

Studies on the effect of Gibberellin* on Growth and Flowering of Dahlia

by
S. P. MITTAL†

Introduction: Gibberellins display a remarkable diversity of physiological effects, including those on growth, flowering, fruiting and dormancy. In most cases, if not always, the direct action of GA is stem elongation, followed by flower bud formation as a direct effect of this stem elongation but as an indirect effect of GA (Phinne and West 1960, Wellensiek 1962.) The stem elongation is due to the increased length of internodes; the number of internodes is generally not affected (Brain 1958), Marth *et al* 1956 and Ralley 1959). Within a certain range, the increase in height following treatment with GA is proportional to the dose applied. Marked increase in fresh and dry weight as a result of GA application has also been reported by Rappaport (1957 b) and Bukovac and Wittwer (1956) in Earlypak tomato and Celery plants respectively. In the present study an attempt has been made to study the effect of foliar application of GA on general growth and flowering of Dahlia.

Material and Methods: Five seeds of Dahlia were sown in January, 1965 in unglazed earthen pots (30 x 30 cm.), containing two parts of garden soil and one of compost. The seedlings were thinned out to two in each pot later on.

The plants were sprayed twice, before anthesis, with aqueous solutions of gibberellic acid (B. D. H.) at concentrations of 50, 100, 200, 300 and 500 ppm. The first treatment was given when the plants had formed 2-3 nodes and the second at 6-7 node stage. Ten replicates of each treatment along with equal number of controls were maintained. Detailed observations on days to the visual appearance of the first flower bud, height, number of internodes, internode length, number of branches and fresh and dry weight of plants were made. The plants were dried in an oven at 80°C for 72 hours. The data were statistically analyzed.

Results: *Effect on shoot growth:* Applications of GA significantly increased the plant height by increasing the main axis internode length in all treatments over control. The increase in height and mean internode

* "Gibberellin" as used herein, is Gibberellin A₂ (Gibberellic acid) and is abbreviated as "GA" in the text.

† Present address: Soil Conservation Research Centre, Bellary (Mysore State).

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length was proportional to the GA concentrations upto 300 ppm where maximum height (98.5 cm) and internode length (8.21 cm) were obtained. But at still higher concentration (500 ppm) the effect was inhibitory, as the height and internode length were reduced to 87.3 cm and 7.27 cm respectively. However, no significant differences were observed between 100, 200 and 300 ppm GA with regard to the height and internode length. The correlation between height and number of internodes was highly significant in plants treated with 100 ppm. GA. There was a positive correlation between the height and number of internodes in plants treated with 50, 200 and 500 ppm. GA, but the correlation was not statistically significant. No positive correlation was noted with control and 300 ppm. GA (Table I).

TABLE I
Effect of GA on Vegetative Growth of Dahlia.

Character	GA concentration ppm.						S.E.M.	C. D at 1%
	Control (1)	50 (2)	100 (3)	200 (4)	300 (5)	500 (6)		
Height (cm.)	58.2	84.0	93.7	94.8	98.5	87.3	±1.43	5.5
Number of internode	14.5	13.8	13.2	12.9	12.8	12.3	±0.42	1.6
Coefficient of correlation between height and internode number (r)	-0.091	+0.345	-0.657	+0.414	-0.093	+0.258
Mean internode length (cm)	4.15	6.46	7.21	7.90	8.21	7.27
Number of branches	0.9	3.0	3.7	3.8	4.5	8.1	±0.32	1.23

Bar diagrams: Height : (5) (4) (3) (6) (2) (1)
 No. of internodes : (1) (2) (3) (4) (5) (6)
 No. of branches : (6) (5) (4) (3) (2) (1)

The GA treatments significantly enhanced the production of branches on the main axis over control. The effect was striking and proportional to the GA concentrations. It is interesting to note that GA concentration of 500 ppm. recorded 8.1 branches on an average per plant as against 0.9 in control and 4.5 with 300 ppm. (Table I). Branching was more frequent in the treated plants than in the control and the branches were mainly formed at the lower nodes. However, a few branches also developed below the main shoot apex towards the end of the growing period.

The general appearance of the plants was also altered markedly due to GA treatment. The control plants looked short and stout, while the treated ones looked tall and with more branches at the lower nodes of the main axis.

