigorous; canopy round, spreading; shoots thick without pigmentation or waxy bloom; trunk stocky.

**Leaves :** Medium to small (Length - 19.7 cm); upheld; base obtuse; tip acuminate; shape oval lanceolate; lamina not twisted, not recurved, not folded (Length - 18.0 cm, Breadth - 5.0 cm); margin smooth; tender leaf pale green; mid rib and veins without pigments; waxy bloom on petiole sinus.

**Bearing :** Alternate; medium yielder.

**Season :** Late (May - June).

**Inflorescence :** Medium to small (Length - 18.0 cm, Breadth - 16.0 cm); pyramidal; compact; rachis and rachilla moderately pubescent with pink pigmentation; stamens neither equal nor parallel to pistil; staminodes poorly developed.

**Fruit :** Medium, weighs 302.0 g, 9.4 cm long, 9.0 cm broad, 6.8 cm thick, L/B = 1.04; asymmetric; cordate; base obliquely flattened; stalk insertion oblique; stalk moderately thick; cavity deep; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder; back rounded; sinus absent; beak just a point; apex broadly pointed.

Skin smooth; bright yellow; pink blush on both shoulders and stalk; tough; membranous; thick; easily peeled; non bitter; dots medium, moderately close, in flush with skin, same colour as skin.

Pulp firm, lemon yellow; aromatic (rose aroma); fibre abundant, medium long, coarse; juice abundant; taste sweet, starchy; flavour pleasant; T.S.S. 19° Brix; flesh - 72.85%.

Quality good, shelf life good.

**Stone :** Oblong, full, plump; medium (36.0 g), 7.3 cm long, 5.0 cm broad, 2.4 cm thick; veins raised, forked; fibres abundant, medium long, soft, concentrated on ventral ridge; endocarp thick, woody; monoembryonic.

## 6. BABIO

*Syn :* Babie

A large fruited variety located in Madkai of N. Goa. It was propagated as a novelty owing to the large roundish fruits which can be used for pickling (Dry pickles). Used as table fruit, it has nothing special worthy of for its continued propagation except for breeding purposes.

**Tree :** Large; vigorous; crown dome shaped,

spreading; shoots thick, pubescent, without any waxy bloom or pigmentation; trunk is stocky.

**Leaves :** Big to medium (Length - 27.4 cm); upheld; base cuneate; tip subacuminate; elliptic; lamina not twisted, strongly recurved, slightly folded (Length - 23.5 cm, Breadth - 7.0 cm); margin smooth; tender leaf pale green; mid rib and veins devoid of any pigmentation; waxy bloom present on petiole sinus.

**Bearing :** Alternate; low yielder.

**Season :** Late (May - June).

**Fruit :** Big, weighs 438.0 g, 9.65 cm long; 9.65 cm broad, 8.5 cm thick, L/B = 1.0; asymmetric; roundish; base slightly flattened; stalk insertion vertical; stalk thick; cavity shallow; shoulders equal, level; back rounded; sinus absent; beak absent or just a point; apex round.

Skin smooth; yellowish orange tinged green; blush absent; tough; leathery; thick; easily peeled; bitter; dots big, distant, in flush with skin, same colour as skin.

Pulp soft; orange; fibre scanty; non aromatic; juice abundant; taste resinous; flavour turpentine; T.S.S. - 11° Brix; flesh - 67.76%.

Quality poor; shelf life poor.

**Stone :** Oblong; full, plump, thick; big size; heavy (47.75 g), 6.9 cm long, 4.63 cm broad, 2.5 cm thick; veins raised, forked, parallel; fibres sparse, soft, short, concentrated on ventral ridge; endocarp thick and woody; monoembryonic.

**General :** Susceptible to fruit flies.

## 7. BALL

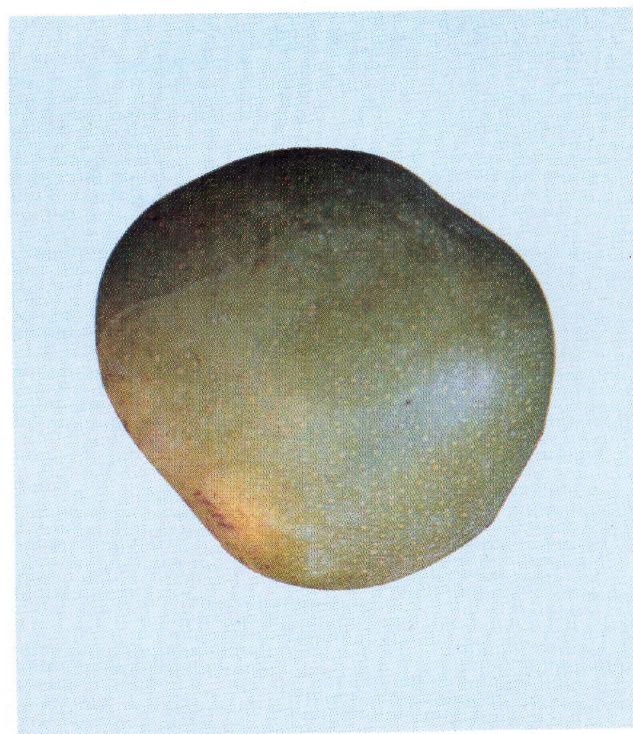
*Syn :* Bollo

A very rare variety occasionally seen in the markets. The name is derived from the 'Ball' like shape of the fruit. Used as table fruit. Branches tend to break due to heavy weight of the fruits.

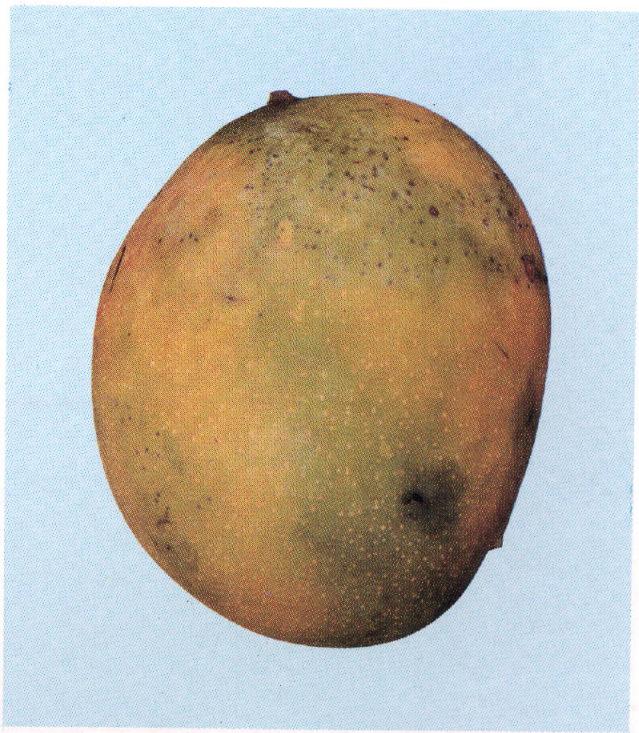
**Tree :** Medium, vigorous; canopy round and



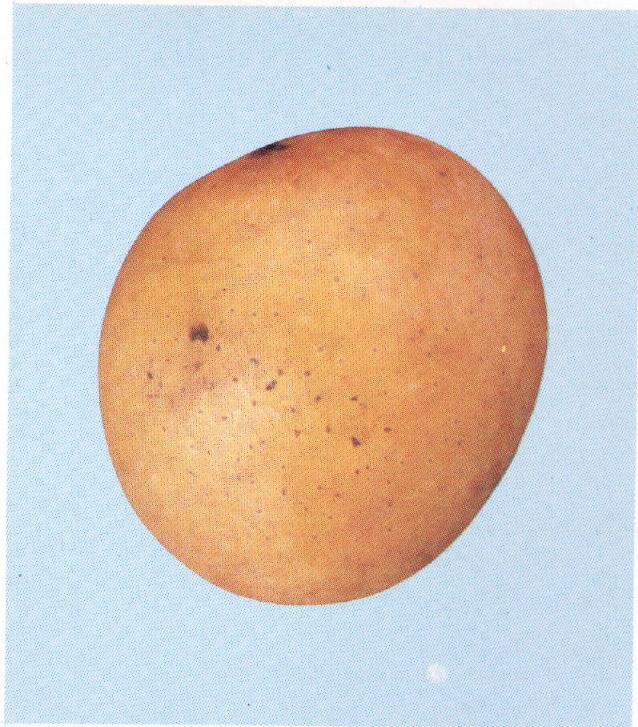
**Fig 5 : Aqua Rosea**



**Fig 6 : Babio**



**Fig 7 : Ball**



**Fig 8 : Barreto**

spreading; shoots thick, brownish green without waxy bloom, trunk is stocky.

**Leaves :** Big to medium (Length - 25.1 cm); upheld; base obtuse; tip acuminate; shape elliptic; lamina not twisted, recurved, not folded, (Length - 22.4 cm, Breadth - 6.7 cm); margin smooth; tender leaf deep reddish brown; midrib and side vein without pigmentation; waxy bloom on petiole sinus.

**Bearing :** Alternate; medium yielder.

**Season :** Late (May - June).

**Inflorescence :** Medium, loose (Length - 24.0 cm, Breadth - 17.0 cm); rachis and rachilla densely pubescent with brown pigmentation; stamens equal and parallel to pistill; staminodes not developed.

**Fruit :** Big, weighs 494.0 g, 9.95 cm long, 9.4 cm broad, 9.1 cm thick, L/B = 1.06; round; base slightly flattened; stalk insertion vertical; stalk thick; cavity shallow; both shoulders equal and rounded, or dorsal shoulder curved; back rounded; sinus slight; beak projecting, pointed and prominent; apex round.

Skin smooth; orange; blush absent or slight; less tough; leathery; thick; easily peeled; taste disagreeable; dots big, distant, in flush with skin, same colour as skin.

Pulp soft; orange; non aromatic; fibre scanty; juice medium to abundant; taste less sweet; subacid; flavour blant or slightly fermented; T.S.S. 17° Brix; flesh - 85.09%.

Quality poor, shelf life very poor.

**Stone :** Oblong, full, plump, big (40.0 g), 7.45 cm long, 3.95 cm broad, 2.45 cm thick; veins grooved, parallel; fibre sparse, soft, short concentrated on ventral ridge; endocarp thick, woody; monoembryonic.

**General :** Susceptible to fruit flies, stem borer.

## 8. BARRETO

A very rare and superb variety located in Margao of S. Goa. Distribution is limited. Used as table fruit; the quality is as good as Hilario of N. Goa.

**Tree :** Large; vigorous; crown open, pyramidal, highly spreading; shoots thick; devoid of any waxy bloom or pigmentation; trunk is stocky.

**Leaves :** Medium (Length - 26.0 cm); upheld; base cuneate; tip acuminate; lanceolate; lamina crinkled, twisted, recurved, flat (Length - 23.8 cm, Breadth - 5.8 cm); margin smooth; tender leaf pale pink; mid rib and veins without any pigmentation; no waxy bloom on petiole sinus.

**Bearing :** Alternate; high yielder.

**Season :** Mid to late (April - June)

**Fruit :** Medium; 214.0 g, 8.0 cm long, 7.05 cm broad, 6.7 cm thick; L/B = 1.14; asymmetric; ovate or oval; base flattened obliquely; stalk insertion oblique; stalk medium thick; cavity slight; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded broader than dorsal shoulder; back curved; sinus absent; beak absent; apex round or pointed broadly.

Skin smooth; yellowish orange; pink blush mostly on ventral shoulder; tough; leathery; thin; easily peeled; disagreeable taste; dots small, medium close, in flush with the skin, lighter coloured than skin.

Pulp soft, melting; deep yellow with orange centre; fibre scanty; weakly aromatic; juice medium; taste very sweet; flavour pleasant, delightful; T.S.S. 25.5° Brix; flesh - 70.81%.

Quality excellent; shelf life good.

**Stone :** Oblong; full, thin, small size; medium (24.05 g), 6.3 cm long, 3.65 cm broad; 1.80 cm thick; veins grooved; forked, parallel; fibres sparse,

soft, short concentrated on ventral ridge; endocarp thick and woody; monoembryonic.

## 9. BEMCORADA TYPE - I

*Syn* : Bemcurado

A variety, once popular, is almost getting extinct. Fruit shape is similar to Mankurad but having better colour. Bemcorado in Portuguese, means good coloured. It was disfavoured due to its low yield and lack of flavour when Mankurad became prominent. It is rarely seen in North Goa. Variation is seen in the variety.

**Tree :** Large, vigorous; canopy dome shaped and spreading; shoots thick with waxy bloom and pink pigmentation; trunk stocky.

**Leaves :** Medium (Length 30.0 cm); ovoid and spreading; base cuneate; tip acuminate; shape lanceolate; lamina twisted, recurved, not folded (Length - 26.1 cm, Breadth 5.4 cm); margin smooth; tender leaf pinkish brown; midrib has red pigment on upper surface; wax present on petiole sinus.

**Bearing :** Alternate; low yielder.

**Season :** Early (March - April).

**Inflorescence :** Medium (Length - 28.0 cm, Breadth 26.2 cm); conical; rachis and rachilla densely pubescent with rose red pigmentation throughout; stamens equal and parallel to pistil; staminodes developed.

**Fruit :** Medium to small, weighs 228.0 g, 8.92 cm long, 7.3 cm broad, 6.5 cm thick, L/B = 1.22; asymmetric, oblique to ovate; base obliquely flattened; stalk insertion oblique; stalk medium thick; cavity shallow; dorsal shoulder narrow, moderately curved, ventral shoulder rising, rounded and broader than dorsal shoulder; back rounded; sinus slight or absent; beak just a point or absent; apex broadly pointed.

Skin smooth; yellowish orange; crimson blush on both shoulders; tough; leathery; thin;

easily peeled; non bitter; dots medium, distant, in flush with skin, lighter coloured than skin.

Pulp firm, melting; deep orange; weakly aromatic; fibre scanty; juice medium; taste sweet; flavour pleasant; T.S.S. 19.21° Brix; flesh - 73.68%.

Quality excellent, shelf life good.

**Stone :** Oblong, full, plump; medium (26.0 g), 6.8 cm long, 3.5 cm broad, 2.3 cm thick; veins raised and parallel; fibers sparse, soft, short, mostly on ventral ridge; endocarp medium thick, woody; monoembryonic.

**General :** Highly susceptible to shoot borers and fruit flies.

## 10. BEMCORADA TYPE - II

*Syn* : Bemcurado

A large tree located in Verna of S. Goa laden with red coloured immature fruits giving an ornamental look. Used as table fruit. Its export potential needs to be studied on account of the intense colour, shape, size and large amount of flesh. The vegetative and fruit characters differ from the Type I described earlier but the taste and flavour are similar.

**Tree :** Very large; very vigorous; canopy dome shaped, spreading; shoots very thick with reddish brown pigmentation and devoid of waxy bloom; trunk stocky.

**Leaves :** Big to medium (Length - 26.8 cm); spreading; ovoid; base obtuse; tip subcuminute; elliptic; lamina slightly twisted, strongly recurved, not folded (Length - 24.0 cm, Breadth - 6.8 cm); margin smooth, slightly wavy; tender leaf pale green; mid rib and veins without pigmentation; waxy bloom present on petiole sinus.

**Bearing :** Irregular; medium yield.

**Season :** Mid to late (April - June).

**Inflorescence :** Large (Length - 42.5 cm, width -

38.5 cm); pyramidal; rachis and rachilla densely pubescent with rose red pigmentation; stamens equal but not parallel to pistil; staminodes not developed.

**Fruit :** Big, weighs 395.0 g, 11.6 cm long, 11.35 cm broad, 10.5 cm thick, L/B = 1.02; asymmetric; oblique or roundish; base obliquely flattened; stalk insertion oblique; stalk thick; cavity shallow; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder; back curved or rounded; sinus absent; beak absent; apex round.

Skin smooth; orange (even immature fruits are rose pink coloured); crimson blush seen throughout; tough; membranes; thin; easily peeled; nonbitter; dots small to medium, very close, in flush with skin, same colour as skin.

Pulp firm, melting, thick; deep orange; fibre none; non aromatic; juice scanty; taste sweet; flavour pleasant; T.S.S. - 20° Brix; flesh - 86.02%.

Quality good; shelf life good.

**Stone :** Oblong; full, plump; size big; heavy (46.0 g), 7.6 cm long, 5.3 cm broad, 2.3 cm thick; veins raised, parallel; fibre nil seen only on ventral ridge; endocarp thick and woody; monoembryonic.

**General :** The export potential of this variety needs to be studied.

## 11. BISHOP

**Syn :** Bispo

A big fruited variety of limited cultivation in North Goa. Local legend is that the name has been derived from the big fatty or bloated nature of the fruit akin to the fat belly of a bishop. It is a table fruit of mediocre quality and is usually sold in the market towards the end of May and the fruit is not preferred unless other varieties are not available or if prices are too high. This is also gradually disappearing.

**Tree :** Large, vigorous; canopy dome shaped

and spreading; shoots thick without any waxy bloom or pigmentation; trunk stocky.

**Leaves :** Big to medium (Length - 27.7 cm); upheld; base obtuse; tip acuminate; shape ovate; lamina neither twisted nor recurved nor folded (Length - 25.8 cm, Breadth - 6.5 cm); margin smooth; tender leaves brownish green; mid rib and veins without any pigmentation; no waxy bloom on petiole sinus.

**Bearing :** Alternate or irregular; low yields.

**Season :** Late (May - June).

**Inflorescence :** Medium (Length 24.0 cm, Breadth - 17.0 cm); conical; rachis and rachilla moderately pubescent without any pigmentation; stamens equal and parallel to pistil; staminodes developed.

**Fruit :** Very big, weighs 618.0 g, 12.8 cm long, 10.40 cm broad, 7.95 cm thick, L/B = 1.23; asymmetric; heart shaped or ovate; base flattened obliquely; stalk insertion oblique; stalk thick; cavity deep; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder; back rounded; sinus slight; beak just a point or absent; apex pointed.

Skin smooth; greenish yellow; blush absent; tough; leathery; very thick, medium peeling; bitter; dots medium, moderately close, in flush with skin, whitish or blackish coloured.

Pulp firm, melting, deep yellow; non aromatic; fibre scanty; juice medium; taste sweet; flavour turpentine; T.S.S. 18° Brix; flesh - 73.46%.

Quality poor; shelf life poor.

**Stone :** Oblong, full and plump; big (46.0 g), 10.4 cm long, 5.8 cm board, 2.5 cm thick; veins raised and forked; fibre sparse, soft, short, mostly on ventral ridge; endocarp thick, woody; monoembryonic.

**General :** Highly susceptible to fruit flies and shoot borer.

## 12. BLACK CULAS

This is a variety of recent origin located in Galjibad and Talpona of Canacona taluka of South Goa. Only few grafts have been made and planted. The vegetative and fruit characters have no similarity to the popular Culas variety. The only common feature between these varieties is the elongated, oblong shape of the fruit. It is called 'Black Culas' because of the dark olive green colour of the fruit, almost blackish and it remains so even after ripening. The fruit is of medium size; the flesh is fibreless creamy white with good flavour and sweetness. The tree is reported to be regular bearing as against the alternate bearing Culas. The tree is vigorous, large; canopy is dome shaped with spreading habit; shoots are thick with waxy bloom and tender shoots are pubescent. Shoots do not have any pigmentation. Fruits mature late in the season and yield is medium. Leaves are medium; base obtuse; elliptic; tip acute; margin smooth and dark green in colour. Thick waxy bloom is seen on petiole sinus. Considering the local popularity and descriptions the fruit has good commercial potential than Culas, which needs to be exploited.

## 13. BRINDAO

*Syn:* Bindao

One of the oldest varieties, rarely seen at present. The variety gets its name from the resemblance of the fruit to the kokum or binda in size, shape and colour (Red). The tree is large and vigorous; canopy is round and spreading; shoots are thick without any waxy bloom or pigmentation. The tree is alternate bearing with medium yields. Leaves are medium, lanceolate, recurved and convoluted. The fruits are small ovate or heart shaped with a reddish brown colour akin to that of kokum. There is nothing special about this variety and hence has gone out of cultivation.

## 14. CARREIRA

*Syn:* Karrel

A popular variety grown throughout Goa for pickling purpose. Fruits are also used as table fruit. A lot of variation is seen among trees. Fruits are used mainly for making hot pickles.

**Tree:** Large; vigorous; canopy round, spreading; shoots thick without any waxy bloom or pigmentation; trunk stocky.

**Leaves:** Medium (Length - 19.7 cm); upheld; base obtuse; tip subacute; shape elliptic; lamina not twisted, not recurved, not folded (Length - 18.0 cm, Breadth - 4.8 cm); margin smooth; tender leaf pale green; midrib and veins without any pigmentation; waxy bloom on petiole sinus.

**Bearing:** Alternate; medium yielder.

**Season:** Late (May-June).

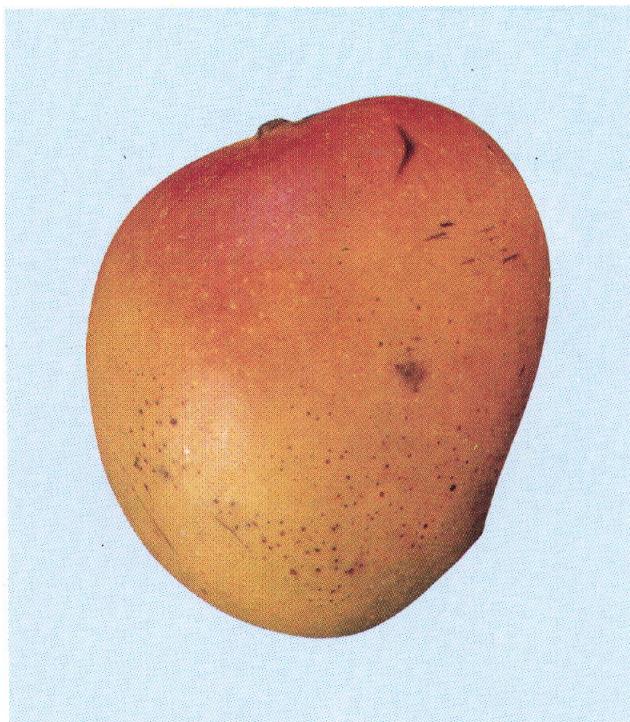
Early if used for pickles.

**Inflorescence:** Medium (Length - 17.7 cm, Breadth - 22.0 cm); pyramidal; compact; rachis and rachilla densely pubescent with brownish pigmentation; stamens equal and parallel to pistil; staminodes poorly developed.

**Fruit:** Medium; weighs 245.0 g, 8.43 cm long, 7.7 cm broad, 6.75 cm thick, L/B = 1.09; asymmetric; ovate; base obliquely flattened; stalk insertion oblique; stalk moderately thick; cavity shallow; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder; back round or curved; sinus absent; beak just a point; apex broadly pointed.

Skin smooth; yellowish orange; pink blush on both the shoulders; tough; leatherly; medium thick; easily peeled; non bitter; dots small, very close, in flush with skin, same colour as skin.

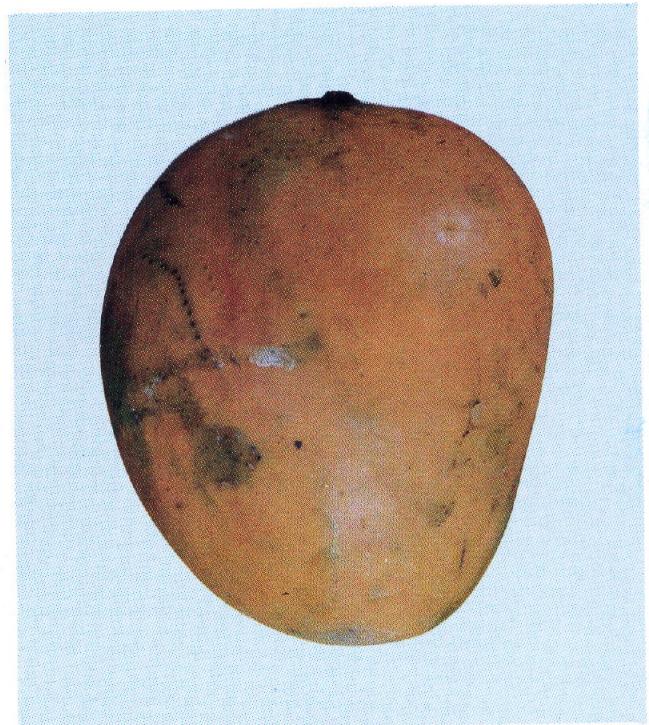
Pulp firm, thick, meaty; yellowish orange to orange; non aromatic; fibre scanty; juice scanty;



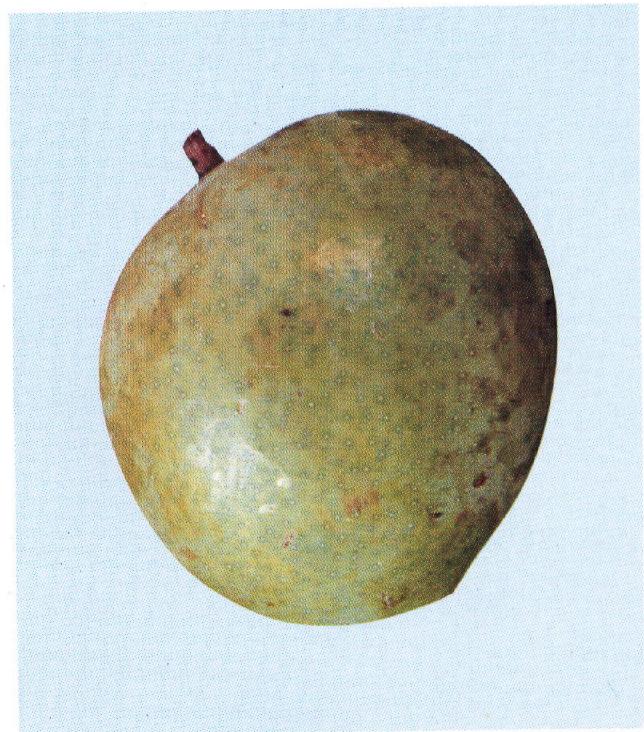
**Fig 9 : Bemcorada Type I**



**Fig 10 : Bemcorada Type II**



**Fig 11 : Bishop**



**Fig 12 : Carreira**

taste acidic; flavour bland; T.S.S. 12° Brix; flesh - 69.33%.

Quality poor, shelf life excellent.

**Stone:** Oblong; medium (35.0 g), 6.75 cm long, 4.7 cm broad, 2.6 cm thick; veins grooved, parallel; fibre sparse, soft, short, concentrated on ventral ridge; endocarp thick, woody; monoembryonic.

## 15. CARREIRA BRANCA

*Syn:* White Carreira

A popular variety of South Goa characterised by white fruits used for pickling purposes. Origin unknown. This is becoming extinct. It might have originated from Carreira as a mutant as the leaf characters are similar.

**Tree:** Medium, moderately vigorous; canopy dome shaped, spreading; shoots medium thick without any pigmentation or waxy bloom; trunk medium.

**Leaves:** Medium (Length- 20.5 cm); spreading and ovoid; base obtuse; tip subacute; shape elliptic; lamina not twisted not recurved, not folded (Length - 18.0 cm, Breadth - 5.3 cm); margin smooth; tender leaves pale coffee colour; mid rib and vein without any pigmentation; waxy bloom on petiole sinus.

**Bearing:** Regular; medium yielder.

**Season:** Late (May - June).

**Inflorescence:** Medium (Length - 23.0 cm, Breadth 17.1 cm); conical; rachis and rachilla slightly pubescent without any pigmentation; stamens neither equal nor parallel to pistil; staminodes developed.

**Fruit:** Medium to big; weighs 304.0. g; 10.28 cm long; 7.9 cm broad; 7.04 cm thick, L/B = 1.30; asymmetric; oblong; base obliquely flattened; stalk insertion oblique; stalk moderately thick; cavity slight; dorsal shoulder narrow, moderately curved;

ventral shoulder rising, rounded and broader than dorsal shoulder; back curved; sinus absent; beak mammiform; apex broadly pointed.

Skin smooth; orange yellow; pink blush around stalk and dorsal shoulder seen to a limited extent; moderately tough; leathery; medium thick; easily peeled; non bitter; dots medium, distant, in flush with skin, same colour as skin.

Pulp soft; yellow with pinkish tinge; aromatic; fibre none; juice medium; taste mildly sweet; acidic; flavour agreeable, T.S.S. 16° Brix; flesh - 73. 85%.

Quality fair; shelf life fair.

**Stone:** Oblong; medium (38.0 g), 8.25 cm long, 4.1 cm broad, 2.33 cm thick; veins grooved, parallel; fibres moderate, soft, medium long, concentrated on ventral ridge, endocarp thick, woody; monoembryonic.

