NANO-FERTILIZERS ~~EFFECT OF~~for NITROGEN MANAGEMENT ~~THROUGH NANO FERTILIZERS ON~~Concerning GROWTH~~,~~ and YIELD~~ATTRIBUTES AND YIELD~~OF MAIZE ~~(*Zea mays* L.)~~

Abstract

We carried out a~~A~~ field experiment ~~on "Effect of nitrogen management through nano fertilizers on growth, yield attributes and yield of maize (*Zea mays* L.)"~~ was carried out during ~~*Kharif*~~*Fall* 2022-23 at the Integrated Farming System demonstration unit, L-block, GKVK, Bengaluru, consisting of 11 treatments~~replicated thrice~~with three replicates~~and laid out~~ in a Randomized Complete Block Design. The treatments consisted of T_1-(No nitrogen), T_2-Nitrogen management as per package of practices (UASB), T_3-50%RDN+foliar ~~spray of~~ nano-N at 30 and 50 DAS, T_4-50%RDNP+ foliar ~~spray of~~nano-NP at 30 and 50 DAS, T_5-Foliar ~~spray of only~~ nano-N at 30, 50 and 70 DAS, T_6-Foliar ~~spray of only~~ nano-NP at 30, 50, and 70 DAS, T_7-25%RDN+foliar ~~spray of~~ nano-N at 30, 50 and 70 DAS, T_8-25%RDNP+foliar ~~spray of~~ nano-NP at 30, 50 and 70 DAS, T_9-100% RDN+NDVI based nano-N spray, T_{10}-100% RDN+NDVI based nano-NP spray and T_{11}-100% RDN+NDVI based conventional urea spray. The resultsrevealed that application of 100%RDN+NDVI based nano-N spray recorded higher plant height (229.3 cm), number of leaves at 90 DAS (15.76), dry matter production (354.9 g plant^{-1}), GreenSeeker readingat 30, 50 and~~at~~70 DAS after spray (0.43, 0.58 and 0.73, respectively), cob length, cob girth and cob weight (20.5 cm, 5.49 cm, and 201.9 g plant^{-1}, respectively) and higher kernel and stover yield (7729 and 8948 kg ha^{-1}, respectively)over other treatments and on it was par with 100% RDN+NDVI based conventional urea spray and 100% RDN + NDVI based nano NP spray.

Keywords: Conventional urea, Foliar spray, GreenSeeker, Nano-nitrogen

INTRODUCTION

Maize (*Zea mays*) is one of the important cereal crops with wide adaptability to various agro-climatic conditions in the world.It holds the top position ~~with respect to~~concerning production in the world. In India, it ranks third after rice and wheat. The maize is being called the "Queen of cereals" due to its higher production potential. Maize grains are used for human consumption~~,~~and feed for poultry and livestock. In India, it is cultivated in an area of 9.95 million hectares with a production of 34.61million tonnes and productivity of 3.38t ha^{-1}. In Karnataka, it occupies an area of 1.59 million hectares~~,~~ with ~~the~~ aproduction of 5.22 million tonnes and productivity of 3.20 t ha^{-1}(Anon., 2022).

Maize is an exhaustive crop and requires a balanced supply of the entire 3 major nutrients (N, P, and K). The hybrids of maize are very responsive to the external supply of nutrients. ~~Application~~ The application rate of nutrients depends on soil nutrient status.Conventional fertilizers greatly impact ~~the~~global food security and without which, there would be only half of the amount of food production that we are producing now. About 35-40% of the crop productivity depends upon fertilizer(Rameshaiah., *et al*. 2015). These applied conventional fertilizers are subjected to various types of losses such as leaching, volatilization, denitrification, and fixation,*etc*. which reduces their efficiency. Based on recent fertilizer use efficiency studies it is identified that the efficiency of fertilizer nitrogen is only 30-40% in rice and 50-60% in other cereals, while the efficiencies of fertilizer~~sphosphorus~~P, and ~~potassium~~ Kare 15-20%, 45-70% in most of the crops (Rakshit, 2012).

