Response of Onion (*Allium cepa L.*) to Foliar Application of Nano Urea and Urea

ABSTRACT

A field study was conducted during *Rabi* season 2022at the Horticultural Research Farm, Mangalayatan University, Jabalpur to study the effect of foliar application of nano urea and urea on growth and yield of onion. The experiment was laid out in RBD with three replications and consisted of 9 treatments viz., T1-100% RDF (100:50:50 kg NPK ha^{1}), T2-75:50:50 kg NPK ha^{-1} + foliar spray of 0.4% nano urea on 30 and 60 DAT, T350:50:50 kg NPK ha^{-1} + foliar spray of 0.4% nano urea on 30 and 60 DAT, T4-75:50:50 kg NPK ha^{-1} + foliar spray of 0.4% nano urea on 30 DAT, T5-50:50:50 kg NPK ha^{-1} + foliar spray of 0.4% nano urea on 30 DAT, T6-75:50:50 kg NPK ha^{-1} + foliar spray of 0.5% urea on 30 and 60 DAT, T7-50:50:50 kg NPK ha^{-1} + foliar spray of 0.5% urea on 30 and 60 DAT, T8-75:50:50 kg NPK ha^{-1} + foliar spray of 1% urea on 30 and 60 DAT, and T9-50:50:50 kg NPK ha^{-1} + foliar spray of 1% urea on 30 and 60 DAT. Each treatment showed their significant effects on the recorded growth and yield parameters. Among all the treatments, treatment T2 with 25% reduced nitrogen application plus foliar spray of 0.4% nano urea on 30 and 60 DAT recorded maximum plant height on 90 DAT (57.82 cm),number of leaves (9.13), equatorial diameter (5.51 cm), polar diameter (5.17), average bulb weight (69.56 g), bulb yield (336.40 kg) than other treatments.

KEYWORDS: ***Nano urea, foliar application, onion***

INTRODUCTION:

Onion*Allium cepa* L.is widely grown vegetable crop in the word,belongs to the family Alliaceae. Global onion production area has increased considerably from less than 2 million ha in 1990 to more than 5 million ha in 2019. The gross production value of onions produced worldwide ranks second among vegetable crops after tomatoes (FAO, 2021).

Nitrogen (N) is an essential macronutrient for the plant function and component of amino acids, is often a yield limiting in crop production. It is required by plants in larger amounts compared to most other nutrients. Nitrogen is one of the important nutrients for onions growth because of its key part in chlorophyll production, which is basis for the photosynthesis process. Crop growth, yield and biomass are profoundly affected by nitrogen fertilization (Tremblay *et al*., 2011;Mailhol*et al*., 2007).Nitrogen's pivotal function within the plant is to guarantee the availability of energy precisely when and where the plant requires it for maximizing yield. This essential nutrient is also found in the roots, where proteins and enzymes aid in the regulation of water and nutrient absorption.

The productive components of onion crop were highly affected and influenced by nitrogen fertilization. Despite other vegetables, onions require more nitrogen fertilizer application rates, because, onions are more susceptible to nutrient deficiencies than any other crop plants due to their shallow and unbranched root system (Visser *et al*., 1995; Halvorson *et al*., 2002; Brewster, 2008). Hence, they require and often respond well to addition of fertilizers. However, a major limitation of conventional nitrogeneous fertilizers is their low crop nutrient use efficiency and high loss into water bodies. Excessive use of nitrogen can lead to a declining trend in nitrogen use efficiency. It has been reported that not more than 33% of applied nitrogen is used by the plant and the remaining is lost through leaching, volatilization and other losses which causing environmental pollution and emission of green-house gases (Raun *et al.*, 2002; Greenwood *et al*., 1989;Visser*et al*. 1995).

Nano urea, a novel technology in fertilizer designing, is expected to reduce the environmental pollution caused by the granular form by reducing its excessive application that causing environmental pollution. Nano urea is gaining importance in Indian agriculture because of its ability in increasing nutrient use efficiency, increasing crop yields, and reducing excessive use of synthetic fertilizers. Being required in small quantities compared to bulky nitrogenous fertilizers like urea, it is easy to store and transport. Farmers can easily carry bottles of nano urea over bulkier urea bags, which have a substantial influence on relative logistics and warehousing costs. Nano urea boosts nitrogen availability to crop by more than 80%, resulting in increased nutrientuse efficiency (Kumar *et al*., 2020). Increased chlorophyll and photosynthesis in leaves, as well as an increase in root biomass and the number of effective tillers/ branches, resulting in higher crop yields. Nano urea makes the use of bulk nitrogen fertilizers like urea more efficient.

Some previous findings indicated that application of nitrogen fertilizer to the leaves is more efficient because of the many possible pathways for nitrogen loss from the soil are avoided (Adesemoye*et al.*, 2010). Nano urea and other nano fertilizers can enable better nutrient availability to crops, leading to increase in nitrogen use efficiency through efficient usage of reduced dosage of conventional fertilizers application.

