International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2017; 5(6): 1734-1737

Received: 15-09-2017
Accepted: 17-10-2017

**P Manimaran**
Ph.D. Scholars, Department of Floriculture and Landscaping, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

**Rajasekar P**
Ph.D. Scholars, Department of Floriculture and Landscaping, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

**Rameshkumar D**
Department of Vegetable Crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

**Jaison M**
Department of Vegetable Crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

**Correspondence**
**P Manimaran**
Ph.D. Scholars, Department of Floriculture and Landscaping, Crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

# Role of nutrients in plant growth and flower quality of rose: A review

**P Manimaran, Rajasekar P, Rameshkumar D and Jaison M**

**Abstract**
Nutrients play a vital role in plants to survive and produce quality production. Roses needs frequent supply of plant nutrients to produce good growth and beautiful flowers. In addition to the beautiful foliage and flowers, other benefits result from a desirable fertilization program. A vigorous healthy rose can better withstand attacks by diseases and insects than those struggling for survival. They can also better withstand wind damage and adverse weather conditions. Roses require vigorous pruning, they regularly lose nutrients, which must be replaced to guarantee a healthy bloom every season. Nutrients are divided into two categories are macronutrients and micronutrients. Macronutrients are the primary nutrients and there are three key nutrients which plants need in large quantities *viz.*, Nitrogen (N), Phosphorus (P) and Potassium (K). Micronutrients or trace minerals are required in smaller quantities but are still vital to rose plants.

**Keywords:** nutrients, plant growth, flower quality, rose

## Introduction
Rose, a symbol of affection, elegance, inspiration, sensuality, spirituality and source of aesthetic gratification for human beings, is one of the leading cut flowers in global floriculture trade. It belongs to family Rosaceae and genus Rosa, which contains 200 species and more than 18,000 cultivars (Gudin, 2000) [8]. It has always been the most favorite flower in the subcontinent. There is hardly any event where roses are not displayed in varied fashion. Cut rose flowers play an important role in event decoration and add charm to different occasions like marriage ceremonies, arrival and departure of different dignitaries, birthdays, Valentine's Day etc. India being an agricultural country with diverse agro climatic conditions has a great potential for the production of cut rose flowers.
Rose is top most cut flower in global floriculture trade. The plant management practice, proper ratio of macro and micronutrients is indeed a secret of success and help to maximize productivity and quality of flowers. Foliar application is one of the best ways to supply micronutrients help to increase yield by enhancing the plants quality, number and size of flowers. Essential elements have been established to play important role in proper growth and development of rose. Flower yield and oil yield of rose are correlated with NPK levels in leaf at bud development stage. Foliar application is one of the best ways to supply micronutrients to plants (Cabrera *et al*., 1993) [4]. In order to maximize productivity and quality, adequate quantities of nutrients must be supplied to plants.

## Role of nutrients in plant growth and development
Nitrogen fertilizer recovery by plants is influenced by many factors. These include: the nature of the plant and its root system; the form, amount, and frequency of application of nitrogen; soil physical and chemical properties, including soil organic matter, and cation and anion exchange capacities; biological, chemical, and physical immobilization; rate of water percolation; amount of irrigation or rain frequency and intensity; and volatilization.

## Plant height
In rose cv. gruss -an –Teplitz, application of FYM @ 5 kg m-2 + Azotobacter + nitrogen 60 g m-2 resulted in maximum height of the plant (Singh 2006) [21].This may due to FYM supplied available nutrients directly to the plants and improved the physical and biological property of the soil and uptake of micronutrients is influenced due to the Azotobacter.

(Singh *et al.,* 2004) [19] noticed that higher level of nitrogen 80 g m-2 significantly increased plant height in rose because nitrogen is used largely in synthesis of protein and is a part of chlorophyll molecule thus increased vegetative parameters at higher concentration.

Plant spread was significantly increased by the application of nitrogen 15 g m-2 and 30 g m-2 in rose. This may due to nitrogen is a major constituent of several of the most important substances that occur in plants, its application increased number of stem (Nagaraju *et al.,* 2003) [12].

