Biological Forum – An International Journal **14(5): 07-11(2022)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Effect of Different Levels of Nutrients (Nitrogen, Phosphorus, Potassium) on Vegetative Features of Jasmine (*Jasminum sambac* L. Aiton) during Summer Season

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(Received 06 September 2022, Accepted 20 November, 2022)
(Published by Research Trend)

ABSTRACT: The present study "Effect of Different levels of Nutrients (Nitrogen, Phosphorus, Potassium) on vegetative features of Jasmine *(Jasminum sambac* L. Aiton) during Summer Season" was conducted in the last week of December 2021–November 2022 at the Educational Garden of the Department of Floriculture and Landscaping, College of Agriculture, O.U.A.T., Bhubaneswar. This experiment, which was adapted to RBD and triple replicated, included a total of nineteen treatments with different N, P and K fertilizer combinations (Kg/ha). Out of all the treatments, treatment T_{13} (N=100 kg/ha, P=120 kg/ha, and K=120 kg/ha) was determined to be the most fruitful in resulting luxuriant vegetative characteristics i.e. plant height (101.51 cm), East-West spreading (83.34 cm), North-South spreading (82.63cm), Leaf area (87.91 cm^2), primary shoot length (182.86 cm), Primary shoot thickness (1.34 cm), Number of laterals (17.5). Therefore, it is advised that the jasmine crop in Odisha condition be fertilized with N=100 kg/ha, P=120 kg/ha, and K=120 kg/ha in order to achieve optimal vegetative development and yield qualities.

Keywords: Jasmine, NPK levels, Vegetative, Laterals, Leaf area.

INTRODUCTION

Jasmine occurrences are distributed in tropical and subtropical ecologies around the world. Out of the several species that exist, only three have become significant in terms of commercial production i.e., *Jasminum sambac*, *Jasminum auriculatum*, *Jasmin umgrandiflorum*. The East Indies are thought to be the native home of *jasminum sambac*. Since ancient times, jasmine blossoms have been used for ceremonial purposes, religious offerings, perfume hair oils, and other purposes in China, India, and other mystic orient countries. Arabic in origin, the name Jasmine is thought to have sprung from Yasmin. The value-added products of *Jasminum sambac* flowers are widely utilized in the production of drinks, toilet paper, paper tissues, and detergent, among other consumer goods and cosmetics (Kanlayavattanakul *et al.*, 2013). Additionally, flowers have been reported to have medicinal uses for treating dermatitis, diarrhea, conjunctivitis, abdominal pain (Yu *et al.*, 2017) and soothing irritating sneeze (Prabuseenivasan *et al.*, 2006), they have also been used to prevent breast cancer and stop uterine bleeding (Sushant *et al.,* 2015). Moreover, *J. sambac* flowers possess many physiological and pharmacological attributes, including antioxidant, antiaging, skin-lightening, and antibacterial actions (Widowati *et al.*, 2018) and no systemic biological damage or death was observed in examined mice (Kunhachan *et al*., 2012).

Although jasmine is widely planted in selected states like Tamilnadu, Karnataka, Andhra Pradesh, Uttar Pradesh, Maharashtra, West Bengal, and Odisha, but it is grown commercially throughout the country. The effective production of jasmine is controlled by several factors, including soil fertility, irrigation, plant density, plant protection techniques, etc., but the manurial schedule has the effective impact on crop yield. Throughout the growing season, the majority of ornamental plants require more than one fertilizer application. Therefore, in order to achieve good vegetative growth and excellent flowering, fertilizing must continue. Many chemical components are necessary for plants to grow and thrive, but the three most crucial ones are nitrogen, phosphorus, and potassium (Wang *et al.*, 2013). For jasmine to produce more and of higher quality buds, plant nutrition is crucial. As there has never been a study of this type on jasmine in the state of Odisha, it has been decided to observe different vegetative features under different N, P and K concentrations.

