Acta Scientific Microbiology (ISSN: 2581-3226)

Volume 7 Issue 12 December 2024

Research Article

Effect of INM on Yield and Economics of *Alstroemeria* Under NVPH

Pavitra S Hadapad[1], B Hemla Naik[2]*, Chandrashekar SY[3], Kantharaj Y[4], Shivaprasad M[5] and Hemanth Kumar P[6]

[1]*PG Scholar, Department of Floriculture and Landscaping, College of Horticulture, Mudigere, Keladi Shivappa Nayaka University of Agriculture and Horticultural Sciences, Shivamogga, Karnataka, India*

[2]*Director of Education and Senior Professor (HAG), Department of Horticulture, Keladi Shivappa Nayaka University of Agriculture and Horticultural Sciences, Iruvakki, Shivamogga, Karnataka, India*

[3]*Professor and Head, Department of Floriculture and Landscaping, Keladi Shivappa Nayaka University of Agriculture and Horticultural Sciences, Iruvakki, Shivamogga, Karnataka, India*

[4]*Assistant Professor and Head, Department of Postharvest Management, College of Horticulture, Mudigere, Keladi Shivappa Nayaka University of Agriculture and Horticultural Sciences, Shivamogga, Karnataka, India*

[5]*Professor and Head, Department of Agronomy, College of Horticulture, Mudigere, Keladi Shivappa Nayaka University of Agriculture and Horticultural Sciences, Shivamogga, Karnataka, India*

[6]*Assistant Professor and Head, Department of Floriculture and Landscaping, College of Horticulture, Mudigere, Keladi Shivappa Nayaka University of Agriculture and Horticultural Sciences, Shivamogga, Karnataka, India*

***Corresponding Author:** B Hemla Naik, Director of Education and Senior Professor (HAG), Department of Horticulture, Keladi Shivappa Nayaka University of Agriculture and Horticultural Sciences, Iruvakki, Shivamogga, Karnataka, India.

DOI: 10.31080/ASMI.2024.07.1455

Received: October 23, 2024

Published: November 20, 2024

Abstract

The present investigation entitled, "Effect of INM on yield and economics of *Alstroemeria* under NVPH" was carried out at Down Ham Farm Kalhatty, Ooty, during the year 2023-2024 from Department of floriculture and landscaping, College of Horticulture, Mudigere. The experiment was laid out in Randomized Block Design comprising of nine treatments viz., T1 [RDF (30:15:30 g/m^2)], T2 [RDF (30:15:30 g/m^2)+ *Azospirillum*], T3 (75% N + 100% PK + *Azospirillum*), T4 [RDF (30:15:30 g/m^2) + PSB), T5 (75% P + 100% NK + PSB), T6 [RDF (30:15:30 g/m^2) + KSB], T7 (75% K + 100% NP + KSB), T8 [RDF (30:15:30 g/m^2) + *Azospirillum* + PSB + KSB), T9 (75% NPK + *Azospirillum* + PSB + KSB) with three replications. Productivity and profitability of *Alstroemeria* were significantly impacted by the conjugative use of both inorganic and organic fertilizers along with organic mannures. The maximum yield parameters viz., Number of spikes per plant (9.07), number of spikes per m^2 (36.27), number of spikes per 1000 m^2 (36266.67), number of rhizomes per plant (11.01), yield of rhizome per m^2 (1.14 kg/m2), yield of rhizome per 1000 m2 (11.41 q/1000 m^2) with the maximum gross return (4,72,766 Rs), net return (3,45,214 Rs) and B:C ratio of 2.71. ratio were recorded with the treatment comprising of application of 75% NPK + *Azospirillum* (1.5 g/m^2) + Phosphate Solubilizing Bacteria (1.5 g/m^2) + Potash Solubilizing Bacteria (1.5 g/m^2).

Keywords: *Azospirillum*; PSB; Economics; Yield; Integrated Nutrient Management; KSB; *Alstroemeria*

Introduction

Floriculture is rapidly becoming one of the fastest-growing markets globally, offering significant financial potential for many countries. A wide range of flowers and ornamental plants are cultivated for both domestic use and export, providing higher returns per unit area compared to other agricultural or horticultural crops. In India, the floriculture industry is transitioning from traditional flowers to cut flowers aimed at export. The liberalized economy has encouraged Indian entrepreneurs to set up export-focused floriculture units in controlled environments.

