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Effect of Foliar Sprays of Super Nano Urea on Yield and Economics of Hybrid Maize in Inceptisols

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ABSTRACT

A field experiment entitled, "Effect of foliar sprays of super nano urea on growth, yield, nutrient uptake, nutrient availability and economics of hybrid maize in inceptisols" was conducted during the year 2023-2024 at the Research Farm of Interfaculty Department of Irrigation water Management, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahilyanagar, Maharashtra, India, with objectives, to study the growth, yield attributes, yield and economics of hybrid maize as influenced by foliar application of super nano urea.

The experiment was carried out in Randomized Block Design with eleven treatments replicated three times. Maize crop was planted by dibbling on 11th July, 2023 at 0.60 x 0.20 m spacing. The irrigations were provided as per requirement based on climatological parameters. The cultural operations and plant protections measures were carried out timely.

The results indicated that the application of 100% recommended dose of $N:P_2O_5:K_2O$ significantly enhanced the yield contributing characters at 30, 60, 90 DAS. Treatment T_2 (100 % RDF) produced significantly maximum grain yield (75.00 q ha^{-1}) and stover yield (90.00 q ha^{-1}) than all other treatments. However, treatment T_{11} (75 % RDN) grain yield (72.14 q ha^{-1}) and stover yield (86.56 q ha^{-1}) was at par with T_2. The per cent increase over treatment T_3 in grain yield was maximum in T_6 i.e. 23.32 per cent followed by T_7 i.e. 22.12 per cent.

Among 50% RDN with foliar sprays of SNU treatments, treatment T_6 (50% RDN + 2 sprays of SNU @1 .0% at 30 DAS and 55 DAS) recorded highest grain yield (68.74 q ha^{-1}) and stover yield (82.48 q ha^{-1}) as compared to treatment T_7 (50% RDN + 2 sprays of conventional urea @1 .0% at 30 DAS and at 55 DAS) i.e. grain yield (68.07 q ha^{-1}) and stover yield (81.68 q ha^{-1}).

The treatment T_2 (100 % RDF) resulted into higher gross monetary returns of ₹ 187050 ha^{-1}, net monetary returns (₹ 83317 ha^{-1}) and B:C ratio (1.80).

On the basis of the results obtained, from one year of research experiment, it can be concluded that application of 75% RDN along with 100% RD of P_2O_5 and K_2O (90:60:40 $N:P_2O_5:K_2O$ kg ha^{-1}) can be beneficial for increase in the yield contributing characters, yield and net monetary returns of hybrid maize. The per cent increase in grain yield of 23.32 per cent in T_6 (50 % RDN + 2 sprays of SNU @ 1.0% (30 DAS and 55 DAS)] followed by T_7 [50% RDN + 2 sprays of conventional urea @ 1.0% (30 DAS and 55 DAS)] i.e. 22.12 per cent over T_3 might be due to foliar application of super nano urea.

Key words: *Super nano urea, per cent increase in yield, conventional urea and recommended dose of fertilizer.*

Introduction

Maize (*Zea mays* L.) is the third most significant cereal crop in the world, following wheat and rice. It is the most cultivated among the food crop for its ample food calories and protein for more than one thousand million human beings in the world. Maize is often referred to as a "miracle crop" and the "queen of cereals" due to its remarkable productivity (Ikramullah *et al*., 2011). Globally it is grown in 197 M ha area producing 1147.6 M tons grains with an average productivity of 5920 kg ha^{-1}. Alone in India, maize is grown on 10.74 M ha area producing 38.08 Mt grains with productivity of 3545 kg ha^{-1}. In India, maize is grown on 1.34 m ha area producing 3.91 Mt grains with productivity of 2913 kg ha^{-1} (Anonymous, 2022). There are plenty of opportunities in the Indian maize sector throughout all of its subsectors, including seed, farm mechanization, processed food items, industrial goods, storage, and processing etc. Additionally, it has a promising capacity to give maize growers an increased income along with food, feed, and nutritional security.

