Plant Archives Vol. 25, Supplement 2, 2025 pp. 2358-2361 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org
DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2025.v25.supplement-2.298

NANO UREA APPLICATION AND MINERAL NUTRITION INFLUENCE ON THE ECONOMIC PROFITABILITY OF FRENCH MARIGOLD (*TAGETES PATULA* L.)

Assma Rashid[1], Nomita Laishram[1], Arvinder Singh[1*], Sarabdeep Kour[2], Gurdev Chand[3] and Deep Ji Bhat[4]

[1]Division of Floriculture and Landscaping, SKUAST-J, Chatha-180009, Jammu, India
[2]Division of Soil Science and Agriculture Chemistry, SKUAST-J, Chatha-180009, Jammu, India
[3]Division of Plant Physiology, SKUAST-J, Chatha-180009, Jammu, India
[4]Division of Fruit Science, SKUAST-J, Chatha-180009, Jammu, India
*Corresponding author E-mail: arvindersingh4601@yahoo.com
(Date of Receiving-13-04-2025; Date of Acceptance-18-06-2025)

ABSTRACT

The present investigation entitled "Nano urea application and mineral nutrition influence on the economic profitability of French marigold (*Tagetes patula* L.)" was conducted at the Experimental Farm, Division of Floriculture and Landscaping, Sher-e-Kashmir University of Agricultural Sciences and Technology, Chatha during the year 2022-2023 & 2023-24. The experiment was laid out in Complete Randomized Block Design with three replication and fifteen treatments viz., T_1 =100% RDF (Control i.e. 200 kg N, 100 kg P_2O_5 and 100 kg K_2O/ha);T_2 = 100% RDF + 1ml/l nano urea foliar application;T_3 =100% RDF + 1.5 ml/l nano urea foliar application;T_4 =100% RDF + 2 ml/l nano urea soil application;T_5 = 100% RDF + 4 ml/l nano urea soil application;T_6 = 75% RDF;T_7=75% RDF + 1ml/l nano urea foliar application;T_8 = 75% RDF + 1.5 ml/l nano urea foliar application;T_9 = 75% RDF + 2 ml/l nano urea soil application;T_{10} = 75% RDF + 4 ml/l nano urea soil application;T_{11} = 50 % RDF;T_{12} = 50 % RDF + 1 ml/l nano urea foliar application;T_{13} = 50 % RDF + 1.5ml/l nano urea foliar application;T_{14} = 50 % RDF + 2 ml/l nano urea soil application;T_{15} = 50 % RDF + 4 ml/l nano urea soil applicationThe results revealed that

Keywords **:** French marigold; profitability; mineral nutrition; nano urea; application; foliar.

Introduction

Marigold (*Tagetes patula*) is one of the most popular and commercial loose flower crop of Jammu. Popularly known as the city of temples, Jammu region witnesses a huge demand of marigold flowers for garland making, offering in temples and other decorative purposes during various festive occasions. As a result, the production of flowers in Jammu alone cannot meet the ever-increasing demand, and flowers worth lakh need to be procured from neighbouring states. Keeping in view the importance of crop and the present demand of quality flower, the investigations were carried out an experiment with the combine application of fertilizers and nano urea for enhancing flower yield parameters in French marigold under Jammu subtropics. To fulfil the demand and rule out this limitation, it is necessary to increase its production through improved production technologies. Excessive use of chemical fertilizers following hit and trial methods by the farmers nowadays results in poor health of the soil, nutrient imbalances and ultimately poor fertilizer use efficiency. Also, small hold farmers do not have access to chemical fertilizer because of high price of fertilizers, poor distribution and other socio-economic factors involved. Therefore, modern nutrient management strategy aims towards the concept of sustainability. (Rashid *et al.*, 2022) Nano urea is liquid formulations manufactured by Nano Biotechnology Research Centre in association with Indian Farmers. Fertilizers Cooperative Limited. It contains nano scale nitrogen particles (55,000 nano particles) with high surface area (10,000 times over

1mm Urea prilled). On foliar application, these small particles are delivered directly to the plant cell, thereby releasing nitrogen inside the cells as per the requirement in a phased manner which ensure low and target efficient release for providing the nutrients to the crop and thus increase nutrient use efficiency. Nano urea when sprayed on crop leaves triggers pathway for uptake and assimilation of nitrogen inside the plants. (Attri *et al.*, 2022). Thus, foliar application of nano urea enhances availability of nitrogen through stomata of leaves via gaseous uptake and may activate many enzymes involved in biochemical pathways for maintenance of biological membranes. Therefore, the present study is being undertaken in view of the importance of marigold (Tagetes *patula* L.) crop in the region as well as need for eco-friendly foliar and soil Nano-Urea under Jammu conditions as economically viable fertilizer-input options.

