International Journal of Agriculture and Food Science 2025; 7(6): 211-214

ISSN Print: 2664-844X
ISSN Online: 2664-8458
NAAS Rating: 4.97
IJAFS 2025; 7(6): 211-214
www.agriculturaljournals.com
Received: 18-04-2025
Accepted: 21-05-2025

Yashaswini KP
M.Sc. (Horticulture) Scholar, Department of Soil Science and Agricultural Chemistry, College of Horticulture, UHS Bagalkot, Karnataka, India

SM Prasanna
Assistant Professor and Head Department of Soil Science and Agricultural Chemistry, College of Horticulture, UHS Bagalkot, Karnataka, India

Maheshwarappa HP
Directorate of Research, University of Horticultural Sciences, Bagalkot, Karnataka, India; Principal Scientist, (CPCRI), Kasaragod, Kerala, India

BL Tamadaddi
Associate Professor, MHREC, University of Horticultural Sciences Bagalkot, Karnataka, India

Rudresh DL
Assistant Professor, Department of Micro-Biology, College of Horticulture, UHS Bagalkot, Karnataka, India

Anitha R Gandhe
Assistant Professor, Department of Natural Resource Management, College of Horticulture, UHS Bagalkot, Karnataka, India

Corresponding Author:
Yashaswini KP
M.Sc. (Horticulture) Scholar, Department of Soil Science and Agricultural Chemistry, College of Horticulture, UHS Bagalkot, Karnataka, India

Impact of nitrogenous fertilizers (Urea and Nano urea) on quality and sensory attributes of tomato fruits

Yashaswini KP, SM Prasanna, Maheshwarappa HP, BL Tamadaddi, Rudresh DL and Anitha R Gandhe

DOI: https://www.doi.org/10.33545/2664844X.2025.v7.i6c.459

Abstract
Tomatoes are one of the most widely consumed fruits globally, and their quality plays a crucial role in determining their market value and consumer acceptance. The application of nano-fertilizers, such as nano urea, has emerged as a promising approach to enhance crop productivity and quality. In this context, a study was conducted to investigate the "Impact of nitrogenous fertilizers (Urea and Nano Urea) on Quality and Sensory Attributes of Tomato Fruits" at the University of Horticultural Sciences, Bagalkot, during 2022-2023. A randomized complete block design with 12 treatments and 3 replications was employed for testing different levels of nitrogen (100%, 75%, and 50%) applied through urea and nano urea (2 ml L^{-1}). The results revealed that, the plants treated with 100% RDN: 50% as basal dose of urea and another 50% through foliar application of nano urea (2 ml L^{-1}) at 30 and 45 DAT (T_4) exhibited superior fruit quality, characterized by optimal firmness (1.47 N), fruit colour with respect to L^*, a^* and b^* value (37.54, 39.79 and 27.08, respectively), and sensory scores for color (8.67), texture (8.67), appearance (8.67), and overall acceptability of the fruits (9.00). These findings highlight the potential of nano urea in enhancing tomato quality.

Keywords: Tomato, nano urea, quality, firmness, colour

Introduction
The world's growing population demands increased food production, which heavily relies on fertilizer use. As the global population continues to rise, the dependence on fertilizers will inevitably intensify (Roberts, 2009) [9]. Crop growth and yield are directly influenced by the quality and quantity of fertilizers applied. However, the excessive use of agrochemicals, particularly nitrogen, poses significant environmental and economic concerns. Minimizing nitrogen consumption while maintaining optimal crop yields is essential for achieving sustainable agricultural production with low costs and high returns (Chauhan, 2023) [4].
To address this challenge, scientists have been developing innovative technologies to enhance nutrient use efficiency, with a particular focus on nitrogen (Rashmi *et al*., 2020) [8]. These advancements aim to optimize fertilizer application, reduce waste, and promote sustainable agriculture. One promising solution is the use of nano-fertilizers, which have emerged as a viable alternative to traditional fertilizers. Notably, nano urea has shown remarkable potential in increasing nitrogen availability to crops by over 80%, resulting in higher nutrient use efficiency and crop yields (Maurya *et al*., 2023) [7]. This approach not only helps to address global food shortages but also mitigates environmental pollution. The development of nano urea by Indian Farmers Fertiliser Cooperative Limited (IFFCO) and its commercial release in India in 2020 marks a significant milestone in the adoption of this technology (Kumar *et al*., 2020) [6].
Tomato is one of the most widely consumed vegetables worldwide, prized for its nutritional value and flovour (Wang *et al*. 2022) [12]. The quality of tomatoes significantly impacts consumer acceptance, nutritional benefits, and economic returns for producers. Enhancing tomato quality through sustainable agricultural practices and optimized fertilizer management can increase consumer satisfaction, support public health, and boost the economic viability of tomato production.