**General:** Highly susceptible to fruit flies.

## 16. CHIMUT

*Syn:* Timot, Timoteo

A popular table fruit variety of North Goa producing fruits in clusters. Chimut means 'pinch'.

**Tree:** Medium; moderately vigorous; canopy oval and upright, shoots thick without any wax or pigmentation; trunk is medium stocky.

**Leaves:** Medium to small (Length - 26.0 cm); upheld; base cuneate; tip acuminate; shape lanceolate; lamina twisted, slightly recurved, not folded (Length - 23.1 cm, Breadth - 4.8 cm); margin smooth; tender leaf pale brown; mid rib and veins without any pigmentation; waxy bloom on petiole sinus.

**Bearing:** Irregular, medium yielder.

**Season:** Late (May - June).

**Inflorescence:** Medium to small (Length - 23.2 cm, Breadth - 18.1 cm); conical; rachis and rachilla densely pubescent with pale pink pigmentation;

stamens equal and parallel to pistil; staminodes developed.

**Fruit:** Medium to small borne in clusters; weighs 310.0 g, 9.18 cm long, 8.12 cm broad, 7.5 cm thick, L/B = 1.13; asymmetric; oblique or roundish or peento; base obliquely flattened; stalk insertion oblique; stalk moderately thick; cavity shallow to deep; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder; back curved; sinus slight or absent; beak just a point or absent; apex broadly pointed or round.

Skin smooth; yellowish orange; blush absent; less tough; leathery; thin; adhering; non bitter; dots medium, very close to moderately closer; in flush with skin, same colour as skin.

Pulp firm, melting; yellow to yellowish orange; non aromatic; fibre scanty; juice medium to abundant; taste sweet; flavour pleasant with a slight turpentine tinge; T.S.S. 17° Brix; flesh - 73.39%.

Quality good; shelf life poor.

**Stone:** Oblong; full, plump; medium (30.5 g), 7.0 cm long, 3.6 cm broad, 2.25 cm thick; veins grooved, forked; fibres sparse, soft, short on ventral ridge only; endocarp thin, woody; monoembryonic.

**General:** Highly susceptible to fruit flies.

## 17. CULAS

*Syn:* Colaco

A late variety popular throughout Goa. It is used exclusively as a table fruit and many people like its peculiar flavour. A lot of variation exists in this variety. The origin is not known. Many people like its tangy flavour, though less sweet.

**Tree:** Large; moderately vigorous; canopy dome shaped, spreading; shoots moderately thick to slender, devoid of any pigmentation or waxy bloom; trunk stocky.

**Leaves:** Medium (Length - 27.0 cm); spreading and obovate; base cuneate; tip acuminate; shape lanceolate; lamina twisted, recurved, slightly folded (Length - 22.8 cm, Breadth - 5.7 cm margin slightly wavy; tender leaf pale green; midrib and veins without any pigmentation; wax bloom on petiole sinus.

**Bearing:** Alternate to irregular; high yielder.

**Season:** Late (May - June).

**Inflorescence:** Medium to small (Length - 1 cm, Breadth 9.5 cm); conical; rachis and rachilla densely pubescent with pink pigmentation; stamens not equal nor parallel to pistil; staminode poorly developed.

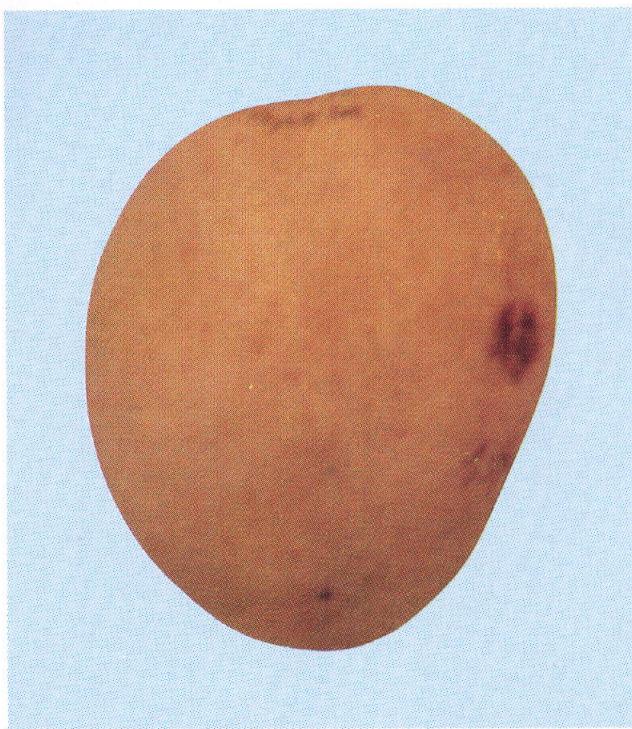
**Fruit:** Big to medium, weights 345.0 g, 11 cm long, 7.6 cm broad, 6.85 cm thick, L/B = 1.6; asymmetric; oblong; base obliquely rounded; stalk insertion oblique; stalk thickness medium; cavity slight; dorsal shoulder narrow and moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder; back curved; sinus absent; beak just a point; apex round.

Skin smooth; yellowish orange or yellow with a greenish tinge; pinkish blush may or not be present on shoulders but mostly on ventral shoulder; tough; papery; thin; easily peeled; non bitter; dots medium, distant, in flush with skin, same colour as skin.

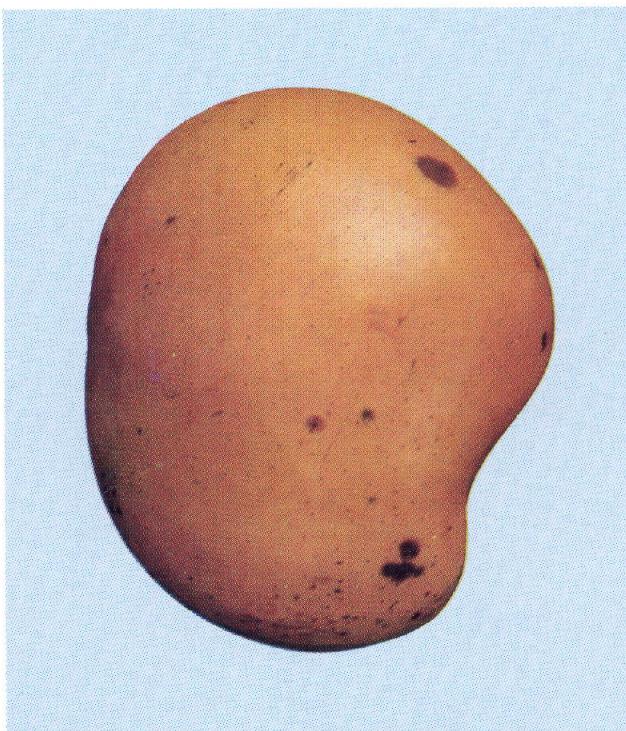
Pulp soft, melting; weakly aromatic; yellow; fibre scanty; juice medium to abundant; taste less sweet and little spicy flavour with a slight turpentine tinge; T.S.S. 14° Brix; flesh - 78.7%.

Quality fair, shelf life poor.

**Stone:** Elongated; full and plump; medium (34.09 g), 8.2 cm long, 3.5 cm broad, 1.8 cm thick; veins raised and forked; fibres sparse, short, soft, mostly seen on ventral ridge; endocarp medium thick, waxy; monoembryonic.



**Fig 13 : Carreira Branca**



**Fig 14 : Chimut**

shoulder narrow, abruptly falling; ventral shoulder rising, rounded, broader than dorsal shoulder; back curved; sinus slight or absent; beak just a point; apex pointed.

Skin smooth; bright yellow; blush absent; tough; leathery; thin; easily peeled; bitter; dots small, moderately close, in flush with skin, whitish coloured.

Pulp firm, melting; yellowish orange; non aromatic; fibre none; juice scanty to medium; taste sweet; flavour agreeable, leaves a bitter taste afterwards if not properly ripened; T.S.S. 18° Brix; flesh - 70.11%.

Quality fair; shelf life fair.

**Stone:** Oblong; medium (29.5 g); full, plump; 7.65 cm long, 3.55 cm broad, 2.0 cm thick; veins grooved, forked; fibre short, soft, seen only on ventral ridge; endocarp medium thick, woody; monoembryonic.

**General:** Susceptible to fruit flies.

## 20. COSTA

A table fruit variety once popular in South Goa. It is gradually getting out of cultivation.

**Tree:** Large; vigorous; canopy round and spreading; shoots thick without any pigmentation or waxy bloom; trunk stocky.

**Leaves:** Medium to big (Length- 29.0 cm); upheld; base obtuse; tip acuminate; shape oval lanceolate; lamina slightly twisted, slightly recurved, not folded (Length - 26.0 cm, Breadth - 5.9 cm); margin smooth; tender leaf light green; mid rib and veins without any pigmentation; no waxy bloom on petiole sinus.

**Bearing:** Alternate; medium yielder.

**Season:** Late (May - June).

**Inflorescence:** Medium (Length - 29.0 cm, Breadth - 27.2 cm); pyramidal; rachis and rachilla moderately pubescent with rose pink pigmentation;

stamens neither equal nor parallel to pistil; staminodes poorly developed.

**Fruit:** Medium, weighs 223.0 g, 8.45 cm long, 7.5 cm broad, 6.6 cm thick, L/B = 1.12; asymmetric, oblique or ovate; base obliquely flattened; stalk insertion oblique; stalk thick; cavity shallow; dorsal shoulder narrow and moderately curved; ventral shoulder rising, rounded and broader than dorsal shoulder; back rounded or curved; sinus shallow; beak absent; apex round.

Skin smooth; yellowish orange; blush absent; less tough; leathery; thin; easily peeled; non bitter; dots big, distant, in flush with skin and lighter coloured than skin.

Pulp firm, melting; deep orange; aromatic (rose like aroma); fibre none; juice scanty; taste less sweet; flavour pleasant; T.S.S. 10° Brix; flesh - 74.83%.

Quality good; shelf life good.

**Stone:** Oblong; full plump; medium (25.5g), 6.85 cm long, 4.25 cm broad, 2.1 cm thick; veins grooved and parallel; fibres soft, short, mostly on ventral ridge; endocarp medium thick, woody, monoembryonic.

**General:** Highly susceptible to fruit flies, shoot borers.

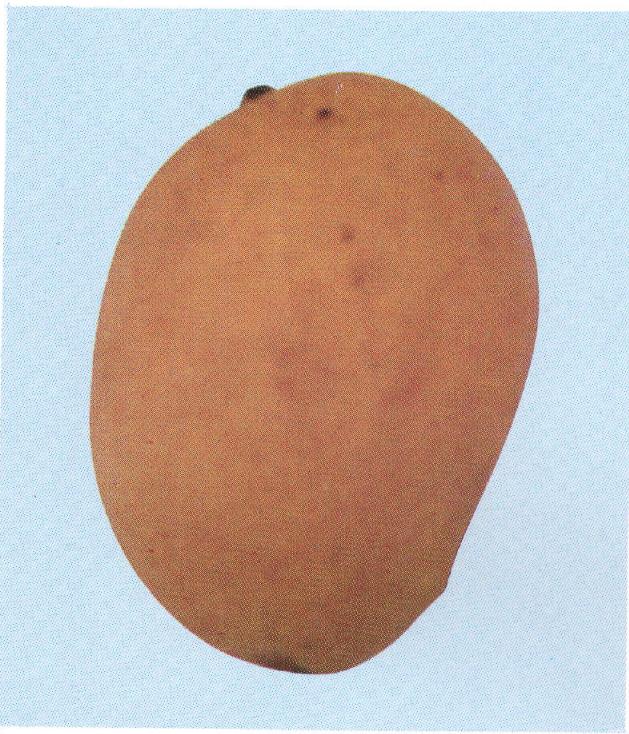
## 21. DOURADO

*Syn:* Dourado Mangueira

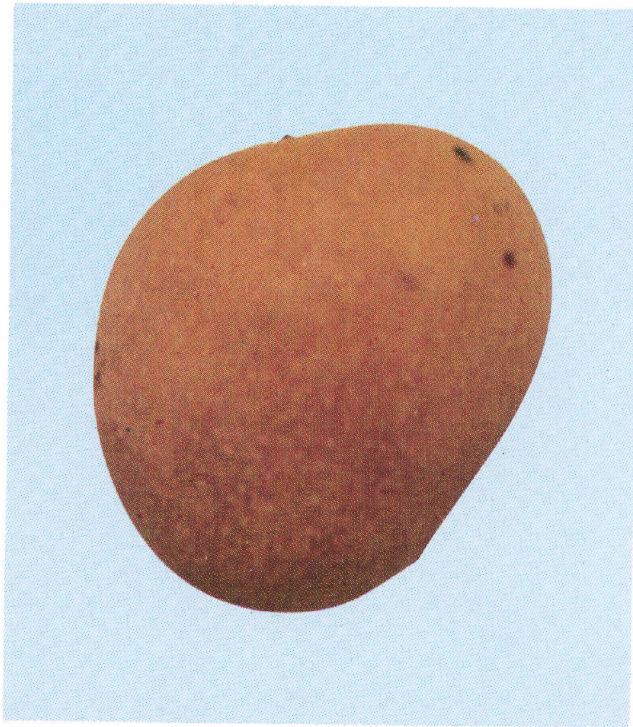
A variety once popular in Tiswadi taluka of North Goa becoming rare as new grafts are seldom planted. It is reported to be sweet when mature before ripening. Trees were located in Taleigao. Used as table fruit.

**Tree:** Large; vigorous; canopy oval or round, spreading; shoots thick without any waxy bloom or pigmentation; trunk is stocky.

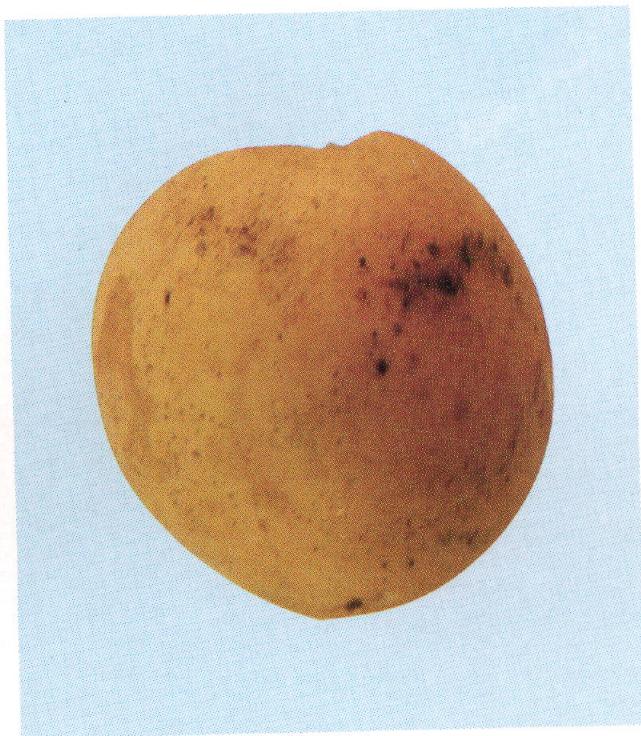
**Leaves:** Medium (Length - 27.8 cm); upheld; base cuneate; tip acuminate; lanceolate; lamina slightly twisted, reflexed, strongly folded (Length -



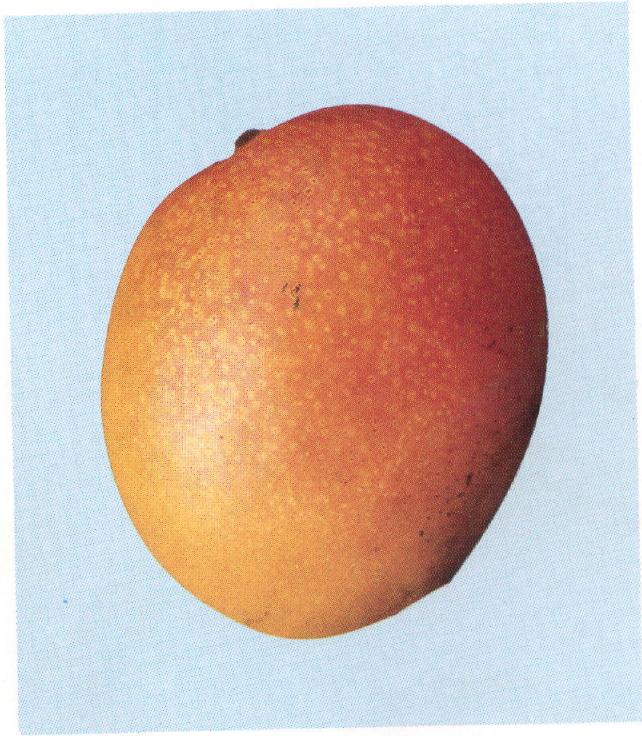
**Fig. 17 : Cota**



**Fig. 18 : Costa**



**Fig. 19 : Dosi Ambo**



**Fig. 20 : Dourado**

24.1 cm, Breadth - 5.8 cm); margin smooth; tender leaf pale green; mid rib and veins devoid of any pigmentation; no waxy bloom on petiole sinus.

**Fruit:** Medium; weighs 257.0g, 9.37 cm long, 7.5 cm broad, 6.33 cm thick, L/B = 1.25; asymmetric; oblique or ovate; base obliquely flattened; stalk insertion oblique; stalk medium thick; cavity slight; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder; back curved; sinus slight or absent; beak absent or just a point; apex broadly pointed.

Skin very smooth; yellowish orange; crimson blush on both shoulders; tough; leathery; thin; easily peeled; non bitter; dots medium, very close, in flush with skin, lighter coloured than skin.

Pulp firm, melting; deep orange; fibre scanty; strongly aromatic; juice medium, taste sweet; flavour pleasant; T.S.S. 18° Brix; flesh - 63.1%.

Quality good; shelf life good.

**Stone:** Oblong; full, plump; medium size; medium heavy (34.43 g), 6.87 cm long, 4.2 cm broad, 2.2 cm thick; veins raised, parallel; fibre sparse, soft, short, concentrated on ventral ridge; endocarp thick and woody; monoembryonic.

**General :** Susceptible to fruit flies.

## 22. DOSI AMBO

*Syn:* Manga da Dos

A variety located at Sazora in Salcete taluk of S. Goa used for making mango candies. A rare variety on the verge of extinction. The eating quality is also good.

**Tree:** Medium; vigorous; canopy dome shaped, spreading; shoots thick without any waxy bloom or pigmentation; trunk medium.

**Leaves:** Medium (Length - 26.3 cm); upheld; base obtuse; tip subacuminate; elliptic; lamina not twisted; reflexed slightly, flat (Length - 22.8 cm,

Breadth - 5.6 cm); margin smooth; tender leaf pale green; mid rib and veins without any pigmentation; waxy bloom on petiole sinus.

**Bearing:** Alternate; low yielder.

**Season:** Late (May - June).

**Fruit:** Big; weighs 363.0 g, 10.6 cm long, 9.0 cm broad, 7.9 cm thick, L/B = 1.18; asymmetric; oval; base flattened obliquely; stalk insertion oblique; stalk thick; cavity shallow; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder, ridged; back curved; sinus absent; beak absent; apex broadly pointed.

Skin smooth; lemon yellow; blush absent; tough; leathery; thick; easily peeled; non bitter; dots small, very close, in flush with skin, same colour as skin.

Pulp firm, melting; yellowish orange or lemon yellow; fibre scanty; non aromatic; juice medium; taste very sweet like candy; flavour pleasant, faintly camphoraceous near skin; T.S.S. - 19° Brix; flesh - 69.66%.

Quality excellent; shelf life good.

**Stone:** Oblong; full, plump; medium size; medium (19.5 g); 8.05 cm long, 4.1 cm broad, 2.2 cm thick; veins raised, forked, parallel; fibres sparse soft, short, mostly on ventral ridge; endocarp thick and woody; monoembryonic.

## 23. DURBATE

A variety known in Siolim of North Goa becoming extinct. It is used as a table fruit.

**Tree:** Large; very vigorous; canopy dome shaped and spreading; shoots thick without any waxy bloom or pigmentation; trunk stocky.

**Leaves:** Big (Length - 33.1 cm); upheld; base obtuse; tip subacuminate; shape elliptic; lamina twisted and crinkled, strongly reflexed or recurved, flat, (Length - 25.3 cm, Breadth - 8.0 cm); margin

smooth; tender leaf light green; midrib and veins without any pigmentation; waxy bloom on petiole sinus.

**Bearing:** Alternate; medium yielder.

**Season:** Late (May - June).

**Inflorescence:** Large (Length - 37.0 cm, Breadth - 13.0 cm); conical; rachis and rachilla moderately pubescent with rose red pigmentation; stamens neither equal nor parallel to pistil; staminodes not developed.

**Fruit:** Big to medium; weighs 318.0 g, 10.2 cm long, 8.1 cm broad, 6.85 cm thick, L/B = 1.26; asymmetric; oblong; base obliquely flattened; stalk insertion oblique; stalk thick; cavity slight; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder; back curved; sinus slight; beak mammiform, double beaked, apex broadly pointed.

Skin rough; orange; pinkish red blush seen mostly on ventral shoulder; less tough; leathery; thick; easily peeled; bitter; dots medium, very close, in flush with skin and same colour as skin.

Pulp soft; yellowish orange with orange centre; non-aromatic; fibre abundant, coarse, long; juice medium; taste sweet; flavour agreeable; T.S.S. 18° Brix; flesh - 68.66%.

Quality fair; shelf life poor.

**Stone:** Oblong, full, plump, big (38.0 g), 7.6 cm long, 3.65 cm broad, 2.35 cm thick; veins grooved, forked; fibres abundant, soft, long, concentrated on ventral ridge; endocarp thick, woody; monoembryonic.

**General:** Susceptible to shoot borer, fruit flies.

## 24. ELAVAYANGAN

This is a collection from Dodamarg of Bicholim taluka in N. Goa. The name is derived from the wiry nature of the shoot. It yields big fruits of average quality in limited numbers. The

slow growth habit may be used for rootstock purposes or in breeding dwarf types.

**Tree:** Small; less vigorous; canopy dome shaped, spreading; shoots thin, wiry without any waxy bloom or pigmentation; trunk slender.

**Leaves:** Medium to small (Length - 20.6 cm); upheld; base cuneate; tip subacuminate; lanceolate; lamina not twisted, not reflexed, convolute (Length - 18.4 cm, Breadth - 3.5 cm), narrow; margin smooth; tender leaf pale green; midrib and vein devoid of any pigmentation; no waxy bloom on petiole sinus.

**Bearing:** Irregular; low yielder.

**Season:** Late (May - June).

**Inflorescence:** Medium (Length - 25.2 cm, Breadth - 19.0 cm); conical; rachis and rachilla moderately pubescent without any pigmentation; stamens equal and parallel to pistil; staminodes poorly developed.

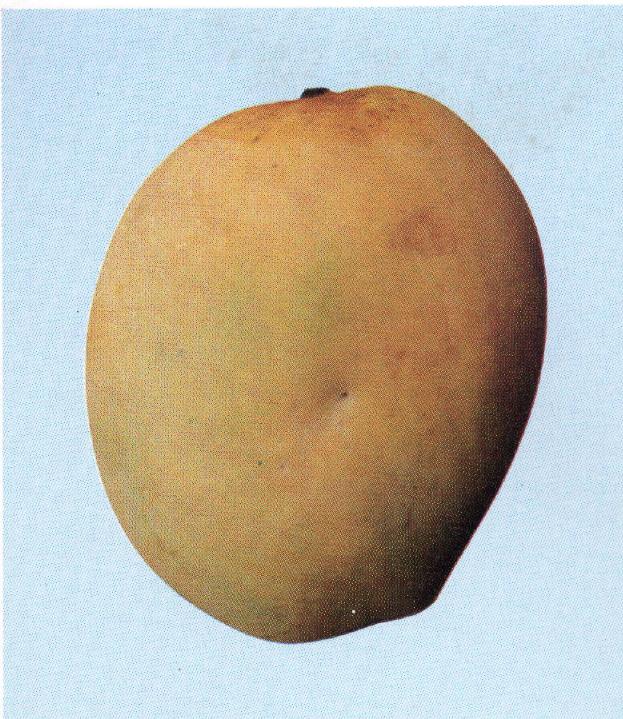
**Fruit:** Big, weighs 458.0 g, 10.75 cm long, 8.75 cm broad, 7.8 cm thick, L/B = 1.23; asymmetric; oblique; base necked; obliquely flattened; stalk insertion oblique; stalk thick; cavity shallow or deep; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded, ridged, broader than dorsal shoulder; back curved; sinus deep; beak prominent, nipple like; apex round.

Skin rough, undulating; greenish yellow; blush absent; less tough; leathery; very thick; medium peeling; bitter; dots big, distant, raised, dark coloured.

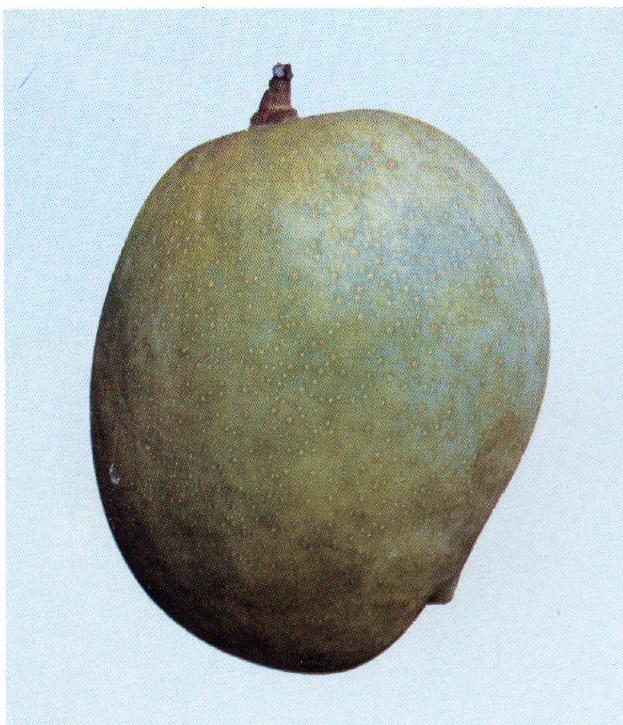
Pulp firm, melting and buttery; yellowish orange; fibre none; non aromatic; juice scanty; taste sweet; flavour pleasant; T.S.S. - 20° Brix; flesh - 63.98%.

Quality fair; shelf life poor.

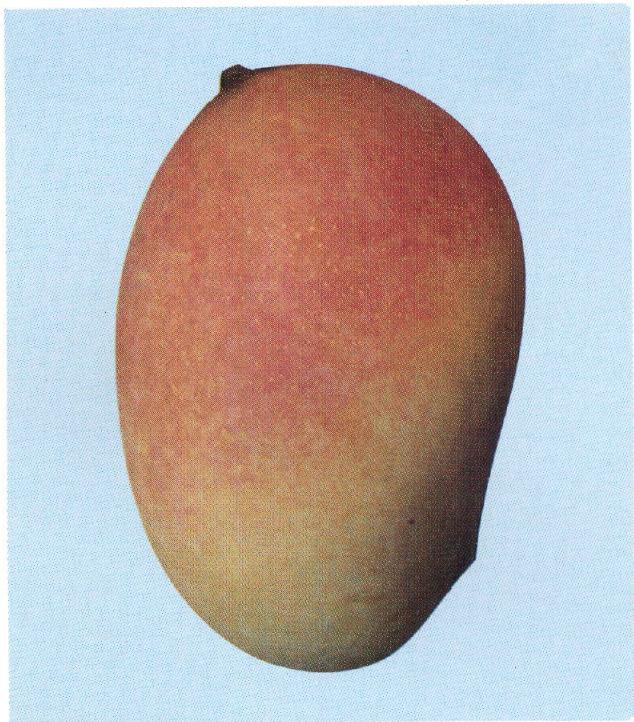
**Stone:** Oblong; full, plump; big (50.9 g), 9.0 cm long, 4.8 cm broad, 2.75 cm thick; heavy; veins



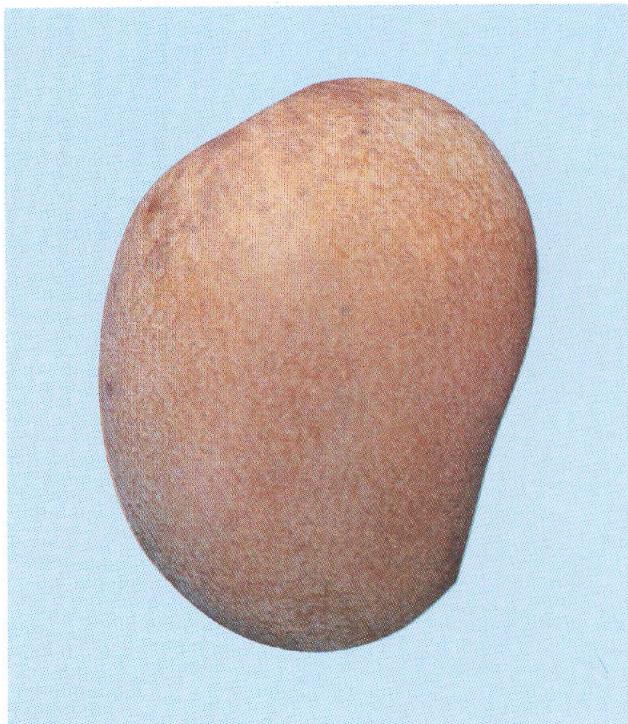
**Fig 21 : Durbate**



**Fig 22 : Elavayangan**



**Fig 23 : Fernandin**



**Fig 24 : Furtad**

raised, forked, parallel; fibres sparse soft, very short, mostly on ventral ridge; endocarp thick and woody; monoembryonic.

