



RESEARCH ARTICLE

EVALUATION OF UREA, NPK AND ORGANOMINERAL FERTILIZERS ON THE GROWTH, NUTRIENT UPTAKE AND YIELD OF MAIZE IN NUTRIENT DEPLETED SOIL

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ABSTRACT

A two-year (2018 and 2019) experiment was carried out at two locations of the Ambrose Alli University Teaching and Research Farm, Ekpoma to evaluate the effect of organic base granular and prilled urea fertilizers on the growth, nutrient uptake and yield of maize. These experiments were fitted in a Randomized Complete Block Design (RCBD) with seven treatments (granular, prilled urea, P&K + 75% granular urea, P&K + 75% N prilled urea (NPK), P&K + 75% N granular urea + 25% N through farmyard manure (FYM), P&K + 75% N prilled urea + 25% N FYM and the control) replicated thrice. The soil and organic manure were analyzed; the soil nutrient status was below critical values; therefore, the application of fertilizer was necessary. The application of fertilizers either sole or combination improved the soil nutrient, growth and yield of maize significantly compared to the control. The application of P&K + 75% N granular urea + 25% N through FYM and P&K + 75% N prilled urea+25% N through FYM significantly ($P \leq 0.05$) increased the growth, grain yield and nutrient uptake of maize compared to other treatments. The application of P&K + 75% N granular urea + 25% N through FYM increased the growth and yield of maize than the application of P&K + 75% N prilled urea+25% N through FYM. Therefore, the application of P&K + 75% N granular urea + 25% N through FYM can be recommended to farmers.

KEYWORDS

Farmyard manure, organomineral, maize, granular, prilled urea, yields.

1. INTRODUCTION

Maize (*Zea mays* L) is an important staple food crop consumed by man particularly in the tropics; it is used to feed livestock and raw material for industrial industries. It is therefore necessary to increase the production of maize to meet the consumption demand of the increasing population. To meet the demand for maize, increase yield per hectare is inevitable and this can be achieved by improving soil nutrient through the use of fertilizer. The inherently low fertility status in the tropical soils is a major problem responsible for poor crop yield, therefore, appropriate fertilizer application is necessary (Tankou, 2004). The use of inorganic fertilizers to sustain crop production has an outstanding output but not on long-term.

Urea as N- fertilizer not only improve crop yield, it also enhance the metabolic process that influences the physico-chemical environment at the soil - root interface and modifies the rhizospheric conditions of the soil (Gazel, 2005). Despite these beneficial effects, the use of inorganic fertilizer in improving soil fertility has been reported to be ineffective due to certain limitations, such as declined soil organic matter content, increase in soil acidity as well as degradation of certain soil physical properties with resultant increase incidence of soil erosion (Avery, 1995; Rodale, 1995). The increasing cost of fertilizers, deterioration of soil health and environmental quality, calls for effective management strategies capable of reducing the cost of input and increase the soil environmental quality (Hati et al., 2007).

Organic fertilizer which includes compost, animal manure and plant residue, have been reported to significantly ($P \leq 0.05$) improved the growth and yield maize. However, manure lack adequate amount of some

nutrients required for crop production and are very bulky. To enhance soil quality and crop yield, the combine beneficial effects of the application of organic manure and mineral fertilizer becomes inevitable. The integration of inorganic and organic fertilizers play a key role in the sustenance of soil fertility, organic matter content and maximum yield of crops (Gastal and Saugier, 1986; Dania et al., 2016). Due to the effectiveness of combine application of organic and inorganic fertilizer and its residual effect on soil nutrient content, it was therefore the objectives of the research to evaluate the effects of organic base trial of granular and prilled urea fertilizer on the growth, yield and nutrient uptake of maize.

2. MATERIALS AND METHODS

2.1 Description of Experimental Site

The experiment was conducted at the Teaching and Research Farm, Faculty of Agriculture, Ambrose Alli University, Emaudo and Ujemen campus, the locations are in the humid rainforest vegetation belt of Nigeria, lying between latitude 6°42' North and longitude 60°8' East, with a mean annual rainfall of 1500mm and temperature 15°C - 34°C.

