Progress Report on the Unfruitfulness of the Minneola Tangelo

BY

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Tangelos are hybrids of the tangerine or mandarin orange *(Citrus reticulata)* with either the grapefruit or pummelo *(C. paradisi* and *C. grandis)* (Webber and Batchelor, 1948). The different varieties vary somewhat in size, shape, skin color, and flavor. The Minneola variety is considered an excellent fruit due to its fine flavor, few seeds, attractive color and good shipping quality. It resembles the Temple orange in shape, size, and color.

Individual Minneola trees in mixed citrus plantings are reputed to be quite productive; however, solid plantings of Minneolas have not produced adequate crops. It is well known that numerous factors, either alone or in combination, will effect fruit set. An investigation of some of the factors which may effect Minneola fruit set is in progress at the Univertiy of Miami.

Reference will first be made to some aspects of the investigation which have already been published in detail. Butcher (1955) has shown that honey bees as pollinating insects do have a beneficial effect on Minneola fruit set but of insufficient magnitude to provide an adequate explanation for the overall problem. Lynch and Mustard (1955) reported that the solution of the problem is not one of nitrogen, phosphorus, or potash nutrition, although some increase in yield was noted with an increase in nitrogen level. The latter workers also reported negative results from the use of boron as foliar and flower sprays.

The hypothesis that self-unfruitfulness might be an important factor in the low crop yields of solid plantings of Minneolas seemed tenable because of the similarity of the problem to that sometimes encountered in solid plantings of other fruit and the fact that some tangelo are known to be self-sterile (Webber and Batchelor, 1948).

It has been noted in some other species of citrus (Webber and Batchelor, 1948) that self-pollination may be inhibited by the maturation of the stamens and shedding of pollen before the stigmas become receptive. In the case of the Minneola tangelo this is not the case as the anthers begin to dehisce just prior to or at the time of opening of the flower. The stigma at this time has secreted stigmatic fluid and, as

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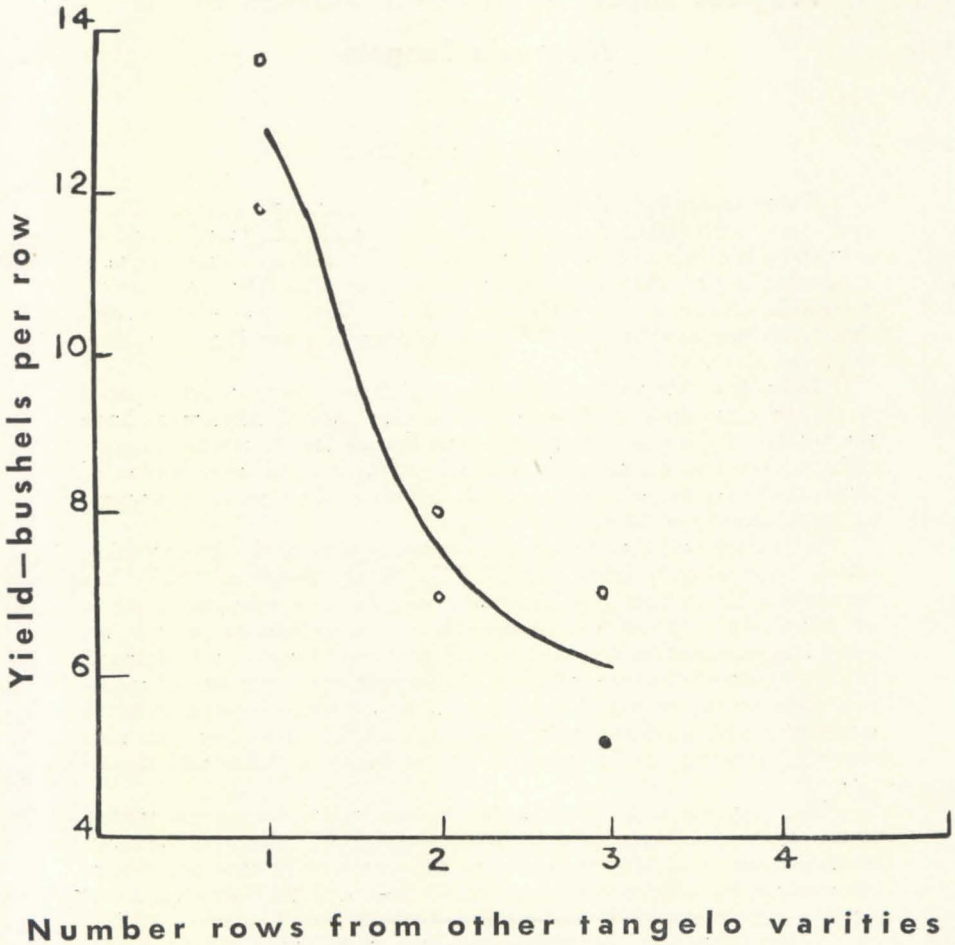

Fig. 1 Number of rows from other tangelo varieties and yield in bushels per row.

will be shown later, is receptive to pollen. The anthers are so located with reference to the stigma that there is adequate opportunity for self-pollination.

