Gas chromatography was performed on a Varian model 1200 equipped with a tritium electron capture detector, a 1.8 meter x 2 mm I.D. glass column packed with 10% DC-200 operated at 210°C with a carrier flow of 60 ml/min.

Results and Discussion

Table 1 illustrates that high recoveries were obtained throughout a wide range of spiked sample concentrations.

Table 1. Recoveries of fortified control Valencia orange peel and pulp.[z]

Sample	Fortification	% Recovery
Peel	0.00 ppm	—
"	0.05	90
"	0.10	71
"	0.25	76
"	0.50	80
"	1.0	82
"	2.0	85
"	4.0	84
"	8.0	82
Pulp	0.00	—
"	0.05	87
"	0.10	80
"	0.25	86
"	0.50	94

[z]Average of 3 separate determinations.

Table 2 presents the residues observed in the control and treated 'Valencia' oranges. The edible portion exhibited a maximum of 0.17 ppm (0 week, 1000 ppm), while the peel of this sample was also the highest (6.8 ppm). Storage time at 4.4°C had a pronounced effect on the 2,4-D levels observed, a steady decline being evident. Also, as expected, the 1000 ppm treatment produced consistently higher residues than did the 500 ppm. At no time did the recommended concn of 500 ppm give residues in either part of the orange above the listed 5 ppm tolerance.

Table 2. 2,4-D residues in Valencia oranges following a half-minute dip.[z,y]

Storage	Pulp		Peel	
	500 ppm	1000 ppm	500 ppm	1000 ppm
0 week	0.042 ppm	0.170 ppm	1.9 ppm	6.8 ppm
8	0.015	0.041	1.0	4.4
10	0.010	0.044	1.1	4.1

[z]Average of two separate determinations.
[y]Average RSD of duplicates 7.7%.

Note that the label for postharvest use on citrus fruits generally, i.e. over and beyond the traditional use solely on lemons, was on a "24(c) state label," thus restricting its use to the state of Florida.

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WEED CONTROL PRACTICES IN THE INDIAN RIVER CITRUS AREA[1]

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Abstract. **Forty-one growers representing 32,070 ha (79,249 acres) of citrus in Indian River, St. Lucie, Martin and Palm Beach counties were interviewed and 13,456 ha (33,250 acres) of groves were inventoried in 1976 to determine current weed control practices and their effects on weed populations. All growers used some type of rotary mower as the primary means of weed control in middles between tree rows. A sickle bar mower was the most common type of mechanical equipment for under-tree weed control. Three growers had never used herbicides, 16 were on a regular program, 18 were using chemicals to a limited extent, 4 had stopped for various reasons and only 10 applied them to their entire acreage. A combination of bromacil and diuron with additives applied once or twice a year was the most common herbicide treatment. The weed control program generally received a low priority in the production schedule, and many aspects were therefore erratic. There was no standard under-tree weed control program and the timing of mechanical cultivation was not consistent. Herbicide applications were not always adequate and many groves required supplemental mowing. Hand labor was usually necessary for vine control regardless of the type of weed control program. Improper timing of herbicide applications is the major problem in most weed control programs.**

Weed control is an important component of the production program for citrus grown on poorly drained soils in the Indian River (I.R.) area (3). Tree rooting depth is limited, necessitating planting on shaped, raised beds and increasing the probability of moisture stress (4, 5). Much of the land was previously planted in torpedograss, bermudagrass, bahiagrass or pangolagrass (Table 1) for pasture, and weed control programs have been hampered by the presence of these and other problem weeds and vines (1, 4). Suitable mechanical equipment is limited due to the shallow rooting depth and bed slope (2). The prevalence of certain perennial, herbicide-tolerant weed species, variable soil types and the need to maintain a sod to minimize water and wind erosion are constraints upon the use of chemical weed control (6, 7, 9). Reduced availability of hand labor and increasing costs of mechanical and chemical methods have

[1]This research was conducted as partial requirement for a Master of Science degree.

Table 1. Common[z] and scientific names of some weed species[y] encountered in certain Indian River citrus groves.

Common name	Scientific name
	Grasses
Torpedograss	*Panicum repens* L.
Bermudagrass	*Cynodon dactylon* (L.) Pers.
Bahiagrass	*Paspalum notatum* Fluegge
Guineagrass	*Panicum maximum* Jacq.
Vaseygrass	*Paspalum urvillei* Steud.
Pangolagrass	*Digitaria decumbens* Stent.
Paragrass	*Panicum purpurascens* Raddi
	Broadleaf weeds
Spanishneedles	*Bidens pilosa* L.
Lantana	*Lantana camara* L.
Common ragweed	*Ambrosia artemisiifolia* L.
Southern sida (Teaweed)[x]	*Sida acuta* Burm.
	Vines
Balsamapple	*Momordica charantia* L.
Virginia creeper	*Parthenocissus quinquefolia* L.
Peppervine	*Ampelopsis arborea* L.
Moon vine	*Ipomoea alba* L.
Muscadine grape	*Vitis rotundifolia* Michx.
	V. munsoniana Simpson ex. Mims
Narrow-leaf milkweed vine	*Cynanchum scoparium* Nutt.
Dewberry (Blackberry)[x]	*Rubus trivialis* Michx.
Milkweed vine[x]	*Morrenia odorata* Lindl.