2.2 Sample Collection and Analyses

Composite soils (0-15cm) were collected from the experimental sites prior to planting to ascertain the nutrient status of the soil. The soils were air dried, sieved and analyzed for physical and chemical properties. Particle size distribution was determined by hydrometer method (Bouyoucos, 1962). The pH was measured in a 1:1 (soil-water) ratio by glass electrode pH meter, organic carbon was determined by the wet dichromate acid oxidation method (Maclean, 1982; Nelson and Sommers, 1982). Total

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nitrogen was determined by the micro kjedahl method, available phosphorus was by Bray-1 extraction method (Bremner and Mulvaney, 1982; Bray and Kurtz, 1945). Al^{3+} and H^+ were extracted with KCl (Jing et al., 2012). Calcium (ca), magnesium (mg), sodium (Na) and potassium (K) were extracted with NH_4OAc pH 7.0 (Ammonium acetate). Potassium and sodium were determined with flame emission photometer while calcium (Ca) and magnesium (Mg) were determined by the atomic absorption spectrophotometer (IITA, 1979). ECEC was calculated by the summation of exchangeable base and exchangeable acid (Anderson and Ingram, 1993).

2.3 Experimental Design

The experimental design was Randomized Complete Block Design (RCBD) with seven (7) treatments replicated three times. The treatments applied were 100% N through Indorama Granular urea, 100% N through prilled urea, full dose of phosphate and murate of potash (P&K) + 75% N through Indorama Granular urea + 25% N through FYM (organomineral), full dose of P&K + 75% N through prilled urea + 25% N through FYM (organomineral), full dose of P&K + 75% N through Indorama Granular urea, full dose of P&K + 75% N through prilled urea and the control. All data collected were analyzed statistically using the Analysis of variance (ANOVA) test and the least significant difference (LSD) was used to separate means that significantly differs at 5% probability (SAS, 2005).

2.4 Cultivation, Planting and Management Practices

The pre-planting operations carried out includes; site selection, clearing of vegetation, packing of debris, mapping and herbicide application. The cultivated area measured 35m x 22m, the trial was laid in 21 replicates; each plot / replicate size (consisting of flatbeds) measured 4m x 4m. The maize variety used for planting was SUWAN-1-SR, three (2) seeds were sown per hole at a spacing distance (standard spacing) of 75cm x 25cm and later thinned to one plant, two weeks after planting.

2.5 Fertilizer Application

The various organic manures were initially composted before used in combination with inorganic fertilizer. Granular and prilled urea, compounded NPK and the fortified compost (organ mineral) fertilizer were applied four (4) weeks after planting using the ring method of application.

2.6 Collection of Data

The following growth parameters were taken, heights, leaf area, stem girth. The readings were taken at five to eight weeks after planting (5-8 WAP). Maize height was measured with the aid of measuring tape, stem girth with veneer caliper and leaf area was determined thus.

Leaf area = Length x width x 0.75. Where 0.75 is a constant (Remison and Lucas, 1982).

Cobs, grain yield and above ground biomass weight were determined using a weighing balance.

The nutrient uptake was also determined.

Nutrient uptake = Dry matter yield (kg) x Nutrient content (%)

3. RESULTS AND DISCUSSION

The soils were analysed for both physical and chemical properties as presented in Table 1. The pH of Ujemen and Emaudo soils were 5.86 and 5.68 respectively, the soils were slightly acidic. The organic carbon content values of the Ujemen and Emaudo soils were 9.56 and 7.88 g kg⁻¹ respectively and these were below the critical level of 10 g/kg. The soil nitrogen and available phosphorus (P) were below the critical level of 1.5 g/kg and 15mg/kg at Emaudo and Ujemen site according to (Enwenzor et al., 1989). The initial results of the soil analyses of the experimental site were below critical levels and it was therefore necessary to improve the soil nutrient content through the application of fertilizer.