As it is a heavy feeder of nutrients, it require substantial amounts of fertilizers, particularly nitrogen (N), phosphorus (P), and Potassium (K), to achieve optimal growth and yield (Chauhan 2023) [4]. The efficient uptake of these essential nutrients are influenced by factors such as availability and concentation of these nutrients in soil, time and method of application, and irrigation regime (Rashmi *et al* 2020) [8]. Effective management of these factors is critical, as it can significantly impact on tomato yield, fruit quality, and overall plant health (Wang and Xing, 2017) [13]. This study focuses on the impact of nitrogenous fertilizers on tomato quality, aiming to determine the optimal timing and dosage of nitrogen application for enhancing quality attributes of tomato fruits.

Materials and Methods

The study was conducted at the College of Horticulture, Bagalkot (2022-23). which comes under northern dry agro climatic zone of Karnataka (Zone-3). located at 16º 10¹ latitude, 74º 42¹ longitude with an altitude of 542 meters above the mean sea level. During the study period, the region received a total rainfall of 49.9 mm, and the maximum and minimum mean temperature of 35.71 °C and 18.57 °C, respectively. The soil of the experimental site is red sandy loam, where Tomato (Hybrid: Abhilash) seedlings were transplanted by maintaining a spacing of 90 x 45 cm during spring summer. The experiment was conducted using a Randomized Complete Block Design (RCBD) with twelve treatments replicated thrice.

Experimental details

T_1 (100% RDN): 50% as basal dose + 25% urea at 30 DAT + 25% urea at 45 DAT

T_2 (100% RDN): 50% as basal dose + nano urea (2 ml L^{-1}) at 30 DAT +25% urea at 45 DAT

T_3 (100% RDN): 50% as basal dose + 25% urea at 30 DAT + nano urea (2 ml L^{-1}) at 45 DAT

T_4 (100% RDN): 50% as basal dose + nano urea (2 ml L^{-1}) at 30 and 45 DAT

T_5 (75% RDN): 50% as basal dose + 25% urea at 30 DAT + 25% urea at 45 DAT

T_6 (75% RDN): 50% as basal dose + nano urea (2 ml L^{-1}) at 30 DAT + 25% urea at 45 DAT

T_7 (75% RDN): 50% as basal dose + 25% urea at 30 DAT + nano urea (2 ml L^{-1}) at 45 DAT

T_8 (75% RDN): 50% as basal dose + nano urea (2 ml L^{-1}) at 30 and 45 DAT

T_9 (50% RDN): 50% as basal dose + 25% urea at 30 DAT + 25% urea at 45 DAT

T_{10} (50% RDN): 50% as basal dose + nano urea (2 ml L^{-1}) at 30 DAT + 25% urea at 45 DAT

T_{11} (50% RDN): 50% as basal dose + 25% urea at 30 DAT + nano urea (2 ml L^{-1}) at 45 DAT

T_{12} (50% RDN): 50% as basal dose + nano urea (2 ml L^{-1}) at 30 and 45 DAT

Recommended dose of FYM (38 t ha^{-1}), P_2O_5 (250 kg ha^{-1}) and K_2O (250 kg ha^{-1}) was applied to all the treatments, and recommended dose of nitrogen (RDN) is 250 kg ha^{-1}

Measurement of quality parameters

Firmness of the fruit

The TAXT plus texture analyser was used to determine the firmness of the tomato fruit (Make: Stable Micro System, **Model:** Texture Export Version 1.22). The force with which the sample was cut was graphed and the peak force value in the graph was used to calculate the texture value in Newton force (N).

