

The government of Taiwan is responsible for the small size of the farms in that country. In the early 1950's land reform policies provided the vehicle for redistribution of land. With strong cooperation between government agricultural agents and growers, this program has flourished. It allowed more people to own and enjoy the benefits of land that they worked. Land is considered of great value in this country and is generally handed down from generation to generation. Sometimes it is split up among children. The end result being the reduction of farm size. Three quarters of the farms in Taiwan are smaller than 2.4 acres (7). When it becomes available, land is also costly. Land suitable for carambola growing sells for approximately U.S. \$75,000 per acre.

The small size of the farms is now considered to be an impediment to further agricultural progress. Since mechanization is not cost effective, farmers often have to diversify into non-farm jobs to support themselves. The number of acres of carambolas, 6900, is remarkable when viewed besides the number of farms that would be necessary to make up that figure. Nonetheless, the carambola industry in Taiwan seems very healthy and is apt to continue to be so in the near future.

Discussion

The leading carambola cultivars in Malaysia and Taiwan are large in size (0.7-0.8 lbs.) due to thinning. They are sweet, low acid, fiberless fruits having extended ribs.

These cultivars apparently satisfy their marketing and shipping requirements. It is questionable whether fruits with such large ribs would ship as easily or be as amenable to handling as the 'Arkin'. Then too, there is the question of optimal size for markets. There may be a point at which the fruit is too large to generate the best price per unit of weight.

The methods of growing and marketing carambolas in Malaysia and Taiwan, reflects conditions unique to that part of the world.

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THE NATIVE SUBTROPICAL AND TROPICAL FRUITS IN YUNNAN, CHINA

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Abstract. The background situation of the location, topography, climate, and plant germplasm resources in Yunnan Province of the People's Republic of China is briefly reported. The scientific names, some cultivar names, their distribution and usage of 18 families, 29 genera, and 91 species of subtropical and tropical fruit plants originated from Yunnan and its nearby areas are listed. Of genera and species existing in China, 3 of 4 *Myrica* species, 11 of 17 *Citrus* species, 20 of 42 *Actinidia* species, 8 of 10 *Musa* species, 9 of 11 *Eriobotrya* species, and all 3 species of *Dimocarpus* can be found in the province. There are some specific and important fruits in this area, such as *Citrus hongheensis* Y.L.D.L., *Poncirus polyandra* Ding et al, *Myrica rubra* Sieb., *Eriobotrya bengalensis* (Roxb.) Hook. f., *Actinidia chinensis* Planch., *Dimocarpus logana* Lour., *Dimocarpus yunnanensis* Wu et Ming, *Mangifera persiciforma* Wu et Ming, *Musa acuminata* Colla, and *Musa balbisiana* Colla.

Yunnan Province is situated in southwestern area of the People's Republic of China. It covers an area of 394,000 square kilometers with mountainous areas, hilly lands, and plains respectively taking up 84%, 10%, and 6% of the province's total land area. Yunnan has a long border line with Burma to its west, and with Laos and Vietnam to its south. There is a population of 33.62 million people of 25 different nationalities.

The province is a part of Yun-Gui Plateau with an average elevation of 2,000 meters above sea level. Its topography slopes from the northwest to the southeast, with the highest point of 6,740 meters (Kagebo Peak of Meili Snow Mountains) and the lowest point of 76 meters (Hekou County). It has a complex terrain and vast altitudinal differences.

The climate in Yunnan is of the subtropical highland monsoon type. There are a variety of climatic types, namely the tropical, subtropical, temperate, and frigid regions. There exists a fairly distinct demarcation of the dry season and rainy season. The former spans from November to April while the latter from May to October. The average annual precipitation is about 1,100 mm, 83% of which occurs in the rainy season. The annual temperature difference is slight (about 10-12°C), but daily temperature range can be relatively large (about 12-16°C). Some

places combine climate conditions of the temperate, subtropical, and tropical zones. A local saying goes to the effect that four seasons can be found along the same mountain slope and different weathers can be experienced over a distance of 5 kilometers.

Yunnan is renowned as the 'Kingdom of Plants' due to its amazing variety of plants. There are 15,000 native species of higher plants in this area, accounting for more than half of China's total. The province is also rich in horticultural germplasm resources, including fruit, vegetable,

and ornamental plants. Nearly all kinds of temperate, subtropical, and tropical fruits can be grown in Yunnan. Its apple, pear, pomegranate, ponkan mandarin, mango, red bayberry, and bananas are famous in China. There are many vegetable species and varieties. Yunnan camellia, azalea, magnolia, primrose, lily, cymbidium, rough gentian, and meconopasas are the eight famous ornamental plants. The major native subtropical and tropical fruit plants in Yunnan are listed in Table 1.

Table 1. A list of subtropical and tropical fruits in Yunnan, China.

