Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(4): 2571-2575
Received: 25-05-2019
Accepted: 27-06-2019

Somendra Verma
Collage of Horticulture, Department of Fruit Science, C.S.A. University of Agriculture & Technology, Kanpur, Uttar Pradesh, India

Ashok Kumar
Department of Horticulture, N.D. University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Akhilesh Kumar Dwivedi
Collage of Horticulture, Department of Fruit Science, C.S.A. University of Agriculture & Technology, Kanpur, Uttar Pradesh, India

Correspondence
Somendra Verma
Collage of Horticulture, Department of Fruit Science, C.S.A. University of Agriculture & Technology, Kanpur, Uttar Pradesh, India

Studies on effect of nitrogen and phosphorus on the performance of snapdragon (*Antirrhinum majus* L.): A review

Somendra Verma, Ashok Kumar and Akhilesh Kumar Dwivedi

Abstract
Flowers have gained very high economic values for their eternal beauty, love and tranquility. Flower is used for religious offering, decoration, pharmaceuticals, foods supplement and coloring agent for cosmetics. Snapdragon is one of the most popular and widely grown as garden annuals. Snapdragon flowers are used as cut flower, floral arrangements and in bouquets. Nitrogen and phosphorus play a vital role in the production of good quality flowers. Nitrogen and phosphorus are required in sufficient quantities to attain better growth of snapdragon and promote flowering. The application of nitrogen and phosphorus have potential to increase plant height, plant spread, number of branches per plant, length of spike, duration of flowering, number of spike per plant, average weight of spike, days taken to spike initiation, days taken to opening of first florets, number of spike per hectare, spike yield per hectare and vase life of snapdragon.

Keywords: Nitrogen, phosphorus, snapdragon etc.

Introduction
Flowers have gained very high economic values for their eternal beauty, love and tranquility. Flower is used for religious offering, decoration, pharmaceuticals, foods supplement and coloring agent for cosmetics (Priyanka *et al*., 2013) [21].

Snapdragon is an important annual grown in the winter season, though traditionally they cultivated as perennial, due to its curious shape of flowers, which resemble a dog, rabbit or dragon, so it is popularly called as snapdragon, dog flower, bunny rabbit or bunny mouth. Snapdragon is one of the most popular and widely grown as garden annuals. It is ideally suited for beds, pots, edging, window boxes, rockens and mixed borders or with herbaceous plants. Snapdragon flowers are used as cut flower, floral arrangements and in bouquets.

Snapdragons originally get their name from the fact that they look like the mouth of a dragon and children sometimes pick off the flowers and put their fingers into the top and bottom portion of the "dragon mouth" and make them open and close. Flower characteristic: show, Light requirement: plant grows in part shade/part sun, Soil tolerances: acidic; slightly alkaline; clay; sand; loam, Plant spacing: 6 to 12 inches, Flower color: yellow; white; pink; orange; salmon; lavender; purple.

Research has shown that fertilizer input contributes about 40–50% of total yield increase for most crops (Dassand Mitali, 2016) [10]. In fact 50% of the total increase in crop production comes from the use of fertilizers and rest from all other factors combined together. Good flower production requires optimal fertilizer management to attain a high ornamental value and to reduce production cost of a plant (Zhang *et al.*, 2012) [41]. Nitrogen, phosphorus and potassium play a vital role in the production of good quality flowers. Nitrogen and phosphorus are required in sufficient quantities to attain better growth of marigold and promote flowering (Pandey and Mishra, 2005) [29]. It was reported that nitrogen, phosphorus, and potassium greatly influence the growth, flower, and tuber production of tuberose (Khan *et al*., 2012) [19].

