Table 1

Seed germination, radicle growth, and lysis of the seeds as influenced by an exposure to the indicated temperature for 168 hours.*

Temperature (°F)	Percent Germination	Average Radicle Length (mm)	Percent of Seeds Rooted
41.0	0	-	-
44.5	0	-	-
47.5	0	-	-
50.75	0	-	-
53.75	40	1.0	-
56.75	78	4.5	-
60.0	100	7.0	-
62.75	100	13.5	-
65.75	100	15.0	-
68.50	100	15.5	-
71.25	100	20.0	-
74.0	100	19.7	-
77.0	89	22.0	11
79.75	100	15.0	-
82.75	100	17.0	-
85.25	100	8.8	-
88.0	67	9.2	22
90.5	22	7.0	56
93.0	0	-	44
95.5	0	-	78
98.0	0	-	78

*The data were taken from the same experiment as Part A of Figure 1.

SUMMARY

Using a temperature gradient apparatus, a critical study was undertaken of the influence of temperature on the germination of Okinawa peach seeds. When seeds, preconditioned so that temperature was the limiting factor for germination, were subjected to various temperatures, it was found that Okinawa peach seeds would germinate over a rather broad temperature range from approximately 50° to 95° F. However, the resulting seedlings from the seeds germinated in this broad spectrum of temperatures were found to differ widely in their capacity for growth. In general, the growth capacity of the seedlings was decreased markedly by a temperature greater than 78° F. during the period of germination. Accompanying the decrease in the growth capacity of the seeds exposed to warm temperatures was an increased vulnerability to invasion by organisms which caused seed-rot.

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PAPAYA FRUIT FLY CONTROL

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The papaya fruit fly, *Toxotrypana curvicauda* Gerstaecker, is a serious pest of the papaya in Florida, making control measures a frequent necessity. The species apparently exists throughout the Caribbean countries wherever papayas are grown. Control measures, however, are generally not practiced, although it is often a serious pest. Although the fly is prevalent at all seasons and breeds continuously, it is much more abundant in some seasons than in others, and in some areas more than in others. In Cuba it is usually more prevalent in the dry than in the rainy season, according to Acuña and de Zayas (1946). Papaya fruit is the obligate host of the papaya fruit fly; although larvae are occasionally found in mango fruit, they seldom or never develop to maturity therein.

Thick fleshed varieties are infested less frequently than fruit with thin flesh. Selection and production of varieties having thick flesh were recommended by Knab and Yothers (1914) for reducing fly infestations. All fruit in the younger stages, however, is thin fleshed and is easier for the fly to penetrate for oviposition. Removal and destruction of all infested fruit before the larvae mature and emerge to pupate in the soil surface have been recommended as a control measure.

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Bait sprays composed of brown sugar-molasses-lead arsenate materials applied as fine mists were recommended as control measures by Mason (1922). Such baits were seldom used, however, owing to the danger of burning foliage and to the ineffectiveness of such treatments. Mason (1922) recommended covering the plants with cheesecloth or mosquito netting as a means for reducing injury. Covering of individual fruits with paper bags was advocated by Mason (1922) and Brogdon and Wolfenbarger (1955). Coverings of trees and fruits with mechanical barriers (nettings and paper bags) require repeated attention, which is sometimes almost impractical. The use of DDT, 2 pounds 50 W per 100 gallons water, was suggested by Brogdon and Wolfenbarger (1955), Harkness (1955) and Stambaugh (1955).

Soil Treatments

Since mature fruit fly larvae leave the fruit and enter the soil to pupate, it seemed possible that insecticides applied to the soil surface might be an effective means of control. Two experiments were conducted in which insecticides were applied to plots, one yard square, in randomized blocks. These insecticides were scattered over the soil surfaces, on each of four replications. Infested or possibly infested fruits were placed on each plot in approximately equal amounts. Screen cages were placed over the plots to catch the emerging flies. The results are given in Tables 1 and 2.

June-August Experiment—A summary of the results of one test is given in Table 1.

October-January Experiment—A summary of the second test is given in Table 2.

