



## EFFECT OF FOLIAR APPLIED, NEEM AND MICRONUTRIENT COATED UREA FERTILIZERS ON GROWTH AND YIELD OF MAIZE ON ALFISOLS IN SAMARU, NORTHERN NIGERIA

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### ABSTRACT

The study was conducted to evaluate the effect of foliar, neem and micronutrient coated urea fertilizers on growth and yield parameters of maize on Alfisols at Samaru, Zaria, Northern Guinea Savannah Nigeria. The treatments consisted of eighteen (18) fertilizer treatments, (Boron (B) 100%DDP, CROPMIX (17%Zn, 18%Mn, 2%B, 1%Fe, 1% Cu) 100%(DDP), Zinc (Zn) 100% (DDP), Zn + B 100% (DDP), MDS 2,0L/MT 100%), Foliar fertilizer (Candel) and Neem (at different formulation 0.5L/MT at 100% and 75% , 0.75 L/MT at 100% and 75%, 1.0L/MT at 75% and 1.25L/MT at 100% and 75%), Urea 120%, Control with (P and k), control with (120 60 60) and Control plots were applied to the crop in two split doses at three and five weeks after planting in Randomized Complete Block Design (RCBD) replicated four times in two different locations for 2022 cropping season. The growth parameters measured were plant height, number of leaves and leave area index, while the yield parameters observed in the study were weight of cobs, number of cobs, grain yield and 100 seed weight. The result showed a significant ( $P < 0.05$ ) increase in growth and yield performance of maize with neem and micronutrient coated urea fertilizers performing higher than other treatments. While higher yields were observed in neem coated urea fertilizer at 1.25 MT/90Kg N ha<sup>-1</sup> (63.50), followed by boron coated urea at 100% DDP (59.25). This indicates that all neem coated fertilizer formulations applied performed higher than other treatments in improving growth and yield of maize.

**Keywords:** Neem, Coated, Foliar, Micronutrient, Boron, Maize

### INTRODUCTION

Soils of the Northern Guinea Savannah are low in fertility, this is as a result of extensive cultivation of crops due to increase in food demand, thus mining the available nutrient stock from soil. This led to supplementation with inorganic fertilizer to achieve the recommended nutrients needed for optimum growth and development of crops. Estimates of overall efficiency of these applied fertilizers have been recorded as low, about 50% or lower for N, less than 10% for P, and close to 40% for K (Baligar *et al.*, 2001). These lower efficiencies are due to significant losses of nutrients through various processes, such as crop uptake, volatilization, denitrification, leaching, run-off and fixation by soil. The inefficiency of N uptake to crops is of a great concern globally. The nutrients being lost to environment, causing contamination, reduced yield and subsequently leads to inadequate nutrition in our diet (Cameron *et al.*, 2013). Hence, there is need to find a suitable carrier's media for fertilizers to optimize their efficiency on application to crops.

Urea (CH<sub>4</sub>ON<sub>2</sub>) is a straight fertilizer, containing only nitrogen (N), it is one of the most common nitrogenous fertilizers. This fertilizer is highly soluble in water, releasing CNO<sup>-</sup> and NH<sub>4</sub><sup>+</sup>, subsequently converted to NO<sub>3</sub><sup>-</sup> by nitrifying bacteria, making it available for plant uptake. When urea is applied to the soil, chemical and biological reactions transform it into several other N forms, which become susceptible to loss, therefore leading to reduced N availability to crop plants. This has led to idea of coating of urea, which aims in reducing its loss within the soil. The most notable broad categories of transformations are; hydrolysis of urea by urease enzyme, which rapidly converts Urea-N to ammonium-N and nitrification brought about by a group of nitrifying bacteria subsequently leads to conversion of the ammonium N to



Nitrate-N. Even though, plants can access both ammonium-N and Nitrate-N from urea in their ionic forms through mineralization. Nitrate could be easily lost via leaching below the root zone of plant (Myrold, 2008). Urea is the most mobile, volatile and the most exhausted nutrient fertilizer due to its ability to transform and exist in different forms, hence it is easily leached (Mugendi *et al.*, 2003; Mucheru-Muna *et al.*, 2009).

