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Influence of nano urea and boron on quality parameters of onion under northern Karnataka

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Abstract
A field experiment was conducted during *kharif* 2022-23 at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad to access the effect of nano urea and boron on quality parameters of onion. The experiment was laid out in randomized block design with twelve treatments and three replications. The plants grown with RDPK + 50% N (basal) + 50% N (nano urea) + Borax (0.5%) @ 45 & 60 DAT (25% N and 0.25% borax each) (T_{10}) recorded significantly higher total soluble solids (12.32 °Brix), pyruvic acid (2.15 µ moles g^{-1}), reducing sugar (2.60%), non-reducing sugar (3.28%) and total sugar (5.88%) compared to RDF and absolute control. Suggesting the application of RDPK + 50% N (basal) + 50% N (nano urea) + Borax (0.5%) @ 45 & 60 DAT (25% N and 0.25% borax each) (T_{10}) was found suitable for quality onion production.

Keywords: Foliar, Nano urea, onion, quality parameters

Introduction
Onion (*Allium cepa* L.) is important bulbous crop belongs to family *Alliaceae*. The South-West Asia is considered as primary center of origin. It is an indispensible item in every kitchen and used as vegetable, condiment cum spice for its flavour, aroma and medicinal properties. Hence it is referred as "Queen of Kitchen". The onion bulb is a valuable source of vitamins, proteins, quercetin and flavonoids. The Quercetin helps in elimination of free radicals in human body. The pungency in onion is due to presence of *Allyl propyl disulphide* which is colourless, odourless and volatile in nature. In India onion is grown mainly in *kharif*, late *kharif* and *rabi* seasons. Among the seasons, the *kharif* season produce have less quality parameters due to improper nutrient management practices. This constraint can be minimized by integrating nutrient management practices during *kharif* season.

Application of essential nutrient are necessary for getting quality produce. Among the essential nutrients, the quality of produce is mainly depends upon timely supply of nitrogenous nutrient. The basal applied nitrogenous fertilizer restrict its availability to the crop due to many reasons. To meet requirement of crop, farmers are supplying more nitrogenous fertilizers in the form of urea. The soil applied urea undergoes rapid transformation processes like leaching, volotization, denitrification etc., resulting into losses. In this regard, use of nano urea become alternative source because the nano particles are very smaller in size (10^{-9}) and also releases nutrients slowly as compared to traditional fertilizers (Rathanayaka *et al.*, 2018) [9] besides, boron micro-nutrient also plays important role in quality of onion and it helps in nitrogen metabolism, cell division, protein formation and maintains a balance between starch and sugar in the plant. By considering the above points in view, the present work was undertaken.

Materials and Methods
The present field experiment was carried out at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad, during *kharif* season of 2022-23. The experimental area located in Northern Transitional Zone (Zone VIII) of Karnataka. The experiment was laid out in the Randomized Block Design (RBD) with twelve treatments and three replications *viz.*, T_1: RDF (FYM at 30 t + 125:75:125 N, P_2O_5 and K_2O kg ha^{-1}), T_2: RDPK + 50% N (basal) + 50% N (nano urea) @ 45 DAT, T_3: RDPK + 50% N (basal) + 50% N (nano urea) @ 60 DAT, T_4: RDPK + 50% N (basal) +50% N (nano urea) @ 45 & 60 DAT (25% N each), T_5: RDF + Borax (0.5%) @ 45 DAT, T_6: RDPK + 50% N (basal) + 50% N (nano urea) + Borax (0.5%) @ 45 DAT, T_7: RDPK + 50% N (basal) + 50% N (nano urea) + Borax (0.5%) @ 60 DAT, T_8: RDPK + 50% N (basal) + 50% N (nano urea) @ 45 & 60 DAT (25% N each) + Borax (0.5%) @ 45 DAT, T_9: RDPK + 50% N (basal) + 50% N (nano urea) @ 45 & 60 DAT (25% N each)

+ Borax (0.5%) @ 60 DAT, T_{10}: RDPK + 50% N (basal) + 50% N (nano urea) + Borax (0.5%) @ 45 & 60 DAT (25% N and 0.25% borax each), T_{11}: Absolute control for N, T_{12}: Absolute control. The well decomposed FYM at the time of land preparation along with recommended half dose of nitrogen and full dose of phosphorous and potassium was applied as a basal dose and the remaining half dose of nitrogen was given in the form nano urea and boron, both were sprayed as per the treatments. From each treatment, harvested bulb was utilized for analysis of quality parameters like TSS, pyruvic acid, reducing sugar, non-reducing sugar and total sugar. Further the data was subjected to statistical analysis.

Results and Discussion

The significant variation in quality attributes of onion was observed in different foliar nano urea and boron applied treatments (Table 1 and 2). The treatment T_{10} [RDPK + 50% N (basal) + 50% N (nano urea) + Borax (0.5%) @ 45 & 60 DAT (25% N and 0.25% borax each)] resulted in higher TSS (12.32 ° Brix) content compared to other treatments (Table 1). The increased TSS content may be due to better synthesis and translocation of photosynthate from source to sink. Besides, boron might helped in biosynthesis of total soluble solids such as amino acid, organic acid, carbohydrates and other inorganic compounds within the plant. The results of improved TSS content are inline with findings of Deshmukh (2017) [2] and Kaur *et al.* (2022) [4] in onion, Rani *et al.* (2018) [8] and Mehta *et al.* (2017) [7] in garlic. Similarly higher pyruvic acid content (2.15 µ moles g^{-1}) was observed in treatment T_{10} (Table 1) might be due to foliar applied nano urea and boron enhanced metabolic activity and enzymatic bio-process within the plant. Similar improved pyruvic acid content in onion was observed by Jain *et al.* (2014) [3], Manna *et al.* (2014) [6], Sethupathi and Paramasivan (2019) [10] and Tekalign *et al.* (2012) [11].

