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## MANGO AND AVOCADO EVALUATION IN SOUTHEASTERN FLORIDA

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### ABSTRACT

The work with mango and avocado germ plasm at the U. S. Plant Introduction Station, Miami, has involved introduced cultivars and seedling populations derived from introductions. Dependable productivity and disease resistance are of first importance, as are horticultural quality and extension of the season of ripening at both ends. In addition, cold tolerance is an objective with the avocados. Few introduced cultivars of either crop are sufficiently attractive in all respects to justify extensive cultivation, but can be valuable in specialized situations and as parents. Outstanding seedling selections are under test and this aspect of the work shows promise.

### INTRODUCTION

At the U.S. Plant Introduction Station, work on mango (*Mangifera indica* L.) and avocado (*Persea Americana* Mill.) dates from 1923 when the first fruit trees were established on the present site with budwood or seeds from the older Government Plant Introduction Garden in Miami. Among the material first planted were old mango introductions, including a grafted tree of the 'Cambodiana' (P.I. 11645) and a number of seedlings of this introduction that show evidence of cross-breeding with Indian and possibly other recently introduced cultivars then growing in southeastern Florida.

Avocado cultivars collected in Guatemala by Wilson Popenoe during World War I are among those that were established soon after the Plant Introduction Station on Old Cutler Road began operations. Seeds of Mexican race avocados were sent from the Brooksville Plant Introduction Garden of the U.S. Department of Agriculture, to be used at Miami as rootstocks. Years later, one of these rootstock plants recovered and fruited after a hurricane twisted away the 'Ward' top that had been grafted on it. Because of its earliness and hardiness this tree was retained, and dubbed 'Brooksville'. It has been the parent of seedlings evaluated for germ plasm quality (3).

Introductions of potentially useful fruit tree cultivars have continued from the establishment of the station to the present time. Foreign introductions have been examined for their own horticultural quality and also as sources of germ plasm. A number of objectives have motivated the evaluators. Among these are 1) extension of ripening season to obtain earlier and later-ripening cultivars than those presently available; 2) uncovering sources of disease resistance; 3) obtaining more dependably productive material, less prone to alternate high and low cropping than are currently

available cultivars; 4) discovering sources of cold tolerance; and 5) comparing potentially useful material with cultivars of commercial importance in Florida. Disease resistance has included field resistance to pathogens that prevent fruit set or destroy young, developing fruit as well as resistance to organisms that cause early destruction of ripe fruit and thus shorten its shelf life. Cold tolerance, in the case of avocados, has involved actual resistance of stem and leaf tissue to temperatures below freezing. Mangos show much less infraspecific variation in response of external tissues to cold than do avocados, but vary in the degree of resistance of the flowers and young fruit to such long-range effects of low temperature as seedlessness and small "shot fruit" or "golf balls" (3).

## PROCEDURES AND RESULTS

About a dozen years ago a program of evaluation of seedling populations of subtropical fruit species was initiated. Since then several hundred mango and avocado seedlings have been planted, and the evaluation of resultant populations is currently in progress. Because of the difficulty of obtaining seed of both these species from hand pollination, seedlings from open-pollination were grown. Because both species are adapted to crosspollination when their breeding systems function normally (2, 5), the resultant populations show a high degree of heterozygosity.

Four mango cultivars were used as parents of the first seedlings planted: three were so-called "Saigon seedlings" that showed obvious mixture with other types, and the fourth was a cultivar from Hawaii, 'Ono' (P.I. 75269). All the parent trees were prominent for earliness, disease resistance, and (with one exception) bright-colored fruit. The exception (M-13269) was a tree that bears attractive, disease-free yellow fruit. Seedlings from two outstanding trees that were selected from the first populations planted, M-20220 and M-20221, have been employed as seed parents to some extent during the past three years.

The first avocado cultivars used as parents were 'Arue' (P.I. 99805) and 'Capac' (P.I. 53895), the latter one of Wilson Popenoe's introductions from the Chota Valley of Ecuador. Although neither of these clones is of outstanding commercial value, both have the property of off-season flowering in Florida, to produce fruit that matures very early in the season. A cultivar combining off-season production with high fruit quality would be of obvious value.

