Gibberellin Accelerates Flowering of *Cyclamen persicum* Mill[1]

R. E. Widmer, L. C. Stephen, and M. V. Angell[2]
University of Minnesota, St. Paul

Abstract. **Gibberellin (GA_3) treatment of 6 cyclamen cultivars accelerated flowering 28 to 35 days and increased simultaneous flower production per plant up to 100%. Leaf size, leaf count, and plant size were not altered by GA_3. A single spray of 50 ppm GA_3 applied 60 to 75 days prior to desired time of bloom is suggested to promote more accurate, efficient scheduling of cyclamen crops.**

Cyclamen flower buds were found in leaf axils from the 7th leaf on by Hagemann (2), but the buds usually remain as small specimens in the crown for many months. Cyclamen plants usually do not flower until 30 or more cm in diameter. Thus, an extended production period and oversized plants contribute to high production cost. A treatment to hasten scape elongation and subsequent flowering is needed.

Gibberellins are plant growth regulating compounds which induce stem elongation and earlier flowering in some species. Kohl and Kofranek (4) reported that 9 weekly applications of 100 ppm GA to the crown of "mature" cyclamen plants triggered rapid flower development in summer. The flowers were not commercially desirable as they did not fully reflex and the flower scapes were excessively long and weak. Jansen (3) advanced flowering 14 to 18 days with 3 weekly spray applications of GA when flower bud scapes were 1-2 cm long. Dörr (1) claimed that 1-year-old cyclamen did not respond to GA_3.

Our primary objective was to determine whether GA_3 effectively triggers earlier, more uniform flowering of greenhouse-grown cyclamen.

Seed was sown and germinated in peat discs. Seedlings were transferred to 8 × 8 cm spacing in nutrient-enriched moss peat in 12½-cm plastic azalea pots. A balanced fertilizer was applied as needed. All plants were grown in the natural photoperiod. Plants, which averaged 20-25 cm in diam, were graded for uniformity and treated with a commercial formulation of GA_3 (Pro-Gibb), minimum purity 90%, to which a common household detergent (Ivory liquid) wetting agent (WA) had been added. Control plants were sprayed with a WA solution. Eight ml of solution were sprayed on the crown of each plant. Data recorded in each of 2 trials included start of bloom, flowers, no. of leaves and leaf size, and plant height, width, and general quality. A plant was considered in bloom when the first flower fully opened. Data taking was initiated 37 and 55 days after plant treatment in 1971 and 1972, respectively.

1971 Study. 'Bonfire #7' seed were sown March 15 and the plants potted August 15. Plants were treated Nov. 1 and again Nov. 15, and 29. Temperatures were maintained at 20°C night and 24-26° day through flowering.

A higher percentage of plants was flowering 37 days after treatment with 100 ppm GA_3, and 58 days after GA_3 application for all other treatments (Table 1). Within 58 days, 76% of the treated plants were flowering versus 41% for the control. Only 64% of the control plants bloomed ppm and 1 of 25 ppm were similar in effect as were 2 applications of 25 ppm and one of 50 ppm (Table 1). Although plants treated with 100 ppm were the earliest flowering, their floral scapes were excessively long, thin and weak, and were commercially unacceptable. Scapes on plants in all other treatments were normal. All flowers opened normally.

Simultaneous flower production tended to be greater within 44 days and was more than double that of the control 51 and 58 days after application of 100 and 50 ppm GA_3, respectively (Table 2). All treated plants except those receiving 1 application of 25 ppm produced significantly more flowers within 58 days. Mean flower production of all GA-treated plants was double that of the control within 65 days. Flower production was directly related to the quantity of GA_3 applied. Leaf size and no. and plant size were similar for plants in all treatments. Plant diam averaged 25-28 cm 93 days after the first GA treatment.

1972 Study. Seeds were sown April 19 and the plants potted August 16. The simplest, most effective, satisfactory 1971 treatment, 50 ppm GA_3, was applied to 6 cultivars Oct. 18, 1972. A night temp of 20°C was maintained until Oct. 15, 18.5° until Oct. 31, and 17° for the remainder of the study; day temp were 5-6° higher.

A higher percentage of GA_3-treated plants of all cultivars flowered significantly earlier than control plants 55 days after treatment (Table 3). Of the treated plants, 75% flowered within 62 days and 90% within 75 days versus 31 and 60%, respectively, for untreated plants. 'Weihenstephan Selection' was the earliest flowering cultivar followed by 'Rosa von Zellendorf' (Tas Type).