Nitrogen is one of the very important major plant nutrients which directly affect the plant growth and flowering behavior. It is constituent of nucleic acid, protoplasm and might have increased carbohydrates synthesis, amino acid etc. from which the Phyto-Harmones like auxins, gibberellins and cytokinins have been synthesizes resulting plant growth (Haque, 2001) [15]. Very little work has been done on nitrogen requirements of snapdragon. Proper manuring and fertilization is very important for better growth and flowering of the plants. Application of appropriate amount of nitrogen is important as its deficiency causes several abnormalities like over growth and less flowering.

Phosphorus is one of the important elements for plant growth and metabolism. It plays key roles in many plant processes such as energy metabolism, the synthesis of nucleic acid and membranes, photosynthesis, respiration, nitrogen fixation and enzyme regulation. Adequate phosphorus nutrition enhances many aspects of plant development including flowering, fruiting and root development. Phosphorus and potash contents resulted in maximum increase in nutrient uptake by virtue of more photosynthesis through more chlorophyll formation with an increased leaf area (Belorker *et al*., 1992) [6].

A. Effect of Nitrogen

Nitrogen is integral part of the plant tissues, and has direct and positive effects on the crop growth and performance. These also play a key role in the higher production and seed yield of ornamental flowers (Delgado *et al.*, 1998) [11]. Nitrogen enhances the vegetative growth and assists the plant during the blooming period to mobilize the process of flower opening. Flowering can be increased with increased levels of N application (Fan *et al.*, 2005) [14].

1. Effect of Nitrogen on vegetative growth of snapdragon

Agrawal *et al*., (2002) [2] applied four levels of nitrogen (0, 100, 200, 300 kg ha^{-1}) and three levels of potassium (0, 100 and 200 kg ha^{-1}) and reported that increase in levels of nitrogen and potassium significantly increased plant height, number of branches per plant was height with application of 200 kg ha^{-1} nitrogen and potassium in marigold. Sharma and Mohammad (2004) comprising four levels of nitrogen (0, 100, 200 and 300 kg ha^{-1}) and found maximum plant height (72.03 and 72.03 cm) was recorded with the application of 100 kg N ha^{-1} in Tuberose. Anil *et al*., (2004) [3] applied four doses of nitrogen (20, 40, 60 and 80 g m^{-2}) in rose crop and found maximum plant height with 80 g N m^{-2}. Pradhan *et al.*, (2008) [30] conducted an experiment with different levels of urea (0, 10, 20 and 30 g m^{-2}) and results revealed that's plant height were maximum with highest level 30 g m^{-2}) of nitrogen on snapdragon. Lehri *et al*., (2011) [25] performed a field experiment to determine the response of different doses of N and P_2O_5 on the growth and flower quality of gladiolus. Six treatments were included in the trial *viz.*, T_1 (125+100); T_2 (125+200); T_3 (150+100); T_4 (150+200); T_5 (175+100) and T_6 (175+200) NP kg ha^{-1}. and results reveal that fertilizer treatments had significant response on leaves length, leaves number, florets number per spike and spike length. The highest N and P_2O_5 dose 175+200 kg ha^{-1}produced significantly maximum length of leaves (44.4 cm), number of florets per spike (14.00) and longer spike length (99.75 cm).

