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Effect of plant growth regulators on plant growth, flower yield and quality of dahlia (*Dahlia variabilis L.*) cv. Kenya

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Abstract
The field experiment entitled "Effect of plant growth regulators on plant growth, flower yield and quality of Dahlia cultivar was planned and conducted during Rabi season 2013-2014 at Research Farm of Department of Horticulture, Sam Higginbottom Institute of Agriculture Technology and Sciences, Allahabad, (Deemed-to-be-University), Allahabad Uttar Pradesh India, with combination of different source of plant growth regulators on plant growth, flower yield and quality of Dahlia. Experiment consisted of 10 treatments with 3 replications laid in RBD. The result obtained from the experiment show that combination of different hormone source of plant growth regulators significantly affected the growth parameters of Dahlia such as plant height (124.08cm), plant spread (114.75cm), number of leaves / per plant (126.23), days of 1st bud initiation (83.50), flower diameter (23.92cm), number of flower / per plant (10.08), flower weight (75.25gm), flower yield / ha (16.9t), Average tuber weight (50.26gm), Average yield of tuber (17.83t/ha). The flower yield attributes of Dahlia were also influenced significantly by combination of different plant growth regulators. The maximum value of yield and yield attributes parameters viz. Maximum number of flower per plant, flower yield / ha, number of flower / plant were found to be higher under the treatment T_6 (GA_3 @ 200ppm).

Keywords: dahlia, GA_3, NAA, MH, quality and yield

Introduction
Dahlia (*Dahlia variabilis* L.) is a tuberous rooted half hardy herbaceous perennial. Stems are mostly erect, branched, glabrous or scabrous, belonging to the family Asteraceae having its origin in Mexico (Pandey *et al.*, 2017). Dahlia was named in honor of the Swedish botanist Dr. Andereas Dahl, pupil of Linnaeus from where it was first introduced into Madrid (Spain) in 1789 and other European countries. Dahlia was introduced to India as early as 1857 under the auspices of the Agri Horticultural Society of India Calcutta (Malik *et al.*, 2017).
Dahlia is one of the most important garden plants. Multitude of colors, great variation in sizes (ranging from miniature, less than 2.5 cm across to giant over 40 cm in diameter), attractive shapes, many forms, profusion of flowering and easy cultivation have made them immensely popular (Vinaynanda, 1985). They are easy to grow both in ground and pot, and are extensively used for exhibition, garden display and home decoration and cut flowers of pompon and, miniature types stay fresh in flower vases for many day and also make moderately good garlands.
Plant growth regulators (PGRs) are designed to affect plant growth and/or development and applied for specific purposes to elicit specific plant responses (Joyce, 2012). Controlling plant size is one of the most important aspects in floricultural crops which can be achieved genetically, environmentally, culturally or chemically. To obtain more flowers per plant, stress should be given on the number of branches per plant during selection of cultivars and strains. Plant height and number of leaves also showed a slight positive effect on the number of flowers Singh and Singh (2005). Keeping above facts this study was aimed at Effect of plant growth regulators on plant growth, flower yield and quality of Dahlia.

Materials and Methods
The study of the Effect of plant growth regulators on plant growth, flower yield and quality of Dahlia (*Dahlia variabilis* L.) cv. Kenya was carried out under Allahabad agro climatic conditions at the experimental field of the Department of Horticulture, Allahabad school of Agriculture, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Deemed to-be University, (formerly known as Allahabad Agriculture Institute AAI-DU). The details

pertaining to the materials and methods adopted are presented here; the experimental site is situated at of a latitude of 20^0 and 15^0 North and longitude of 60^0 3 East and at an altitude of 98 meters above mean sea level (MSL). The area of Allahabad district comes under subtropical belt in the South East of Uttar Pradesh, which experience extremely hot summer and fairly cold winter. The maximum temperature of the location reaches up to 46^0C - 48^0C and seldom falls as low as 4^0C - 5^0C. The relative humidity ranged between 20 to 94 percent. The average rainfall in this area is around 1013.4 mm annually. The experimental site was a fairly level land with sandy loam soil of uniform fertility status with low clay and high sand percentage. Soil samples were collected at random spots up to depth of 0-30 cm and the soil was analyzed for pH, electrical conductivity (EC), organic carbon, available nitrogen, available phosphorus and available potassium at Indian Farmers and Fertilizers Co-operative Limited (IFFCO), Allahabad. For nitrogen fertilizer, Urea at 65 g/m^2 was used. For phosphorus, Single Super Phosphate 125 g/m^2 and for potash, Muriate of Potash 30 g/m^2 were used. Gibberellic acid (Company- Devi Dayal) & NAA (Company- Indofil) was purchased from, local market Allahabad. Certain amount of GA3 & NAA (according to the treatment) was measured on electronic balance and dissolve in a litter amount of ethylene alcohol. Then one litter of distilled water was added to it to make the final solution.

Result and Discussion

A field experiment entitled, "Effect of plant growth regulators on plant growth, flower yield and quality of Dahlia (*Dahlia variabilis* l.) cv. Kenya" was carried out at Horticultural experimental field, Department of Horticulture, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Deemed-to-be University (formerly known as Allahabad Agricultural Institute-AA-IDU), during rabi season of 2013-2014. The detail pertaining to the materials and methods adopted are presented in this chapter.

