(P-model). The P-model uses knowledge of the physics of the lower atmosphere to set up cooling equations and solve these for future temperatures at the key stations. The P-model extrapolates from the past through the present into the future. The forecaster can help the P-model by forecasting changes in some of the inputs and asking the model to take these into consideration in its forecast. The P-model promises with such refinements and more experience to become a more interesting component of SFFS.

The space model (S-model) uses these data and the current satellite view to build the future or predicted map after the P-model predicts the future temperatures at key stations. The S-model uses historical data concerning the tendency for the cold temperature patterns to be similar from one frost to another (3) to construct the predicted map. The S-model promises to become more refined as more maps are collected and archived in the SFFS memory banks.

IFAS/Climatology has a great interest in continued refinement of the models that provide the predictive feature of SFFS; consequently, it will continue to seek ways to improve the models.

The Key Stations. Ten key stations are operated over the peninsula during the frost season. These now have microprocessors that automate the communication of their sensings to SFFS. Currently, the sensings consist of 3 air temperatures, 3 soil temperatures (one being the surface), and an average wind speed. Net radiation is sampled on 4 of the 10 towers. Shielded net pyrradiometers were used prior to this frost season and required frequent maintenance. Ventilated pyrradiometers of the Gier-Dunkle type will be used in their stead in many locations this season.

Lack of uniformity in the quality of the telephone lines and switching mechanisms through which data flow from key stations to SFFS computer reduces reliability of data acquisition. Automated acquisition remains superior to that of formerly used voice communications and dependence upon volunteer observers.

Automated communication of data from the key stations to the HP computer controlling SFFS and instruments at the stations have problems yet to be solved but the concept of acquiring weather data for predictive models in agriculture has been convincingly demonstrated. It is only a matter of time (and perhaps some additional effort) until key stations of this type will remain in place throughout the year and support several programs in addition to the SFFS, not the least of which are the IPM (Integrated Pest Management) programs.

Changes in SFFS over 3.5 years of development have cost time but resulted in improvement. Recent changes have added flexibility and reliability. Extension of the thermal maps beyond the NWS forecasters, while part of the SFFS concept from its beginning, is one of the most recent improvements.

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TEMIK ALDICARB FOR CONTROL OF PESTS ON FLORIDA CITRUS[1]

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Abstract. **The efficacy of 5 and 10 lb. AI rates per acre (5.6 and 11.2 kg/ha) of granular aldicarb chiselled in or broadcast and disked into the soil was evaluated for control of mite and insect pests of citrus. Its effectiveness against citrus rust mite, spider mites, aphids, whitefly, and mealybug suggests that aldicarb would provide the Florida grower with multiple pest control benefits.**

Various formulations of Temik™ aldicarb had been evaluated in the United States for a decade prior to 1976 to determine its effectiveness for control of insects and mites attacking citrus (2, 3, 4, 5, 6, 8, 11, 12, 13, 14, 15).

The decision, in that year, to manufacture a single granular formulation plus the development of a mechanical method of applying the granules provided a standardized treatment procedure for all investigators to use in their test work.

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The purpose of the investigations reported here was to determine the performance of aldicarb at different rates and methods of application to soils of orange groves in the Indian River area for 4 successive seasons, 1976-1979.

Materials and Methods

Aldicarb, as a Temik™ 15G formulated on corn cob grits, was used throughout these investigations. The material was applied for 4 successive years on March 30, 1976, March 30, 1977, April 4, 1978 and April 4, 1979 to a block of 'Valencia' orange trees at Gates grove. Trees were planted in 1964 on a double-bed scheme with a 21 x 30-foot spacing on the bed and 27 feet across ditches.

In all years, a 5 and 10 lb. AI/acre (5.6 and 11.2 kg/ha) rate of Temik was evaluated except for the 5 lb. AI/acre rate only in 1979. Treatments were replicated 5 times in a completely randomized block design. Each plot was 0.13 acre in size and contained 10 trees.

A second location, at Strazzulla grove, planted to 'Valencia' orange trees in 1960 on a 4-row-bed scheme with a 15 x 27½-foot spacing on the bed, was treated in March 1979. Two-acre plots were replicated 4 times in this commercial application.

The application equipment consisted of 3 electric-driven Gandy™ granular applicators mounted on a tool bar behind the tractor. Granules were either broadcast and incorporated or were chiselled in. The first method required plots to be disked prior to treatment. The granules were delivered through 6 banders spaced at 12-inch intervals on the applicator in a 5-foot-wide band at the dripline on both sides of the tree row. Granules were then incorporated to a 3-inch depth with a disc. The second method delivered the granules into self-closing cuts in the turf produced by modified discs (chisels) spaced 12 inches apart across the 5-foot-wide band at the edge of the dripline on both sides of the tree row.

The experimental area was mowed prior to treatment applications in 1976 but was not mowed in preparation for treatments in subsequent years. The applicator was off-set on the tool bar after the first year so that the treatment band extended 18 inches beneath the tree canopy.