Effect on fresh and dry weight : GA concentrations of 200 ppm and higher resulted in significant increase in the fresh and dry weight of plants over control and other treatments. However, GA concentration of 50 ppm. reduced the fresh weight of plants significantly, while concentrations of 50 and 100 ppm. both reduced the dry weight, but not significantly, over control (Table II).

TABLE II

Effect of GA on Fresh weight, Dry weight and Flowering of Dahlia.

Character	GA concentration ppm.						S.E.M.	C. D. at 1%
	Control (1)	50 (2)	100 (3)	200 (4)	300 (5)	500 (6)		
Fresh weight (gm)	123.2	115.8	122.8	147.6	146.9	152.7	± 0.22	0.84
Dry weight (gm)	14.9	14.3	14.7	19.4	18.8	20.8	± 0.53	1.07
Day to first flower	75.6	73.7	68.5	66.3	71.3	70.6	± 1.62	6.19

Bar diagram t

Fresh weight : $\overline{(6)}$ $\underline{(4)}$ $\overline{(5)}$ $\underline{(1)}$ $\underline{(3)}$ $\underline{(2)}$

Dry weight : $\overline{(6)}$ $\underline{(4)}$ $\underline{(5)}$ $\underline{(1)}$ $\underline{(3)}$ $\underline{(2)}$

Days to first flower : $\underline{(1)}$ $\underline{(2)}$ $\underline{(5)}$ $\underline{(6)}$ $\underline{(3)}$ $\underline{(4)}$

Effect on flowering : The control plants took nearly 76 days, on an average, for the emergence of the first flower bud. The applications of GA made twice, before anthesis, induced early flowering. Plants treated with 100 ppm GA recorded significantly lower number of days for the emergence of the first flower bud over control, while 200 ppm GA recorded significantly lower number of days over both control and 50 ppm GA. There was no significant difference between 100, 200, 300 and 500 ppm GA treated plants.

Discussion : A characteristic effect of GA on plants is to make them taller. This has been shown particularly well with garden peas by Brian (1958) with a number of genera and species by Marth *et al* (1956) and by Bukovac and Wittwer (1956) using different plants. Application of GA twice before anthesis, brought about changes both in the vegetative as well as reproductive phases of growth of Dahlia. Treatments with GA increased the height of plants by increasing the length of stem internodes; but reduced the number of internodes. The increase in height following GA treatment was proportional to the GA concentrations upto 300 ppm. but higher concentration (500 ppm) was found to be inhibitory as the height and internode length reduced significantly.

The general growth of *Dahlia* plant was also affected by GA. The untreated plants remained short, stout and with very few branches on the main axis. The treated plants, on the other hand, became very tall and

developed more axillary branches, especially at the lower nodes of the main axis. Brian *et al* (1959) also observed similar changes in the growth of Cupid sweat peas. The treated plants exhibited great apical dominance so long as the effect of GA persisted. The inhibition of development of lateral branches was released first in the lower and then in the upper nodes of the main axis Wickson and Thimana (1958).

Associated with the increase in size of shoot, induced by GA, there was significant increase in the fresh and dry weight of plants treated with 200 ppm and higher concentrations of GA. Marked increase in fresh and dry weight of Earlypak tomato have also been reported by Rapport (1957 b) as a result of GA treatment. This increase appears to be mainly due to the increased number of branches and higher internode length recorded by these treatments.

The effect of GA applications on the earliness of flowering in Dahlia was well marked. The plants treated with 100 and 200 ppm. GA recorded an earliness of about seven and nine days respectively over control. Similar results were obtained by Desai and Pathak (1965) with *Trigonella* using lower dose of GA. The earliness was due only to the GA treatment. The higher concentrations (300 and 500 ppm) did show earliness but the differences were not significant. The control plants took the longest time (75.6 days) while the 200 ppm. plants took only 66.3 days to induce flowering.

Summary: Applications GA, twice before anthesis, brought about changes in the vegetative and reproductive phases of growth of Dahlia. The control plants remained short, stout with more number of internodes and a few axillary branches. The GA treated plants, on the other hand, became tall, developed less number of internodes, but more number of branches at the lower nodes. The increase in height was due to the increased length of stem internodes.

Treatments with higher concentrations of GA brought about an increase in fresh and dry weight of plants by increasing the length of internodes and number of branches. GA induced early flowering in plants treated with 100 and 200 ppm. GA over control.

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