Another group of avocados derived from seeds of 'Taylor' (P.I. 26710) grown in a mixed planting with 'Lula'. Both of these cultivars are of the same ("A") flowering type. More recent plantings have included seedlings of 'Itzamna' (P.I. 55736, a very late-maturing introduction of Wilson Popenoe from Guatemala, still used as a commercial cultivar in South Africa), 'Dunedin' (M-3896), another late ripening clone, and 'Brooksville' (M-18686). The last-named entity was selected because, as was earlier noted, it is early-ripening and very resistant to cold damage; however its fruit is small, thin and dark-skinned, and prone to anthracnose fungus infection although of excellent flavor.

The information reported here derives from observations of the seedling material that has fruited to date. Based upon these observations we conclude that the mango and

avocado material we have tested is highly heterozygous. Since many of the variants noted are markedly different from the trees of the original parent stock, they afford a confirmation of out-crossing as the breeding system for both crops as has been previously reported (2, 5). Bergh and Storey's (1) success in obtaining inter-racial avocado hybrids from open-pollinated parents in mixed plantings, has already established the soundness of this method for avocado breeding. Our results would indicate a similar feasibility for mango breeding.

Seedlings of "Saigon seedling" mango parentage have been much more precocious than those of 'Ono' or of the Indian-type cultivars commonly planted in Florida. Inasmuch as the "Saigon seedling" populations are highly heterozygous for fruit and tree characters, these cultivars make better prospective parents than others that do not transmit precocity.

Judging from their low percentage in the open pollinated seedling mango populations, individuals showing a pure light yellow, unblushed fruit must represent the homozygous recessive condition of genes for external fruit color, i.e. light yellow must be recessive to blushed fruit in *Mangifera indica*. Inasmuch as relatively few seedlings have brightly blushed or entirely red fruit, this trait may depend upon modifiers inherited independently of the character (s) determining a blushed exterior, i.e. fruit color in the mango very probably is inherited quantitatively, as are many of the characters of fruit plants.

In the case of avocados, seedlings of the Mexican race and those of mixed Mexican-West Indian origin are more precocious than those of Guatemalan or mixed Guatemalan origin. External fruit color in avocado is quite possibly inherited quantitatively, as Bergh (2) indicates, but where one parent is dark-colored a high proportion of the offspring may be expected to be dark-colored also. The off-season flowering shown by both 'Arue' and 'Capac' must be genetically recessive inasmuch as only a few of their seedlings show this trait (Both the 'Arue' and 'Capac' parent trees grew close to other cultivars that do not flower off season) .

Although both 'Taylor' and 'Lula' are of the same ("A") flowering type, a significant proportion of the 'Taylor' seedlings are of a phenotype that strongly resembles that of 'Lula' (including marked scab susceptibility!). Thus crossing between the two cultivars can occur under South Central Florida conditions (Highlands County) despite their being of the same flowering type.

Avocado seedlings from a hardy parent, open pollinated, have shown above-average tolerance of artificially imposed freezing conditions (4). This promising group, on which evaluation is not complete, comprises seedlings of the 'Brooksville' Mexican (M-18686) cross-pollinated by other, non-Mexican cultivars. Each season more of the Mexican hybrid seedlings enter production and it is evident that, given a large population, one can make selections of value as parents and also as cultivars for cooler parts of Florida. The parent Mexican tree is surrounded by a mixed lot of West Indian, Guatemalan and hybrid cultivars, and the seedlings show much variation in vegetative characters. The most precocious seedlings, which by definition were the first ones to commence bearing, showed a mixture of West Indian and Mexican characters: fruit ripened early in the season, and was thin and smooth-skinned. Less precocious individuals, of which a

number first fruited in 1971, show Guatemalan racial characters in having thicker, rougher skins (apparently more resistant to anthracnose spotting) than the first seedlings to fruit, and in ripening somewhat later in season (as late as November 1). The majority of these seedlings have dark-skinned, brown or black fruit, but a few have skins of a dark marbled grey-green that approaches the color of 'Fuerte'.