Fruit and foliage were monitored periodically for pest populations during the growing season. Citrus rust mite (*Phyllocoptruta oleivora* (Ashmead)) populations were determined by searching a 10X lensfield at 2 sites on the surface of 10 fruit randomly selected while circling the 6 interior trees of each plot. Fruit stems and 'buttons' of a similar sample were searched for citrus mealybug (*Planococcus citri* (Risso)). Citrus whitefly (*Dialeurodes citri* (Ashmead)) was determined from harvested spring flush leaves examined in the laboratory under a binocular microscope.

Spider mite populations were determined on randomly harvested leaves preserved in 50% *alcohol, processed* through a Millipore™ filter system, and counted with the aid of a binocular microscope in the laboratory.

Surveys for the spirea aphid (*Aphis citricola* Van der Goot) were conducted after complete petal fall by examining 20 randomly selected fruit on 5 alternate trees in the 2 center rows of each plot. A total of 1600 fruit per treatment was inspected.

Fruit injury was determined with the aid of a 2 ft² frame positioned at a height of 6 ft on the perimeter of the tree canopy. All the fruit within the square was rated for peel russet. For each treatment, a frame count was made in each quadrant of 60 trees.

Results and Discussion

Neither rates nor methods of application of aldicarb significantly influenced the control of citrus whitefly and spider mite 6 weeks after treatment during 1976 (Table 1). All aldicarb-treated plots had insect populations lower than non-treated plots. Control of citrus rust mite on fruit and foliage was excellent at 13 weeks and remained lower than the untreated plots 17 weeks after aldicarb application.

In 1977, chisel applications of aldicarb at the less-than-recommended rates of 3.3 and 6.6 lbs/acre (3.7 and 7.4 kg/ha) had significantly lower numbers of whitefly and Texas citrus mite (*Eutetranychus banksi* (McGregor)) than in untreated plots (Table 2). Fewer citrus rust mite were present on fruit and foliage of trees in treated plots as compared with control plots.

In 1978, low aldicarb rates for both methods of application significantly controlled whitefly and mealybug for 8 weeks and rust mite for 11 weeks after treatment when compared to untreated plots (Table 3).

In 1979, both application methods were equal in their ability to deliver a single rate of aldicarb that provided significantly better control of rust mite at 10 weeks post-treatment as compared to untreated plots (Table 4).

The chisel application used in the commercial treatment of Strazzulla grove (Table 5) provided significantly better control of aphids and rust mite as well as more blemish-free fruit than untreated plots.

Soil application of aldicarb controlled citrus rust mite in our tests for 8 weeks or longer. Selhime et al., (11) reported effective control for 16 weeks in the field and French and Timmer (7) obtained 3 months or more control before a miticide spray was required. Our population pressure was

Table 1. Control of whiteflies, spider mites and rust mites with aldicarb soil treatments (Gates Grove, St. Lucie County, 1976).

Treatment	Rate per acre	Application method	White-fly^z	Spider mite^z	Rust mite infestation, Weeks after treatment: 12 Leaves	12 Fruit	17 Leaves	17 Fruit
	(Lbs. AI)		number		%			
Temik 15G	5	broadcast band-disked	4.8 a^y	0	2	3 a	12	23 a
Temik 15G	10	broadcast band-disked	0.8 a	0	1	3 a	6	24 a
Temik 15G	5	chisel	2.6 a	0	1	6 a	5	30 a
Temik 15G	10	chisel	0.8 a	0	2	4 a	5	19 a
Untreated	0	—	14.4 b	3.6	50	60 b	43	67 b

^yMean separation within columns by Duncan's multiple range test, 5% level.
^zMean number per leaf 6 weeks after treatment.

Table 2. Control of whiteflies, spider mites and rust mites with aldicarb soil treatment (Gates Grove, St. Lucie County, 1977).

Treatment	Rate per acre	Application method	White-fly[z]	Texas mite[z]	Red mite[z]	Rust mite Leaf	Rust mite Fruit
	(Lbs. AI)		number			%	
Temik 15G	5	broadcast band-disked	1.3ab[y]	5.2b	1.6	2[x]	2
Temik 15G	10	broadcast band-disked	1.2ab	3.3ab	1.2	1	2
Temik 15G	3.3	chisel	0.8a	1.5a	0.8		0
Temik 15G	6.6	chisel	0.7a	1.3a	0.5	0	1
Untreated	0	—	1.8b	9.7c	0.6	19	14

[z]Mean number per leaf 8 weeks after treatment.
[y]Mean separation within columns by Duncan's multiple range test, 5% level.
[x]Infested leaves or fruit 8 weeks after treatment.

Table 3. Control of whiteflies, mealybugs and rust mites with aldicarb soil treatments (Gates Grove, St. Lucie County, 1978).

