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INFLUENCE OF NITROGEN ON GROWTH PARAMETERS AND LEAF NUTRIENT COMPOSITION OF ROSE CV. SAMURAI UNDER PROTECTED CONDITIONS

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ABSTRACT

Influence of different levels of nitrogen *viz.*, 100, 150, 200, 250 and 300 mg/ plant/ week on rose cv. Samurai was studied. Application of nitrogen @ 300 mg per plant per week significantly exhibited maximum increase in increased growth parameters like plant height (64.80, 95.10, 115.95 cm), number of leaves (19.75, 41.25, 52.75), leaf area (58.10, 78.23, 90.05 cm^2) and plant spread (51.85, 58.62, 67.20 cm) as recorded at three months interval. Leaf tissue N (2.73%), P (0.19%) and K (1.87%) content was also found maximum with the higher dose of nitrogen. Flowering parameters like bud size in terms of length (1.74, 2.24, 2.57 cm) and diameter (1.42, 1.89, 2.17 cm), stalk length (42.20, 54.15, 62.65 cm) and number of flowers per plant (4.10, 5.40, 6.85) were also higher with highest dose of nitrogen application. Chlorophyll content (4.36 mg/g) was also found maximum in the same treatment followed by nitrogen @ 250 mg per plant per week while vase life (8.0, 8.75, 9.50 days) and anthocyanin pigment content (2.10 mg/g) of flower was found maximum in the treatment of 250 mg nitrogen per plant per week which was at par with the treatment of 300 mg nitrogen.

INTRODUCTION

Rose (*Rosa indica* L.) is one of the oldest flowers under cultivation and most traded among all commercial flowers throughout the world. Protected cultivation plays eminent role in quality cut flower production (Patel *et al*., 2014). 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.,* 2015, Kumar *et al*., 2012). Poor quality leads to price fluctuation in national as well as international market. Improper nutrition management and lack of technical knowhow for crop regulation is one of the major cause for poor flower quality. Nutrition management plays important role in quality production in roses, especially nitrogen which is one of the macro elements. Nitrogen application not only enhances the vegetative growth but also assists the plant during blooming period to mobilize the processes of flower opening. Nitrogen enhances the vegetative growth (Gurav *et al.,* 2005) and increases flower buds (Lovatt *et al.,* 1988). Nitrogen application and low plant density increases plant height, number of leaves, plant spread and maximum flower number and weight. Protected cultivation has been steadily increasing in the past decade in the western region in Gujarat in general and in Maharashtra and Gujarat in particular. However, research with regard to nutrition management in rose under protected cultivation is meager. Hence, considering the immense role of nitrogen in growth and development of plant present study was designed to optimize nitrogen requirement for enhancing growth and flower yield of Rose cv. Samurai under protected conditions.

MATERIALS AND METHODS

Experiment was carried out in naturally ventilated polyhouse situated at Greenhouse complex of ASPEE College of Horticulture and Forestry, N.A.U, Navsari. The experiment was laid out in Completely Randomized Design (CRD) with five treatments and four repetitions. Treatments were T_1: 100 mg/ plant/ week, T_2: 150 mg/ plant/ week, T_3: 200 mg/ plant/ week, T_4: 250 mg/ plant/ week and T_5: 300 mg/ plant/ week. Nitrogen @ 100 mg to 300 mg per plant per week was applied in the form of urea from Monday–Thursday for a period of six months through drenching. Management practices like irrigation weeding and plant architecture were same for all treatments during entire period of study. Vegetative parameters like plant height (cm), number of leaves per stalk (count), leaf area (cm^2) and plant spread (cm) 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. Leaf area was measured with the help of leaf area meter. Chlorophyll from leaf tissue (mg/g) was estimated by DMSO method (Wellburn, 1994). Anthocyanin (mg/g) from petal tissue was analyzed as per the method suggested by and Lees and Francis (1972). NPK (%) of leaf tissue was estimated for nitrogen as suggested by Gerherdt (2007), for phosphorus by Vando Molybdate method (Jackson, 1967) and Flame photometry method for potassium (Jackson, 1967). The experimental data pertaining to all the characters studied were subjected to statistical analysis of variance technique as described by Panse and Sukhatme (1967). 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 DISCUSSION

