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Effect of various levels of nitrogen on quantitative and qualitative parameters of Rose var. "Top Secret" under poly house condition

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Abstract: Study was conducted to find out the effect of various levels (100, 150, 200, 250,300 mg/plant/week) of nitrogen on growth parameters in terms of qualitative and quantitative traits of rose var. Top Secret. Plant growth in general increased with increase in nitrogen levels. Among various levels of nitrogen application, 300 mg nitrogen per plant per week significantly increased all vegetative growth parameters and showed maximum plant height (117.45 cm), leaf area (98.91 cm^2) and a number of leaves (62.50). Further, flowering parameters like stalk length (83.53cm), bud diameter (2.45cm), bud length (2.55 cm), number of flowers per plant (7.30) as well as per square meter (53.05) were also significantly maximum in plants given nitrogen @ 300 mg per plant per week. Leaf N (2.94 %), P (0.19%), K (1.87%) and chlorophyll content in leaves (4.41mg/g) was also higher with 300 mg N per plant per week. Vase life (10 days) and anthocyanin content in petal tissue (2.09 mg/g) were found the maximum in plants given nitrogen @ 250 mg per plant per week, which was at par with the treatment of nitrogen @ 300 mg per plant per week. Nitrogen should be applied at the rate of 300 mg/plant/week under protected cultivation as the optimum dose for good plant growth and qualitative flower production in rose var. Top Secret under protected cultivation.

Keywords: Nitrogen, Poly house, Rose var., Vegetative growth parameters

INTRODUCTION

Flowers are entwined in our day to day activities like religious and social ceremonies, weddings and birthday celebrations, interior decoration as well as for shelf adornment. Floriculture is now considered a viable option in agriculture. Rose is the highly popular cut flower in the world and most traded flower (31.6%) in the international market (CBI Market Intelligence, 2015). In the modern age, floriculture that was restricted to growing for loose flowers in the field is shifted to growing of high quality cut flowers under protected cultivation. Rose has been found to be highly feasible for cultivation under protected conditions in the Indian climate. The variety Top Secret is a popular cut rose valued for long stalked flowers and is among the leading cut flowers under protected cultivation. Although roses occupy the prominent place in all international cut flower markets, competitions are very intensive where quality plays a critical role (Tatte *et al*., 2016). Nitrogen is an important element involved in protein and chlorophyll biosynthesis, which ultimately affects photosynthetic rate and accumulation of food reserves (Thanapornpoonpong *et al.,* 2008) and thereby affects good plant growth as revealed in carnation (Chaudhary, 2007), gladiolus (Bijmol and Singh, 2003) and lilium (Rani *et al.,* 2005), tuberose (Singh, 2000). Although research with regard to nutrition management in cut roses cultivated under open conditions has been well documented (Cabrera 2004) but that under protected conditions is meager. The present investigation was under taken in order to study the effect of various levels of nitrogen on growth and flowering of cut rose flowers.

MATERIALS AND METHODS

The experiment was carried out in greenhouse complex, Dept. of floriculture and landscape architecture Navsari agricultural university, Navsari. The research work was carried out in hybrid tea rose variety Top Secret. This variety is highly suitable for the production of long stalked cut flowers for international markets.

Treatment details: The experiment was laid out with five treatments in a completely randomized design (CRD) with four replications. One year old uniform budded rose plants of var. Top Secret grown on raised beds in polyhouse were used for the study. The study involved with various levels of nitrogen@ 100 mg/ plant/week (T_1),150 mg/plant/week (T_2), 200mg/plant/ week (T_3), 250mg/plant/week (T_4) and 300 mg/ plant/

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week (T_5) in the form of urea from Monday–Thursday through drenching.

Measurement of traits: Vegetative parameters like plant height (cm), number of leaves per stalk (count), leaf area (cm^2) and flowering parameters *viz*., length of flower stalk (cm), length and diameter of flower bud (cm), number of flowers per plant and vase life (days) were recorded at three months interval from August to February during the year 2013-14. Leaf area was measured with the help of leaf area meter. Chlorophyll from leaf tissue (mg/g) was estimated by DMSO (Dimethylsulphoxide) method as given by Wellburn, 1994. Anthocyanin (mg/g) pigment from petal tissue was analyzed as per the method suggested by and Lees and Francis (1972). NPK (%) of leaf tissue was estimated as suggested by Gerherdt (2007) for nitrogen, Vando Molybdate method (Jackson, 1967) for phosphorus and Flame photometry method for potassium (Jackson, 1967).