The viability of Minneola pollen and that used for cross-pollination on the Minneola was checked using the below medium. (1) It was found that Minneola pollen is somemhat less viable than Lake and Seminole tangelo pollen and develops shorter pollen tubes than are developed by the other two tangelo varieties.

A comparison of the total length of the stigma and styles of Minneola, Seminole, and Lake tangelos showed that the Minneola stigma and styles are approximately nine percent longer than those of the other two varieties.

Histological work completed to date shows no other morphological abnormalities to which the failure to set fruit on the Minneola might be attributed.

In order to determine the effect of cross-pollination on fruit set of the Minneola the writer, in the spring of 1955, hand-pollinated a number of Minneola flowers with Seminole and Lake pollen. Well developed, unopened buds of the varieties to be used as pollen sources were collected and allowed to dry in a warm room for a couple of days. Under these conditions the anthers dehisced making abundant pollen available for cross-pollination. Approximately 200 Minneola buds which were about to open but which had not begun to shed pollen were emasculated by running a scalpel around the base of the bud removing the petals and stamens. The Seminole and Lake pollen was applied by dusting it from the dehisced anthers onto the receptive sticky stigmas of the emasculated Minneola flowers. All excess buds and open flowers adjacent to the cross-pollinated flowers were removed, then the pollinated flowers were bagged. In the case of the self-pollinated Minneolas, no emasculation was done; instead, the buds which were about to open were bagged after the removal of all adjacent flowers and buds. The bags were removed from the flowers after approximately three weeks, and counts made of the number of set fruit. In those instances where fruit had set, the bags were replaced by 12 × 12 inch cheesecloth squares.

The results of this pollination work is summarized in Table I. It will be noted from these data that no Minneola flowers set fruit when self-pollinated, whereas, 18.9% and 9.3% set fruit when the flowers were cross-pollinated with Seminole and Lake pollen respectively. Subsequent shedding was greater in the case of the Minneolas which had been pollinated with Lake pollen than in those pollinated with Seminole pollen. At maturity, the Minneolas pollinated with Seminole pollen were found to contain an average of 39.8 seeds per fruit; whereas, no seeds were found in those pollinated with Lake pollen.

A check was made on the average number of seeds in mature fruit resulting from open pollination. Fruit from the Minneola block,

1. Checked by hanging drop technique using 20% sucrose media. After 24 or 48 hours storage at room temperature, percentage germination and average pollen tube length determined for representative fields of each hanging drop slide.

three rows from a row of Seminole trees, were found to contain 3.6 seeds per fruit, whereas mature fruit from a Minneola tree located adjacent to a number of other types of citrus contained 16.1 seeds per fruit. It seems of value to note that the latter tree bore a heavy crop as compared to those born by the individual trees in the solid Minneola planting which were the same age and which received comparable cultural treatment.

TABLE I. Effect of Pollen Source on Fruit Set of Minneola Tangelos

VARIETY	Nº of Flowers Pollinated	Percent Set	Percent Reaching Maturity	Nº Seeds Per Fruit	
				Average	Range
Minneola X Lake	107	9.3	2.8	0	—
Minneola X Seminole	106	18.9	16.0	39.8 + (4.2)★	53-31
Minneola X Minneola	91	0	0	—	—

★ Figure in parenthesis is the average number of aborted seeds per fruit.

Yield records were taken on a block of Minneolas consisting of six rows of thirteen trees each having a single row of Seminoles on one side of the block and several rows of Lake tangelos on the other. These yield data are summarized in Figure I. A. marked increase in yield with decreased distance from either of these pollen sources was noted.

From these observations it would seem tenable to conclude that Minneola fruit set can be increased by providing for cross-pollination.

Based on these data, plans are now being made to topwork some of the Minneola trees in the solid planting to a suitable pollinizer. Additional hand-pollinations have just been made to compare Valencia orange, Pinneapple orange, and Seminole tangelos as potential pollinizers for use in topworking these trees. The exact topworking or planting plan best suited to Minneola plantings has not yet been determined but it would seem that one in which no Minneola tree would be more than two or possibly three rows from the pollinizer would be desirable.

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