3.1 Growth Parameters of Maize

The application of full dose of P&K + 75% N through granular urea + 25% N through FYM and full dose of P&K + 75% N through prilled urea + 25% N through FYM significantly ($P \leq 0.05$) increased the height of maize (Table 2, 3, 4 and 5) compared to other treatments. Ipimoroti reported increase in maize height due to combined application of organic and inorganic fertilizer and this was also in agreement with the earlier work done (Ipimoroti, 2002; Busari et al., 2008). It was also observed that the application of NPK increased the growth of maize compared to straight urea fertilizer application. The application of full dose of P&K + 75% N through granular urea + 25% N through FYM and full dose of P&K + 75%

N through prilled urea + 25% N through FYM significantly ($P \leq 0.05$) increased the stem girth of maize compared to other treatments (Table 2, 3, 4 and 5). Also, the application of full dose of P&K + 75% N through granular urea + 25% N through FYM and full dose of P&K + 75% N through prilled urea + 25% N through FYM significantly ($P \leq 0.05$) increased the leaf area of maize compared to other treatments at Emaudo and Ujemen locations (Table 2, 3, 4 and 5). According to a study, the combined application of organic and inorganic fertilizer significantly ($P \leq 0.05$) increased the growth of maize compared to the application of sole mineral fertilizer (Bationo and Koala, 1998).

3.2 Yield and Nutrient Uptake

The cob weight of maize was significantly ($P \leq 0.05$) higher with the application of full dose of P&K + 75% N granular urea + 25% N through FYM and full dose of P&K + 75% N prilled urea + 25% N through FYM compared to other treatments while the control had the lowest cob yield (Table 4 and 5). This confirmed the earlier work of Makinde that combined application of organic and inorganic fertilizers increase the yield of maize than the application of sole mineral fertilizer (Makinde, 2007). The application of full dose of P&K + 75% N granular urea + 25% N through FYM, full dose of P&K + 75% N prilled urea + 25% N through FYM significantly ($P \leq 0.05$) increased the grain yield of maize compared to other treatments. The combine application of inorganic and organic fertilizer has dual benefits, the quick release of nutrients from inorganic fertilizers to enhanced crop yield and improvement of soil physical condition derived from organic manure (Vanlauwe et al., 2001).

According to a study, the application of organ mineral fertilizer significantly ($P \leq 0.05$) increased the yield of maize compared to sole mineral fertilizer and the finding corroborated with the results obtained from this experiment (Dania et al., 2022). The dry matter yield of the above ground biomass of maize was significantly ($P \leq 0.05$) increased with the application of full dose of P&K + 75% N granular urea + 25% N through FYM and full dose of P&K + 75% N through prilled urea + 25% N through FYM at Emaudo and Ujemen experimental sites. It has been reported by that the addition of farmyard manure to soil increased shoot biomass via hormonal effect on root elongation and plant development (Zeng-Yang and Chen, 2004). The dry matter and grain yield were significantly ($p > 0.05$) higher in soil amended granular urea + P&K + FYM and prilled urea + P&K + FYM in both locations. During the second planting season, the combined application of both granular and prilled urea + P&K + FYM significantly ($P \leq 0.05$) increased the yield of maize compared to other treatments.

Though Nitrogen (N) is a macronutrient that is required by crops in large amounts, however, the application of urea alone cannot sufficiently supply the essential nutrient needed to improve a hungry soil. The improvement of soil nutrient through the combined application of inorganic and organic fertilizer is necessary as the fertilizer significantly ($P \leq 0.05$) improved the yield of maize in both planting seasons and locations. The combined application of granular urea, P&K and FYM in both locations significantly ($P \leq 0.05$) increased the nitrogen, phosphorus and calcium uptake compared to other treatments (Table 6 and 7). According to a group researcher, they reported that the combined application of mineral and organic manure significantly ($P \leq 0.05$) increased the nutrient uptake of maize (Muhammad et al., 2008). Also, the application of granular and prilled urea + P & K significantly ($P \leq 0.05$) increased the uptake of nitrogen, phosphorus, calcium, potassium and magnesium in maize compared to the application of sole granular and prilled urea. It was also reported by that the application of NPK significantly ($P \leq 0.05$) increased the nutrient uptake in maize than the application of sole granular and prilled urea (Tulsiram and Mohan, 2018).