Latest technologies such as controlled release techniques and targeted delivery of agrochemicals (fertilizers and pesticides) for plant nutrition and pest control ~~and~~ thus, increase food safety and security. Nano fertilizers. have theproperties to release nutrients effectively on-demand that regulate plant growth andenhance target activity (Derosa*et al*., 2010). The nano-coated materials enhance thepenetration via stomata with a size exclusion limit above 10 nm (Perez, 2017). Inaddition to this, nano-carriers transport the nutrients in the right place and right timeand act~~s~~ as the right source, reducing the extra amount of active chemicals deposited intothe plant system and increasing nutrient use efficiency. Nano-fertilizers have a highsurfacearea,sorptioncapacity,andcontrolled-releasekineticstotargetedsitesandhavebeenconsidered thesmartdeliverysystem

Foliar application of nano fertilizers is being researched in India to see if theymight boost

nutrient production and improve plant nutrition when compared to ~~regular~~fertilizers. The usage of nano fertilizers extends the time and rate of element release intheplantsystem,allowingittomatchplantnutritionalrequirements.Asaresponse,theplant can absorb the maximum amount of nutrients, ~~resulting in an increase in~~increasing cropyield.

Material and methods

~~A~~We carried out a field experiment was conducted during the ~~*khariffall*~~of 2022-23 at the Integrated Farming System demonstration block (L-block), Zonal Agricultural Research Station, Gandhi KrishiVignana Kendra (GKVK), University of Agricultural Sciences (UAS), Bangalore. The site of experimentation was in Agroc~~ C~~limatic Zone V (Eastern Dry Zone) of Karnataka, located ~~in~~ at12º 51' N Latitude and 77º 35' E Longitude at an altitude of 930 m above mean sea level (MSL). ~~There were~~We designed11 treatments ~~laid~~ ina Randomized Complete Block Design ~~and~~ with three~~replicated~~ replicates~~three times~~. The treatments were T_1- (Nonitrogen), T_2- Nitrogen management as per the PoP (UASB), T_3-50% RDN + foliar ~~spray of~~ nano-nitrogen at30 and 50 DAS, T_4- 50% RDNP+ foliar ~~spray of~~ nano-NP at 30 and 50 DAS, T_5-~~only~~foliar ~~spray of~~ nano-nitrogen at 30, 50 and70DAS, T_6-~~only~~ foliar ~~spray of~~ nano-NP at 30, 50 and70DAS,T_7- 25%RDN + foliar ~~spray of~~ nano-nitrogen at 30, 50 and 70 DAS T_8-25%RDNP + foliar ~~spray of~~ nano-NP at 30,50 and 70 DAS, T_9-100% RDN+ NDVI based nano-nitrogen spray,T_{10}-100%RDN+ NDVI based nano-NP spray, and T_{11}-100% RDN + NDVI based conventional urea spray. The crop was raised using a standard package of practices for all other aspects. ~~For all the treatments, t~~The recommended dose of potassium was applied for all the treatments~~commonly~~.High yielding, disease tolerant, stay green single cross maize hybrid MAH-14-5 suitablefor all seasons was selected for the study.

The soil of the experimental site ~~is~~ wasred sandy loam with coarse sand (32.50%), fine sand (31.70%), Silt (6.70%), and Clay (29.10%) as soil components. The soil reaction was neutral (6.18) with an EC of 0.22 dS m^{-1}, medium in available nitrogen (292 kg ha^{-1}), ~~available~~ phosphorus (52.7 kg ha^{-1}), and ~~available~~ potassium (188.5 kg ha^{-1}). ~~The experimental data obtained at different growth stages was compiled and subjected to statistical analysis by adopting Fischer's method of analysis of variancetechnique as outlined by Gomez and Gomez (1984). The level of significance used in 'F' test was p = 0.05.The critical difference (CD) value was given in the table at 0.05 per cent level of significance.~~