Considering the maize crop, the absence of water in the soil restricts metabolic activity of maize, lowers its biomass and leaf area, and lowers its photosynthetic rate by lowering the amount of chlorophyll in the leaves. All of these factors eventually result in an overall decrease in maize production (Liu *et al*., 2018). So, to ensure the water availability and proper irrigation scheduling plays an important role here. In comparison to surface irrigation methods, which have an irrigation efficiency of only around 40 per cent, well designed and managed drip and sprinkler irrigation systems have irrigation

efficiency of approximately 90 per cent and 70 per cent, respectively (Jain *et al.,* 2019). Drip irrigation offers several benefits over surface irrigation, including reduced water use (30–50 per cent), increased crop yield, maximum use of available water, no water for weed growth, high fertilizer use efficiency, less labour, no soil erosion, possible sophisticated automatic control, no runoff, no fertilizer leaching into ground water, and less evaporation losses (Cetin and Akalp, 2019). The studies imply that the subsurface drip irrigation method could be an alternative to sprinkler irrigation for maize in regions with limited water resources. This would save water and boost the water productivity of maize (Valentin *et al*., 2020).

Nitrogenous fertilizer has a major impact on crop productivity and soil fertility. The application of nitrogen fertilizer increases grain yield (43-68 per cent) and biomass (25-42 per cent) in maize crop (Ogola *et al.,* 2002). Hence optimal application of nitrogen fertilizer plays an essential role (Fathi and Zeidali, 2021). India's soils lack nitrogen, which is necessary for plant growth. The primary causes of this nutrient loss are volatilization, denitrification, surface runoff and leaching (Yadav *et al.,* 2017). It occurs when we add nutrients and fertilizers to the soil; thus, we can use foliar application of fertilizers to prevent these losses. The process of applying fertilizer directly to a plant's leaves is known as foliar application. Using their foliage, plants can absorb nutrients. Foliar fertilization has become a popular technique in recent years for treating plant nutritional deficits. It may be more effective than applying fertilizers to the soil and has certain potential benefits (Silberbush, 2002). Similarly, for both macro and micronutrients in various soil types, foliar application is more effective in terms of yield than soil fertilizations (Arif *et al.,* 2006 and Ali *et al.,* 2008).

Nano fertilizer is a product of nanotechnology. The study, creation, and application of structures, machines, and systems by the manipulation of atoms and molecules at the nano scale that is, with one or more dimensions of the order of 100 nano meters (100 millionth of a milimeter) or less is known as nanotechnology. Nano fertilizers provide multiple benefits, including a threefold rise in nutrient use efficiency, a 55–60 times reduction in the need for chemical fertilizers, a 10–12 times increase in crop stress tolerance, a 30-35 per cent increase in plant nutrient mobilization, and an 18–54 per cent increase in crop yield (Rathore *et al.,* 2022). Super nano urea being a potential emerging nano fertilizer, its different concentrations and their effects on the maize crop have noteworthy role to play in agriculture sector and so in the food security. The present study aims to explore the response of maize to foliar application of super nano urea.

Materials and Methods

A field experiment conducted at the Research Farm of Interfaculty Department of Irrigation water Management, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahilyanagar, Maharashtra, India, during *kharif* season of 2023-2024 with objectives, to study the growth, yield attributes, yield and economics of hybrid maize as influenced by foliar application of super nano urea. Geographically, the central campus of Mahatma Phule Krishi Vidyapeeth, Rahuri situated between 19^0 47' and 19^0 57' N latitude and between 74^0 19' and 74^0 32' E longitude. The altitude is 495 to 565 m above the mean sea level. This tract is located on the eastern side of Western Ghat and lies in the west shadow zone.