Treatment	Rate per acre	Application method	Whitefly[z]	Mealybug[x]	Rust mite[w] Weeks after treatment: 11	Rust mite[w] Weeks after treatment: 19
	(Lbs. AI)		number	%		
Temik 15G	5	broadcast band-disked	0.8 a[y]	8 a	1	11
Temik 15G	10	broadcast band-disked	0.3 a	7 a	0	8
Temik 15G	5	chisel	0.2 a	8 a	1	7
Temik 15G	10	chisel	0.2 a	8 a	0	6
Untreated	0	—	1.8 b	35 b	45	11

[z]Mean number per leaf 8 weeks after treatment.
[y]Mean separation within columns by Duncan's multiple range test, 5% level.
[x]Infested fruit 8 weeks after treatment.
[w]Infested fruit.

Table 4. Control of citrus rust mites with aldicarb soil treatments (Gates Grove, St. Lucie County, 1979).

Treatment	Rate per acre	Application method	Rust mite weeks pre- and post-treatment: −1	+5	+10	+17
	(Lbs. AI)					
Temik 15G	5	broadcast band-disked	3.83[z]	0.01a[y]	0.11a	0.01
Temik 15G	5	chisel	3.24	0.00a	0.04a	0.01
Untreated	0		2.08	0.95b	0.53b	0.04

[z]Mite population density in 1.2 cm^2 lensfield on fruit.
[y]Mean separation within columns by Duncan's multiple range test, 5% level.

Table 5. Control of aphids and citrus rust mites with aldicarb soil treatments (Strazzulla Grove, St. Lucie County, 1979).

Treatment	Rate per acre	Application method	Aphids	Rust mite, weeks after treatment 4: Fruit	4: Density	12: Fruit	12: Density	% Russet Fruit
	(Lbs. AI)		%	%		%		
Temik 15G	5	chisel	1.5[z]	2	0.1[x]	14	0.37	0.6
Untreated	0		20.2	77	5.5	99	29.40	16.8
			*[y]		*		*	*

[z]Infested stems and fruit at complete petal-fall.
[y](*) Mean separation within columns at 5% level.
[x]Mite population density in 1.2 cm^2 lensfield on fruit.

severe enough only in the Strazzulla grove to require spraying.

Our population of citrus whitefly, citrus mealybug, and Texas citrus mite were significantly reduced for at least 8 weeks. Boling and Dean (3) had reported control or Texas citrus mite in nursery trees.

Excellent protection of tender foliage from spirea aphid attack in young plantings was obtained by Tashiro et al. (15) and Brooks (4). Aldicarb will protect mature trees, also.

The low rate of Temik aldicarb gave effective control of rust mite, whitefly, mealybug, aphid, and Texas mite. No significant differences in insect or mite control were observed due to method or application except for the superior performance of the chisel treatment vs. Texas citrus mite in 1977 (Table 2).

The potential of aldicarb to control citrus thrips (15, 16), citrus red mite (2, 11, 12, 13, 14, 15), armored scale (3, 5, 15), soft scale (3, 8), leaf miner (1), the citrus weevil *Diaprepes abbreviatus* (10), and disease vectors (6, 9) has been investigated in the United States and abroad.

Our investigations confirm the performance of aldicarb as a control agent for rust mite, Texas mite, and aphids and provides evidence of control for whitefly and mealybug on citrus.

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HISTORY AND ESTABLISHMENT OF THE PARASITE, PROSPALTELLA LAHORENSIS, FOR THE BIOLOGICAL CONTROL OF CITRUS WHITEFLY IN CENTRAL FLORIDA[1]

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Abstract. **The hymenopterous parasite,** Prospaltella lahorensis **Howard was introduced into central Florida in the fall of 1977 and winter of 1978 for the biological control of the citrus whitefly. By the fall of 1978, the parasite was well established in the Lakeland-Auburndale area on citrus and ornamental plants. During 1979-80, the parasite dispersed rapidly throughout Polk County, Florida, to approximately 50 km from the original release sites. Parasitization ranged 0.0-8.2% on host plants sampled within the 50 km radius of the release sites in 1980. Within 13 km of the release sites parasitization exceeded 30%. Parasitization and frequency of parasite recovery were highest in commercial citrus indicating minimum effect on survival from conventional horticultural practices. Although results are encouraging it is premature to assess the degree of biological control to be achieved by the introduction of** P. lahorensis **on commercial citrus.**

The citrus whitefly, *Dialeurodes citri* (Ashmead) has been found singly or coexisting with the cloudy-winged whitefly, *Dialeurodes citrifolii* (Morgan) and a few lesser important whitefly species in all citrus-growing regions of Florida (5, 12). It is native to countries of southeast Asia but is found in virtually all citrus-growing areas of the world (7). In the United States, it is distributed throughout most states inhabiting citrus and numerous introduced and native ornamental plants (7).

Citrus whitefly was probably introduced into Florida in the northern part of St. Johns County circa 1880 (7). Withstanding severe freezes from 1890-1900, it emerged as a major citrus pest at the turn of the century. Over a period of six years, reduction of yield due to whitefly nymphal feeding and its subsequent effect on tree vitality were re-

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