[z]Common names accepted by the Weed Science Society of America.
[y]Species most commonly encountered in survey.
[x]Local common names.

made weed control more expensive. The present study was undertaken to assess the status of weed control in commercial citrus groves in the I.R. area.

Materials and Methods

A survey conducted in April to June, 1976 consisted of grower interviews to ascertain basic weed control programs and grove inspections to determine weed populations. Frequency of weed species within populaions were related to programs. Growers and grove managers from Indian River, St. Lucie, Martin and Palm Beach counties were contacted by mail, then interviewed for information on all facets of weed control programs. Groves were divided into units, usually blocks of the same cultivar, with further subdivision based on variation in herbicide treatment, tree age or distribution of weed populations within a block. Presence of individual species in tree rows was rated as a high (nearly solid stand), medium (frequent occurrence, interspersed with other species) or low (general infrequent occurrence throughout the block) population.

Results and Discussion

Forty-one growers representing 32,072 ha (79,249 acres) of citrus were interviewed. Eighteen had regularly scheduled weed control programs to which labor, equipment and materials were allocated at certain times of the year. Eleven considered weed control to be of primary importance if labor and equipment were not in use for other regularly scheduled, cultural programs, 2 controlled weeds only when necessary and 10 had haphazard programs of weed control.

All growers surveyed mowed with a rotary mower for weed control in row middles. Most mowed from 2 to 5 times a year, most often during the period of most rapid weed growth from May to September. Data were inconsistent, however, and there was no standard time for or frequency of mowing. Six growers also disced drain middles once a year for bed maintenance.

All but 2 growers used sickle-bar mowers for mechanical under-tree weed control. Most mowed from 2 to 4 times a year when herbicides were not used, generally between April and October, 10 reporting an additional mowing during the winter. Two to 3 months were required for a single under-tree mowing of the grower's entire acreage in most cases. Hence, timing of herbicide treatments was difficult when mowing was necessary prior to application.

Mechanical cultivation under trees was used on 19,542 ha (47,966 acres) and herbicides were applied to the remaining 12,530 ha (31,283 acres). Thirty-four growers used herbicides, only 10 of which regularly treated their entire acreages. Three had never used herbicides and 4 had stopped because of cost or poor performance. Sixteen growers used established, regular programs while the remaining 18 used chemicals on a short-term or experimental basis. Seventeen used herbicides only in bearing groves, 3 in non-bearing groves and 14 in both situations. Ten growers applied herbicides to bearing groves twice a year. One application was usually during April, May or June and the other from October to December. Nineteen growers made single applications, usually in April to July. Hence, most plantings were treated in early summer before the onset of rapid weed growth and so rainfall would activate soil-sterilant herbicides.

A combination of bromacil and diuron, usually with an added contact material, was the most common herbicide treatment (Table 2). Six growers mixed these 2 materials to compensate for different weed situations, but most used the commercially pre-mixed formula of 2/3 bromacil and 1/3 diuron. Dosages of these and other materials were usually within the proper range, although some growers used materials recommended for use only in bearing groves around young trees at reduced rates.

Table 2. Number of growers using certain herbicide treatments in bearing and non-bearing groves in the Indian River area.

Treatment	Bear. Grow. using (no.)	Non-bear. Grow. using (no.)
Brom[y] + di[x] + con[w]	22	9
Brom + di only	13	10
Brom only	4	7
Terb[v] only		6
Con only	2	3
Sim[u] + con	4	
Brom + sim	2	
Brom + sim + con	2	
Terb + con		2
Brom + di + am[t]	1	1
Brom + di + terb		1
Brom + di + sim	1	
Brom + am	1	
Brom + dal[s]		1

[z]Growers may have used more than 1 treatment.
[y]Brom = bromacil.
[x]Di = diuron.
[w]Con = contact.
[v]Terb = terbacil.
[u]Sim = simazine.
[t]Am = ametryn.
[s]Dal = dalapon.