The topography of experimental field was uniform and leveled. The soil of experimental field was well drained with 45 cm soil depth. Representative and composite soil sample was collected from experimental site for assessing the initial soil fertility status of the soil. The infiltration rate of the soil was 4.50 cm hr^{-1}. The soil was slightly alkaline in reaction (pH 7.87). The soil was low in available nitrogen (168.50 kg ha^{-1}), medium in available phosphorus (19.20 kg ha^{-1}) and high in available potassium (385.70 kg ha^{-1}). The mean values of moisture constants viz., field capacity and permanent wilting point were 40.30% and 17.26%, respectively. The bulk density of soil was 1.27 Mg m^{-3}.

The experiment was carried out in Randomized Block Design with eleven treatments replicated three times. The experiment comprised of T_1 – T_1 – Control i.e. No N: P_2O_5: K_2O, T_2 – 100 % Recommended Dose of Fertilizer (RDF), T_3 –50% RDN, T_4 –50% RDN+ 2 sprays of SNU @ 0.25% (30 DAS and 55 DAS), T_5 –50% RDN + 2 sprays of SNU @ 0.5% (30 DAS and 55 DAS), T_6 –50% RDN + 2 sprays of SNU @1.0% (30 DAS and 55 DAS), T_7 – 50% RDN + 2 sprays of conventional urea @ 1.0% (30 DAS and 55 DAS), T_8 –50% RDN + 1 spray of SNU @1.0% (55 DAS), T_9 -50% RDN + 2 sprays of SNU @ 0.5% (55 DAS and 75 DAS), T_{10} - 25% RDN + 3 sprays of SNU @ 0.5 % at 30 DAS (55 DAS and 75 DAS), T_{11} - 75 % RDN.

(RDN- Recommended Dose of Nitrogen, SNU- Super Nano Urea, DAS- Days After Sowing, 0.25% SNU concentration- 2.5 ml SNU L^{-1} water, 0.5% SNU concentration- 5 ml SNU L^{-1}, 1.0% SNU concentration- 10 ml SNU L^{-1}).

The fertilizers viz., urea, contains 46% of N, SSP contains 16% P2O5 and MOP containing 60% K2O and SNU (20% N) were applied as per the treatments. The recommended dose of fertilizer for Maize is 120:60:40: N: P_2O_5: K_2O kg ha^{-1}. The foliar application of SNU with different concentrations was carried out at different growth stages of maize crop. SNU (liquid) is an advanced formulation of nano urea with higher concentration of nitrogen (20% N w/v). It contains nitrogen forms (urea-amide, ammonaical, aminos etc.) and is functionalized with bio polymers and other excipients. It has nano size less than 100 nano meters with more surface area to volume ratio and higher loading of nitrogen. Thus, due to its better ability to spread on crop foliage followed by its efficient assimilation leads to higher chlorophyll and photosynthesis efficiency, enhanced crop yield and the quality of crop produced (Anonymous, 2024). The fertilizer schedule is given in Table 1.

Table 1 Fertilizer schedule for maize

Tr. No.	NPK (%)	Basal Dose	1st urea top dressing (30 DAS)	2nd urea top dressing (55 DAS)	3rd urea top dressing (75 DAS)
T_1	$N_0P_0K_0$	-	-	-	-
T_2	$N_{100}P_{100}K_{100}$	25% N	25% N	25% N	25 % N

T_3	$N_{50}P_{100}K_{100}$	25% N	25% N	-	-
T_4	$N_{50}P_{100}K_{100}$	25% N	25% N +First spray of SNU @ 0.25 %	Second spray of SNU @ 0.25%	-
T_5	$N_{50}P_{100}K_{100}$	25% N	25% N +First spray of SNU @ 0.5%	Second spray of SNU @ 0.5%	-
T_6	$N_{50}P_{100}K_{100}$	25% N	25% N +First spray of SNU @ 1.0%	Second spray of SNU @1.0%	-
T_7	$N_{50}P_{100}K_{100}$	25% N	25 % N +First spray of conventional urea @ 1.0%	Second spray of conventional urea @ 1.0%	-
T_8	$N_{50}P_{100}K_{100}$	25% N	25% N	First spray of SNU @ 1.0%	-
T_9	$N_{50}P_{100}K_{100}$	25% N	25% N	First spray of SNU @ 0.5%	Second spray of SNU @ 0.5%
T_{10}	$N_{25}P_{100}K_{100}$	25% N	First spray of SNU @ 0.5%	Second spray of SNU @ 0.5%	Third spray of SNU @ 0.5%
T_{11}	$N_{75}P_{100}K_{100}$	25% N	25% N	25% N	-