GreenSeeker is an optical sensor technology used in agriculture to assess and manage crop health, particularly ~~with regard to~~concerning nitrogen management. It works by emitting and measuring the reflection of light at two specific wavelengths one in the visible spectrum (660 nm) and the other inthe near-infrared spectrum (770 nm). Measured spectral reflectance is expressed as spectral vegetationindices such as the Normalized Difference Vegetation Index (NDVI). NDVI is a valuableindicator of crop health and more specifically, the nitrogen status of the crop canopy. NDVI valuestypically range from 0 to 1higher value indicating healthier and ~~nitrogen-~~nitrogen-rich vegetation. For instance,if NDVI values are below 0.3 between 15-30 DAS, application of 25 kg ha^{-1}nitrogen is recommended, if values are below 0.5 between 45-60 DAS, application of 25 kg ha^{-1}nitrogen is recommended. When NDVI values reach more than 0.7 between 70 DAS -silking, noadditional nitrogen application. (Puneet, 2011 and GurunathRaddy, 2022).

Statistical analysis

The experimental data obtained at different growth stages was compiled and subjected to statistical analysis by adopting Fischer's method of analysis of variancetechnique as outlined by Gomez and Gomez (1984). The level of significance used in the 'F' test was p = 0.05.The critical difference (CD) value was given in the table at a 0.05%~~per cent~~level of significance.

Results and Discussion

Growth attributes: ~~Phenotypic~~ The phenotypic character of plants is vital in realizing the crops' potentialoutput. The data ~~pertaining to~~aboutplant height, number of leaves, and dry matter production at various growth stages under the influence of nitrogen management practices using nano fertilizers is presented in Table 1.

At 30 DAS, there were no significant differences in plant height between the treatments. Whereas, at 60, 90 DAS, and at harvest,application of ~~100% RDN + NDVI based foliar spray of nano nitrogen~~T_9 recorded significantly (P< 0.05) higher plant height ~~(200.3, 216.4 and 222.9 cm, respectively)~~and it was on par with T_{11}~~100% RDN + NDVI based conventional urea spray(196.3, 211.0 and 217.4 cm, respectively)~~,T10,~~100% RDN + NDVI based nano NP spray (192.5, 209.0 and 215.3 cm respectively)~~and T_2~~nitrogen management as per package of practice (189.1, 207.8 and 212.1 cm respectively)~~. Whereas, T_1~~treatment with no nitrogen treatment~~ recorded significantly (P<0.05) lower plant height at 60, 90 DAS, and at harvest ~~(134.2,146.5~~

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~~and 152.9 cm, respectively)~~. Initially, a greater plant height was observed with T_2 ~~nitrogen management as package of practices~~. Nevertheless, in the later stages, the application of nano-nitrogen through foliar spraying led to enhanced plant height might be due to spraying of nano-nitrogen based on NDVI value synchronized with the crop demand, ~~resulted~~ resulting in higher nutrient uptake both from the root, as well from leaves in turn increased cell division and growth (Raddy*et al*., 2022). Nanoparticles can move more easily within the plant and ~~facilitating~~ facilitate ~~for~~ better distribution of nutrients which ~~helped~~ helps in the growth of new cells thereby increased plant height (Asha Kiran, 2022). Similar results were noticed by Samui*et al*, (2022) and Prakasha*et al*, (2020).

Table 1: Plant height and number of leaves of maize as influenced by nitrogenmanagementthroughnano-fertilizers

Treatments	Plant height (cm)				Number of leaves per plant			
	30 DAS	60 DAS	90 DAS	At harvest	30 DAS	60 DAS	90 DAS	At harvest
T_1	32.49	134.2	146.5	152.9	6.29	9.81	10.67	10.01
T_2	36.61	189.1	207.8	212.1	7.06	13.23	15.13	13.50
T_3	34.26	179.5	194.3	200.7	6.62	12.46	14.15	12.72
T_4	34.75	182.3	197.8	204.0	6.72	12.66	14.40	12.91
T_5	29.42	154.8	168.1	174.4	5.72	10.75	12.24	10.96
T_6	30.16	155.8	169.0	175.3	5.86	10.82	12.31	11.04
T_7	32.75	166.7	180.7	187.1	6.35	11.57	13.16	11.81
T_8	33.06	169.5	183.7	190.1	6.40	11.77	13.38	12.01
T_9	35.87	200.3	216.4	222.9	6.92	13.77	15.76	14.06
T_{10}	35.06	192.5	209.0	215.3	6.77	13.37	15.22	13.64
T_{11}	35.05	196.3	211.0	217.4	6.77	13.65	15.37	13.93
F test	NS	*	*	*	NS	*	*	*
S.Em±	1.54	4.2	4.6	5.8	0.29	0.30	0.33	0.31
CD at 5%	-	12.3	13.4	17.1	-	0.87	0.98	0.90

