Effect of Various Forms of Urea and GA3 on Floral Characters of Chrysanthemum (*Chrysanthemum morifolium Ramat*)

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Abstract— *The experiment on effect of various forms of urea and GA3 on floral characters of chrysanthemum (Chrysanthemum morifolium Ramat.) was carried out at Department of Horticulture, Faculty of Agriculture, Annamalai University, Tamil Nadu. Forty five days old rooted cutting of the variety "White" grown on a media containing a mixture of one part of sand, one part of red earth and one part of farm yard manure were subjected to four forms of urea (liquid feeding, tarcoated urea, neemcake coated urea and prilled urea) and four levels of GA3 (water spray, 50 ppm, 75 ppm and 100 ppm). The highest number of flowers per plant (102), maximum spray length (18.40 cm) and flower diameter (5.27 cm) was obtained from the plants supplied with neemcake coated urea and sprayed with 100 ppm of GA3 at 60,90 and 120 days after planting.*

Keywords— Chrysanthemum, neemcake coated urea, GA3, Floral characters.

I. INTRODUCTION

Chrysanthemum is an important commercial cutflower grown all over India. Uniformity of flower production with elegant range of colour, shades, shapes and ease of cultivation has made it very popular among flower growers. Recently, container system of growing cut chrysanthemum is becoming popular because of its advantages over ground cultivation. In container production, due to its limited volume of media and less buffering capacity needs new management techniques for increasing the efficiency of system. Frequent watering necessitated by limited volume of media reduces the fertilizer use efficiency under container production system. Among the various nutrients, the loss of N has been reported by several workers (Muneshwar singh and Singh, 1986; Rayar, 1990). Recently, fertigation and use of slow release fertilizers are recommended to increase the nutrient use efficiency in container production system. Better growth and quality of cut chrysanthemum when grown with slow releasing fertilizers like osmocote has been reported by Prince et al. (1990). However, unavailability and high cost of various slow releasing fertilizers recommended in high – tech growing of chrysanthemum in our country emphasizes the need to look out for alternative materials to increase the availability of nutrients throughout the growing period. Various problems do limit the development of such fertilizer. Coating of urea is one such technology which has been tried in many field crops in order to improve use efficiency and maximize production. The possibility of using locally available and less costly than imported, as well as with no pollution limitation has been considered as an important aspect. In order to improve the production and quality, the plants were also treated with various concentrations of gibberellic acid. Hence, the present investigation was carried out with a view to find out the efficient form of urea and concentration of GA3 on floral characters of Chrysanthemum (Chrysanthemum morifolium Ramat).

II. MATERIALS AND METHODS

The effect of various forms of urea and GA3 on floral characters of Chrysanthemum (Chrysanthemum morifolium Ramat.) grown under naturally ventilated green house was carried out in the floriculture complex, Department of Horticulture, Annamalai University, Annamalai Nagar, Tamil Nadu.

Stock plants of variety "White" procured from Pondicherry Government Nursery were used for this investigation. Forty five days old, uniform, rooted terminal cuttings with vigorous growth were planted in one foot mud pots filled with a mixture consisting of sand, red earth and farm yard manure in equal proportions and supplemented with super phosphate @ 5g per pot, potassium phosphate @ 10 g per pot and magnesium phosphate @ 2 g per pot. The plants were subjected to various forms of urea and graded levels of GA3 as detailed below.

1. Forms Of urea

N_1 – Liquid feeding @ 200 ppm N per pot perweek.

N_2–Tarcoated urea

N_3 – Neem Cake coated urea.

N_4 - Prilled Urea.

N2, N3, N4 were applied @ 8 g per pot at the time of planting and two top dressing on 30th and 60th day after planting. Measured amount of urea was mixed with measured amount of neemcake and coal tar in the ratio of 5:1 and 100: 1 respectively before application. The growth regulator concentrations employed are detailed below.
G_1- Water spray (Control)

G_2 – GA3 50 ppm

G_3 – GA3 75 ppm

G_4-GA_3 100 ppm

2. GA_3 application

A stock solution of 1000 ppm GA3 was prepared by dissolving 1g GA3 in little quantity of ethyl alcohol (5-10ml) and then making the volume to one litre with distilled water. The lower concentrations of GA3 were prepared by diluting this 1000 ppm stock solution. Spraying was done in the early morning hours using a hand sprayer. Three sprays of GA3 were given at 60th, 90th and 120th day after planting. The effects of factorial combination of treatments were studied by adopting factorial completely randomized design with three replication. In each replication five plants were maintained for observation.