MATERIALS AND METHODS:

A field experiment was conducted at Horticulture Research Farm, Barela, Jabalpur,Department of Horticulture Mangalayatan University. Jabalpur. (M.P.) during the Rabi season 2022. The soil of the experimental field was medium black with good drainage and uniform texture with medium NPK status. The physico-chemical properties of the soil of the experimental field (0-15 cm) was: clay 45%, silt 22%, and sand 33%, pH 7.29, electrical conductivity (EC) 0.22 dsm^{-1}, organic carbon 0.58%. Available nitrogen 287 kg ha^{-1}, available P_2O_5 25.9 kg ha^{-1} and available K_2O 289 kg ha^{-1}. The experiment was laid out in a Randomized Complete Block Design with three replications consisting of nine treatments viz, T1-100% RDF (100:50:50 kg NPK ha^{1}), T2-75:50:50 kg NPK ha^{-1}+ foliar spray of 0.4% nano urea on 30 and 60 DAT, T3-50:50:50 kg NPK ha^{-1}+ foliar spray of 0.4% nano urea on 30 and 60 DAT, T4-75:50:50 kg NPK ha^{-1}+ foliar spray of 0.4% nano urea on 30 DAT, T5-50:50:50 kg NPK ha^{-1}+ foliar spray of 0.4% nano urea on 30 DAT, T6-75:50:50 kg NPK ha^{-1}+ foliar spray of 0.5% urea on 30 and 60 DAT, T7-50:50:50 kg NPK ha^{-1}+ foliar spray of 0.5% urea on 30 and 60 DAT, T875:50:50 kg NPK ha^{-1}+ foliar spray of 1% urea on 30 and 60 DAT, and T9-50:50:50 kg, NPK ha^{-1}+ foliar spray of 1% urea on 30 and 60 DAT. A basal dose of 50 kg P_2O_5 ha^{1}, 50 kg K_2O ha^{1} and 15t FYM ha^{1} were applied and nitrogen dosage was followed as per treatment in three splits as basal application (40%), top dressing on 30 and 60 DAT (30% each). Observations were recorded on different growth, yield and quality parameters from each treatment in every replication and analyzed statistically as per standard procedures to test the significance.

RESULTS AND DISCUSSION:

The observations on various growth, yield and quality parameters viz., plant height (cm), number of leaves/ plant, polar diameter (cm), equatorial diameter (cm), neck thickness (cm), average bulb weight (g), bulb yield (q/ha), Total Soluble Solids and thrips incidence was recorded and analysed statistically.

Plant height, being an important plant growth parameter in onion, shows significant differences among the reduced applications of nitrogen along with boosting provided by foliar application of either nano urea or urea which differs according to treatment combinations. Analysed data revealed that the plant heights of onion were significantly influenced by different nutrient management practices.,the maximum plant height of onion at 90 DAT (57.82 cm) was recorded with treatment T2 involving 75:50:50 kg NPK ha^{-1} + foliar spray of 0.4% nano urea, which was found at par with application of 100:50:50 NPK kg ha^{-1}(T2). The effect of foliar application of either nano urea or urea is not absolutely accountable after one spray in onion. However, after two foliar sprays, 0.4% nano urea gave better results on plant height with 25% reduced nitrogen fertilization through soil which was found superior over usual recommended dose of nitrogen. The improvement in plant height due to nano urea foliar application could be attributed due to the effect of nitrogen on cell division, elongation, protein synthesis etc. which enhanced the plant height and growth of leaves. Similar effects of nano fertilizers with regard to maximum plant height was reported by Rathnayaka *et al.* (2018), Moghadam *et al*. (2012), and Khater (2015).

Analysis of results revealed that the number of leaves in different treatments were significantly influenced by different nutrient management practices. application of 75:50:50 kg NPK ha^{-1} + foliar spray of 0.4% nano urea on resulted with 9.13 number of leaves which was found on par with the number of leaves obtained from applying 100:50:50 NPK kg ha^{-1}. Alike results of increased number of leaves and enhanced growth rate in spinach due to nanofertilizer application was reported by Moghadam *et al*. (2012).

The bulb diameter of onion (both polar and equatorial diameter) are affected significantly by the foliar application of nano urea and urea along with reduced nitrogen fertilization through soil. Of this, the treatment with foliar spray of 0.4% nano urea on 30 and 60 DAT + 75:50:50 kg NPK ha^{-1} has given better results in terms of polar diameter (5.17 cm) and equatorial diameter (5.51 cm) of bulbs which was found to be partly superior than the treatment T1 with 100% nitrogen fertilization. The increase in bulb size might be due to the increase in height and number of leaves, which influenced directly by nitrogen nutrient. This might have accumulated more carbohydrates, resulting in an increase in bulb diameter.

