ticide efficacy, is the most difficult to evaluate in the landscape. Pests and pathogens may be nonuniform in distribution while necessary unsprayed, but affected plants, are seldom left as controls. Perhaps the best estimate of sustained efficacy in a tank-mix combination of pesticides is the estimate of chemical compatibility in a jar test. Precipitation of pesticide mixtures implies chemical interaction among products and hence the risk of altered efficacy.

Fosetyl Al is best paired with either benomyl, chlorothalonil WP, or iprodione as a complementary fungicide. All the insecticides were compatible with these fungicide pairs. Benomyl offers the broadest categorical use label for ornamental plants as well as systemic action and legal use as either a foliar spray or a drench. Chlorothalonil WP and iprodione are both protectant products, but only iprodione has both drench and foliar spray labels. Use of fosetyl Al with either cupric hydroxide, mancozeb, or mancozeb + thiophanate methyl leads to measurable chemical incompatibility and undetermined efficacy loss. Pairings of these fungicides can be improved by addition of either dimethoate or diazinon to reduce foaming and obvious chemical incompatibility. Neither chlorothalonil F, triadimefon, nor triforine is recommended for tank-mixing with fosetyl Al due to pH-dependent solubility, chemical incompatibility, and restrictive labelling (respectively). Professional users of fosetyl Al should realize *its acidic nature* and refrain from supplemental additions of acidifying agents to compensate for alkaline water situations.

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EFFECT OF PACLOBUTRAZOL AND UNICONIZOLE-P ON *HIBISCUS ROSA-SINENSIS*[1]

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Additional index words. growth retardents, uniconizole-p.

Abstract. ***Hibiscus rosa-sinensis* L., a common landscape plant in southern Florida, has a large market potential as a potted flowering plant for interior use. However, the characteristically long internodes of hibiscus detract from its aesthetic appeal as a floral crop. This experiment compared drench rates of 0, 50, 100, and 200 ppm—0, 0.71, 1.41, and 2.82 mg A.I. respectively, of paclobutrazol (Bonzi) and XE-1019 (Sumagic, uniconizole-p) on 'Seminole Pink' hibiscus. Plant height was reduced by all rates of both growth regulators as compared to the control plants height. All rates of both regulators intensified the green color of the leaves. The number of flowers was increased at the 50 ppm rate for uniconizole-p, but was unaffected at the higher rates. None of the rates of paclobutrazol tested affected the number of flowers produced. Lateral branching was inhibited at all three rates of uniconizole-p but stimulated at all three concentrations of paclobutrazol.**

The popularity of containerized hibiscus as a potted flowering plant is increasing (4), but the expansion of production requires that several production drawbacks be overcome. Bud abscission during shipping can now be controlled with an application of silver thiosulfate (3). However, hibiscus tends to become leggy in production, with internode length between leaves up to several inches. These characteristically long internodes can detract from the aesthetic appeal of a floral crop. Growth regulators can be used to overcome this problem (2). The two growth regulators used in this experiment work as gibberellin biosynthesis inhibitors, reducing but not eliminating the synthesis of gibberellin. A decrease in gibberellin causes a reduction in cell size at the apical meristems and juvenile internodes of growing shoots (6). A treated plant produces the same number of cells, except the cells are smaller, thus reducing the length of the new shoots.

Existing commercially available growth regulators are expensive and need to be applied frequently. These qualities can reduce profits from plant production. Paclobutrazol and uniconizole-p are new growth regulators that are chemical analogs. Paclobutrazol is now commercially available and uniconizole-p will soon be available. The objective of this experiment was to evaluate the effects of paclobutrazol and uniconizole-p on growth of hibiscus.