The experiment was carried out in the Randomized Block Design (RBD) with 3 replication and 10 treatments. The different level of Naphthalene acetic acid, Gibberellic acid and Melic hydrazide were applied. The results and discussion which were presented in the preceding chapters are being summarized and concluded below.

Plant heights were significantly increased by different levels of GA_3 and NAA at all successive stages of growth. 200 ppm of GA_3 produced maximum plant height (124.08 cm) followed by (109.17 cm) with 700 ppm MH. The minimum plant height (54.67 cm) was observed with control. The Maximum number of leaves (126.50) were recorded with 200 ppm GA_3 followed by (116.08) with 700 ppm MH. Minimum number of leaves (47.67) per plant was noticed in control. The Minimum days to first bud initiation (50.20) day were recorded with 200 ppm GA_3 followed by (62.42) with 700 ppm MH. Maximum days to first spike initiation (82.50) were noticed in 800 ppm MH. Flower diameter was significantly affected by different levels of GA_3 and NAA at all successive stages of growth. 200 ppm of GA_3 produced maximum flower diameter (23.92 cm) followed by (22.92cm) with 700 ppm MH. The minimum Flower diameter (18.83 cm) 50ppm NAA was observed with control. Numbers of Flower/plant were significantly increased by different levels of GA_3 and NAA at all successive stages of growth Similarly observation were recording (Sekar and Sujata 2001). 200 ppm of GA_3 produced maximum Number of Flower/plant (10.08) followed by (9.58) with 700 ppm MH. The minimum Number of Flower/plant (4.75) 50 ppm NAA was observed with control. Flower weight (g) significantly increased by different levels of GA_3 and NAA at all successive stages of growth. 200 ppm of GA_3 produced Maximum flower weight (g) (75.25) followed by (73.67) with 700 ppm MH. The Minimum flower weight (g) (40.67) 50 ppm NAA was observed with control. Flower yield (t/ha) significantly increased by different levels of GA_3 and NAA at all successive stages of growth. 200 ppm of GA_3 produced Maximum flower yield (t/ha) (13.50t/ha) followed by (12.73t/ha) with 700 ppm MH. The Minimum flower yield (t/ha), (7.93t/ha) 50ppm NAA was observed with control. Average tuber weights (g) were significantly increased by different levels of GA_3 and NAA at all successive stages of growth. 200 ppm of GA_3 produced Maximum Average tuber weight (g) (50.26 g) followed by (44.49 g) with 700 ppm MH. The Minimum Average tuber weight (g) (27.29g) 50 ppm NAA was observed with control. Average yield of tuber (t/ha) were significantly increased by different levels of GA_3 and NAA at all successive stages of growth. Similarly observation were recorded by Khan and Tiwari (2003). 200 ppm of GA_3 produced Maximum Average yield of tuber (t/ha) (17.83t/ha) followed by (17.17t/ha) with 700 ppm MH. The Minimum Average yield of tuber (t/ha) (12.75t/ha) 50ppm NAA was observed with control. Maximum net return (Rs. 262,344) and benefit cost ratio (1.51) was noticed in 200 ppm GA_3. The Minimum net return (Rs -1,856) and benefit cost ratio (0.99) was recorded in control.

Conclusion

From the experiment it is concluded that application of T_6 GA_3@ 200 ppm at 30, 45 and 60 DAP had a significantly direct effect on Dahlia flower and tuber production. Application of different plant growth regulator may be adopted for obtaining maximum yield and quality of dahlia with B C R 1.51.

Table 1: Effect of plant growth regulators on plant growth, flower yield and quality of Dahlia (*Dahlia variabilis l.*) cv. Kenya

Treatment	Plant height (cm)	Plant spread area(cm)	Number of leaves	Days of 1st bud initiation	Flower diameter (cm)	Number of flower/plant	Flower weight (g)	Flower yield (t/ha)	Average tuber weight (g)	Average yield of tuber (t/ha)	Benefit: Cost ratio
T0	47.33	47.33	45.00	63.83	18.08	4.17	37.33	7.17	25.58	12.26	1.06
T1	54.67	54.67	47.67	80.25	18.83	4.75	40.67	7.93	27.29	12.75	1.10
T2	65.50	65.58	53.08	75.83	19.83	5.83	52.25	8.84	30.32	12.92	1.22
T3	70.75	70.17	57.25	74.42	20.33	6.33	57.25	9.63	32.57	13.33	1.30
T4	73.08	73.60	63.00	71.58	21.17	7.00	60.08	10.36	37.09	14.08	1.32
T5	78.08	78.83	76.58	69.50	21.67	7.42	63.25	10.92	37.46	14.83	1.40
T6	124.08	114.75	126.33	83.50	23.92	10.08	75.25	13.50	50.26	17.83	1.51
T7	106.58	99.25	104.17	62.42	22.33	8.68	71.83	11.92	42.01	16.17	1.20
T8	109.17	105.42	116.08	59.67	22.92	9.58	73.67	12.73	44.49	17.17	1.42
T9	87.98	85.07	90.50	50.20	21.92	7.75	68.00	11.33	40.32	15.42	1.35

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