Colour by colorimetry (*L* a* b) values**

The colour of tomato was measured using a Hunter Lab colorimeter with a 45 mm (diameter) measurement tube on a white tile background. The *L**, *a** and *b** representing lightness (white-black), red-green and yellow-blue scales, respectively.

Sensory quality

The sensory evaluation of tomato fruits was carried out by a panel of well-trained judges (n=10). The tomato fruits were evaluated for the appearance, colour, texture and overall acceptability on a 9-point hedonic scale. Where, 9=like extremely, 8=like very much, 7=like moderately, 6=like slightly, 5=neither like nor dislike, 4=dislike slightly, 3=dislike moderately, 2=dislike very much, 1=dislike extremely.

Results

Influence of nitrogenous fertilizers (urea and nano urea) on firmness of tomato

The data concerning to firmness of tomato as analyzed by TAXT plus texture analyser is made available in figure 1. Application of various dose of urea and nano urea at different interval of time shows the significant difference with respect to the firmness of tomato. The treatment T_9 (50 % RDN: 50% as basal dose + 25% urea at 30 DAT + 25 % urea at 45 DAT) depicted the highest (2.40 N) firmness value. While the treatment T_3 (100 % RDN: 50% as basal dose + 25% urea at 30 DAT + nano urea (2 ml L^{-1}) at 45 DAT) recorded the lowest (0.92 and 0.94 N, respectively) firmness values. However, the treatments T_2, T_4, T_6, T_8 and T_{12} showed the better firmness value (1.43, 1.47, 1.50, 1.64 and 1.69 N, respectively).

Colour by colorimetry

The data related to instrumental colour *L**, a* and b* value of the fruit as influenced by application of nitrogenous fertilizer (urea and nano urea) is displayed in Table 2.

The instrumental colour *L**, a* and b* value vary significantly among the treatments. The maximum (37.54 and 39.79, respectively) *L** and a* values were recorded in T_4 (100% RDN: 50% as basal dose + nano urea (2 ml L^{-1}) at 30 and 45 DAT) and it shows minimum (29.72 and 30.23, respectively) *L** and *a** value in treatment T_9 (50% RDN: 50% as basal dose + 25% urea at 30 DAT + 25% urea at 45 DAT). Whereas, the observations on *b** value recorded the maximum in T_9 (50% RDN: 50% as basal dose + 25% urea at 30 DAT + 25 % urea at 45 DAT), and minimum (27.08) *b** value in T_4 (100% RDN: 50% as basal dose + nano urea (2 ml L^{-1}) at 30 and 45 DAT).

Sensory quality (colour, texture, appearance and overall acceptibility of the fruit)

Data presented in the table 1 shows that the sensory quality (appearance, colour, texture) found to have significant difference between the treatments with respect to the scores given by the panelists. The highest score for sensory quality was recorded by the treatment T_4 (100 percent RDN: 50% as basal dose + nano urea (2 ml L^{-1}) at 30 and 45 DAT) and T_8

(75% RDN: 50% as basal dose + nano urea (2 ml L^{-1}) at 30 and 45 DAT), respectively for colour (8.67, 8.67), texture (8.67 and 8.33) and appearance (8.67 and 8.33) and overall acceptability of the fruit (9.00). Where as the treatment T_9 (50 % RDN: 50% as basal dose + 25% urea at 30 DAT + 25 % urea at 45 DAT) recorded the lowest (6.00, 6.00, 5.67 and 6.33, respectively) sensory score for colour, texture, appearance. And overall acceptability of the fruit.