Neem (*Azadirachta indica*) is a fast-growing tree, most commonly found in the tropical regions. Varying components such as neem cake, neem oil, its leaves and bark serve as sources of soil amendments for improving soil fertility (Neem Foundation, 2014). These parts also have some medicinal properties and are commercially exploitable, hence considered as a valuable source of unique natural products for development of medicines against various diseases (Neem Foundation, 2014). On the other hand, supplementing of micronutrients becomes an area of interest, being a beneficial to plant as well as humans. This causes increase in quality of fertilizer analysis, breeding of new varieties with high and specific fertilizer requirements (Patel *et al.*, 2015). Hence, Malakouti (2008) further emphasized the need to fill the gap of educating farmers on the use of micronutrient fertilizers as it improves crop yield both in quantity and quality. Studies have been geared towards incorporating macronutrients with beneficial micronutrients, with respect to specific plant requirements. Foliar applied fertilizers are media for fertilizer in liquid form. It is designed to apply directly plant leaves. Foliar fertilizer application is one of the most effective methods to enhance nutrients absorption through leaves, and to supplement the plant nutrients for more efficient nutrient utilization (Girma *et al.*, 2007; Smith *et al.*, 2001).

Maize production in Northern Nigeria is constrained by poor soil fertility, low fertilizer use, and low nutrient use efficiency (NUE). The use of conventional inorganic fertilizers is limited by high cost, poor accessibility, and environmental concerns. The high cost of urea fertilizer, which makes it unaffordable for farmers with limited resources, makes it unfeasible to optimize maize production potential. Hence, the concern to find solution for increased maize production as well as to increase nutrient use efficiency. Therefore, the need to explore alternative fertilizers that are more affordable, accessible, and environmentally friendly. These led to extensive application of modified forms of urea fertilizers by farmers, for improved efficiency to meet up with the limiting N from the soil. Therefore, this study was conducted to evaluate the effect of foliar applied, neem and micronutrient coated urea fertilizers on growth of maize in Northern Guinea Savanna.

## **MATERIALS AND METHODS**

The study was conducted under rain-fed condition in the 2022 cropping season at the experimental farm of Institute for Agricultural Research (IAR), Ahmadu Bello University, Samaru, Zaria, within the Northern Guinea Savannah of Nigeria. Samaru is located between latitude of 11.16070 N, and longitude 7.63850E. The experimental farms were under continuous cultivation and fertilizer application amendments for years, mostly for research purposes. The study area has lowest relative humidity in February as 13.93% and highest as 83.20% in August. Annual temperature ranges from 35°C to 20 °C, while the rainfall is from April to October with the mean average is 1015.9 mm (Yamusa and Abdulkadir 2020). The soil textural class/types ranges from loam to sandy loam soil having a high proportion sand particle (Maniyunda *et al.*, 2020).

Two locations in the IAR research farms were used for the studies. The selection of the locations was based on previous history of the crops cultivated. The treatments were foliar, neem and micronutrients coated urea in different formulations; eight combinations of micronutrients coated used are: Boron (B) 100%DDP, CROPMIX (17%Zn, 18%Mn, 2%B, 1%Fe, 1% Cu) 100%(DDP), Zinc (Zn) 100% (DDP), Zn + B 100% (DDP), MDS 2,0L/MT 100% and Foliar fertilizer (Candel) and Neem at different formulation 0.5L/MT at 100% and 75% , 0.75 L/MT at 100% and 75%, 1.0L/MT at 75% and 1.25L/MT at 100% and 75%, Urea 120%, Control with (P and K), control with (120 60 60) and Control plots. The experiment was laid out in a Randomized Complete Block Design (RCBD) replicated four times and the treatments were appropriately allocated to the plots for the two locations ((ROD and T20). The recommended rate of 120;60;60 (NPK) was also applied on treatment plots. Maize variety (SAMMAZ-51) used as a test crop was obtained from the Institute for Agricultural Research, Ahmadu Bello University (IAR/ABU), Samaru, Zaria, Nigeria. The neem and micronutrient coated urea fertilizers



were obtained from Indorama Eleme and chemical fertilizer company. While the foliar plus urea fertilizer was obtained from Candel company.

### **Soil Sampling and Analysis**

Soil samples were collected using simple random sampling methods from each location before the establishment of the experiment during the rain-fed season, with an auger from 5 points in each location in order to have a representative sample for each location respectively. The 5 soil samples obtained at the depth of 0 – 15 cm from each location were bulked together to form a composite sample and passed through 2 mm sieve. Routine analysis was carried out at the laboratory in the Department of Soil Science, Ahmadu Bello University Zaria, Nigeria.