According to (Nagraju *et al.,* 2003) [12] significantly more number of first and second order lateral in rose were recorded in the plant receiving 30 g N plant-1 as compared to those receiving 15 g N plnat-1 or no N. (Singh *et al.,* 2004) [19] noticed that application of nitrogen 60 g m-2 resulted in maximum number of first order lateral shoot plant-1 in rose which was at par with 80 and 40 g N m-2.

Nitrogen at 600 kg ha-1 resulted in production of maximum number of second order lateral shoots plant-1 in rose (Singh, 2005) [20]. In rose maximum number of second order lateral shoot plant -1was recorded with 4 kg FYM per m-2 + Azotobacter with 50 % NPK (Singh 2007) [22]. This may be due to better physical condition of soil and increased population of microflora which probably resulted in production of more productive part that is second order lateral shoot.

Application of higher level of N 80 g m-2 significantly increased dry leaf biomass, which was at par with 60 g N m-2 (Sigh *et al.,* 2004) [19]. Similarly (Singh 2005) [20] reported that application of 800 kg N ha-1 significantly increased dry weight of leaves which was on par with 600 kg N ha-1.

According to (Singh 2007) [22] application of 4 kg FYM m-2 + remaining NPK by chemical fertilizer + PSB (4 g m-2) resulted in maximum dry weight of leaves which were on par with full dose of NPK (50 : 40: 30 g m-2) and 4 kg FYM m-2 + remaining NPK by chemical fertilizer + Azotobacter (4 g m-2).

In rose, maximum average dry weight of flower was recorded with application of FYM (5 kg/m2) and nitrogen (60 g/m2), whereas inoculation of Azotobacter failed to exert any striking effects on dry weight of flower during the first flush (Singh, 2006) [21].

According to (Viridia and Singh 2004) [24] application of nitrogen 40 g plant-1 gave significantly higher quality of cut flower production with longer stem length. Similarly plant receiving 30 g N + 24 g K plant-1 recorded significantly increased stem and bud length of rose flower (Nagaraju *et al.,* 2003) [12].

In rose *cv* First Red application of 400:200:200ppm NPK plant-1 week-1 under polyhouse condition produced flower with longer stalk length (Gurav *et al.,* 2004) [9].

The quality of flowers like shelf life did not show any positive response at the application of higher level of nitrogen (60 g/m2) but the lower level (40 g N per m2)improved the vase life (141.20 h) of rose cut flowers cv.”Super Star” (Sindhu and Yamdagni, 1992) [18].

**NPK Application**

The growth and quality of roses are greatly influenced by nutrient management flower development is dependent on nutrient supply. Which affects phytohormone balance and source – sink relationship through the transport of photoassimilate. The concentration of N, P and K reduced 35%, 67% and 25% respectively between bud development stage and main flowering stage.

The potassium should be applied in a judicious manner, Excessive amount of potassium can induce deficiency of other essential nutrients Calcium ammonium nitrate is the best source of nitrogen for rose cultivation. Phosphorus and potassium both are less mobile in soil than nitrogen.

**The Effect of Iron Chelate and NPK on Yield of Rose**

The application of NPK and iron chelate agents is developing the plant system and increase the yield quality. Different amounts of nitrogen, potassium, phosphorus and their interaction dramatically affect qualitative and quantitative features of *Rosa damascena* such as flowers number, yield of flower and oil content (Daneshkhah *et al*., 2007 [6]; Rezaie *et al*., 2003) [16]. The iron chelate it is making good vegetative growth has been increased flowers number. Fresh weight of flower increased due to photosynthesis increased, making more carbohydrates and store it in the flowers as reproductive organs.

(Nagaraju *et al.,* 2003) [12] reported that plant receiving 30 g N + 24 g K recorded significantly highest bud length in rose.

In rose application of nitrogen 40 g plant-1 resulted in the maximum floral bud diameter and number of petals per flower and increased duration of flowering (Prasad *et al.,* 1994) [15]. Application of 400:200:200 ppm NPK plant-1 week-1 recorded the maximum flower bud size in rose (Gurav *et al.,* 2004) [9].

Nagaraju *et al.,* (2003) [12] reported that plant receiving 30 g N + 24 g K recorded significantly highest bud diameter in rose cv. Gladiator. According to (Singh 2006) [21] diameter of rose flower was found maximum with the application of higher dose of nitrogen 60 g m-1 and minimum with lower dose of nitrogen 20 g m-1.