~~Number~~ The number of leaves per plant didn't ~~varied~~ varysignificantly at different growth stages of maize as ~~influences~~ influencedby nitrogen management through nano fertilizers. Whereas, at 60, 90 DAS, and at harvest, significantly ($P<0.05$) more ~~number of~~ leaves per plant ~~(13.77, 15.76 and 14.06, respectively)~~ were recorded with the application of T_9~~100% RDN + NDVI based foliar spray of nano nitrogen~~ and it was on par with T_{11}~~100% RDN + NDVI based conventional urea spray (13.65, 15.37 and 13.93, respectively)~~,T_{10},~~100% RDN + NDVI based nano DAP spray (13.37, 15.22 and 13.64, respectively)~~and T_2~~nitrogen management as per package of practice (13.23, 15.13 and 13.50, respectively)~~. Whereas, T_1~~no nitrogen treatment~~ recorded a

significantly (P<0.05) lesser number of leaves per plant at 60, 90 DAS, and at harvest ~~(9.81, 10.67 and 10.01, respectively)~~.

In case of dry matter production per plant significantly higher total dry matter production was observed under treatment received with T_9 100% RDN + NDVI based foliar spray of nano nitrogen (100.5, 300.7 and 354.9 g plant^{-1}, respectively) at 60, 90, and at harvest and it was it was on par with T_{11} 100% RDN + NDVI based conventional urea spray (97.4, 292.5 and 346.5 g plant^{-1}, respectively), T_{10} 100% RDN + NDVI based nano DAP spray (95.8, 290.5and 344.6 g plant^{-1}, respectively) and T_2 nitrogen management as per package of practice (95.2, 288.6 and 341.2 g plant^{-1}, respectively). Whereas, T_1 control treatment recorded a significantly (P<0.05) lesser number of leaves per plant at 60, 90 DAS and at harvest (64.2, 197.7 and 228.7 g plant^{-1}, respectively)presented in Table 2.

Table 2: Total dry matter production and days to 50% tasseling of maize as influenced by nitrogenmanagement throughnanofertilizers

Treatments	Dry matter production (g plant^{-1})				Days to 50% tasseling
	30 DAS	60 DAS	90 DAS	At harvest	
T_1	15.5	64.2	197.7	228.7	61.6
T_2	17.9	95.2	288.6	341.2	61.5
T_3	16.8	89.8	270.5	320.7	59.8
T_4	17.1	91.3	276.3	327.6	59.9
T_5	15.1	77.1	235.8	280.0	60.3
T_6	15.2	77.7	237.1	281.5	60.3
T_7	16.2	83.2	253.8	301.2	58.6
T_8	16.3	84.7	258.1	306.3	58.7
T_9	17.6	100.5	300.7	354.9	59.1
T_{10}	17.2	96.8	290.5	344.6	59.6
T_{11}	17.2	97.4	292.5	346.5	59.8
F test	NS	*	*	*	NS
S.Em±	0.64	2.14	5.52	6.53	1.27
CD at 5%	-	6.28	16.20	19.15	-

Initially (up to 30 DAS) higher dry matter accumulation was observed in T_2 ~~nitrogen management as per package of practice treatment~~ due to an adequate quantity of nutrients available for crop growth and establishment. During later stages, both soil application and ~~NDVI~~ NDVI-based foliar spray of nano nitrogen improved dry matter production in plants which is mainly due to spraying of nano nitrogen based on NDVI value synchronized with the crop demand, nanoparticles easily enter plant epidermis due to higher surface area of the particles resulted in higher nutrient uptake and enhanced the photosynthetic activity in turn production of more photosynthates resulted in higher plant height and leaf area and reflected on higher dry matter production. These results ~~are in conformity~~conform withWang *et al*. (2011), Chandana*et al*. (2021) ~~and~~,and Choudhary*et al*. (2022).