2. Effect of nitrogen on flowering and yield of snapdragon

Nitrogen application enhances metabolic process and results in maximum plant height. Malik (1994) [26] reported that basically nitrogen is part of chlorophyll, proteins which enhance plant vegetative growth ultimately increases the flowering in plants. Yadav *et al.*, (2000) [40] reported that application of N @ 0, 60, 120, 180, 240 and 300 ppm and FYM @ 0, 0.5, 1.0 and 2% on floral characters and yield of marigold. Flower size increased progressively up to 120 ppm N. Flower weight increased with increasing N levels and maximum weight (11.80g) was obtained with 180 ppm N. Increasing nitrogen levels also increased pedicel length and the maximum length was observed at 120 and 180 ppm N. A significantly decrease in pedicel length was observed at 300 ppm N. Sharma *et al.*, (2009) [32] A performed field experiment was conducted in sandy loam soil to study the effect of graded doses of N, P and K on growth, flowering and bulb production of tuberose (*Polianthes tuberosa* L.) cv. Double. Nitrogen was applied @ 100, 150, 200 and 250 kg ha^{-1} with phosphorus @ 50, 60 and 70 kg P_2O_5 ha^{-1} and potassium @ 40, 50 and 60 kg K_2O ha^{-1}. Increasing levels of nitrogen up to 200 kg ha^{-1}significantly increased the plant height, number of leaves per plant, flower yield and quality over control. Maximum plant height (39.3 cm), spike length (78.1 cm), number of florets per spike (38.6) maximum number of bulbs (10.6) and bulb weight (14.3 g) was recorded with 200 kg N ha^{-1}. Kundu *et al.*, (2010) [24] studied the effect of different levels of nitrogen (0, 10, 20, 30 and 40 g m^{-2}) and phosphorus (0, 10 and 30 g m^{-2}) for better flower production in African marigold. And Observed that maximum number of buds per plant, number of flowers per plant, days to flowering, duration of flowering, flower diameter, stalk length and flower yield per plant were recorded when applied the nitrogen @ 30 g m^{-2} and phosphorus 20 g m^{-2} significantly improved floral and yield parameters. Khalaj *et al.*, (2012) [18] conducted trials on different levels of nitrogen (0, 50, 100, 150, 200, 250 Kgha^{-1}), in the form of ammonium nitrate and results showed that an application of 200 Kg ha^{-1} N can improve growth and yield of tuberose in terms of flower stalk height, stem diameter and bulb weight. Khan *et al.*, (2012) [19] a study was conducted to determine the optimum rate of N and K for better growth and yield of corm and cormel of gladiolus. The treatment combination (N 150 and K 200 kg ha^{-1}) produced the longest plant (42.1 cm), the broadest leaf (1.93 cm), the maximum percentage of spikes (88.1%), and corm (97.6%), the heaviest and the largest corm (19.5 g and 4.11 cm, respectively), cent percent flowering sized corm, and the highest corm number and cormel yield (1,20,000 and 1.66 t ha^{-1}, respectively). The corm produced from this treatment combination also showed better performances in the next year in respect of plant emergence (100%), florets/spike (13.1), spike and rachis length (82.2 cm and 45.4 cm, respectively), flower stick weight (57.1 g) and percentage of flower sticks (113%). Verma *et al.*, (2015) [39] conducted trials to assess the effect of nitrogen, planting geometry and corm size on gladiolus. The treatments having four graded doses of nitrogen (0, 100, 200, 300 kg ha^{-1}) in combination with two planting geometry 30×30 and 30×20 and two corms size (*i.e.* 3-4 cm and 4-5 cm in size). The investigation revealed that 300 kg N ha^{-1} gave better result for flowering attributes and vase life of cut spikes of gladiolus.

B. Effect of Phosphorus

Phosphorus is one of the major essential plant nutrients after nitrogen and is the second most deficient plant nutrients. The optimum rate of phosphorus application is important in improving yields of most crops (Cisar *et al*., 1992) [7]. Adequate phosphorus nutrition is critical for root development, increased stalk and stem strength, increased flowering and seed production, uniform and early crop maturity, improved crop quality, and increased resistance to plant diseases.

1. Effect of phosphorus on vegetative growth on snapdragon

Doddagoudar (2000) [13] reported that China aster recorded maximum number of flowers $plant^{-1}$, flower weight, flower diameter and flower yield with application of 240:180:80 kg NPK ha^{-1}. Baboo and Singh (2003) [5] tried four levels of nitrogen *viz.*, 0, 125, 250 and 375 kg ha^{-1}) and three levels of phosphorus (*viz*., 0, 110 and 220 kg ha^{-1}) and found that

