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EFFECT OF FOLIAR APPLICATION OF NANO UREA PLUS ON GROWTH AND YIELD OF ONION (*ALLIUM CEPA* L.) UNDER TELANGANA CONDITIONS

T. Haripriya[1]*, A.V.N. Lavanya[2], R. Preetham Goud[3] and Veena Joshi[4]

[1]Department of Vegetable Science, Post graduate Institute for Horticultural Sciences, SKLTGHU, Mulugu, Siddipet, Telangana, India.
[2]Department of Vegetable science, College of Horticulture, Sri Konda Laxman Telangana Horticultural University, Rajendranagar, Telangana, Hyderabad, India.
[3]Department of Agronomy, Vegetable Research Station, SKLTGHU, Rajendranagar, Telangana, Hyderabad, India.
[4]College of Horticulture, SKLTGHU, Rajendranagar, Hyderabad, Telangana, India.
*Corresponding author E-mail : haripriyathatikonda98@gmail.com

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ABSTRACT

The present investigation entitled "Effect of foliar application of nano urea plus on growth and yield of onion (*Allium cepa* L.) under Telangana conditions" was carried out during the *Rabi* season of 2024–25 at the Post Graduate Institute for Horticultural Sciences, Sri Konda Laxman Telangana Horticultural University, Mulugu, Telangana. The experiment was conducted in a Randomized Block Design (RBD) with 12 treatmental combinations, each replicated thrice. The treatments consists of different levels of recommended nitrogen (100, 75 and 50%) in combination with 100 percent recommended doses of phosphorus, potassium and sulphur, supplemented with foliar sprays of Nano Urea Plus or 2 percent urea at varying intervals. The primary objective of the study was to evaluate the effect of foliar application of Nano Urea plus on growth and yield of onion under Telangana condition integrating nano urea with conventional fertilizers. The results revealed that the treatment T_3, which comprised two foliar sprays of Nano Urea Plus @ 4 ml/l at 30 and 45 DATalong with 100 percent recommended dose of NPKS, consistently outperformed all other treatments. This treatment registered the maximum vegetative growth with plant height of 44.27, 54.03 and 73.90 cm, leaf girth of 0.63, 0.86 and 0.96 cm and the highest number of leaves per plant 11.07 and 14.10 at 60 and 90 days after transplanting. Bulb development was also superior in T_3, with the largest polar diameter (5.55 cm), equatorial diameter (6.33 cm), neck thickness (1.27 cm) and average bulb weight (98.08 g), clearly indicating its effectiveness in improving bulb formation. A similar trend was observed in yield parameters, where T_3 recorded the highest total yield (39.23 t/ha) and marketable yield (37.27 t/ha). These findings strongly suggest that the combined use of 100 percent RDF with two foliar sprays of Nano Urea Plus enhances both growth and productivity of onion, thereby demonstrating its superiority as an efficient and sustainable nutrient management practice for achieving higher yields and improved profitability under Telangana conditions.

Key words : Onion, Nano urea plus, Agri-found light red, Growth parameters, Yield and Yield attributes.

Introduction

Onion (*Allium cepa* L.), popularly known as the "Queen of the Kitchen," is one of the most widely consumed vegetables worldwide due to its culinary versatility, nutritional value and medicinal properties. The bulb, derived from modified leaf is consumed raw, cooked or as a seasoning and plays a significant role in human health (Bashir and Satish, 2024). Is belongs to the genus *Allium* of the family Liliaceae, onion is a monocotyledonous, cool-season, cross-pollinated crop with a diploid chromosome number of 2n = 16 (Anonymous, 2023). Onion is nutritionally rich in vitamin-c, potassium, folic acid, calcium, vitamin B_6 and fibre, while being fat-free, cholesterol-free and low in calories

(Kwenin *et al*., 2017). They contain flavonoids, anthocyanins and phytosterols with strong anti-oxidant, anti-inflammatory, anti-bacterial and anti-histamine properties, offering multiple health benefits including reduced DNA damage and management of type-2 diabetes (Marrelli *et al*., 2018; Yogesh *et al*., 2017). In India, onion is grown in three seasons *kharif*, late *kharif* and *rabi*—with *rabi* accounting for about 50% of total production. Productivity is highest in *rabi* and late *kharif* (around 25 t/ha), whereas *kharif* yields are much lower (8–10 t/ha) (Anonymous, 2024).