### **Cultural Practices**

Land preparation and layout was carried out in the month of May at the onset of rainfall. Following the time frame of this research work, planting of maize (Sammaz 51) between 23 /26 of June 2022. Germination was observed to be 98%, where few ridges were transplanted to obtained 100% plant density at 25cm inter space. Manual weeding was done at three weeks after planting and application of first split dose of fertilizer NPK (15:15:15) was also applied as basal, using the Randomized complete block design (RCBD) and carefully allocated treatment appropriately. Second weeding was carried out 5th - 6th weeks after planting, soil sample (Rhizosphere) and growth parameters were obtained before application of second split of fertilizer dose which serve as treatments. while treatments as foliar, micronutrients and neem coated urea fertilizers in different formulation as shown in table 1, was applied at 7 weeks. All growth parameters and soil samples from each plot was obtained at 2 weeks after application of treatments to evaluate the effects of treatments on nitrifying bacterial and plant parasitic nematode on maize field. Currently, post-harvest data were carried out at the field for soil, plant and yield

### **Data Collection**

Morphology of maize plant was characterized by growth parameters which was observed at 6 weeks and 7 weeks after application of last split dose of fertilizers, these include the following: number of leaves, leaf length, leaf area index and shoot length, these were obtained after each application of treatment. Yield parameters were also collected, which were number of cobs per plant, cobs diameter, cobs length, grain weight and 100 seed per net plot where also obtained after harvest.

### **Data Analysis**

Data collected were subjected to analysis of variance (ANOVA) using the general linear model (GLM) tool of the statistical analysis system for the treatments and Duncan's Multiple Range Test (DMRT) was adopted in separating the means, while T-Test was used to test the relationships between the locations.

## **RESULT AND DISCUSSION**

### **Physical Properties**

Results of the particle size distribution as determined for soils from the two experimental field is presented in Table 1. The distribution of sand, silt and clay was used to classify the soils of the two locations as predominantly loam which is similar to the findings of Yau *et al.* (2022). This implies that such soils are well drained, relatively stable and are suitable for arable crop production which also agrees with the findings of Daniel *et al.* (2021).

**Table 1:** Physical and Chemical Properties of the Experimental Sites

Parameters	Location 1	Location 2
<b>Physical Parameters</b>		
Particle Size Distribution (g/Kg)		
Clay	100.00	100.00
Silt	400.00	400.00
Sand	500.00	500.00
<b>Textural Class</b>		
	<b>Loam</b>	<b>Loam</b>
Bulk Density (g/cm <sup>3</sup> ) 0-15 cm		
0-30 cm	1.51	1.55
	1.62	1.64
<b>Chemical Properties</b>		
pH (H <sub>2</sub> O)	5.82	6.16
pH (0.01m CaCl <sub>2</sub> )	4.96	5.36
EC (dS/m)	0.05	0.07
OC (g/Kg)	4.60	3.70
TN (g/Kg)	0.30	0.20
AP (mg/kg)	12.07	50.53
<b>Exch. Bases (Cmol<sup>+</sup>g<sup>-2</sup>)</b>		
Ca	1.64	3.55
Mg	0.41	0.45
K	0.17	0.29
Na	0.26	0.35
H+Al	1.20	1.20
CEC	4.20	9.40

The dominantly of coarse fraction (sand) could be as a result of siliceous granite and gneiss parent material which are inert and resistant to further weathering (Yaqub *et al.*, 2017) and pulverization of soil due to continues tillage operation (Omenihu and Opara-Nadi (2015). The silt content in both locations is relatively high. In (ROD), silt fraction has been reported by Ya'u (2015); Ya'u and Maniyunda, (2018) who ascribed it to be influence of the Harmattan dust especially in the Northern Guinea Savannah of Nigeria. While that of location 2 (T20) could be attributed to the fact that these units received constant alluvial materials from Bomo dam (Yau *et al.*, 2022). However, the low clay content of the surface soil could be a characteristic of soils formed on Basement Complex and relatively high eluviation of clay in both locations (Maniyunda, 2012; Adugna and Abegaz, 2015).

