Effect of I-naphthylacetic acid on the growth of chrysanthemum plants

M. KHATTAB AND M. R. HASSAN

ABSTRACT

Different concentrations of NAA (0, 50, 100, 200 and 400 ppm) were sprayed three times on *Chrysanthemum morifolium* cv. «White Canova». The results showed that there were significant effects on growth and flower quality when the level of NAA was between 50 and 200 ppm. Using 400 ppm NAA gave a slight effect on some recorded data.

INTRODUCTION

The wide range of synthetic chemical species which can engender auxin responses is striking; especially impressive is the fact that close analogs of IAA may be inactive as auxins and yet chemicals of such diverse types as the phenoxyacetic, naphthalenacetic, benzoic, and picolinic acids are highly active as auxins (3). Auxins are present in all higher plants. They appear to be synthesized mainly in meristematic tissues such as those of the stem and root apex, young developing leaves, flowers and fruits. They are of fundamental importance in the physiology of growth and differentiation (8)..

The aim of the present work was to study the effect of various concentrations of I-Naphthylacetic acid (NAA) on the vegetative growth and flower quality of chrysanthemum plants under the prevailing conditions in Alexandria.

MATERIALS AND METHODS

The present work was carried out through the years 1979 and 1980, at the Experimental Station of Floriculture and Ornamental Horticulture, Faculty of Agriculture, University of Alexandria.

Rooted cuttings of *Chrysanthemum morifolium* (Ram.) cultivar «White Canova» were planted during the third week of February 1979 in seed pans using two parts of light soil and one part of sand by volume. In May, the rooted cuttings were transferred to pots of 10 cms diameter using the same medium used before.

In July of the same year, the plants were transferred to the final clay pots of 25 cms diameter using a loamy soil. In the third week of August one branch was selected per plant to produce large flowers for export, and the other branches were removed. Thereafter, the plants were sprayed until runoff with zero (control), 50, 100, 200, and 400 ppm of I-Naphthylacetic acid (NAA = $C_{10}H_7CH_2COOH$). The weights of NAA were dissolved in 50 ml ethyl alcohol 5%, then diluted to give the forementioned concentrations. The spray treatments were applied three times on August 18, September 8, and 29, 1979 with a hand-compressed air sprayer.

The experiment layout was designed to provide randomized complete blocks with 4 replications. Each treatment was represented by two plants (Plot) in the replicate. Analysis of variance was calculated for the mean of each plot as described by Snedecor (6).

Horticulture Department, Faculty of Agriculture, University of Alexandria, Egypt.

The data recorded at the end of that experiment were length, diameter, and dry weight of the stem, leaf dry weight, number of florets per capitulum, and inflorescence dry weight. Leaf chlorophyll (a + b) was determined in the middle leaves at showing colour stage. The experiment was repeated in 1980 with the same steps and treatments.

RESULTS AND DISCUSSION

Vegetative Growth: There was no stable trend for the effects of various concentrations of NAA on the stem length. Generally, the treatments 50, 100, and 200 gave significant increase in the stem length during the first season 1979 as compared with the control treatment (Table 1). However, a maximum increase of the stem length was obtained when the plants were sprayed with 200 ppm NAA. Meanwhile no significant differences in stem length were achieved during the second season, 1980.

These results were probably due to application of NAA at specific concentration that led to elongation in the stem internodes, and consequently, the length of the stems would be increased. A similar trend of results was reported by Galston and Purves (1) and Scott and Briggs (5).

The two seasons experiments showed that spraying chrysanthemum with 50 and 100 ppm NAA led to significant increases in the stem diameter as compared with the control plants, with the exception of the 200 ppm NAA in the second season, 1980 (Table 1). These results were probably due to the addition of NAA between 50 and 100 ppm that led to the stimulation of cambial activity and increased xylem development in the plant stem, consequently, the stem's diameter could be increased. Similar results were obtained by (8).

The data in Table 1 showed that the highest stem dry weight in 1979 and 1980 was obtained by the application of 50 ppm and 200 ppm, respectively.