Herbicide application equipment was usually tractor-mounted 378-liter (100-gallon) fiberglass or stainless steel tanks, with low-pressure double-piston pumps. Nine growers used larger capacity tractor-drawn tanks. Materials were generally applied in strips through covered 0.4 to 2.7 m (1.5 to 9 foot)-long booms mounted in the center of the tractor. Seventeen growers used flat-fan nozzles with the outside nozzle offset and 13 used flood-jet nozzles. Nozzle spacing and numbers varied with output, swath width, boom length and height. Growers treated from 12 to 428 ha (30 to 1050 acres) per herbicide machine. Attempts at treating large acreages often took 2 or 3 months, hence accurate timing in regard to weed growth stages was not accomplished.

Nearly all growers supplemented herbicide applications with mechanical cultivation in old and young bearing groves. Twenty-six growers usually mowed once before each application whether groves were treated once or twice a year, and some also mowed from 1 to 4 times between applications.

Vines were not generally controlled adequately with routine weed control programs. Thirty-four growers used supplemental measures specifically for this purpose (Table 3).

Table 3. Vine control methods used by 41 citrus growers in the Indian River area.

Method	Growers (no.)
Hand labor	16
Hand labor & sickle-bar mowing	8
Normal weed control program only	7
Mechanical vine pullers	4
Hand labor & special herbicide applications	4
Special herbicide applications	2

The grove survey include 13,456 ha (33,250 acres) in the 4 counties, divided into 479 blocks which ranged from 2 to 142 ha (5 to 350 acres). Sixty-four percent were double-bedded (2 tree rows per bed), 26% were single-bedded, 8% had 4-row beds, 1% had 5-row beds, and 1% were not bedded. Most were flood irrigated, necessitating reliance on natural rainfall for herbicide activation.

Weed populations in tree rows differed little between herbicide-treated and mechanically-cultivated blocks (Table 4). Spanishneedle was quite prevalent, even though it is highly susceptible to diuron. It must be treated before becoming established, however, and improper timing of applications was undoubtedly responsible for unsatisfactory control (8).

Table 4. Percentage of 109 blocks mechanically cultivated in the past and 250 blocks presently treated with bromacil & diuron in which certain weed species[z] occurred as high, medium or low populations.[y]

Weed	High		Medium		Low	
	Mech. only	Brom. + di.	Mech. only	Brom. + di.	Mech. only	Brom. + di.
	%	%	%	%	%	%
			Grasses			
Torpedograss	16.5	6.0	8.3	7.6	5.5	6.8
Bermudagrass	3.7	6.4	18.3	12.4	17.4	10.8
Bahiagrass			7.3	5.6	1.8	13.2
Guineagrass	9.2	6.0	3.7		2.8	2.4
Vaseygrass			1.8	10.4	8.3	17.6
Pangolagrass	.9	1.2	10.1		1.8	
Paragrass	6.4	14.4			2.8	2.0
			Broadleaf weeds			
Spanishneedles	12.8	14.4	24.8	20.0	32.1	19.6
Lantana	12.8	7.2	8.3	6.0	12.8	11.2
Common ragweed	.9	1.6	7.3	7.6		7.6
Southern sida		1.2	9.2		6.2	

[z]Species most commonly encountered in the survey.
[y]See Materials and Methods for definitions of population levels.

The frequencies of occurrence of lantana and guineagrass suggest that they are normally present in both types of blocks. However, the range of weed species in herbicide-treated blocks was not as great resulting in more vigorous lantana and guineagrass growth due to reduced competition.

Vaseygrass occurred more frequently in herbicide-treated blocks but was less of a problem than guineagrass as it did not normally form solid stands. Paragrass was usually present as a high population and, where severe, was not controlled by either mechanical or chemical methods.

Normal mechanical cultivation programs did not seem to be satisfactory for balsamapple control as it occurred in 67% of those blocks (Table 5). Herbicide applications limited populations, but balsamapple was still quite widespread in treated blocks. Other vine species were present only in localized areas within a grove and were not controlled with presently used weed control programs, necessitating supplemental measures.

Table 5. Percentage of 479 blocks surveyed, 109 blocks not treated with herbicides in the past and 250 blocks presently treated with bromacil & diuron in which certain vine species occurred in the Indian River area.

Vine	Blocks		
	All	Not trt.	Brom. + di.
	%	%	%
Balsamapple	55.3	67.0	48.0
Va. creeper	7.9	12.8	6.4
Peppervine	2.9	1.8	3.2
Moon vine	2.7	7.3	.8
Muscadine grape	1.5	3.7	
Narrow-leaf milkweed v.	1.5		2.0
Dewberry	1.3		1.2
milkweed v.	.2		.4

Conclusions

The weed control program in the Indian River area generally received a moderate or low priority in the production schedule. Many aspects of the weed control program were therefore quite haphazard and erratic. There was no standard under-tree weed control program and the timing of mechanical cultivation varied widely. The latter was usually necessary to supplement herbicides to achieve adequate weed control.