4. CONCLUSION

There was significant ($P \leq 0.05$) increase of the growth and yield of maize with the application various fertilizers compared to the control. The grain and dry matter yield obtained from 100% N granular urea was higher than 100% N prilled urea. The application of granular urea + P & K significantly ($P \leq 0.05$) increased the yield of maize compared to the application of straight (sole granular and prilled) urea fertilizer. The application of full dose of P&K + 75% N granular urea + 25% N through FYM and full dose of P&K + 75% N prilled urea + 25% N through FYM significantly ($P \leq 0.05$) increased the growth and yield maize compared to other treatments, however, the application of full dose of P&K + 75% N granular urea + 25% N through FYM increased the growth and yield of maize than the application of full dose of P&K + 75% N prilled urea + 25% N through FYM. In conclusion, the application of full dose of P&K + 75% N granular urea + 25% N through FYM increased the growth, yield and nutrient uptake of maize and farmers can adopt its application.

Table 1: Initial Physicochemical Properties of Ujemen And Emaudo Soil, Compost and Organo-Mineral Fertilizer

parameter	pH	OM	N	P	Ca ²⁺ Mg ²⁺ K ⁺		Na ⁺ E.A		CEC	ECEC		Mn E.B Fe ²⁺ Cu ²⁺			Zn ⁺		Particle size			Textural class
	↔	g/Kg	↔	m/kg	↔		Cmol/Kg		↔	↔		mg/Kg			↔		Sand silt clay g/kg			
Ujem. Soil	6.23	9.56	1.34	19.20	2.62	0.70	0.26	0.39	0.60	3.97	4.57	86.78	71.00	32.00	1.03	0.74	820	65	115	Sandy loam
Compost	8.13	37.23	4.01	31.35	10.78	6.37	8.14	8.14	4.00	33.43	38.03	89.48	20.24	20.24	83.10	94.00				
OMF	8.18	47.18	4.16	38.37	5.45	13.35	19.62	6.42	9.20	44.84	54.04	83.46	8.60	8.60	11.10	23.30				
Em. Soil	4.68	7.88	0.31	4.01	1.03	0.40	0.08	0.04	0.99	1.55	2.54	1.55	37.10	10.21	0.14	1.11	810	70	120	Sandy loam

E.A: Exchangeable Acidity, Ujemen soil (Ujem. soil); Emaudo Soil (Em. soil), CEC: Cation Exchange Capacity, ECEC: Effective Cation Exchange Capacity, E.B: Exchangeable Bases, OMF: Organomineral Fertilizers.

Table 2: Evaluation of Granular, Prilled Urea, NPK and Combined Application of NPK and Organic Fertilizers on the Growth and Yield of Maize at Emaudo (Year one)

Treatment	Plant Height (cm)				Stem Girth (mm)				Leaf Area(cm ²)				Cob wt (tha-1)	DMY (tha-1)	GY (tha-1)
	5	6	7	8	5	6	7	8	5	6	7	8			
	↔				↔				↔						
Control	37.38ab	49.83c	68.25b	91.25c	14.50ab	16.33c	16.75b	17.50b	92.30d	308.17c	517.71c	519.73b	10.56d	7.09d	2.96c
G.U	35.06b	50.51b	65.29b	95.08c	11.75c	16.83c	17.50b	19.83b	308.40c	453.11b	533.64c	591.66b	12.69c	9.04c	3.88b
P.U	34.38b	47.17c	65.95b	96.52c	14.83ab	16.58c	18.33b	19.42b	289.10c	393.16b	523.80c	554.58b	12.59c	9.14c	3.57b
G.U+P&K	37.00ab	58.08b	77.21ab	122.63ab	14.92ab	17.42c	19.67b	20.75a	314.20b	462.64b	560.99c	577.55b	14.52b	12.09b	4.19b
P.U+P&K	40.29a	64.67a	93.38a	131.16a	15.08a	17.67c	21.17a	22.92a	372.00a	507.50b	744.82a	757.66a	14.61b	12.58b	4.15b
G.U+P&K+ FYM	39.06ab	66.38a	89.27a	130.99a	16.58a	20.33a	24.00a	24.58a	363.00a	613.85a	787.25b	838.03a	17.19a	18.17a	4.88a
P.U+P&K+ FYM	44.54a	73.13a	94.00a	135.68a	16.83a	22.17a	23.83a	24.50a	412.10a	632.35a	791.81a	805.98a	18.49a	16.40a	4.79a
LSD	6.97	11.73	13.48	21.50	3.12	2.84	3.40	4.31	74.30	120.90	89.10	137.60	1.63	3.18	0.60