The Agricultural and Processed Food Products Export Development Authority (APEDA) oversees the promotion and development of floriculture exports in India. States such as Tamil Nadu, Karnataka, Madhya Pradesh, West Bengal, Chhattisgarh, Andhra Pradesh, Gujarat, Uttar Pradesh, Assam, and Maharashtra have emerged as key floriculture hubs. In 2023-24, around 297 thousand hectares were dedicated to floriculture cultivation. Flower production is estimated at 2,284 thousand tonnes of loose flowers and 947 thousand tonnes of cut flowers during the same period. According to APEDA, India exported 19,677.89 metric tonnes of floriculture products worth Rs. 717.83 crores or USD 86.63 million in 2023-24.

Specialty cut flowers (SCF) are becoming increasingly popular compared to traditional cut flowers, driven by several factors such as market trends, economic benefits, wider variety, sustainability, and aesthetic appeal. Their unique qualities and adaptability to evolving consumer preferences make them a growing and significant segment in the floral industry. Among various SCFs, *Alstroemeria* stands out due to its unique appearance, long vase life, symbolic significance, versatility in floral arrangements, year-round availability, ease of cultivation, breeding advancements, and affordability. These factors are boosting its popularity and distinctive status within the floral market.

Alstroemeria (*Alstroemeria* spp.) lily like flowers belonging to the flowering plants genus of the family *Alstroemeria*ceae, known as the Lily of Incas or lily of Perus or Peruvian lily or red parrot beak or New Zealand Christmas bell. It was named in honour of "Klas Van Alstroemer" who in 1754 brought rhizomes of *Alstroemeria* to his father Linnaeus, a plant taxonomist. Besides being native flowers of South America, it is also grown in the United States, Mexico, Australia, New Zealand, Madeira and the Canary Islands. The Netherlands is one of the important producers of *Alstroemeria* and its ranks first among the producer of *Alstroemeria* (Monya., *et al*. 2021) [5]. In India, it is recently introduced as a new cut flower, its cultivation is started around Bangalore, Pune and Hyderabad. It was also introduced in Palampur, Solan, Srinagar and Ooty to popularize the crop among growers for domestic and export markets. It is gaining popularity in Indian flower market due to its long stem flowers, prolonged vase life and various colour and shades of petals, generally having lavender, maroon, white, orange, yellow, pink, red and purple colours. They are used as cut flowers or as potted or garden plants and also as filler flowers which are perfect addition to a "wildflower" arrangement.

*Alstroemeria*s are rhizomatous perennials, consisting of sympodial fleshy and multi-stemmed rhizomes. The leaves are entire, grey green to dark green in colour, hairless and thick. Depending on the environmental conditions, the shoots are either reproductive or vegetative. The inflorescence is a whorled cymose. Each cyme is sympodially branched up to four florets per cyme. The flowers resemble miniature lilies and are generally spotted and marked striped colours with contrast patches. They are propagated through division of rhizomes.

Alstroemeria species are found in various climatic conditions. Mid and high hill areas are most suitable for its growth. *Alstroemeria* does well in light, well-drained and slightly acidic soil for the succulent roots to develop freely. Recommended pH is 5.5-6.5. *Alstroemeria* cultivars are sensitive to high temperatures. So, soil temperature above 20^0 C must be avoided because it inhibits and reduces flower induction. A lower temperature causes a slower start in the production but can provide higher quality and shorter stem length. During the summer, an average of 17-22 ^{0}C is an excellent temperature for its growth. Cool nights and soil temperatures between 14-17 ^{0}C are desirable for high-quality results. The flower development occurs at a temperature; between 14-20 ^{0}C. *Alstroemeria* does best when humidity is between 65-85%.

After green revolution, the use of chemical fertilizers and pesticides in plant production has increased, which has posed threat to ecology and environment. Problems like leaching, volatilization, denitrification of nitrogen and deposition of non-available phosphorus in soil are also the result of heavy use of chemical fertilizers

(Maurya and Beniwal, 2003) [4]. The current global scenario firmly emphasizes the need to adopt eco-friendly agricultural practices for sustainable production, moreover, the cost of inorganic fertilizers is increasing enormously to an extent that they are out of reach to small and marginal farmers. To cope-up with all these problems a cheaper, better and safer way is necessary in order to improve soil fertility status, maximize the productivity with minimum eco hazards (Baruati., *et al*. 2018) [1]. In recent times, biofertilizers have emerged as a supplement to mineral fertilizers and hold a promise to improve the yield as well as quality of crop.