Materials and Methods

Rooted cuttings of *Hibiscus rosa-sinensis* 'Seminole Pink' were transplanted into 11.5-cm containers using media containing 5:4:1 pine bark: Florida peat: coarse sand (v:v:v). This medium was chosen because it is frequently used in Florida, and bark has been shown to absorb and

[1]This research was conducted as a project of ORH 4276L at the Fort Lauderdale Research and Education Center.

render unavailable some of the growth retardant (5). Plants were grown for 5 weeks in a shade house with 73% light exclusion, under daily irrigation. Uniform plants were treated with 0, 50, 100, 200 ppm solutions of paclobutrazol and 0, 50, 100, 200 ppm of uniconizole-p. The treatments were applied as a soil drench with a volume of 14.1 ml of solution administered per pot, control pots received 14.1 ml of distilled water. The 50, 100, and 200 ppm treatments of paclobutrazol and uniconizole-p received 0, 0.71, 1.41, and 2.82 mg, respectively, of active ingredient per 14.1 ml volume delivered.

Plants were not irrigated for 24 hours after treatment and were arranged in a completely randomized design. Four grams of Osmocote (TM) 18-6-12 brand fertilizer were applied to each plant. Plants were grown for 4 months after growth regulator treatment, and plant height and lateral growth measurements were made every 2 weeks. Eighty-seven days from treatment application, floral production began to peak. Flower numbers were then measured daily for 28 additional days. Data were evaluated by the analysis of variance with the Tukey honestly significantly difference test used for mean separation.

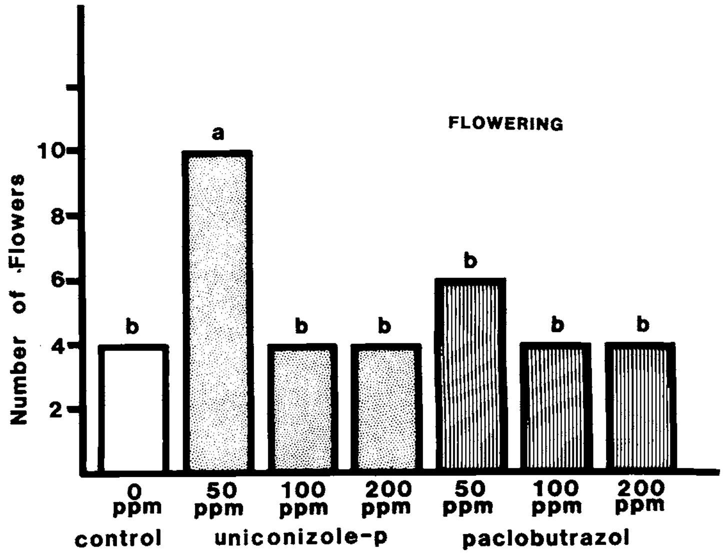

Fig. 2. Average number of flowers produced on *Hibiscus rosa-sinensis* 'Seminole Pink' spanning 28 day period, 87 days after growth regulator treatment applied as a drench. Mean separation is by the Tukey test at the 0.05 level.

Results and Discussion

Both compounds applied as a soil drench effectively reduced the height of hibiscus. The height of plants for both compounds, regardless of concentration, was approximately 50% shorter than the height of the control plants (Fig. 1). Rates above 50 ppm for either chemical do not further reduce plant growth of hibiscus (1, 7). In an unpublished test where paclobutrazol and uniconizole-p were applied at the 200 ppm rate as a foliar spray the uniconizole-p reduced plant height as effectively as the soil drench application, but the paclobutrazol treated plants were unaffected at this rate and were as tall as the control plants.

Another difference attributed to the growth regulators was the effect on flowering (Fig. 2). The data showed that uniconizole-p increased flowering by 60% over that of the controls, with the 50 ppm rate. The higher rates of uniconizole-p and paclobutrazol both did not alter flower numbers, and while there was a slight increase in flower number with the 50 ppm rate of paclobutrazol, it too was statistically not different from that of the control treatment.

Another effect attributable to these growth regulators was that lateral branching was altered. All three rates of paclobutrazol increased lateral branching by approximately 50% over that of uniconizole-p, and by approximately 80% over that of the controls (Fig. 3). The effect of uniconizole-p on lateral branching was not as dramatic but there was still an increase statistically over that of the control.

