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Effect of Nitrogen, Phosphorus and Potassium on Vegetative and Reproductive Growth of Rose (*Rosa centifolia*)

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ABSTRACT

Nitrogen and potassium were applied alone as well as in combination, keeping phosphorus at a constant dose to study their effect on vegetative and reproductive growth of rose (*Rosa centifolia*). The maximum spread of plants and higher number of flowers and leaves were obtained when plants were treated with potassium alone @ 774 gm/plot. However, nitrogen and potassium in combination (N=1680 gm/plot + K=516 gm/plot or N=1680 gm/plot + K=774 gm/plot) gave best height of plant and number of petals/flower; and the best size of flowers. Most of the vegetative characters such as height and spread of plant and number of leaves were enhanced with higher doses of nitrogen. Interaction of nitrogen and potassium gave positive results for vegetative growth when dose of nitrogen was higher and that of potassium was lower. Number of flowers, flower size and quality was improved when dose of potassium was increased.

Key Words: Fertilizers (NPK); Vegetative Growth; Reproductive Growth; Rose

INTRODUCTION

Application of nitrogen (N), potassium (K) and phosphorus (P) in different combinations have been widely reported to influence growth of flowering plants. For instance, an increase in yield, stem length and number of blossoms of roses was observed with increased N (Young *et al.* 1986). Number and size of rose flowers was enhanced when grown on sand cultures using NPK solution (Tanaka, 1985). Increased yield and number of branches/vegetative growth of pollmeriana and laxa (rose cultivars; Martin, 1985) and jasmine (Bhallaeharjee, 1985) was observed when treated with different combinations of NPK. The optimum concentrations/levels of NPK for roses have been reported to be in the ratios of 80:160:80 kg ha^{-1}, respectively (Samiolenko, 1983) or application of NPK at 0.3% (Koriesh, 1984). The current study was carried out to develop an optimum combination of NPK with an objective to increase yield and quality of flowers of *Rosa centifolia.*

MATERIALS AND METHODS

The experiment was conducted on 4-year old *Rosa centifolia* in Floriculture Area, Department of Horticulture, University of Agriculture, Faisalabad, Pakistan. The plot size was 4.50 sq.m. The different treatments and amount of fertilizers was as under:

T_1 = Control
T_2 = N_1K_1-1636 gm/plot
T_3 = N_2K_0-1680 gm/plot
T_4 = N_1K_0-1120 gm/plot
T_5 = N_1K_2-1894 gm/plot
T_6 = N_2K_2-2454 gm/plot
T_7 = N_2K_1-2196 gm/plot
T_8 = N_0K_1- 516 gm/plot
T_9 = N_0K_2- 774 gm/plot

N_0 = 0 gm/plot
N_1 = 1120 gm/plot
N_2 = 1680 gm/plot
K_0 = 0 gm/plot
K_1 = 516 gm/plot
K_2 = 774 gm/plot

Nitrogen[1] and potassium[2] fertilizers were each used at 0, 250 and 375 kg ha^{-1}; and 0, 125 and 187.5 kg ha^{-1}, respectively. Phosphorus[3] fertilizer was applied at a constant level (375 kg ha^{-1}) to all the plots.

Farm yard manure was applied @ 25 tons ha^{-1}, ploughed and mixed properly. N and K were divided into four split doses and applied at fortnightly intervals for two months. All the fertilizers were broadcasted. The experiment was laid out according to Randomized Complete Block Design with nine treatments and four replications. Data were collected on the height of plants, spread of plants, size of flowers, number of flowers, number of petals/flower and number of leaves. DMR test was used to compare the treatment means at 5%

[1] Urea 46%, National Fertilizer Corporation, Pakistan.
[2] Potassium sulfate K_2SO_4 (50% K) imported from Jordan.
[3] Superphosphate (18% N), National Fertilizer Corporation, Pakistan.

probability. The data were analyzed according to the method described by Steel and Torrie (1980).

RESULTS AND DISCUSSION

Height of plants. The height of plants differed significantly (Table I) between the treated (T_4 to T_9) and untreated (T_1) plants and among different levels of treatments. The maximum height (148.50 cm) of plants was recorded with T_7 followed by T_8, T_9, T_6, T_5, T_4, T_3, T_2 and T_1, respectively. The lowest height (73.25 cm) of plants was recorded in control (T_1) where no fertilizer was applied. It is evident from the data that for getting proper plant height, the amount of nitrogen should be about three times more than that of potassium.

Spread of plants. The spread of plant differed significantly (Table I) between the treated (T_5 to T_9) and untreated (T_1) plants and among different levels of treatments. The maximum spread (99.00 cm) of plant was recorded with T_9 followed by T_8, T_5, T_6, T_7, T_2, T_4, T_3 and T_1, respectively. The minimum spread (48.75 cm) of plant was recorded in control (T_1) where no fertilizer was applied. These results indicate that potassium plays an important role to increase the spread of plant.

