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RESEARCH ARTICLE

Comparative effects of urea, NPK and organomineral fertilizer on the growth and yield of rice in Ekpoma, Nigeria

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ABSTRACT

At two locations on the Ambrose Alli University Teaching and Research Farm in Ekpoma, Nigeria, a two-season experiment was undertaken. Control, granular urea (GU), prilled urea (PU), full dose of PK+75 N through granular urea (GUPK), full dose of P&K+75 percent N prilled urea (PUPK), full dose of P&K+75 percent N through granular urea+25 percent N through Farmyard manure (FYM) (GUPK+FYM), and full dose of P&K+75 percent N through The FARO 59 rice variety was planted, and the data gathered was statistically examined. The soil nutrients status was below a crucial level, and fertiliser application increased the fertility of the soil, resulting in increased output. The GU-affected rice grain yield was higher than the PU-affected rice grain yield, but both were considerably higher than the control. In comparison to GU and PU, GUPK and PUPK treatment considerably boosted rice grain production. In addition, when compared to other treatments, GUPK+FYM and PUPK+FYM application considerably boosted rice growth and grain yield, with grain yields of 8.90 and 8.54 t ha^{-1}, respectively. When GUPK+FYM and PUPK+FYM were used instead of other therapies, nutrient uptake increased dramatically. In conclusion, the use of GUPK+FYM and PUPK+FYM boosted rice growth, nutrient uptake, and yield significantly.

Keywords: Integrated fertilizer; Granular urea; Growth; Prilled urea; Nutrient uptake; Rice; Yields

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INTRODUCTION

Rice (Oryza sativa L.) is the primary source of nutrition for an estimated 40% of the world's population (Liu et al., 2013; FAO, 2010). Rice comes in third place in terms of global production behind wheat and maize, but it delivers more calories than any other cereal crop in terms of value as a food crop. It is a vital staple meal for over 3 billion people on the planet (Schalbroeck, 2001). Nigeria is one of several countries across the world with ideal ecologies for various rice types, which may be used to increase rice production to fulfil domestic need and even export surpluses. Given the high demand for rice and the limited supply of high-quality rice on the international market, interactive research work in practically every element of rice is required, including the identification of fertiliser type and dosage that will suffice to boost production. Rice demand is rapidly increasing due to rapid population growth, greater urbanisation, and rice's popularity as a convenience food. Nigeria consumes over 5 million metric tonnes of rice each year, with over 80% of that being imported, costing the economy a fortune (Onuet al., 2015).

In Nigeria, local rice production is limited, and efforts to raise it are hampered by high input costs and low pricing, especially in rain-fed areas. Most rice farmers in Africa, according to Lenis et al. (2014), still utilise conventional technologies with limited use of modern inputs such as better seed and fertiliser. Because most soils are deficient in organic carbon and have a widespread shortage in nitrogen (N), nitrogen fertiliser has become a crucial input in rice cultivation (Olaleyeet al., 2008). Nitrogen is also the most limiting nutrient in rice production, with significant losses in the system. The most often used nitrogen fertiliser is urea. Conventional prilled urea is a fast-acting nitrogen fertiliser that can quickly be lost due to ammonia volatilization, immobilisation, de-nitrification, and surface runoff when applied using broadcasting methods (Jena et al., 2003). As a result, slow-released nitrogenous fertiliser, such as granular urea, has been advised with deep placement to prevent nitrogen losses. The use of urea fertiliser boosted rice output significantly (p0.05), and urea fertiliser can help rice thrive in nutrient-depleted soil (Tankou, 2004).

The use of granular urea ensures higher N utilisation throughout the growing season, good yield, and a 20-30% reduction in nitrate loss (Wojciechowska, 2002), however Khalil et al. (2009) found that the volatilization loss of prilled urea (PU) is quite high (Khalil et al., 2009). According to Hussain et al. (2003), utilising granular instead of prilled for cabbage and cauliflower saved 20 percent urea. The granular urea technology could be beneficial to upland and dryland crops. When compared to the application of prilled urea (PU), deeper placement of granular urea has been found to significantly lower NH3 and NO3 emissions (Khalil et al., 2006, Haque, 2002).

To boost soil fertility, bio-fertilizers can be employed instead of chemical fertilisers alone, resulting in higher-quality crops. Compost and inorganic fertiliser are the most prevalent types of bio-fertilizer, and they are both environmentally benign. When compared to the usage of urea alone, bio-urea can efficiently improve soil nitrogen and sustain crop yield. It has been reported that using bio-urea boosted maize, rice, and soil nutrient status (Ledha et al., 2000). The purpose of this study was to see how solitary urea (granular and pilled), NPK, and organomineral (NPK +FYM) fertilisers affected rice growth and yield.