The sowing of the crop was done on 11th July 2023 at 0.60 x 0.20 m spacing. The plant protection measures were adopted as per recommended package of practices. The observations on various growth, yield contributing and yield parameters were recorded at different growth stages. The drip irrigation is applied at every alternate day Initial and treatment wise soil samples at 30, 60, 90 days after planting and at harvest of plant from 0-20 cm soil depth were collected from experimental field. These soil samples were mixed thoroughly and dried in shade, grind in mortal and pestle and sieved through 2 mm sieve. The periodical available nitrogen, available phosphorus and available potassium were determined by using standard methods. The observational maize plants and cobs were collected at harvest for chemical analysis. These plant samples were sundried and then in oven at 65^0C till constant weight. The samples are then grinded into fine powder and used for analysis of total nitrogen, phosphorus and potassium content. The standard methods were used for determination of nutrient content in plant sample.

The total cost of cultivation was calculated as cost of cultivation plus the fixed cost on irrigation systems which was more in 100% RDF treatment due to full application of fertilizers than 50% RDN treatments. Gross monetary returns were the returns from grain and stover yield, net monetary returns were gross monetary returns minus cost of cultivation and B:C ratio was gross monetary returns divided by cost of cultivation. The statistical analysis was performed by using analysis of variance (ANOVA) for randomized block design as per Panse and Sukhatme (1985).

Results and Discussion

Yield Contributing Characters

The data regarding the average number of cobs plant^{-1}, average number of grains plant^{-1}, average length of cob (cm), average girth of cob (cm) is presented in Table 2.

Tr. No.	**Treatments**	**No. of cobs plant^{-1}**	**No. of grains cob^{-1}**	**Length of cob (cm)**	**Girth of cob (cm)**	**100 grain weight (g)**	**Total weight of cob (g)**	**Weight of outer sheath of cob (g)**
T_1	Control	1.00	403.00	20.20	12.20	28.47	219.99	19.18
T_2	Recommended Dose of Fertilizer (RDF)	1.67	697.00	29.93	16.14	43.66	287.16	56.36
T_3	50% RDN	1.00	462.00	22.50	13.00	31.47	228.68	24.00

T_4	50% RDN+ 2 sprays of SNU @ 0.25% (30 DAS and 55 DAS)	1.00	507.02	22.90	13.01	32.57	236.68	25.34
T_5	50% RDN + 2 sprays of SNU @ 0.5% (30 DAS and 55 DAS)	1.00	532.00	23.10	13.07	33.09	238.22	28.91
T_6	50% RDN + 2 sprays of SNU @ 1 .0% (30 DAS and 55 DAS)	1.33	615.00	25.90	14.96	36.92	272.75	42.21
T_7	50% RDN + 2 sprays of conventional urea @ 1 .0% (30 DAS and 55 DAS)	1.33	615.00	25.43	14.06	36.11	261.16	40.320
T_8	50% RDN + 1 spray of SNU @ 1.0% (55 DAS)	1.00	588.00	24.50	13.52	34.14	250.43	35.09
T_9	50% RDN + 2 sprays of SNU @ 0.5% (55 DAS and 75 DAS)	1.00	555.00	23.20	13.11	33.77	241.28	33.81
T_{10}	25% RDN + 3 sprays of SNU @ 0.5% (30 DAS, 55 DAS and 75 DAS)	1.00	420.00	21.13	12.76	31.02	225.19	20.30
T_{11}	75% RDN	1.33	678.00	28.66	15.12	40.98	281.20	51.78
	S.E.(m) ±	0.19	9.01	0.68	0.35	1.38	4.49	2.12
	C.D at 5%	NS	26.58	2.02	1.02	4.08	13.46	6.36
	General mean	1.152	552.00	24.40	13.72	34.74	249.34	34.30