Size of flowers. The size of flower differed significantly (Table I) between the treated (T_2 to T_9 except T_4) and untreated (T_1) plants and among different levels of treatments. The maximum size (5.56 cm) of flower was recorded with T_6 followed by T_8/T_9, T_5, T_3, T_7, T_2, T_4 and T_1, respectively. The minimum size (3.44 cm) of flower was recorded in control (T_1) where no fertilizer was applied. These findings are suggestive of using higher doses of nitrogen and potassium to increase the flower size.

Number of flowers per plant. The number of flowers/plant differed significantly (Table I) between the treated (T_2 to T_9) and untreated (T_1) plants and among different levels of treatments. The maximum number (21.75) of flowers was recorded with T_9 followed by T_6, T_5, T_8, T_3, T_7, T_2, T_4 and T_1, respectively. The minimum number (4.50) of flowers was recorded in control (T_1) where no fertilizer was applied. Higher doses of potassium proved much helpful to boost up flower production.

Number of petals per flower. The number of petals/flower differed significantly (Table I) between the treated (T_2 to T_9 except T_3) and untreated (T_1) plants and among different levels of treatments. The maximum number (55.25) of petals was recorded with T_7 followed by T_9, T_8, T_4, T_6, T_5, T_3, T_2 and T_1, respectively. The minimum number (40.00) of petals was recorded in control (T_1) where no fertilizer was applied. Higher doses of nitrogen and potassium were found much helpful to increase the number of petals.

Number of leaves. The number of leaves differed significantly (Table I) between the treated (T_4 to T_9) and untreated (T_1) plants and among different levels of treatments. The maximum number (122.50) of leaves was recorded with T_9 followed by T_7, T_5, T_6, T_4, T_8, T_3, T_2 and T_1, respectively. Lowest number (42.00) of leaves was recorded in control (T_1) where no fertilizer was applied. The data indicates that the maximum number of leaves was observed in T_9 where higher dose of potassium was applied without nitrogen.

Briefly, T_9 (only K @ 774 gm/plot) produced best spread of plants, number of flowers and leaves; T_7 (N=1680 gm/plot + K=516 gm/plot) produced best height of plant and number of petals/flower; and T_6 (N=1680 gm/plot + K=774 gm/plot) produced best size of flowers. These results indicate that the vegetative and

Table I. Effect of NPK on vegetative and reproductive growth of rose (*Rosa centifolia*)

Treatments	Height of plants (cm)	Spread of plants (cm)	Size of flowers (cm)	Number of flowers	Number of petals	Number of leaves
$T_1 = N_0K_0$	73.25 d	48.75 f	3.44 d	4.50 g	40.00 d	42.00 d
$T_2 = N_1K_1$	77.00 d	57.25 e	4.44 bc	9.75 ef	42.00 bc	105.50 d
$T_3 = N_2K_0$	82.25 d	52.75 ef	4.63 bc	11.25 de	44.00 cd	99.25 d
$T_4 = N_1K_0$	120.25 c	54.00 ef	4.06 cd	9.00 f	51.50 bc	105.50 bc
$T_5 = N_1K_2$	121.00 c	78.00 c	4.88 ab	14.00 c	49.25 b	108.50 c
$T_6 = N_2K_2$	121.25 c	73.25 cd	5.56 a	16.50 b	49.50 bc	106.75 a
$T_7 = N_2K_1$	148.50 a	72.00 d	4.56 bc	10.00 def	55.25 a	116.00 a
$T_8 = N_0K_1$	142.00 b	91.00 b	5.44 a	12.50 d	54.50 bc	104.00 ab
$T_9 = N_0K_2$	134.00 b	99.00 a	5.44 a	21.75 a	55.00 a	122.50 a

P value=5%; Different letters indicate difference

reproductive characters of *Rosa centifolia* are affected by various doses of N and K. Higher doses of nitrogen were found much helpful to improve the health of the plant by increasing its size. The productivity of the plants was found affected with potassium and its increased doses increased flower production. Phosphorus in general improved the vegetative growth of the plants by improving its root system. Similar findings for different flowering plants have been reported previously (Semiolenko, 1983; Koriesh, 1984; Tanaka, 1985; Martin, 1985; Bhallaeharjee, 1985; Young *et al.*, 1986).

CONCLUSIONS

Nitrogen and Potassium may be used according to the choice of the desired characters. Use of K alone is recommended if spread of plants and higher number of flowers and leaves is desired. However, N and K in combination (N=1680 gm/plot + K=516 gm/plot or N=1680 gm/plot + K=774 gm/plot) is recommended for best height of plant and number of petals/flower; or for the best size of flowers.

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