Application of nitrogen at 75 g per 1.44 m2 gave maximum beneficial response on number of petals per flower in rose (Bhattacharjee and Damke, 1994) [3].

In rose application of nitrogen 40 g plant-1 resulted in the maximum floral bud diameter and number of petals per flower and increased duration of flowering (Prasad *et al.,* 1994) [15].

Bhattacharjee (1999) [2] reported that application of N at 60 g per 1.44m-2 resulted in pronounced improvement in flower bud size, and number of petals per flower in rose cv. Raktagandha.

(Haripriya *et al.,* 2004) [10] reported that highest number of petals per flower (78.8) were obtained with 100% RDF (6:12:12 kg NPK per plant through urea, superphosphate and muriate of potash, respectively) + 200 g vermicompost per plant in rose cv. “Andhra Red”. In rose cv. Landore (Nagaraju 2003) [12] reported that application of neem cake 100 g gave maximum number of flowers per plant.

According to (Singh *et al.,* 2004) [19] higher level of N 80 g plant-1 increased number of flowers plant-1. (Singh 2005) [20] noticed increased number of flowers during first and second flushes with 600 kg N ha-1 in rose. Similarly (Viridia and Singh 2004) [24] reported increased number of flowers with 40 g N plant-1 in rose cv. Gladiator.

(Nambisan *et al.,* 1981) [13] studied the effect of nitrogen levels (0, 10, 20, 30 and 40 g per plant) and pruning frequencies (once in December and twice in December and June) on yield of Edward rose. The yield of flower was maximum at 40 g nitrogen and pruning of plants once in year.

According to (Viridia and Singh 2004) [24] application of nitrogen 40 g plant-1 gave significantly higher quality of cut flower production with longer stem length. Similarly plant receiving 30 g N + 24 g K plant-1 recorded significantly

increased stem and bud length of rose flower (Nagaraju *et al.*, 2003) [12].

In rose cv. First Red application of 400:200:200ppm NPK plant-1 week-1 under polyhouse condition produced flower with longer stalk length (Gurav *et al.*, 2004) [9].

(Maharana and Pradhan 1976) [11] reported that longevity of the "Celebration" rose cut flowers enhanced with the application of potash, but reduced with nitrogen.

The quality of flowers like shelf life did not show any positive response at the application of higher level of nitrogen (60 g/m2) but the lower level (40 g N per m2)improved the vase life (141.20 h) of rose cut flowers cv."Super Star" (Sindhu and Yamdagni, 1992) [18].

(Sankar and Bhattacharjee 2000) [17] reported that application of N @ 300 kg ha-1yr-1 recorded the longest vase life with good quality flowers in rose.

(Viridia and Singh 2004) [24] reported that lower level of nitrogen 20 g plant increased vase life of cut flower in rose, but higher level of nitrogen 60 g plant-1 reduced it.

**Application of NPK in the form of fertigation:**

Fertigation control involves the determination of both timing and quantity of fertilizer and water application. The effects of fertigation frequency on growth, flower production and quality of rose plants can help to propose optimal fertigation scheduling. The right combination of water and nutrients is the key for high yield and quality.

NPK Application in the form of fertigation enhanced various growth indices and increased flower yield of *Rose*. Early flower emergence in roses in response to NPK @ 300 ppm it's indicate that high frequency irrigation enhanced photosynthetic rate which increases carbohydrate reserves of the plants which resulted in early flower emergence (Palai *et al*., 2002) [14]. Optimum use of compound fertilizer (NPK) at high frequency proved better towards vigorous growth and maximum flower production in rose.

First Red was reported by (Ashok and Rengasamy 2000) [1] who studied the effect of fertigation with ammonium nitrate @150 mg L by high frequency of water (irrigation) and these increase may be due to more number of branches produced by this treatment which resulted in more carbohydrate synthesis which increased number of petals.

**Role of Micronutrients**

Micronutrient sprays with optimum concentrations have a role in improving flower yield and they also play important role improving the vase life and flower yield.