Mean flower production per plant 76 days after GA_3 treatment was 67% greater than that of control plants (Table 4). Although flower production of GA_3-treated plants of all cultivars tended to increase, the degree of increase varied. 'Hallo' and 'Weihenstephan Selection' were the most responsive and 'Rosa von Zellendorf' also showed a significant increase.

Leaf size and no. and plant size were not altered by GA_3 treatment. Plant diam averaged 28-31 cm 79 days after GA_3 treatment with differences attributed to cultivar rather than to treatment.

Jansen (3) suggested GA application when flower scapes were 1-2 cm long, and because of plant variability, 3 weekly applications to insure treatment at the right stage for a greater portion of the crop. In our study, a single spray of 50 ppm GA_3 was just as effective as multiple sprays of lower concn, thus reducing the labor required (Table 1). Flowering of 'Bonfire #7' was advanced

Table 1. Percent of Bonfire #7 in flower following application of GA; 42 plants per treatment.

GA_3 treatment[z]	Flowering (%) Days after initial (Nov. 1) treatment of GA								
	37	44	51	58	65	72	79	86	93
0 (control)	24a[y]	31a	36a	41a	43a	50a	55a	57a	64a
10 ppm, 3x	17a	36a	52b	62a	71b	83b	86b	86b	88b
25 ppm	24a	31a	48ab	71bc	81bc	88b	91b	93b	93b
25 ppm, 2x	26ab	41ab	62b	79c	81bc	83b	88b	91b	91b
50 ppm	21a	33a	60b	76c	86bc	88b	88b	88b	88b
100 ppm	33b	50b	79c	91d	93c	93b	93b	95b	98b
Mean, treated plants	24	38	60	76	82	87	89	91	92

[z]Single application Nov. 1; 2x=Nov. 1, 15; 3x=Nov. 1, 15, 29, 1971. Each plants received 0.08, 0.2, 0.4 or 0.8 mg GA_3 per treatment.

[y]Mean separation in columns by Duncan's multiple range test, 5% level.

[1]Received for publication June 11, 1974. Paper No. 8504 Scientific Journal Series, Agricultural Experiment Station, University of Minnesota, St. Paul, Minnesota.

[2]Professor, Graduate Student and Junior Scientist, respectively, Department of Horticultural Science.

Table 2. Mean no. of flowers produced per blooming plants of Bonfire #7; 42 plants per treatment.

GA_3 treatment[z]	Mean no. of flowers per blooming plant								
	Days after initial (Nov. 1, 1971) treatment of GA								
	37	44	51	58	65	72	79	86	93
0 (control)	1.7a[y]	2.5a	2.5a	3.7a	4.8a	6.2a	6.5a	7.3a	7.7a
10 ppm, 3 x	1.3a	2.6a	4.0a	7.0bc	9.8bc	11.3bc	13.0bcd	14.5bc	15.3bc
25 ppm	2.1a	2.8a	3.8a	5.5ab	7.5ab	8.4ab	9.4ab	10.3ab	11.4ab
25 ppm, 2x	1.8a	2.7a	4.0a	6.9bc	10.0bc	11.6bc	12.8bc	13.7bc	15.0bc
50 ppm	1.4a	3.2a	4.6a	7.6c	10.0bc	12.5bc	14.2cd	15.6c	16.8c
100 ppm	2.0a	3.7a	5.8a	9.5c	12.5c	15.2c	17.1d	17.8c	18.8c
Mean, treated plants	1.7	3.0	4.4	7.1	10.0	11.8	12.9	14.4	15.6

[z]Single application Nov. 1; 2x=Nov. 1, 15; 3x=Nov. 1, 15, 29, 1971. Each plant received 0.08, 0.2, 0.4, or 0.8 mg GA_3 per application.
[y]Mean separation in each column by Duncan's multiple range test, 5% level.

Table 3. Effect of 50 ppm GA_3 (0.4 mg/plant) applied on Oct. 18, 1972 on flowering of cyclamen cultivars; 42 plants per cultivar per treatment.