Mean values on the vertical column with same letters are not significantly (p≤0.05) different, means separated by LSD.

Recommended dose of 100% N through Indorama Granular urea

Recommended dose of 100% N through prilled urea

Full dose of P&K + 75% N through Indorama Granular urea

Full dose of P&K + 75% N through prilled urea

Full dose of P&K + 75% N through Indorama Granular urea + 25% N through FYM

Full dose of P&K + 75% N through prilled urea + 25% N through FYM

Table 3: Evaluation of Granular, Prilled Urea, NPK and Combined Application of NPK and Organic Fertilizers on the Growth and Yield of Maize at Emaudo (Year Two).

Treatment	Plant Height (cm)				Stem Girth (mm)				Leaf Area (cm ²)				Cob (t ha-1)	GY (tha-1)	DMY (tha-1)
	5	6	7	8	5	6	7	8	5	6	7	8			
	↔				↔				↔						
Control	29.83	41.13c	72.67b	80.60c	11.91	16.90	19.00b	20.33	301.00	412.40	448.80c	481.60b	9.54e	6.72d	1.46c
G.U	32.62	63.26b	105.21a	125.20ab	16.59	18.87	19.61b	20.67	407.10	434.20	506.70b	550.0ab	10.59d	8.06c	3.89b
P.U	37.30	60.52b	102.33a	125.30ab	17.16	18.61	19.37b	20.45	404.30	519.20	555.9b	573.70ab	11.48c	8.82c	3.83b
G.U+ P&K	37.40	74.56a	106.37a	123.16ab	15.33	18.88	20.33ab	22.03	402.70	535.90	616.20ab	648.80a	13.73b	10.15b	3.98b
P.U+ P&K	33.98	76.88a	102.91a	132.43a	15.66	19.11	20.44a	21.25	311.50	429.10	574.10b	631.10a	13.82b	11.21c	4.05b
G.U+ P&K+ FYM	38.73	81.65a	114.23a	144.50a	15.67	18.87	20.97a	21.70	350.80	551.90	571.00b	621.40a	16.36a	14.37b	4.76a
P.U+ P&K +FYM	37.56	79.87a	111.10a	136.46a	15.88	19.11	21.40a	21.93	389.20	535.40	656.00a	651.30a	16.80a	16.37a	4.64a
LSD	NS	8.26	14.63	12.04	NS	NS	1.01	NS	NS	NS	119.10	95.7	0.87	1.33	0.46

Mean values on the vertical column with same letters are not significantly (p≤0.05) different, means separated by LSD.