The requirement of micronutrients viz. Magnesium (Mg), Manganese (Mn), Iron (Fe), boron (B), Zinc (Zn) and Copper (Cu) is relatively less but their role in normal crop production is indispensible, because of their active role in plant metabolic processes, involving in cell wall development, photosynthesis, chlorophyll formation, respiration, various enzyme activities, hormone synthesis and nitrogen fixation. Foliar spray is one of the best ways to supply Micronutrients to the rose plants.

Spraying of three-year- old hybrid tea roses cv. Raktagandha with $ZnSO_4$, $FeSO_4$ and $MnSO_4$ or $CuSO_4$ one month after pruning was the most effective to stimulate secondary shoot production and increasing bud length, flower diameter, number of petals flower-1 and flower production (Cabrera *et al.*, 1993) [4]. Pre-harvest sprays of micronutrients applied twice after pruning to 3-year-old roses cv. Raktagandha, on flower improved the quality and longevity of flowers Singh and Bhattacharjee (1997) [23].

**Iron (Fe)**

Iron (Fe) plays an important role in improvement of higher plants growth and development. The main role of Fe in plant body is in some metabolic processes. In addition, it is a structural part of some enzymes. The effect of Fe fertilizer on rose cultivation and reported a significant effect on essential oil content and flower quality. High absorption of Fe by crops will reduce their ability to absorb other micronutrients except for the chlorine.

Iron induce good vegetative growth has been increased flowers number. Fresh weight of flower increased due to photosynthesis increased, making more carbohydrates and store it in the flowers as reproductive organs.

**Zinc (zn)**

Zinc plays an important role in enhancing tolerance of rose cultivars to biotic stress of mildew infection. Zinc application increase in plant height due to $ZnSO_4$ spray might be due to synthesis of tryptophan, a precursor of Indoleacetic acid (IAA) (Chatopadhyay 1994) [5]. Zinc influences the Auxin and nucleic acid levels in plants and activates the enzymes involved in protein synthesis.

The increase in flower fresh weight in $ZnSO_4$ treatments may be due to association of Zinc in regulating semi permeability of cell walls, thus mobilizing more water into flowers and also increased the synthesis of iron which promotes cell size and in turn increases flower weight.

**Copper (cu)**

Application of $CuSO_4$ Increase in plant spread and leaf area in copper treatments might be due to Copper participates in numerous physiological processes and is an essential co factor for many metalloproteins. It's also Increase in flower stalk length in $CuSO_4$ spray may be due to the role formation of various compounds with amino acids and protease in the plant which might have increase the flower stalk length.

**Boron (B)**

The application of Boron induce early flower bud opening in Boric acid spray may be due to its role in translocation of sugars, starches, phosphorous etc. might have utilized for better development of bud size and early flower bud opening.

Increase in vase life of flowers in Boric acid 0.5% treatment might be attributed to the role of Boron in regulation of K/Ca ration in plants (Das, 1996) [7] which in turn helped in increased water uptake and reduced transpirational loss of water during vase life period, which ultimately resulted in prolonged vase life of the flowers. It is maintain highest flower fresh weight during vase life.

**Manganese (Mn)**

Manganese application of rose plants it's Increase in number of flowers in $MnSO_4$ might be due to the role of (Mn) in many enzyme reactions and its role in electron transport in photosystem II. It's activation of IAA protectors & Influences the Auxin levels in plants and it high concentration it may breakdown of Indole acetic acid in plants which might have induced flowering.

It's also increase in flower Fresh and dry weight with $MnSO_4$ 0.5% might be due to the role of Mn in photosynthesis, Carbon dioxide assimilation and nitrogen metabolism that might have accumulation of large quantities of metabolites.

## Conclusion

All essential macro and micro nutrients are very important role in the rose plant metabolism. It's correct dose of application of nutrients increase the plant quality and quantity characters mainly in yield characters.

