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Ethephon Forces Plumeria for Winter Flowering

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A plumeria lei is a traditional greeting among both residents and tourists in Hawaii. As a lei flower, plumeria is much underestimated in terms of its value in the floriculture industry, because many flowers are gathered from backyards and roadside plantings and thus are not counted in the annual census conducted by the Hawaii Agricultural Statistical Service, which has reported on average about 10 commercial producers over the past decade. In 1998, nine farms reported total plumeria sales of $601,000 from 23.8 million blooms (HASS 2000). But the "image value" of plumeria flowers to Hawaii's tourist industry is probably many times that amount.

Background

During winter, plumeria flower production nearly ceases at a time when visitor counts are high. Other flowers are imported to meet the needs for lei flowers. Plumeria growers have tried different strategies in an effort to produce flowers for the winter market, ranging from hand defoliation to planting many acres so that at least a few flowers can be gathered, or choosing warm parts of the state in which to grow plumeria trees.

Inflorescences are largely produced in the spring and may continue to bear flowers for six months, although the last flowers are small and infrequent. Murashige (1966) reported that leaf retention and abscission were controlled by daylength. Lawton and Akpan (1968) reached the same conclusion and added that stem growth and leaf production continued under long days. Sheehan and Murashige (1962) reported that plants treated with long days or gibberellic acid continued to produce leaves and did not go dormant until natural short days were imposed. Criley (1995) reported success in preventing fall dormancy by chemical defoliation of the trees with ethephon. The result was early development of inflorescences already initiated in the summer.

This report summarizes additional research, including an experiment involving cultivars in addition to the common yellow plumeria, 'Celadine'.

Research description

Research was conducted at the University of Hawaii's Waimanalo Research Station during fall-winter 1994–1995. Eighteen trees of 'Celadine' planted in 1986 were used. Ethephon was applied as a foliar spray of 800 mg ai/liter of water plus 2 ml of X-77 spreader (after Criley 1995). Three trees were treated at each spray date. Comparable control trees were not sprayed. Dates of ethephon application were September 13 and 26, and October 10. The data consisted of counts of inflorescences at the emerging bud, elongation of the peduncle, and open flower stages of development. Data were collected every two weeks between October 10, 1994, and April 7, 1994.

Because defoliation and inflorescence-forcing were successful with 'Celadine' (the common yellow plumeria), the extension of this work to other cultivars was of interest. Foliar applications of 800 ppm ethephon were made to 'Donald Angus', 'Kimo', 'Lurline', 'Scott Pratt', and an unnamed white hybrid designated 18-41. Trees of 'Celadine' were included in this plot. Single ethephon applications were made to one tree of each cultivar on September 13, 24, or October 10. Ob-

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servational and flower count data were taken every two weeks from October 10 through March 24, 1995.

It should be noted that the trees used for cultivar-effects were water-stressed and had not been fertilized for many years. For this reason, perhaps, defoliation was not as uniform as on the 'Celadine' plants in the other planting. For ethephon applications made in September, nearly all cultivars still retained the youngest leaves near the branch tip when observed on October 10. The treatment of September 24 was somewhat more successful than that of September 13 in achieving defoliation.

Results

The controls responded similarly for each treatment date, and only one set is presented (Figure 1). Although old inflorescences were still in bloom into December, no new flower buds were evident until late January. Elongation of the peduncle took four to six weeks until open flowers wre produced, with peak flowering commencing in April 1995. In contrast (Figure 1), ethephon-treated trees, which defoliated within two weeks of treatment, began showing inflorescence buds about four weeks after treatment, and produced open flowers before Christmas in the case of the September 13 treatment. Both the September 26 and October 10 treatments also produced open flowers well in advance of the controls. It should be noted that the majority of the bud and flower production on ethephon-treated plants followed the same timing as on control trees, but a small percentage were so much earlier that the efforts made to stimulate them would have been worthwhile.

Except for very early treatments (Criley 1995), ethephon-treated trees have not shown any adverse effects in the same or subsequent years. However, once the inflorescence is initiated, sometime in July, I believe, defoliation may force elongation of a poorly developed inflorescence stump that fails to produce flowers. It is my opinion that plumeria probably should not be defoliated much before the end of August in order to permit initiation and development of the individual flowers in the inflorescence. The early inflorescences appear to have fewer flowers on them than do those produced at the normal time, but flower size and shape were normal. No other distortion of either flowers or foliage resulted from treatment with this concentration of ethephon.