The basic concept underlying the Integrated Nutrient Management (INM), nevertheless, remains the maintenance and possible improvement of soil fertility for sustained crop productivity on long term-basis and also to reduce fertilizer input cost. Hence, an attempt was made to reduce the amount of nitrogenous, phosphatic and potassic fertilizers by substituting with organic manures and biofertilizers to increase yield and their by improve B:C ratio of *Alstroemeria* cultivation.

Materials and Methods

The investigation was carried out at Down Ham Farm Kalhatty, Ooty, during the year 2023-2024, part of the Department of Floriculture and landscaping at College of Horticulture mudigere. Ooty which is situated in the Hill and high-altitude zone (Zone-7) of Tamil Nadu and lies at 11^0 27' North latitude and 76^0 41' East longitude with an altitude of 2,240 m above mean sea level (MSL). The texture of the soil that was employed in the experimental field was clay loam. The temperature ranged anywhere from 8.9 °C to 19.3 °C while the crop was actively growing. Likewise, the minimum and highest relative humidity ranged from 48% to 64.7%. At the same time, the crop season's overall rainfall totaled 265.8 mm. The experiment was laid out in Randomized Block Design comprising of nine treatments *viz*., T_1 [RDF (30:15:30 g/m^2)], T_2 [RDF (30:15:30 g/m^2)+ *Azospirillum*], T_3 (75% N + 100% PK + *Azospirillum*), T_4 [RDF (30:15:30 g/m^2) + PSB), T_5 (75% P + 100% NK + PSB), T_6 [RDF (30:15:30 g/m^2) + KSB], T_7 (75% K + 100% NP + KSB), T_8 [RDF (30:15:30 g/m^2) + *Azospirillum* + PSB + KSB), T_9 (75% NPK + *Azospirillum* + PSB + KSB) with three replications. While preparing the land, a well-decomposed FYM (3 kg/m^2), Vermicompost (750 g/m^2), VAM (1.5 g/m^2) was applied. The different biofertilizers like *Azospirillum*, PSB, KSB along with the recommended dose of chemical fertilizers for *Alstroemeria* at 30:15:30 g/m^2 NPK has been applied according to the treatments after 30 days of transplanting to the respective plots. The fertilizers like nitrogen, phosphorus and potassium in suitable sources were applied in the form of urea, di ammonium phosphate and muriate of potash, respectively. The net profit was determined by deducting the treatment cultivation expense from the total profit. To determine the benefit-cost ratio, divide the total profit by the total input costs. A randomized block design with analysis of variance (ANOVA) was applied for analyzing data on crops.

Results and Discussion

The mean values for the Number of spikes per plant, number of spikes per m^2, number of spikes per 1000 m^2, number of rhizomes per plant, yield of rhizome per m^2, yield of rhizome per 1000 m^2 of *Alstroemeria* were recorded at harvest. The maximum number of spikes per plant (9.07), number of spikes per m^2 (36.27), number of spikes per 1000 m^2 (36266.67) were recorded in the treatment T_9 (75% NPK + *Azospirillum* + PSB + KSB) which it was on par with T_8 and T_3. However, the control (T_1) treatment produced minimum number of spikes per plant (4.87), spikes per m^2 (19.47) and 1000 m^2 (19466.67). The increase in flower yield may be attributed to the use of biofertilizers, which promote the synthesis of amino acids that serve as precursors to polyamines and secondary messengers, crucial for flower initiation and the development of more flowers per spike. This amino acid synthesis is further influenced by phytohormones produced in plants due to the application of both chemical and biofertilizers. When combined with vermicompost, biofertilizers and chemical fertilizers enhance soil microbial activity, improve root aeration and increase the availability and uptake of macro- and micronutrients, resulting in a higher number of spikes per plant. These findings are in line with those reported by Patokar., *et al*. (2022) [8], Sathyanarayana., *et al*. (2018) [9], Pansuriya and Chauhan (2015) [6] in gladiolus and Sudhagar., *et al*. (2020) [11] in tuberose. A maximum number of rhizomes per plant (11.01), yield of rhizome per m^2 (1.14 kg) and 1000 m^2 (11.41 q) was recorded in the treatment T_9 (75% NPK + *Azospirillum* + PSB + KSB) where number of rhizomes per plant on par with T_8, T_5 and T_3, yield of rhizome per m^2 and 1000 m^2 was on par with treatment T_8. However, the control (T_1) recorded minimum number of rhizomes per plant (8.87), yield of rhizome per m^2 (0.91 kg/m^2) and 1000 m^2 (9.08 q/m^2). This might be due to application of biofertilizers enhances soil microbial activity, leading to better root development, increased nutrient and water uptake, vigorous plant growth and improved food storage, which ultimately boosts yield. These findings align with those reported by Sathyanarayana., *et al*. (2018)