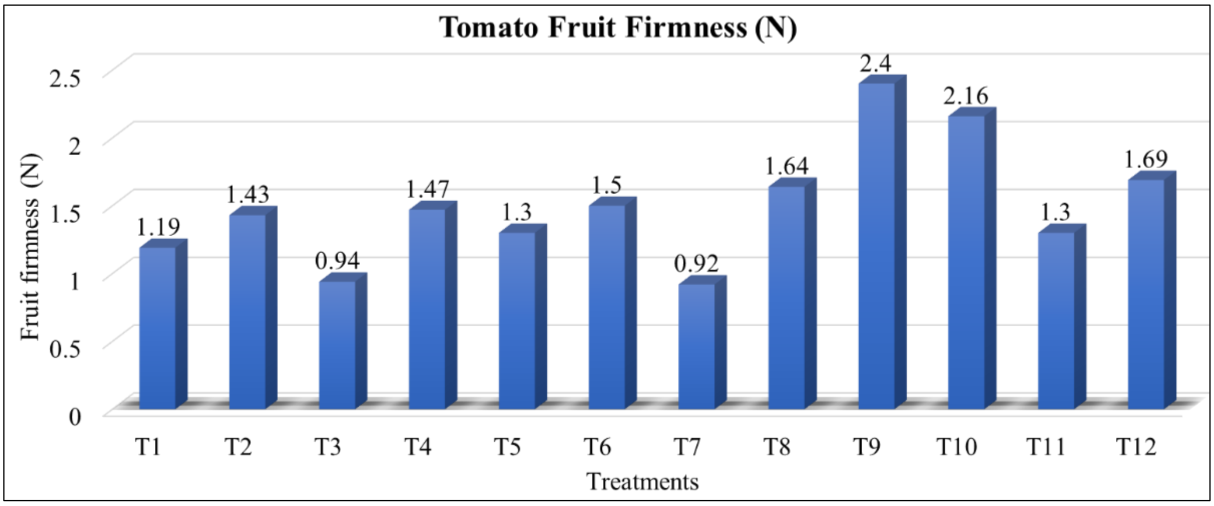

Fig 1: Influence of nitrogenous fertilizers (urea and nano urea) on fruit firmness of tomato

Table 1: Influence of nitrogenous fertilizers (urea and nano urea) on instrumental colour values (*L*a*b**) of tomato fruit

Treatments	*L**	*a**	*b**
T_1 (100% RDN): 50% as basal dose + 25% urea at 30 DAT + 25% urea at 45 DAT	33.91^{ab}	36.92^{abc}	30.36^{cde}
T_2 (100% RDN): 50% as basal dose + nano urea (2 ml L^{-1}) at 30 DAT +25% urea at 45 DAT	27.87^{cd}	38.14^{ab}	28.10^{de}
T_3 (100% RDN): 50% as basal dose + 25% urea at 30 DAT + nano urea (2 ml L^{-1}) at 45 DAT	26.59^{cd}	38.05^{ab}	28.55^{de}
T_4 (100% RDN): 50% as basal dose + nano urea (2 ml L^{-1}) at 30 and 45 DAT	37.54^{a}	39.79^{a}	27.08^{e}
T_5 (75% RDN): 50% as basal dose + 25% urea at 30 DAT + 25% urea at 45 DAT	30.23^{bc}	33.44^{de}	30.75^{cde}
T_6 (75% RDN): 50% as basal dose + nano urea (2 ml L^{-1}) at 30 DAT + 25% urea at 45 DAT	34.85^{ab}	36.88^{abc}	31.93^{bcd}
T_7 (75% RDN): 50% as basal dose + 25% urea at 30 DAT + nano urea (2 ml L^{-1}) at 45 DAT	30.67^{bc}	31.95^{ef}	32.48^{bcd}
T_8 (75% RDN): 50% as basal dose + nano urea (2 ml L^{-1}) at 30 and 45 DAT	35.10^{ab}	39.11^{a}	29.44^{cde}
T_9 (50% RDN): 50% as basal dose + 25% urea at 30 DAT + 25% urea at 45 DAT	23.95^{d}	30.23^{f}	38.86^{a}
T_{10} (50% RDN): 50% as basal dose + nano urea (2 ml L^{-1}) at 30 DAT + 25% urea at 45 DAT	30.01^{bc}	34.53^{cde}	33.68^{bc}
T_{11} (50% RDN): 50% as basal dose + 25% urea at 30 DAT + nano urea (2 ml L^{-1}) at 45 DAT	29.72^{bc}	34.50^{cde}	35.59^{ab}
T_{12} (50% RDN): 50% as basal dose + nano urea (2 ml L^{-1}) at 30 and 45 DAT	28.22^{cd}	36.08^{bcd}	31.51^{bcd}
S.Em ±	1.59	1.03	1.63
CD (5%)	4.67	3.03	4.79

