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RESEARCH ARTICLE

Effect of application of plant growth regulators in sustainable improvement of gladiolus production in Manipur

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SUMMARY

An experiment was conducted during 2008-2009 at College of Agriculture, Central Agricultural University, Imphal to identify the effect of plant growth regulators on growth, flowering and corm production of gladiolus cv. Applause. Seven treatments with two different plant growth regulators *viz*., GA_3 and NAA at three concentrations of each, including one control was set up in gunny bags. It was found that number of leaves per plant was more (8.267) with T_5 while plant height was more with T_3 (90.133cm). GA_3 (500 ppm) recorded early flowering (78.53 days) followed by GA_3 750 ppm (83.63 days) and (T_5) NAA 500 ppm (81.30 days). Number of florets per spike (14.30) was recorded with T_3. Spike length (81.233 cm), rachis length (42.067 cm) were more with T_2 while control (T_7) was found minimum in all parameters.

Key Words : Gladiolus, Plant growth regulators, Applause, Spike, Rachis

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Gladiolus is a glamorous bulbous flower of beauty and perfection. It is said to be queen of bulbous flower crops grown in many parts of the world. In international cut flower trade gladiolus occupies fifth place. The total area under the floricultural crops in India has been estimated around 94, 000 hectares. Among which bulbous ornamentals are cultivated over 3,500 hectares with maximum under gladiolus (1,270 hectares). Gladiolus with its wide range of characteristics such as huge size, styles and patterns always interested the consumers, floriculturists, interior designers and exporters. It has a great share in cut flower industry and fetches good price. It is a potential money spinner for India's floriculture industry (Barman *et al.*, 2005). Gladiolus has almost established in India. In Manipur also growing of Gladiolus has been started at Ukhrul and Senapati districts. Even though wide spread cultivation of gladiolus in North Eastern India particularly in Manipur has not yet been taken up.

With its congenial climate, the state of Manipur offers great scope for cultivation of gladiolus. However, due to limited access to technologies, the farmers have very little idea about the scientific growing of this crop. The use of growth regulators in horticulture has brought about a revolution in the floriculture industry (Vijaykumar and Singh, 2005). Synthetic growth regulating chemicals were reported to be very effective in manipulating growth, flowering and corm production in gladiolus (Misra *et al.*, 1993). Mohanty *et al.* (1994), Pal *et al.* (1998), have reported in enabling removal of many of the barriers imposed by hereditary and environment.

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It is now an established fact that plant growth regulators play an important role in manipulation of growth and development of plants for agricultural and horticultural purposes. Plant growth regulators could be used to enhance productivity of crop plants. Growth promoters are types of phytohormones which promote, enhance or accelerate the overall growth, modify development and metabolism of plants, while growth retardants are usually synthetic chemicals which suppress the overall growth slowing down cell division and cell elongation without altering their gross morphology (Cathey, 1964). Plant growth regulators shifted the balance of sex expression reversing maleness to femaleness as certain flowering plants (Heslop , 1959). Plant growth regulators added a new dimension to the possibility for modifying plant growth, quality, yield etc. under such circumstances the present investigation was taken up to examine the effects of GA_3 and NAA on sustainable improvement such as on growth, flowering and corm production of gladiolus in Manipur.

MATERIALS AND METHODS

A trial was conducted to identify the effect of plant growth regulators on growth and flowering characteristics of gladiolus var. Applause at Botany and Plant Pathology department, College of Agriculture, Central Agricultural University, Imphal, Manipur for consecutive two seasons during 2008-2009. 21 bags of gunny bags (5x20 cm size) with soil: sand: FYM in the ratio of 1:1:1 were used for planting the corms. Altogether seven different treatments with two different plant growth regulators *viz.*, GA_3 and NAA with 3 different concentrations of each including one control was laid out in Randomized Block Design with three replications. The treatments were T_1:GA_3 250 ppm, T_2:$GA_3$500 ppm, T_3:$GA_3$750, T_4:NAA 100 ppm. T_5:NAA 250 ppm, T_6:NAA 500 ppm, T_7-control (No growth regulator application). Healthy corms were planted at a spacing of 30 × 20 cm and depth of 10 cm in the first week of March. Corms were dipped in growth regulator solution for two-hours and shade dried. Growth regulators were sprayed at 45 and 60 days after planting. It was grown successfully with all the recommended cultural practices throughout the cropping period and the corms were collected after removal of spike and shade dried to avoid any disease infection.

Leaf number and height of plant was also recorded. Leaf area was measured by using the formula, leaf area (y) = 115 – 1050 (Asif, 1977). Various flowering parameters *viz.*, days taken to spike emergence, (DAP), days taken to flowering (DAP), spike length (cm), rachis (length), number of florets per spike were also recorded. Number of corms per plant was recorded. Diameter of corms (cm) was measured with the help of vernier caliper. Weight of corms (g) was measured in automatic balance.

For each replication, five plants were randomly tagged for different treatments. An average value of tagged plants for particular parameter was recorded and the average value was noted as one replication. Mean values of three replications after subjecting them to statistical calculations was recorded statistical analysis was carried out. Significance was identified at 5 per cent level.

RESULTS AND DISCUSSION

Effect of different growth regulators on vegetative growth of gladiolus is presented in Table 1.