LEGEND

GU = Recommended dose of 100% N through Indorama Granular urea

PU = Recommended dose of 100% N through prilled urea

GU+PK = Full dose of P&K + 75% N through Indorama Granular urea

PU+PK = Full dose of P&K + 75% N through prilled urea

PU+PK+FYM = Full dose of P&K + 75% N through Indorama Granular urea + 25% N through FYM

GU+PK+FYM = Full dose of P&K + 75% N through prilled urea + 25% N through FYM

Table 4: Evaluation of Granular, Prilled Urea, NPK and Combined Application of NPK and Organic Fertilizers on the Growth and Yield of Maize at Ujemen (Year one)

Treatment	Plant Height (cm)				Stem Girth (mm)				Leaf Area (cm ²)				Cob (t ha ⁻¹)	DMY (t ha ⁻¹)	GY (t ha ⁻¹)
	↔				↔				↔						
	5	6	7	8	5	6	7	8	5	6	7	8			
Control	51.97	71.10b	100.67b	132.42b	14.90	15.91	16.33	16.83	368.40	518.70	520.66	544.00	10.45c	7.18c	2.11b
G.U	48.91	70.68b	102.28b	138.75b	14.93	17.06	17.75	18.17	413.40	540.21	579.80	590.71	14.49a	12.76a	3.58b
P.U	52.09	77.05a	107.33b	149.08b	16.08	16.15	16.95	17.42	438.30	547.12	581.77	589.75	12.68b	10.76ab	3.57b
G.U+ P&K	49.80	75.20a	113.25a	161.92a	14.92	15.91	16.58	17.00	469.26	530.49	551.00	577.66	14.34a	10.82ab	3.78b
P.U+ P&K	49.93	80.93a	116.83a	157.50a	15.08	17.08	17.92	18.50	410.00	556.82	569.83	583.08	13.89a	12.92a	3.62b
G.U+ P&K+ FYM	52.46	80.65a	107.25b	165.33a	15.67	16.00	16.83	17.33	447.80	569.10	582.23	594.00	15.11a	13.59a	4.54a
P.U+ P&K+ FYM	49.67	81.22a	119.00a	162.83a	15.08	16.25	17.00	17.58	405.40	533.11	561.09	578.19	12.22b	12.52a	4.33a
LSD	NS	9.20	14.90	11.45	NS	NS	NS	NS	NS	NS	NS	NS	2.09	4.11	0.56

Mean values on the vertical column with same letters are not significantly ($p < 0.05$) different, means separated by LSD.

Recommended dose of 100% N through Indorama Granular urea

Recommended dose of 100% N through prilled urea

Full dose of P&K + 75% N through Indorama Granular urea

Full dose of P&K + 75% N through prilled urea

Full dose of P&K + 75% N through Indorama Granular urea + 25% N through FYM

Full dose of P&K + 75% N through prilled urea + 25% N through FYM.

Table 5: Evaluation of Granular, Prilled Urea, NPK and Combined Application of NPK and Organic Fertilizers on the Growth and Yield of Maize at Ujemen (Year Two).

Treatment	Plant Height (cm)				Stem Girth (mm)				Leaf Area (cm ²)				Cobwt (tha ⁻¹)	DMY (tha ⁻¹)	GY (tha ⁻¹)
	5	6	7	8	5	6	7	8	5	6	7	8			
	↔				↔				↔						
Control	28.55	40.66	65.72b	79.40b	15.55	15.66	18.00b	18.53c	327.40	392.40	446.90c	478.80d	8.46d	7.09d	1.79d
G.U	30.66	61.22	100.22a	136.20a	15.22	18.55	18.95b	20.48ab	392.20	465.90	501.60b	537.00c	9.88c	9.04c	2.97c
P.U	29.78	54.77	106.94a	123.20ab	17.11	18.44	18.43b	19.28b	390.50	511.60	572.40ab	579.80b	9.79c	9.14c	2.66c
G.U+P&K	35.16	63.11	104.05a	123.80ab	14.55	18.22	20.55	21.36ab	399.80	490.60	552.40ab	596.30bc	11.52b	11.83b	3.39b
P.U+P&K	23.16	57.55	78.83b	131.16a	12.66	13.66	19.28b	20.14ab	374.50	437.60	574.40ab	602.20ab	11.31b	11.66b	3.34b
G.U+P&K+ FYM	30.28	57.89	103.66a	130.99a	14.66	17.77	20.50	22.28ab	384.60	530.00	581.30ab	619.20a	13.24a	18.96a	4.48a
P.U+P&K+ FYM	29.22	53.11	101.94a	134.68a	15.33	18.55	23.44a	24.64a	389.30	531.40	639.4a	676.50a	13.47a	18.64a	4.25a
LSD	NS	NS	18.46	24.50	NS	NS	2.31	2.31	NS	NS	95.40	72.53	1.43	2.34	0.33

Mean values on the vertical column with same letters are not significantly ($p \leq 0.05$) different, means separated by LSD.