Material and Methods

Site and location

The present investigation was conducted at Research Farm, Sher-e-Kashmir University of Agricultural Sciences Technology of Jammu, Chatha located at latitude of 32 40°', longitude of 74 58' and at an altitude of 332 meters º above mean sea-level in the Shiwalik foothills of North Western Himalayas, found below critical level.

Cultivation practices

Seedlings of French marigold (Tagetes *patula* L.) were transplanted at a spacing of 40 cm x 40 cm during first fortnight of November there by accommodating 20 seedlings per bed size of 2 m × 1.6 m. Transplanting was done during evening hours when the temperature was low to avoid the transplanting shock. Light irrigation was given immediately after transplanting. The application of fertilizers along with nano urea soil application was done in accordance with the requirement of the treatments as per technical programme of the experiment. Foliar spray of 1 ml and 1.5 ml of nano urea (according to the treatment combinations) was given twice during the experiment. First foliar application of nano urea was given at 30 days after transplanting (DAT) and second application at 60 days after transplanting. Intercultural operations and plant protection measures were adopted as per the recommended package of practices, whenever required from sowing up to the crop harvest. The crop was irrigated as and when necessary to maintain the optimum moisture condition of the field. No insect-pest incidence was reported during the experimental trial period.

Experimental Treatment Details and Notations

The experiment was laid out in Complete Randomized block design with three replication and fifteen treatments at the experimental farm of the Division of Floriculture and landscaping, during the year 2022-2023. The experimental treatments are T_1 =100% RDF (Control i.e. 200 kg N, 100 kg P_2O_5 and 100 kg K_2O/ha);T_2 = 100% RDF + 1ml/l nano urea foliar application;T_3 =100% RDF + 1.5 ml/l nano urea foliar application;T_4 =100% RDF + 2 ml/l nano urea soil application;T_5 = 100% RDF + 4 ml/l nano urea soil application;T_6 = 75% RDF;T_7=75% RDF + 1ml/l nano urea foliar application;T_8= 75% RDF + 1.5 ml/l nano urea foliar application;T_9 = 75% RDF + 2 ml/l nano urea soil application;T_{10} = 75% RDF + 4 ml/l nano urea soil application;T_{11} = 50 % RDF;T_{12} = 50 % RDF + 1 ml/l nano urea foliar application;T_{13} = 50 % RDF + 1.5ml/l nano urea foliar application;T_{14} = 50 % RDF + 2 ml/l nano urea soil application;T_{15} = 50 % RDF + 4 ml/l nano urea soil application.

Recording of data and economic calculations

Data on various growth and lowering parameters were recorded and statistically analysed by applying the technique of analysis of variance using Completely Randomized Block Design (Gomez and Gomez 1985). The level of significance for t-test was kept at 5% (P=0.05). The yield of loose flowers was calculated and expressed in kilograms. The economics of the individual treatment was calculated based on the total cost of cultivation and gross income. The expenditures incurred during the cropping period were computed taking into account the cost of land preparation, material inputs, irrigation, harvesting and assembling expenses, etc. with labour charges taken as Rs. 400 per man day. For calculating the gross income, sale price of the loose Flower has been taken as Rs. 40/kg. Gross monetary returns (Rs./ha) was worked out for different treatments as:

Gross Income = Marketable flower yield per Hectare x sale price of the flower in rupees

Net Income = Gross Returns – Total expenditure

Benefit Cost ratio (BCR) = Net returns/Total expenditure

Results and Discussion

The benefit cost ratio (BCR) of the treatments is the most important factor which determines its usefulness and acceptance by the grower. It is the most important single factor which decides the adoption of any improved cultural practice by the grower. A treatment should not only be effective but also should be profitable in proposition to be accepted by a grower.