[8] in gladiolus. Biofertilizer application might be attributed to enhanced nutrient availability, which boosts photosynthetic activity and accelerates the movement of photosynthates towards the rhizome. Additionally, biofertilizers increase carbohydrate and auxin levels in the roots, leading to thicker and more branched roots. Similar results were reported by Kore., *et al*. (2020) [2] and Yadav., *et al*. (2023) [12] in tuberose. The treatment T_9 (75% NPK + *Azospirillum* + PSB + KSB) recorded maximum gross return, net return and B:C ratio i.e., 4,72,766 Rs, 3,45,214 Rs and 2.71, respectively. The benefit-cost ratio is a crucial factor for determining the optimal input levels to maximize crop production and returns. In this study, the benefit-cost ratio was calculated for various levels of NPK fertilizers and biofertilizers. For *Alstroemeria*, the highest benefit-cost ratio (2.71) was achieved with the application of treatment T_9 (75% NPK + *Azospirillum* + PSB + KSB) which reduced the need for the remaining 25 per cent of chemical fertilizers and lowered input costs. The lowest benefit-cost ratio (1.18) was observed with the recommended dose of NPK alone due to higher input costs and lower returns. These results are consistent with findings reported by Sowmya and Prasad (2017) [10] in china aster, Patil., *et al*. (2020) [7] in chrysanthemum and Mageswari., *et al*. (2017) [3] in gladiolus.

Tr. No.	Treatment details	No. of spikes/ plant	No. of spikes/ m^2	No. of spikes/ $1000m^2$	No. of rhizomes/ plant	Yield of rhizome kg/m^2	Yield of rhizome $q/1000^m 2$
T_1	Recommended Dose of Fertilizer (30:15:30 g/m^2)	4.87	19.47	19466.67	8.87	0.91	9.08
T_2	RDF (30:15:30 g/m^2) + *Azospirillum*	6.87	27.47	27466.67	9.73	0.98	9.76
T_3	75% N + 100% P and K + *Azospirillum*	8.47	33.87	33866.67	10.13	1.07	10.65
T_4	RDF (30:15:30 g/m^2) + PSB	6.20	24.80	24800.00	9.63	0.93	9.32
T_5	75% P + 100% N and K + PSB	7.87	31.47	31466.67	10.33	1.01	10.10
T_6	RDF (30:15:30 g/m^2) + KSB	6.67	26.67	26666.67	9.27	0.91	9.11
T_7	75% K + 100% N and P + KSB	7.93	31.73	31733.33	9.33	0.99	9.89
T_8	RDF (30:15:30 g/m^2) + *Azospirillum* + PSB + KSB	8.80	35.20	35200.00	10.87	1.13	11.25
T_9	75% NPK + *Azospirillum* + PSB + KSB	9.07	36.27	36266.67	11.01	1.14	11.41
S. Em±		0.25	0.98	980.80	0.34	0.01	0.12
C.D @ 5%		0.74	2.94	2940.45	1.02	0.04	0.37

Table 1: Effect of integrated nutrient management (INM) on Yields.