**General:** Susceptible to fruit flies and anthracnose rot.

## 25. FERNANDIN

*Syn:* Fernandina

A late variety, very popular throughout Goa as the fruits do not get spoiled by rains. Origin is unknown. Clonal variation is observed in the variety. A compact growing type, the fruits are not spoiled by fruit flies. It is used exclusively as table fruit.

**Tree:** Medium, moderately vigorous; canopy oval, upright; shoots thin, slender with brownish pigment without any waxy bloom; trunk medium.

**Leaves:** Medium to small (Length - 21.0 cm); upheld, base cuneate; tip acuminate; shape lanceolate; lamina twisted and recurved, not folded (Length - 19.7 cm, Breadth - 4.4 cm); smooth with slight waviness; tender leaf pale green with pinkish midrib; mid rib and veins without any pigmentation; waxy bloom on petiole sinus.

**Bearing:** Regular; high yielder.

**Season:** Late (May - June).

**Inflorescence:** Large, loose (Length - 38.0 cm, Breadth - 22.0 cm); conical in shape; rachis and rachilla densely pubescent with rose red pigmentation; stamens neither equal nor parallel to pistil; staminodes poorly developed.

**Fruit:** Big to medium, weighs 369.0 g, 10.95 cm long, 8.0 cm broad, 7.5 cm thick, L/B = 1.38; asymmetric; oblong; base obliquely flattened; stalk insertion oblique; stalk moderately thick; cavity shallow; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded and broader than dorsal shoulder; back curved; sinus absent; beak just a point; apex broadly pointed or rounded.

Skin smooth; bright yellow; crimson blush on both shoulders; less tough; leathery; thin; easily peeled; bitter; dots medium, very close, in flush with skin, same colour as skin.

Pulp firm, melting; weakly aromatic; lemon yellow to deep yellow; fibre none; juice scanty; taste sweet; flavour delightful pleasant; T.S.S. 19° Brix; flesh - 76.29%.

Quality excellent, shelf life excellent.

**Stone:** Oblong; full, plump; heavy (37.5 g), 8.4 cm long, 3.6 cm broad, 2.2. cm thick; veins grooved, forked; fibres soft, short, concentrated on ventral ridge; endocarp medium thick, woody; monoembryonic.

**General:** Susceptible to shoot borer, hoppers, not generally affected by fruit flies. Some say that a white form is also available lacking the red blush, but it could not be located so far.

## 26. FURTAD

*Syn:* Furtado

A very popular variety of South Goa, which was relegated to the back ground due to the prominence of Mankurad. Externally both resemble to each other and often people mistake one for the other. However, the flesh characteristics are different. This variety is known for its profuse bearing and fruit set and also immature fruit fall. It is a common feature to see half mature fruits fall and lie around the trees in large numbers. This also had added to its disfavour. Furtad is not so sweet or aromatic as Mankurad. Flesh colour is reddish orange in Furtad unlike the yellowish orange colour of Mankurad. It is also reported to be resistant to shoot borer of mango. It is used as table fruit and is seen marketed in South Goa during the season. This may be a useful parent in breeding. Origin is not known.

**Tree:** Large; vigorous; canopy round and spreading; shoots thick, not pigmented; waxy bloom present; trunk is stocky.

having big size fruit, cultivated to a limited extent in Siolim of N.Goa. 'Irmao' means 'Brother'. Probably the variety is a budsport of the most popular variety Xavier. The limited occurrence of trees indicates a comparatively recent origin. The variety is unheard of in the South of Goa. Vegetative, inflorescence and fruit characters are almost the same as Xavier. The large fruit size and more firm flesh distinguish the variety from Xavier. Used as table fruit.

**Tree:** Medium; moderately vigorous; canopy round, spreading; shoots moderately thick or thin without any waxy bloom or pigmentation; trunk is medium.

**Leaves:** Medium (Length - 29.0 cm); upheld; base attenuate; tip acuminate; lanceolate; lamina twisted, slightly recurved, flat (Length - 23.8 cm, Breadth - 4.6 cm); margin smooth; tender leaf pale green; midrib and veins without pigmentation; waxy bloom on petiole sinus.

**Bearing:** Regular; medium yielder.

**Season:** Late (May - June).

**Fruit:** Big to medium; weighs 352.0 g, 10.43 cm long, 8.47 cm broad, 7.27 cm thick, L/B = 1.23; asymmetric; oblique or ovate or oval; flattened; base obliquely flattened; stalk insertion oblique; stalk thick; cavity slight; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder; back curved; sinus absent; beak absent or mammiform; apex broadly pointed or round.

Skin smooth; orange; blush absent; medium tough; leathery; thick; easily peeled; bitter; dots medium, distant, in flush with skin, green coloured.

Pulp soft; orange with yellow border; fibre intermediate, coarse, long; non aromatic; juice abundant; taste sweet; flavour pleasant; delightful; T.S.S. - 19° Brix; flesh - 65.81%.

Quality excellent; shelf life poor.

**Stone:** Oblong; full, plump; big size; heavy

(44.0 g), 9.03 cm long, 4.47 cm broad, 2.47 cm thick; veins raised, forked, parallel; fibres abundant, coarse, long, throughout; endocarp thick and woody; monoembryonic.

**General:** Susceptible to fruit flies.

### 30. JAPAO

A large fruited variety located from Madkai in Ponda taluka. The leaves are very long similar to Malgesh. The fruit is roundish yellowish green in colour with a rough surface. A late bearing variety, it has nothing special about the fruit that warrant continued cultivation. Probably, it might have been cultivated owing to the large fruits with large quantity of flesh. It is also alternate in bearing.

A red fruited type of seedling origin resembling Bardez Mussarat is also commonly called 'Japao' in Nerul area of North Goa. The fruit is of mediocre quality.

### 31. JOSE

Located at Goa Velha of South Goa and of limited importance. Fruits are used for pickling purposes.

**Trees:** Large; vigorous; canopy round, spreading; shoots thick, without any pigmentation or waxy bloom; trunk stocky.

**Leaves:** Medium (Length - 24.8 cm); spreading and upheld; base cuneate; tip subacuminate; shape lanceolate or elliptical; lamina twisted, slightly recurved, not folded (Length - 22.1 cm, Breadth - 5.3 cm); margin smooth; tender leaf pale green; mid rib and veins without any pigmentation; waxy bloom on petiole sinus.

**Bearing:** Alternate; medium yield.

**Season:** Late (May - June).

**Inflorescence:** Medium (Length - 28.5 cm, Breadth - 19.5 cm); conical; rachis and rachilla densely pubescent with rose pink pigmentation;

broad, 2.47 cm  
parallel; fibres  
endocarp thick

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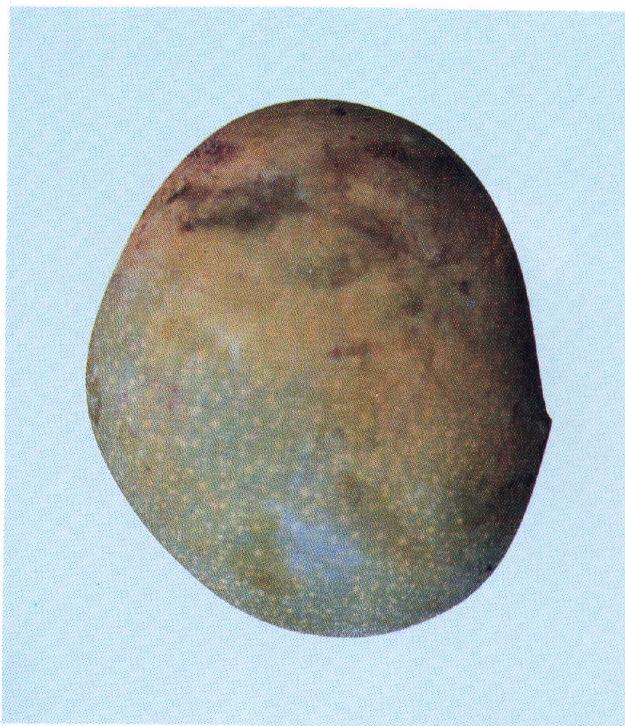
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**Fig 25 : Godgo**



**Fig 26 : Hilario**

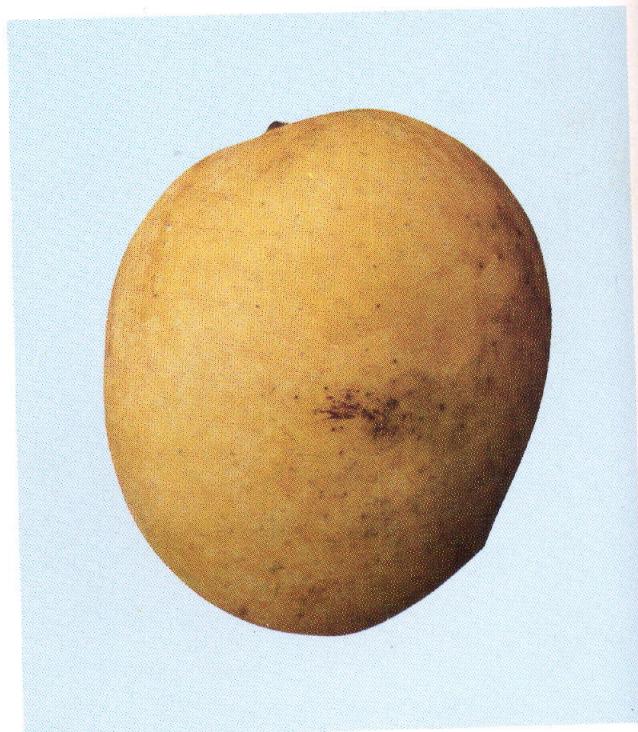


Fig 27 : Irmao Xavier

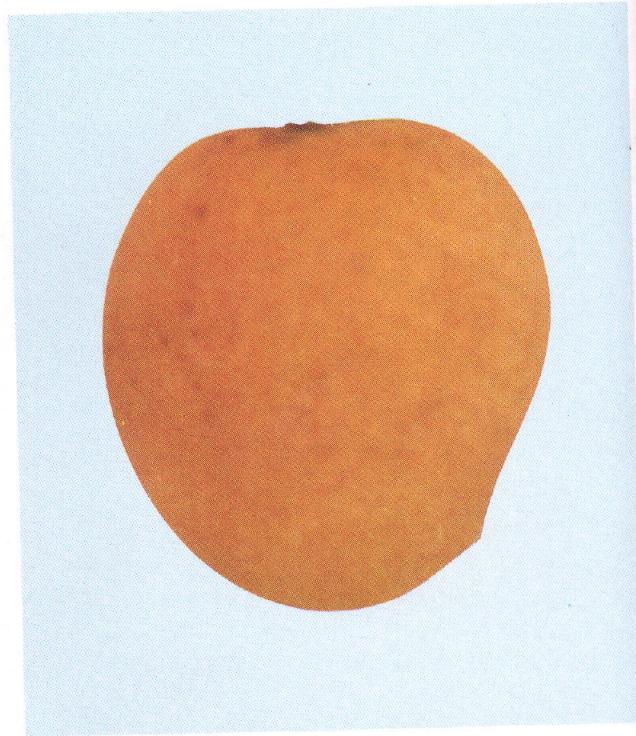


Fig 28 : Jose

stamens equal and parallel to pistil; staminodes poorly developed.

**Fruit:** Medium, weighs 294.0 g, 9.25 cm long, 8.05 cm broad, 7.15 cm thick, L/B = 1.15; asymmetric; roundish; base obliquely flattened; stalk insertion oblique; stalk thick; cavity shallow; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder; back curved, sinus shallow; beak just a point; apex round.

Skin smooth; yellowish orange; blush absent; less tough; leathery; thin; easily peeled; bitter; dots medium, distant, in flush with skin, same colour as skin or black.

Pulp soft, melting; orange; non aromatic; fibre scanty; juice abundant; taste less sweet, subacid; flavour agreeable; T.S.S. 16° Brix; flesh - 74.45%.

Quality fair, shelf life poor.

**Stone:** Oblong; full, plump; medium (34.0 g), 7.05 cm long, 4.25 cm broad, 2.45 cm thick; veins raised, parallel; fibres abundant, soft, medium long, seen throughout; endocarp thick, woody; monoembryonic.

### 32. JERONIMO

One of the old Portuguese varieties located at Aldona in N. Goa. The fruit is used for table purpose though the quality is mediocre.

**Tree:** Large; vigorous; canopy round, spreading; shoots medium thick, waxy bloom present without any pigmentation; trunk medium.

**Leaves:** Medium (Length - 22.0 cm); upheld; base cuneate; tip acuminate; lanceolate; lamina twisted, slightly reflexed, flat (Length - 19.2 cm, Breadth - 5.1 cm); margin smooth; tender leaf pale green; mid rib and veins devoid of any pigmentation; waxy bloom on petiole sinus.

**Bearing:** Alternate; medium yielder.

**Season:** Late (May - June).

**Fruit:** Big, weighs 393.0 g, 12.0 cm long, 9.0 cm broad, 8.23 cm thick, L/B = 1.33; asymmetric; oblique; base flattened obliquely; stalk insertion oblique; stalk medium thick; cavity deep; dorsal shoulder narrow, abruptly falling; ventral shoulder rising, rounded, ridged, broader than dorsal shoulder; back curved; sinus slight; beak mammiform; apex broadly pointed.

Skin smooth; yellowish orange; blush absent; tough; leathery; thick; easily peeled; having repugnant taste; dots small, very close, in flush with skin, same colour as skin.

Pulp orange or deep orange; firm, melting; fibre scanty; weakly aromatic; juice medium, taste sweet, subacid, flavour pleasant; T.S.S. 17° Brix; flesh - 67.36%.

Quality good; shelf life good.

**Stone:** Oblong or elongated; full, plump; big size; heavy (40.0 g), 8.15 cm long, 4.05 cm broad, 2.55 cm thick; veins raised; parallel; fibres sparse, soft, short, mostly on ventral ridge; endocarp thick and woody; monoembryonic.

**General:** Susceptible to fruit flies.

### 33. JESUIT

A rare variety located at Benaulim used as table fruit. It is named after Jesuit fathers who named it for the first time and they promoted its cultivation through grafting.

**Tree:** Large; vigorous; canopy round, spreading; shoots thick, without any pigmentation or waxy bloom; trunk stocky.

**Leaves:** Medium (Length- 22.8 cm), upheld; base obtuse; tip subacuminate; shape elliptic; lamina twisted, recurved, not folded (Length - 19.4 cm, Breadth - 5.6 cm); margin smooth; tender leaf pale green; midrib and veins without pigmentation; waxy bloom on petiole sinus.

**Bearing:** Alternate; medium yielder.

**Season:** Late (May - June).

**Inflorescence:** Medium to large (Length - 29.1 cm, Breadth - 21.0 cm); conical; rachis and rachilla densely pubescent with pink pigmentation; stamens equal and parallel to pistil; staminodes developed.

**Fruit:** Big, weighs 386.0 g, 11.05 cm long, 8.55 cm broad, 7.45 cm thick, L/B = 1.29; asymmetric; oblong; base flattened slightly; stalk insertion oblique; stalk medium thick; cavity shallow; dorsal shoulder narrow; abruptly falling; ventral shoulder rising, rounded, broader than dorsal shoulder; back curved; sinus absent; beak just a point; apex obtuse or round.

Skin smooth; yellowish orange tinged green; blush absent; tough; leathery; thick; easily peeled; bitter; dots small, distant, in flush with skin, same colour as skin.

Pulp medium soft; deep orange; non aromatic; fibre abundant, long, coarse; juice medium to abundant; taste sweet; subacid; flavour pleasant; T.S.S. 18° Brix; flesh - 65.41%.

Quality fair, shelf life fair.

**Stone:** Oblong or elongated; full, plump, big (55.0 g), 9.3 cm long, 4.78 cm broad, 2.25 cm thick; veins grooved forked; fibres abundant, coarse, long, seen throughout; endocarp thick, woody; monoembryonic;

### 34. KALA ALFONSO

A variety located in Madkai of N.Goa. The fruit remains olive green even after ripening being almost black and hence the name Kala Alfonso. Taste is sweet similar to Goa Alfonso. Used as table fruit. A rare variety facing extinction.

**Tree:** Large; vigorous; canopy round, spreading; shoots thick without any waxy bloom or pigmentation; trunk is stocky.

**Leaves:** Medium (Length - 26.8 cm ); upheld;

base cuneate; tip acuminate; lanceolate; lamina twisted, strongly reflexed, flat (Length - 23.8 cm, Breadth - 4.9 cm); margin smooth; tender leaf pale green; mid rib and veins devoid of any pigmentation; waxy bloom on petiole sinus.

**Fruit:** Medium; weights 361.0 g, 10.4 cm long, 8.25 cm broad, 8.15 cm thick, L/B = 1.26; asymmetric; oval or oblong; base obliquely rounded; stalk insertion oblique; stalk thick; cavity absent; dorsal shoulder narrow, abruptly falling or moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder; back curved; sinus absent; beak absent; apex round.

Skin smooth; olive green tinged yellow; faintly pink blush on both shoulders; tough; leathery; thick; easily peeled; bitter; dots medium; thick; easily peeled; bitter; dots medium, distant, in flush with skin, gray coloured.

Pulp soft; yellowish orange; fibre abundant, fine, long; non aromatic; juice medium; taste sweet, starchy; flavour pleasant; T.S.S - 22° Brix; flesh - 66.16%.

Quality good; shelf life poor.

**Stone:** Oblong; full, plump; medium size; heavy (36.5 g), 8.25 cm long, 4.3 cm broad, 2.25 cm thick; veins raised, forked; fibres intermediate, coarse, medium length, seen throughout; endocarp thick and woody; monoembryonic.

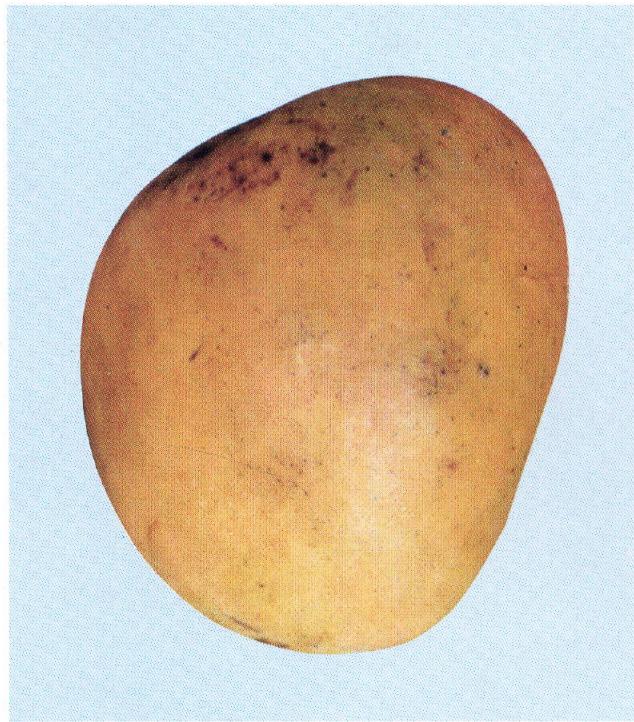
**General :** Susceptible to fruit flies.

### 35. KAPRI

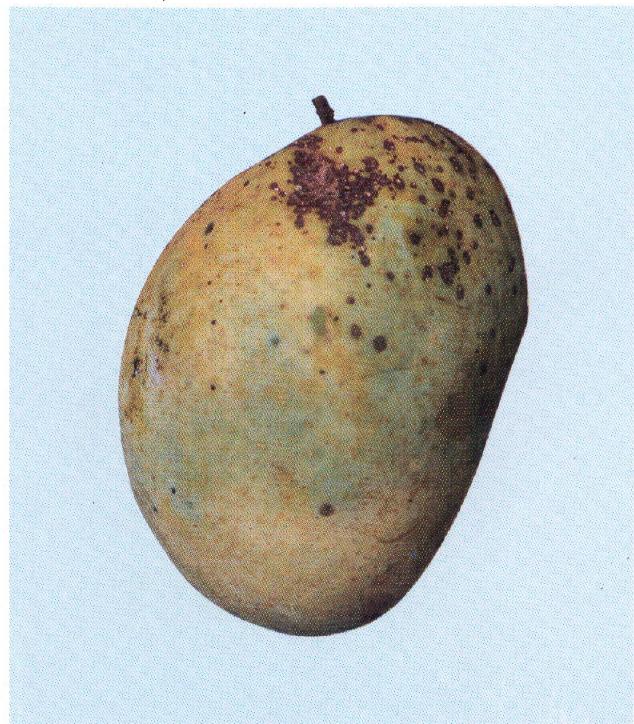
The variety was located in Nerul of Bardez taluka. The name is derived from the fact that the fruit does not attain good colour after ripening. The fruit is used for table purpose but are available even in July - August.

**Tree:** Large; vigorous; canopy dome shaped, spreading; shoots moderately thick, devoid of any waxy bloom or pigmentation; trunk is stocky.

**Leaves:** Medium to small (Length - 21.7 cm); upheld; base obtuse; tip subacuminate; oval



**Fig 29 : Jeronimo**



**Fig 30 : Jesuit**



**Fig 31 : Kala Alphonso**



**Fig 32 : Kapri**

lanceolate; lamina twisted, slightly recurved, flat (Length - 20.0 cm, Breadth - 4.9 cm); margin smooth; tender leaf pale brown; midrib and veins without any pigmentation; waxy bloom on petiole sinus.

**Bearing:** Alternate; medium yielder.

**Season:** Very late (June - August).

**Fruit:** Medium; weights 274.0 g, 8.45 cm long, 9.0 cm broad, 7.25 cm thick, L/B = 0.94; asymmetric; blocky or ovate; base flattened obliquely; stalk insertion oblique; stalk thick; cavity slight; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded broader than dorsal shoulder; back curved; sinus absent; beak prominent; apex round.

Skin smooth; greenish yellow; blush absent; less tough; leathery; thick; easily peeled; non bitter; dots big; distant, in flush with skin, dark coloured.

Pulp firm, thick; yellowish orange; fibre abundant, coarse, long; non-aromatic; juice medium; taste sweet; flavour pleasant; T.S.S. 15° Brix; flesh - 60.42%.

Quality fair; shelf life good.

**Stone:** Ovate; full, plump; big size; heavy (41.0g), 6.65 cm long, 5.56 cm broad, 2.4 cm thick; veins grooved, parallel; fibres abundant, coarse, long, throughout; endocarp thick and woody; monoembryonic.

## 36. KOITA

*Syn:* Padrecha Ambo

A rare type having elongated papaya like fruits. It is named after 'Koita' meaning a type of cutting knife used in Goa, as the fruit shape resembles it. It is used as a table fruit out of curiosity. The trees are found occurring in Old Goa and Diwadi areas. The fruit shape is quite unusual for mango. It is also called as 'Padrecha ambo'.

**Tree:** Large; vigorous; canopy round and

spreading; shoots moderately thick or thin, without any wax or pigmentation; trunk is medium stocky.

**Leaves:** Medium to small (Length - 20.0 cm); upheld; base cuneate; tip acute; shape elliptic; lamina twisted, strongly recurved, not folded (Length - 17.2 cm, Breadth - 4.7 cm); margin smooth; tender leaf reddish brown; mid rib and veins without any pigmentation; waxy bloom on petiole sinus.

**Bearing:** Irregular to alternate; medium yielder.

**Season:** Late (May - June).

**Inflorescence:** Large (Length - 36.1 cm, Breadth - 21.2 cm), loose; conical; rachis and rachilla moderately pubescent without any pigmentation; stamens neither equal nor parallel to pistil; staminodes poorly developed.

**Fruit:** Medium, weighs 302.0 g, 18.0 cm long, 5.9 cm broad, 5.7 cm thick, L/B = 3.05; asymmetric; elongated like a thin long papaya in the shape of a Koita; base rounded obliquely; stalk insertion oblique; stalk moderately thick; cavity absent, dorsal shoulder narrow, abruptly falling; ventral shoulder rising, rounded and broader than dorsal shoulder; back of fruit curved; sinus deep; beak absent; apex round.

Skin smooth; greenish yellow; blush absent; tough; leathery; thick; easily peeled; non bitter; dots medium, very close, in flush with skin, same colour as skin.

Pulp soft, melting; yellowish orange; non aromatic; fibre scanty; juice medium; taste sweet; subacid; flavour poor slightly akin to papaya fruit; T.S.S. 15° Brix; flesh - 75.5%.

Quality fair, shelf life poor.

**Stone:** Long, full, plump, medium (31.0 g), 14.0 cm long, 2.8 cm broad, 1.9 cm thick; veins grooved, forked, parallel; fibre sparse, soft, short mostly on ventral ridge only; endocarp medium thick, woody; monoembryonic.

**General:** Susceptible to fruit flies.

## 37. MADAME

This variety was located in Siolim of N. Goa and distribution is localised. It is likely to disappear unless cultivated. The fruit quality is good and is used as table fruit.

**Tree:** Large; vigorous; crown pyramidal, spreading; shoots thick, without any waxy bloom or pigmentation; trunk is stocky.

**Leaves:** Medium (Length - 26.2 cm); spreading and upheld; base cuneate; tip acute; elliptic; lamina not twisted, slightly reflexed, slightly folded (Length - 23.5 cm, Breadth - 6.8 cm); margin smooth; tender leaf light green; mid rib and veins devoid of any pigmentation; waxy bloom present on petiole sinus.

**Bearing:** Alternate; medium yielder.

**Season:** Late (May - June).

**Inflorescence:** Medium, (Length 30.5 cm, Breadth - 28.7 cm); conical; compact; rachis and rachilla densely pubescent with rose red pigmentation; stamens equal but not parallel to pistil; staminodes not developed.

**Fruit:** Medium to big; weighs 390.0 g, 8.9 cm long, 9.13 cm broad, 7.9 cm thick, L/B = 0.97; asymmetric; roundish to ovate; base obliquely flattened; stalk insertion oblique; stalk thick; cavity deep; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded, broader, than dorsal shoulder; back curved or rounded; sinus absent; beak absent; apex round.

Skin smooth; bright yellow; pink blush on both shoulders; medium tough; leathery; thick; easily peeled; bitter; dots small to medium, distant, in flush with skin, dark coloured.

Pulp firm, melting; deep yellow to orange; fibre none; aromatic; juice scanty; taste sweet; flavour pleasant; T.S.S. 18° Brix; flesh 71.89%.

Quality good; shelf life fair.

**Stone:** Oblong; full, plump, thick; big size; heavy (41.0 g), 6.6 cm long, 4.2 cm broad, 2.43

thick; veins grooved, parallel, forked; fibres sparse, coarse, short, concentrated on ventral ridge; endocarp thick and woody; monoembryonic.

## 38. MANKURAD

*Syn:* Goa Mankur, Kurad, Malcorado, Corado.

This is the most important variety popular throughout Goa and preferred to other varieties. The origin is unknown. The Portuguese named it Malcorado meaning 'poor coloured' and this word metamorphosed to Mankurad by long period of use. Occurrence of large number of trees and popularity indicate long history of its cultivation. A lot of variation exists in this variety owing to indiscriminate propagation. This is used as table fruit exclusively and most esteemed in the local market.

**Tree:** Large; vigorous; canopy is round and spreading; shoots are thick devoid of any pigmentation or waxy bloom; trunk is stocky.

**Leaves:** Medium (Length - 31.0 cm); upheld; base cuneate; tip acuminate; shape oval lanceolate; lamina slightly twisted and recurved, not folded (Length - 25.7 cm, Breadth - 6.6 cm); margin smooth; tender leaf pinkish brown; mid rib and veins without any pigmentation; waxy bloom on petiole sinus.