nitrogen level (375 kg ha^{-1}) had sustainable boosting effect on number of secondary branches (17,103) followed by 0, 125 and 250 kg ha^{-1}. The application of phosphorus (220 kg ha^{-1}) significantly increased the number of secondary branches per plant than lower levels of phosphorus and control in marigold. Muktanjali *et al*., (2004) conducted an experiment where plants were supplied 50, 100, 150 and 200 kg N ha^{-1} and 50 and 100 kg P ha^{-1}. In field observation, duration of crop, flower diameter, number of flowers and vase life were increased with increasing rates of N and P on China aster. Combined application of 150 kg N and 100 kg P ha^{-1} resulted in highest values for the parameter measured. Manish *et al*., (2008) [27] studied the effect of nitrogen and phosphorus levels on China aster. He further reported that the application of Nitrogen and phosphorus at their higher levels *i.e.,* 300 kg ha^{-1} and 200 kg ha^{-1} resulted tallest plants, maximum number of leaves, branches and flowers, thickest stem, largest sized flowers, longest flowering duration, maximum fresh and dry weight of flowers and the highest yield of flowers. Sonawane *et al*., (2009) [36] the application of N @ 200 kg ha^{-1}through urea, P @ 75 kg ha^{-1} through single superphosphate**,** K_2O @ 50 kg ha^{-1} through murate of potash was found beneficial to increase the growth parameter, flower yield and N and P uptake by China aster.

2. Effect of phosphorus on flowering and yield of snapdragon

Anuradha *et al*., (1988) [4] applied @ 0, 30, 60, and 90 kg N ha^{-1} in marigold and concluded that days taken to 50% flowering have reduced with increasing levels of N and P_2O_5. The flower number plant^{-1} and weight of single flower increased significantly with increase in fertility levels. Singh *et al*., (1990) [34] reported that the N was applied in two split doses, one half at the three leaf stage and the other half at the six leaf stage showed significant effect on improvement of gladiolus corms with N @ 40 kgm^{-2} or P_2O_5 at 20 kg/m^2. Kumar and Mishra (2002) [23] reported that application of 80 g Nm^{-2} resulted in maximum number of flowers plant^{-1}, size of flower and weight of flower gladiolus. Acharya *et al*., (2004) [1] studied the effects of different levels of nitrogen (0, 50, 100, 150 and 200 kg ha^{-1}) and phosphorus (0, 100 and 200 kg ha^{-1}) on the growth and flowering of *Tagetes erecta* cv. Pusa Basanti Gainda. Application of 200 kg ha^{-1} each of nitrogen and phosphorus produced the maximum plant height, plant spread, diameter of flower and early flowering. The maximum number of branches and flowers per plant with flower yield per plant and per hectare basis were recorded with 150 kg ha^{-1} N and 200 kg ha^{-1} P. The maximum weight of a single flower was obtained with 150 kg N ha^{-1} and 100 kg P ha^{-1} in Pusa Basanti Gainda. Kishanswaroop *et al*., (2007) [20] study the effect of nitrogen and phosphorus on growth, flowering and seed yield of African marigold, variety Pusa Narangi Gainda with four levels of N and P (0, 40, 80 and 120 kg N and 0, 25, 50 and 75 kg P ha^{-1}). And result revealed that these treatments had significant effect on growth, flowering and seed yield. Maximum plant height (67.91 cm), plant spread (65.16 cm) number of primary (16.50) and secondary branches (56.83) were recorded with application of 120 kg N ha^{-1}.Besides, several floral and seed characters like, diameter of flower (8.30 cm), number (61.91) and fresh yield of flowers (1018 g) per plant, fresh weight of single flower (16.48 g), flowering duration (51.58 days), seed yield per flower (1.249 g) and per plant (77.60 g) as well as 1000 seed weight (2.982 g) were also significantly improved at 120 kg N ha^{-1}.Application of P at 75 kg ha^{-1} recorded maximum plant height (59.75 cm) and number of secondary branches (43.25) whereas, fresh yield of flowers per plant (722 g) was maximum with 50 kg P ha^{-1}. Dabke *et al*., (2008) [8] studied the effect of different levels of nitrogen and phosphorus with and without FYM on yield and quality of China aster and found that the application of nitrogen @ 200 kg ha^{-1}, phosphorus @ 75 kg ha^{-1} and FYM @ 10t ha^{-1} was found effective to achieve significant maximum flower yield over other levels of nitrogen, phosphorus and FYM.

