Control of Flower Initiation in the New Durable Poinsettia 'Paul Mikkelsen'

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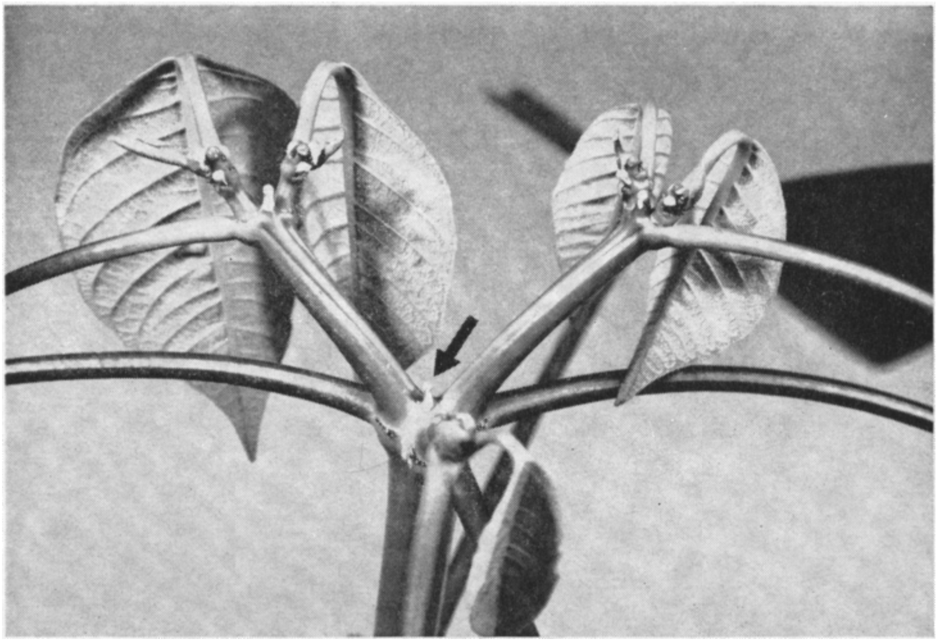

Photo 1. Branching of 'Paul Mikkelsen' poinsettia caused by premature flower bud initiation. Flower bud (indicated by arrow) fails to develop further.

A NEW CULTIVAR of poinsettia will be in plentiful supply for the 1965 holiday season in California market places. This relatively new introduction, named 'Paul Mikkelsen' (after the plant breeder), has outstanding keeping qualities. If placed in the north window and properly watered, it may remain attractive beyond the Easter season. This endurance is unequalled in the standard cultivars. The bracts are not as large as the older cultivars, but they have the same vivid red color. Because of its upright stem habit, stake support is not usually required (cover and photo 2).

While this new introduction is a spectacular advance and is attractive to the consumer, it still poses many cultural problems to the flower grower. This cultivar is troublesome because stock plants, cuttings, and young plants initiate flower buds under environmental conditions known to prevent flower bud initiation in other cultivars. These premature flower buds do not develop, but break apical dominance and cause the plant to branch (see photo 1). This branching creates undesirable plant forms and may disrupt the Christmas timing schedule.

Poinsettias are short-day plants and initiate flower buds during the shortening days of fall. The critical daylength in California for the established cultivars occurs between September 28 and October 8. Much research has been conducted on the standard cultivars over the years concerning daylength and temperature which control the timing of the flower bracts. Flowering is dependent on the proper daylength and temperature combination. As temperatures are increased, shorter days are required for flower initiation and development, and, conversely, as temperatures are decreased flower initiation will occur at longer daylengths. Because temperature and daylength normally control flower initiation in poinsettias, the effect of this factor on premature flower initiation in 'Paul Mikkelsen' was studied in the UCLA controlled-environment growth rooms.

The study showed that flowers initiate under conditions which prevent initiation in standard cultivars. In one experiment with 'Paul Mikkelsen,' flower buds formed over a range of 8- to 16-hour photoperiods and temperatures of 55 to 80° F, inclusive. At high temperatures (70 and 80° F) and long days (16 hours) initiation was delayed. In contrast, past work has shown that temperatures of 65 and 70° F delayed initiation in older cultivars at 13-hour photoperiods, and flowers did not form in 100 days at 14-hour photoperiods at temperatures of 55 to 70° F. In summary, there is evidence that with a marginal daylength of 13½ hours 'Paul Mikkelsen' will initiate flowers at temperatures that prevent initiation in standard cultivars. Furthermore, at a given temperature, 'Paul Mikkelsen' will initiate flowers under longer daylengths than will other cultivars.