**Bearing:** Alternate to irregular; medium yield.

**Season:** Early (March to April).

**Inflorescence:** Medium to large (Length - 26.0 cm, Breadth - 22.0 cm); conical or oval in shape; rachis and rachilla moderately pubescent with rose pink pigmentation; stamens equal but not parallel to pistil; staminodes developed.

**Fruit:** Medium to small, weighs 278.0 g, 9.1 cm long, 7.65 cm broad, 7.0 cm thick, L/B = 1.19; asymmetric; oblique or ovate; base obliquely flattened; stalk insertion oblique; stalk medium thick; cavity slight; dorsal shoulder narrow and

moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder; back curved; sinus absent; beak just a point; apex broadly pointed or rounded.

Skin smooth bright yellowish orange; deep pink or red blush seen mostly on ventral shoulder; tough; leathery; thin; easily peeled; bitter; dots medium, moderately closer, in flush with skin, lighter coloured than skin.

Pulp melting; strongly aromatic (rose aroma); yellowish orange; fibre scanty; juice medium; taste sweet; flavour delightful, pleasant; T.S.S. 21° Brix; flesh -75.98%.

Quality is excellent, shelf life poor.

**Stone:** Oblong, thin but full, medium (28.5 g), 7.35 cm long, 4.2 cm broad, 1.55 cm thick; veins grooved, parallel; fibres sparse, soft, short and concentrated on ventral ridge; endocarp medium thick, woody; monoembryonic.

**General:** Susceptible to hoppers, shoot borer, pink disease, powdery mildew.

There is good scope for selection of good clones. Generally two types of flesh colour are seen; deep orange and yellow to yellowish orange. Presence of fibre in fruit is a serious problem. Trees have been observed to give fibreless fruit in one branch and fibrous fruit in another branch. So the possibility of chimeral variation is quite high. Some variability is also due to seedling origin. Trees also express variability of rose aroma in the fruit. The best quality is seen in the fruit with good skin colour, yellowish orange flesh of delightful flavour and rose aroma. Because of this variation, one has to clearly observe the fruits in a branch before making grafts to get true to type plants of the desired quality.

### 39. MALGOA

Origin of this variety is not known. This is different entirely compared to the Mulgoa of Andhra Pradesh. This is used as a table fruit grown in North Goa. Only few trees have been located.

**Tree:** Large; vigorous; canopy round; spreading; shoots thick without any pigmentation or waxy bloom; trunk stocky.

**Leaves:** Medium (Length - 24.0 cm); upheld; base cuneate; tip acuminate; shape lanceolate; lamina slightly twisted, recurved, not folded (Length - 21.8 cm, Breadth - 5.1 cm); margin smooth; tender leaf pale brown with red midrib; midrib and veins devoid of any pigmentation; waxy bloom on petiole sinus.

**Bearing:** Regular; high yielding.

**Season:** Late (May - June).

**Inflorescence:** Medium (Length - 30.0 cm, Breadth - 24.0 cm); pyramidal; rachis and rachilla densely pubescent with rose red pigmentation; stamens equal and parallel to pistil; staminodes developed.

**Fruit:** Medium to small, weighs 203.0 g, 8.95 cm long, 7.38 cm broad, 5.98cm thick, L/B = 1.21; asymmetric; ovate or oblique; base obliquely flattened; stalk insertion oblique; cavity slight; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder; back curved or rounded, broader than dorsal shoulder; back curved or rounded; sinus shallow; beack mammiform; apex broadly pointed.

Skin smooth; yellowish orange or reddish orange with green patches; crimson blush on both the shoulders; tough; leathery; thin; easily peeled; nonbitter; dots small, moderately close, in flush with skin, lighter coloured than skin.

Pulp medium soft, melting, reddish orange; aromatic (rose like aroma); fibre none; juice medium; taste sweet; flavour pleasant; T.S.S. 20° Brix; flesh - 65.93%.

Quality good; shelf life fair.

**Stone:** Oblong; full, plump; medium (32.0 g), 6.9 cm long, 3.83 cm broad, 2.15 cm thick; veins raised, parallel; fibres nil, mostly concentrated on

ventral ridge; endocarp moderately thick, woody; monoembryonic.

**General:** Susceptible to fruit flies.

#### 40. MALGESH

*Syn:* Malgesta, Malgessa, Malgueso, Malges

A variety popular in North Goa with a lot of variation for fruit colour, size and quality. Two types are generally recognised; one with thick skin and lower quality known as Khand Malgesh and another with a finer quality called Akno Malgesh. Both are used as table fruit. In the market, these differences are not marked. The name itself suggests difficult to digest, in Portuguese.

**Tree:** Large; vigorous; canopy round and spreading; shoots thick without any waxy bloom or pigmentation; trunk stocky.

**Leaves:** Medium (Length - 29.3 cm); upheld; base cuneate; tip acuminate; shape linear; lamina twisted and recurved, not folded (Length - 25.8 cm, Breadth - 4.9 cm); margin smooth; tender leaf pale brown; mid rib and vein without any pigmentation; waxy bloom on petiole sinus.

**Bearing:** Alternate or irregular; medium yielder.

**Season:** Mid (April - May).

**Inflorescence:** Medium (Length - 38.4 cm, Breadth - 23.3 cm); conical; rachis and rachilla densely pubescent with pinkish brown pigmentation; stamens neither equal nor parallel to pistil; staminodes poorly developed.

**Fruit:** Medium; weighs 262.0 g, 9.0 cm long, 7.65 cm broad, 3.21 cm thick, L/B = 1.18; asymmetric; oblique; base flattened obliquely, stalk insertion oblique; stalk moderately thick; cavity shallow; dorsal shoulder, narrow, abruptly falling; ventral shoulder broader, rising, rounded than dorsal shoulder; back curved; sinus absent; beak absent or a point; apex broadly pointed.

Skin smooth to slightly rough; yellowish orange; pinkish red blush on both shoulders (mostly on ventral shoulder); tough; leathery; thick; easily peeled; bitter; dots medium, very close, in flush with skin, same colour as skin.

Pulp firm, melting; deep orange; non aromatic; fibre moderate, long and slightly coarser; juice medium; taste sweet and subacid; flavour pleasant; T.S.S. 18° Brix; flesh - 65.20%.

Quality good; shelf life good.

**Stone:** Oblong; full and plump; medium (35.0 g), 7.65 cm long, 4.41 cm broad, 2.2 cm thick; veins grooved and parallel; fibres abundant, medium long, soft, mostly on ventral ridge; endocarp thick, woody; monoembryonic.

**General:** Susceptible to shoot borer.

#### 41. MANGLECH

*Syn:* Babio (white)

A variety located in Siolimof N. Goa used for pickling purposes. The fruits being big makes a resounding noise when fallen to the ground and hence the name. Some name it as Babio white due to the fair colour of the skin of the immature fruit. Ever since it was collected, the tree has been cut and no other trees could be located.

**Tree:** Very large; very vigorous; crown round, spreading; shoots thick without any waxy bloom or pigmentation; trunk is stocky.

**Leaves:** Big (Length - 32.6 cm); upheld; base obtuse; tip subacute; elliptic; lamina not twisted, not reflexed, not folded (Length - 29.0 cm, Breadth - 8.5 cm); margin smooth; tender leaf brown; mid rib and veins without pigmentation; wax present on petiole sinus.

**Inflorescence:** Medium (Length - 28.5 cm, width - 25.0 cm); pyramidal; rachis and rachilla moderately pubescent without pigmentation; stamens equal and parallel to pistil; staminodes developed.

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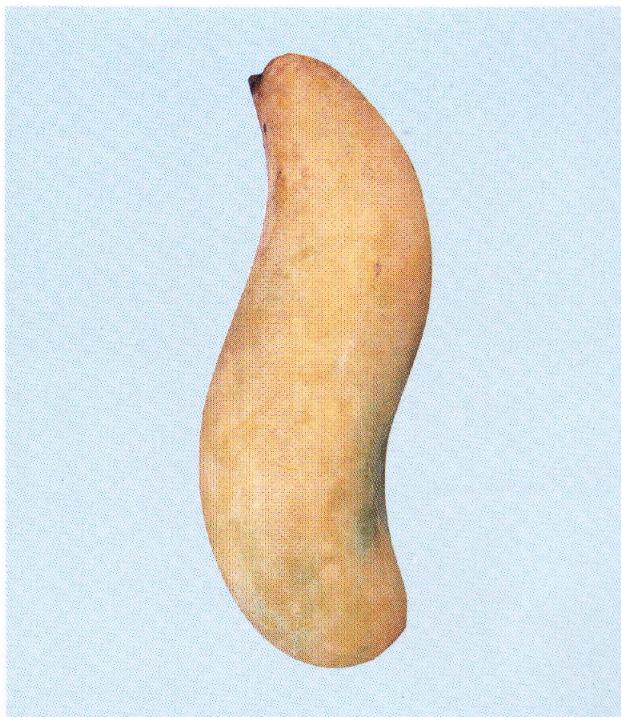
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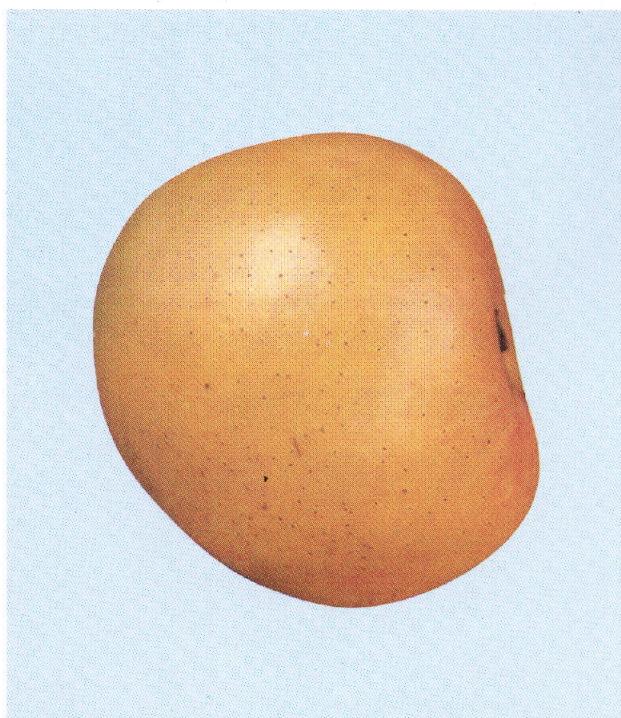
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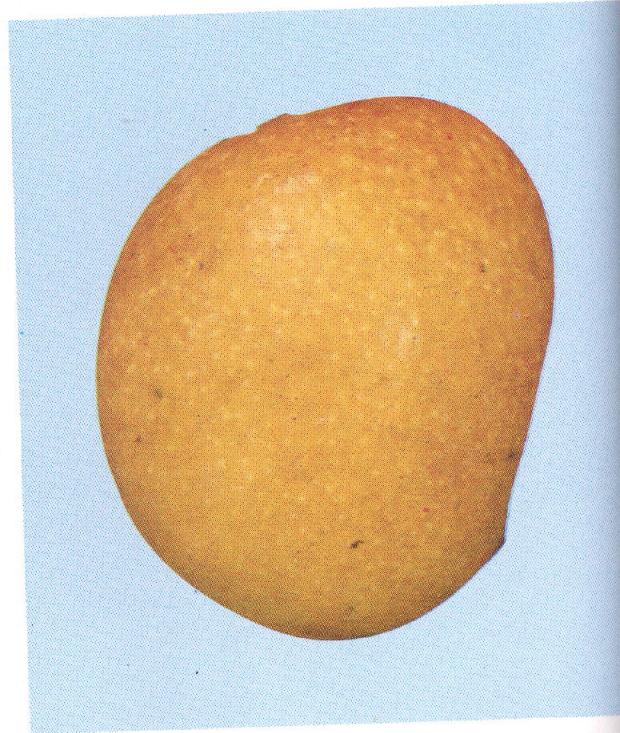
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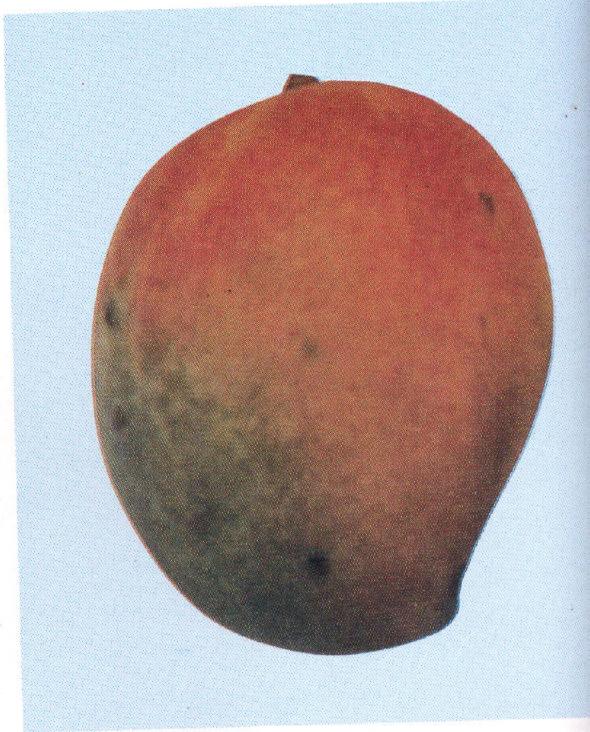
**Fig 33 : Koita**



**Fig 34 : Madame**



**Fig 35 : Mankurad**



**Fig 36 : Malgoa**

**Fruit:** Big, weighs 607.0 g, 12.1 cm long, 10.55 cm broad, 9.6 cm thick, L/B = 1.15; asymmetric; shape variable, oblique or round or oval; base obliquely flattened; stalk insertion oblique; stalk thick; cavity deep; dorsal shoulder abruptly falling or moderately curved, narrow; ventral, shoulder rising, rounded, broader than dorsal shoulder; back curved; sinus absent; beak absent or marked by a swelling; apex round.

Skin light yellow; smooth; blush absent; tough; leathery; thick; easily peeled; nonbitter; dots big, very close, in flush with skin, lighter coloured than skin.

Pulp firm, thick or meaty; yellowish orange; fibre abundant, intermediate, long; non aromatic; juice scanty; taste acidic; flavour bland; T.S.S. - 11.4° Brix; flesh - 78.1%.

Quality poor; shelf life good.

**Stone :** Oblong; full, plump, big (37.5 g), 8.65 cm long, 4.7 cm broad, 2.1 cm thick; heavy; veins raised, parallel; fibre abundant, coarse, long, throughout seen; endocarp thick and woody; monoembryonic.

## 42. MANCHERON

*Syn : Manicheran*

A variety of limited circulation located in Siolim of N. Goa used as table fruit.

**Tree :** Large; vigorous; canopy round, spreading; shoots thick without any waxy bloom or pigmentation; trunk is stocky.

**Leaves :** Medium (Length - 27.5 cm); upheld; base cuneate; tip subacuminate; elliptic; lamina twisted, strongly reflexed, flat (Length - 24.9 cm, Breadth - 6.9 cm); margin smooth; tender leaf pale green; mid rib and vein without pigmentation; waxy bloom on petiole sinus.

**Bearing :** Regular; medium yielder.

**Season :** Late (May - June).

**Fruit :** Big; weighs 328.0 g, 11.05 cm long, 8.5 cm broad, 7.15 cm thick, L/B = 1.3; asymmetric; oblong; flattened; base obliquely flattened; stalk insertion oblique; stalk thick; cavity shallow; dorsal shoulder abruptly falling, narrow; ventral shoulder rising, rounded, ridged, broader than dorsal shoulder; back curved; sinus slight; beak mammiform; apex round.

Skin smooth; orange; light pink blush on both shoulders; less tough; leathery; thick; easily peeled; repugnant taste; dots small, very close, in flush with skin, lighter coloured skin.

Pulp soft; yellowish orange; fibre intermediate, medium long, coarse; weakly aromatic; juice abundant; taste sweet, acidic; flavour turpentine; T.S.S. - 12° Brix; flesh - 60.0%.

Quality fair; shelf life poor.

**Stone :** Oblong; full, plump; big to medium size; medium weight (33.4 g), 8.8 cm long, 4.35 cm broad, 2.15 cm thick; veins raised, parallel; fibre abundant, soft, long, seen throughout; endocarp thick and woody; monoembryonic.

## 43. MATEKIN

A popular variety of Siolim of N. Goa preferred for the preparation of a sweet meat called 'Raita'. The fruits are quite juicy and are used after ripening. This is also facing extinction owing to the limited plantings available.

**Tree :** Large; vigorous; canopy round, spreading; shoots thick devoid of any waxy bloom or pigmentation; trunk is stocky.

**Leaves :** Medium (Length - 24.5 cm); upheld; base cuneate; tip subacuminate; elliptic; lamina twisted, strongly recurved, flat (Length - 20.9 cm, Breadth - 5.3 cm); margin smooth; tender leaf pale green; mid rib and veins without any pigmentation; waxy bloom on petiole sinus.

**Bearing :** Alternate; medium yielder.

**Season :** Late (May - June).

**Fruit :** Small; weighs 170.0 g, 7.63 cm long, 7.5 cm broad, 6.1 cm thick, L/B = 1.02; asymmetric; oblique or roundish; base flattened obliquely; stalk insertion oblique; stalk medium thick; cavity slight; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder; back curved; sinus absent; beak just a point; apex broadly pointed or round.

Skin smooth; orange; rose red blush on both shoulders; medium tough; leathery; thick; easily peeled; non bitter; dots big, distant, in flush with skin, white coloured.

Pulp soft, melting; deep orange; fibre scanty; weakly aromatic; juice medium; taste sweet; flavour pleasant, turpentine; T.S.S. - 20° Brix; flesh - 53.22%.

Quality good; shelf life poor.

**Stone :** Oval; full, plump; medium size; medium (28.5 g), 6.4 cm long, 4.25 cm broad, 2.15 cm thick; veins grooved, not parallel; fibre sparse, soft, short, mostly on ventral ridge; endocarp thick and woody; monoembryonic.

**General :** Susceptible to fruit flies.

#### 44. MAXIMA

A variety of limited distribution located in Goa Velha used as table fruit. The name given by the owner of the tree is reproduced here though the real name may be different. The fruit colour is attractive. Most probably a variant of Malgoa of Goa.

**Tree :** Large; vigorous; canopy round and spreading; shoots moderately thick without any waxy bloom or pigmentation; trunk moderately stocky.

**Leaves :** Medium (Length - 22.0 cm); upheld; base cuneate; tip subacuminate; shape lanceolate; lamina faintly twisted, recurved not folded (Length - 19.6 cm, Breadth - 5.0 cm); margin smooth;

tender leaf pale green; mid rib and veins without any pigmentation; waxy bloom on petiole sinus.

**Bearing :** Regular; high yielder.

**Season :** Late (May - June).

**Inflorescence :** Medium (Length - 27.0 cm, Breadth - 23.0 cm); loose; pyramidal; rachis and rachilla densely pubescent with rose red pigmentation; stamens equal and parallel to pistil; staminodes not developed.

**Fruit :** Medium to small, weighs 210.0 g, 9.4 cm long, 7.1 cm broad, 6.13 cm thick, L/B = 1.32; asymmetric; oblique or oval; base obliquely flattened; stalk insertion oblique; stalk moderately thick; cavity shallow; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder; back curved; sinus deep; beak prominent; apex broadly pointed.

Skin smooth; yellowish orange; crimson blush on both shoulders; tough; leathery; thin; easily peeled; non bitter; dots medium, moderately closer, in flush with skin, whitish coloured.

Pulp firm, melting; deep orange; weakly aromatic; fibre scanty; juice medium; taste sweet; flavour pleasant; T.S.S. 22° Brix; flesh - 74.76%.

Quality excellent, shelf life flair.

**Stone :** Oblong; full, plump; small (18.0 g), 7.1 cm long, 3.4 cm broad, 1.7 cm thick; veins raised, parallel; fibres sparse, soft, short mostly on ventral ridge; endocarp thin, woody; monoembryonic.

**General :** Susceptible to fruit flies.

#### 45. MIRANDA

The variety was located from Raia. A very irregular bearing type. The variety is very rare. The fruit is reported to be of medium size, of greenish yellow colour and of good quality. Used as table fruit, much is not known about the variety.

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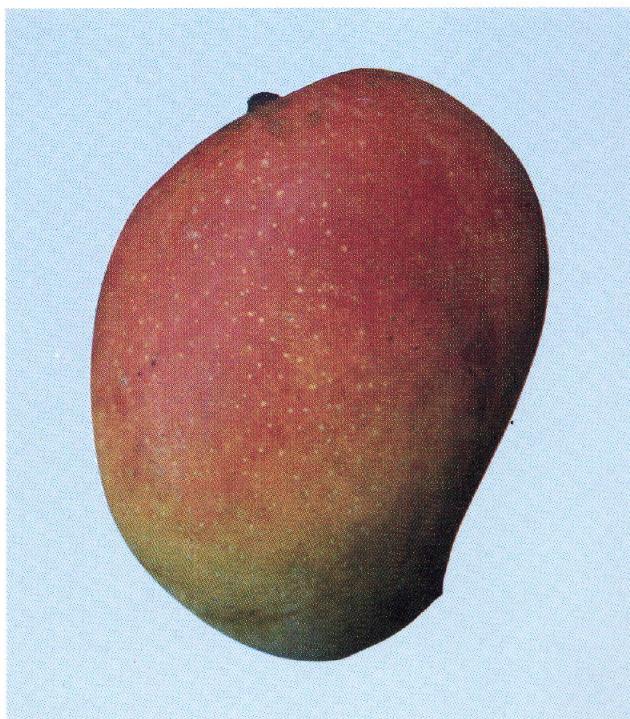
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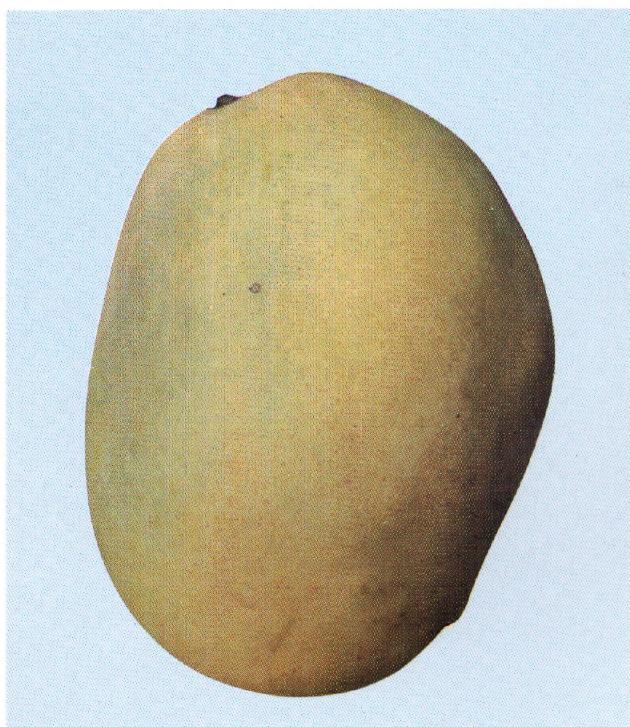
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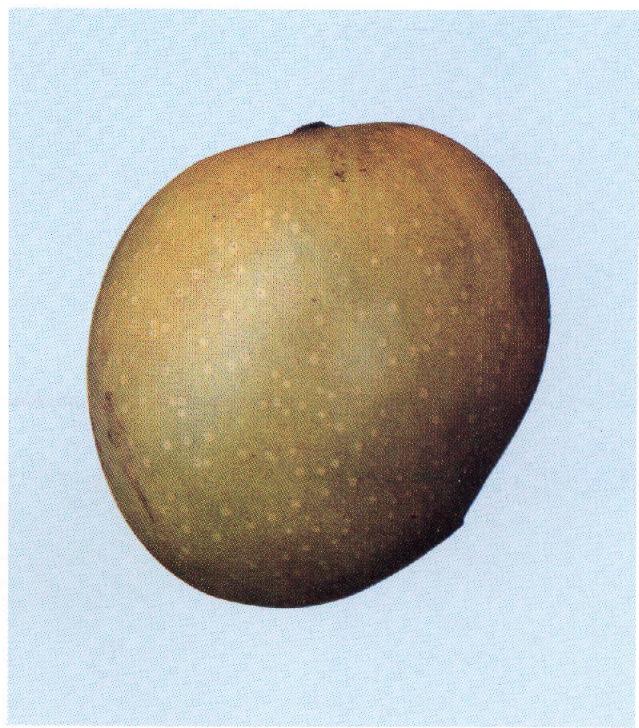
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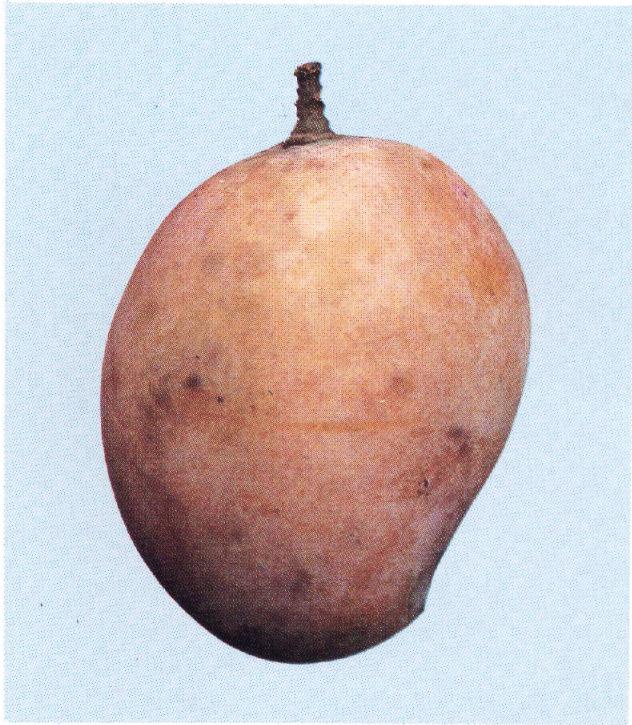
**Fig 37 : Malgesh**



**Fig 38 : Mancheron**



**Fig 39 : Matekin**



**Fig 40 : Maxima**

## 46. MONTEIRO

A small fruited sweet variety located at Assolna in South Goa. So far only one tree could be located and is in the verge of extinction. The name given by the owner is doubtful. It is used as a table fruit which is borne in clusters. An excellent variety suitable for home gardens. An erect growing type.

**Tree :** Large; vigorous; canopy oval or round with an upright habit; shoots thick without any waxy bloom or pigmentation; trunk stocky.

**Leaves :** Medium (Length - 26.4 cm); upheld; base obtuse; tip subacuminate; shape elliptic; lamina not twisted, slightly recurved, not folded (Length - 23.4 cm, Breadth - 6.4 cm); margin smooth; tender leaf pale greenish brown; midrib and veins without any pigmentation; waxy bloom on petiole sinus.

**Bearing :** Regular; high yielding.

**Season :** Late (April - June).

**Inflorescence :** Medium (Length - 23.5 cm, Breadth - 20.0 cm); conical; rachis and rachilla slightly pubescent with brown pigmentation; stamens equal to pistil but not parallel; staminodes developed.

**Fruit :** Small, weighs 145.0 g, borne in clusters; 6.67 cm long, 6.53 cm broad, 5.53 cm thick, L/B = 1.02 asymmetric, cordate; base obliquely flattened; stalk insertion oblique; stalk thin; cavity deep; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded; sinus slight; beak absent; apex round.

Skin smooth; bright yellow; pink blush on both shoulders; tough; leathery; thin; easily peeled; nonbitter; dots medium, moderately close, in flush with skin, same colour as skin.

Pulp firm, melting; deep yellow with orange centre; nonaromatic; fibre none; juice scanty; taste extremely sweet; flavour delightful, pleasant; T.S.S. 28° Brix; flesh - 69.12%.

Quality excellent; shelf life excellent.

**Stone :** Ovate; full, thin; small (22.0 g), 4.8 cm long, 4.3 cm broad, 1.78 cm thick; veins raised, parallel; fibres sparse, soft, short, mostly on ventral ridge; endocarp thin, woody; monocembryonic.

**General :** Needs to be popularised. Susceptible to shoot borer. Mealy bugs on roots have been found to kill young grafts.

## 47. MOZAMBIQUE

A variety introduced from Mozambique as seed about 30 years ago and planted at Murida of Cuncolim in Salcete taluka. Two trees exist resembling each other in all respects indicating the polyembryonic nature of the variety. The fruit is very large and is similar to the Baneshan of Andhra Pradesh but the flavour and taste is slightly different. Similarly the vegetative characters also differ from Baneshan. However, genetic mapping of the varieties may be required to really ascertain the parentage of the variety. Nevertheless, the type is having good commercial potential due to the large size, attractive yellow colour, flesh completely free from fibre with scanty juice, excellent flavour and sweetness and good keeping quality. The owner has reported that fruits are available from January to July-August. This maybe because of the nearness of the tree to the kitchen from where it receives a lot of smoke and this character needs to be studied and confirmed. Much is not known about the variety locally as it has been protected till date. It is used as a table variety.