Table 2: Influence of nitrogenous fertilizers (urea and nano urea) on sensory quality of tomato fruit

Treatments	Colour	Appearance	Texture	Overall acceptability
T_1 (100% RDN): 50% as basal dose + 25% urea at 30 DAT + 25% urea at 45 DAT	8.00^{ab}	7.50^{abc}	7.67^{abc}	7.83^{bcd}
T_2 (100% RDN): 50% as basal dose + nano urea (2 ml L^{-1}) at 30 DAT +25% urea at 45 DAT	8.33^{a}	8.00^{ab}	8.33^{ab}	8.33^{ab}
T_3 (100% RDN): 50% as basal dose + 25% urea at 30 DAT + nano urea (2 ml L^{-1}) at 45 DAT	8.33^{a}	8.00^{ab}	7.67^{abc}	8.00^{bc}
T_4 (100% RDN): 50% as basal dose + nano urea (2 ml L^{-1}) at 30 and 45 DAT	8.67^{a}	8.67^{a}	8.67^{a}	9.00^{a}
T_5 (75% RDN): 50% as basal dose + 25% urea at 30 DAT + 25% urea at 45 DAT	7.67^{abc}	7.33^{abc}	7.33^{bcd}	7.66^{bcd}
T_6 (75% RDN): 50% as basal dose + nano urea (2 ml L^{-1}) at 30 DAT + 25% urea at 45 DAT	8.33^{a}	7.16^{bc}	7.33^{bcd}	7.00^{def}
T_7 (75% RDN): 50% as basal dose + 25% urea at 30 DAT + nano urea (2 ml L^{-1}) at 45 DAT	7.67^{abc}	7.33^{bc}	6.67^{cde}	7.33^{cde}
T_8 (75% RDN): 50% as basal dose + nano urea (2 ml L^{-1}) at 30 and 45 DAT	8.67^{a}	8.33^{ab}	8.33^{ab}	8.50^{ab}
T_9 (50% RDN): 50% as basal dose + 25% urea at 30 DAT + 25% urea at 45 DAT	6.00^{d}	5.67^{d}	6.00^{e}	6.33^{f}
T_{10} (50% RDN): 50% as basal dose + nano urea (2 ml L^{-1}) at 30 DAT + 25% urea at 45 DAT	6.33^{d}	6.33^{cd}	6.33^{de}	6.66^{ef}
T_{11} (50% RDN): 50% as basal dose + 25% urea at 30 DAT + nano urea (2 ml L^{-1}) at 45 DAT	7.00^{bcd}	6.67^{cd}	6.00^{e}	6.66^{ef}
T_{12} (50% RDN): 50% as basal dose + nano urea (2 ml L^{-1}) at 30 and 45 DAT	6.67^{bcd}	6.67^{cd}	7.00^{cde}	7.33^{cde}
S.Em ±	0.43	0.47	0.45	0.29
CD (5%)	1.27	1.39	1.33	0.86

Discussion

For fresh tomatoes, the two quality attributes that are most important to buyers and consumers are firmness and skin colour (Tijskens and Evelo, 1994) [10]. Texture is influenced by flesh firmness and skin strength (Kader *et al.*, 1978) [5]. The data concerning to quality attributes of tomato influenced by the application of nitrogenous fertilizers (nano urea and urea) showed a significant difference among the treatments. The treatment T_9 depicted the highest (2.40 N) fruit firmness value whereas the treatment T_3 depicted the lowest (0.92 N) firmness, however the treatments T_2, T_4, T_6, T_8 and T_{12} showed the firmness value (1.43, 1.47, 1.50, 1.64 and 1.69 N, respectively) which is best for marketing of tomatoes (Batu, 2004) [2]. Adequate nitrogen supply can lead to healthier and more robust fruit bearing plants (Bhatti *et al.*, 2023) [3], which can in turn produce fruit with better texture and firmness.