Scientific Name	Distribution	Usage
A. Rutaceae		
1. <i>Citrus hongheensis</i> Y.L.D.L.	south Yunnan, alt. 800-2,000 m	wild and semi-cultivated, dry young fruit used as medicine.
2. <i>Citrus hystrix</i> DC	south Yunnan, alt. 500-600 m	wild
3. <i>Citrus ichangensis</i> Swingle	north and west Yunnan, alt. 1,700-2,400 m	wild, fruit used as medicine.
4. <i>Citrus medica</i> L.	west and south Yunnan	wild and cultivated
var. <i>sarcodactylis</i> Swingle	west Yunnan	cultivated, medical and ornamental uses.
var. <i>multiensis</i> W.D. et Y.	south Sichuan and north Yunnan, alt. 1,600-2,400 m	cultivated, medical, preserve, and wine-making uses.
var. <i>yunnanensis</i> S.Q. Ding	west Yunnan, alt. 1,500-2,000 m	cultivated, as a rootstock of sweet orange and mandarins.
var. <i>stigmaepersistens</i> Liang et Pen	south Yunnan, alt. 600-800 m	wild and cultivated, fruit as a medicine.
5. <i>Citrus limoni</i> Osbeck	south Yunnan, alt. 500-1,300 m	cultivated, fruit juice used as a vinegar and shapoo, also as rootstock of sweet orange.
6. <i>Citrus aurantifolia</i> Swingle	south Yunnan	cultivated
7. <i>Citrus junos</i> (Sieb.) Tanaka	north Yunnan	wild and cultivated, citrus rootstock and fruit as a medicine
8. <i>Citrus grandis</i> (L.) Osbeck	south and west Yunnan, alt. 300-1,000 m	wild and cultivated, major cvs: Monglen Early, Monghan, Bokaheng, and Mangshailong.
9. <i>Citrus sinensis</i> Osbeck	alt. 100-1,100 m	cultivated, major cvs: Jincheng, Xinhucheng, and several selections.
10. <i>Citrus reticulata</i> Blanco	alt. 600-1,800 m	cultivated, major cvs: Ponkan, Hongju, Niengju, Mitong, Tuju, and Zhoupigan.
11. <i>Citrus sunki</i> Hort. ex Tan.	south Yunnan, alt. 200-1,500 m	wild, as a rootstock.
12. <i>Poncirus polyandra</i> Ding et al	Fumin County, alt. 2,390 m	wild, evergreen, with larger flowers.
13. <i>Clausena lansium</i> (Lour.) Skeels	south Yunnan	cultivated
14. <i>Clausena lenis</i> Drake	south Yunnan	wild
15. <i>Clausena yunnanensis</i> Huang	south Yunnan	wild
16. <i>Clausena indica</i> (Dalz.) Oliv.	south Yunnan	wild
17. <i>Clausena excavata</i> Burm. f.	south Yunnan	wild
18. <i>Clausena ferruginea</i> Huang	southeast Yunnan	wild
19. <i>Clausena emarginata</i> Huang	southeast Yunnan	wild
20. <i>Clausena dentata</i> (Willd.) Roem.	southeast Yunnan	wild
21. <i>Clausena odorata</i> Huang	south Yunnan	wild
B. Myricaceae		
1. <i>Myrica rubra</i> Sieb. & Zucc.	south Yunnan	wild and cultivated, major cvs: Biqizhong, Dongkui, Datangmei, and Dayexiti.
2. <i>Myrica esculenta</i> Buch.-Ham.	south and west Yunnan	wild, fresh fruit.
3. <i>Myrica nana</i> Cheval	central and north Yunnan, alt. 1,700-3,600 m	fresh and processing fruit
C. Rosaceae		
1. <i>Eriobotrya japonica</i> Lindl.	central and south Yunnan	cultivated, major cvs: Dahongpao, Ruantiaobaisha etc.
2. <i>Eriobotrya malipoensis</i> Kuan	south Yunnan, alt. 1,200-1,500 m	wild
3. <i>Eriobotrya prinoides</i> Rehd. & Wils.	south Yunnan, alt. 800-1,700 m	wild
4. <i>Eriobotrya tengyuehensis</i> W. W. Smith	west Yunnan, alt. 1,700-2,500 m	wild
5. <i>Eriobotrya salwinensis</i> Hand.-Mazz.	northwest Yunnan, alt. 1,600-2,400 m	wild
6. <i>Eriobotrya bengalensis</i> (Roxb.) Hook. f.	south Yunnan, alt. 1,000-1,900 m	wild
7. <i>Eriobotrya henryi</i> Nakai	southeast Yunnan, alt. 1,800-2,000 m	wild
8. <i>Eriobotrya seguinii</i> (Levl.) Cardot	southeast Yunnan, alt. 500-1,500 m	wild
9. <i>Eriobotrya delavayi</i> Schneid.	south and west Yunnan	wild
10. <i>Eriobotrya indica</i> (Wall.) Dcne.	south and west Yunnan	wild
D. Sapindaceae		
1. <i>Litch chinensis</i> Sonn	south Yunnan	cultivated, major cvs: Guiwei, Gualu, Feizhixiao, Heiye, etc.
2. <i>Dimocarpus longana</i> Lour.	south Yunnan, alt. 600-1,200 m	cultivated, major cvs: Fuyan, Chiko, Wulongling, Shixia, etc. also wild.
var. <i>magnifolius</i> Lee	southwest Yunnan, alt. 600-1,200 m	wild, fresh fruit