The average bulk density (pb) obtained from two locations ranges from 1.51 and 1.55 g/cm<sup>3</sup> for surface soil (0-20 cm), while the sub surface is 1.62 and 1.64 g/cm<sup>3</sup> for location 1 and 2 respectively as shown in Table 2. Surface soils have similar values of pd lower than the sub surface soils, this could be attributed to continuous cultivation that loosen the soil particles (Aliyu, 2022). Ayolaha and Opene (2012) observed that bulk density at pedal depth could be resultant effect of decrease in organic matter and less aggregation of the soil. High values obtained at the sub surface may be due to eluviation of clay down the soil profile. This is inconformity with the observation of Ahukamere and Akpan (2012) that clay migration into the subsoil was responsible for high bulk density in the subsoil. However, the values of bulk density obtained (Table 1) were below the critical value of 1.7 to 1.8 mg/m<sup>3</sup> for sandy soils stated by FAO (2006). This result implies that the soils will support good plant growth and root penetration as according to Yau *et al.* (2022).

#### **Chemical Properties of Soils before the Experiment**

Table 1 also shows the results of the chemical properties of the soils before establishing the experiment, which indicates that the soil reaction was moderately acidic in ROD (5.82) and slightly acidic at T20 (6.16). This indicates nutrients will be available for crop uptake in the soils. Although, total nitrogen (TN), organic carbon (OC), cation exchange capacity (CEC) and exchangeable bases (EB) were generally low, while available phosphorus is moderate in location ROD and high in T20. The results observed could be due to the nature of Alfisols of Savana soils, which are sandy, hence easily loss nutrients through continues cultivation, leaching and erosion. The nature of the parent materials is





basement complex rocks that facilitates leaching of basic cations down the profile (Olowolafe, 2002; Fasina and Adeyanju, 2006). Hence, the soils are low in OC, OM, EC, TN and the soil aggregates and structure are unstable (Odunze, 2003). The Organic matter (OM) is known to be essential factor supporting chemical and biological properties and acts as a reservoir of nutrients and water in the soil, therefore, the low organic matter content could be responsible for low levels of other properties of the soils observed (Funderburg, 2001). The low nutrients level of the soils makes it inability to support the growth and yield of crops, hence, the need to compliment them using inorganic fertilizer, especially nitrogen.

The moderately  $< 20$  mg/Kg and high  $> 50$  mg/Kg amount of available P in ROD and T20 respectively, contradicts the report of Odunze *et al.*, (2004), who observed low in AP ( $< 7$  mg/Kg) in their study. This could be due to the influence of yearly addition of organic amendments and/or phosphorus fertilizers from the previous cultivation in both locations. However, the antagonistic of phosphorus with pH values such as slightly acidic to alkaline in soils increases the availability of phosphorus in soil. The availability of P is maximized at pH 6.5 for mineral soils and pH 5.5 for organic soils according to Penn and Camberato (2019).

The morphological characteristics of maize in both locations is shown in Table 2, indicating that the maize plants responded to fertilizer application. Plant height significantly ( $P<0.05$ ) increased compared with un-fertilized plots. Ther highest values were obtained in both neem coated urea and micro nutrient coated urea fertilizer. This agrees with findings of Adhikari *et al.* (2022) in a study observed significant increase in plant height under different source of nutrient. Similar results were reported by Ghafoor and Akhtar (1991) who stated that application of high N rates had significant effect on plant height and subsequent growth of the maize crop. The lowest plant height was observed from foliar and control plots. Maize is an exhaustive feeder hence nutrients requirement in maize are high (Shrestha *et al.*, 2018). Other studies concluded that proper fertilizer management is crucial in cultivation of maize (Baral *et al* 2015, Adhikari *et al* 2016). The fertilizer interaction between the two locations of the study shows that there is significant ( $P<0.05$ ) difference on the plant height within the treatments, this agrees with the findings of Kogbe and Adediran (2003), which state that the productivity of maize varies from location to location. This could be attributed to the same soil characteristic of the two locations as shown in Table 1.

The leaf length of maize plant was observed to be not significant within the location as shown in Table 2. While interaction within the treatment was highly significant as shown in Table 2. This agrees with the report of Toungos (2019) who observed the increase in leaf length of maize with application of inorganic fertilizer. The number of leaves and leaf area index (LAI) have similar distribution. The effect of treatment within the two locations observed significantly ( $P<0.05$ ) increased across the treatments. According to Lukeba *et al.* (2013) who observed LAI in a genetically improved maize variety are greater than unimproved variety of maize, hence Lufuluabo *et al.* (2011) reported a similar finding. This implies that the use of one maize variety SAMMAZ 51 in two locations gave a similar distribution.

