tended the few selfings made.

The more than 3-fold increase in seed production from crossing over that from selfing (table 2) must represent genuine differences in the number of pollen grains effecting fertilization, as an effort was made to cover all stigmas thoroughly and uniformly in this work. A critical threshold number of fertilizations, approximating the number of seeds obtained from selfing, may be required for fruit to set. However if this threshold exists it apparently does not always operate since one fruit was found to contain only 13 seeds, and one seedless fruit, similar to the "hollow" fruit reported from Hawaii (3), was obtained this season. The partial breakdown of stigmatic inhibition of the pollen tube's growth within group II apparently does not result from segregation in heterozygous genotypes. If this were the case fertilization and contingent fruit set would result regularly, rather than only occasionally, from intra-group pollinations.

The present work was done on a few clones derived from 2 foreign introductions, each presumably a progeny of siblings, and 1 clone (3-32) obtained in Florida. Present data support the existence of 2 incompatibility groups (table 2). Until a larger sample is examined, it cannot be assumed that only 2 incompatibility groups exist in the species. Obviously additional information is desirable on the inheritance of incompatibility and any possible loss of incompatibility in seedlings from self-pollinated parent plants. Such work may be delayed by the expense inherent in raising plants which require as much space as does this passionvine.

The nearly-total absence of hymenopterous pollen vectors from the *Passiflora* plots at the Miami Station during the entire spring and summer of 1962 may be largely responsible for the low set of fruit from open pollinations (table 1). Research on means of attracting and encouraging the multiplication of carpenter bees as recommended for Hawaii (2) might be rewarding. Investigation of pollination of *Passiflora edulis* in its native area (Brazil, Paraguay and northern Argentina) should answer the question of the advisability of introducing pollen vectors other than Hymenopterids already present in Florida and Hawaii.

Since dependable production is directly contingent upon a high percentage of compatible pollinations, fully self-compatible clones of yellow passionfruit, if obtainable, would be of value provided this trait were combined with other essential characteristics.

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HERBICIDE TRIALS WITH YOUNG TROPICAL AND SUBTROPICAL FRUIT AND NUT TREES

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Numerous reports have discussed the effects of various herbicides on several of the horticultural crops of the tropics and subtropics, but little information is available about the response of evergreen fruit trees other than citrus. During evaluation of several introduced fruit crops it became desirable to determine those species which might safely be maintained as young plants in areas where herbicides are used. The purpose of the studies reported here was to determine whether herbicides could be used during the first season of growth in the field, when extensive hand weeding would otherwise be required for satisfactory maintenance.

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MATERIALS AND METHODS

Experiments in two previous seasons demonstrated that diuron (3-(3,4-dichlorophenyl)-1, 1-dimethyl urea) and atrazine (2-chloro-4-ethylamino-6-isopropylamino-s-triazine) provided satisfactory control of native weeds in plantings of 3- and 4-year-old mangos. Both materials at a rate of about 5 pounds active ingredient per acre inhibited weed growth for 6 or more weeks under heavy rainfall or irrigation. Tests using various types of herbicides led to recognition of

these two materials as generally satisfactory for weed control in older plantings of several species at this station. To study their effects on the growth rate of newly planted fruit trees the experiments reported herein were conducted in the spring and summer of 1962, using seedlings grown from seeds planted in 1961.

Seven species were transplanted to the field in March for the first test. They were arranged in a randomized complete block design in a sandy soil which originally had an oolitic limestone base at a depth of about 6 inches. The soil had been scarified to a depth of 16 inches several months before planting, and limestone was distributed throughout the surface sand. At the time of planting the soil had a pH of about 7. Herbicide treatments were applied on the day after transplanting, after water had been applied for 6 hours with overhead sprinklers. The treatments consisted of control, diuron, atrazine and one treatment in which the two herbicides were combined. The materials were applied at the rate of 5 pounds active ingredient per acre when used alone and of 3 pounds of each when they were used in combination. The chemicals were applied in 200 gallons of water per acre with a fan-type nozzle operated at the lowest pressure which would produce uniform dispersion of the spray. The plants were watered thoroughly at 2-day intervals for a week after planting and thereafter at approximately 4-day intervals for the next 3 weeks. At that time watering was reduced to 2 inches of water at weekly intervals when rainfall was insufficient to supply that amount.

Stem diameters were measured 4 inches above ground level when the plants were placed in the field, and again after 5 months. The per cent increase was calculated from the 2 sets of measurements, and the increase in stem diameter was used as a growth index for determining treatment effects.