A characteristic imparted to the leaves of hibiscus can also be attributed to the growth regulators. All rates of both compounds deepened the green color of the leaves. Compared to the controls, leaf color of the growth reg-

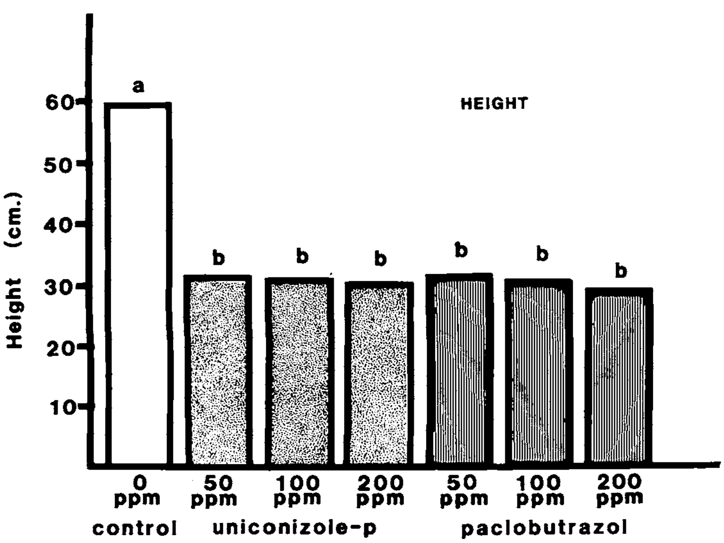

Fig. 1. Average height of plants of *Hibiscus rosa-sinensis* 'Seminole Pink' 4 months after growth regulator treatment applied as a drench. Mean separation is by the Tukey test at the 0.05 level.

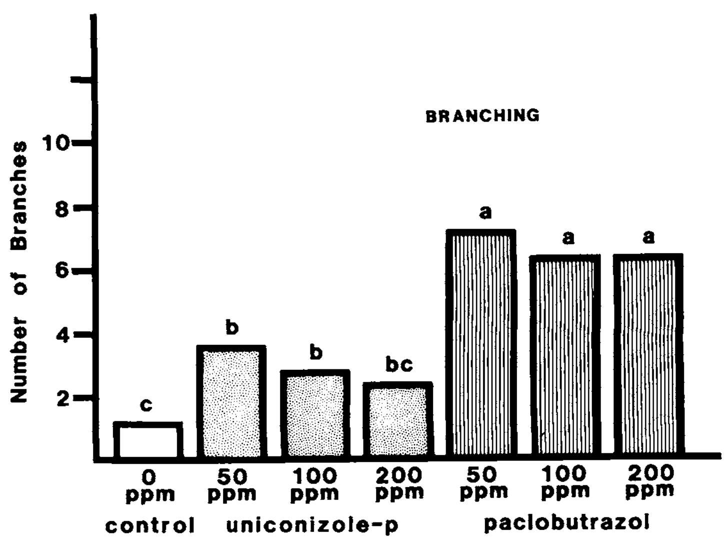

Fig. 3. Average number of lateral branches on *Hibiscus rosa-sinensis* 'Seminole Pink' 4 months after growth regulator treatment applied as a drench. Mean separation is by the Tukey test at the 0.05 level.

ulator treated plants had a saturated, deep green coloration.

An unanticipated effect of the treatments is that there appeared a peculiar leaf crinkling. The highest rates for both regulators showed convolutions of the leaf margins. The effect was much lessened at the 50 ppm rate for both compounds. This would suggest that the 100 and 200 ppm solutions are too concentrated to achieve the desired results. The 50 ppm rate for both compounds achieved the results desired most closely. It is possible that a slightly lower rate might show optimal results. As it stands with this work the 50 ppm rate for paclobutrazol increased lateral branching, the 50 ppm rate for uniconizole-p increased flowering and both effectively reduced amount of growth by 50% from that of the controls. However, as a whole, results for both regulators at the 50 ppm rate are satisfactory in producing an aesthetically pleasing flowering potted plant that is more desirable than the untreated form of hibiscus.