3. Treatment Combinations

N_1G_1	:	Liquid feeding (LF) + water spray
N_1G_2	:	Liquid feeding (LF) + GA_3 50 ppm
N_1G_3	:	Liquid feeding (LF) + GA_3 75 ppm
N_1G_4	:	Liquid feeding (LF) + GA_3 100 ppm
N_2G_1	:	Tar Coated Urea (TCU) + water spray
N_2G_2	:	Tar Coated Urea (TCU) + GA_3 50 ppm
N_2G_3	:	Tar Coated Urea (TCU) + GA_3 75 ppm
N_2G_4	:	Tar Coated Urea (TCU) + GA_3 100 ppm
N_3G_1	:	Neem Cake Coated Urea (NCCU) + water spray
N_3G_2	:	Neem Cake Coated Urea (NCCU) + GA_3 50 ppm
N_3G_3	:	Neem Cake Coated Urea (NCCU) + GA_3 75 ppm
N_3G_4	:	Neem Cake Coated Urea (NCCU) + GA_3 100 ppm
N_4G_1	:	Prilled Urea (PU) + water spray
N_4G_2	:	Prilled Urea (PU) + GA_3 50 ppm
N_4G_3	:	Prilled Urea (PU) + GA_3 75 ppm
N_4G_4	:	Prilled Urea (PU) + GA_3 100 ppm

III. RESULT AND DISCUSSION

The data related to the effect of various forms of urea, GA3 and their interactions on spray length of chrysanthemum are depicted in Table 1. All treatments differed significantly for this trait. The flowers from neemcake coated urea (N3) treatment exhibited the maximum spray length (17.83). This was significantly superior to liquid feeding (N1) (15.13) while the shortest spray length was produced by tar coated urea (N2) (13.71). The superiority of neemcake coated urea over other forms of

urea might be due to the contribution of NPK from the neemcake itself and the better inhibition of nitrification on account of the nimbidin and sulphur present in it (Patil, 1992). This is in conformity with the findings of Praburam and Sathyamoorthy (1993).

Significant superiority of GA3 in increasing the spray length as compared to water spray was observed at all levels of GA3. The maximum length was observed in 100 ppm of GA3 (G4) (16.06) and it was significantly superior to GA3 75 ppm. The minimum spray length was observed under water spray (G1) (14.05). Enhancement in the spray length might have resulted from increased cell division and elongation under the influence of GA3. This is in conformity with the findings of Jyothi Prasad Dutta et al.(1995) on Chrysanthemum and Pobudkiewic and Nowak (1992) on Gerbera.

Among the treatment combinations, the maximum spray length was obtained due to the interaction effect of neemcake coated urea (N3) with 100 ppm of GA3 (G4) (N3G4) (18.40) which was found to be on par with the same form of urea at 75 ppm of GA3. Whereas, the minimum spray length was observed under the treatment combinations of prilled urea with 0 ppm of GA3 (N4G1) (12.87).

TABLE 1:
EFFECT OF VARIOUS FORMS OF UREA AND GA3 ON SPRAY LENGTH (CM)

Urea forms	**GA_3**				
	G_1	**G_2**	**G_3**	**G_4**	**U mean**
LF-($N_{1)}$	13.73	14.63	15.53	16.60	15.13
TCU-($N_{2)}$	13.07	13.63	13.83	14.30	13.71
NCCU-($N_{3)}$	16.53	18.03	18.33	18.40	17.83
PU-($N_{4)}$	12.87	13.50	14.57	14.93	13.97
G- Mean	14.05	14.95	15.57	16.06	15.16

Effects	**S.Ed.**	**C.D(p=0.05)**
Urea forms	0.03	0.07
GA_3	0.03	0.07
Urea x GA_3	0.07	0.14

The data on the effect of various forms of urea, GA3 and their interaction on flower diameter of chrysanthemum are given in Table 2. Among the various forms of urea, the maximum flower size (4.98) was found in the neemcake coated urea (N3) while the size was minimum (4.16) in liquid feeding (N1). This might be due to the facts that neemcake coated urea has prolonged release rate when compared to tarcoated urea. The sustained release rate of neemcake coated urea has also been reported by Som et al. (1992) and Sankaran and Subbiah (1997).