**Tree :** Tree is large; moderately vigorous; canopy is spreading, pyramidal; shoots thin and wiry devoid of any waxy bloom or pigment; trunk stocky.

**Leaves :** Medium (Length - 21.4 cm); upheld; base cuneate; tip acuminate; shape lanceolate; lamina neither twisted nor recurved and flat (Length - 19.7 cm; Breadth - 4.5 cm); margin

smooth; tender leaf pale green; midrib without pigmentation; no waxy bloom or petiole sinus.

**Bearing :** Reported to be regular; medium yield.

**Season :** Late (May - June).

**Fruit :** Big, weighs 558.0 g, 12.2 cm long, 10.6 cm broad, 8.1 cm thick, L/B = 1.15; asymmetric; oblique; flattened; base obliquely flattened; stalk insertion oblique; stalk thick; cavity deep; dorsal shoulder narrow, abruptly falling; ventral shoulder rising, rounded and broader than dorsal shoulder; back curved; sinus slight; beak absent; apex pointed.

Skin very smooth; bright yellow; blush absent; less tough; leathery; thick; easily peeled; non bitter; dots small, distant, in flush with skin, same colour as skin.

Pulp firm, melting, buttery; yellowish orange or faintly orange; fibre none; aromatic; juice scanty to medium; taste sweet; flavour pleasant; T.S.S. 18° Brix; flesh - 67.35%.

Quality good; shelf life good.

**Stone :** Oblong; thin; size big but light (40.0 g), 10.2 cm long, 7.45 cm broad, 1.9 cm thick; veins raised, forked; fibre sparse, soft, very short on ventral ridge only; endocarp woody, thin; appears polyembryonic.

**General :** Susceptible to fruit flies.

#### 48. MUSSARAT (BARDEZ)

*Syn :* Monserrate de Bardez

Popularly cultivated in North Goa. The variety is named after Bardez Taluk where it originated. A tree laden with fruits is a beautiful sight as even its immature fruits exhibit intense red colour. Variation is observed in this variety. Fruits are used for jams, sweet pickles and processed products. This is preferred in the northern markets of Goa for preparing mango products.

**Tree :** Large; very vigorous; canopy oval or round, spreading; shoots thick without waxy bloom or pigmentation; trunk stocky.

**Leaves :** Medium (Length - 27.1 cm); down held; down held; base cuneate; tip subacuminate; shape oval lanceolate; lamina slightly twisted at tip and reflexed at petiole, not folded (Length - 24.4 cm, Breadth - 6.9 cm); margin smooth; tender leaf pale green; midrib and side veins without pigmentation; no waxy bloom on petiole sinus.

**Bearing :** Alternate; high yielder.

**Season :** Late (May - June).

**Inflorescence :** Medium (Length - 32.0 cm, Breadth - 28.0 cm), pyramidal in shape; rachis and rachilla moderately pubescent with deep rose red pigmentation; stamens unequal and not parallel to pistil; staminodes developed.

**Fruit :** Big to medium, weighs 365.0 g, 10.58 cm long, 8.25 cm broad, 7.65 cm thick, L/B = 1.28; asymmetric; oblique; base obliquely flattened; stalk insertion oblique; stalk moderately thick; cavity shallow; dorsal shoulder narrow and moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder; back curved; sinus deep to shallow; beak just a point; apex broadly pointed.

Skin very smooth; deep orange; crimson blush seen on both shoulders or throughout the surface; medium tough; leathery; thin; easily peeled; non bitter; dots medium, very close, in flush with skin, same colour as skin.

Pulp firm, melting; aromatic; deep orange; fibre scanty or none; juice medium to abundant; taste sweet; flavour pleasant, T.S.S. 19° Brix; flesh - 76.27%.

Quality good, shelf life good.

**Stone :** Oblong; full, plump, thick; medium (33.0 cm), 7.65 cm long, 4.0 cm broad, 2.1 cm thick; veins raised, forked; fibres sparse, soft, short, concentrated on ventral ridge; endocarp thick, woody; monoembryonic.

**General :** Susceptible to hoppers, fruit flies, shoot borers and sooty mould.

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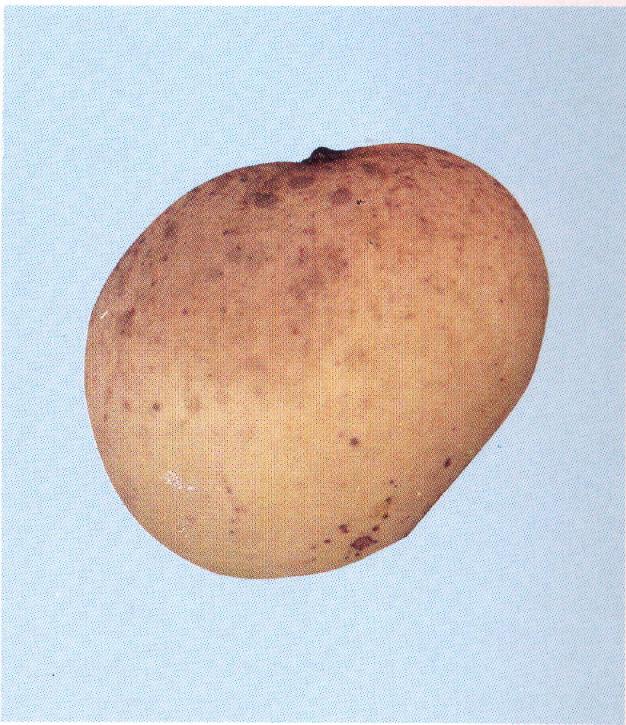
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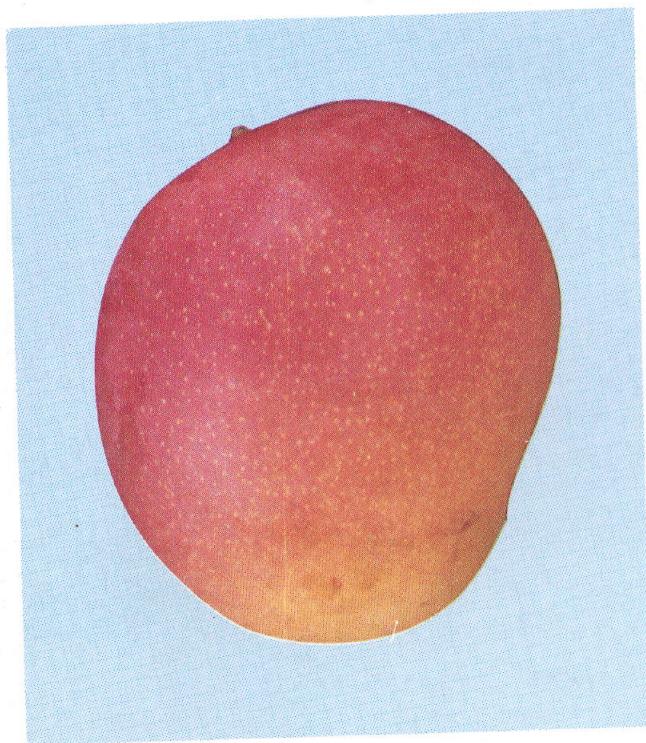
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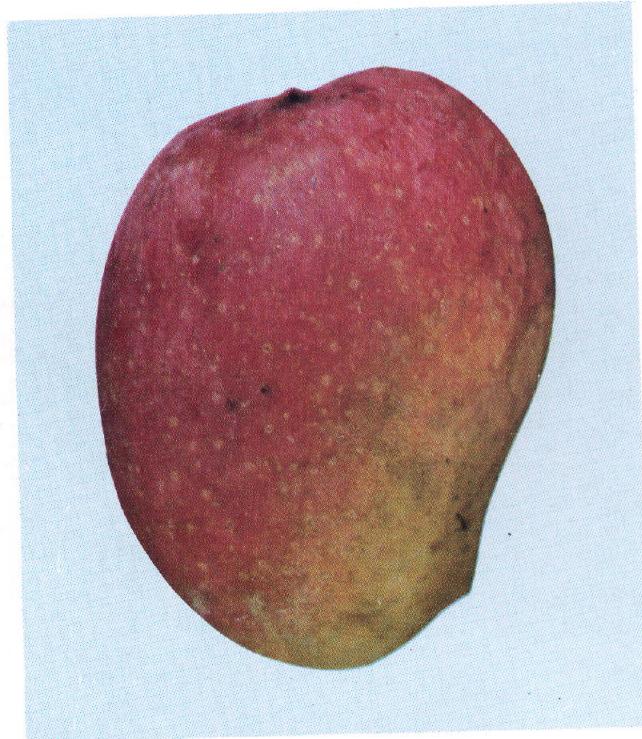
**Fig 41 : Monteiro**



**Fig 42 : Mozambique**



**Fig 43 : Mussarat Bardez**



**Fig 44 : Mussarat Salcete**

## 49. MUSSARAT (SALCETE)

*Syn* : Monserrate de Salcete, Monserrate Vermelho

A popular variety of South Goa and is named after 'Salcete' Taluka where it originated. The exact location of its origin is not known. It is used mainly for jam making, canning, sweet pickles and other processed products as it contains a lot of flesh. Variation exists in this variety for fruit size.

**Tree :** Large; very vigorous; canopy is round and spreading; shoots thick, devoid of waxy bloom or any pigmentation; trunk is stocky.

**Leaves :** Medium (Length - 28.2 cm); upheld; base cuneate; tip acuminate; shape lanceolate; lamina slightly twisted, moderately recurved, not folded (Length - 24.0 cm, Breadth - 4.8 cm); margin smooth; tender leaf dark coffee colour; midrib and veins without any pigmentation; no waxy bloom on petiole sinus.

**Bearing :** Alternate; high yielder.

**Season :** Late (May - June).

**Inflorescence :** Large (Length - 47.5 cm, Breadth - 29.0 cm); conical in shape; rachis and rachilla densely pubescent with reddish purple pigmentation throughout; stamens equal and parallel to pistil; staminodes developed.

**Fruit :** Big to medium, weighs 368.0 g, 11.25 cm long, 8.55 cm broad, 7.30 cm thick, L/B = 1.35; asymmetric; oblique; base obliquely flattened; stalk insertion oblique; stalk medium thick; cavity shallow; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder; back curved; sinus absent; beak just a point; apex broadly pointed.

Skin rough; yellowish orange; dark red blush seen on both shoulders; leathery; medium tough; thick; easily peeled; non bitter; dots medium, very close, in flush with skin, same colour as skin.

Pulp firm and melting; aromatic; orange; fibre moderate, fine texture; juice medium; taste sweet; flavour pleasant; T.S.S. 19° Brix; flesh 78.56%.

Quality is good; shelf life fair.

**Stone :** Oblong; thick, plump; medium to big (37.5 g), 8.7 cm long, 4.45 cm broad, 2.15 cm thick; veins grooved and forked; pores moderate, coarse, intermediate in length and concentrated in ventral ridge; endocarp woody, thick; monoembryonic.

**General :** Susceptible to sooty mould, pink disease, shoot borer, hoppers, fruit flies.

## 50. NICOLAU AFONSO

*Syn* : Firingi Mussarat

Monserrate Branca

White Mussarat

Dhawo Mussarat

A popular variety widely grown in Salcete and Tiswadi talukas. It might have originated as a budsport from the Salcete Mussarat as the vegetative and fruit characters are similar except the strongly twisted and recurved nature of leaf and fairer colour of the fruit skin. In Tiswadi taluka the variety is invariably known as Nicolau Afonso. However, many people interchange the above names indiscriminately for both the varieties, especially the traders without any distinction of Nicolau Afonso and Salcete Mussarat.

**Tree :** Large; vigorous; canopy dome shaped and spreading; shoots thick with waxy bloom but no pigmentation; trunk is stocky.

**Leaves :** Medium (Length - 27.0 cm); upheld; base attenuate; tip acuminate; lanceolate; lamina strongly twisted, strongly recurved not folded (Length - 21.5 cm, Breadth - 5.0 cm); margin smooth; tender leaf pale brown; midrib and veins without any pigmentation; waxy bloom present on petiole sinus.

**Bearing :** Alternate; medium yielder.

**Stone :** Oblong; full, plump, medium (29.0 g) 7.75 cm long, 3.83 cm broad, 2.10 cm thick; medium heavy; veins grooved, parallel; fibre abundant, coarse, long, throughout; endocarp thick and woody; monoembryonic.

**General :** Susceptible to fruit flies.

#### 54. PAPEL BRANCO

A variety of limited popular appeal and distribution used as table fruit, mostly seen in Colva of South Goa.

**Tree :** Large; vigorous; canopy round and spreading; shoots thick without any pigmentation or waxy bloom; trunk stocky.

**Leaves :** Medium (Length- 26.4 cm); upheld; base obtuse; tip subacuminate; shape elliptic; lamina not twisted, slightly recurved, not folded (Length - 23.4 cm, Breadth 7.4 cm); margin smooth; tender leaf light green; mid rib and veins without any pigmentation; waxy bloom on petiole sinus.

**Bearing :** Alternate; medium yielder.

**Season :** Late (May - June).

**Inflorescence :** Large to medium (Length - 51.0 cm, Breadth - 36.1 cm); conical; rachis and rachilla densely pubescent without any pigmentation; stamens neither equal nor parallel to pistil; staminodes not developed.

**Fruit:** Small, weighs 125.0 g, 6.77 cm long, 5.63 cm broad, 5.57 cm thick, L/B = 1.20; asymmetric; roundish to oblique; base obliquely flattened; stalk insertion oblique; stalk thin; cavity shallow; dorsal shoulder narrow, abruptly falling; ventral shoulder rising, rounded and broader than dorsal shoulder; back rounded; sinus absent or slight; beak absent; apex round.

Skin smooth; greenish yellow to bright yellow with white waxy bloom; blush absent; moderately tough; papery; thin; easily peeled; non

bitter; dots medium, moderately colser, in flush with skin, same colour as skin.

Pulp soft; deep yellow to yellowish orange; aromatic; fibre scanty; juice medium to abundant; taste sweet; flavour pleasant; T.S.S. 18° Brix; flesh - 71.93%.

Quality fair; shelf life poor.

**Stone:** Oblong; full, plump, small (19.33 g), 5.2 cm long, 3.2 cm broad, 2.0 cm thick; veins grooved, forked, parallel; fibre nil or sparse on ventral ridge; endocarp moderately thick, woody; monoembryonic.

**General :** Susceptible to fruit flies.

#### 55. REBELLO

A rare variety of North Goa used as table fruit, occasionally seen in the markets. Origin is unknown.

**Tree :** Medium; moderately vigorous; canopy round, spreading; shoots moderately thick and slender without waxy bloom or pigmentation; trunk slender.

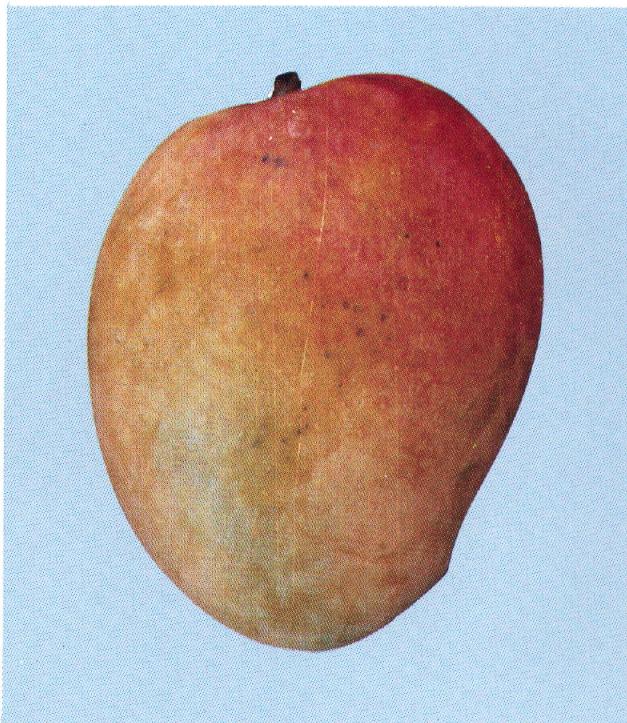
**Leaves :** Medium (Length -25.0 cm); spreading and upheld; base cuneate; tip acuminate; lanceolate; lamina slightly twisted, recurved, flat (Length - 21.0 cm, Breadth - 3.6 cm); margin smooth; tender leaf pale brown; mid rib and veins without pigmentation; waxy bloom on petiole sinus.

**Bearing :** Alternate; medium to poor yielder.

**Season :** Late (May - June).

**Inflorescence :** Medium to large (Length - 28.0 cm, Breadth - 24.0 cm); conical; rachis and rachilla densely pubescent and pale yellow colour; stamens neither equal nor parallel to pistil; staminodes poorly developed.

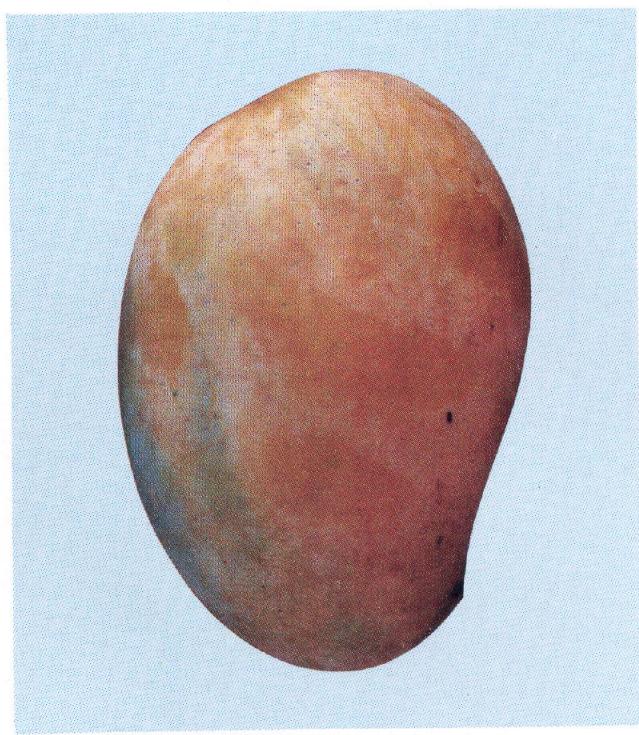
**Fruit :** Medium, weighs 251.0 g, 10.55 cm long, 6.83 cm broad, 6.45 cm thick, L/B = 1.54; oblong or elongated; base obliquely flattened; stalk



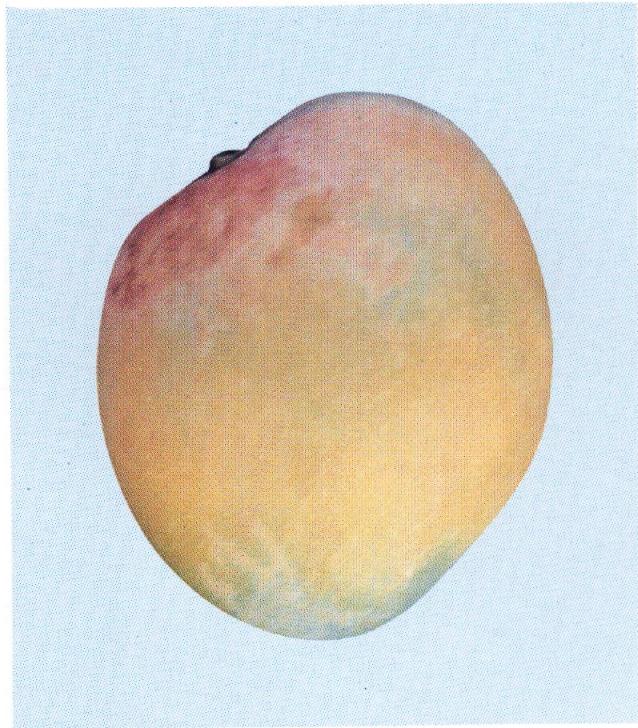
**Fig. 45 : Nicolau Afonso**



**Fig. 46 : Oliveira**



**Fig 47 : Oval Appus**



**Fig 48 : Papel**

insertion oblique; stalk moderately thick; cavity shallow; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder; back curved; sinus deep; beak just a point, apex broadly pointed or round.

Skin smooth; bright yellow; blush absent; medium tough; leathery; thick; easily peeled; bitter; dots big; very close, in flush with skin, same colour as skin.

Pulp medium soft; melting; deep orange; non aromatic; fibre scanty; juice medium, taste sweet; flavour pleasant; T.S.S. 18° Brix; flesh - 67.93%. Types with deep yellow flesh are also seen.

Quality good; shelf life fair to good.

**Stone :** Elongated; full, small, (26.5 g), 8.7 cm long, 3.43 cm broad, 2.1 cm thick; veins grooved, parallel; fibre sparse, soft, short, concentrated on ventral ridge; endocarp moderately thick, woody, monoembryonic.

**General :** Susceptible to fruit flies.

## 56. REYNOLD

*Syn* : Reinol, Reinold

A rare variety valued for its juice. It is also used as a table fruit. Only one tree has been located at Uthorda in South Goa.

**Tree :** Large; vigorous; canopy round and spreading; shoots thick without any pigmentation or waxy bloom; trunk stocky.

**Leaves :** Medium to big (Length - 24.3 cm); upheld; base obtuse; tip acuminate; shape ovate lanceolate; lamina twisted, recurved, not folded (Length - 22.3 cm, Breadth - 5.9cm); margin smooth; tender leaf pale green; mid rib and side veins without any pigmentation; waxy bloom on petiole sinus.

**Bearing :** Regular; medium yielding.

**Season :** Mid to late (April - May).

**Inflorescence :** Medium (Length - 28.0 cm, Breadth - 22.0 cm); conical; rachis and rachilla moderately pubescent with rose pink pigmentation; stamens neither parallel nor equal to pistil; staminodes developed.

**Fruit :** Big to medium, weighs 348.0 g, 9.85 cm long, 8.0 cm broad, 7.8 cm thick, L/B = 1.22; asymmetric; oblique; base obliquely flattened; stalk inserted obliquely; stalk thick; cavity shallow; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder; back curved; sinus deep; beak just a point; apex broadly pointed.

Skin smooth; bright yellow or yellowish orange with greenish tinge; blush absent; tough; leathery; thick; non bitter; easily peeled; dots medium, moderately closer, in flush with skin, more darker coloured than skin.

Pulp soft, melting; non aromatic; yellowish orange; fibre scanty; juice abundant; taste less sweet; subacid; flavour pleasant; T.S.S. 17° Brix; flesh - 75.83%.

Quality good; shelf life poor.

**Stone :** Oblong; full, plump, medium (24.5 g), 6.85 cm long, 3.45 cm broad, 1.85 cm thick; veins grooved, forked; fibres sparse, soft, short seen mostly on ventral ridge and apex; endocarp medium thick, woody; monoembryonic.

**General :** Susceptible to shoot borers.

## 57. ROSA TYPE I

*Syn* : Manga Rosa

A variety common in North Goa used as table fruit. It arrives in the market during April to May. Not grown extensively.

**Tree :** Large; vigorous; canopy round, spreading; shoot thick without any waxy bloom or pigmentation; trunk is stocky.

**Leaves :** Medium (Length - 26.7 cm); upheld;

base cuneate; tip acuminate; shape lanceolate; lamina twisted, recurved, not folded (Length - 24.0 cm, Breadth - 3.80 cm); margin smooth; tender leaves pale green; mid rib and veins without any pigmentation; no waxy bloom on petiole sinus.

**Bearing:** Regular; medium yielder.

**Season :** Mid (April - May).

**Inflorescence :** Large (Length - 33.0 cm, Breadth - 28.0 cm); conical; rachis and rachilla densely pubescent with red pigmentation; stamens equal and parallel to pistil; staminodes developed.

**Fruit:** Medium, weighs 240.0 g; 9.1 cm long, 7.4 cm broad, 6.6 cm thick, L/B = 1.23; asymmetric; cordate; base obliquely flattened; stalk inserted obliquely; stalk moderately thick; cavity shallow; dorsal shoulder narrow, abruptly falling; ventral shoulder rising, rounded, broader than dorsal shoulder; back rounded; sinus absent; beak absent; apex round.

Skin smooth; yellowish orange with green tinge; crimson blush on both shoulders; tough; leathery; thin; easily peeled; non bitter; dots medium, moderately close, in flush with skin, same colour as skin or greenish.

Pulp medium soft, melting; deep orange; non aromatic; fibre scanty; juice medium; taste sweet, subacid; flavour pleasant; T.S.S. 17° Brix; flesh - 71.46%.

Quality good; shelf life poor.

**Stone:** Oblong, full, plump, medium (30.5 g), 7.0 cm long; 4.3 cm broad, 2.2 cm thick; veins raised, forked, fibre abundant, soft, short, concentrated on ventral ridge; endocarp thick, woody; monoembryonic.

**General:** Highly susceptible to fruit flies. Another type with slightly elongated/ oblong fruit of yellow colour having plenty of juice is also seen; known as Rosa. However the above described type is marketed as Rosa, in general. The real Rosa variety is yet to be ascertained. Both

have been located from Siolim, North Goa. The other type is designated as Rosa Type II.

## 58. ROSA TYPE - II

This is the second type of 'Rosa' located from Siolim of Bardez Taluka. This type is more juicy compared to Type I. Fruit shape is elongated and skin colour is uniform yellow compared to Type I. It has to be ascertained if this is the 'Rosario', one of the 30 varieties yet to be located. Used as table fruit.

**Tree:** Medium, moderately vigorous; canopy dome shaped and spreading; shoots thick devoid of any waxy bloom or pigmentation, trunk medium.

**Leaves:** Medium (Length - 26.2 cm); upheld; base cuneate; tip acuminate; lanceolate; lamina twisted, strongly reflexed, slightly folded (Length - 23.2 cm, Breadth - 5.2 cm); margin smooth; tender leaf pale pink; mid rib and veins faintly pigmented pink; waxy bloom on petiole sinus.

**Bearing:** Alternate; low yielder.

**Seasong:** Late (May - June).

**Fruit:** Medium, weighs 304.0 g, 10.6 cm long, 7.25 cm broad, 7.0 cm thick, L/B = 1.46; asymmetric; oblong; base flattened obliquely; stalk insertion oblique; stalk medium thick; cavity slight; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder; back curved; sinus slight; beak just a point; apex broadly pointed.

Skin smooth; greenish yellow or yellowish orange; blush absent; medium tough; leathery; thin; easily peeled; non bitter; dots big, medium closer, in flush with skin, same colour as skin.

Pulp soft, melting; pale yellow; fibre none; aromatic; juice abundant; taste less sweet, subacid; flavour camphoraceous; T.S.S. - 16.5° Brix; flesh - 78.78%.

**Stone:** Oblong; full, plump; medium size; medium weight (23.5 g), 8.4 cm long, 3.75 cm

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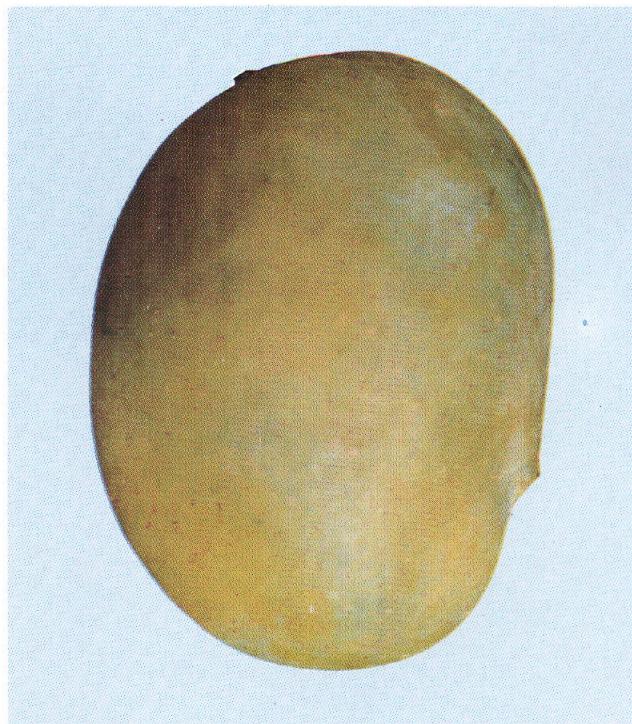
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**Fig 49 : Papel Branco**



**Fig 50 : Rebello**



Fig 51 : Reynold

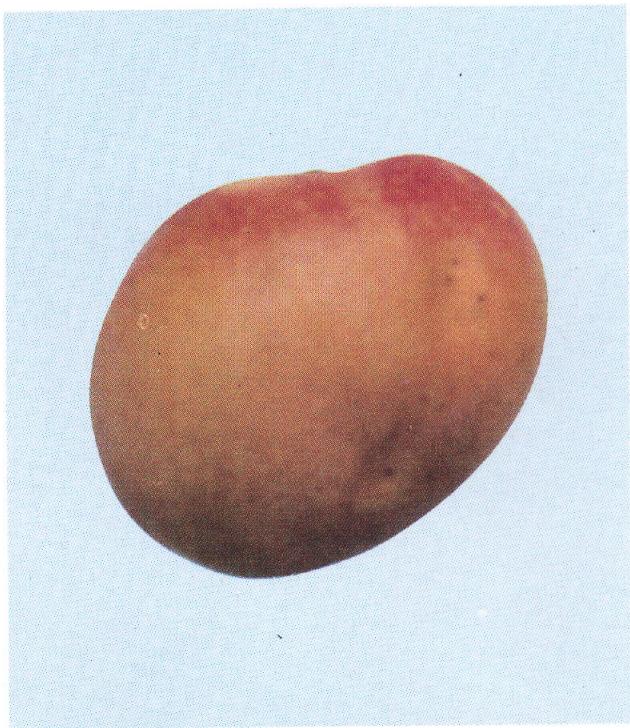


Fig 52 : Rosa Type I

broad, 1.65 cm thick; veins grooved, parallel; fibre sparse, soft, short, mostly on ventral ridge; endocarp thick and woody; monoembryonic.