In the present study, the different treatments showed clear impact on the comparative economics of the production of flowers in annual chrysanthemum. The details pertaining to costs and returns are given in Table 2.

Flowering and Yield Parameters

Flower fresh weight (g)

Data presented in Table 1 shows that application of treatment T_8 consisting of 75% RDF + 1.5ml/L nano urea foliar application recorded the highest individual flower weight (4.70 g) among the treatments whereas treatment T_{11} (50 % RDF) recorded the lowest individual flower weight (3.08 g). The shift of food reserves from vegetative to reproductive area increases carbohydrate reserves in the flower component, resulting in an increase in bloom size and as a result of which the weight of the flower increases. Kumar *et al.* (2023)

Number of flowers plant^{-1}

Data presented in Table 1 shows that application of treatment T_8 (75% RDF + 1.5ml/L nano urea foliar application) recorded significantly highest number of flowers plant^{-1} (147.94) whereas, lowest number of flowers plant^{-1}(117.01) were recorded in T_{11}(50 % RDF). Ding *et al*., 2014 observed that nitrogen can enhance localised cytokinin biosynthesis in plants and an increased level of cytokinin can regulate the number of flowers in plants (Barazesh and Mc Steen, 2008). The research results are in close affirmative with the findings of Kaur and Kumar (2001) in the verbena plant and Dogra and Sirohi (2020) in the pansy plant.

Flower yield plant^{-1} (kg)

Data presented in Table 1 shows that application of treatment T_8 (75% RDF + 1.5ml/L nano urea foliar application) produced the maximum flower yield plant^{-1} (0.70 kg) and the lowest flower yield plant^{-1} (0.36 kg) was observed in T_{11} (50 % RDF). The optimum supply of nutrients to the crop at the different growth stages, ultimately increased the carbohydrates assimilates which leads to increase in flower yield of the plant. The present findings are in close conformity with Priyanka *et al*. (2018) in crossandra, Tiwari *et al.* (2021) in potato and Venkatesh *et al*. (2022) in african marigold.

Economic profitability

Table 1 : Effect of nano urea and mineral nutrition on yield attributes of French marigold (*Tagetes patula* L.)

Treatment Details	Flower fresh weight (g)	Number of flowers plant^{-1}	Flower yield plant^{-1} (Kg)
T1 = 100% RDF (Control)*	3.99	131.82	0.53
T2 = 100% RDF + 1ml/l nano urea foliar application	4.12	136.21	0.56
T3 = 100% RDF + 1.5 ml/l nano urea foliar application	4.11	134.53	0.55
T4 = 100% RDF + 2 ml/l nano urea Soil application	4.00	132.43	0.53
T5 = 100% RDF + 4 ml/l nano urea Soil application	4.15	137.80	0.57
T6 = 75% RDF	4.18	141.90	0.59
T7 = 75% RDF + 1ml/l nano urea foliar application	4.56	147.85	0.67
T8 = 75% RDF + 1.5 ml/l nano urea foliar application	4.70	147.94	0.70
T9 = 75% RDF + 2 ml/l nano urea Soil application	4.18	144.92	0.61
T10 = 75% RDF + 4 ml/l nano urea soil application	4.22	144.54	0.61
T11 = 50 % RDF	3.08	117.01	0.36
T12 = 50 % RDF + 1 ml/l nano urea foliar application	3.77	129.20	0.49
T13 = 50 % RDF + 1.5ml/l nano urea foliar application	3.48	121.27	0.42
T14 = 50 % RDF + 2 ml/l nano urea soil application	3.34	118.78	0.40
T15 = 50 % RDF + 4 ml/l nano urea soil application	3.94	131.61	0.52
$C.D_{0.05}$	0.81	8.13	0.11

*Recommended dose of fertilizer (RDF): 200 kg N, 100 kg P_2O_5 and 100 kg K_2O/ha)

Table 2 : Effect of nano urea and mineral nutrition on economic profitability of French marigold (*Tagetes patula* L.)