Within 1 month after treatment plants of *Dovyalis abyssinica* (A. Rich) Warb. and *Averrhoa carambola* L. showed prominent symptoms of injury in plots where atrazine was applied. A few mango plants also showed faint leaf clearing patterns associated with the atrazine treatments. When these preliminary observations indicated that atrazine would prove toxic to several species, further testing of diuron was considered desirable. To provide a more precise indication of the effects of diuron upon mango, avocado, lychee and macadamia, the species of most interest in the first trial, a second experiment was initiated. With only diuron-treated and control plots, the general procedure of the first experiment was repeated by applying treatments in the same manner to plants which had been set in the field at approximately the same time as those used in the first experiment. In this second trial the second set of stem diameter measurements was recorded in mid-September, 4 months after treatment.

Results and Discussion

The data in Table 1 indicate a significant growth depression by atrazine applied to plots containing *Dovyalis abyssinica* and *Averrhoa carambola*. Since the growth-index figures for the combination treatment containing 3 pounds of atrazine are intermediate between those for atrazine treatment and control there is a suggestion that depression of growth of these 2 species is proportional to atrazine concentration.

Both these species showed symptoms of injury by atrazine approximately 3 weeks after treatment. Most *Dovyalis abyssinica* plants were completely defoliated after 6 weeks. Before abscission the leaves showed injury by a progressive loss of chlorophyll, originating at the margins and advancing to the center of the leaf.

Averrhoa carambola leaves showed loss of chlorophyll only at the margins, and leaf abscission was not pronounced. Leaves which did drop were in all cases older ones on the lower branches. In contrast with their reaction to atrazine both these species tolerated diuron without evidence of injury, and their appearance was actually superior to that of control plants when diuron was applied. The mean growth index was higher than that of controls by a non-significant amount in the plots where weed growth was controlled by diuron. The results of this test offer tentative evidence that diuron may be safely used at rates sufficient to control weeds encountered in southern Florida, in plantings of these species. However since atrazine proved decidedly toxic its use should be avoided where *Dovyalis abyssinica* or *Averrhoa carambola* is planted.

With the other species tested there were no significant differences between controls and plants receiving any of the herbicidal spray treatments in either experiment. The atrazine treatment means in the first experiment were in most cases nonsignificantly lower than those for other treatments and for the controls. Both mango and avocado showed significantly higher growth rates for the diuron-atrazine combination treatment when this was contrasted with atrazine alone.

Table 1. Percent mean stem diameter increases during 5 months, following diuron or atrazine applications to young trees.

SPECIES	Diuron (5 lbs/A.)	Atrazine (5 lbs/A.)	Diuron (3 lbs/A.) + atrazine (3 lbs/A.)	Control	Coefficient of variation
Litchi chinensis	38.3 a[1]	29.1 a	29.3 a	42.3 a	74
Mangifera indica	104.2 a	84.9 a	141.9 b	115.6 a	23
Dovyalis abyssinica	44.3 b	4.7 a	11.0 ab	42.9 b	25
Persea americana	53.0 ab	26.3 a	65.6 b	37.0 ab	14
Averrhoa carambola	108.6 c	26.6 a	61.3 ab	87.6 bc	9
Eugenia dombeyii	46.0 a	24.3 a	39.3 a	32.3 a	18
Macadamia ternifolia	33.3 a	33.6 a	41.3 a	27.7 a	19

[1] Means for each species not followed by the same letter are significantly different.

These results suggest that it would be desirable to test the treatments used in the first experiment in more extensively replicated trials, and thus to estimate all the effects more precisely. The results of the experiments reported define satisfactorily treatments which can or cannot be utilized to replace hand weeding in young plants of the species tested, but they do not identify treatments which would promote optimum growth.

Table 2. Per cent mean stem diameter increases during 4 months, following diuron applications to young trees.

SPECIES	Diuron (5 lbs/A.)	Control	Coefficient of variation (per cent)
Litchi chinensis	56.2	59.8	15
Mangifera indica	51.2	40.1	18
Persea americana	25.1	33.0	23
Macadamia ternifolia	23.6	24.7	14

In the second experiment with diuron only, no significant differences were indicated for any of the 4 species included. As indicated in Table 2, replication was sufficient to indicate treatment effects with considerable precision. The combined results of these 2 experiments suggest therefore that young plants such as those in these tests may be protected from weed competition by a diuron application at the time of planting or as soon thereafter as it appears desirable.

These experiments did not investigate the effects of repeated herbicide applications. While repeated use of chemical treatment of weeds and soil for protection of the young plants would be convenient and economical, the conventional methods of mowing and occasional hand cultivation are satisfactory after the plants become established and start growth. Further tests are in progress, however, to determine whether diuron sprays can be utilized safely at approximately 3-month intervals during the first season of growth and thus make other methods of weed control unnecessary.