**Table 2:** Effect of Location, Treatments and their Interaction on Growth Parameters of Maize plant (Sammaz 51)

Locations	Plant height(cm)	Leaf Length (cm)	Number of Leaves	Leaf Area Index
ROD	154.34a	76.20a	11.07a	1.39
T20	143.50b	75.77b	10.34b	1.81
SE±	2.21	0.86	0.10	0.07
LSNN	**	NS	*	*
<b>Treatments</b>				
Control 1	144.00	71.96abcde	10.46	1.73
Control 2	132.55	67.58cde	10.38	1.71
Urea fertilizer 46%	155.20	76.89abcde	10.67	1.45
B +coated urea 100%DDP	154.37	78.37abc	10.96	1.20
Zinc coated urea 100%DDp	158.87	80.09abc	11.17	1.46
Zn + B coated urea 1000%DDP	151.62	77.96abc	10.71	1.40
CROP MIX 100%DDP	146.15	78.71abc	10.67	2.07
MDS 2.0L/MT 100%DDP	155.43	77.90abc	11.29	1.60
FOLIAR FERTILIZER 1	131.38	64.79de	10.38	1.79
FOLIAR FERTILIZER 2	131.80	64.20e	10.04	1.79
Urea	152.44	77.49abcd	10.79	1.52
Neem coated urea (A1)	150.10	78.96abc	10.25	2.03
Neem coated urea (A2)	139.92	69.16bcde	10.21	1.69
Neem coated urea (B1)	152.22	80.12abc	10.46	1.27
Neem coated urea (B2)	159.40	83.43a	11.29	1.99
Neem coated urea (C2)	163.44	81.180ab	11.13	1.50
Neem coated urea (D1)	142.66	76.87abcde	10.63	1.45
Neem coated urea (D2)	159.02	81.94ab	11.25	1.13
SE±	6.62	3.66	0.311	0.232
LS	NS	**	NS	NS
<b>Interaction</b>				
Location x Treatments	*	**	**	NS

\* = significant at 0.05 level, \*\* = significant at 0.01, \*\*\* = significant at 0.001, \*\*\*\* = significant at 0.0001, NS = Not significant at 0.05 level of probability, NS = Not significant, LS= Level of significant, SE = Standard Error,

Effect of application of the treatments on maize yield are presented in Table 3. Within locations, the results show no significant difference in cobs weight per net plot (CWN) and cobs diameter per net plot (WCN). While number of cobs per net plot (NCN), Length of cobs per net plot (LCN), weight of grains after threshing per net plot (WGAT) and 100 seed weight significantly ( $P < 0.05$ ) increased as shown in Table 3.

The influence of different application of coated urea fertilizer at recommended rate on all maize yield parameters was positive and significantly higher in both locations as presented in Table 3. This result is in line with previous observation by Taye *et al.*, (2013). The influence of coating urea fertilizer on crop could be linked to the availability of N required for plant growth and development. In addition, coating could slow the rate of mineralization and leaching of N from urea fertilizer, which meets the growth and development of plant. Low values were obtained in foliar and control plots in all the parameters. This could also be attributed to higher release and absorption of nutrient by plant roots than foliar application, similarly, foliar applied fertilizer may be more slowly absorbed by the plants or diverted by wind or rainfall.

It was observed that influence of coated urea fertilizer on maize cobs weight significantly increased across the treatments. High values were obtained in neem coated urea and B coated urea; (5.93 and 5.78 kg per net plot, respectively). This implies that coating urea with micronutrient and neem oil improves the cobs of maize. Average number of cobs per net plots significantly increased as higher value was obtained in neem coated urea 1.25 MT/90Kg N ha<sup>-1</sup> (63.50), followed by Boron coated urea 100% DDP (59.25). Similar trend was observed in the weight of grain and 100 seed weight. This indicates the complementary effect of applied nutrients to maize plant (Yusuf *et al.*, 2009). It also shows a progressive

response of maize to the coating of urea and synchronization of absorption N application to growth rate of maize plant (Tofa *et al.*, 2022). Coating of urea probably helps to synchronize N release and uptake by maize, through slow degradation of the coated neem oil and micronutrients as time passes, which serves as additional nutrients to plants. An appropriate blend of N fertilizers with suitable coating material could be an attractive choice (Balaganesh *et al.*, 2021).