Table 2 Yield contributing characters of maize as influenced by foliar application of super nano urea

The data regarding number of cobs plant $^{-1}$ as influenced by different treatments was non significant. The maximum average number of grains cob^{-1} (697.00), average length of cob (29.93 cm), average girth of cob (16.14 cm), 100 grain weight (43.66 g), total weight of cob (287.16 g) and weight of outer sheath of cob (56.36 g) of maize were recorded in treatment T_2 (100% RDF of N:P_2O_5:K_2O). However, treatment T_{11} (75% RDN) was at par with T_2. These results are in close confirmation with the observations recorded by Navya *et al.* (2021).

Treatment T_1 i.e. no N:P_2O_5:K_2O recorded minimum figures for average number of grains cob^{-1} (403.00), average length of cob (20.20 cm), average girth of cob (12.20 cm), 100 grain weight (28.47 g), total weight of cob (219.99 g) and weight of outer sheath of cob (19.18 g). It might be due lack of proper nutrition.

Yield

The data regarding the grain yield (q ha^{-1}), stover yield (q ha^{-1}) and per cent increase in the grain yield as influenced by different treatments of super nano urea is presented in Table 3.

Table 3 Yield of maize as influenced by foliar application of super nano urea

Tr. No.	**Treatments**	**Grain yield (q ha^{-1})**	**Stover yield (q ha^{-1})**	**Increase in the grain yield (%)**	**Increase in the stover yield (%)**
T_1	Control	46.81	56.17	-	-
T_2	Recommended Dose of Fertilizer (RDF)	75.00	90.00	-	-
T_3	50% RDN	55.74	66.83	-	-
T_4	50 % RDN+ 2 sprays of SNU @ 0.25 % (@ 30 DAS, @ 55 DAS)	59.88	71.85	7.42	7.51
T_5	50 % RDN + 2 sprays of SNU @ 0.5 % (@ 30 DAS, @ 55 DAS)	61.20	73.44	9.79	9.89

T_6	50 % RDN + 2 sprays of SNU @ 1 .0 % (@ 30 DAS, @ 55 DAS)	68.74	82.48	23.32	23.41
T_7	50 % RDN + 2 sprays of Conventional Urea @ 1 .0 % (@ 30 DAS, @ 55 DAS)	68.07	81.68	22.12	22.22
T_8	50 % RDN + 1 spray of SNU @ 1.0 % (@ 55 DAS)	66.37	79.64	19.07	19.16
T_9	50 % RDN + 2 sprays of SNU @ 0.5 % (@ 55 DAS, 75 DAS)	60.98	73.17	9.40	9.48
T_{10}	25 % RDN + 3 sprays of SNU @ 0.5 % (@ 30DAS, 55 DAS, 75 DAS)	52.28	62.730	-	-
T_{11}	75% RDN	72.14	86.56	-	-
	S.E.(m) ±	1.37	1.28	0.86	3.21
	C.D at 5 %	4.07	3.77	2.54	9.47
	General mean	62.47	56.71	8.28	0.09

The significantly maximum grain yield (75.00 q ha^{-1}) and stover yield (90.00 q ha^{-1} of maize were recorded in treatment T_2 (100% RDF of $N:P_2O_5:K_2O$). However, treatment T_{11} (75% RDN) i.e. grain yield (72.14 q ha^{-1}) and stover yield (86.56 q ha^{-1}) was at par with T_2.