Vegetative growth

Data depicted in Table.1 revealed that the treatment of nitrogen @ 300 mg per plant per week has recorded maximum plant height (64.80, 95.10 and 115.95 cm), higher number of leaves (19.75, 41.25, 52.75), maximum leaf area (58.10, 78.23 and 90.05 cm^2) and higher plant spread (51.85, 58.62 and 67.20 cm), which were followed by treatment of nitrogen @ 250 mg per plant per week as recorded at different intervals from August to February. Nitrogen 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 as reported by Ashok *et al.* (2000). It is also a major component of amino acids, the building blocks of proteins which may be increased by addition of N fertilizer. Further, it is known as an important component of many important structural, genetic and metabolic compounds in plant cells. Uma and Gowda (1987), 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. With increase in nitrogen application vegetative characters were improved as reported by Quasim *et al.* (2008), Maharana and Pradhan (1976) and Saini *et al.* (1978) in rose, Chaudhary (2007) in carnation, Rani *et al.* (2005) in lilium and Gurav *et al.* (2005) in rose.

Flowering, Yield, Pigments and Leaf NPK content

A similar trend was observed with respect to flowering characteristics as shown in Table.2. Treatment of nitrogen @ 300 mg per plant per week recorded highest length of flower stalk (42.20, 54.15 and 62.65 cm), maximum length and diameter of bud (1.74, 2.24 and 2.57 cm) (1.42, 1.89 and 2.17 cm) which were followed by treatment of nitrogen @ 250 mg per plant per week as observed at different intervals. Similarly maximum number of flowers per plant was also recorded in the same treatment (4.10, 5.40 and 6.85), which was followed by nitrogen application @ 250 mg per plant per week (3.50, 4.75, 6.15). The improvement in all these flower characters was due to improved vegetative growth of plant in terms of plant height, plant spread and leaf area under the highest level of nitrogen which resulted in more storage of carbohydrates Lovatt *et al.* (1988). Nitrogen is a constituent of the proteins, nucleic acids and nucleotides that are essential for the metabolic functions necessary for the plant growth (Thanapornpoonpong *et al.*, 2008). Influence of nitrogen on cell elongation and cell division is well established (Macadam *et al.*, 1989). Further, it is known that nitrogen can stimulate meristematic activity involved in flower bud differentiation through polyamines biosynthesis (Lovatt *et al.*, 1988) that further added to increase in bud and flower diameter and stalk length. Similar effects of nitrogen application on flower size, number of flowers and stalk length have also been reported previously in rose by Gurav *et al.* (2005) and Katiyar *et al.* (1999).

Data mentioned in the Table. 3 represented that the application

Table1: Effect of levels of nitrogen on vegetative characteristics of rose cv. Samurai

Treatment	Plant height (cm)			Leaves per stalk			Leaf area (cm^2)			Plant spread (cm)		
	Aug	Nov	Feb	Aug	Nov	Feb	Aug	Nov	Feb	Aug	Nov	Feb
T_1 = 100 mg / plant/week	53.95	78.20	96.75	10.50	28.00	36.50	23.12	44.14	62.18	29.01	36.10	43.28
T_2 = 150 mg / plant/week	59.95	81.75	101.80	14.00	31.50	39.35	31.24	51.54	69.08	34.56	42.66	49.79
T_3 = 200 mg / plant/week	62.05	86.15	107.00	16.00	34.00	44.25	39.25	59.88	74.24	42.90	47.38	56.13
T_4 = 250 mg / plant/week	63.90	90.05	112.00	17.75	38.00	48.50	48.47	70.04	80.41	48.05	52.97	62.50
T_5 = 300 mg / plant/week	66.80	95.10	115.95	19.75	41.25	52.75	58.10	78.23	90.05	51.85	58.62	67.20
S.Em. ±	0.88	0.44	0.64	0.33	0.60	0.63	0.71	0.68	0.79	0.88	0.77	0.67
C.D. at 5%	2.65	1.32	1.92	0.99	1.81	1.91	2.15	2.05	2.38	2.65	2.32	2.03
C. V %	2.89	1.02	1.20	4.22	3.49	2.87	3.57	2.24	2.10	4.27	3.24	2.42

Table 2: Effect of levels of nitrogen on flower characteristics of rose cv. Samurai