MATERIALS AND METHODS

The experiment was conducted at Educational Garden of Department of Floriculture and Landscaping, College of Agriculture, O.U.A.T., Bhubaneswar from last week of December 2021 to November 2022 in RBD to investigate the impact of nutrient management on different vegetative traits of *Jasminum sambac* L. Aiton with nineteen treatments *viz*., T_1-60-120-120 (RDF); T_2-60-120-100; T_3-60-100-120; T_4-60-100-100; T_5-60-80-120; T_6-60-80-100; T_7-80-120-120; T_8-80-120-100; T_9-80-100-120; T_{10}-80-100-100; T_{11}-80-80-120; T_{12}-80-80-100; T_{13}-100-120-120; T_{14}-100-120-100; T_{15}-100-100-120; T_{16}-100-100-100; T_{17}-100-80-120; T_{18}-100-80-100; T_{19}-Control (NPK-Kg/ha), replicated thrice. Five-year-old *Jasminum sambac* L. Aiton plant bushes were subjected to the treatments. Pruning, a crucial procedure for jasmine, was carried out in the final week of November 2021 at a height of 45 cm above the ground. Following pruning, 5 kg of FYM/bush was applied. In first week of December basal application of fertilizer was done, which included the application of all phosphorus doses, 50% N and 50% K, and the remaining 50% N and 50% K at top dressing on third week of January. Data just like height of plant bush, East-West and North-South spreading, Leaf area, primary shoot thickness, primary shoot length and number of laterals were observed from four randomly selected bush from each treatment at full bloom stage. The data obtained were averaged and computed.

RESULT AND DISCUSSION

Maximum plant height of Jasmine (105.51cm) was obtained in treatment number T_{13} (N=100Kg/ha, P=120 Kg/ha, K=120 Kg/ha) and this was closely followed by treatment numbers T_{14} (N=100Kg/ha, P=120 Kg/ha, K=100 Kg/ha) and T_{15} (N=100Kg/ha, P=100 Kg/ha, K=120 Kg/ha) where plant heights of 104.25 cm and 102.80 cm were obtained, which were significantly superior to all other treatments. Nonetheless, with the control treatment (T_{19}) without any fertilizer combination, the minimum plant height of 74.80 cm was observed as deficiency of nitrogen resulted in reduced photosynthesis rate and reduction in production of chlorophyll contents as well as accessory components. (Center *et al*., 2017) and protein contents (Ding *et al*., 2005), also enhanced stunted growth (Sett and Soni 2013). But in case of treatment $T_{13,}$ nitrogen concentrations may have encouraged the growth of vegetation and the build up of dry materials. In addition to the protoplasm synthesis, division, and elongation of meristem cells, as well as an increase in the manufacture of proteins and carbohydrates, which eventually boosted plant development, the stimulating effects of N, P, and K may also be caused by the activation of adjacent meristems. These agree with the conclusions stated by Kumar and Rana (2003) in Carnation cv. Chaubad Yellow, Doddagoudar *et al.* (2002) in China aster and Tapan *et al.* (2017) in lilium. The increased dosage of nitrogen, which is a component of protein and nucleic acid and aids in plant growth as well as quick growth, is also responsible for the increase in plant height (Haque and Jakhro 2001). Additionally, phosphorus promotes the development of cell walls, which increases plant height. And this was also reported by Ayemi *et al*. (2021) in gerbera and Acharya and Dashora (2004) in marigold. Potassium has been linked in formation of peptide bonds, the metabolism of proteins and carbohydrates, as well as the quick division and differentiation of cells (Belorkar *et al*., 1992). So, potassium among other macro nutrients also involved in enhancement of plant height because potassium has important contribution in synthesis and translocation of carbohydrate. Joshi (2002); Patel (2004); Karavadia and Dhaduk (2002) in annual chrysanthemum, Shinde *et al.* (2014) in African marigold, Singh and Nigam (2015); Nikam *et al*. (2018) in chrysanthemum.