The maximum (37.54 and 39.79, respectively) instrumental colour L^* and a^* value and the minimum (27.08) b^* value is obtained in T4 (100% RDN: 50% as basal dose + nano urea (2 ml L^{-1}) at 30 and 45 DAT). The L^* value indicates how dark or light a colour is, and a^* value is indicator for red colour development and the degree of ripening in tomato while the b^* value shows yellow discolouration (Artes *et al.*, 1999) [1].

Sensory evaluation reported that, the highest (8.67, 8.67, 8.67 and 9.00, respectively) ratings were obtained in T_4 (100% RDN: 50% as basal dose + nano urea (2 ml L^{-1}) at 30 and 45 DAT) for colour, texture, appearance and overall acceptability of the fruit. This might be due to the balanced supply of nutrients that might have led to the supply of required amount of nutrient to plants (Venkatesh *et al.*, 2022) [11].

Conclusion

The study reveals that the application of nitrogenous fertilizers, urea and nano urea, significantly influences the firmness, color, and sensory quality of tomatoes. The treatment T_4, which involved 100% recommended dose of nitrogen with two sprays of nano urea at 30 and 45 days after transplanting, exhibited superior performance in terms of fruit firmness, color (L^*, a^* and b^* values) and sensory quality, including colour, texture, appearance and overall acceptability. In contrast, treatment T_9, which relied solely on urea application with only 50% RDN, showed the poor performance with respect to the quality attributes. These findings suggest that the judicious use of nano urea can enhance the quality attributes of tomatoes, making it a promising strategy for optimizing tomato production.

Reference

1. Artes F, Conesa MA, Harnendez S, Gil MI. Keeping quality of fresh-cut tomato. Postharvest Biol Technol. 1999;17:153-162.
2. Batu A. Determination of acceptable firmness and colour values of tomatoes. J Food Eng. 2004;61:471-475.
3. Bhatti D, Varu DK, Dudhat M. Effect of different doses of urea and nanourea on yield and quality of guava (*Psidium guajava* L.) cv. Lucknow-49. Pharma Innov. 2023;12(6):4151-4156.
4. Chauhan A, Pallvi RP, Ludarmani SA. Effect of pre-soaking of potato (*Solanum tuberosum* L.) tubers in nano-urea and nano-zinc on its growth, quality and yield. Pharma Innov J. 2023;12(7):980-995.
5. Kader AA, Morris LL, Chen P. Evaluation of two objective methods and subjective rating scale for measuring tomato firmness. J Am Soc Hortic Sci. 1978;103:70-73.
6. Kumar Y, Tiwari KN, Nayak RK, Rai A, Singh SP, Singh AN, *et al*. Nano fertilizers for enhancing nutrient use efficiency, crop productivity and economic returns in winter season crops of Uttar Pradesh. Indian J Fertilizers. 2020;16(8):772-786.
7. Maurya AK, Maji S, Razauddin M, Rawat AK, Meena RC. Studies on vegetative growth of dragon fruit [*Hylocereus costaricensis* (Web.) Britton and Rose] as influenced by nano urea, urea, FYM and vermicompost. Environ Ecol. 2023;41(1C):709-716.
8. Rashmi CM, Prakash SS, Bhavani P, Yogananda SB, Ashoka KR. Quality of tomato under greenhouse condition as influenced by the application of urea modified hydroxyapatite nano fertilizer. *IJCS*. 2020;8(6):2944-2948.
9. Roberts TL. The role of fertilizer in growing the world's food. Better Crops. 2009;93(2):12-15.
10. Tijskens LMM, Evelo RW. Modelling colour of tomatoes during postharvest storage. Postharvest Biol Technol. 1994;4:85-89.
11. Venkatesh M, Babu KK, Prasanth P, Lakshminarayana D, Kumar SP. 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. Pharma Innov. 2022;11(11):1313-1317.
12. Wang C, Li M, Duan X, Abu-Izneid T, Rauf A, Khan Z, *et al*. Phytochemical and nutritional profiling of tomatoes; impact of processing on bioavailability—A comprehensive review. Food Rev Int. 2022;1-25.
13. Wang X, Xing Y. Evaluation of the effects of irrigation and fertilization on tomato fruit yield and quality: A principal component analysis. Sci Rep. 2017;7(1):350. https://doi.org/10.1038/s41598-017-00373-8