C. Interaction effect of nitrogen and phosphorus on growth, flowering and yield of snapdragon

Kadu *et al*., (2009) [16] conducted a field experiments in two seasons to study the effect of four levels, each of nitrogen (0, 100, 200 and 300 kg ha^{-1}) and phosphorus (0, 100, 150 and 200 kg ha^{-1}) with a fixed level of potassium @ 100 kg ha^{-1} in tuberose cv. Single. Among all the NPK combinations, treatment of 300:150:100 kg NPK ha^{-1} showed more spike length (106.32 cm), maximum number of florets plant^{-1} (41.58) and number of spikes plant^{-1} (2.47), fresh weight of flowers plant^{-1} (90.89 gm) and yield of flowers hectare^{-1} (15.15 tones). Kumar and Singh (2011) [22] a field experiment was conducted on calendula *(Calendula officinalis* L.) to assess the effect of nitrogen and found that application of N @ 150 kg ha^{-1} was most effective in increasing the flower yield. Kaur and Sharma (2012) [17] found that application of NPK @ 50, 30 and 20 g/m^2, respectively improved sprouting time, leaves per plant, length of leaves, plant height, spike initiation, length of spike, flowering duration and spikes per clump in tuberose per clump, bullblet weight and size, and bulb NPK content. The best results were obtained when bulbs were planted in April and treated with the highest rate of NPK fertilizer in split doses. Dhaked *et al*., (2013) [12] conducted field experiment on calendula (*Calendula officinalis* L.) with the nitrogen levels *viz*., 0, 50 and 100 kg N ha^{-1}, and found that maximum improvement in various growth and flowering characters were observed with 100 kg N ha^{-1}.

Conclusions

In the highlights of above scientific description about nitrogen and phosphorus from the different research aspects, we are giving conclusion that nitrogen and phosphorus has play great role for growth, flowering and qualitative yield of snapdragon. Only big reason of limited yield with lower most quality of flower throughout the world is improper and non-judicious use of nitrogen as well as phosphorus. Therefore, proper management of nitrogen and phosphorus for snapdragon crop is essential.

References

1. Acharya MM, Dashora LK. Response of graded levels of nitrogen and phosphorus on vegetative growth and flowering in African marigold (*Tagetes erecta* L.). Journal of Ornamental Horticulture. 2004; 7(2):179-183.
2. Agrawal S, Agrawal, N, Dixit A, Yadav RN. Effect of nitrogen and potash on African marigold in Chhattisgarh Region. Journal of Ornamental Horticulture. 2002; 5(1):86.
3. Anil K, Singh KK, Shiva J. Response of nitrogen on growth and flowering parameters in Rose. Journal of Horticulture. 2004; 7(1):90-94.
4. Anuradha K, Pampapathi K, Sreenivasalu R. Effect of nitrogen and phosphorus on flowering and yield of marigold (*Tagetes erecta* L.). South Indian Horticulture. 1988; 36(6):321-323.