Statistical analysis: The statistical analysis was done by adopting the standard procedures of Panse and Sukhatme (1985), and the results were interpreted.The method of analysis of variance for completely randomized design (CRD) was used. The test of significance among treatments was worked out by 'F' test.

RESULTS AND DISSCUSSION

During the present study results indicated an increasing trend in vegetative growth with an increase in levels of nitrogen application. However, maximum plant height (117.45 cm), no. of leaves per stalk (62.50), leaf area (98.91 cm^2). Nitrogen is a major component of amino acids, the building blocks of proteins (Harper and Paulsem, 1969) and thereby it plays an important role in metabolic activities of the plant resulting in the synthesis of chlorophyll and cytochromes, which are essential for photosynthesis and respiration process in the plants (Thanapornpoonpong *et al*., 2008). Further, it is known as an important component of many important structural, genetic and metabolic compounds in plant cells (Macadam *et al*., 1989). Uma and Gowda (1987) and Katiyar *et al*. (1999) reported a reduction of cell division and cell elongation rate and shortening of the growth zone in rose due to Nitrogen deficiency. An increase in vegetative growth with the higher level of nitrogen has also been earlier also reported in rose (Qusim *et al.,* 2008 and Chaudhary *et al.,* 2016).

Chlorophyll content (4.41mg/g) and leaf N (2.94%), P (0.19%), K (1.87%) content in leaf tissue were also found higher in rose var. Top Secret plants treated with 300mg nitrogenous fertilizer per plant. Nitrogen is a structural element of chlorophyll and protein molecules and thereby affects the formation of chloroplasts and accumulation of chlorophyll in leaves (Tucker, 2004 and Wellburn,1994). Application of higher nitrogen favored the optimum plant growth and extensive root system resulting in higher feeding power and nutrient absorption by the plant. Increase in Phosphorus and potassium content in leaf could be a result of the synergistic effect of nitrogen availability on leaf nutritional status in marigold (Sunitha, 2006) and tuberose (Singh, 2000).

Table 1. Effect of various levels of nitrogen on plant height leaves /stalk and leaf area in rose var. "Top Secret" under poly house condition.

Treatment	Plant height (cm)			leaves /stalk			Leaf area (cm^2)		
	AUG	NOV	FEB	AUG	NOV	FEB	AUG	NOV	FEB
T_1=100 mg / plant/week	54.20	76.45	91.70	16.75	31.25	46.50	17.54	38.98	52.78
T_2=150 mg / plant/week	60.35	79.25	96.98	17.75	34.75	50.25	28.29	49.51	70.94
T_3=200 mg / plant/week	63.65	81.40	103.88	19.25	38.25	54.25	39.95	60.13	82.35
T_4=250 mg / plant/week	66.60	85.40	108.80	20.25	41.00	58.00	47.89	69.66	90.97
T_5=300 mg / plant/week	68.80	97.70	117.45	22.00	44.25	62.50	55.20	76.88	98.91
S.Em.±	0.73	0.51	0.77	0.43	0.47	0.60	1.06	0.80	0.72
C.D. at 5%	2.21	1.55	2.33	1.29	1.40	1.80	3.20	2.40	2.17
C. V %	2.33	1.22	1.49	4.46	2.46	2.20	5.63	2.70	1.82

Values in the table are an average of four replications

Table 2. Effect of various levels of nitrogen on flower stalk length, bud length, bud diameter, Anthocynin content in petals (mg/g) and Chlorophyll content in leaves (mg/g) in rose var. "Top Secret" under poly house condition.

Treatment	Flower stalk length (cm)			Bud length (cm)			Bud diameter (cm)			Anthocynin content in petals (mg/g)	Chlorophyll content in leaves (mg/g)
	AUG	NOV	FEB	AUG	NOV	FEB	AUG	NOV	FEB		
T_1=100 mg / plant/week	22.80	40.90	55.65	1.46	1.88	2.17	1.28	1.86	2.26	1.80	2.84
T_2=150 mg / plant/week	27.05	47.60	62.00	1.57	1.98	2.26	1.37	1.95	2.33	1.88	3.26
T_3=200 mg / plant/week	34.25	54.30	68.98	1.66	2.08	2.32	1.46	2.06	2.40	1.96	3.76
T_4=250 mg / plant/week	40.15	60.70	76.18	1.74	2.15	2.37	1.56	2.15	2.49	2.09	4.11
T_5=300 mg / plant/week	46.20	67.70	83.53	1.82	2.24	2.45	1.60	2.27	2.55	2.06	4.41
S.Em.±	0.48	0.65	0.85	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01
C.D. at 5%	1.46	1.95	2.55	0.04	0.05	0.03	0.05	0.04	0.03	0.03	0.03
C. V %	2.84	2.39	2.44	1.61	1.45	0.82	2.17	1.21	0.90	0.83	0.52

Values in the table are an average of four replications

Table 3. Effect of various levels of nitrogen on no. of flowers/ plant, no.of flowers/m ^{2} ,vase life and NPK content in rose var. "Top Secret" under poly house condition.