Among 50% RDN treatments, treatment T_6 [50 % RDN + 2 sprays of SNU @ 1 .0% (30 DAS and 55 DAS)] recorded higher grain yield (68.74 q ha^{-1}) and stover yield (82.48 q ha^{-1}) as compared to T_7 [50% RDN + 2 sprays of conventional urea @ 1 .0% (30 DAS and 55 DAS)] i.e. grain yield (68.07 q ha^{-1}) and stover yield (81.68 q ha^{-1}) and remained at par with each other. This might be due to nano fertilizers can be easily penetrate through cuticle of leaves, so more absorption ensuring controlled release and the targeted delivery resulting in efficient use of nutrient. These results are in close confirmation with the observations recorded by Veeresh *et al.* (2024) that application of 100% RDN has recorded significantly higher grain yield and straw yield in comparison to no nitrogen and 50% RDN. However, 75% RDN found at par with 100% RDN. Among foliar nitrogen, spray of nano urea recorded significantly higher grain yield compared to 0.5% and 1% conventional urea.

The per cent increase in grain yield was of 23.32 per cent in treatment T_6 [50 % RDN + 2 sprays of SNU @ 1 .0% (30 DAS and 55 DAS)] followed by T_7 [50% RDN + 2 sprays of conventional urea @ 1 .0% (30 DAS and 55 DAS)] i.e. 22.12 per cent grain yield over treatment T_3 (50% RDN) was observed. This might be due foliar spray of nano fertilizers which can be easily penetrate through cuticle of leaves, so more absorption ensuring controlled release and the targeted delivery resulting in efficient use of nutrient and increase in percent increase in yield. These results are in close confirmation with the observations recorded by the Nirere *et al.* (2019), reported that foliar spray of water soluble fertilizer recorded significantly higher grain yield as compared to other treatments. Similar results were observed by Samui *et al.* (2022), Kalyana Murthy *et al.* (2024), Kumar *et al.* (2024).

The minimum in treatment grain yield (46.81 q ha^{-1}) and stover yield (56.17 q ha^{-1}) of maize were recorded T_1 i.e. no $N:P_2O_5:K_2O$ at harvest due to lack of proper nutrition.

Economic Analysis

The data regarding the seasonal cost of cultivation (₹ ha^{-1}), net seasonal income (₹ ha^{-1}), and B:C ratio and net extra income over control of maize as influenced by foliar application of super nano urea is presented in Table 4.

Cost of Cultivation

The cost of cultivation of maize was influenced by application of fertilizer and foliar sprays of super nano urea (Table 4). The maximum cost of cultivation of ₹ 103733 ha^{-1} was observed in treatment T_2 (100% RDF of $N:P_2O_5:K_2O$) followed by T_6 [50% RDN + 2 sprays of SNU @ 1.0% (30 DAS, 55 DAS)] i.e. ₹ 103707 ha^{-1}.

The lowest cost of cultivation was observed in the control (T_1) of ₹ 85403 ha^{-1} where no fertilizers were applied and no spraying resulting in low cost of cultivation.

Gross Monetary Returns

The gross monetary returns of maize were influenced by application of fertilizer and foliar sprays of super nano urea (Table 4). The significantly maximum gross monetary return of ₹ 187050 ha^{-1} was observed in treatment T_2 (100% RDF of $N:P_2O_5:K_2O$). However, T_{11} (75% RDN) i.e. ₹ 179916.20 ha^{-1}, was at par with T_2.

The lowest gross monetary return was observed in control treatment T_1 of ₹ 116743.90 ha^{-1} where no fertilizers and no spraying were applied resulted in low gross monetary returns.

Net Monetary Returns

The net monetary returns of maize were influenced by application of fertilizer and foliar sprays of super nano urea (Table 4). The significantly maximum net monetary return of ₹ 83317 ha^{-1} was observed in treatment T_2 (100% RDF of $N:P_2O_5:K_2O$). However, T_{11} (75% RDN) i.e. ₹77556.27 ha^{-1}, was at par with T_2.

The lowest net monetary return was observed in treatment T_{10} (25% RDN + 3 sprays of SNU @0.5% (30 DAS, 55 DAS and 75 DAS) i.e. ₹ 27124.13 ha^{-1}. These results are in close conformity with the results reported by Rajesh *et al*. (2021).

B:C Ratio

When the B:C ratio is greater than 1 the treatment is said to be profitable and if it is less than 1, then treatment show more expenditure than income so not profitable and if the value is 1 then there is no profit or loss. The B:C ratio was improved under different treatment with foliar spray of super nano urea fertilizer.