## References


1. Ashok A, Rengasamy P. Effect of N fertigation at different levels and sources on the growth of cut rose cv. "First Red" under greenhouse conditions. *South Indian Hort*., 2000; 48:139-141.
2. Bhattacharjee SK. Growth flowering post-harvest life and nutrient content of "Raktagandha" roses as affected by nitrogen. Advances in Horticulture and Forestry. 1999; 7:175-184.
3. Bhattacharjee SK, Damke MM. Response of Super Star rose to nitrogen, phosphorus and potash fertilization.indian jornal of Horticulture. 1994; 51(2):207-213.
4. Cabrera. R.I. Cabrera, R.Y. Evans, J.L Paul, Leaching losses of nitrogen from container-grown roses Scientia Horticulturae. 1993; 53:333-345.
5. Chatopadhaya PK. A text book of Pomology, Kalyani publishers, B-I /1292, Rajendranagar, Ludhiana, Punjab, India. 1994, 144-181.
6. Daneshkhah MM, Kafi A Nikbakht, Mirjalili MH. Effect of different levels of nitrogen and potassium on yield indicators and oil of *Rosa damascena*. Journal of Horticultural Science and Technology. 2007; 8(2):83-90.
7. Das DK. A Text book of Introductory Soil Science, General functions of plant nutrients, Kalyani publishers, 1996, 295-302.
8. Gudin S. Rose: Genetics and breeding. Plant Breed. Rev. 2000; 17:159-189.
9. Gurav SB, Singh BR, Katwate SM, Sabale RN, Kakade DS, Dhane AV. Influence of NPK nutrients on yield and quality in rose under polyhouse conditions. Journal of Ornamental Horticulture. 2004; 8(3):228-229.
10. Haripriya K, Senthilkumar S, Sriramachandrasekharan MV. Effect of vermicompost and fertilizer on the growth and yield of rose. Journal of Interacademicia. 2004; 8(2):207-210.
11. Maharana T, Pradhan RC. Effect of NPK and their combinations on growth flowering and anthocyanin development of hybrid rose cv. Celebrations. Punjab Hort. J. 1976; 16(1-2):77-79.
12. Nagaraju CG, Reddy TV, Madaiah D. Effect of N, K and Multiplex on growth, production and quality at harvest of field grown roses cultivar Gladiator. Journal of Ornamental Horticulture. 2003; 6(4):287-293.
13. Nambisan KMP, Krishnan BM, Veeraraghavathatam D, Rajasekaran LR. Effect of nitrogen levels and pruning frequencies on the yield of Edward rose (*Rosa bourboniana* Desp) South Indian Horticulture. 1981; 29(4):211-214.
14. Palai S, Misha M, Mishra H. Response of rose cv. Montezuma to different levels of N, P and K fertigation. Arissa J. Hort. 2002; 30:51-53.
15. Prasad A, Agrawal M, Dwivedi RM, Mishra A. Effect of N P and K on flowering behavior in rose. Floriculture Tec Tra. And Tre.Oxford & IBH Pub Co Pvt Ltd New Delhi, 1994, 76-80.
16. Rezaei MB, Naderi-Kandi M, Tabaei-Aghdaei SR. Mineral elements in different genotypes of *Rosa damascena* in Tehran, Azarbayjan Sharghi and Golestan. J. of Medicinal and Aromatic Plants Research. 2003; 20(3):291-299.
17. Sankar MV, Bhattacharjee SK. Effect of nitrogen on growth, flowering and post harvest life of rose cv. Arjun. J. Ornament Hort. New Series. 2000; 3(1):22-25.
18. Sindhu S, Ymdagni R. Nutritional studies on hybrid tea rose cv. Super Star. Thesis Abstract. 1992; 18(2):126-127.
19. Singh. Effect of farmyard manure Azotobacter and Nitrogen on leaf nutrient composition growth flowering and yield in rose. Indian Journal of Horticulture. 2004; 63(1):62-65.
20. Singh AK. Response of rose plants growth and flowering to nitrogen, Azotobacter and farm yard manure. Journal of Horticulture. 2005; 8(4):296-298.
21. Singh AK. Effect of farm yard manure, Azotobacter and nitrogen on leaf nutrient composition, growth, flowering and yield in rose. Indian Journal of Horticulture. 2006; 63(1):62-65.
22. Singh AK. Response of integrated nutrient management on growth and flowering attributes in rose. Journal of Ornamental Horticulture. 2007; 10(1):58-60.
23. Singh UC, Bhattacharjee SK. Effect of pre-harvest micronutrients on postharvest life of Raktagandha roses. Ann. Agri. Res. 1997; 18:375-360.
24. Viridia R, Singh P. Quality production of cut roses cv Gladiator as influenced by nutrient, plant density and water management. J of Ornamental Horticulture 2004; 7(3-4):171-176.