There was no significant difference between the treatments in the case of days to 50%~~per cent~~ tasseling. But, numerically ~~lesser~~ fewer daysto attain~~ed~~ 50%~~per cent~~ tasseling with application of T_5 ~~25% RDN + nano nitrogen spray 30, 50 and 70 DAS(58.6 days)~~ followed by T_6 ~~25%RDNP + foliar spray of nano DAP at 30, 50 and 70 DAS (58.7)~~. While a higher number of days is required to attain 50%~~per cent~~ tasseling in T_1 ~~no nitrogen treatment (61.6)~~ and T_2 ~~nitrogen management as per PoP (61.2)~~.

GreenSeeker reading

The data regardingGreenSeeker readings before and 7 days ~~after~~ post-spray of nano-fertilizers at 30, 50, and 70 DAS asinfluenced by nitrogen management through nano-fertilizers aredepicted in ~~figure~~ Figure 1. The NDVIvalue of maize leaf (GreenSeeker reading) significantly (P<0.05) varied before and 7 days ~~after~~ post-spray of nano-fertilizer at 30 DAS. Before the spray of nano-fertilizer, a significantly (P<0.05) higher GreenSeeker reading ~~(0.42)~~ was observed with T_2 ~~100% RDN as per PoP~~ compared to other treatments, and lower GreenSeeker reading was noticed under T_1 ~~no nitrogen treatment (0.25)~~.Significantly (P<005) higher GreenSeeker reading was observed seven days ~~after~~ post-spray of nano fertilizer at 30 DAS in 100%RDN along with ~~NDVI~~ NDVI-based nano-nitrogen spray~~(0.43) Whereas~~, lower GreenSeeker value was observed in T_1 ~~no nitrogen treatment (0.26)~~.

At 50 DAS ~~before~~ pre-spray, GreenSeeker readings varied significantly (P<0.05) during ~~before~~ pre and ~~after~~ post-spray of nano-fertilizer. Application of ~~nitrogen management as~~ T_2 had a ~~per PoP recorded~~ significantly (P<0.05) higher GreenSeeker reading ~~(0.53)~~, followed by T_9 ~~100% RDN + NDVI based nano N spray (0.52)~~. Whereas a significantly (P<0.05) lower GreenSeeker reading was observed in T_1 ~~no nitrogen treatment (0.31)~~. ~~After~~ Post-spray of nano-fertilizer at 50 DAS, GreenSeeker readings varied significantly (P<0.05) with thea~~A~~pplication of T_9 ~~100% RDN + NDVI based nano DAP spray recorded~~ higher GreenSeeker reading ~~(0.60)~~, followed by T_9 ~~100% RDN + NDVI based nano nitrogen spray,~~ and T_{10} ~~100% RDN + NDVI based conventional urea spray(0.58, and 0.57, respectively)~~. Whereas, a lower NDVI value was observed with T_1 ~~no nitrogen treatment (0.34)~~.

At 70 DAS, ~~Before~~ pre-spray of nano fertilizer, a significantly (P<0.05) higher NDVI reading ~~(0.70)~~ was noticed in T_9 ~~100% RDN+NDVI based nano DAP spray~~ compared to other treatments, and a lower GreenSeeker reading was noticed in T_1 ~~no nitrogen treatment (0.41)~~. Seven days ~~after~~ post-spray of nano-fertilizer at 70 DAS, the GreenSeeker reading varied significantly (P<0.05). Plants supplied with the application of T_9 ~~100% RDN along with NDVI based nano nitrogen spray~~ recorded higher GreenSeekerreadings ~~(0.74)~~, followed by T_{11} ~~100% RDN + NDVI based conventional urea spray,~~ and T_{10} ~~100% RDN +NDVI based foliar spray (0.70 and 0.72, respectively)~~.