The data regarding B:C ratio of maize as influenced by application of fertilizer and foliar sprays of super nano urea is presented in Table 4. The maximum value of B:C ratio was observed in treatment T_2 i.e. 1.80 (100% RDF of $N:P_2O_5:K_2O$) followed by T_{11} (75% RDN) i.e. 1.75. The lowest B:C ratio was observed in control treatment T_{10} (25% RDN + 3 sprays of SNU @0.5% (30 DAS, 55 DAS and 75 DAS) i.e. 1.26.

These results are in close conformity with the results of Nirere *et al.* (2019) and Sankar *et al*. (2020).

Table 4 Economics of maize as influenced by foliar application of super nano urea

Tr. No.	Treatments	Cost of Cultivation (₹ ha^{-1})	Gross Monetary Returns (₹ ha^{-1})	Net Monetary Returns (₹ ha^{-1})	B:C ratio
T_1	Control	85403	116743.90	31340.90	1.36
T_2	Recommended Dose of Fertilizer (RDF)	103733	187050	83317	1.80
T_3	50% RDN	94255	139014.60	44759.60	1.47
T_4	50% RDN+ 2 sprays of SNU @0.25% (30 DAS and 55 DAS)	101417	1493340	47923	1.47
T_5	50% RDN + 2 sprays of SNU @0.5% (30 DAS and 55 DAS)	102847	152632.80	49785.80	1.48
T_6	50% RDN + 2 sprays of SNU @1 .0% (30 DAS and 55 DAS)	103707	171436.60	67729.60	1.65
T_7	50% RDN + 2 sprays of conventional urea @1 .0% (30 DAS and 55 DAS)	100615	169766.10	69151.10	1.68
T_8	50% RDN + 1 spray of SNU @1.0% (55 DAS)	101929	165526.30	63597.30	1.62
T_9	50% RDN + 2 sprays of SNU @0.5% (55 DAS and 75 DAS)	102825	152083.40	49258.40	1.47
T_{10}	25% RDN + 3 sprays of SNU @0.5% (30 DAS, 55 DAS and 75 DAS)	103261.47	130385.60	27124.13	1.26
T_{11}	75% RDN	102359.93	179916.20	77556.27	1.75
	S.E.(m) ±	-	3342	3342	-
	C.D at 5%	-	10047	10047	-
	General mean	-	155808.70	55594.83	-

Conclusion

On the basis of the results obtained, from one year of research experiment, it can be concluded that application of 75% RDN along with 100% RD of P_2O_5 and K_2O (90:60:40 $N:P_2O_5:K_2O$ kg ha^{-1}) can be beneficial for increase in the yield contributing characters, yield and net monetary returns of hybrid

maize. The per cent increase in grain yield of 23.32 per cent in T_6 (50 % RDN + 2 sprays of SNU @ 1.0% (30 DAS and 55 DAS)] followed by T_7 [50% RDN + 2 sprays of conventional urea @ 1.0% (30 DAS and 55 DAS)] i.e. 22.12 per cent over T_3 might be due to foliar application of super nano urea.

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Principal Investigator or Research Guide or Chairperson of research: Dr. K.D. Kale

University: Mahatma Phule Krishi Vidyapeeth, Rahuri, 413 722, India.

Research project name or number: [If any], PhD Thesis, M.Sc. (Agri) Thesis.

Author Contributions: All authors equally contributed

Author statement: All authors read, reviewed, agreed and approved the final manuscript. Note-All authors agreed that- Written informed consent was obtained from all participants prior to publish / enrolment

Study area / Sample Collection: PGI Farm, Rahuri, 413 722

Cultivar / Variety / Breed name: Maize, PAC 751

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

Ethical Committee Approval Number:

Ethical Committee Approval Number: Institutional Animal Ethics Committee (IAEC) -if the project involves field trails/experiments/exchange of specimens, human & animal materials etc.

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