5. Baboo R, Singh MK. Response of graded levels of nitrogen and phosphorus on growth and flowering in African marigold. Journal of Ornamental Horticulture. 2003; 6(4):400-402.
6. Belorkar PV, Patel BN, Golliwar VJ, Kothare AJ. Effect of nitrogen and spacing on growth, flowering and yield of African marigold. Journal of Soils and Crops. 1992; 2:62-64.
7. Cisar GD, Synder GH, Swanson GS. Nitrogen and Potassium fertilization for histosols grown Augustine grass sod. Agronomy Journal. 1992; 84:475-479.
8. Dabke SS, Dodke DJ, Rathod SB. Studies on the effect of different levels of nitrogen and phosphorus on yield and quality of China aster. Journal of Soil and Crops. 2008; 18(1):130-134.
9. Dahiya SS, Mohansundram S, Singh S, Dahiya DS. Effect of nitrogen and phosphorus on growth and dry matter yield of tuberose (*Polianthes tuberose* L.). Haryana Journal of Horticulture Science. 2001; 30(3/4):198-200.
10. Das DK, Mithali M. Advance technology of fertilizer uses for crop production. In Book: Fertilizer Technology-I Synthesis, (1st ed.), Studium Press, LLC, USA, 2016, 101-150.
11. Delgado VF, Lopez OP, Gonzalez EA. Effect of sunlight illumination on marigold flowers meals and egg yolk pigmentation. J Agric. Food Chem. 1998; 46:698-706.
12. Dhaked R, Chand S, Srivastava R. Effect of spacing and levels of nitrogen on growth, flowering and yield of calendula (*Calendula officinalis* L.). Pantnagar Journal. 2013; 11(3):365-368.
13. Doddagoudar SR. Effect of mother plant nutritional and chemical spray on seed and quality of China aster. M. Sc. (Agri.) Thesis, University of Agricultural Sciences, Dharwad, 2000.
14. Fan MF, Jiang R, Liu X, Zhang F, Lu S. Interaction between noon-flooded mulching cultivation and varying nitrogen inputs in rice-wheat rotations. Field Crops Res. 2005; 91:307-318.
15. Haque I, Jakhro AA. Soil and fertilizer potassium. In "Soil Science National Book Foundation, Islamabad, Pakistan, 2001, 261-263.
16. Kadu AP, Kadu PR, Sable AS. Effect of nitrogen, phosphorus and potassium on growth, flowering and bulb production in tuberose cv. Single. Journal Soils and Crops. 2009; 19(2):367-370.
17. Kaur R, Sharma A. Growth and flowering as affected by NPK fertilizers in tuberose cv. Single. Asian Journal of Horticulture. 2012; 7(2):619-620.
18. Khalaj MA, Edrisi B. Effect of plant spacing and nitrogen levels on quantity and quality characteristics of tuberose (*Polianthes tuberosa* L.) under field experiment. Indian journal of Agriculture Science. 2012; 2(3):244-255.
19. Khan FN, Rahman MM, Karim AJ, Hossain KM. Effects of nitrogen and potassium on growth and yield of gladiolus corms. Bangladesh Journal of Agriculture Research. 2012; 37(4):607-616.
20. Kishanswaroop, Raju DVS, Singh KP. Effect of nitrogen and phosphorus on growth, flowering and seed yield of African marigold, variety Pusa Narangi Gainda (*Tagetes erecta* L.).Orissa Journal of Horticulture. 2007; 35(2):15-20.
21. Kishore GR, Arya JK, Ghalot PK. Effect of different levels of nitrogen, phosphorus and potassium on growth and flowering of African marigold cv. Pusa Narangi. Progressive Agriculture. 2010; 10(1):80-83.
22. Kumar A, Singh AK. Effect of spacing and nitrogen levels on vegetative growth, flowering behavior and yield of calendula (*Calendula officinalis* L.). Plant Archives. 2011; 11(2):941-944.
23. Kumar R, Mishra RL. Response of gladiolus to nitrogen, phosphorous and potassium fertilization. Journal of Ornamental Horticulture. 2002; 6(2):95-99.