It is evident from the data in Tables 1 and 2 that the soil treatments were ineffective in control of the papaya fruit fly. Apparently some method of control other than by soil treatment must be used.

Table 1. Average number of papaya fruit flies that emerged from treated plots.

Material Name	Lbs./A. tech.	Flies caught per sq. yd.
Check	--	2.3
Heptachlor, 10 G	5	13.5
Aldrin, 20 G	5	16.3
DDT, 50 W	10	16.5
Phosphamidon 5 G	5	22.0
Dieldrin, 10 G	5	40.5

Table 2. Average number of papaya fruit flies that emerged from treated plots.

Material Name	Lbs./A. tech.	Flies caught per sq. yd.
Aldrin, 20 G	5	12.3
Dieldrin, 10 G	5	29.8
Di-Syston, 10 G	5	40.8
Endrin, 5 G	5	48.0
Check	-	49.3
Heptachlor, 10 G	5	52.5

Fruit Treatments

Although mechanical coverings and DDT syraps have been used successfully for control of the papaya fruit fly, definitive evaluations of the treatments appear not to have been obtained previously. Such treatments and evaluations may require several months or years of time unless very large plantings are available for experimental use.

Single plant treatments were used in the tests herein described, with from 4 to 6 replications of each treatment. Treatments were randomized in each replication.

Mechanical and spray coverage treatments were used in the tests summarized in Tables 4 and 5. Mechanical coverages were applied weekly, or as needed, to cover the young fruit. Spray applications were made every two weeks, except during cool periods of the dry seasons, in which they were made at 3 to 4 week intervals.

Mechanical barrier treatments consisted of the following:

Bags-Brown paper (Kraft) sizes of 3 and 5 pounds were used; Glassine, sime-opaque, 7 x 9 inches

Sheets,—made into rolls with diameters of about 3 inches or large enough to enclose the fruit and tied at one end, then slipped over a fruit with the other end tied around the fruit peduncle.

Newspapers—Cut to about 12 x 15 inches

Plastic, a clear to semi-opaque material, cut to sheets about 15 x 15 inches in size.

Paper strips (skirts)—Newspapers, 3 to 4 sheets in thickness, of about 23½ x 15 inches, cut into 1 to 1½ inch strips

except for a supporting portion at the folder section. This was in effect a skirt with freely movable fringes. These were placed around the plants to enclose the fruit below the blossoms.

Spray barrier treatments consisted of two materials, DDT 50 W, 2 pounds per 100 gallons of water, and Savin, 50 W at 2 and 3 pounds per 100 gallons of water. A surfactant, Plyac, was used with the insecticides at the rate of 1 pint per 100 gallons of water to increase wetting of the waxy fruit covering.

In presenting the results, Tables 3, 4 and 5, the number of infested fruit was placed as the numerator and the number of possible total infested fruit was placed as the denominator. These figures were converted to percentages to show comparative results.

Experiment in 1959—A test was conducted in 1959 using mechanical or physical barriers placed over the fruit and gave the results summarized in Table 3.

All treatments were effective in reducing the infestation, compared with the check.

Experiment in 1960—DDT was added to the test in 1960 for comparison with other treatments and gave results summarized in Table 4.

All treatments were effective in reducing the infestations, compared with the check.

Experiment in 1961—Savin was added to the test in 1961, for comparisons with other treatments, with the results summarized in Table 5. All treatments gave reductions of infested fruit compared with the check. The two mechanical barriers were more effective than were the spray mixtures. A higher population level of flies was evident among plants in the above test than in plants in previous tests. Although the plants were sprayed during the blooming period, there was no evidence of any fruit yield reduction.

Results and Discussion.—Mechanical barriers, as well as spray applications, were effective in reducing fruit injury caused by the fruit fly. Soil treatments, however, were ineffective in reducing fly populations.

The five-pound size of brown paper bag was preferable to the three-pound. Such bags are more convenient to use and are more resistant to rain and to irrigation water than are newspaper rolls. Newspaper rolls are more economical than the heavier paper bags and are also satisfactory. Glassine bags were also satisfactory although less

Table 3. Papaya fruit fly infested fruit from different treatments.