Lantana, guineagrass and paragrass were present in both mechanically-cultivated and herbicide-treated blocks, but no herbicide program was effective in controlling these species. Most growers regularly used hand labor for vine control as routine weed control programs were largely ineffective. A major drawback of the present weed control programs in the Indian River area was improper timing of herbicide applications for best suppression of existing weed populations.

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LEAF TISSUE ANALYSES IN THE FERTILITY PROGRAM

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Abstract. **There are a number of questions to be considered in including leaf tissue analyses in a fertility program. Possibly the three main questions are: (1) How can I personally use it? (2) Of what value will it be to my operation? (3) Is the cost justified?**

Data are presented of instances where leaf tissue analyses have been included in various programs showing improper fertilizer placement, lack of magnesium in tissue although soil analyses indicated sufficient amounts, micro-element deficiencies and boron toxicity.

Most fertility programs are based on information gathered by the production manager from a variety of sources. These sources may be other production managers, University recommendations, and various types of consultants to include fertilizer salesmen, private consultants and people noted in this field.

In addition, soil analysis is a technical aid used by the production manager in his fertility program to keep the soil reaction and cerain nutrients within a desired range. Likewise, leaf tissue analysis also can be used as a technical aid in a fertility program. It does not replace soil analysis, and its greatest advantage is being a form of measurement in areas that cannot be seen visibly. The main disadvantage is that in its present form it is of little value to the crop on the tree at time of sampling.

The present standard ranges of leaf tissue values are the work of many researchers. A publication by Reuther and Smith (5) and later revised by Smith (6) discussed the different factors affecting the results of leaf tissue analyses, and included tables of the various nutritional ranges. Chapman (2) compiled his earlier work into a manual in 1960. Most of these works were related to the spring flush, but varied with fruiting and non-fruiting terminal sampling. More recently, Embleton *et al* (3) compiled most of the work to date. A review of these cited works should be made by anyone attempting to interpret results from leaf tissue analyses.

Data presented in this paper are not from tagged flushes which Anderson (1) found to give more exact data. With the use of tagged flushes more reliability can be placed on the contents of calcium and potassium in relation to age.

Assuming the production manager has the correct samples and analysis, he can personally use leaf tissue analysis to determine the nutritional status of his grove, the need for adjustments in his fertility program, to investigate problem areas, and to become aware of how his grove feeds. It is an aid that can be used in conjunction with soil analysis and experience.

If a grove or area is suffering from too much water, too little water, disease or some other problem that cannot be related to nutrition, it is doubtful that leaf tissue analysis will be of value. Results from many of these groves will give data that appear normal but the visual condition of the grove contradicts this conclusion. Therefore, judgement must be used in determining its value in each situation and in making interpretations against better judgement.

The first step in the use of leaf tissue analysis is to establish sampling sites within the grove. The site may consist of 10 to 20 trees in a line perpendicular to the direction in which the grove is fertilized. These trees should represent the condition of the majority of the trees *within the grove* and they should be sampled each year. At times, information can be obtained from the first year sampling, but usually basic trends need to be established and this can only be accomplished with sampling over a period of years.

The total number of sampling sites will depend on the extent to which the data will be used. If the production manager only wants to check his fertility program he need only establish enough sites to give him adequate coverage of his area. In addition, he will probably include sites in problem areas or in varieties that have different nutritional requirements, such as the Murcott. He should consider the size of the grove, soil differences, past history, and how the grove is managed.

If each block is going to be considered individually and pushed for maximum production, then each block should be sampled. This data is used along with yield per block, irrigation and rainfall, soil analysis, tree count, etc., to examine the performance of the block. It should be stated again that data from one year will probably be of little value.

Therefore, the area represented by a sampling site is variable and may extend from less than 20 up to 200 acres, or possibly more.

It is noted in the nutrient range table (4) that there is a range for each element. The manner in which a grove is taken care of, the amount and time of fertilization, irrigation, etc., usually determines where leaf tissue values will fall with respect to this range. Many years these values will be approximately the same as previous years, but there are exceptions which appear to be due largley to crop size.

Table 1 shows two growers from the ridge area, Grower A and Grower B, with different views on fertilization. What would happen if a bumper crop year should come along?

If each continued yearly with the same program, the grower with the higher potassium values would have a grove with better nutrient status; although, at present his values appear to be a little too high. But, if the grower with the lower potassium recognizes that he has a bumper crop, and applies additional potassium early in that crop year, he probably can maintain a nutritional status within the satisfactory range. This effect on yield and lowering of potassium leaf tissue values due to the heavy crop are illustrated in Table 2. This holds true for nitrogen, but since it does not have the requirement of needing to be applied early in the season, it may not always be recognized.

Since a potassium problem is probably the most difficult