The cultivars 'Kimo', 'Celadine', and 'Donald Angus' continued to produce flowers from old inflorescences through December 8. Nearly all plants were out of bloom by December 22.

'Celadine'

New buds began to appear December 22 on the September 13 treatment, with some of these reaching bloom January 21 and flowering continuing to build well ahead of the other treatments and control. The late September and October treatment yielded new buds on January 21 and increased the bud count the rest of the observation period. Elongation was pronounced during March. Nontreated plants showed the same timing as the late ethephon treatments. Plants in this experiment were well behind the 'Celadine' plants in the previous experiment.

'Donald Angus'

New buds were evident January 6 on the September 13 treated plant, while the September 25 plant started pushing buds on January 21 and the October 10 plant on February 8. The two plants from the September treatments were in good bloom the first week of March, while the inflorescences from the October treatment were elongating at this time and reached bloom by March 24. An untreated control plant paralleled the plant of the September 24 treatment.

'18-41' white

This selection is always an early bloomer, and new flower buds were apparent on all treated plants by November 23. The nontreated control plant had many buds by December 22, slightly behind the treated plants. Bud development continued on through the winter, with first bloom on treated plants occurring December 22. Both treated and control plants were in good bloom from early January on through the observation period.

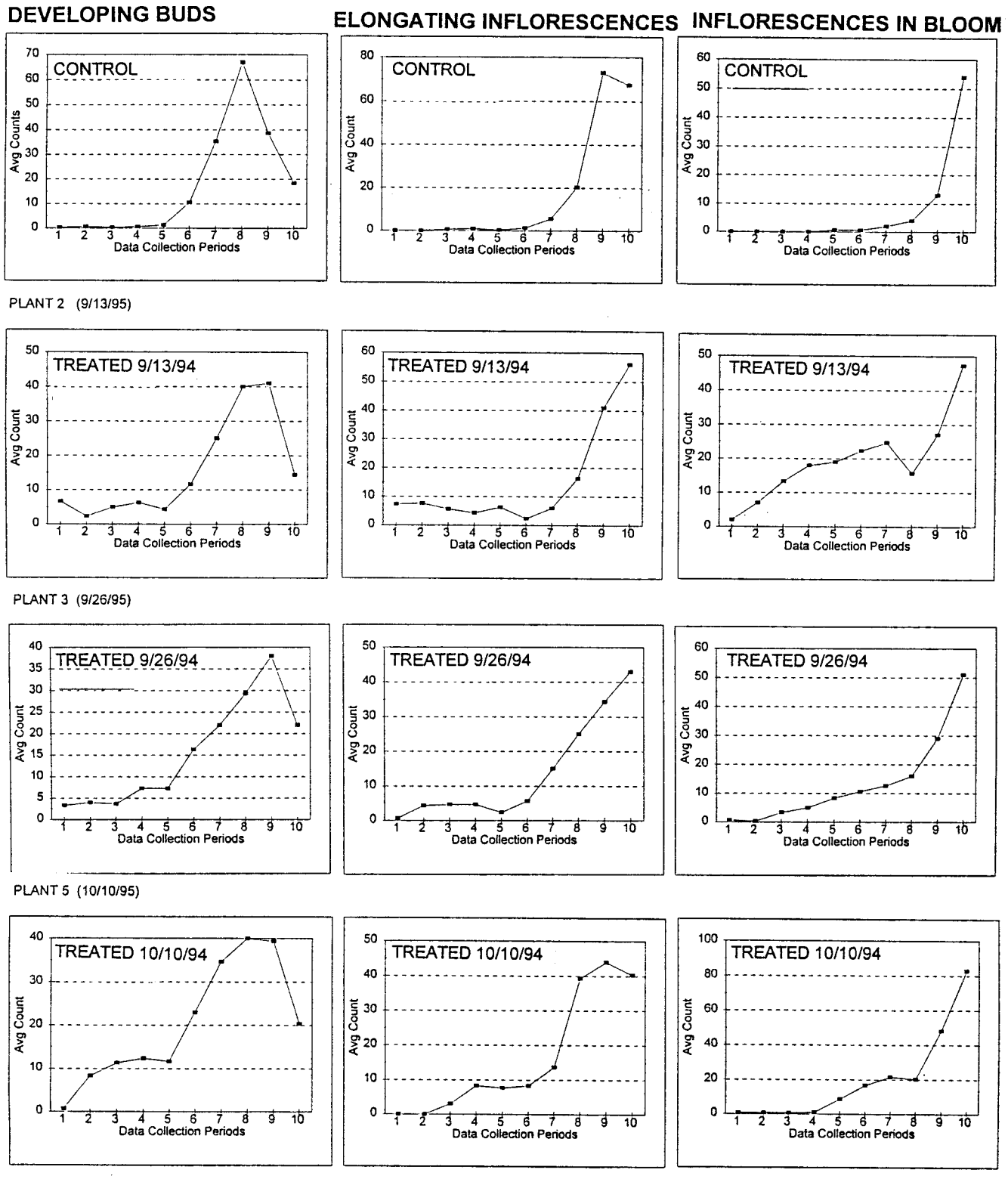
'Lurline'