Treatment	Bags			Sheets		Check
	Glassine	Brown paper				
		Large	Small	Plastic	Newspaper	
% infested	0	0	5	0	0	28

Table 4. Papaya fruit fly infested fruit from different treatments.

Treatment	Bags		Sheets		DDT	Check
	Glassine	Brown paper	Plastic	Newspaper	Spray	
% infested	0.06	0	0.06	0.08	0.07	11.87

Table 5. Papaya fruit fly infested fruit from different treatments.

Treatment	Bags	Sheets	Spray			Check
	Brown paper	Newspaper	DDT, 2	Sevin, 2	Sevin, 3	
% infested	3	7	32	40	31	41

economical than newspaper rolls or brown paper bags. Plastic sheet enclosures resulted in "scalding" of the fruit. Paper strips (skirts) were satisfactory in plantings where there were low fly populations.

DDT sprays also were effective in plantings where there were low fly populations. At higher population levels, however, spray treatments were less effective than were the mechanical barriers (Table 5).

Difficulties are often encountered in getting paper bags tied over the fruit, owing to short fruit peduncles on some plants, which make enclosures more difficult. Fruit is sometimes clustered so closely that it is difficult to tie the bags. Scale insects, *Aspidiotus destructor sign.* and *Coccus hesperidium* (Linn.), and the papaya webworm. *Homalopalpia dalera* Dyar, occasionally become more abundant on bagged fruit than on unbagged fruit.

DDT was effective where the fly population levels were low (Table 5). All treatments tended to be more ineffective where the fly population levels were high. DDT has been observed to fail, as reported by Harkness (1960), and may be attributed to high population levels of the fly.

Recommendations.—Sanitation through detection, removal and destruction of infested fruit is a primary recommendation. Bagging is recommended if the labor involved is excessive. If labor for bagging the individual fruits is impractical, often DDT sprays may be used effectively. Sulfur is recommended for use with DDT since it assists in controlling the papaya whitefly, *Trialeurodes variabilis* Quaintance, and it may add to the effectiveness of the DDT. From 2 to 4 pounds of DDT, 50 W combined with 8 pounds of wettable sulfur per 100 gallons of water, is recommended.

SUMMARY

Soil Treatments were ineffective in reducing papaya fruit fly emergence. The fruit was successfully protected by mechanical and spray coverings. Paper coverings, bags and newspapers were effective and are recommended where plantings are small and infestation is abundant. Spray applications of DDT 50 W, 2 to 4 pounds per 100 gallons of water, are recommended for a large planting or where the fly population level is low.

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A PROGRESS REPORT ON SOME MANGO HYBRIDS

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The better quality mangos brought from India and other countries, over the years, have not been very successful in southern Florida. Being susceptible to climatic influence these monoembryonic varieties are readily upset in fruiting by adverse weather conditions at the time of blooming. Natural hybrids have been derived from them but, by the light of present day standards, most of them have been disappointing. On the other hand the polyembryonic Philippine (Pico) has been very successful in growth, and prolific in fruiting, in the humid climate of southern Florida and the West Indies. It has become the favorite mango of Latin America. Despite these good qualities the Philippine mango has not been generally accepted in southern Florida, due chiefly to its small size—12-14 oz.

Notwithstanding the large number of mango varieties introduced from other countries, and the large number of mediocre seedlings produced from them, we seem to be still waiting for the ideal mango to turn up from chance seedlings. Certainly we do need better varieties if we are to build a profitable mango industry in southern Florida, but they will have to be created under some measure of control, with some thought given to the qualities desired, and to the source from which these qualities may be obtained.

Peter J. Wester, for many years in charge of the U.S.D.A. Exp. Sta. in the Philippine Islands, and a student of the mango, suggested hybridizing the prolific, high quality Philippine with the bright colored East Indian mango. This suggestion was carried out by Edward Simmonds, at that time in charge of the U.S.D.A. Plant In-