Table 1. Continued

Scientific Name	Distribution	Usage
var. <i>obtus</i> (Pierre) Leenh.	south Yunnan, alt. 300 m	wild, fresh fruit
3. <i>Dimocarpus fumatus</i> (Bl.) Leenh.	south Yunnan, alt. 120-1,000 m	wild
4. <i>Dimocarpus yunnanensis</i> (W. T. Wang) Wu et Ming	south Yunnan, alt. 1,000 m	wild
E. <i>Burseraceae</i>		
1. <i>Canarium album</i> Raeusch	south Yunnan	cultivated
2. <i>Canarium tokinese</i> Engl.	south Yunnan	wild and cultivated
3. <i>Canarium parvum</i> Leenh	south Yunnan, alt. 120-700 m	wild
4. <i>Canarium bengalense</i> Roxb.	south Yunnan, alt. 400-1,300 m	wild
5. <i>Canarium subulatus</i> Guill	south Yunnan, alt. 450-1,500 m	wild
6. <i>Canarium strictum</i> Roxb.	south Yunnan	wild
F. <i>Anacardiaceae</i>		
1. <i>Mangifera indica</i> L.	south and west Yunnan	cultivated, major cvs: Ivory, shannienmang, Thailand, etc.
2. <i>Mangifera persiciformis</i> Wu et Ming	southeast Yunnan	cultivated, fresh fruit and ornamental trees
G. <i>Moraceae</i>		
1. <i>Artocarpus heterophyllus</i> Lam.	south and west Yunnan	cultivated
2. <i>Artocarpus brevisericea</i> Wu et Wang	south Yunnan	wild
3. <i>Ficus tikoua</i> Bur.	south Yunnan	cultivated, fresh fruit
H. <i>Leguminosae</i>		
1. <i>Tamarindus indica</i> L.	south Yunnan	cultivated, sweet and sour types
2. <i>Gleditsia delavay</i> Franch	south Yunnan	wild, with edible seed
I. <i>Cucurbitaceae</i>		
1. <i>Hodgsonia macrocarpa</i> Cogn. var. <i>capnicarpa</i> Trai	south Yunnan, alt. 100-2,000 m	wild, oil seed
J. <i>Musaceae</i>		
1. <i>Musa nana</i> Lour.	south Yunnan, alt. 70-900 m	cultivated, major cvs: Honghejiao, Hekoujiao, Dazhonggaiba, Xiangdajiao, etc.
2. <i>Musa sapientum</i> L.	whole Yunnan, alt. 70-1,800 m	cultivated, major cvs: Niujiaojiao, Xigongjiao, etc.
3. <i>Musa babiliana</i> Colla	south and west Yunnan	wild
4. <i>Musa acuminata</i> Colla	south and west Yunnan	wild
5. <i>Musa itinerans</i> Cheesm	west Yunnan	wild
6. <i>Musa wilsonii</i> Tutch	west and south Yunnan	wild
7. <i>Musa rubra</i> Wall. ex Kurz	southwest Yunnan	wild
8. <i>Musa coccinea</i> Andr.	south Yunnan	wild
9. <i>Ensete glaucum</i> (Roxb.) Cheesm	west and south Yunnan, alt. 800-1,100 m	cultivated and wild
10. <i>Musella lasiocarpa</i> (Fr.) Wu ex Li	central and west Yunnan	cultivated and wild
K. <i>Palmae</i>		
1. <i>Cocos nucifera</i> L.	south Yunnan	cultivated
2. <i>Phoenix hanceana</i> Naud.	south Yunnan	wild
3. <i>Caryota urens</i>	south Yunnan	wild
4. <i>Caryota umbraculifera</i>	south Yunnan	wild
L. <i>Dilleniaceae</i>		
1. <i>Actinidia chinensis</i> Planch	east Yunnan	wild and cultivated
2. <i>Actinidia venosa</i> Rehd.	west Yunnan, alt. 1,000-3,650 m	wild
3. <i>Actinidia callosa</i> Lindl	south Yunnan	wild
4. <i>Actinidia coracea</i> Dunn		
5. <i>Actinidia glauco-callosa</i> Wu		
6. <i>Actinidia henry</i> Dunn		
7. <i>Actinidia holotricha</i> Finet et Gagnep		
8. <i>Actinidia indo-chinensis</i> Merr.		
9. <i>Actinidia kungshanensis</i> Wu et Chen		
10. <i>Actinidia petilotu</i> Diels.		
M. <i>Euphorbiaceae</i>		
1. <i>Phyllanthus acidus</i> Skeels	south Yunnan	wild, fresh and processing
N. <i>Passifloraceae</i>		
1. <i>Passiflora cupiformis</i> Mast.		wild
2. <i>Passiflora henryi</i> Hemsl.		wild
O. <i>Sapotaceae</i>		