## 59. ROTTO

A rare variety located in Siolim of North Goa characterised by big size fruit with attractive colour. It is getting extinct. The fruit is used for table purpose.

**Tree:** Large; vigorous; crown round, spreading; shoots thick without any wax or pigmentation; trunk is stocky.

**Leaves:** Medium (Length - 23.5 cm); upheld; base cuneate, tip sub acuminate; elliptic; lamina twisted, strongly recurved, not folded (Length - 21.0 cm, Breadth - 5.6 cm); margin smooth; tender leaf pale green; mid rib and vein without pigmentation; wax present on petiole sinus.

**Bearing:** Alternate to irregular; medium yield.

**Season:** Late (May - June).

**Fruit:** Big, weighs 513.0 g, 11.65 cm long, 9.7 cm broad, 8.85 cm thick, L/B = 1.20; asymmetric; oblique; base obliquely flattened; stalk insertion oblique; stalk thick; cavity slight; dorsal shoulder moderately curved, narrow; ventral shoulder rising, rounded and broader than dorsal shoulder; back curved; sinus absent; beak absent; apex broadly pointed.

Skin is yellowish orange; smooth; pink blush present on both the shoulders; tough; leathery; thick; easily peeled; non bitter; dots medium, distant, in flush with skin, lighter coloured than skin.

Pulp soft; with lemon yellow border and deep orange centre; fibre abundant, coarse, long; non aromatic; juice medium; taste sweet, subacid; flavour pleasant but slightly turpentine; T.S.S. 18° Brix; flesh 66.18%.

Quality is fair; shelf life poor.

**Stone:** Oblong; full, plump; big (51.0 g), 10.0 cm long, 5.0 cm broad, 2.5 cm thick, veins raised, forked; fibres abundant, coarse, long, seen throughout; endocarp thick and woody; monoembryonic.

**General:** Susceptible to fruit flies.

## 60. SALDAD

A variety reported from Korgao in Pernem Taluka of North Goa. It is of recent origin and not much is known about the variety and has not gone beyond this village to other parts of Goa.

Fruits are medium to small weighing about 203.0 g, 9.0 cm long, 6.72 cm broad, 6.20 cm thick having L/B = 1.34; asymmetric; oblong; base flattened obliquely; stalk is moderately thick; cavity slight; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder; back curved; sinus slight; beak just a point; apex is broadly pointed. Skin surface is rough; yellowish orange coloured with green patches; pink blush is on ventral shoulder; leathery and thick; dots on the skin are small, very close, slightly raised above surface having same colour as above. The flesh is deep orange; firm, melting; fibre moderate; aromatic; juice scanty; taste sweet; flavour pleasant; T.S.S. 20° Brix. Flesh is 62.56%. Quality is excellent and shelf life is also excellent. Stone is medium sized weighting about 35.0 g having an oblong shape.

## 61. SALGADA

*Syn:* Salgado

A variety once popular in South Goa probably cultivated for its large fruits containing plenty of flesh. Salgado means the taste of pig meat and the fruit tastes more or less the same. This is becoming a rare variety as only few trees are existing at present.

**Tree:** Very large; very vigorous; canopy

round and spreading; shoots thick, devoid of any pigmentation or waxy bloom; trunk is stocky.

**Leaves:** Big to medium (Length - 23.7 cm); spreading and upheld; base obtuse; tip acuminate; shape lanceolate; lamina slightly twisted, moderately recurved, not folded (Length 21.2 cm, Breadth - 5.8 cm); margin smooth with slight waviness; tender leaf pale green; mid rib and veins without any pigmentation; waxy bloom on petiole sinus.

**Bearing:** Alternate; medium yielder.

**Season:** Late (May - June).

**Inflorescence:** Large (Length - 31.8 cm, Breadth - 33.0 cm); semiloose; pyramidal; rachis and rachilla moderately pubescent without any pigmentation; stamens equal and parallel to pistil; staminodes poorly developed.

**Fruit:** Big, weighs 452.0 g, 10.75 cm long, 8.85 cm broad, 8.45 cm thick, L/B = 1.21; asymmetric; oblong; base slightly flattened; stalk insertion vertical; stalk thick; cavity shallow; dorsal shoulder narrow, moderately curved; ventral shoulder level, rounded, broader than dorsal shoulder; back curved; sinus deep; beak prominent; apex round.

Skin rough; yellowish orange tinged green; blush absent; tough; leathery, very thick, easily peeled; bitter; dots big, distant, in flush with skin, dark or brown coloured.

Pulp soft; yellowish orange; non aromatic; fibre scanty; juice abundant; taste sub-acid, less sweet; flavour piquant; T.S.S. 14° Brix; flesh - 65.04%.

Quality poor; shelf life poor.

**Stone:** Oblong; full, plump, medium (36.3 g); 7.75 cm long, 4.22 cm broad, 2.37 cm thick; veins grooved, forked; fibre nil, negligible on ventral ridge; endocarp thick, woody; monoembryonic.

**General:** Susceptible to shoot borer, pink disease, fruit flies. Variation in fruit shape is noticed.

## 62. SALGADIN

*Syn:* Salgadina

A very rare and superb variety of limited occurrence located from Chandor of South Goa, used as table fruit. The variety is highly suited for home gardens owing to the open crown and less vigorous growth.

**Tree:** Large; less vigorous; canopy round, open and spreading; shoots medium thick or thinner, without any waxy bloom and pale brown pigmentation; trunk is medium stocky.

**Leaves:** Small to medium (Length - 26.6 cm); upheld; base attenuate; tip acuminate; lanceolate; lamina not twisted, not folded, strongly recurved (Length - 22.5 cm, Breadth - 4.2 cm); margin smooth; tender leaf pale green; mid rib and veins without any pigmentation; waxy bloom present on petiole sinus.

**Bearing:** Regular to alternate; medium yielder.

**Season:** Late (May - June).

**Fruit:** Medium, weights 236.0. g; 11.0 cm long, 7.55 cm broad, 6.88 cm thick, L/B = 1.46; asymmetric; oblong or elongated; base obliquely flattened; stalk insertion oblique, stalk thin; cavity shallow; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder; back curved; sinus absent; beak absent or sometimes mammiform; apex round.

Skin smooth; bright yellow; pink blush seen on both shoulders; less tough; leathery; thick; easily peeled; bitter; dots medium, distant, in flush with skin, same colour as skin.

Pulp is deep yellow in the outer border and deep orange in the centre; firm, melting, butter like; fibre scanty; strongly aromatic (rose like);

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Fig. 53 : Rosa Type II

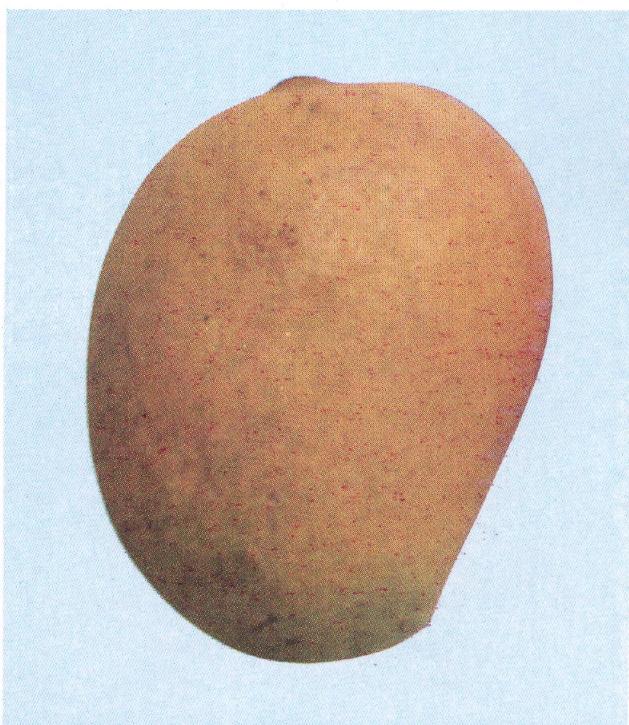


Fig. 54 : Saldad

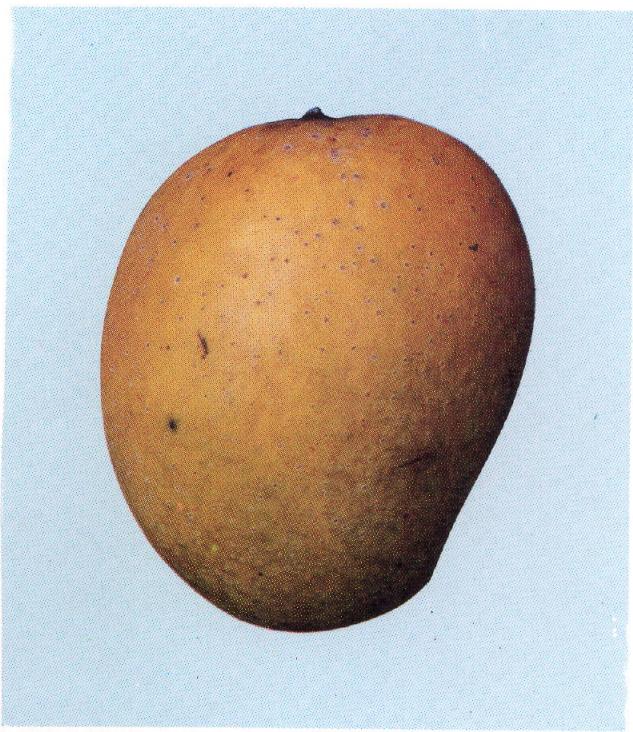


Fig 55 : Salgada

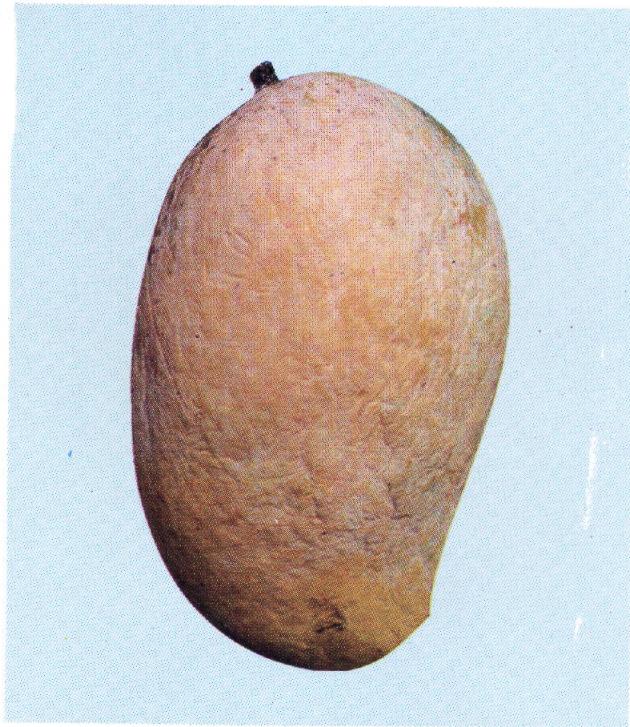


Fig 56 : Salgadin

juice medium; taste sweet; flavour pleasant and delightful; T.S.S. 21° Brix; flesh - 63.1%.

Quality is excellent; shelf life fair.

**Stone:** Elongated; full, plump; medium (27.5 g); 9.05 cm long, 3.6 cm broad, 3.2 cm thick; veins raised, parallel; fibres sparse, soft, short mostly on ventral ridge; endocarp thick, woody; monoembryonic.

**General:** Fruit quality is as good as Mankurad and hence commercially exploitable due to the excellent flavour and colour with a tendency to bear fruits every year. The open crown expose fruits to sunlight and helps in colour development.

### 63. SAKAR AMBO

A rare localised variety located at Benaulim used as table fruit. This is different from the Sakri or Saccaradin mango in all respects. It is not so sweet as it is purported to be, probably because, the fruits ripen during rainy season.

**Tree:** Medium; moderately vigorous; canopy dome shaped, highly spreading; shoots thin and wiry, without any pigmentation or waxy bloom; trunk medium stocky.

**Leaves:** Medium to big (Length - 29.0 cm); upheld; base attenuate or cuneate; tip subacuminate; shape elliptic; lamina slightly twisted, slightly recurved, not folded (Length - 23.2 cm, Breadth - 6.1 cm); margin smooth; tender leaf pale green; midrib pink; waxy bloom on petiole sinus.

**Bearing:** Regular; medium yielder.

**Season:** Late (May - June).

**Inflorescence:** Medium (Length - 28.8 cm, Breadth - 18.2 cm); conical; loose; rachis and rachilla moderately pubescent with rose pink pigmentation; stamens equal but not parallel to pistil; staminodes poorly developed.

**Fruit:** Medium, weighs 259.0 g, 10.2 cm long,

8.18 cm broad; 6.0 cm thick, L/B = 1.25; asymmetric; oblique or ovate; flattened; base obliquely flattened; stalk insertion oblique; stalk moderately thick; cavity shallow; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder; back curved; sinus slight; beak just a point; apex broadly pointed.

Skin smooth; greenish yellow to yellowish orange; pink blush on ventral shoulder; medium tough; leathery; thick; easily peeled; non bitter; dots medium, moderately close, in flush with skin, lighter coloured than skin.

Pulp medium firm, melting; pale yellow or creamy white; non aromatic; fibre none; juice abundant; taste sweet; flavour pleasant; T.S.S. 18° Brix; flesh - 65.06%.

Quality good; shelf life fair.

**Stone:** Oblong; full, plump heavy (40.5 g), 8.35 cm long, 4.85 cm broad, 2.55 cm thick; veins grooved, forked; fibres almost nil, soft and short seen only on ventral ridge; endocarp thick, woody; monoembryonic.

**General:** Susceptible to fruit flies. Branches tend to trail or creep.

### 64. ST. ANTONY TYPE I

*Syn:* Santanton

A very late variety located in Calangute of North Goa with elongated fruits. Some say it is St. Antony. However another variety with roundish fruits is also known as St. Antony or Santanton. Used as table fruit which may be available upto June end and inspite of the rains the quality appears to be satisfactory; at that time few mangoes are also available to compete with it. A rare variety.

**Tree:** Large; vigorous; canopy round, spreading; shoots thick without any pigmentation or waxy bloom; trunk is stocky.

**Leaves:** Medium (Length - 23.5 cm); spreading and ovoid; base cuneate; tip acuminate; shape lanceolate; lamina not twisted, slightly recurved; slightly folded (Length - 21.0 cm, Breadth - 5.1 cm); margin smooth but wavy; tender leaf pale brown; midrib and veins without any pigmentation; no waxy bloom on petiole sinus.

**Bearing:** Alternate to irregular; medium yielder.

**Season:** Very late (June).

**Inflorescence:** Medium (Length - 23.0 cm, Breadth - 15.6 cm); conical; rachis and rachilla moderately pubescent with pink pigmentation; stamens equal but not parallel to pistil; staminodes not developed.

**Fruit:** Big, weighs 470.0 g, 14.25 cm long, 8.25 cm broad, 7.68 cm thick, L/B = 1.73; asymmetric; elongated; base obliquely flattened; stalk insertion oblique; stalk moderately thick; cavity slight; dorsal shoulder narrow, abruptly falling; ventral shoulder ridged, rising, rounded, broader than dorsal shoulder; back flat; sinus shallow; beak just a point; apex pointed.

Skin smooth; yellowish orange; pink blush on both shoulders; tough; leathery; thick; easily peeled; bitter; dots big, moderately close, in flush with skin, same colour as skin.

Pulp firm, melting; orange; weakly aromatic; fibre scanty; juice medium; taste sweet; flavour camphor like; T.S.S. 21° Brix; flesh - 75.51%.

Quality fair; shelf life poor.

**Stone:** Elongated; full, plump; medium (34.0 g), 10.1 cm long, 3.6 cm broad, 2.13 cm thick; veins raised, parallel; fibres sparse, soft, short mostly on ventral ridge; endocarp thick, woody; monoembryonic.

**General:** Susceptible to fruit flies.

## 65. ST. ANTONY TYPE II

*Syn:* Santanton

A very popular variety once grown in North Goa and is becoming rare as new plantings are not being taken up. This type has oval or oblique fruits of medium size. Used as table fruit.

**Tree:** Large; vigorous; canopy pyramidal, spreading, shoots moderately thick without any wax or pigmentation; trunk is stocky.

**Leaves:** Medium (Length - 23.0 cm); spreading and ovoid; base cuneate; tip acuminate; lanceolate; lamina not twisted, reflex slightly or nil, flat (Length - 21.0 cm, Breadth - 5.3 cm); margin smooth; tender leaf pale green; mid rib and veins without any pigmentation; waxy bloom on petiole sinus.

**Bearing:** Alternate; medium yield.

**Season:** Late (May - June).

**Inflorescence:** Medium to small (Length - 26.0 cm, Breadth - 18.0 cm); rachis and rachilla moderately pubescent without any pigmentation; stamens equal and parallel to pistil; staminodes developed.

**Fruit:** Medium, weighs 250.0 g, 8.7 cm long, 8.25 cm broad, 6.85 cm thick, L/B = 1.05; asymmetric; ovate or oblique; base obliquely flattened; stalk insertion oblique; stalk medium thick; cavity shallow; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder; back curved; sinus shallow; beak absent or a point; apex broadly pointed.

Skin smooth; orange; blush absent; tough; leathery; thick; easily peeled; bitter; dots medium, very close, in flush with skin, same colour as skin.

Pulp firm, thick; orange; fibre scanty; non aromatic; juice scanty; taste sweet, subacid; flavour pleasant; T.S.S. Brix 17.7°; flesh - 63.40%.

Quality good; shelf life good.

**Stone:** Oblong; full, plump; medium (24.5 g), 6.5 cm long, 4.25 cm broad, 2.3 cm thick; veins grooved, parallel, forked; fibres sparse, soft, short, mostly on ventral ridge; endocarp woody; thick; monoembryonic.

## 66. SAKRI

A variety used as table fruit popular in North Goa. Though it is assumed that Sakri and Saccardin are synonymous, it is not so. Both are distinctly different in many respects. This is popular probably because of its early and heavy yields and cheaper availability. Sakri means sweet but the fruit is not so sweet as being claimed where as the Saccardin is really sweet. Variation is observed in the variety.

**Tree:** Large; vigorous; canopy round, spreading; shoots thick or moderately thick without any waxy bloom or pigmentation; trunk is stocky.

**Leaves:** Medium (Length - 24.4 cm); upheld; base cuneate; tip acuminate; shape elliptic; lamina slightly twisted, slightly recurved and flat (Length - 22.2 cm, Breadth- 5.0 cm); margin smooth; tender leaf pale brown; midrib and veins without any pigmentation; no waxy bloom on petiole sinus.

**Bearing:** Regular; high yielder.

**Season:** Early to Mid (April - May).

**Inflorescence:** Medium to small (Length - 21.0 cm, Breadth - 13.0 cm); rachis and rachilla densely pubescent without any pigmentation; stamens equal and parallel to pistil; staminodes developed.

**Fruit:** Small, weighs 175.0 g, 8.0 cm long, 6.87 cm broad, 5.85 cm thick, L/B = 1.16; asymmetric, oblique to ovate; base obliquely flattened; stalk insertion oblique; stalk thin; cavity shallow; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder; back rounded; sinus absent; beak just a point or absent; apex round.

Skin smooth; bright orange; blush absent;

tough; leathery; thick; medium peeling; non bitter; dots very small, very close, in flush with skin, orange coloured.

Pulp medium soft; yellowish orange to deep orange; weakly aromatic; fibre abundant, coarse and long; juice medium to abundant; taste sweet but leaves a bitter aftertaste; flavour good; T.S.S. 20° Brix; flesh - 66.38%.

Quality good to fair; shelf life good or excellent.

**Stone:** Ovate; full and plump; small (26.0 g), 5.61 cm long, 3.33 cm broad, 2.10 cm thick; veins grooved, not forked, not parallel; fibre abundant, coarse, long, concentrated on ventral ridge; endocarp medium thick, woody; monoembryonic.

**General:** Resistant to fruit flies.

## 67. SECRETIN

*Syn:* Saccardin, Secretina, Saccardin

A popular variety of Tiswadi Taluka of North Goa known for its exceptional keeping quality and sweetness. Among all known Goan varieties this may be possessing the best keeping quality and the fruit has a solid firm flesh with thick skin making it resistant to rough handling during transshipment, harvest and other post harvest operations. It is used as a table fruit, mostly confined to home gardens and the fruits rarely come to the market. Inspite of its good qualities it is not extensively grown owing to its smaller fruit size.

**Tree:** Medium; vigorous, canopy round and spreading; shoots thick without any waxy bloom or pigmentation; trunk is stocky.

**Leaves:** Medium to big (Length- 25.8 cm); upheld; base obtuse; tip acuminate; shape ovate; lamina slightly twisted, slightly recurved, not folded (Length - 23.1 cm, Breadth - 6.9 cm); margin smooth; tender leaf pale green; mid rib and

vein without any pigmentation; waxy bloom on petiole sinus.

**Bearing:** Regular; medium yielder.

**Season:** Mid (April - May)

**Inflorescence:** Medium (Length - 27.0 cm, Breadth - 21.0 cm); conical; rachis and rachilla densely pubescent without any pigmentation; stamens neither equal nor parallel to pistil; staminodes poorly developed.

**Fruit:** Small to medium, weighs 227.0 g, 7.9 cm long, 7.0 cm broad, 6.2 cm thick, L/B = 1.12; asymmetric; roundish, oblique to ovate; base obliquely flattened; stalk insertion oblique; stalk thick; cavity slight; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder; back curved or rounded; sinus absent; beak absent; apex round.

Skin smooth; yellowish orange to orange; blush absent; tough; leathery; very thick; medium peeling; nonbitter; dots big, distant, in flush with skin, same colour as skin.

Pulp firm, thick; yellowish orange to orange; nonaromatic; fibre abundant, fine, long; juice scanty to medium; taste very sweet; flavour pleasant; T.S.S. 22° Brix; flesh - 68.91%.

Quality good to excellent; shelf life excellent.

**Stone:** Ovate; full, plump, small (25.3 g), 6.0 cm long, 3.5 cm broad, 2.0 cm thick, veins grooved, parallel; fibre abundant, coarse, long; seen throughout; endocarp thick, woody; monoembryonic.

**General:** Resistant to fruit flies and spoilage during storage.

## 68. SEVERINA

A very rare variety located from Benaulim. The fruit is used for table purpose.

**Tree:** Medium; moderately vigorous; canopy

round and spreading; shoots moderately thick, devoid of any waxy bloom or pigmentation; trunk is medium.

**Leaves:** Small (Length - 21.7 cm); upheld; base cuneate; tip acuminate; lanceolate; lamina not twisted, slightly reflexed, flat (Length - 18.3 cm, Breadth - 4.5 cm); margin smooth; tender leaf pale green; mid rib and veins without any pigmentation; waxy bloom on petiole sinus.

**Bearing:** Alternate; medium yielder.

**Season:** Mid to late (April - May).

**Fruit:** Medium, weighs 233.0 g, 8.35 cm long, 7.15 cm broad, 6.65 cm thick, L/B = 1.17; asymmetric; ovate; base flattened obliquely; stalk insertion oblique; stalk medium thick; cavity slight; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder; back curved; sinus absent; beak just a point; apex round or broadly pointed.

Skin very smooth; orange; blush absent; tough; leathery; thin; easily peeled; bitter; dots medium; medium closer, in flush with skin, lighter coloured than skin.

Pulp firm, melting, buttery; orange; fibre scanty; weakly aromatic; juice scanty to medium; taste sweet, subacid; flavour pleasant; T.S.S. - 19.3° Brix; flesh - 69.1%.

Quality good; shelf life good.

**Stone:** Oblong; full, plump; medium size; medium weight (31.65 g), 6.85 cm long, 3.35 cm broad, 2.1 cm thick; veins raised, parallel; fibres sparse, coarse, short, mostly on ventral ridge; endocarp thick and woody; monoembryonic.

## 69. TANQUE

*Syn:* Taque

A small fruited variety located in Madkai and Chorao of North Goa, on the verge of extinction. Two types are reported to exist, one

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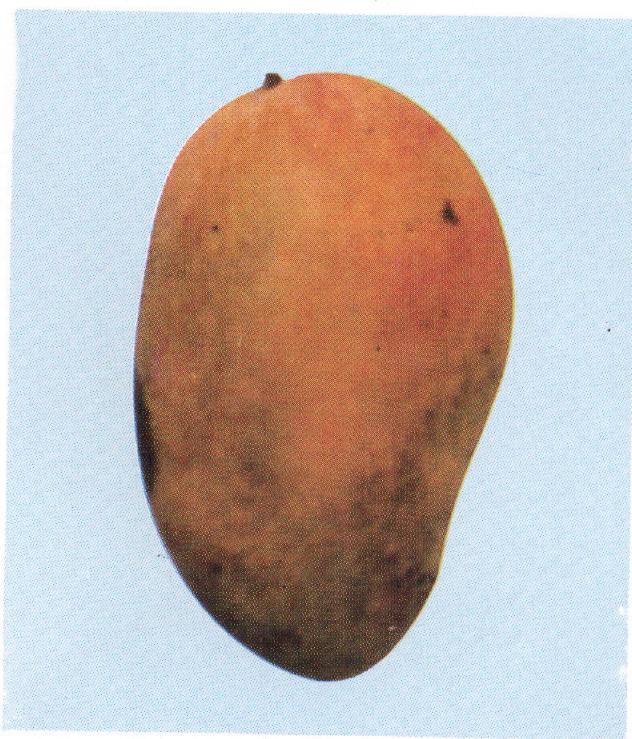
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**Fig 57 : Sakar Ambo**



**Fig 58 : St. Antony Type I**

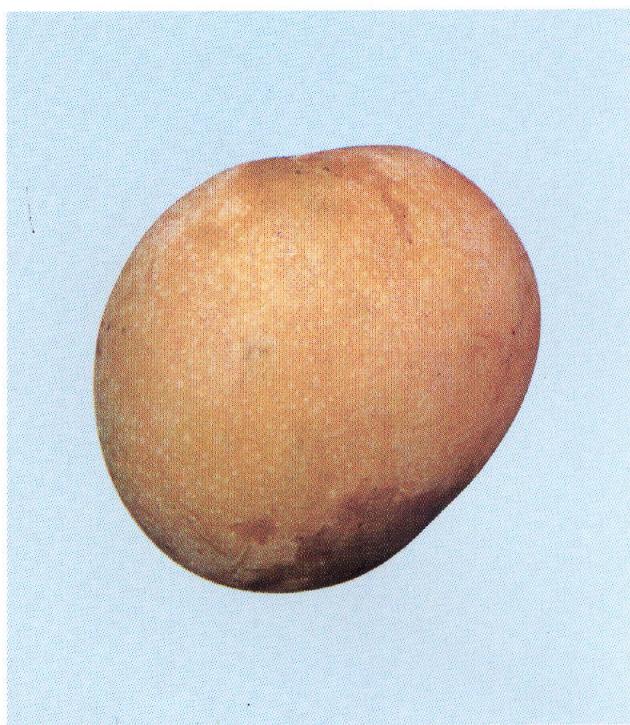


Fig 59 : St. Antony Type II

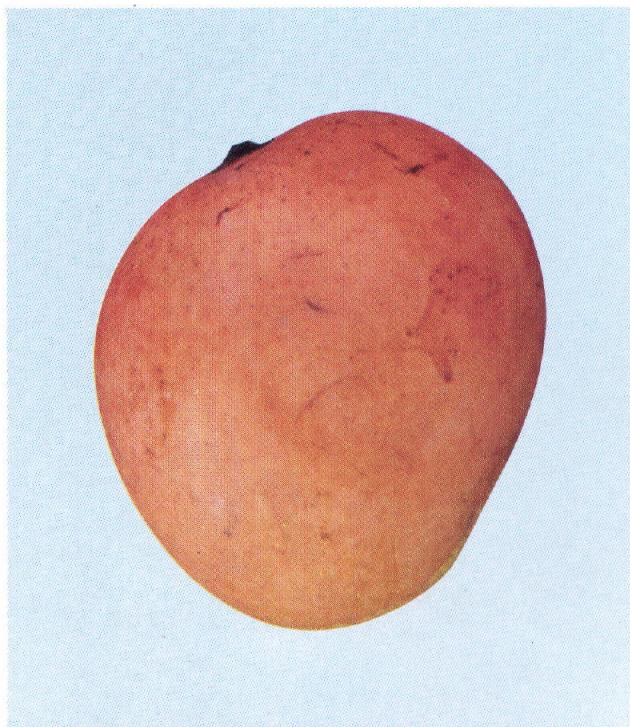


Fig 60 : Sakri

with good colour and another with only green colour. Used as table fruit.