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TRIALS WITH GROWTH RETARDANTS ON ORNAMENTAL FOLIAGE PLANTS

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Additional index words. paclobutrazol, ancymidol, XE-1019, daminozide, *Peperomia obtusifolia, Dieffenbachia maculata* 'Camille', *Schefflera arboricola, Philodendron scandens oxycardium, Dieffenbachia* x 'Victory'.

Abstract. **Paclobutrazol and ancymidol reduced height of *Peperomia obtusifolia* and *Dieffenbachia maculata* 'Camille' plants. Paclobutrazol (Bonzi) also retarded root growth in both species, whereas ancymidol retarded root growth in *P. obtusifolia*, but not in *D. maculata* 'Camille'. Both chemicals reduced leaf area in *D. maculata* 'Camille', but not in *P. obtusifolia*. In *D. maculata* 'Camille', paclobutrazol caused the leaves to become twisted with little or no variegation. Neither paclobutrazol nor ancymidol affected *Schefflera arboricola* or *Philodendron scandens oxycardium*. XE-1019 (Sumagic) reduced plant height and leaf size in *P. obtusifolia* and *Dieffenbachia* x 'Victory'. Leaf variegation and the number of leaves of *Dieffenbachia* x 'Victory' were also reduced, whereas resistance to chilling injury during simulated shipping was not affected. XE-1019 enhanced branching and the development of adventitious roots along the stems of *P. obtusifolia*. In *Philodendron scandens oxycardium*, XE-1019 caused only a temporary reduction in leaf size, whereas daminozide (B-Nine) increased leaf width and reduced vine length, internode length and number of nodes per vine.**

Extensive research has been directed to the use of growth retardants in controlling height of fruit trees (2, 15, 16, 17, 24) and flowering ornamental plants such as poinsettia (5, 10, 13, 21, 22, 23) and chrysanthemum (4, 10, 12, 14, 18, 19). Until recently, however, the use of growth retardants on foliage plants had received relatively little interest from researchers. Nevertheless, the work done so far has yielded some very promising results (3, 6, 7, 8, 9, 11). The purpose of this study, which includes 12 experiments, was to explore the feasibility of using different growth retardants, including two relatively new chemicals (paclobutrazol and XE-1019), on a variety of foliage plants.

Materials and Methods

Experiments 1, 2, 3, 4, 5 and 6: Six experiments were conducted to test the effect of paclobutrazol (experiments 1, 2 and 3) and ancymidol (experiments 4, 5, 6) on three foliage plant species. On 24 Sep. 1986, fifty 6-inch plastic pots were planted with each of *Peperomia obtusifolia* (L.) A. Dietr. (2 rooted cuttings per pot), *Dieffenbachia maculata* (Lodd.) G. Don 'Camille' (one tissue-cultured plantlet per pot) and *Schefflera arboricola* H. Ayata (three seedlings per pot). Experiments 1, 2 and 3 were initiated 2 weeks later (8 Oct.) by applying five paclobutrazol drench treatments to each species. Rates used were 0, 0.0625, 0.125, 0.1875, and 0.25 mg a.i./pot. On 20 Oct. experiments 4, 5 and 6 were initiated by applying ancymidol drench treatments to *P. obtusifolia, D. maculata* 'Camille' and *S. arboricola*, respectively. The rates applied were 0, 0.25, 0.5, 0.75, and 1.0 mg a.i./pot. In all six experiments, plant height (from soil surface to highest point of the plant), number of leaves per pot, leaf area (average of areas of the two largest most recent fully developed leaves) and a visual rating (percentage) of root ball coverage were recorded 3 months after treatment application. The chlorophyll contents (chlorophyll A and chlorophyll B) in leaves of paclobutrazol-treated peperomia plants were measured on 18 Nov.

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