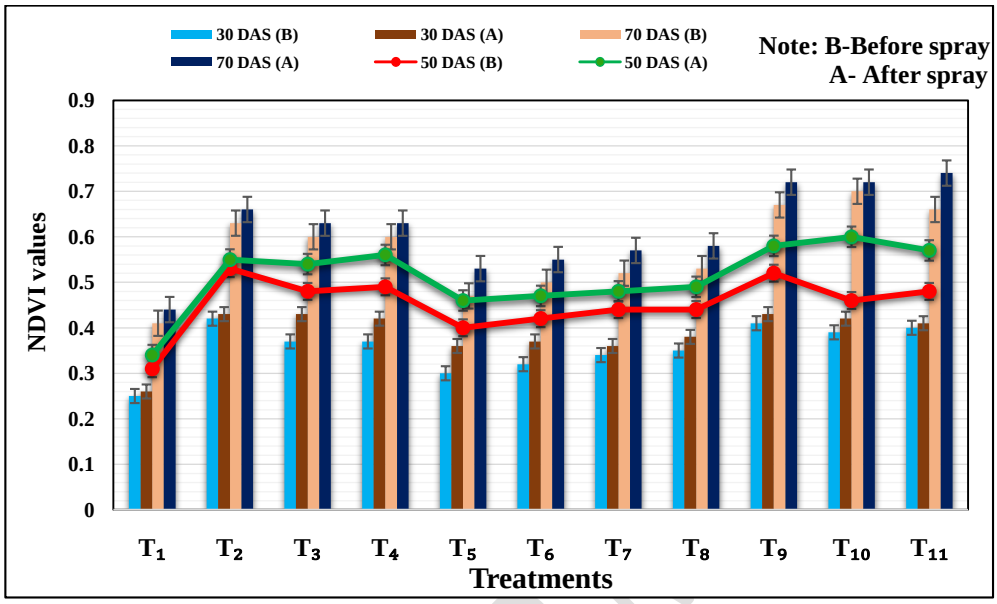

Fig.1: NDVI values (GreenSeeker readings) before and seven days ~~after~~ post-spray of nano-fertilizers at different growth~~s~~ stages as influenced by nitrogen management through nano fertilizers in maize

Increased ~~in~~ GreenSeeker reading (NDVI value) ~~after~~ post-nano~~nitrogen~~ Nand ~~phosphorus~~ Pspray at all the stages mainly due to smaller particle~~s~~ size and increased surface area of nano fertilizer easily entering the epidermis of plant leaves resulted in higher nutrient absorption through leaves along with roots, in turn, increased the chlorophyll content these higher the NDVI value indicating that higher biomass production. Krishna Desaiand Mudalagiriyappa(2022), Mallikarjuna (2022) and GurunathRaddy (2022).

Yield attributes

The dataconcerning~~respect to~~the number of cobs plant^{-1}, cob length, and cob weight plant^{-1}as affected by nitrogen managementpractices through nano fertilizers in maize~~on~~ arementioned in Table3.

~~Significantly~~ A significantly ($P<0.05$) higher number of cobs per plant, cob length, cob girth,and cob weight per plant wererecorded in plants supplied with T_9~~100%RDN + NDVI based~~

nano-nitrogen-spray (1.30 plant^{-1}, 20.5 cm, 5.49 cm and 201.9 g plant^{-1}, respectively), It was found on par withthe application of T_{11}100%RDN +NDVI based conventional urea spray(1.27 plant^{-1}, 19.5 cm, 5.31 cm and 196.5 g plant^{-1}, respectively), T_{10}100 % RDN +NDVI based nano DAP spray (1.25 plant^{-1}, 19.3 cm, 5.21 cm and 192.0 g plant^{-1}, respectively,)and $T_2$100% RDN as per the package of practices (1.23, 19.0 cm, 5.00 cm and 188.6 g plant^{-1}, respectively). Whereas, a significantly (P<0.05) lesser number of cobs per plant,cob length, cob girth, and cob weight per plant wererecorded with T_1treatment of no nitrogen treatment (1.04 plant^{-1}, 12.9 cm, 4.03 cm and 118.7 g plant^{-1}).This was due to the fact thatbecausenano-fertilizers stimulate the enzymes activityactivity of the enzymeby integrating with the creation of chlorophyll in most plants, this led to an acceleration in the synthesis of growth hormones, results resultingin a heightened production of carbohydrates within plants (Afshar*et al*. 2014 andParmarsnehalbhai, 2016).