**Tree:** Large; vigorous; canopy dome shaped, spreading; shoots moderately thick, devoid of any waxy bloom or pigmentation; trunk is stocky.

**Leaves:** Medium (Length - 28.2 cm); spreading and upheld; base cuneate; tip acuminate; lanceolate; lamina twisted slightly, reflexed slightly, flat (Length - 24.0 cm, Breadth - 5.0 cm); margin smooth; tender leaf pale pink or brown; mid rib and veins without any pigmentation; waxy bloom on petiole sinus.

**Bearing:** Alternate; medium yielder.

**Season:** Late (May - June).

**Fruit:** Small, weighs 197.0 g, 8.25 cm long, 6.55 cm broad, 6.30 cm thick, L/B = 1.26; asymmetric; oblique or ovate; base obliquely flattened; stalk insertion oblique; stalk medium thick; cavity shallow; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder; back curved; sinus absent; beak just a point; apex round or broadly pointed.

Skin smooth; bright yellow; crimson blush on both shoulders; tough; leathery; thick; easily peeled; repugnant taste; dots medium; distant, in flush with skin, lighter coloured than skin.

Pulp soft, melting, reddish orange; fibre scanty; non aromatic; juice medium; taste sweet, subacid; flavour pleasant; T.S.S. - 22° Brix; flesh - 73.03%.

Quality good; shelf life fair.

**Stone:** Oblong; full; small size; medium (22.5 g), 6.05 cm long, 3.40 cm broad, 1.90 cm thick; veins raised, forked, parallel; fibre nil, seen only on ventral ridge; endocarp thick and woody; monoembryonic.

**General:** Susceptible to fruit flies.

## 70. TIMOZ

A rare variety located in Curti in Ponda Taluka characterised by large fruit and plenty of flesh. Used as table fruit. It is of limited popularity.

**Trees:** Large; vigorous; canopy dome shaped, spreading; shoots thick, without any pigmentation or waxy bloom; trunk stocky.

**Leaves:** Medium to big (Length - 23.0 cm); upheld; base cuneate; tip acuminate; shape lanceolate; lamina twisted slightly, recurved, not folded (Length - 21.0 cm, Breadth - 4.3 cm); margin smooth but slightly wavy; tender leaf pale green; midrib and veins devoid of any pigments; wax on petiole sinus.

**Bearing:** Alternate; medium yielder.

**Season:** Late (May - June).

**Inflorescence:** Medium to large (Length- 28.0 cm, Breadth- 21.0 cm); conical; rachis and rachilla moderately pubescent without any pigmentation; stamens equal and parallel to pistil; staminodes developed.

**Fruit:** Big, weighs 454.0 g, 10.95 cm long, 8.9 cm broad, 8.2 cm thick, L/B = 1.23; asymmetric; oblique; base obliquely flattened; stalk insertion oblique; stalk thick; cavity deep; dorsal shoulder narrow, moderately curved; ventral shoulder rising, rounded, broader than dorsal shoulder; back curved; sinus shallow; beak just a point; apex round.

Skin smooth; bright yellow; blush absent; tough; leathery; thick; easily peeled, bitter; dots, small very close, in flush with skin, same colour as skin.

Pulp firm, melting; yellowish orange; non-aromatic; fibre abundant, coarse, long; juice abundant; taste sweet; flavour pleasant; T.S.S. 18° Brix; flesh - 76.54%.

Quality good; shelf life fair.

**Stone:** Oblong; full; plump; medium (29.5 g),

7.75 cm long, 3.8 cm broad, 2.45 cm thick; veins raised, forked; fibres sparse, soft, short concentrated on ventral ridge; endocarp thick, woody; monoembryonic.

## 71. TOKIO

*Syn:* Tongio

A popular variety of Bardez Taluka in North Goa. Distribution of the trees is limited. The name is derived from the word 'Tok' which means a sharp point referring to the prominent beak of the fruit. Used as table fruit.

**Tree:** Large; moderately vigorous; canopy round, spreading; shoot moderately thick to thin without any waxy bloom or pigmentation; trunk medium.

**Leaves:** Medium (Length - 27.8 cm); upheld; base cuneate; tip subacuminate; elliptic; lamina not twisted, slightly reflexed, flat (Length - 24.0 cm, Breadth - 4.8 cm); margin wavy; tender leaf pale green; mid rib and veins without pigmentation; waxy bloom on petiole sinus.

**Bearing:** Regular to irregular; medium yields.

**Season:** Late (May - June).

**Fruit:** Small, weighs 192.0 g, 9.4 cm long, 6.7 cm broad, 6.0 cm thick, L/B = 1.42; asymmetric; oblong or elongated; base flattened obliquely; stalk insertion oblique; stalk medium thick; cavity shallow; dorsal shoulders narrow, moderately curved or abruptly falling; ventral shoulder rising, rounded, broader than dorsal shoulder, both shoulders ridged; back curved; sinus deep; beak prominent, mammiform; apex broadly pointed.

Skin smooth; bright yellow; pink blush on both shoulders; tough; leathery; thick; easily peeled; non-bitter; dots big, distant, in flush with skin, white coloured.

Pulp soft, melting; pale or lemon yellow; fibre scanty; non aromatic; juice medium; taste

sweet; flavour pleasant; T.S.S. - 21° Brix; flesh - 64.5%.

Quality good; shelf life fair.

**Stone:** Elongated; full, plump; small size; medium (22.5 g), 7.95 cm long, 3.0 cm broad, 2.15 cm thick; veins grooved; parallel; fibres sparse, soft, short mostly on ventral ridge; endocarp thick and woody; monoembryonic.

## 72. TORANJA

A single grafted tree was located in Loutolim of South Goa. The fruit is large and look like toranja or pummelo and hence the name. The tree is large, vigorous in nature having a round canopy which is spreading. The shoots are very thick without any waxy bloom. Leaves are big to medium, spreading and ovoid on shoots, lanceolate in shape, the margin is wavy, the lamina is recurved and waxy bloom is seen on petiole sinus.

Fruits are big in size, roundish or ovate in shape with plenty of flesh. Bearing is alternate, late in season and is reported to be a medium yielder. Fruit quality is reported to be good. Other details could not be studied so far.

## 73. XAVIER

A very popular, juicy and sweet variety planted throughout Goa. It is used exclusively as a table fruit and is marketed both in North and South Goa. Both fibrous and fibreless forms exist. Fibreless form needs to be propagated by selection.

**Tree:** Medium; moderately vigorous; canopy round and spreading; shoots moderately thick without any waxy bloom or pigmentation; trunk medium stocky.

**Leaves:** Medium (Length - 29.0 cm); upheld; base attenuate; tip acuminate; shape lanceolate; lamina slightly twisted, slightly recurved, not folded (Length - 23.0 cm, Breadth - 4.7 cm); margin smooth; tender leaf light coffee brown;

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**Bearing:** Regular; high yielder.

**Season:** Late (May - June).

**Inflorescence:** Large (Length- 46.0 cm, Breadth - 28.5 cm); pyramidal; rachis and rachilla glabrous with pink pigmentation; stamens equal and parallel to pistil; staminodes developed.

**Fruit:** Medium to small, weighs 266.0 gm, 9.65 cm long, 7.35 cm broad, 6.45 cm thick, L/B = 1.31; symmetric; oblong; base rounded; slightly necked; stalk insertion vertical; stalk thickness medium; cavity absent; shoulders equal, level, curved; back curved; sinus absent; beak just a point or absent; apex rounded.

Skin smooth; orange; blush absent; less tough; leathery; thick; easily peeled; bitter; dots medium, moderately close, in flush with skin, greenish orange coloured.

Pulp soft; orange with yellow colour close to the skin; non aromatic; fibre scanty; juice abundant; taste sweet; flavour pleasant, delightful; T.S.S. 23° Brix; flesh -67.29%.

Quality excellent; shelf life very poor.

**Stone:** Oblong; full and plump; medium weight (33.5 g), 8.1 cm long, 4.0 cm broad, 2.2 cm thick; veins grooved and parallel; fibres medium long, coarse, mostly on ventral ridge; endocarp moderately thick, woody; monoembryonic.

**General:** Susceptible to fruit flies, shoot borer, powdery mildew, fruit drop.

## 74. UDGO

A late maturing juicy variety grown all over Goa possessing a sweet rose like aroma and beautiful colour. Even the immature fruits exhibit deep pink or reddish colour and at this stage anybody can get it easily confused with Bardez Mussarat. It is used as a table fruit generally, but is also good for juice making. Two types are reported

to exist; one with more juice called as 'Rasau Udgo' and another with less juice. These differences are however not real but may be due to influence of the site, stage of ripeness etc. The origin is not known.

**Tree:** Large; medium vigour; canopy dome shaped, spreading; shoots thick with pinkish brown pigmentation and without waxy bloom; trunk is medium stocky.

**Leaves:** Medium (Length - 26.3 cm); upheld; base cuneate; tip subacute; shape lanceolate; lamina twisted, recurved not folded, (Length - 23.2 cm, Breadth - 4.8 cm); margin smooth; tender leaf pale green; mid rib and vein with slight pink pigmentation; waxy bloom on petiole sinus.

**Bearing:** Alternate; medium to heavy yields.

**Season:** Late (May - June).

**Inflorescence:** Large (Length - 32.3 cm, Breadth- 34.1 cm) pyramidal; rachis and rachilla densely pubescent with deep rose red pigmentation; stamens equal and parallel to pistil; staminodes developed poorly.

**Fruit:** Medium, weighs 275.0 g, 10.05 cm long, 7.55 cm broad, 6.55 cm thick, L/B = 1.33; asymmetric; oval; base obliquely flattened; stalk insertion oblique; stalk medium thick; cavity slight; dorsal shoulder narrow and moderately curved; ventral shoulder rising, rounded and broader than dorsal shoulder; back curved; sinus absent; beak absent; apex rounded.

Skin very smooth; bright yellow; deep pink to dark red blush present on both the shoulders; tough; papery; thin; easily peeled; bitter; dots medium, distant, in flush with skin, same colour as skin.

Pulp soft, melting; strongly aromatic (rose aroma); deep yellow to yellowish orange; fibre none; juice abundant; taste sweet; flavour pleasant; T.S.S. 18° Brix; flesh - 76.14%.

Quality excellent; shelf life very poor.

**Stone:** Oblong, full, thick; medium weight

(30.5 g), 8.0 cm long, 3.5 cm broad, 2.0 cm thick; veins grooved, forked; fibres sparse, soft, short concentrated on ventral ridge; endocarp medium thick, woody; monoembryonic.

**General:** Susceptible to shoot borers, hoppers and fruit flies. A selection with bigger size fruit, more flesh (82.6%) and lemon yellow flesh has been collected, purported to be the best Udgo. This has been located in Neura-Pecan near Agassim, Tiswadi Taluka.

## SEEDLING SELECTIONS

### I. Improved Mankurad seedling

*Syn:* Cardoz Mankurad

An outstanding tree located in the garden of Dr. A. B. Cardozo of Mapusa of Bardez Taluka. The seedling was raised from a seed of the popular variety Mankurad and was planted by his niece in 1935. The seedling was uprooted twice to plant a mango graft in its place. However, due to sentimental reasons it was replanted again and after five years, it has borne the first fruit. It is regular, early and has acquired almost all the flavour characters of Mankurad with the added good qualities such as big size, oval shape, free from beak, good attractive colour and better keeping quality. The average yield is reported to be about 1500 fruits per tree per year. Vegetatively the tree resembles Mankurad. The inflorescence is similar to Mankurad except that the pigmentation is deeper and brighter. The selection needs to be popularised for commercial cultivation. It came to light during an exhibition of mangoes organised by the Lions Club of Margao in 1992, where it was exhibited as Improved Mankurad and won the first prize.

**Fruit:** The fruit is medium to big, weighs 320.0 g, 9.82 cm long, 7.53 cm broad, 7.57 cm thick, L/B = 1.30; asymmetric, oval or oblong, base obliquely rounded; stalk insertion oblique; stalk medium thick; cavity absent; dorsal shoulder moderately curved, narrow; ventral shoulder rising, rounded, broader than dorsal shoulder; back

curved; sinus slight or absent; beak just a point; apex broadly pointed.

Skin smooth; yellowish orange; deep pink blush seen on both shoulders; tough; leathery; medium thin; easily peeled; bitter; dots medium, very close, in flush with skin, same colour as skin.

Pulp melting; firm; aromatic; deep orange; fibre none; juice medium; taste sweet; flavour pleasant, delightful; T.S.S. - 22-25° Brix; flesh - 78.29%.

Quality is excellent; shelf life good (Better than Mankurad).

**Stone:** Oblong, full, plump, medium weight (22.67 g), 7.52 cm long, 3.68 cm broad, 1.78 cm thick; veins grooved, forked and parallel; fibres sparse, soft, short mostly on ventral ridge; endocarp medium thick, woody; monoembryonic.

**General:** A new selection of seedling origin. Probably a natural cross between Mankurad and Bardez Mussarat or Udgo. The variety has several commercial attributes and needs to be popularised.

### II. Khute

All mangoes of seedling origin and not grafted are commonly called as Khute many of which are useful for various purposes and are marketed locally. One type with small, sweet fruits was collected from Benaulim and is included in the germplasm collection at Old Goa.

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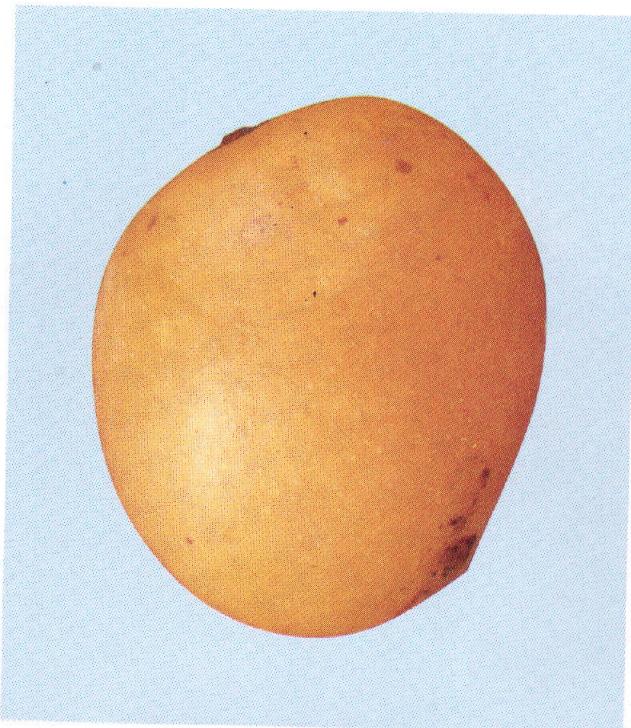


Fig 61 : Secretin

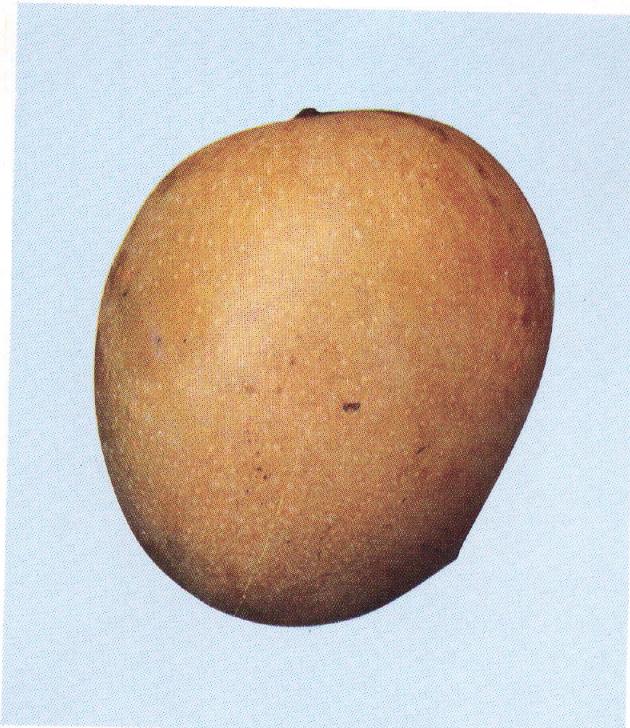


Fig 62 : Severina



Fig 63 : Tanque

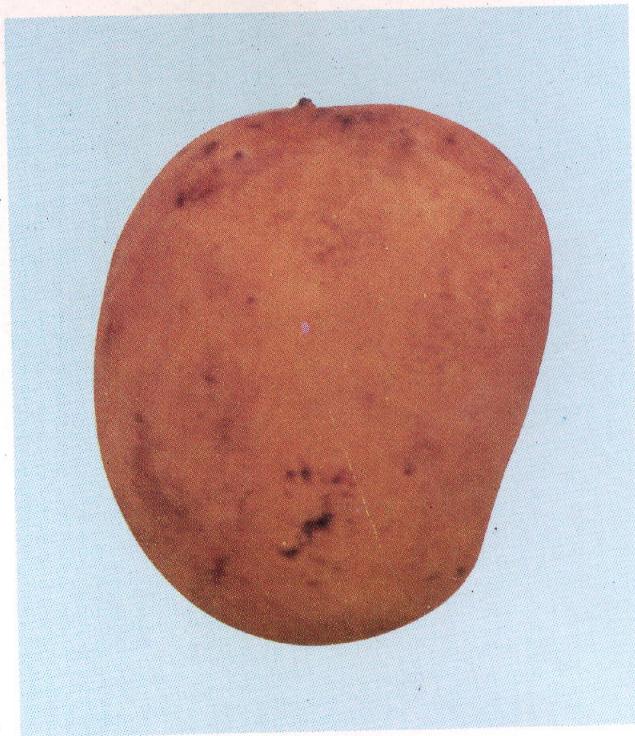


Fig 64 : Timoz

## CHAPTER - 3

# PROPAGATION AND CULTURE OF MANGO

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### Soil and Climate

Mango is known to grow well in a wide range of soils such as lateritic, alluvial, sandy loam and sandy soils. Though, it grows well in medium to high fertility soils, it can be successfully cultivated in poor soils with good management practices. It likes very deep but well drained soil in which its roots can get plenty of space to feed and develop. The extremely sandy, shallow, rocky, water logged, alkaline and calcareous soils are not suitable for mango cultivation. In Goa, mangoes are successfully grown in lateritic and coastal sandy soils.

Mango is well adapted to tropical and subtropical climate. It grows well in humid as well as dry climate. In India, it thrives almost in all regions up to an altitude of 1,500 m from sea level. But it cannot be grown on commercial scale in regions above 600 m. It blossoms and fruits well in the dry regions where there is good rainfall for four months from June to September followed by dry period for eight months. Strong winds and cyclones during the fruiting season cause damage to the crop. Rain during flowering interferes with pollination. The climate of Goa is suitable for mango.

### Propagation

Mango can be propagated by seed or by different methods of vegetative propagation (Gunjate, 1990). Propagation by seed is easy and cheap. However, it is not advisable to propagate mango by seed as seedling progeny segregates,

bearing is late or irregular and growth is huge. Therefore, in order to ensure uniformity, parental quality, early bearing and productivity in the progeny, it is necessary to propagate the desirable varieties of mango by vegetative propagation methods.

Several methods of vegetative propagation in mango were in vogue with varying degrees of success. However, grafting is the most preferred method. In grafting, shoots are grafted on to a seedling known as 'rootstock' which provides the root system. Until recently, methods like inarching and veneer grafting were used. These methods are cumbersome and time consuming. Presently, stone grafting and softwood grafting are widely accepted for mango propagation as these can be taken up throughout the year (Sawake *et.al.*, 1990). The techniques are described below:

### Stone grafting

This method includes four steps, a) raising seedling b) selection of scion c) grafting and d) after care of the graft.

#### i) Raising seedlings

Collect fresh stones for raising mango seedlings. The mango stones loose viability after 30 days and should never be allowed to dry or exposed to sun. Therefore, it should be sown within 30 days. Wash the collected stones thoroughly with water to remove the adhering pulp. Remove the light stones which float on water. Take 10.0 litres. of water and add 40.0 g each

of BHC 50% and Fytolan to this water. Dip the stones in this solution for five minutes. For sowing the stones, beds of 1 metre width, 15 cm height and of convenient length are prepared. Heavy basal dressing of F.Y.M. @ 3.0 tonnes per 1,000 m<sup>2</sup> is added while preparing the beds. Pebbles, stones, big clumps of earth are removed from the bed upto a depth of 20-30 cm. Place the stones side by side and cover it with 6-7 cm layer of soil and F.Y.M. (1 : 1). Irrigate the bed regularly if sowing is done in summer. The stones germinate in about 15-30 days. Seeds with sprouts, preferably before the leaves have expanded, are used for stone grafting in mango. The seeds of mango are called 'stones'. Vellaikolamban, a dwarfing and polyembryonic variety, if used as rootstock material, will be useful in reducing vigour and bringing uniformity in the orchard.

### **ii) Selection and preparation of scion**

Select the tree of one's choice variety which one desires to graft. Shoots used for grafting are termed as 'scions'. Choose scions more than three months old with dark green leaves and having dormant terminal or side bud on it. The angular and immature scions may be avoided. The scion should be free from any pest or disease infestation and should be 15-20 cm in length. The lower end of the scion is mended up to 4 to 6 cm length into a wedge shape by chopping off the bark and little wood from two opposite sides, taking care to retain some bark on remaining two sides. Now the scion is ready for grafting on the root stock. The scion should never be allowed to dry. If the scions are to be collected from a considerable distance, these can be wrapped in moist paper and covered with polythene sheets to avoid drying.

### **iii) Preparation of root stock and grafting**

Seed sprouts are uprooted before the leaves expand from the bed. Decapitate the seedling at the height of about 8 cm from the base. Make a cleft of

4 to 6 cm deep in the middle of decapitated stem of the seedling by giving a downward longitudinal cut.

Insert the wedge of the scion into the cleft of the stock seedling, taking care that the cambium layers of the stock and scion are in perfect contact with each other. The cambium layer is in between the bark and the wood indicated by a line separating them. Tie the graft joint firmly with 1.5 cm wide and 30 cm long polythene strip of 100 gauge thickness. Even two rootstock seedlings can be used for each graft if thickness of seedlings are low. Use polythene bags of 30 cm x 20 cm size of 300 gauge thickness for planting the prepared graft. Punch 15-20 holes on the bag to provide drainage. Fill the bag upto brim with potting mixture of soil, sand and cowdung in 2 : 1 : 1 proportion. Add mussoriphos @ 5.0 g per bag, at the time of preparing soil mixture. Plant the grafted seedling in the bag and drench it thoroughly with water. Planting in bag should be done in such a way that graft joint remains above the soil level.

### **iv) Aftercare of the graft**

Keep the grafted plants under shade. Sprouting of the terminal bud is seen after about 15-20 days. Water the grafts as and when required depending upon the season and weather conditions. Any sprouts observed on the root stock portion below the graft joint should be removed at frequent intervals. Spray Nuvacron @ 2ml/litre. or BHC 50% 3.0 g/litre to control leaf eating insects. Remove the polythene strip from graft joint about 3 months after grafting to avoid girdling. After 6 months, shift the grafts from one place to another or just lift the grafts and keep them at same place once in a month to prevent them from striking roots into the ground below. In order to avoid this shifting work, grafts may be kept on polythene sheets 1,000 gauge thickness spread on the ground. Protect the graft from the pest and diseases as and when they are noticed.

June to August is the ideal period for the

stone grafting in mango with 80-90 percent success.

### Softwood grafting

This is the latest mango grafting method. In this method, mango seedlings are grown in polythene bags of 30 cm x 20 cm size of 300 gauge. Seedlings aged two months to one year are used for soft-wood grafting depending on availability of new flush. The method of grafting and after care of the graft are same as in stone grafting, the only difference being that the grafting is done on the new flush having bronze coloured leaves, using comparatively older seedlings.

Some of the advantages of this method over stone grafting are given below.

1. Less care is needed for grafts as compared to stone grafts.
2. Those seedlings that cross the age required for stone grafting can be utilized.
3. Longer period is available for grafting.
4. Mortality of successful grafts is less than that of stone grafts.

### Selection of graft for planting

In Goa, there is a tendency to plant very big grafts with a very small root system. Select a well developed graft with good root development. If a graft is putting forth new growth it indicates that the union is complete. If the tying material on the graft joint is not removed, it may be removed and examined to see if the union is perfect as otherwise the graft is likely to die after planting. Avoid grafts with too many side branches. Also observe these grafts for mealy bugs or scales that suck the juice and kill them. Try to plant dwarf grafted plants with a perfect graft union as these plants do not grow too big.

### Top working in mango

Conversion of grown up mango trees of inferior varieties or seedling origin or rejuvenation of old trees with scions of superior cultivars is known as 'Top working'. Different methods like in-arching, side grafting, crown grafting, veneer grafting, cleft or wedge grafting are used for top working in mango (Kolekar, 1990). However side grafting and coppice grafting are mostly used as these methods give good success. In case of top working by side grafting, grafting is done first on the tree and once it has become successful, top of the inferior tree is cut off. In case of top working by coppice grafting, tree is cut first and then the emerging sprouts are grafted. Details of both the methods are given below:

#### A) Top working by side grafting

In this method, a triangular notch is cut out of the bark on the trunk of the tree, 60 cm above the ground by means of a chisel or sharp knife. The base of the triangular notch should be almost 6 cm. Two longitudinal and parallel cuts are given below the triangular notch upto the length of 8 cm extending down from both ends of the transverse cut of the notch. The flap of the bark of this cut portion is lifted to accept the prepared scion. About 50 cm long scion is selected and about 8 cm long slanting cut is given on one side of the base of the scion and a small notch is made on the other side. The mended scion is inserted into the flap of the bark in such a way that cut portion of scion comes in contact with the wood of the tree. The bark flap is then closed firmly with the scion and tied with jute thread. Exposed cuts on the bark is then sealed with an equal mixture of wax and natural resin. Apply some BHC 10% powder over the wax to prevent the wax from being eaten by ants. Top working by this method is done in the month of August - September. The success of the grafting is indicated by the sprouting of the scion which may take about one month.

### b) Top working by coppice grafting

In this method, tree which is in the age group of 5-20 years is cut at the height of 1 m to 1.5 m from the ground level with the help of sharp knife or saw. The cut wounds are covered with copper fungicides and the whole stump is coated with a solution of BHC 50% to prevent stem borer attack. It is recommended to coppice the tree in April or May so that grafting could be done in July or August. The sprouts appear on the trunk after 1-2 months. Four to six vigorous shoots are selected and grafted with the scions of superior variety by the soft wood grafting technique. Remaining sprouts are trimmed and gradually removed later on. Supporting the new sprouts with thread or rope or sticks may be necessary to avoid snapping of shoots due to wind in the initial years.

Since the root system of the grown up tree is well developed, the growth of the top worked tree is faster than that of newly planted graft. One can anticipate the yield from third year onwards. By top working method, two or more different mango varieties can be grafted on the same tree provided they are of equal growth rate or by controlling growth of the vigorous scion variety. In this case, do the grafting of different varieties at same level on different coppice shoots.