The flower with maximum size (4.65) was obtained under treatment with 100 ppm of GA3 (G4). This was on par with the treatment with 75 ppm of GA3 (G3) (4.53). Enhancement of flower size might be due to increase in the length of petals and pedicels accompanied by increased number of petals. It was opined by Zielsin et al. (1974) that the enlargement of flower size was caused by drawing of photosynthates to the flower as a consequence of intensification of the sink.

Among the interaction effects, the influence of 100 ppm of GA3 with neemcake coated urea (N3G4) produced flowers with maximum size (5.27), which was found to be on par with same form of urea with 75 ppm of GA3 and 50 ppm of GA3.The minimum flower diameter was found in liquid feeding under water spray (N1G1) (4.03).

TABLE 2
EFFECT OF VARIOUS FORMS OF UREA AND GA3 ON FLOWER DIAMETER (CM)

Urea forms	**GA_3**				
	G_1	**G_2**	**G_3**	**G_4**	**U mean**
LF-($N_{1)}$	4.03	4.10	4.17	4.33	4.16
TCU-($N_{2)}$	4.23	4.30	4.57	4.63	4.43
NCCU-($N_{3)}$	4.73	4.93	4.97	5.27	4.98
PU-($N_{4)}$	4.33	4.37	4.40	4.43	4.38
G- Mean	4.38	4.39	4.53	4.65	4.49

Effects	**S.Ed.**	**C.D(p=0.05)**
Urea forms	0.03	0.06
GA_3	0.03	0.06
Urea x GA_3	0.06	0.12

The data on the effect of various forms of urea, GA3 and their interaction on number of flowers per plant are depicted in Table 3. Among the various forms of urea, neemcake coated urea (N3) recorded the maximum number of flowers per plant (90.00). This was followed by tarcoated urea (N2) (75.00). The minimum number of flowers was obtained in the prilled urea (N4) (58.33). This might be due to steady release of nitrogen with minimum losses and better utilization of nitrogen might have influenced the number of flowers per plant. Similar results were also reported by Ahmed and Baroova (1992).

GA3 treatments proved to be significantly superior to water spray (G1) (65.08) in increasing the number of flowers per plant. The maximum number of flowers (84.50) was obtained in the treatment with 100 ppm of GA3 (G4). It was significantly superior to 75 ppm of GA3 (G3) (75.25). This may be attributed to production of large number of leaves and more number of laterals (Dahiya and Rana, 2001). Such increments in number of flowers fit in with reports of Sen and Maharana (1971) and Shanumgam and Muthusamy (1974) also reported increased number of flowers due to GA3 application in Chrysanthemum. Similar reports in various ornamental crops like gerbera, aster, tuberose, anthurium (Roberts, 1969; Gorini, 1965; Ram et al., 1970; El-shafie and Hassan, 1978; Jana and Biswas, 1979) also support the results of the present investigation.

Among the interaction effects, the treatment combination of neemcake coated urea with 100 ppm of GA3 (N3G4) resulted in the production of maximum number of flowers (102.00) followed by tarcoated urea with 100 ppm of GA3 (N2G4) (99.00). The minimum number of flowers was recorded in prilled urea under water spray (N4G1) (53.33).

TABLE 3
EFFECT OF VARIOUS FORMS OF UREA AND GA3 ON NUMBER OF FLOWERS PLANT-1

Urea forms	GA_3				
	G_1	G_2	G_3	G_4	U mean
LF-($N_{1)}$	66.00	68.00	71.00	75.00	70.00
TCU-($N_{2)}$	62.00	67.00	72.00	99.00	75.00
NCCU-($N_{3)}$	79.00	81.00	98.00	102.00	90.00
PU-($N_{4)}$	53.33	58.00	60.00	61.00	58.33
G- Mean	65.08	68.50	75.25	84.50	73.33

Effects	S.Ed.	C.D(p=0.05)
Urea forms	1.71	3.49
GA_3	1.71	3.49
Urea x GA_3	3.42	6.98

IV. CONCLUSION

The results indicated that application of neemcake coated urea had improved the nitrogen use efficiency and yield potential in container production of chrysanthemum. However, the efficiency depends on the amount and frequency of application. Increased rate of urea and frequency through neemcake coated formulation in addition to developing slow release fertilizer containing all the three major nutrients is recommended for future research before arriving at economic conclusions.

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