24. Kundu M, Joon MC, Beniwal BS, Mehta PK. Effect of nitrogen and phosphorus application on flowering and yield of African marigold (*Tagetes erecta* L.). National Seminar on Recent Trends in Horticulture Crops – issues and strategies for research and development, March, 22-24, 2010. CCS HAU., Hisar, 2010, 88.
25. Lehri SM, Kurd AA, Rind MA, Bangulzai NA. The response of Gladiolus to N and P_2O_5 fertilizers. Sarhad Journal of Agriculture. 2011; 27(2):185-188.
26. Malik MN. Floriculture and Landscape gardening, Horticulture, National Book Foundation, Islamabad. 1994; 5:546-547.
27. Manish, Mohit, Umarao, Kumar V, Tyagi AK, Meena PM. Effect of nitrogen and phosphorous levels on growth, flowering yield of China aster. Agricultural Science Digest. 2008; 28(2):97-100.
28. Muktanjali J, Paithankar DH, Warade AD, Anjali TP. Effect of nitrogen and phosphorus were supplied in a field of experiment the plant height, number of branches and vase life increasing rates and highest values for the parameters measured in China aster. Advances in Plant Science. 2004; 17(1):163-165.
29. Pandey RK, Mishra A. Effect of nitrogen, phosphorus and potassium on growth, flowering and seed yield in marigold cv. Pusa Narangi Gainda. Progressive Horticulture. 2005; 37(2):341-344.
30. Pradhan S, Maiti RG. Study on the response nitrogen fertilizer in the field grown snapdragon (*Antirrhinum majus* L.). Journal of Interacademicia. 2008; 12(2):176-181.
31. Priyanka D, Shalini T, Navneet VK. A brief study on marigold (*Tagetes species* L.). International Research Journal of Pharmacy. 2013; 4(1):43-48.
32. Sharma JR, Panwar RD, Gupta RB, Singh S. Nutritional studies in tuberose (*Polianthes tuberosa* L.). Journal of Ornamental Horticulture. 2009; 37(1/2):85-86.
33. Sharma RK, Shaffat M. Influence of graded levels of nitrogen on growth, flowering and essential oils content in tuberose cv. Mexican single. Journal of Ornamental Horticulture. 2004; 7(1):52-57.
34. Singh KP, Jha KS, Suja NK. Influence of different levels of nitrogen and phosphorous in gladiolus cv. green meadow cormels production. South Indian Horticulture. 1990; 38(8):208-210.
35. Singh SRP, Kumar D, Singh VK, Dwivedi R. Effect of NPK fertilizers on growth and flowering of tuberose cv. Single. Haryana journal of Horticultural Science. 2005; 1(l/2):84.
36. Sonawane SPD, Dodke DJ, Dhane SB. Studies on N and P application with and without farmyard manure on the growth of plant, branches and flowering character of China aster. Journal of Maharashtra Agriculture University. 2009; 34(1):90-91.
37. Swaroop K, Raju DVS, Singh KP. Effect of nitrogen and phosphorus on growth flowering and seed yield of African marigold variety Pusa Narangi Gainda (*Tagetes*

erecta L.) Orissa Journal of Horticulture. 2007; 35(2):15-20
38. Umrao VK, Monish M, Tyagi AK, Meena FM. Effect of nitrogen and phosphorus levels on growth flowering and yield of China aster. Agricultural Digest. 2008; 28(2):97-100.
39. Verma RP, Kumar A, Verma SK, Verma A, Verma PK. Influence of nitrogen, planting geometry and corm size on vegetative growth and corm and cormel production of gladiolus cv. Nova Lux. Environmental and Ecology. 2015; 33(1):199-201.
40. Yadav PK, Singh S, Dhindwal AS. Effect of nitrogen and FYM application on floral characters and yield of African marigold (*Tagetes erecta* L.). Horti. 2000; 29(1-2):69-71.
41. Zhang W, Li X, Chen F, Lu J. Accumulation and distribution characteristics for nitrogen, phosphorus and potassium in different cultivars of *Petunia hybrid* Vlim. Science in Horticulture. 2012; 141:83-90.