Spraying the plants with NAA leads to an increase in the thickness of stems, consequently, the stem dry weight would be increased. The results presented in Table 1 also indicated that using 50 ppm NAA led to maximum increases in the leaves dry weight in the two season experiments as compared with the other treatments including the control. Furthermore, using 200 or 400 ppm NAA led to significant increases in the dry weight of leaves in one season, 1980. The application of NAA at 50 ppm may lead to an increase in either leaf area or leaf thickness or both, consequently, the leaf's dry weight would be increased. This is in agreement with the results obtained by Wareing and Phillips (8).

Flower Quality: There was no consistent trend for the effects of different concentrations of NAA on the time taken from the date of the last spray with NAA to the showing colour stage for the flower buds (Table 1).

Generally, the treatments, 50, 100 and 200 ppm NAA in one season (1979) led to significant reduction in the period needed to flowering with a difference of 4, 2.75 and 2.63 days compared with the control treatment, respectively.

These results may be explained on the basis that the used concentrations of NAA had a slight effect on the initiation and development of the florets in chrysanthemim plants and/or due to the initiation and development of the florets in chrysanthemum plants that may be controlled by other conditions such as temperature, day length and fertilizers. Similar trend of results was reported by Leopold (2).

Inflorescence diameter was significantly increased by all NAA treatments as compared with the control treatment, with the exception of the 400 ppm treatment in the second season 1980. The maximum increase in the inflorescence diameter was obtained when the plants were sprayed with 100 ppm NAA (Table 1).

The increase in inflorescence diameter may be attributed to the expansion of ray florets in the capitulum. These results are in agreement, with those reported by Leopold and Kriedemann (3).

There were no significant differences in the number of the ray florets per capitulum among the various treatments during the two seasons (Table 1). These results were pro-

bably because the NAA at the foregoing concentrations had no effect on formation of the ray florets.

There was no stable trend for the effect of various NAA concentrations on the number of disc florets per capitulum. In general, the treatments namely, 50, 200 and 400 ppm NAA gave significant increases in the number of disc florets per capitulum in one season, 1980. Inconsistency in the results could be because the number of florets per capitulum may be controlled by other conditions such as light, temperature, fertilizers and genetic structure of the plants.

The obtained data of the two seasons showed that spraying the plants with 50 or 100 ppm NAA led to significant increase in the dry weight of the inflorescences as compared with the other treatments (Table 1). The application of NAA at 50 and 100 ppm probably leads to an increase in the thickness of inflorescence parts and, consequently, the dry weight of the inflorescence could be increased.

Chlorophyll Content: In general, chlorophyll (a and b) content of the middle leaves of chrysanthemum plants at showing colour stage was significantly increased by all NAA concentrations as compared with the control treatment, with the exception of the 400 ppm level in the second season, 1980 (Table 1). These results may be because the application of NAA to chrysanthemum plants led to a delay in the degradation of chlo-

Table 1 — Effect of different concentrations of NAA on the vegetative growth, flower quality and chlorophyll content of *Chrisanthemum morifolium* cv. «White Canova» during the two seasons 1979 and 1980