According to the Second Advance Estimates (2023–24), India produced 31.12 million metric tonnes from 1.91 million ha while Telangana contributed 107,966 tonnes from 4,244.80 ha (Anonymous, 2023). Nitrogen plays a crucial role in onion cultivation as the crops shallow and unbranched root system, make them more prone to nutrient deficiencies nitrogen use efficiency of conventional fertilizers is only about 33%, while the rest is lost through leaching, volatilization and denitrification, reported to be causing economic loss and environmental pollution (Raun *et al*., 2002; Brewster, 2008). To overcome these issues, nano-fertilizers, particularly nano urea, have been developed as "smart fertilizers" to enhance nutrient use efficiency, by ensuring sustainable production by minimizing losses (Manjunatha *et al*., 2016). Foliar application of nano urea, with nanoscale particles (1–100 nm), improves absorption, photosynthesis, chlorophyll content and crop quality, while reducing fertilizer cost and environmental risk (Kumar *et al*., 2021; Enigi *et al*., 2022). With more than 80% nutrient use efficiency and ease of storage, transport and application, nano urea offers a promising solution for sustainable onion cultivation (Al-juthery *et al*., 2020).

Materials and Methods

The present investigation has been carried out in 2024 at the Post Graduate Institute for Horticultural Sciences, Mulugu, Sri Konda Laxman Telangana Horticultural University, Telangana. The location is positioned at a latitude of 17°43'02" N, a longitude of 78°40'00" E and an altitude of 536.3 meters above mean sea level (MSL). With minimum and maximum temperatures of 16.2°C and 36.9 °C, respectively. The variety used for the present investigation Agri-found Light Red which was developed by NHRDF, Nasik Maharashtra is a rabi variety with light red, globular bulbs (4–6 cm), maturing in 160–165 days, yielding 30–35 t/ha. It has good pungency (13°Brix, 1.12 mg/g pyruvic acid) and excellent storage quality. The experimental field was well prepared by to fine tilth 2 levelled. It was divided into 36 raised-beds each messuring (1m × 3m) width with 60 cm inter-bed spacing. Onion seeds were sown in portrays and irrigated regularly. After 45 DAS seedlings were transplanted in the main field. The recommended fertilizers (120:50:60:30 N:P_2O_5:K_2O:S kg/ha) along with FYM @ 25 t/ha were applied using Urea, SSP, MOP and elemental sulphur. FYM was incorporated before transplanting. While SSP and MOP were given basal dose and Nitrogen was applied in 100, 75 and 50% RDF to the respective treatment levels and nano-fertilizers were sprayed as according to treatmental combinations. per treatments.