## **CONCLUSION**

Short descriptions of a group of mango and avocado cultivars and seedling selections will conclude this paper. We gratefully acknowledge the aid of Dr. F. D. Yenning and Julia F. Morton, who during the 1971 season helped evaluate the fruit of mango seedling selections in comparison with fruit of three cultivars ('Haden', 'Kensington,' and 'Tommy Atkins'). All fruit was identified by number only, and the comments of these experienced and sensitive evaluators afforded valuable information to supplement and compare with our own conclusions, arrived at over the past several years. The descriptions follow.

## **MANGO**

'Janardhan Pasand', P.I. 269286: Small (130 grams) bright red fruit, very sweet, excellent texture, poor anthracnose resistance. A light cropper in Florida though it blooms heavily, paralleling its behavior in Northern India (6).

'Kensington', M-18409: Large (500 g), attractively blushed, anthracnose-resistant fruit similar to 'Haden' in flavor and texture. Precocious and dependably productive. Polyembryonic. Early. Deserves limited commercial trial.

'Langra', P.I. 266057: Medium-sized fruit (300 g) of a greenish-yellow color considerably spotted with anthracnose under Florida conditions. Very sweet "coconut-like" flavor. Late season.

M-13269: cultivar that originated on U.S. Plant Introduction Station, Miami. Small to medium-sized fruit (275 g), bright yellow color, clean and anthracnose-resistant. Sprightly, sweet and non-resinous flavor. The latest-maturing fruit may be more fibrous than the rest of the crop. A regular, dependable cropper that would serve well as a dooryard variety. Season, second early.

M-19448: second-generation "Saigon seedling" that originated on Station. Medium-sized fruit (350 g), bright red, of fairly pronounced flavor, highly attractive. Fine flesh texture. May tend to alternate though trees vary. Definitely a potential for home, and possibly commercial planting. Late midseason.

M-20218: seedling selection originating on Station. Large (580 g), light pink-blushed fruit of an unusually pleasant somewhat acid flavor. Not a heavy producer but has potential as a fine-flavored cultivar for a home collection. Late midseason.

M-20220: Station seedling selection. Medium-sized fruit (350 g), of a beautiful yellow washed red. Very mild, almost bland flavor, with fine texture. Clean, attractive and free of disease. Potential parent of dependably productive varieties, and possibly a cultivar

for home planting. Midseason.

M-20222: Station seedling selection. Medium-sized fruit (350 g) of a bright red-blushed color with a sweet, mild flavor. Tends to alternate in Florida but crops well in Southern California and is being tried there commercially, on a small scale. Polyembryonic. Midseason (Fla.), late (Calif.).

'Padari', P.I. 269287: Large (420 g), dependably productive precocious cultivar with unattractive greenish-yellow fruit, very sweet and with pronounced aroma. May have potential as a parent of productive cultivars. Late-midseason.

'Pope', M-18410: Large (550 g) dark red fruit of very fine texture and sweet flavor. Flowers very heavily in Florida but sets few fruit because severely attacked by powdery mildew. Anthracnose also attacks fruit. Not recommended for Florida, but may do well in an island situation.

'Rumani', P.I. 269738: Medium-sized (370 g) dull yellowish-orange fruit of a flattened-rounded shape, prone to anthracnose infection. Flavor bland and coconut-like. Not recommended for Florida.

'Totapuri', P.I. 269283: Large (724 g) elongate fruit of dull color, resembling 'Sandersha'. Of low quality but a regular, heavy bearer of fruit suitable for processing. Has a commercial potential where a dependable supply of fruit is wanted for processing. Late-midseason.

'Tyler Premier', P.I. 275486: Large (800 g) unusually rounded, grapefruit shaped mango of a rich yellow color, clean and resistant to anthracnose. Very smooth texture and juicy but tends to be tart-flavored in Florida. Deserves trial in a warmer, drier climate. Early midseason.