Treatment Details	Cost of cultivation (Rs.)	Gross returns (Rs.)	Net returns (Rs.)	B:C ratio
T1 = 100% RDF (Control)	415451	1870110	1454659	3.50:1
T2 = 100% RDF + 1ml/l nano urea foliar application	416091	1995350	1579259	3.80:1
T3 = 100% RDF + 1.5 ml/l nano urea foliar application	416411	1965956	1549545	3.72:1
T4 = 100% RDF + 2 ml/l nano urea Soil application	416731	1883472	1466741	3.52:1
T5 = 100% RDF + 4 ml/l nano urea Soil application	418011	2033341	1615330	3.86:1

T6 = 75% RDF	412588	2108976	1696388	4.11:1
T7 = 75% RDF + 1ml/l nano urea foliar application	413228	2397171	1983943	4.80:1
T8 = 75% RDF + 1.5 ml/l nano urea foliar application	413548	2219785	1806237	4.98:1
T9 = 75% RDF + 2 ml/l nano urea Soil application	413868	2153860	1739992	4.20:1
T10 = 75% RDF + 4 ml/l nano urea soil application	415148	2415454	2000306	4.22:1
T11 = 50 % RDF	409725.5	1281406	871680	2.13:1
T12 = 50 % RDF + 1 ml/l nano urea foliar application	410365.5	1731876	1321510	3.22:1
T13 = 50 % RDF + 1.5ml/l nano urea foliar application	410685.5	1500533	1089847	2.65:1
T14 = 50 % RDF + 2 ml/l nano urea soil application	411005.5	1410596	999590.6	2.43:1
T15 = 50 % RDF + 4 ml/l nano urea soil application	412285.5	1843733	1431447	3.47:1

References

Attri, M., Sharma, M. and Sharma, B.C. (2022). Effect of Foliar Application of Nano Urea on Productivity and Profitability of Fine Rice under Irrigated Subtropics of Jammu Region. *Indian Journal of Ecology*. **49**(5): 1935-1938.

Barazesh, S. and Mc Steen, P. (2008). Hormonal control of grass inflorescence development. *Trends in Plant Science*, **13**(12): 656-662. https://doi.org/10.1016/j.tplants.2008.09.007

Ding, C., You, J., Chen, L., Wang, S. and Ding, Y. (2014). Nitrogen fertilizer increases spikelet number per panicle by enhancing cytokinin synthesis in rice. *Plant Cell Reports,* **33**, 363-371. https://doi.org/10.1007/s00299-013- 1536-9.

Dogra, S. and Sirohi, H.S. (2020). Influence of nitrogen levels and plant geometry on growth, flowering and seed production in pansy (Viola tricolour Hortensis) variety snow white. *The Pharma Innovation Journal*, **9**(7): 596- 599.

Kaur, K. and Kumar, R. (2001). Effect of nitrogen and phosphorus on verbena. *Journal of Ornamental Horticulture*, **4**(1) : 59-60.

Kumar, A., Singh, K., Sharma, S., Mishra, J.P., Sharmila, J.S and Kumar, Y. (2023). Effect of Organic manure, Bio-fertilizer and Nano-fertilizer on Yield and Economics of different Vegetable crops and soil nutrient status. *Researchsquare. com*., **1**(13):201-213.

Priyanka, T.K., Kamble, B.S., Subiya, R.K., Anuradha, R.W. and Gasti, V.D. (2018). Interactive study of spacing and different levels of nutrients on flowering and yield attributes of crossandra (*Crossandra undulaefolia* Salisb.). *Journal of Pharmacognosy and Phytochemistry*, **7**(1):487-490.

Rashid, A., Laishram, N., Singh, A., Pandey, R.K. and Dogra, S. (2022). Conjoint Application of INM Modules on Vegetative, Flowering, and Seed Yield in French marigold. *International Journal of Plant & Soil Science*. **34**(4) : 26-34, 2022.

Tiwari, K.N., Kumar. Y, Nayak. Y, Rai. A, Singh. J and Srivastava. S.S.A. 2021. Nano Urea for enhancing yield and farmers profit with potato in Uttar Pradesh. *Annals of Plant and Soil Research*, **23**: 495-500.

Venkatesh, M., Babu. K.K, Prasanth, P, Lakshminarayana, D. and Kumar, S.P. (2022). Study on effect of different levels of nitrogen in combination with nano urea on growth and yield of marigold (*Tagetes erecta* L.) cv. Pusa Narangi Gainda. *The Pharma Innovation Journal*, **11**(11): 1313- 1317.