Treatment	Length of flower stalk (cm)			Length of flower bud (cm)			Diameter of flower bud (cm)			Flowers/ plant		
	Aug	Nov	Feb	Aug	Nov	Feb	Aug	Nov	Feb	Aug	Nov	Feb
T_1 = 100 mg / plant/week	22.40	35.50	43.83	1.41	1.85	2.28	1.13	1.53	1.88	2.10	3.30	4.20
T_2 = 150 mg / plant/week	26.00	40.20	48.40	1.48	1.95	2.36	1.22	1.63	1.95	2.50	3.60	4.90
T_3 = 200 mg / plant/week	31.80	44.85	53.03	1.57	2.06	2.43	1.27	1.71	2.05	3.10	4.15	5.70
T_4 = 250 mg / plant/week	37.60	49.30	57.90	1.66	2.15	2.50	1.33	1.81	2.11	3.50	4.75	6.15
T_5 = 300 mg / plant/week	42.20	54.15	62.65	1.74	2.24	2.57	1.42	1.89	2.17	4.10	5.40	6.85
S.Em. ±	0.52	0.55	0.65	0.01	0.01	0.01	0.01	0.02	0.01	0.06	0.08	0.09
C.D. at 5%	1.55	1.66	1.95	0.04	0.04	0.02	0.04	0.05	0.02	0.17	0.23	0.26
C. V %	3.22	2.47	2.43	1.51	1.32	0.46	1.84	1.75	0.63	3.77	3.55	3.15

Table 3: Effect of levels of nitrogen on pigment, vase life and leaf nutrient content of rose cv. Samurai

Treatment	Chlorophyll (mg/g)	Anthocyanin (mg/g)	Vase life (days)			Nutrient content of leaf (%)		
			Aug	Nov	Feb	N	P	K
T_1 = 100 mg / plant/week	2.80	1.68	5.50	6.75	8.00	1.61	0.09	1.44
T_2 = 150 mg / plant/week	3.20	1.77	6.25	7.50	8.50	1.89	0.12	1.59
T_3 = 200 mg / plant/week	3.67	1.87	6.75	8.00	9.25	2.17	0.14	1.70
T_4 = 250 mg / plant/week	4.07	2.10	8.00	8.75	9.50	2.45	0.16	1.79
T_5 = 300 mg / plant/week	4.36	1.96	7.50	8.50	9.25	2.73	0.19	1.87
S.Em. ±	0.01	0.01	0.24	0.24	0.24	0.00	0.00	0.01
C.D. at 5%	0.03	0.03	0.73	0.73	0.73	0.01	0.01	0.02
C. V %	0.55	0.97	7.10	6.11	5.43	0.33	4.50	0.79

of nitrogen @ 250 mg per plant per week recorded maximum vase life (7.50, 8.75 and 9.50 days), which was at par with the application of nitrogen @ 300 mg per plant per week. Further, maximum chlorophyll content in the leaf was recorded in treatment of nitrogen @ 300 mg per plant per week (4.36 mg/g), which was followed by nitrogen application @ 250 mg per plant per week. Nitrogen plays vital role in metabolic activities of the plant resulting in the synthesis of more chlorophyll that is essential for photosynthesis, which ultimately leads increase in synthesis of stored carbohydrates. This stored energy is essential for flowering of plants (Bernier *et al*. 1993) and an important energy source facilitating flower opening (Ho and Nichols, 1977). Further, correlation of food reserves with flower longevity is well established (Halevy, 1987). Anthocyanin content was observed maximum (2.10 mg/g) in plants treated with nitrogen @ 250 mg per plant which was followed by the treatment of nitrogen @ 300 mg per plant. Bongue-Bartelsman and Phillips (1995) demonstrated that N stress produces effects on expression of genes encoding enzymes associated with anthocyanin biosynthesis. Increasing dose of nitrogen to optimum level maintain higher anthocyanin content has also been earlier indicated (Politycka and Golcz, 2004).

Maximum nitrogen, phosphorus and potash content (2.73%, 0.19% and1.87 %) was recorded in the treatment of nitrogen @ 300 mg per plant per week. Nitrogen is a structural element of chlorophyll and protein molecules, and thereby affects formation of chloroplasts and accumulation of chlorophyll in plants (Tucker, 2004). Application of higher nitrogen favored the optimum plant growth and extensive root system resulting in higher feeding power and nutrient absorption by the plant. This was also reflected in form of given higher dose of nitrogen higher chlorophyll content found in the leaves as discussed earlier. Further, Cabrera (2004) has given correlation of leaf nitrogen content with leaf colour. Increase in Phosphorus and potassium content in leaf could be a result of synergistic effect of nitrogen availability on leaf nutritional status. Similar results have also been reported previously by Singh (2000) in tuberose.

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