The treatment T_{13}, which included fertilizer combinations of N=100 P=120 K=120 kg/ ha, produced the maximum East-West plant spread (83.34 cm) and North-South plant spread (82.63 cm). This can be achieved due to the effect of nitrogen on plant growth or spreading, as Nitrogen is an elementary constituent of amino acids, nucleic acids, proteins and nucleotides, as well as chlorophyll and numerous secondary substances like alkaloids. It is a crucial component of the protoplasm and is involved in all enzymatic reactions occurring in cells. Photosynthates transported to the growth site are primarily used in the synthesis of nucleic acid and protein, which increases cell expansion and leads to maximum spreading. Due to no application of fertilizer, minimum East-West plant spread (62.81cm) and North-South plant spread (56.00 cm) was obtained in control treatment (T_{19}). These outcomes are consistent with the findings of Haque and Jakhro (2001); Sharma *et al.* (2006) in chrysanthemum. Potassium fertilization also have some roles in spreading as potassium has a stimulating effect on the photosynthesis, phloem loading and translocation of carbohydrates as well as formation of large molecular weight substances. Similar observations were recorded in their earlier studies by Pal and Ghosh (2010); Kishore *et al.* (2010) in *Tagetus erecta*. Since nitrogen and potassium are the two main components of proteins, amino acids, and chlorophylls, a rise in nitrogen levels accelerated photosynthesis, which in turn led to an increase in cell division and elongation and eventually, an increase in vegetative growth. Furthermore, an increase in plant spread indicated improved nitrogen consumption when potassium was present. The aforementioned findings were consistent with previous research conducted in China aster by Kumar *et al.* (2003); Gnyandev (2006).

Highest leaf area (87.91cm^2) was observed in treatment T_{13}(N =100 Kg/ha, P=120Kg /ha, K=120 kg/ ha) while control treatment (T_{19}) showed lowest leaf area

($55.93 cm^2$). The effect of nitrogen in promoting vegetative development by enlarging the size of the leaf and its cells may be the cause of the increase in leaf area. Additionally, the optimal growth of roots and an increase in their physiological activity to absorb water and other nutrients may have resulted from the availability of nitrogen and phosphorus in this combination (Hadimani, 2003). Highest length of primary shoot and shoot thickness were observed in treatment T_{13} (N =100 Kg/ha, P=120Kg /ha, K=120 kg/ ha) i.e.122.86 cm and 1.34 cm respectively. As it is the fact that, the ideal concentration of NPK can promote plant growth because phosphorus is necessary for the synthesis of phosphoproteins and energy compounds like ATP and ADP, while nitrogen is a crucial component of protein synthesis and nucleic acid (Helge and Rolfe 2005). In a similar vein, potassium stimulates a wide range of enzymes necessary for respiration and photosynthesis as well as the production of proteins and starch (Bhandal *et al.*, 1988). Because nitrogen plays a part in the synthesis and transports of phytohormones such cytokinins, which promote vigorous shoot growth, nitrogen has a favourable effect on shoot length and shoot thickness (Wagner and Michael 1971). Similar results were reported by Singh *et al*. (2015) in marigold, Giri and Beura (2020) in Gerbera. Maximum number of laterals (17.5) was obtained in treatment T_{13} (N =100 Kg/ha, P=120Kg /ha, K=120 kg/ ha) which was significantly superior over all other treatments .This might be due to increase in level of Nitrogen. There is increase in number of laterals as Nitrogen, a component of protoplasm, is involved in the basic reaction of photosynthesis and contributes to the production of total biomass, which in turn causes significant branching growth. Secondly, an increase in nitrogen levels at the roots stimulates the production and export of cytokines to the shoots. It's possible that the higher nitrogen delivery rate caused the rise of cytokine levels, which in turn led to production of more laterals per plant bush. These outcomes concur with findings of Chaudhary *et al.* (2016) in rose, Vikram *et al.* (2017) in coriander. The control registered lower number of laterals which indicates that the supply of nutrients in adequate quantity enhance the number of lateral productions.