NAA application had profound effect on production of leaves. NAA and GA_3 at higher concentrations (T_3) were at par with each other. Growth promoting effect of auxin and gibberellin are well documented. The growth regulator promoted cell division and cell elongation thereby, significantly influencing the leaf number, leaf area. Growth regulator application further enhanced the translocation of sugars. The results are in conformity with those of Barman *et al.* (2005) and Jhon *et al.* (1997). Similar trend was observed in leaf area with different growth regulators. Due to less number of leaves, leaf area was also least with control. NAA application profoundly affected the leaf are irrespective of the concentration. GA_3 was modest in its action. Highest plant height was observed with GA_3 application followed by NAA (250 ppm) while the plant height (57.194 cm) was found minimum with control (T_7) Gibberrelins are well known to stimulate dramatically cell proliferation and elongation of the

Table 1: Effect of plant growth regulators on vegetative growth of gladiolus

Treatments (concentration)	No. of leaves/plant	Leaf area (cm^2)	Plant height (cm)
T_1 (250ppm – GA_3)	7.800	363.630	81.933
T_2 (500ppm – GA_3)	7.467	381.367	86.467
T_3 (750ppm – GA_3)	8.000	415.833	90.133
T_4 (100ppm – NAA)	8.100	471.833	71.933
T_5 (250ppm – NAA)	8.267	484.733	76.733
T_6 (500ppm – NAA)	7.867	463.567	82.067
T_7 (000 – Control)	6.200	253.900	57.194
F - value	18.173	4.086E3	610.608
P - value	.000	.000	.000
Critical difference	0.2376	1.846375	0.565393

intercalary meristem level, thus leading to internodal growth. Chowdhury and Pal (1998) observed that GA_3 and IAA increased plant height, number and size of leaves, thickness and width of shoots in gladiolus cv. TROPIC SEA.

Fig. 1: Spikes of applause

Plant growth regulators have significant effect on flowering characteristics of gladiolus (Table 2). GA_3 (500 ppm) took less number of days (75.80 days) followed by T_3 (78.967 days). NAA with higher dose reduce significantly the days to spike emergence while control (T_7) took the maximum days (89.906 days) to spike emergence. Accordingly, the growth regulators followed the same trend in days taken to flowering. Auxins, besides being involved in apical dominance, cell division and cell enlargement, shoot and root growth, also play specific role in growth, flowering and seed germination (Palanikumar and Bhatacharjee, 2001). Reduction in number of days to flowering due to GA application in gladiolus was also reported by Jhon *et al.* (1997). The spike length was more with GA_3 application T_2 (81.233 cm) and followed by NAA application T_6 (79.633 cm) similarly, rachis length was also more with GA_3-T_2 (42.067 cm) and followed by NAA T_6 (41.133 cm). Increase in rachis length due to GA application in gladiolus was also reported by Palanikumar and Bhatacharjee (2001) and Srivastava *et al.* (2005). The number of florets per spike and length of spike are important characters determining the quality of spike. In this investigation, all the growth regulators significantly influenced theses two parameters. Gibberellic acid promotes the auxiliary buds to grow vigorously and their flowering, it might be main reason for production of more flowering spikes. The results in this experiment are in conformity with those reported by Mahesh and Misra (1993) and Mohanty *et al.* (1994).

Table 2: Effect of plant growth regulators on flowering of gladiolus

Treatments	Days to spike emergence (DAP)	Days to flowering (DAP)	Spike length (cm)	Rachis length (cm)	No. of florets/ plant
T_1 (250ppm – GA_3)	84.033	88.133	74.867	34.533	14.133
T_2 (500ppm – GA_3)	75.800	78.533	81.233	42.067	15.200
T_3 (750ppm – GA_3)	78.967	83.633	79.233	38.467	14.300
T_4 (100ppm – NAA)	84.867	90.833	69.633	30.933	9.333
T_5 (250ppm – NAA)	85.033	89.367	76.133	37.133	10.233
T_6 (500ppm – NAA)	80.433	81.300	79.633	41.133	9.100
T_7 (000 – Control)	89.906	98.967	53.539	18.778	8.100
F - value	22.226	21.780	41.912	317.140	51.061
P - value	.000	.000	.000	.000	.000
Critical difference	1.323967	1.915408	1.830638	0.562891	0.599911

Table 3: Effect of plant growth regulators on corms of gladiolus

Treatment	No. of corms/plant	Corm diameter (cm)	Corm weight (g)
T_1 (250ppm – GA_3)	2.900	4.617	63.300
T_2 (500ppm – GA_3)	3.100	4.947	66.067
T_3 (750ppm – GA_3)	3.600	4.200	70.533
T_4 (100ppm – NAA)	1.300	3.800	58.933
T_5 (250ppm – NAA)	1.500	4.300	59.767
T_6 (500ppm – NAA)	1.800	4.200	64.100
T_7 (000 – Control)	1.200	3.001	39.733
F - value	12.902	7.494	277.835
P - value	.000	.002	.000
Critical difference	0.395802	0.292209	0.863244

The number of corms were higher with GA_3 application (T_3). Number of corms produced from mother corms was very low with NAA application followed by control (T_7). However, the diameter of corm significantly varied with all growth regulator application. The corm diameter is greatly influence by the growth regulator application (Jhon *el al.,* 1997). It was clear from the Table 3 that GA application followed by NAA had significant effect on corm weight than control (T_7). The weight of the corms increased significantly with all growth regulator treatments. The results are in conformity with findings of Chowdhury and Pal (1998) and Kamble *et al.* (2004).

From this investigation, it can be concluded that vegetative flowering characteristics were significantly influenced by GA_3 and NAA application. Spike length, rachis length and number of florets were significantly affected by GA_3 application and NAA was best for corm production.

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