Measurements	Season	NAA concentration in ppm					L.S.D. at	
		Zero control	50	100	200	400	0.05	0.01
Stem length (cms)	1979	37.00	41.00	42.00	42.88	40.25	3.73	5.19
	1980	44.15	46.13	46.88	47.38	46.38	N.S.	N.S.
Stem diameter (mm)	1979	5.38	6.69	6.31	5.69	5.38	0.69	0.96
	1980	5.75	6.55	6.38	6.63	6.13	0.57	0.80
Stem dry weight (grms)	1979	2.81	3.76	3.22	2.79	2.77	0.67	0.94
	1980	3.83	4.60	4.02	4.63	3.86	0.47	0.65
Leaf dry weight (grms)	1979	5.56	11.26	7.91	7.28	5.28	2.96	4.15
	1980	8.41	12.90	9.51	10.77	10.13	1.35	1.89
Showing colour (days)	1979	50.63	46.63	47.88	48.00	49.88	2.60	3.64
	1980	49.50	58.38	59.38	58.63	58.50	N.S.	N.S.
Influorescence diameter (cms)	1979	13.50	15.45	15.83	15.03	14.65	0.74	1.04
	1980	11.95	13.00	13.63	13.00	12.45	0.78	1.09
Number of ray floretes	1979	176.75	230.50	219.13	226.50	234.25	N.S.	N.S.
	1980	252.00	256.63	239.88	243.00	241.13	N.S.	N.S.
Number of disc florets	1979	216.00	280.63	224.38	247.63	237.38	N.S.	N.S.
	1980	175.75	206.00	202.00	223.38	223.63	28.06	39.34
Influorescence dry weight (gm)	1979	2.63	3.74	3.59	2.99	2.79	0.74	1.04
	1980	2.64	3.12	3.07	3.48	2.65	0.32	0.45
Chlorophyll (a + b) mg/100g dry weight	1979	296.94	442.34	577.37	496.96	747.09	70.96	99.48
	1980	381.83	453.61	618.84	584.75	372.80	64.84	90.90

L.S.D. at 0.05 = Least significant difference at probability 5%
L.S.D. at 0.01 = Least significant difference at probability 1%
N.S. = Non Significant

rophyll in the leaves or, in general, a delay in the senescence of the leaves. Similar results were reported by Osborne and McCall (4).

LITERATURE CITED

1. Galston, A. W. and W. K. Purves, 1960. *The machanism of action of auxin.* Ann. Rev. Plant Physiol. 11: 239 - 276.
2. Leopold, A. C., 1958. *Auxins uses in the control of flowering and fruiting.* Ann. Rev. Plant Physiol. 9: 281 - 410.
3. Leopold, A. C. and P. E. Kriedemann. 1975. *Plant growth and development.* 2nd Edition. McGraw - Hill Book Company.
4. Osborne, D. J. and D. R. Mc Call, 1961. *Rapid bioassay for kinetin and kinies using senescing leaf tissue.* Plant Physiol. 36: 219 - 221.
5. Scott, T. K. and W. R. Briggs, 1960. *Auxin relationships in the Alaska pea.* Am. J. Bot., 47: 492 - 499.
6. Snedecor, G. W., 1956. *Statistical Methods.* 5th Ed. Iowa State University Press, Amer. Iowa, USA.
7. Wareing, P. F., 1958. *Interaction between indoleacetic acid and gibberellic acid in cambial activity.* Nature, 181: 1744 - 1745.
8. Wareing, P. F. and D. J. Phillips, 1970. *The control of growth and differentiation in plants.* Pergamon Press Ltd.

تأثير هرمون *NAA* على نمو نباتات الاراولا

م. ر. حسن
م. خطاب

المستخلص

درس تأثير الرش ثلاث مرات بتركيزات مختلفة من NAA هى : 50، 100، 200، 400 جزء فى المليون على نمو وإزهار صنف تجارى من الأراولا هو White Canova وقد أجريت هذه الدراسة خلال عامى 1979 - 1980 بمزرعة كلية الزراعة، جامعة الاسكندرية. ويمكن تلخيص النتائج المتحصل عليها كالآتى:

أ - اضافة 50 جزء فى المليون ادت لأقصى زيادة معنوية فى الوزن الجاف للاوراق والنورات، كما اعطت تبكيرا بسيطا فى موعد التزهير.

ب - اضافة 100 جزء فى المليون اعطت اعلى زيادة معنوية فى قطر النورات.

جـ - زيادة التركيز حتى 200 جزءفى المليون ادت لزيادة كل من طول وقطر ووزن الساق الجاف.

د - عدد الزهيرات (الشعاعية والقرصية) فى النورة ليس له اتجاه ثابت نتيجة المعاملة بالـ NAA.

هـ - محتوى الاوراق الوسطية من الكلوروفيل بلغ أقصاه عندما كان تركيز الـ NAA يتراوح ما بين 100 ، 400 جزء فى المليون.