'Vanraj', P.I. 269682: Large (500 g) attractively red-blushed fruit. Precocious and a regular producer but often attacked by anthracnose and usually have very tart-flavored fruit under Florida conditions. Recommended for trial in hot, dry climates. Late (Keitt season). A potential parent of lateripening cultivars.

## **AVOCADO**

M-18941: Flower type A. Seedling of 'Arue' selected at Plant Introduction Station. Mediumsized (420-540 g) bright glossy-green fruit of very regular ovate shape, with slightly pebbled surface. Season 15 Nov. 1 Jan. Attractive fruit with somewhat bland flavor and buttery texture. May tend toward alternate bearing, but deserves further trial.

'Borrego', P.L 281922: Type A. Large (625-725 g) attractive bright green slightly crescent-shaped fruit. Season 1 Oct. 15 Nov. Small tree, productive. Attractive butter-yellow internal color and excellent rich flavor commend it for home planting and possibly for commercial test planting. Fruit is larger than the U.S. market prefers.

'Catalina', P.I. 281923: Type A. Large (550-800 g), attractive bright-green fruit with large seed and slightly irregular shape. Season 1 Oct. 20 Nov. Flesh somewhat fibrous, flavor slightly bland. Limited commercial plantings have been made in Florida.

'D.W.I. Bank', M-19767: Large (650-825 g) rounded fruit with somewhat oily texture and

bland flavor, and a dark red skin color. Season 15 Sept. 15 Oct. (Cropping has been light to date; more time is needed for evaluation.) Because of its color the commercial possibilities are slight.

'He de France', M-19332: Medium-sized (500-575 g) attractive light green fruit of ovate shape. Season 1 Sept. 1 Oct. Nutlike, buttery flavor Deserves limited commercial trial as well as home planting.

'Lima Late', M-20034: Type B. Large (850 g) green fruit, very rough-textured, ripening late in season (after mid-November). Probably could not compete successfully with more attractive cultivars such as Choquette.

'Melendez 2', M-19770: Type B. Medium large (650-750 g), bright glossy green fruit, ovate in shape with slightly pebbled surface, very attractive. Season 15 Nov. 1 Jan. May have commercial possibilities; deserves limited trial.

'Tenerife', P.I. 259464: Type B. Large (625-725 g) green fruit. Season 15 Nov. 15 Dec. moderately rough skin texture. Commercial possibilities may be slight because better cultivars ripen at this season.

'Tensen', P.I. 234281: Type A. Medium-sized (525-750 g) irregular-shaped fruit, green mottled with brown. Season 15 Sept. 1 Nov. Resists fungus diseases well. Useful for home planting but too poorly shaped and colored for commercial planting.

## LITERATURE CITED

1. Bergh, B. O. and Storey, W. B. 1964. Character segregation in avocado racial-hybrid progenies. Calif. Avo. Soc. Yrbk. 48: 61-70.
2. Bergh, B. O. 1969. Avocado, p. 23-51 In Outlines of perennial crop breeding in the tropics. Misc. Papers 4, Landbouwhogeschool, Wageningen, The Netherlands.
3. Knight, R. J., Jr. 1971. Breeding for cold hardiness in subtropical fruits. HortScience 6(2): 157-160.
4. Manis, W. E. and Knight, R. J., Jr. 1967. Avocado germ plasm evaluation: technique used in screening for cold tolerance. Proc. Fla. State Hort. Soc. 80: 387-391.
5. Singh, L. B. 1969. Mango, p. 309-327 In Outlines of perennial crop breeding in the tropics. Misc. Papers 4, Landbouwhogeschool, Wageningen, The Netherlands.
6. Singh, R. N., Majumder, P. K., and Sharma, D. K. 1965. Studies on the bearing behaviour of some South Indian varieties of mango under North Indian conditions, Trop. Agric. (Trinidad) 42(2):171-174.