Treatment	No. of flowers/plant			No. of flowers/m^2			Vase life (days)			NPK content (%)		
	AUG	NOV	FEB	AUG	NOV	FEB	AUG	NOV	FEB	N	P	K
T_1=100 mg / plant/week	2.50	3.95	4.90	19.05	29.90	37.80	6.00	7.25	8.50	1.75	0.09	1.44
T_2=150 mg / plant/week	3.20	4.65	5.55	24.15	34.85	42.80	6.75	7.50	9.00	2.10	0.12	1.59
T_3=200 mg / plant/week	3.90	5.10	6.20	29.05	38.20	47.25	7.50	8.00	9.50	2.38	0.14	1.70
T_4=250 mg / plant/week	4.40	5.50	6.70	34.50	41.05	50.05	8.00	8.75	10.0	2.66	0.16	1.79
T_5=300 mg / plant/week	4.90	5.80	7.30	39.45	45.05	53.05	7.75	8.50	9.75	2.94	0.19	1.87
S.Em.±	0.09	0.07	0.09	0.68	0.51	0.50	0.20	0.24	0.21	0.01	0.00	0.01
C.D. at 5%	0.26	0.21	0.27	2.06	1.55	1.50	0.62	0.73	0.65	0.02	0.01	0.02
C. V %	4.53	2.83	2.89	4.67	2.72	2.16	5.67	6.04	4.58	0.54	4.50	0.79

Values in the table are an average of four replications

Different flowering characters of rose like length of flower stalk (83.53 cm), length of bud (2.45 cm), diameter of bud (2.55cm), number of flowers per plant (7.30) and number of flowers per square meter (53.05) were found significantly highest at 0.05level of significance with the application of nitrogen at the rate of 300 mg per plant per week during the present study. Carbohydrate and nitrogen do not influence flower initiation directly but serve as substrates for the synthesis of keymetabolites that act alone or work with plant hormones to initiate the flowering process (Lovatt *et al.*, 1988). Further, increased photosynthetic area as indicated by higher leaf area and a number of leaves with a higher level of nitrogen application consequently increased carbohydrate accumulation, that stimulated flower growth in terms of higher number of flowers per plant and per square meter. Since the nitrogen percentage content (2.94) in the leaf tissue of plants given 300 mg nitrogen in the present study was also within the optimum range as described by Anjaneyulu (2007) for a rose that was reflected in optimum plant growth in terms of flowering parameters. Similar effect of nitrogen application on flower size, number of flowers and stalk length has also been revealed in rose (Bhattacharjee and Damke, 1995, Katiyar *et al*., 1999 and Ashok and P. Rengasamy, 2000)

Vase life (10days) and anthocyanin pigment content in petal tissue (2.09 mg/g) were found significantly highest at 0.05 level of significance with the application of nitrogen at the rate of 250 mg per plant per week that was at par with 300 mg per plant per week during the present study. A higher level of nitrogen may have resulted in more storage of carbohydrates due to the higher photosynthetic area as indicated by more number of leaves, leaf area and plant spread. Carbohydrates are essential for flowering in plants (Bernier *et al*. 1993) and flower longevity (Halevy and Mayak, 1974). Influence of nitrogen on the expression of genes associated with anthocyanin biosynthesis has been earlier studied (Bongue-Bartelsman and Phillips 1995 and Politycka and Golcz, 2004). Flowerqualities in terms of vase life and flower colour have known to be effected by nitrogen application in rose in variety Samuraiwhich showed best results with250mg/plant/week application (Chaudhary *et al.*, 2016).

Conclusion

In rose variety Top Secret cultivated under protected condition, to obtain good vegetative growth in terms of plant height, leaf area and number of leaves as well as good flower quality production in terms of stalk length(83.53 cm), bud diameter(2.55 cm), flower i.e. yield (7.3 flowers per plant in February month) along with good flower quality with higher anthocyanin content in petal tissue (2.03 mg/g) with higher vase life of 9 days, nitrogen should be applied at the rate of 300 mg/plant/week. Further, leaf tissue analysis also showed the optimum level of leaf N (2.94 %), P (0.19%), K (1.87%) content with the same treatment in rose variety Top Secret. This study will be highly helpful for rose growers under protected cultivation.

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