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Breeding and Selection of Jackfruit for South Florida

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Abstract. The jackfruit has been under investigation and development at Fairchild Tropical Garden since 1987. The program has focused on the conservation of genetic resources, generic promotion and the development of viable cultivars for use in estate and patio agriculture in South Florida. A modest breeding effort was initiated in 1995 in conjunction with studies on the hand pollination of jackfruit. Reciprocal crosses were made among a subset of the core genetic collections. Cultivars were selected for inclusion in the project based on precocity and productivity and the fruit quality traits of aroma, edible percentage, flesh firmness, color and flavor. 'Black Gold', 'Cheena', 'Dang Rasimi', 'Galaxy', 'Golden Nugget', 'Honey Gold', 'Lemon Gold', 'J-30', 'J-31', 'NS-1' and 'Tabouey' were used. Controlled crosses were made over 2 fruiting seasons, seed was collected and 15 seedlings of each cross were planted at the USDA-ARS Subtropical Horticultural Research Unit-Chapman Field. The total seedling population was 600 trees. Evaluations began in 2003 with the objective of the selection of superior jackfruit cultivars for South Florida estate and patio gardening.

The jackfruit (Artocarpus heterophyllus Lam.) has been a focus of the Tropical Fruit Program of Fairchild Tropical Botanic Garden (FTBG) since 1987 (Campbell and Ledesma, 2003). Research efforts have been directed into the introduction and evaluation of cultivars from Tropical Asia and the distribution of superior cultivars for use in Tropical America. Studies into the breeding system of jackfruit were initiated in 1995 with a joint project funded by the Florida Department of Agriculture and Consumer Services and the Tropical Fruit Growers of South Florida. Studies included reciprocal crosses of superior Asian cultivars conserved within the FTBG genetic collection. Progeny of these crosses were planted in the field beginning in 1996. The objective of this paper is to report on the current status of this project for the selection of new cultivars for estate agriculture in South Florida.

Controlled Crosses. Jackfruit are monoecious, producing separate male and female inflorescences on a single tree (Fig 1). In South Florida their breeding system is characterized as insect-assisted wind pollinated (El-Sawa et al., 2003). Beetles, ants and other insects are attracted to the male inflorescences, where they physically dislodge the pollen, which is transported on the wind to the receptive female inflorescence. Controlled crosses were initiated in the 1995

blooming season. Inflorescences were bagged upon emergence from their protective stipules. Pollen was transferred from the male to the female inflorescence by physically rubbing the male to dislodge the pollen and immediately transferring it to a receptive female inflorescence. Inflorescences remained bagged except when pollen was transferred. The procedure was conducted every other day for 1 week or more to insure complete fertilization of the female inflorescence. Complete fertilization resulted in uniform fruit with 200 to 450 seeds per fruit depending on the cultivar. The bags were left covering the developing fruit until the fruit split the bags open, about 2 months after pollination. Additional crosses were made in 1998 and 1999 following the same procedure, modified by the use of a small brush to transfer pollen from the male to the female inflorescence.

Seed removal and planting. Fruit of controlled crosses were harvested at maturity and the seeds were removed and immediately sown in seedling trays. A 1:1:1 soil mix with equal parts of peat, sand and perlite was used. Fifteen healthy seedlings were randomly selected from each cross after germination and potted in 1-gal containers. Seedlings were grown to a height of 3 ft and planted in the field at the USDA-ARS Subtropical Horticultural Research Unit, located in Miami, FL. Trees were planted at a spacing of 2 m between rows and 1 m in the row.

Care of the Trees. Trees were maintained according to standard commercial care programs developed for jackfruit in South Florida. The irrigation system for the planting was damaged when the trees were installed rendering the system non-functional. Of the original population of more than 600 trees, about 400 trees are remaining. There was no correlation between the cross and drought tolerance.

Evaluation and Preliminary Selection. Evaluations of tree and fruit characters have been conducted over the past 2 fruiting seasons (Fig. 2). Few differences have been noted in tree vigor or growth habit, with the exception of ‘Honey Gold’ and ‘Cochin’ progeny, both of which have a generally weak growth habit. This result is independent of the male parent used in the cross. These progeny could hold promise as dwarf selections, but given the bearing habit and fruiting potential of the jackfruit, this trait was considered undesirable. A vigorous, healthy growth habit is important with jackfruit given the considerable production capacity of the tree. Thinning is necessary to avoid dieback and even death in young jackfruit trees or in trees maintained at a small size through annual pruning. Seedling jackfruit trees are routinely used for commercial production in South Florida. Fruiting is common in less than 5 years, and often earlier. For the controlled crosses in this study, fruiting began on 3 seedling trees within 2 years of planting. Within 3 years there were 15 trees producing fruit and in the 4^{th} year there are more than 70 of the 400 trees in production.

Desirable external characteristics include a fruit size of 10 to 15 lb, a uniform shape and smooth skin surface. Internal quality characteristics of interest are a firm, crunchy flesh, deep yellow or orange flesh color and light, non-musky flavor. External appearance of the fruit is similar among the seedling population. The only obvious difference among the seedlings is in the overall size of the fruit, shape and color of the spines. Color differences among the seedlings are in shades of green and the presence or absence of a russet over-color. Preliminary results have shown excellent internal quality characteristics of many of the crosses; however, it is premature to draw conclusions.

Conclusions

The jackfruit has considerable potential for commercial and home garden production in South Florida. Preliminary results show promise for the development of superior cultivars for Florida agriculture; however, given the similar external and internal fruit characteristics among the seedlings, there may be a lack of diversity among the cultivars used for crosses. A recent genetic analysis of the FTBG collection has identified areas of interest for increasing the diversity of the collection (Schnell et al. 2001).

Literature Cited

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Figure 1. Female (A) and male (B) inflorescence of jackfruit.
Figure 2. Evaluations of controlled crosses.

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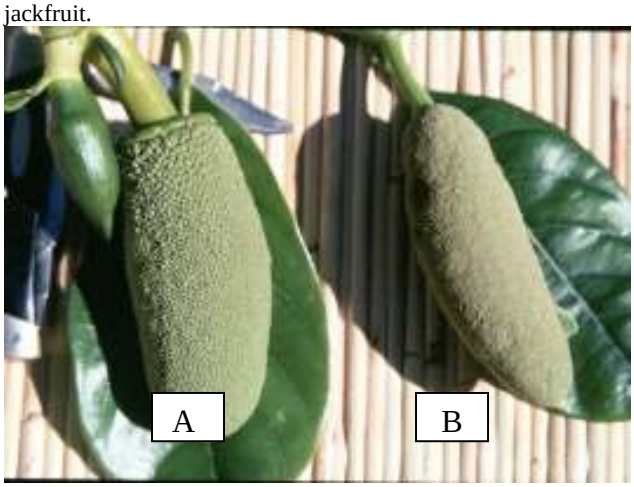

Figure 2 . Evaluations of controlled crosses.