Treatments

T_1 :100% RDN No foliar spray

T_2 : T_1 + One foliar spray of Nano-Urea Plus @ 4ml/l

T_3 : T_1 + Two foliar sprays of Nano-Urea Plus @ 4ml/l

T_4 : T_1 + Two foliar sprays of 2 percent Urea

T_5 : 75% RDN No foliar spray

T_6 : T_5 + One foliar spray of Nano-Urea Plus @ 4ml/l

T_7 : T_5 + Two foliar sprays of Nano-Urea Plus @ 4 ml/l

T_8 : T_5 + Two foliar sprays of 2 percent Urea

T_9 : 50% RDN No foliar spray

T_{10}: T_9 + One foliar spray of Nano-Urea Plus @ 4ml/l

T_{11}: T_9 + Two foliar sprays of Nano-Urea Plus @4 ml/l

T_{12}: T_9 + Two foliar sprays of 2 percent Urea

Methodology

Note: RDF for onion 120:50:60:30 N_2: P_2O_5 : K_2O: S kg/ha respectively FYM at 25t/ha, 2 sprays of nano urea and urea was given during the crop growth period 1st foliar spray-30DAT and 2nd foliar spray-45DAT. Dosage: nano urea plus @ 4ml/l, urea (2%) @ 20gm/l. weeding and plant protection measures were undertaken as need basis. Bulbs were harvested at 60-70% neck fall stage. To record various growth and yield parameters 10 healthy plants in each treatment were labelled and tagged for recording biometric observations periodically.

Results and Discussion

Growth parameters

The data in Table 1 recorded at 30, 60 and 90 DAT showed significant variations in plant height, number of leaves per plant and leaf girth were recorded at 30, 60

Table 1 : Effect of foliar spray of nano urea plus on growth parameters of onion.

Treatments	Plant height (cm)			No. of leaves/plant			Leaf girth (cm)		
	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT
T_1: 100% NPK and S (RDF)	44.24	47.19	65.74	6.32	10.03	13.10	0.63	0.78	0.85
T_2:T_1+One foliar spray of Nano Urea Plus	44.20	50.25	68.52	6.26	10.37	13.63	0.62	0.83	0.91
T_3: T_1+Two foliar sprays of Nano Urea Plus	44.27	54.03	73.90	6.27	11.07	14.10	0.63	0.86	0.96
T_4: T_1 + Two foliar sprays of urea	44.10	52.55	70.23	6.34	10.43	13.67	0.62	0.84	0.92
T_5: 75% N and 100% PKS	38.02	43.49	60.26	5.93	9.33	12.77	0.55	0.71	0.79
T_6:T_5 + One foliar spray of Nano Urea Plus	38.21	45.23	63.24	5.91	9.50	12.93	0.55	0.74	0.85
T_7:T_5+Two foliar sprays of Nano Urea Plus	38.20	48.00	66.75	6.01	10.12	13.20	0.56	0.77	0.89
T_8: T_5 + Two foliar sprays of urea	38.23	47.01	64.66	5.93	9.87	13.00	0.56	0.76	0.86
T_9: 50% N and 100% P KS	32.96	36.11	55.72	5.32	7.20	10.80	0.43	0.65	0.69
T_{10}: T_9+One foliar spray of Nano Urea Plus	32.87	40.09	59.24	5.25	8.00	11.97	0.42	0.67	0.75
T_{11}:T_9 +Two foliar sprays of NanoUrea Plus	32.99	43.27	62.32	5.43	9.13	12.53	0.42	0.70	0.79
T_{12}:T_9 + Two foliar sprays of urea.	32.89	42.75	60.76	5.35	8.30	12.25	0.44	0.68	0.77
S.E m±	**1.66**	**1.83**	**1.80**	**0.16**	**0.40**	**0.49**	**0.02**	**0.03**	**0.03**
CD (0.05)	**4.88**	**5.38**	**5.27**	**0.47**	**1.19**	**1.44**	**0.05**	**0.08**	**0.08**

and 90 DAT among the different treatments. The foliar application of nano urea plus proved most effective, with T_3 (100% RDF + Two foliar sprays of nano urea plus @ 4ml/l) consistently recording the highest values. This treatment produced maximum plant height (44.27 cm, 54.03 cm and 70.23 cm at 30, 60 and 90 DAT, respectively), number of leaves per plant (11.07 at 60 DAT and 14.10 at 90 DAT) and leaf girth (0.63 cm, 0.86 cm and 0.96 cm at 30, 60 and 90 DAT, respectively). These results highlight the positive role of nano urea plus in enhancing vegetative growth of onion.