Besides. the plants receiving RDPK + 50% N (basal) + 50% N (nano urea) + Borax (0.5%) @ 45 & 60 DAT (25% N and 0.25% borax each) (T_{10}) showed maximum reducing (2.60%), non-reducing (3.28%) and total sugar (5.88%) (Table 2) compared to other treatments might be due to foliar sprayed nitrogen and boron might increased accumulation of carbohydrate through enhanced photosynthetic activities. Besides, boron maintains balance between sugar and starch. Similar positive results of increased sugar content with foliar spray of nutrients were reported by Abhishek (2017) [1], Deshmukh, (2017) [2] and Manikanta *et al.* (2023) [5].

Table 1: Effect of foliar application of nano urea and boron on total soluble solid (°Brix) and Pyruvic acid (µ moles g^{-1}) of onion bulb

Tr. No.	Treatment details	TSS (° Brix)	Pyruvic acid (µ moles g^{-1})
T_1	RDF (FYM at 30 t + 125:75:125 N, P_2O_5 and K_2O kg ha^{-1})	9.90	1.29
T_2	RDPK + 50% N (basal) + 50% N (nano urea) @ 45 DAT	10.23	1.61
T_3	RDPK + 50% N (basal) + 50% N (nano urea) @ 60 DAT	9.80	1.25
T_4	RDPK + 50% N (basal) +50% N (nano urea) @ 45 & 60 DAT (25% N each)	11.12	1.80
T_5	RDF + Borax (0.5%) @ 45 DAT	10.16	1.56
T_6	RDPK + 50% N (basal) + 50% N (nano urea) + Borax (0.5%) @ 45 DAT	10.80	1.74
T_7	RDPK + 50% N (basal) + 50% N (nano urea) + Borax (0.5%) @ 60 DAT	10.13	1.45
T_8	RDPK + 50% N (basal) + 50% N (nano urea) @ 45 & 60 DAT (25% N each) + Borax (0.5%) @ 45 DAT	12.16	2.10
T_9	RDPK + 50% N (basal) + 50% N (nano urea) @ 45 & 60 DAT (25% N each) + Borax (0.5%) @ 60 DAT	12.10	1.96
T_{10}	RDPK + 50% N (basal) + 50% N (nano urea) + Borax (0.5%) @ 45 & 60 DAT (25% N and 0.25% borax each)	12.32	2.15
T_{11}	Absolute control for N	7.41	0.98
T_{12}	Absolute control	6.10	0.71
Mean		10.18	1.55
S.Em. ±		0.38	0.10
C.D. @ 5%		1.14	0.24

Note:
RDF- Recommended dose of fertilizer
RDPK- Recommended dose of phosphorous and potassium
DAT- Days after transplanting
TSS- Total soluble solids

Table 2: Effect of foliar application of nano urea and boron on reducing sugar (%), non-reducing sugar (%) and total sugar (%) of onion bulb

Tr. No.	Treatment details	Reducing sugar (%)	Non- reducing sugar (%)	Total sugar (%)
T_1	RDF (FYM at 30 t + 125:75:125 N, P_2O_5 and K_2O kg ha^{-1})	1.90	2.55	4.45
T_2	RDPK + 50% N (basal) + 50% N (nano urea) @ 45 DAT	2.10	2.82	4.92
T_3	RDPK + 50% N (basal) + 50% N (nano urea) @ 60 DAT	1.83	2.42	4.25
T_4	RDPK + 50% N (basal) +50% N (nano urea) @ 45 & 60 DAT (25% N each)	2.28	2.90	5.18
T_5	RDF + Borax (0.5%) @ 45 DAT	2.06	2.72	4.78
T_6	RDPK + 50% N (basal) + 50% N (nano urea) + Borax (0.5%) @ 45 DAT	2.20	2.81	5.01
T_7	RDPK + 50% N (basal) + 50% N (nano urea) + Borax (0.5%) @ 60 DAT	2.00	2.59	4.59
T_8	RDPK + 50% N (basal) + 50% N (nano urea) @ 45 & 60 DAT (25% N each) + Borax (0.5%) @ 45 DAT	2.51	3.20	5.71
T_9	RDPK + 50% N (basal) + 50% N (nano urea) @ 45 & 60 DAT (25% N each) + Borax (0.5%) @ 60 DAT	2.48	3.17	5.65
T_{10}	RDPK + 50% N (basal) + 50% N (nano urea) + Borax (0.5%) @ 45 & 60 DAT (25% N and 0.25%	2.60	3.28	5.88

	borax each)			
T_{11}	Absolute control for N	1.00	2.10	3.10
T_{12}	Absolute control	0.70	1.43	2.13
Mean		1.98	2.65	4.63
S.Em. ±		0.10	0.12	0.19
C.D. @ 5%		0.27	0.34	0.56

Note:
RDF- Recommended dose of fertilizer
RDPK- Recommended dose of phosphorous and potassium
DAT- Days after transplanting

Conclusion

From the present investigation it is inferred that, the basal application of recommended dose of phosphorous and potassium and 50 percent nitrogen followed by foliar application of 50 percent nitrogen (through nano urea) and Borax (0.5 percent) @ 45 & 60 DAT (25 percent N and 0.25 percent borax each, respectively) (T_{10}) was found suitable for Obtaing improved quality onion produce.

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