This cultivar is usually a late bloomer. There was little bud activity on the September-treated plants until January 21, but the October-treated plant had prominent buds December 22. Development was slow, however, and while all plants had buds by February 8, there were no open flowers until late March. Control plants had not produced measurable buds even at that time.

'Kimo'

The first new buds appeared in mid-January on the Sep-

Figure 1. Inflorescence development responses of 'Celadine' plumeria to foliar sprays of 800 ppm ethephon on three treatments dates. Data collection dates (x-axis): 1. 11/23/94; 2. 12/8/94; 3. 12/22/94; 4. 1/6/95; 5. 1/21/95; 6. 2/8/95; 7. 2/24/95; 8. 3/10/95; 9. 3/24/95; 10. 4/7/95.



tember 24 and October 10 treatments. Open flowers appeared between the March 10 and 21 observation dates. Control plants were slightly later in both bud and flower appearance.

'Scott Pratt'

This dark red cultivar is a sparse bloomer and usually quite late. Therefore it was a surprise to see developing inflorescence buds on December 22 on the plant treated on October 10. A few buds appeared on the September 13 plant by January 21. However, none of the early inflorescences matured into flowers. Control plants had not produced flower buds by March 24.

Discussion

The extension of the ethephon treatment to other plumeria cultivars to induce winter flowering appears promising, although there are varietal differences in response, and the environment surely modifies the response. Cultivars that bloom heavily into the fall, such as 'Kimo', 'Donald Angus', and 'Celadine', may be good candidates for the ethephon treatment because of the presence of developed flower buds. The white hybrid '18-41' already blooms early and probalby does not go into as deep a dormancy as do other cultivars. The early forcing of buds on 'Lurline' and 'Scott Pratt' was a surprise, which provided evidence that the treatments really do work, even if early open flowers were not achieved.

The lack of water and fertilizer stressed the trees, making them perhaps more resistant to the defoliation treatment, but as daylength decreased, they were more likely to respond by uniform defoliation. Bud development was affected, as there were generally fewer buds than on comparable trees in a watered and fertilized plot. A warm winter environment promotes rapid development of inflorescence buds, as occurred in the 1994–95 season.

In conclusion, it appears that the ethephon treatment to defoliate plumerias during September–October leads to early inflorescence bud appearance and earlier flowering than on nontreated trees. In this trial, there were flowers from new inflorescences before Christmas only from the '18-41' hybrid, but healthier plants might be induced to flower in time for the winter tourist trade.

This research demonstrated that plumeria trees with well developed inflorescence structures can be forced into flower to meet the demands of the lei flower industry during a season when the availability of plumeria flowers is normally low. A registration is being sought for this use with two companies that market ethephon for various horticultural applications.

References

Criley, R.A. 1995. Enhanced winter flowering of plumeria with ethephon. Acta Hortic. 394:325–330.

Hawaii Agricultural Statistical Service. 2000. Statistics of Hawaii Agriculture 1998. Hawaii Dept. of Agriculture, Honolulu, HI. p. 31.

Lawton, J.R.S., and E.E.J. Akpan. 1968. Periodicity in plumeria. Nature 218:384–386.

Murashige, T. 1966. The deciduous behavior of the tropical plant, *Plumeria accuminata*. Physiol. Plant. 19:348–355.

Sheehan, T.J., and T. Murashige. 1963. Growth responses of plumeria to photoperiod and gibberellic acid. Proc. Fla. State Hort. Soc. 76:477–479.