The findings are in line with earlier reports where nitrogen and nano-fertilizers significantly improved onion growth attributes. Sundaram *et al*. (2020), Ali *et al*. (2021) and Kartina *et al*. (2021) reported similar improvements, corroborated by Patel *et al*. (2022) and Yousuf *et al*. (2022). Comparable results were also observed by Mishra *et al*. (2020), Pawar *et al*. (2017) and Sharma *et al*. (2019). The beneficial effect of nano urea may be attributed to its ultra-fine particle size and large surface area, which enhance nutrient uptake and utilization efficiency. Furthermore, it promotes better chlorophyll synthesis, cell division and photosynthetic activity than commercial fertilizers thereby contributing to vigorous vegetative growth.

Yield and Yield attributes

The data in Tables 2 and 3 showed significant variations in bulb traits and yield parameters. Among the treatments, the maximum bulb polar diameter (5.55 cm), equatorial diameter (6.33 cm), neck thickness (1.27 cm) and average bulb weight (98.08 g) were obtained in T_3 (100% RDF + Two foliar sprays of Nano Urea Plus @ 4 ml/l). The minimum days to harvest (118) were recorded in T_9 (50% N + 100% PKS). T_3 also produced the highest bulb yield per plot (13.73 kg), total yield (39.23 t/ha) and marketable yield (37.27 t/ha). These results clearly indicate that the combined application of recommended nitrogen along with two foliar sprays of nano urea plus enhanced bulb development and yield established in T_3 as the most effective treatment for achieving higher productivity and profitability in onion cultivation.

Nitrogen application significantly influenced onion bulb development. Adequate nitrogen improved leaf girth, polar and equatorial diameters, neck thickness and bulb weight through enhanced nutrient absorption, cell division and assimilate partitioning. Foliar sprays of Nano Urea further enhanced nutrient-use efficiency, resulting in higher yields, with the best performance achieved under 100% RDF combined with two nano urea sprays.

These findings are consistent with earlier studies. Pawar *et al*. (2017), Patel *et al*. (2001), Sundaram *et al*. (2020), Lekshmi *et al*. (2022), Dubey *et al*. (2023) and Yeshiwas *et al*. (2024) also reported that foliar application of nano-fertilizers or adequate nitrogen supply significantly improved bulb characters, yield and quality in onion.

These results suggested that supplementing reduced RDF levels with foliar nutrient applications particularly the cost effective 2% urea sprays, can successfully offset a 25% reduction in conventional fertilizers these by reducing input costs. The treatments integrated nutrient management approaches, enhances soil fertility and also sustaining optimal crop productity.

Table 2 : Effect of foliar sprays of nano urea plus on yield attributes of onion.

Yield attributes					
Treatments	**Polar diameter (cm)**	**Equatorial diameter (cm)**	**Neck thickness (cm)**	**Avg bulb weight (g)**	**Days to harvest**
T_1: 100% NPK and S (RDF)	5.33	5.59	1.10	86.99	121.00
T_2: T1 + One foliar spray of Nano Urea Plus	5.43	6.09	1.24	91.68	121.67
T_3:T1+ Two foliar sprays of Nano Urea Plus	5.55	6.33	1.27	98.08	122.00
T_4:T1 + Two foliar sprays of urea	5.50	6.22	1.25	94.78	121.33
T_5:75% N and 100% PKS	5.08	5.01	0.99	80.14	119.00
T_6:T5 + One foliar spray of Nano Urea Plus	5.20	5.29	1.06	84.30	119.67
T_7:T5+ Two foliar sprays of Nano Urea Plus	5.32	5.82	1.12	87.88	120.33
T_8:T5 + Two foliar sprays of urea	5.26	5.71	1.08	85.58	120.00
T_9: 50% N and 100% P KS	4.10	4.50	0.88	69.36	118.00
T_{10}:T9+ One foliar spray of Nano Urea Plus	4.63	4.97	0.95	72.54	118.67
T_{11}:T9+Two foliar sprays of NanoUrea Plus	4.96	5.20	0.97	78.02	119.00
T_{12}: T9 + Two foliar sprays of urea.	4.84	5.06	0.96	76.04	118.67
S.E m±	**0.17**	**0.15**	**0.05**	**2.27**	**0.47**
CD (0.05)	**0.49**	**0.44**	**0.14**	**6.66**	**1.36**