Maize kernel yield differed significantly among the treatments. Application of $T_9$100% RDN along with NDVI based nano nitrogen sprayrecorded significantly (P<0.05) higher kernel yield (7772 kg ha^{-1}),which was on par with the application ofT_{11}100% RDN + NDVI based conventional urea spray,$T_{10,}$ 100% RDN + NDVI based nano DAP spray and $T_2$100% RDN as per the package of practices(7563, 7481 and 7281 kg ha^{-1} respectively). Control treatment recorded significantly (P<0.05) lower kernel yield (3585 kg ha^{-1}) compared to other treatments.

Similarly, the same trend was observed in stover yield, in which a significantly (P<0.05) higher stover yield (8948 kg ha^{-1}) was noticed in the plot which thatreceived T_9.100% RDN along with NDVI based nano

Table 3: Number of cobs, cob length, cob girth,and cob weight per plant of maize as affected by nitrogen management through nano fertilizers

Treatment	No. of cobs plant^{-1}	Cob length (cm)	Cob girth (cm)	Cob weight plant^{-1}	Kernel yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Harvest index
T_1	1.04	12.9	4.03	118.7	3585	4779	0.42
T_2	1.25	19.2	5.00	188.6	7273	8769	0.45
T_3	1.19	17.3	4.75	175.3	6414	7918	0.44

T_4	1.21	17.7	4.88	179.7	6505	7984	0.44
T_5	1.12	14.9	4.41	150.3	4644	5949	0.43
T_6	1.14	15.3	4.57	153.7	4845	6260	0.43
T_7	1.16	16.6	4.62	166.9	5604	6693	0.45
T_8	1.18	17.0	4.73	169.2	5796	6868	0.45
T_9	1.30	20.5	5.49	201.9	7729	8948	0.46
T_{10}	1.25	19.3	5.21	192.0	7463	8869	0.45
T_{11}	1.27	19.5	5.31	196.5	7548	8845	0.45
F test	*	*	*	*	*	*	NS
S.Em±	0.02	0.41	0.15	4.99	142	133	0.01
CD at 5%	0.06	1.20	0.45	14.63	418	390	-

~~nitrogen spray.~~ However, it was on par with treatment received T_{11} ~~100% RDN + NDVI based conventional urea~~, T_{10}, ~~100% RDN + NDVI based nano DAP~~ and T_2 ~~nitrogen management as per the PoP (8868, 8845 and 8769 kg ha^{-1}, respectively).~~might be duetoimprovement in yieldattributingparameters and it is governed by the factors ~~which~~ thathave direct or indirect impact. Thefactors ~~which~~ thathave a direct influence on the grain yield are the yield components and ~~its~~theiraccumulation into various plant parts have an indirect influence on grainyield through theyield components, which in turn depends on different growth components *viz*., plant height,leaf area and chlorophyll content in leaf. These results are ~~in~~ corroborative with the findings ofTrinh *et al*. (2008), Gheysari*et al*. (2009), Lampteye*t al*. (2017), Chen *et al*. (2017), andWang*et al*. (2019).The Harvest Index indicates the percentage of dry matter partitionedand accumulated inthe economic portion. In the current investigation, the harvest index didn't show any significantdifferencedueto nitrogen management through nano fertilizers.

Conclusion

Higher growth, yield attributes, kernel, and stover yield in the cultivation of maize can be achieved withthe application of 100% RDN along with ~~NDVI~~ NDVI-based nano nitrogen spray (T_9). ~~On the basis of~~Based onthe results obtained under the present investigation and the possible reasons for their unevenness ~~having~~ discussedand the following conclusions were drawn. Maize kernel yield ~~(7772 kg ha^{-1})~~ and stover yield ~~(8948 kg ha^{-1})~~ were significantlyhigher with the application of 100% RDN along with ~~NDVI~~ NDVI-based foliar spray of nano nitrogen which

was followed by 100% RDN along with NDVI-based foliar spray of conventional urea (7548 and 8845 kg ha^{-1}).GreenSeeker based nano nitrogen spray will help to increase nitrogen use efficiency and save the nitrogen in maize.

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