Table 1: Effect of Different levels of Nutrients (Nitrogen, Phosphorus, Potassium) on vegetative features of Jasmine *(Jasminum sambac* L. Aiton) during Summer Season

Treatment (NPK- Kg/ha)	Plant height (cm)	Plant spread (E-W) (cm)	Pant spread (N-S) (cm)	Leaf area (cm^2)	Primary shoot length (cm)	Primary shoot thickness (cm)	No. of laterals
T_1-60-120-120 (RDF)	87.66	72.10	63.30	70.75	103.86	1.20	13.41
T_2-60-120-100	86.08	71.60	61.43	69.73	99.31	1.19	13.25
T_3-60-100-120	86.21	70.61	61.13	68.66	95.19	1.17	13.23
T_4-60-100-100	86.01	70.10	60.28	67.36	94.02	1.16	13.00
T_5-60-80-120	84.02	68.74	59.43	64.91	93.02	1.14	12.50
T_6-60-80-100	82.74	67.48	57.95	63.9.00	89.43	1.10	12.25
T_7-80-120-120	90.60	76.28	76.26	78.33	115.56	1.27	15.50
T_8-80-120-100	90.06	74.88	75.11	76.91	114.77	1.26	15.08
T_9-80-100-120	89.33	74.00	74.17	75.54	111.36	1.24	15.00
T_{10}-80-100-100	88.61	73.09	71.18	74.75	108.24	1.23	14.50
T_{11}-80-80-120	88.12	72.34	70.82	74.08	106.39	1.22	14.25
T_{12}-80-80-100	86.95	71.51	70.21	72.41	105.46	1.21	14.16
T_{13}-100-120-120	**105.51**	**83.34**	**82.63**	**87.91**	**122.86**	**1.34**	**17.5**
T_{14}-100-120-100	104.25	82.67	80.59	87.00	121.28	1.33	16.75
T_{15}-100-100-120	102.80	81.63	80.20	86.16	120.19	1.32	16.33
T_{16}-100-100-100	102.17	80.43	78.84	85.33	119.05	1.30	15.83
T_{17}-100-80-120	99.78	78.76	78.03	84.56	118.72	1.29	15.75
T_{18}-100-80-100	98.70	78.36	77.73	83.83	117.46	1.29	15.58
T_{19}-Control	74.80	62.81	56.00	55.93	71.02	1.03	11.16
C.D at 5%	3.14	1.01	1.18	1.15	1.67	0.02	0.40
SE(d)	1.095	0.354	0.414	0.403	0.583	0.008	0.142

CONCLUSION AND FUTURE SCOPE

Based on the results of the experiment, treatment T_{13} (N=100Kg/ha, P=120 Kg/ha, K=120 Kg/ha) applied twice in split doses as 50 Kg N/ha, 60Kg K/ha, 100 Kg P/ha in basal dose and rest 50 Kg N/ha, 60Kg K/ha in top dressing was proved to be more efficient in boosting various vegetative characteristics. In order to achieve luxuriant yield in jasmine under Odisha conditions, it has been recommended that fertilizer doses of N = 100 kg/ha, P = 120 kg/ha, and K = 120 kg/ha in the form of urea, SSP, and MOP be applied. This recommendation will address the long-standing issues with fertilizer application in jasmine for high flower bud production in Odisha. Hence, it has been recommended that fertilizer dose of N=100Kg/ha, P=120 Kg/ha, K=120 Kg/ha in the form of urea, SSP and MOP produced luxuriant yield in Jasmine under Odisha condition and this recommendation will solve the long awaiting problems of fertilizer application in jasmine for high flower bud production in Odisha.

Acknowledgement. My deepest gratitude goes to my advisor Dr. Sashikala Beura, Professor and Head, Department of Floriculture and Landscaping, College of Agriculture, O.U.A.T., Bhubaneswar, for her important advice and assistance throughout my studies.
Conflict of Interest. None.

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How to cite this article: Subrat Kumar Senapati, Sashikala Beura, Ashish Kumar Gouda, Geeta Pandey and Kaberi Maharana (2022). Effect of Different Levels of Nutrients (Nitrogen, Phosphorus, Potassium) on Vegetative Features of Jasmine (*Jasminum sambac* L. Aiton) during Summer Season. *Biological Forum – An International Journal, 14*(5): 07-11.