Days after treatment	% plants in flower													
	Bonfire #7		Donkersalmrood[z]		Hallo		Weih. Sel.[y]		Rosa von Zellendorf[z]		Zuiver Wit[z]		All cultivars	
	GA	Control	GA	Control	GA	Control	GA	Control	GA	Control	GA	Control	GA	Control
55	55c[x]	14a	55c	26ab	55c	12a	93d	24ab	48bc	17a	67c	10a	62c	17a
62	67c	21a	69c	36a	64bc	29a	95d	41ab	81cd	31a	74cd	31a	75cd	31a
69	74bc	36a	83cd	55ab	71bc	45a	98d	57ab	91cd	57ab	86cd	38a	84cd	48a
76	86cde	50a	91de	60ab	83cde	55ab	100e	69abc	95e	71bcd	86cde	55ab	90de	60ab
83	91c	67ab	91c	64ab	88c	60a	100c	79abc	95c	86bc	88c	64ab	92c	70ab
90	91cd	67ab	93cd	67ab	88cd	60a	100d	79bc	95cd	88cd	88cd	67ab	93cd	71b
97	95bc	81ab	98c	74a	91bc	81ab	100c	86abc	95bc	91bc	95bc	81ab	96c	82ab
104	98bc	98bc	100c	88a	98bc	95abc	100c	95abc	100c	98bc	98bc	91a	99c	94ab
111	100b	100b	100b	93a	100b	98ab	100b	100b	100b	98ab	100b	93a	100b	98b
125	100a	100a	100a	100a	100a	100a	100a	100a	100a	100a	100a	100a	100a	100a

[z]Tas Type.
[y]Weihenstephan Selection, a noncommercial cultivar, obtained from Prof. F. Penningsfeld, Technische Universitat, Feising-Weihenstephan, W. Germany.
[x]Mean separation in columns by Duncan's multiple range test, 5% level.

21 and 28 or more days for 50 and 75% bloom respectively (Table 1, 3). Mean flowering, for the 6 cultivars was advanced 35 and 28 days for 75 and 90% bloom, respectively (Table 3). Jansen advanced flowers only 14 to 18 days with his multiple applications. Increased simultaneous flowering production per plant in the current study confirmed and extended Jansen's findings.

Kohl and Kofranek (4) found 9 weekly applications of 100 ppm GA_3 to be excessive, and in our studies a single application of 100 ppm was excessive.

Acceleration of blooming of GA_3-treated plants was similar each year. Application of GA_3 to plants of adequate (20-25 cm in diam) size 60 to 75 days prior to Christmas should insure having 75 to 90% of the plants of most "early" cultivars in bloom for the holiday. "Late" cultivars may require earlier treatment whereas "very early" cultivars such as 'Weihenstephan Selection' could probably be treated later.

Cyclamen cultivars are less uniform in flowering than cultivars of many other species, and 5-10% of the plants are relatively slow to bloom. This slowness to bloom is usually attributed to genetic variability. The final 10% of GA-treated plants required an extra 35 days to flower (Table 3). Thus, the effectiveness of GA treatment should be judged by the reaction of the majority rather than all of the plants.

A smaller lot of plants was treated in April, 1972. Again, treated plants bloomed earlier than control plants. Thus, GA treatment could conceivably encourage the production of cyclamen for continuous sale throughout the year.

A 20°C minimum finishing temp was used in 1971, but flower quality was below average on both treated and control plants. Thus, lower finishing temp were used in 1972. In both years, lasting quality of GA_3-treated plants and flowers was equivalent to that of control plants in informal tests. Because more flowers developed simultaneously on GA_3-treated plants, subsequent flowering was less than on control plants Since cyclamen plants are not kept in the average home for more than 4-6 weeks, the decrease in late bloom is considered unimportant.

Table 4. Mean flower production per blooming plant for 6 cultivars, 76 days after GA_3 treatment on Oct. 18, 1972; 42 plants per cultivar per treatment.

Cultivar	No. of flowers per plant	
	GA_3-treated	Control
Bonfire #7	8.5bcd	5.7ab[z]
Donkersalmrood	11.8de	9.3cde
Hallo	8.8bcd	4.0a
Weihenstephan Selection	12.5e	5.6a
Rosa von Zellendorf	10.6cde	6.2ab
Zuiver Wit	7.0abc	3.6a
All cultivars	10.3	6.2

[z]Mean separation in columns by Duncan's multiple range test, 5% level.

Literature Cited

1. Dorr, G. 1960. Spraying trials with gibberellin on ornamental plants. *Gartenwelt* 60:403-404.
2. Hagemann, W. 1959. Comparative morphological, anatomical and development studies of *Cyclamen persicum* Mill as well as certain other cyclamen species. *Botanische Studien* 9:1-88. Veb Gustav Fischer Verlag Jena.
3. Jansen, H. 1960. The application of gibberellin to cyclamen. *Gartenwelt* 60:230-232.
4. Kohl, H. C., Jr., and A. M. Kofranek. 1957. Gibberellin on flower crops. *Calif. Agri.* May, p. 9.