Thrips damage (%) was also recorded maximum in treatment T2 with nano urea along with 25% reduced nitrogen application, that may be due to higher number of leaves, higher quantity of cell sap and maximum leaf length. As well as the frequency of nano urea application may also responsible for the higher damage due to thrips in treatment T2.

The neck thickness of onion, an important parameter which reflects the yield and storage ability of onion bulbs were influenced by the different nutrient management strategies followed. The treatment T2 with nano urea along with 25% reduced nitrogen application recorded at par values with T1 with 100% nitrogen fertilization in terms of neck thickness. This might be due to the increased number of leaves and leaf area per plant, resulting in better photosynthesis and accumulation of photosynthates, leading to more vigorous growth of the plant.

The highest average bulb weight (69.56g) and yield per hectare (336.40 q ha-^{1}) was obtained in T2 with 0.4% nano urea through foliar application on 30 and 60 DAT in onion along with 25% reduced nitrogen supply than recommended dose of nitrogen through soil. This might be due to production of taller plants with higher number of leaves, chlorophyll index and LAI which lead to enhanced development of vegetative parts. This ultimately boosted the nutrient absorption, photosynthesis and assimilation of photosynthates in the sink, which resulted in increased bulb size and weight. Similar effects of nano nitrogen fertilizers on yield was reported by Rathnayaka *et al.* (2018). Charbaji*et al.* (2008) also reported that foliar application of nitrogen resulted in maximizing fresh weight of onion bulbs.

Conclusion

The foliar application of nano urea gave significantly better results in terms of TSS of onion bulbs than other treatments except the treatment with 100% RDF and treatments with 75% recommended dose of nitrogen along with two foliar foliar sprays of either 0.5 % or 1% urea. The nano urea foliar application paved ways for vigorous vegetative growth in addition to maximizing chlorophyll content of leaves, which improved photosynthesis and ultimately resulted in increased TSS content. Similar results were reported by Davarpanah*et al.* (2017) that the foliar application of nano nitrogen and normal urea increased TSS of pomegranate fruits than usual fertilizer recommendation. The results are also in conformity with the results of Dewdar*et al.*(2018).

Table1: Growth and yield attributing traits influenced by the application of Urea & Nano-Urea.

Treatments	Plant Height (cm)	Number of leaves/ plant	Polar Diameter (cm)	Equatorial Diameter (cm)	Thrips Incidence (%)	Neck Thickness (cm)	TSS (^{0}brix)	ABW (g)	Bulb Yield (q/ha)
T1= 100% RDF (100:50:50 kg NPK ha^1)	56.79	8.60	4.72	5.29	12.02	0.89	11.09	66.75	331.39
T2=75:50:50 kg NPK ha^{-1}+ foliar spray of 0.4% nano urea on 30 and 60 DAT	57.82	9.13	5.17	5.51	14.86	1.10	12.17	69.56	336.40
T3=50:50:50 kg NPK ha^{-1}+ foliar spray of 0.4% nano urea on 30 and 60 DAT,	50.53	7.13	4.29	4.17	10.11	1.26	12.23	54.56	266.11
T4=75:50:50 kg NPK ha^{-1}+ foliar spray of 0.4% nano urea on 30 DAT	51.09	5.67	4.13	4.78	15.86	1.17	11.45	53.18	273.19
T5=50:50:50 kg NPK ha^{-1}+ foliar spray of 0.4% nano urea on 30 DAT	46.02	7.67	4.32	5.05	13.66	0.95	10.85	44.84	230.93
T6=75:50:50 kg NPK ha^{-1}+ foliar spray of 0.5% urea on 30 and 60 DAT	55.71	6.93	4.88	3.98	15.76	1.18	11.86	60.48	290.13
T7=50:50:50 kg NPK ha^{-1}+ foliar spray of 0.5% urea on 30 and 60 DAT	50.02	6.60	3.66	4.23	12.33	1.92	11.45	50.97	236.11
T8=75:50:50 kg NPK ha^{-1}+ foliar spray of 1% urea on 30 and 60 DAT	54.56	6.93	4.88	4.38	11.65	1.43	10.33	61.05	297.75
T9= 50:50:50 kg, NPK ha^{-1}+ foliar spray of 1% urea on 30 and 60 DAT	49.69	6.33	4.58	5.07	12.74	0.88	11.50	49.07	243.84
SEm (± 5 %)	**0.22**	**0.26**	**0.24**	**0.21**	**-**	**-**	**-**	**0.45**	**0.51**
C.D.	**0.67**	**0.79**	**0.74**	**0.63**	**-**	**-**	**-**	**1.36**	**1.56**
C.V.	**0.73**	**6.25**	**9.37**	**7.66**	**NS**	**NS**	**NS**	**1.37**	**0.32**

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