Greenhouse tests

In another experiment, stock plants were grown in three separate controlled temperature greenhouses having minimum temperatures of 60, 70, and 80° F. Shoots of 10- or 30-inch lengths were removed from the stock plants from May until October. The top 4 inches of these shoots were rooted under long-day high temperature conditions, and later were examined to determine if these cuttings had initiated flower buds. Approximately 90% of the cuttings from the 10-inch shoots were vegetative, but only 33% were vegetative when taken from the longer shoots. Approximately twice as many cuttings were produced at 70 and 80° F as at 60° F. Temperature seemed to have little consistent effect on the percentage of cuttings from 10- or 30-inch shoots that were vegetative; however, cuttings from plants held at 60°F formed flower buds at lower node numbers than those grown at the two higher temperatures. This indicates that if an intermediate shoot length of about 20 inches was chosen, an appreciable effect of temperature on the percentage of vegetative cuttings would have been evident. This study also showed that cuttings taken early in the season were less vegetative than those taken in August and September.

The light intensity and light duration to completely keep the standard cultivars vegetative is 10 to 20 foot-candles for one hour in the middle of the night. A recent experiment on 'Paul Mikkelsen' grown at 70° F revealed that lighting for four hours (10 p.m. to 2 a.m.) with a minimum of 10 foot-candles is necessary to prevent flower bud initiation. This points out that this new introduction is relatively less sensitive to artificial light when compared to standard cultivars.

This series of experiments has resulted in the following recommendations to reduce the amount of premature budding in 'Paul Mikkelsen': (1) Keep the stock plants vegetative all year by lighting the plants each night with a minimum of 10 foot-candles for four hours in the middle of the night. (2) Grow the stock plants at minimum night temperatures of 70° F. (3) Do not allow the shoots of the stock plants to exceed 10 inches at the time the cuttings are made. If the cuttings are not required at that time, the plants should be pruned to keep the shoots below the minimum length.

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Photo 2. 'Paul Mikkelsen' plant about two months after Christmas. Note that it retains its leaves and bracts. No support was required for this multiple stem plant.

EXCESS PHOSPHORUS and IRON CHLOROSIS

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High concentrations of phosphate in plants cause a typical iron deficiency chlorosis with characteristic mineral and biochemical patterns. Studies show that organic acids in leaves are involved in the absorption and distribution of minerals, particularly calcium and potassium, and that their behavior is controlled by an iron-phosphate balance.

The metabolism of iron in living organisms is known to be required for the synthesis of chlorophyll, although the exact location of this function is still unknown.

Iron-deficient plant tissues are often found to contain higher quantities of citric acid than green plant tissues. Since it has been demonstrated in animal tissues that the enzyme responsible for the breakdown of citric acid requires iron in the ferrous or reduced form for its activity, lack of ferrous iron leads to reduced activity of the enzyme and to accumulation of citric acid in the tissues. Addition of ferrous iron restores activity of the enzyme and causes the level of citric acid in the tissues to fall. Studies of this aconitase enzyme in plant leaves show that its activity is much less in iron-deficient leaves than in green leaves containing adequate iron. Although addition of iron to the surface of chlorotic leaves causes a rapid increase in enzyme activity, it has not been possible to isolate this action in a particular system.

Iron-deficient leaf tissues also contain less malic acid than the green leaf tissue, which is compatible with the theory that these acids are metabolized in a cycle—the so-called Krebs or citric acid cycle. This difference is highlighted when the ratio of citric acid to malic acid is considered. These acids are now quantitatively estimated by techniques of column chromatography on silica gel, using a gradient elution system of mixed solvents with increased solubility for various acids. The amount of malic acid contained in a leaf is often equal to the amount of calcium it contains; hence, the genesis of malic acid would appear to be connected with calcium accumulation. Blockage of the formation of malic acid by iron deficiency thus leads to a lower calcium content of the leaf.

An almost perfect relationship between the amount of calcium in a leaf and the oxalic acid content has long been known in plants which contain large amounts of this acid; and, in fact, crystals of calcium oxalate can be observed in many plant tissues. In the past, oxalic acid was considered poisonous and a waste product of metabolism, the plant eliminating it by precipitation with calcium. Recent studies indicate, however, that oxalic acid may arise via a "shunt" or side re-

ANALYSIS OF HEALTHY LEAVES AND CHLOROTIC LEAVES OF RASPBERRY VARIETY, MALLING JEWEL—SOIL ANALYSIS SHOWED HIGH PHOSPHATE CONTENT TO BE ASSOCIATED WITH THE CHLOROSIS

Leaves	Per cent in dry matter						Ratio	
	P	Fe	K	Ca	Na	Mg	P:Fe	K/Ca
Healthy	.22	.015	2.42	1.34	.03	.27	14.4:1	1.8:1
Chlorotic	.66	.005	2.96	0.30	.06	.29	130.2:1	10.0:1