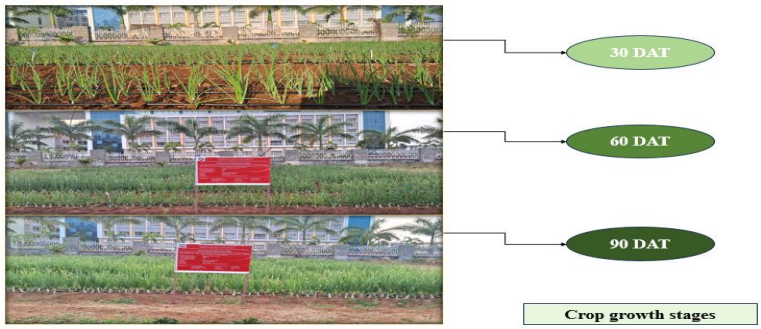
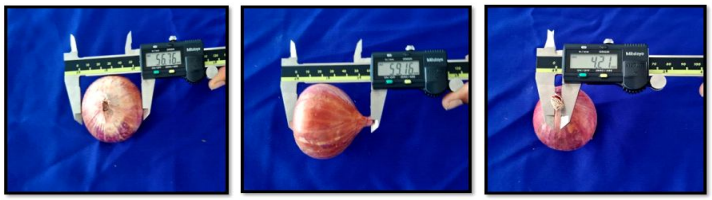


Fig. 1

Fig. 2

Table 3 : Effect of foliar sprays of nano urea plus on yield of onion.

Treatments	**Bulb yield per plot (kg)**	**Total Bulb yield (t/ha)**	**Marketable bulb yield (t/ha)**
T_1: 100% NPK and S (RDF)	12.18	34.79	33.05
T_2:T_1 + One foliar spray of Nano Urea Plus	12.83	36.67	34.84
T_3:T_1+ Two foliar sprays of Nano Urea Plus	13.73	39.23	37.27
T_4:T_1 + Two foliar sprays of urea	13.27	37.91	36.02
T_5:75% N and 100% PKS	11.22	32.06	30.45
T_6:T_5 + One foliar spray of Nano Urea Plus	11.80	33.72	32.03
T_7: T_5 + Two foliar sprays of Nano Urea Plus	12.30	35.15	33.39
T_8:T_5 + Two foliar sprays of urea	11.98	34.23	32.52
T_9: 50% N and 100% P KS	9.71	27.74	26.36
T_{10}: T_9 + One foliar spray of Nano Urea Plus	10.16	29.01	27.56
T_{11}: T_9 + Two foliar sprays of Nano Urea Plus	10.92	31.21	29.65
T_{12}: T_9 + Two foliar sprays of urea.	10.65	30.41	28.89
S.E m±	**0.32**	**0.91**	**0.86**
CD (0.05)	**0.93**	**2.67**	**2.53**



Measurement of bulb polar diameter, equatorial diameter and neck thickness

Fig. 3

Harvesting of onion crop and average bulb weight

Fig. 4

Moreover the findings also revealed that a 25% reduction in the recommended nitrogen dose can be effectively compensated through foliar spray of nano-urea plus or 2% urea, along with 75% RDN and 100% PKS, which produced yields on par to 100% RDF.

Conclusion

The application of 100 percent recommended dose of fertilizers [RDF] combined with two foliar sprays of nano urea plus @ 4 ml/l at 30 and 45 DAT exhibited superior performance with respect to growth, yield and yield attributes with recommended for commercial cultivation of onion in the Telangana region.

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