### Planting

Mango is a long lived fruit tree and as such planting needs to be done with care. After clearing bushes, if any, from the site, pits of 1 m x 1 m x 1 m are dug at a distance of 10 m x 10 m. The pits are filled with top soil, 1.0 kg Mussorie Phosphate, 1.0 kg. Sterameal and 1.0 kg. of neem cake; 50 kg of F.Y.M. or compost or green leaves are also added to the pit. Pit is filled upto the brim and kept ready at least 10 days before the onset of monsoon so that the grafts can be planted when the rain starts to take full advantage of the rainy season.

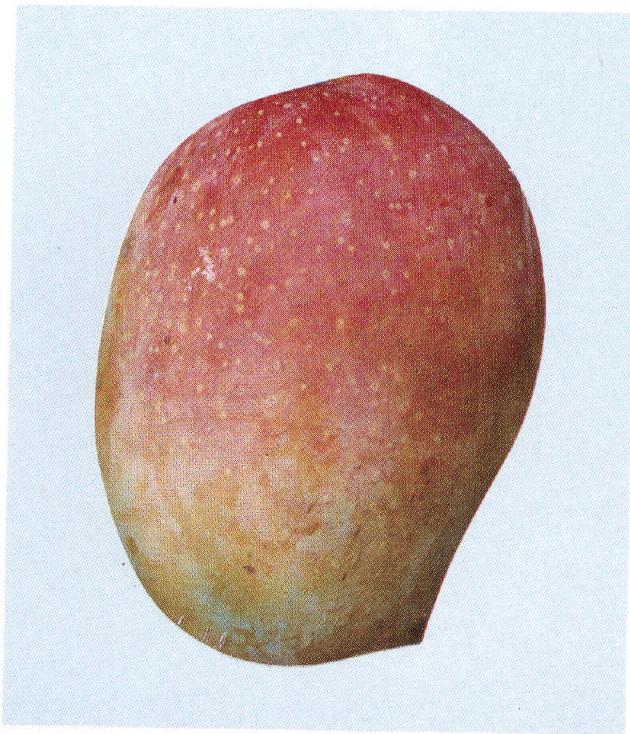
Mango orchard being a capital intensive and long term venture, the selection of suitable and genuine planting material is very important (Magdum, 1990). It is always safer to collect grafts from Government nurseries, reliable private nurseries or self made grafts can be used. The mango grafts are usually sold in polybags. The polybag of the graft is removed carefully, keeping the ball of earth intact and the graft is planted in the centre of the pit taking care that the graft joint remains 4 cm above the ground. Then top soil of the pit is pressed all round the root ball. Stake the graft with bamboo sticks and rope which will keep the graft straight and prevent it from breaking, lodging and swinging in the wind.

### After care of planted graft

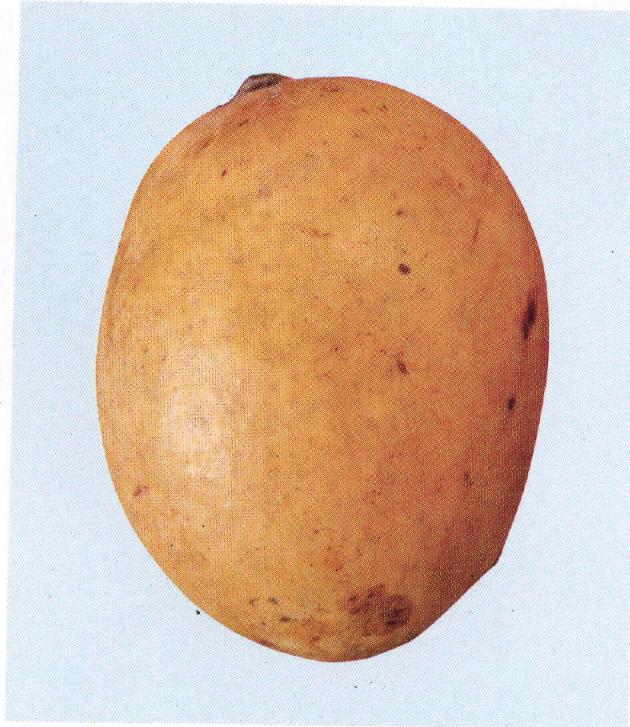
Graft should be protected from stray animals. The sprouts which appear on the root stocks below the graft joint should be removed as soon as they appear. Many grafts flower during the first year itself. All the flowers appearing during the first three years should be removed. Mulch the base of the plant with dry leaves or grass after the monsoon rains to conserve moisture and to control weeds. Spray the new growth with insecticides to control leaf eaters and shoot borers. During summer, the stem can be painted with kaoline to prevent sun scorch. Before monsoon starts, the stem is to be coated with bordeaux paste to control pink disease. Platforms on slopes or basins in level ground can be taken at the base to accommodate manuring etc., easily. Catch pits 1.5 m away from the plants will help to retain rainwater to facilitate growth of the mango trees, due to the impounded rainfall.

### Manuring

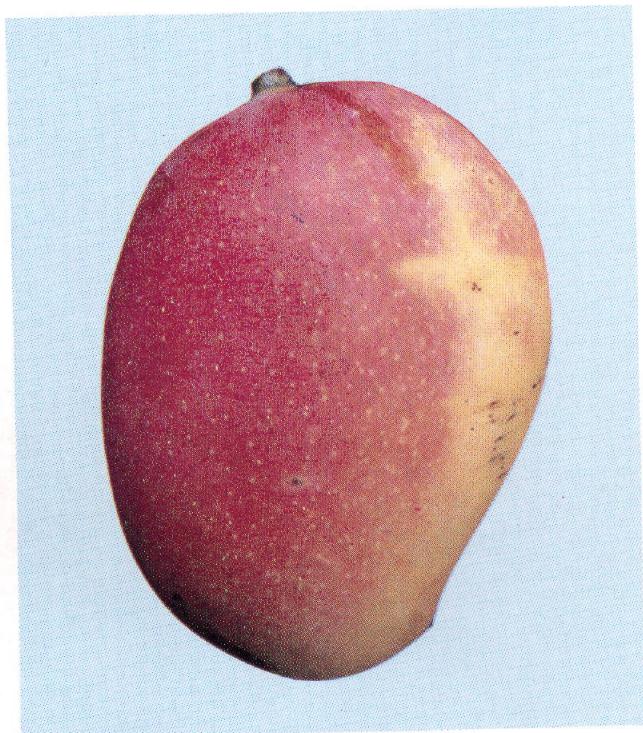
By and large, farmers in Goa generally do not manure their mango trees. Although mango



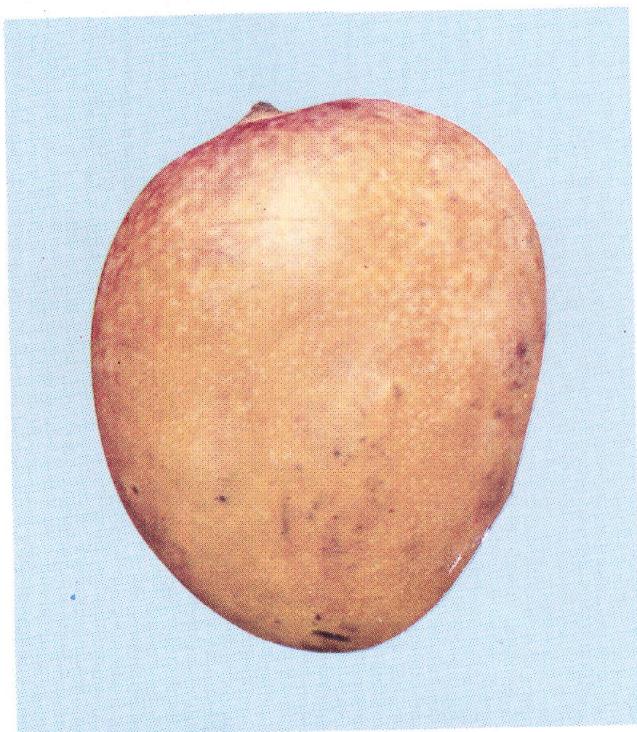
**Fig 65 : Tokio**



**Fig 66 : Xavier**



**Fig 67 : Udgo**



**Fig 68 : Cardoz Mankurad - A seedling selection**

tree grows well even in poor soils because of its deep root system, regular manuring of mango trees helps in getting good growth and yield. Therefore, mango trees should be adequately manured right from the first year. The quantity of nutrients required for mango is given in Table 1 and the quantity of manure and fertilizers to be given are indicated in Table 2 (Pujari, 1990). Full dose of fertilizer may be given in the month of August, where irrigation facilities do not exist. Where irrigation facility is available, the fertilizers may be given in two split doses i.e., once in the month of March after fruit set and another in the month of August in equal split doses. For applying manure and fertilizers, dig a trench 30 cm wide 15-20 cm depth and at a distance of 1-2 m from the tree base, depending on the canopy of the tree. Fill the basin with green leaves / compost / FYM, apply required quantity of fertilizers and cover it with soil. Many farmers apply fertilizers close to the trunk of the tree which is not the correct practice.

**Table 1. Nutrients required for mango**

Age of tree	Nutrients required / tree / year (g)		
	N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
1.	150	50	50
2.	300	100	100
3.	450	150	150
4.	600	200	200
5.	750	250	250
6.	900	300	300
7.	1050	350	350
8.	1200	400	400
9.	1350	450	450
10 and above	1500	500	500

**Table 2. Quantity of manures and fertilizers to be applied to mango**

Age of tree (year)	Fertilizers (g/tree/yr)			Manure/ FYM kg/tree/ yr)
	Urea	Mussorifos	M.O.P	
1.	345	250	85	10
2.	690	500	170	20
3.	1035	750	245	30
4.	1380	1000	350	40
5.	1725	1250	435	50
6.	2070	1500	510	60
7.	2415	1750	595	70
8.	2760	2000	680	80
9.	3105	2250	765	90
10 and above	3450	2500	850	100

### Irrigation

Although mango is grown as a rainfed crop, irrigation can certainly help in increasing mango production. Irrigation requirement mainly depend on soil type and climatic factors. Irrigation during the period of first four to five years of early growth stages is necessary to encourage rapid and vigorous canopy development. During the first year when the plant is very young with the shallow root system, water should be applied at frequent intervals and 2-5 years old plant should be watered less frequently. The trees which have started bearing should not be watered after monsoon till fruit set. These trees can be irrigated after the fruit set is over. The details of irrigation schedule is given in Table 3.

**Table 3. Frequency of irrigation to be given for mango in different seasons and soils (Nawale, 1990)**

Age of tree (year)	Interval between the irrigation (days)				Quantity of water per irrigation (l/tree)	
	Winter		Summer			
	Heavy soils	Light to medium soil	Heavy soils	Light to medium soil		
1	6-7	4-5	4-5	2-3	20	
2-3	10-11	8-9	8-9	6-7	40	
4-5	14-15	12-13	10-11	8-9	60	
5-10	--	--	14-15	12-15	100	

The quantity of water recommended in Table-3 is for the basin irrigation. Mango can also be irrigated by the drip irrigation method.

### Intercropping

In Goa very few gardens are systematically planted. If the mangoes are planted in a systematic manner maintaining the distance of 10 m x 10 m, many intercrops can be taken during the initial years. Under irrigated conditions vegetables and leguminous crops can be grown in rotation as intercrops which will restore the soil fertility. Fruit crops like pineapple and papaya can also be grown successfully in mango orchard. In case of rainfed gardens, vegetables and pulses, paddy or ragi can be grown during rainy season.

### Training and pruning

Mango tree does not usually require much of pruning. However, the training of the plant in the initial stages is very essential to give them a proper shape. If the graft has too low branches they should be pruned. In case of stone or soft wood grafts, occasionally the main shoot may have a tendency to go erect, without branching even after 1 m height. In such cases, pinch off the new growth at 1 m height to induce branching. At least 75 cm of the main stem should be kept free from branching which will facilitate the work of manuring, weeding and other cultural practices. All

the dead and diseased branches, crossed or crowded limbs should be removed carefully. All the shoots arising below the point of the union on the stock portion, should be pruned off as soon as they appear. The cut wounds should be covered with bordeaux paste to avoid disease incidence.

### New tools for mango cultivation

At Dapoli, Konkan Krishi Vidyapeeth has developed two new improved tools for mango growers; viz., AMAR loranthus cutter and NUTAN mango harvester (Patil, 1990). Details of these tools are given below :

#### i) AMAR loranthus cutter

This tool has three cutting edges, two of them plain and one side sharpened and curved. The one facing downward is useful for giving a cut to the branch from above, while the other facing upward is to take a cut from below. Third one with serrated edge sideward in position is designed for side cuts. The tool is provided with 125 mm long pipe holder for fixing bamboo holder. Some important advantages of this tool over traditional koyta are :

- a) One can easily cut the affected branch upto twenty feet height from the ground which is not possible by using traditional koyta.
- b) Average time saved by cutter over the use of koyta, is 55%.



**Fig 69 : Prepared Scion**



**Fig 70 : Prepared root stock**



**Fig 71 : Tied Graft**



**Fig 72 : A Successful Graft**

- c) As the tool helps to take cuts from all sides of the branch, splitting of branch is avoided.

## ii) NUTAN mango harvester

This mango harvester consists of metallic ring meant for fastening the nylon net. The cutting mechanism is provided at the top of the ring and consists of double bladed triangle plate together with toothed wheel. The toothed wheel is riveted at the centre of the two fixed cutting blades. The wheel rotates freely about its central rivet, which holds and carries mango stalk over sharp blade. For fixing a bamboo handle of desired length, a holder is provided to the harvester opposite to the cutting mechanism. Some of the advantages of this harvester over the traditional harvester, are listed below :

- a) All fruits are harvested with pedicel or stalk.
- b) No injury is caused to the fruits or branches
- c) As the fruits are harvested by shearing of stalk, very little force is required.
- d) Coiling and recoiling of branches are avoided and drop of immature fruits is prevented.

## Use of Cultar in mango

Many of the good varieties of mango have a tendency to bear fruits in alternate years. It is largely due to physiological and nutritional imbalance. Many methods were tried to overcome this problem with varying degrees of success. Recently, the use of cultar (Paclobutrazol) has been found to overcome this problem of alternate bearing in mango (Sawke *et. al.*, 1990). The procedure for the use of this chemical is given below.

Dig about 25-30 holes of 30 cm depth at a distance of 1-2 m (depending on the canopy of tree holes should be below the centre of canopy) away from the trunk in the month of July-August

(between 15th July to 15th August for West Coast). Take 20 ml of cultar and mix it in five litres of water. Pour this solution in the 25-30 holes dug around the tree. After application, remove the weeds around the tree. Quantity of cultar differs with the age of the tree, 20 ml being sufficient for 20 year old tree. Quantity can be increased or decreased depending on the age of the tree. Use of cultar not only overcomes alternate bearing of mango but also helps in getting high and early yields by 15-20 days. Tree should be manured and sprayed for blossom protection where cultar is applied for better result. Trials in Goa with 12 year old Mankurad indicated good response to cultar at 15-20 ml per tree.

## Harvesting

Harvesting of mango fruit at proper maturity is an important aspect from the quality and shelf life points of view. Different varieties are ready for harvest at different times of the year. Several parameters have been suggested for determining maturity of mango fruits on the basis of their external appearance. Mangoes are harvested when fully matured. Harvesting is usually done when few fruits ripe and fall from the tree. Mangoes are harvested by hand picking or by using mango harvester. It is recommended to harvest the mango with stalk intact to reduce the loss during storage. Fruits are harvested during morning and evening hours and kept in shade.

The yield varies from tree to tree and from variety to variety. The economics of mango cultivation varies from place to place depending on the factors like labour cost, soil, climate, irrigation, etc. A net income of about Rs. 25,000 per hectare may be obtained from well maintained orchards. The input out put ratio is 1:1.60 for mango which is indicative of its commercial potential (Borude, 1990).

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## CHAPTER - 4

# PESTS AND DISEASES OF MANGO AND THEIR MANAGEMENT

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Insect pests and diseases often cause severe damage to the crop resulting in economic loss of yield. In order to obtain a good crop yield, timely plant protection measures are very essential. The important insect pests and diseases of mango and their control measures are described below.

### **A. INSECT PESTS**

#### **I) Mango hoppers**

As many as twenty species of this pest are known to occur on mango in the Konkan tract including Goa. However, three species viz., *Idioscopus niveasparsus*, *Amritodus atkinsoni* and *Idioscopus pagpurensis* are most dominant. The nymphs and adults suck the cell sap from the inflorescence and flower buds during the flowering season. The infested flowers shrivel, turn brown and ultimately fall off. The losses due to attack by this pest vary between 25 to 60 per cent.

#### **Management**

In endemic pockets, commence the first round of the spray schedule (3-4 sprays) just before the flowering begins either with Endosulfan 35 EC (1.5 ml/l) or Carbaryl 50 WP (2 g/l) or Dimethoate 30 EC (1 ml/l) or Phosphamidon 85 EC (0.5 ml/l) or Monocrotophos 36 EC (1.1 ml/l). Repeat the subsequent sprays at 15 day interval. Care should be taken to spray the bark, shoots and flowers. Once flowering starts, add 2 g of Sulphur or 1.0 g of Carbendazim to 1 litre of insecticidal solution to

control black sooty mould. A medium sized graft (15 yrs. old) will need 10 litre of spray solution.

#### **2) Stem borer (*Batocera rufomaculata*)**

The grubs feed inside the stem, boring upwards. This results in the drying of the branch and may even kill the entire plant in case of neglect.

#### **Management**

- i) Remove and destroy the grubs from the tree trunk mechanically.
- ii) Pour a concentrated solution of BHC 50% (10 g/l) into the holes and plug each hole with a mud paste.

#### **3) Shoot borer (*Chulmetia transversa*)**

The larvae of this moth bore into the young shoots or new flushes especially during September-December. The infested shoots wither and dry up. This affects the fruiting and growth of the plant. This pest has four overlapping generations during a year.

#### **Management**

Spray Monocrotophos 36 EC (1.1 ml/l) 2-3 times at 15 day interval, beginning with the initiation of new flush.

#### **4) Fruitfly (*Dacus dorsalis*)**

In Goa, late maturing varieties like Udgao, Bardez, Mussarat, Chimut, etc. are severely attacked by this pest. The female fruitfly lays small eggs in the mesocarp of mature fruits. The larvae

on hatching feed on the fruit pulp and such fruits rot before ripening. These fruits finally fall down.

### Management

- i) Collect and destroy (burn) all fallen fruits.
- ii) Spray susceptible varieties towards the end of May with Malathion 50 EC (2 ml/l).
- iii) Use lures to attract and kill the flies. Hang tins containing a solution of 20% jaggery (gud) and malathion on the branches of trees to attract the flies and kill them. But do not spray this solution on the fruits.

Besides the above, mango is also attacked by a wide range of minor insect pests viz. mealy bug (*Drosicha mangiferae*), leaf webber (*Orthaga euadrusalis*), stone weevil (*Sternochetus mangiferae*), red ant (*Oecophylla smaragdina*), etc.

## B. DISEASES

### 1. Powdery Mildew (*Oidium mangiferae*)

A white powdery growth of the fungus may be seen on flowers, fruits and leaves. As the flower stalks and flowers are affected, the flower ceases to grow, fail to open and shed. The infected fruits after attaining pea size usually drop. Young leaves are attacked mostly on their underside and the infection is restricted to the area of the central rib. Affected leaves curl and become distorted.

This disease appears during December-January. Warm humid weather and cool nights favour the spread of the disease.

#### Control

Spray Microsul/Thiovit/Sulfex (0.2%) or Karathane E.C./Calixin/Bavistin (0.1%). The first application should be given soon after flowering and subsequently, two more sprays at 10-15 days interval.

### 2. Anthracnose (*Collectotrichum/ Glomerella cingulata*)

The disease produces leaf spot, blossom

blight, wither tip, twig blight and fruit rot symptoms. Tender shoots and foliage are readily affected finally resulting in the 'dieback' of young branches. The bloom blight may vary in severity from slight to a heavy infection of the panicles. Black spots develop on panicles and on the fruits. Young infected fruits develop black spots, shrivel and drop off. The infection at maturity stage will carry the fungus into storage and considerable loss occurs in storage, transit and marketing stages.

The disease is capable of causing serious losses under favourable climatic conditions of high humidity, frequent rains and a temperature of 24-32° C when young shoots, flowers or fruits are produced.

#### Control

The diseased twigs should be pruned and burnt along with fallen leaves. Trees should be sprayed with Benlate/Bavistin (0.1%) twice during flowering at 14 days interval. For nursery, spraying of copper fungicides/diethio carbamate (0.2%) or Bavistin (0.1%) during February, April, September, October and December, is effective. To reduce the incidence of the disease in storage, dip the fruits in Bavistin solution (1 g / 1 l) for 5 seconds.

### 3. Dieback (*Botryodiplodia theobromae*)

The disease is characterized by drying of branches, twigs followed by complete desolation and gives an appearance as if it has been scorched by fire. The onset of die-back is evident by the discolouration and darkening of the bark from the tip, (young green twigs start withering first at the base) and then along the veins of leaf edges. At this stage the twig or branch shrivels, exudes gum, dies and falls. Brown streaking of vascular tissue is seen on splitting the stem length-wise along the axis.

The disease is noticeable at any time of the year but most conspicuous during September-December.

## **Control**

### **(a) Preventive measures for nursery**

- i) Selection of scion from healthy trees.
- ii) Sterilisation of budding knives.
- iii) Placement of budded/grafted plants in dry environment and gradual exposure to full sunlight.

### **b) For Trees**

- i) Pruning of diseased twigs followed by application of Bordeaux paste.
- ii) General spray of Bordeaux mixture or copper fungicide (1%).

## **4. Bacterial canker (*Xanthomonas campestris*, *V. mangiferae*).**

Angular, cankerous, raised lesions surrounded by chlorotic halos are seen on the leaves. In severe infections the leaves turn yellow and drop off. On branches and twig, the lesions are initially water soaked, later become raised and dark brown with longitudinal fissures. On fruits, the initial water soaked lesions gradually develop into cankers and release a gummy ooze.

## **Control**

Monthly spraying of Bavistin (0.1%) followed by Agrimycin (1 g / 10 litre water).

## **5. Red rust (*Cephaeluros virescens*)**

The disease can be easily recognised by the rusty reddish brown spots mainly on leaves and sometimes on petioles, bark and young twigs. The affected areas crack and scale off. In serious cases the bark becomes thickened and the twigs get enlarged and remain stunted.

## **Control**

Avoid close planting. Spraying of Bordeaux mixture (1%) or copper oxychloride (0.3%) before appearance of the disease checks its development.

## **6. Mistletoes / Bhendur (*Loranthus longifolia*) and *Viscum* sp.**

Two types of mistletoes are seen infesting mango in Goa. The *Viscum* sp. has round leaves while the other has long leaves. These parasites suck the sap from the tree and reduce yields. One can see quite often large trees on the verge of death by the infestation of these parasites. The parasite spreads through its sticky seeds which are deposited by the birds after eating the fruit.

## **Management**

- i) The best method is mechanical removal by using bill-hook (bhendurlem). A loranthus remover has been developed and described earlier which is more efficient.
- ii) Severely infested shoots may be cut from below the tumour or swelling where infestation is seen and removed.

## **7. Spongy tissues in fruit**

This is a physiological disorder, the exact cause of which is not known. The fruit looks fine externally but when cut open, reveals formation of sponge like patches generally of a lighter colour than normal pulp without or with an air pocket. This has been observed in Mankurad, Fernandin, Udgo and Costa.

Adopting scientific manuring practices, avoiding exposure of harvested fruit to sun and harvesting at correct stage, may help to alleviate the problem.

## **8. Minor diseases and disorders**

Phoma blight, sooty mould, pestalotia leaf spots, pink disease and black tip, are also found in Goa and can be controlled with the spray schedule recommended (Table 4).

In order to reduce the pest and disease problem in general, the following spray schedule devised for mango crop may be adopted especially for protection of blossoms.

**Table 4. Recommended spray schedule for the control of minor diseases / disorders in mango**

Sl. No	Time of spraying	Pesticide to be used	Quantity of pesticides for 10 litre. of water (for 15 year old tree)
1.	Prebloom spray on trunk, branches when buds begin to sprout or on new emerging leaves.	Endosulfan 35% EC or Carbaryl 50% or Dimethoate 30% EC or Phosphamidon 85% EC or Permethrin 20% EC or Monocrotophos 36% EC or Quinalphos 25% EC	15 ml 20 g 10 ml 5 ml 5 ml 11 ml 20 ml
2.	Immediately after blossoming	Any of above pesticide + wettable sulphur or Carbendazim	20 g 10 g
3.	Two weeks after second spray	- do -	- do -
4.	Two weeks after third spray	- do -	- do -

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Source : Regional Fruit Research Station, Vengurla.



## **5. APPENDIX**

### **METHODOLOGY**

A descriptive blank was prepared using the guidelines followed in the description of Indian mangoes. Some of the characters were relative while others were not consistent owing to variation in fruit and vegetative characteristics. For recording leaf characters, a typical leaf from the middle portion of the shoot has been plucked and observations were made. Similarly, a typical inflorescence of each variety was selected to record the details on inflorescence. Descriptions in detail are given only in those varieties where all characters could be studied. In others, only the salient features are presented. In all, 74 varieties were collected and studied besides one seedling selection of Mankurad. Two fully matured and typical fruits were used to record the fruit characters for each variety. In some cases such as St. Antony, the real name is not clear wherein the most popular name applicable to the fruit in the locality where it was found is followed in the text. Efforts have been made to include as many

characters as possible. Since most of the trees are not under uniform growth conditions, evaluations were made based on the samples collected from the field. Generally, it was observed that fruits tended to be more juicy in sandy soils as compared to laterite soils. In some cases, two types of fruits were noticed bearing the same name. They are designated as type I and II as in Rosa. In varieties such as Black Culas the assessment has been made based on immature fruits and the information given by the local people and its popularity, as all efforts to get mature fruits were of no avail. In some cases no fruits were obtained and hence no details could be collected. The varieties are presented in the alphabetical order.

The present study is, of course, subject to refinements and suggestions are solicited from those who can supplement information about Goan mangoes.



## 6. LIST OF FIGURES

- |                            |                             |
|----------------------------|-----------------------------|
| Fig 1 : Afonso             | Fig 32 : Kapri              |
| Fig 2 : Ananas             | Fig 33 : Koita              |
| Fig 3 : Akno Malgesh       | Fig 34 : Madame             |
| Fig 4 : Araujo             | Fig 35 : Mankurad           |
| Fig 5 : Aqua Rosea         | Fig 36 : Malgoa             |
| Fig 6 : Babio              | Fig 37 : Malgesh            |
| Fig 7 : Ball               | Fig 38 : Mancheron          |
| Fig 8 : Barreto            | Fig 39 : Matekin            |
| Fig 9 : Bemcorada Type I   | Fig 40 : Maxima             |
| Fig 10 : Bemcorada Type II | Fig 41 : Monteiro           |
| Fig 11 : Bishop            | Fig 42 : Mozambique         |
| Fig 12 : Carreira          | Fig 43 : Mussarat Bardez    |
| Fig 13 : Carreira Branca   | Fig 44 : Mussarat Salcete   |
| Fig 14 : Chimut            | Fig 45 : Nicolau Afonso     |
| Fig 15 : Culas             | Fig 46 : Oliveira           |
| Fig 16 : Colaco Branca     | Fig 47 : Oval Appus         |
| Fig 17 : Cota              | Fig 48 : Papel              |
| Fig 18 : Costa             | Fig 49 : Papel Branco       |
| Fig 19 : Dosi Ambo         | Fig 50 : Rebello            |
| Fig 20 : Dourado           | Fig 51 : Reynold            |
| Fig 21 : Durbate           | Fig 52 : Rosa Type I        |
| Fig 22 : Elavayangan       | Fig 53 : Rosa Type II       |
| Fig 23 : Fernandin         | Fig 54 : Saldad             |
| Fig 24 : Furtad            | Fig 55 : Salgada            |
| Fig 25 : Godgo             | Fig 56 : Salgadin           |
| Fig 26 : Hilario           | Fig 57 : Sakar Ambo         |
| Fig 27 : Irmao Xavier      | Fig 58 : St. Antony Type I  |
| Fig 28 : Jose              | Fig 59 : St. Antony Type II |
| Fig 29 : Jeronimo          | Fig 60 : Sakri              |
| Fig 30 : Jesuit            | Fig 61 : Secretin           |
| Fig 31 : Kala Alphonso     | Fig 62 : Severina           |

Fig 63 : Tanque

Fig 64 : Timoz

Fig 65 : Tokio

Fig 66 : Xavier

Fig 67 : Udgo

Fig 68 : Cardoz Mankurad - A seedling selection

Fig 69 : Prepared scion

Fig 70 : Prepared root stock

Fig 71 : Tied graft

Fig 72 : A successful graft