**Table 3:** Effect of Location, Treatments and their Interaction on Yield Parameters of Maize (Sammaz 51)

Locations	CWN(Kg)	NCN	LCN(cm)	WCN(cm)	WGAT(Kg)	100SPN
ROD	4.37	55.44a	13.33b	4.19	3.28a	21.13b
T20	4.46	46.83b	14.11a	4.32	3.03b	22.33a
SE±	0.17	1.49	0.27	0.096	0.12	0.33
LSNN	NS	***	*	NS	*	*
<b>Treatments</b>						
Control 1	2.60bcd	40.12b	15.13	4.34	1.56bc	19.13abc
Control 2	2.21cd	41.50ab	12.73	3.97	1.46bc	18.86bc
Urea fertilizer 46%	5.26a	53.87ab	12.54	4.13	3.79a	21.76abc
B +coated urea 100%DDP	5.93a	59.25ab	13.70	4.37	4.02a	21.95abc
Zinc coated urea 100%DDP	5.65a	58.63ab	13.18	4.09	3.81a	22.09abc
Zn + B coated urea 100%DDP	4.23abcd	51.38ab	14.24	5.16	3.76a	23.54ab
CROP MIX 100%DDP	4.69abc	50.50ab	14.38	4.46	3.53a	23.45ab
MDS 2.0L/MT 100%DDP	5.51a	54.50ab	14.41	4.28	3.91a	22.48abc
FOLIAR FERTILIZER 1	1.99d	39.75b	13.30	4.14	1.26bc	17.88c
FOLIAR FERTILIZER 2	1.94d	38.75b	11.90	3.92	1.02c	19.16abc
Urea	4.19abcd	50.50ab	13.86	4.28	3.00ab	22.40abc
Neem coated urea (A1)	5.175a	53.25ab	13.79	4.25	3.51a	21.46abc
Neem coated urea (A2)	3.98abcd	46.13ab	12.75	4.13	2.77abc	21.91abc
Neem coated urea (B1)	4.71ab	54.38ab	14.47	3.85	3.54a	22.79abc
Neem coated urea (B2)	5.78a	55.63ab	14.14	4.34	4.01a	23.40ab
Neem coated urea (C2)	5.03ab	56.50ab	13.70	4.21	3.70a	22.14abc
Neem coated urea (D1)	4.86ab	52.38ab	15.00	4.49	3.78a	22.76abc
Neem coated urea (D2)	5.76a	63.50a	13.70	4.19	4.28a	23.96a
SE±	0.495	4.48	0.81	0.029	0.35	0.98
LS	***	**	NS	NS	***	***
<b>Interaction</b>						
Location x Treatments	NS	NS	NS	NS	NS	NS

\* = significant at 0.05 level, \*\* = significant at 0.01, \*\*\* = significant at 0.001, \*\*\*\* = significant at 0.0001, NS = Not significant at 0.05 level of probability, SE = Standard Error, CWN= Cobs weight per net plot, NCN= Number of cobs per net plot, LCN= Average length of cobs per net plot, WCN= Average width of cobs per net plot, WGAT= weight of grain per net plot, 100SPN= weight of 100 seed per net plot.

## CONCLUSION AND RECOMMENDATION

Foliar applied, Neem and Micronutrient Coated Urea Fertilizers significantly affected the Growth and Yield of Maize on Alfisols, this was attributed to the effect of coated urea fertilizer in reducing the rate of N lost and increase the mineralization of N for uptake which synchronize with the N demand of the plants. Plant height, leaves length and number of leaves significantly ( $P < 0.05$ ) increased, higher values with neem and micronutrient coated urea fertilizers, the least was obtained from foliar and then the control plots. The yield was significantly ( $P < 0.05$ ) higher in neem coated urea (4.28 Kg /ha in D2), followed by Boron coated urea fertilizer (4.02 Kg/ha) with similar trend in cobs weight, Number of cobs, length of cobs, width of cobs and weight of 100 grains. While the least values of the parameters were observed in the control and foliar fertilizer. This study suggest that urea should be coated to minimize the loss of N and increase N utilization, yield and productivity of maize.



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