LEGEND

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PU+PK+FYM = Full dose of P&K + 75% N through Indorama Granular urea + 25% N through FYM

GU+PK+FYM = Full dose of P&K + 75% N through prilled urea + 25% N through FYM

Table 6: First Season (2018) Nutrient Uptake of Maize in Both Locations (t/ha-1)

Treatments	Emaudo Campus					Ujemen Campus				
	N	Av. P	Ca	Mg	K	N	Av.P	Ca	Mg	K
Control	20.82e	1.70e	0.33e	0.13d	9.01d	20.12d	2.32c	3.70d	1.60d	0.95d
GU	27.87d	2.91d	4.42d	2.43b	14.23c	37.54b	4.39b	6.59c	2.76bc	4.39c
PU	33.30c	2.23d	4.14d	2.78b	14.85c	39.20b	2.63c	6.34c	3.27b	3.49c
GU+PK	33.03c	6.78a	20.07c	5.30a	24.78b	34.10c	5.72a	21.85a	4.44b	6.51b
PU+PK	31.73c	4.42c	19.13c	5.25a	23.90b	32.58c	4.53b	15.05b	5.39b	5.55b
GU+PK+FYM	55.10a	6.50a	34.78a	5.22a	30.91a	55.22a	6.16a	19.29a	6.20a	15.37a
PU+PK+FYM	41.36b	5.23b	26.45b	5.29a	33.21a	38.58b	3.99b	20.19a	4.57c	16.35a
LSD	5.43	0.51	3.01	0.47	4.02	2.23	1.45	2.51	1.14	2.16

Mean values on the vertical column with same letters are not significantly ($p < 0.05$) different, means separated by LSD.

Table 7: Second Season (2019) Nutrient Uptake of Maize in Both Locations (t/ha-1)

Treatments	Emaudo Campus					Ujemen Campus				
	N	Av. P	Ca	Mg	K	N	Av.P	Ca	Mg	K
Control	20.41d	1.61e	0.31d	0.11a	0.34d	16.41d	3.99c	1.15d	0.60d	0.45d
GU	24.85c	2.60d	1.38c	2.83c	7.86c	22.85c	5.21b	4.66c	2.73c	3.32c
PU	24.24c	2.71d	1.32c	2.78c	7.45c	22.24c	5.33b	4.55c	2.27c	3.12c
GU+PK	32.94b	3.63c	13.93b	5.47b	11.98b	28.94b	5.61b	14.54b	4.44b	6.43b
PU+PK	36.63b	3.73c	13.29b	5.25b	11.01b	26.63b	5.60b	15.05b	4.39b	5.84b
GU+PK+FYM	45.63a	5.28a	23.17a	6.22a	24.78a	41.86a	8.50a	20.29a	6.45a	11.78a
PU+PK+FYM	41.58	4.58	22.78	6.01	23.71	39.58	8.88a	19.61	6.34	12.54
LSD	4.78	0.47	2.11	0.52	3.84	4.78	1.10	3.40	1.37	1.89

Mean values on the vertical column with same letters are not significantly ($p < 0.05$) different, means separated by LSD.

LEGEND

GU = Recommended dose of 100% N through Indorama Granular urea

PU = Recommended dose of 100% N through prilled urea

GU+PK = Full dose of P&K + 75% N through Indorama Granular urea

PU+PK = Full dose of P&K + 75% N through prilled urea

PU+PK+FYM = Full dose of P&K + 75% N through Indorama Granular urea + 25% N through FYM

GU+PK+FYM = Full dose of P&K + 75% N through prilled urea + 25% N through FYM

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