RDF: Recommended Dose of Fertilizer, PSB: Phosphate Solubilizing Bacteria, KSB: Potash Solubilizing Bacteria.

saTr. No.	Treatment details	Cost of cultivation (Rs/1000 m^2)	Gross returns (Rs/1000m^2)	Nett returns (Rs/1000m^2)	B:C ratio
T_1	Recommended Dose of Fertilizer (30:15:30 g/m^2)	1,34,014	2,83,368	1,53,466	1.18
T_2	RDF (30:15:30 g/m^2) + *Azospirillum*	1,34,464	3,71,968	2,41,616	1.85
T_3	75% N + 100% P and K + *Azospirillum*	1,34,303	4,39,967	3,09,840	2.38
T_4	RDF (30:15:30 g/m^2) + PSB	1,34,464	3,44,300	2,13,949	1.64
T_5	75% P + 100% N and K + PSB	1,34,149	4,17,967	2,87,931	2.21
T_6	RDF (30:15:30 g/m^2) + KSB	1,34,464	3,59,367	2,29,016	1.76
T_7	75% K + 100% N and P + KSB	1,31,106	4,10,633	2,85,924	2.29
T_8	RDF (30:15:30 g/m^2) + *Azospirillum* + PSB + KSB	1,35,364	4,60,700	3,29,449	2.51
T_9	75% NPK + *Azospirillum* + PSB + KSB	1,34,013	4,72,766	3,45,214	2.71

Table 2: Effect of integrated nutrient management (INM) on economics.

RDF: Recommended Dose of Fertilizer, PSB: Phosphate Solubilizing Bacteria, KSB: Potash Solubilizing Bacteria,

Cost cut flower = 10 Rs/Stalk, Cost of rhizome = 10 Rs/rhizome.

Bibliography

1. BARUATI D., *et al*. "Effect of organic manures and bio fertilizers on growth and yield of gladiolus (Gladiolus grandiflorus L.)". *International Journal of Chemical Studies* 6.5 (2018): 2529-2532.

2. KORE S A. "Effect of Azotobacter, PSB and KMB consortium on the growth and yield of tuberose (Polianthes tuberosa L.). M Sc. (Agri.) Thesis, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra" (2020): 72.

3. MAGESWARI N., *et al*. "Effect of integrated nutrient management on gladiolus cv. Novalux (Gladiolus × hortulanus) under shevaroy condition". *International Journal of Agricultural Science* 9.48 (2017): 4822-4825.

4. MAURYA PR., *et al*. "Use of biofertilizers in horticultural crops". *AGROBIOS NEWSLETTER* 1.11 (2003): 12-13.

5. MONYA M., *et al*. "Enhancing vase life of alstroemeria through various treatments". *Just Agriculture News ltr.,* 2.2 (2021): 1-9.

6. PANSURIYA PB AND CHAUHAN R V. "Effect of Integrated Nutrient Management on Growth, Yield and Quality of Gladiolus (Gladiolus grandiflora L.) cv. Psittacinus Hybrid". *Journal of Horticulture* 2.2 (2015): 3-3.

7. PATIL D., *et al*. "Growth, flowering and economics of chrysanthemum cultivation as influenced by integrated nutrient management". *International Journal of Chemical Studies* 9.1 (2020): 313-316.

8. PATOKAR M J., *et al*. "Effect of integrated nutrient management on growth, flowering and yield of gladiolus cv. PDKV gold". *Journal of Pharmaceutical Innovation* 11.7 (2022): 3261-3264.

9. SATHYANARAYANA E., *et al*. "Influence of integrated nutrient management on gladiolus (Gladiolus grandiflorus L.) cv. American Beauty". *International Journal of Current Microbiology and Applied Sciences* 6.8 (2018): 379-386.

10. SOWMYA K A AND PRASAD V M. "Effect of NPK and bio-fertilizers on growth, yield, quality of china aster (Callistephus chinensis) cv. Shashank for cut flower production under agro climatic conditions of Allahabad, India". *International Journal of Current Microbiology and Applied Sciences* 6.10 (2017): 3204-3210.

11. SUDHAGAR R., *et al*. "Influence of integrated nutrient management on growth and flower yield of tuberose (Polianthes tuberosa L) cv. Prajwal". *Plant Archives* 20.1 (2020): 2415-2418.

12. YADAV R., *et al*. "Influence of vermicompost and bio-fertilizers on growth and flowering of tuberose (Polianthes tuberosa L.) cv. Prajwal". *International Journal of Plant Sciences* 35.16 (2023): 113-120.