Table 1. Continued

Scientific Name	Distribution	Usage
1. <i>Synsepalum dulcificum</i> (Sch.) Donnell		wild
<i>P. Ebenaceae</i>		
1. <i>Diospyros kaki</i> L.f.	whole Yunnan, alt. 800-2,300 m	cultivated, major cvs: Water, Fire, Niouxinshi, etc.
2. <i>Diospyros lotus</i> L.	central Yunnan	cultivated, fresh and dry fruit, also as the rootstock of persimmon
3. <i>Diospyros cathayensis</i> Seward		wild
4. <i>Diospyros mollifolia</i> Rehd. et Wils		wild
<i>Q. Rhamnaceae</i>		
1. <i>Zizyphus jujuba</i> Mill	central Yunnan	cultivated, major cvs: Kanpian, Xiaozhao
2. <i>Zizyphus montana</i> W. W. Smith	north Yunnan, alt. 2,600 m	wild
3. <i>Zizyphus mauritiana</i> Lamk	west Yunnan	wild
4. <i>Zizyphus incurva</i> Roxb.	west Yunnan	wild
5. <i>Zizyphus rugosa</i> Lamk.	west Yunnan	wild
6. <i>Zizyphus oenoplia</i> Mill	west Yunnan	wild
7. <i>Hovenia dulcis</i> Thunb.	central Yunnan	cultivated, fresh and wine-making uses
<i>R. Punicaceae</i>		
1. <i>Punica granatus</i> L.	central and north Yunnan	cultivated, Tianluzhi, Lupi, Huahongpi, Shuiginzhi, etc.

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'TIKAL', AN EARLY-MATURING SAPODILLA CULTIVAR

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Abstract. In 1949 a quantity of sapodilla (*Manilkara zapota* (L.) van Royen) seed was received at the University of Florida Tropical Research and Education Center from Mexico. Trees grown from the seed were planted in the field in 1951 and began to bear fruit 6 to 8 years later. One of the trees bears fruit of good quality which consistently matures from late December to March, significantly earlier than most sapodilla selections in Florida. The fruit is ellipsoid in shape and varies in weight from 80 to 325 g, averaging about 120 g. External color is light brown and the fruit surface is smooth. The pulp is light tan in color and has excellent flavor and smooth texture. The selection was given the name 'Tikal' and planted at several locations in southern Florida for trial. Field observations indicate that grafted trees bear good yields of fruit regularly. The fruit is less susceptible to Caribbean fruit fly infestation than the cultivar 'Prolific'. The earliness, productivity and good quality of the 'Tikal' sapodilla make it desirable for planting in areas where the sapodilla is well adapted.

The sapodilla, *Manilkara zapota*, is a tropical fruit which grows exceptionally well in the limestone soils of southern Florida. It is used as an ornamental tree as well as a source of edible fruit. The species was introduced to Florida in colonial times.

Sapodilla was among the first trees to be planted at the University of Florida Tropical Research and Education Center, Homestead (TREC) when it was established in 1930, and many introductions have been made subsequently (2, 5). The cultivar, Tikal, is a result of this introduction program.

Origin

In 1949 John Martin Reinecke sent to TREC a small quantity of sapodilla seed from a selection called 'Campeche', which he had found in Yucatan, Mexico. Trees were grown from the seed and planted in the field in 1951. Routine care included watering while the trees were small, light fertilizer applications and some protection from frost by oil-burning grove heaters. Observations were made periodically on tree growth, time of first fruiting, fruit production, fruit quality and time of ripening. The trees bore their first fruit in 6 to 8 years after planting.

One tree, which fruited first in 1959, attracted attention because of its heavy fruit production and the fact that the fruit matured from December through March, much earlier than fruit of other sapodilla trees in the area, which mature their main crop from April or May through August or September. The good production and earliness of the selection indicated value as a cultivar for Florida, so it was propagated and given the name 'Tikal' at the suggestion of Dr. Wilson Popenoe. Tikal is an ancient Mayan city which now exists as ruins in Guatemala. Giving this name to a sapodilla cultivar recognizes the importance of the

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