MATERIALS AND METHODS

The experiments were laid RCBD consisting of seven treatments which were replicated three times. Rice (Faro 59 variety) used for planting obtained at Cereal Research Institute, Badeggi, Niger State, Nigeria. The planting distance was 25cm x 25cm within and between rows. Fertilizers (granular urea manufactured by Indorama fertilizer company, pilled urea, single super phosphate, murate potash fertilizer were obtained from the open market, NPK while the compost was prepared at the Department of Soil Science. Treatments were:

Control (zero application)

Recommended dose of NPK (100% N through Indorama granular urea) (GU)
Recommended dose of NPK (100% N through prilled urea) (PU)
Full dose of P & K +75% N through Indorama granular urea (GUPK)
Full dose of P & K +75% N through prilled urea (PUPK)
Full dose of P & K +75% N through Indorama granular urea + 25% N through FYM (GUPK+FYM)
Full dose of P & K +75% N through prilled urea + 25% N through FYM. (PUPK+FYM)

The experimental site was 35m × 20m in size, and it was cleared and demarcated into 4m x 4m plots with 1m within and between duplicates. Rice seeds were seeded four to six seeds per hole, and three weeks later, the stands were trimmed to one plant per stand. Fertilizers were applied to the side of the plants four weeks after they were planted. Before harvesting, the weeds were manually controlled three times.

The following growth parameters were taken for rice, heights, number of leaves, tillers and panicles and the readings were taken from August to October, 2019.

The nutrient uptake was also determined;

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

Data on soil physical, chemical properties as well as rice yield and yield components were collected, analyzed statistically using the ANOVA test and the LSD was used to separate means that significantly differ at 5% probability (SAS, 2005).

The initial results of the soil analyses revealed that the nutrient status was generally low and below critical levels (Enwenzor et al., 1989). The soil had a sandy loam texture, and the distribution of sand, silt, and clay in the soil was 820g kg-1, 65g kg-1, and 115g kg-1, respectively (Table 1). We looked at FYM (compost) and organomineral fertiliser (Table 1). The pH of the soil when it was first tested was 5.68, indicating that it was fairly acidic. The pH of the post-experimental soil with GUPK+FYM and PUPK+FYM application had the highest pH values of 6.92 and 6.76, respectively. It revealed that the soil was slightly acidic, but not overly so.

The addition of organic base fertiliser raises the pH of the soil to near neutral or alkaline, according to Sagaye et al. (2020). (Table 2). As a result, organic manure can help to reduce soil acidity while also preserving the soil's organic matter content (Sisay and Sisay, 2019). The addition of organic matter to acid soils was found to reduce soil acidity considerably (p0.05) (Ano and Agwu, 2005). As a result of its high Ca and Mg concentration, organic matter exerts a liming effect. Olayinka and Ailenubhi (2001) reported that FYM significantly (p0.05) increased soil pH throughout incubation.

In both control and urea and NPK plots, organic carbon content was lower than the threshold level of 10g kg-1. The organic matter content of the soil was raised by using bio-fertilizers (GUPK+FYM and PUPK+FYM), with the highest values of 27.40g kg-1 and 26.10g kg-1, respectively. Organic manure has been shown to boost the organic matter content of soil. As demonstrated in the experiment, the application of organic base fertiliser enhanced organic carbon, confirming the prior study of Leifield et al (2002).

Sobulo and Osiname stated that the total nitrogen concentration of the initial soil test was below threshold limits of 1.5-2.0g kg-1 (1981). With values of 3.66g kg-1 and 3.63g kg-1, respectively, the total nitrogen of the post-experimental soil with the applications GUPK+FYM and PUPK+FYM was substantially greater than the other treatments.

The nitrogen content of the soil was increased after applying GUPK and PUPK. The post-harvest test of soil nitrogen from the plot with granular and prilled urea application, however, was not substantially different from the control. GUPK+FYM and PUPK+FYM fertilisers, as well as NPK fertiliser, significantly enhanced soil nitrogen concentration as compared to other treatments. It has been found that applying solitary urea fertiliser to nitrogen-deficient soil increases the nitrogen content of the soil, enhancing crop development and production, but has no long-term effect on the soil (Rahman 2016).

When compared to other treatments, GU+P&K+FYM and PU+P&K+FYM considerably (p0.05) enhanced the amount of Ca, Mg, and K. In addition, urea alone elevated Ca, Mg, and K values more than the control. According to Li-Na et al. (2010), fertiliser application boosts the soil's Ca, Mg, and K content when done correctly.

The initial soil's available phosphorus (P) was 8.01 mg kg-1, which was less than the critical value of 15 mg kg-1. The use of bio-fertilizers such as GU+P&K+FYM and PU+P&K+FYM raised the value above critical limits to 25.35mg kg-1 and 23.31mg kg-1, respectively. The accessible phosphorus in the control group was 9.71 mg kg-1, which is below the threshold value. The use of bio-fertilizers resulted in a substantial increase in nitrogen and phosphorus (p0.05). This could be due to the use of both inorganic and FYM fertilisers. These enrich the soil with organic matter as well as trace metals like iron, manganese, copper, zinc, and boron, which are essential for rice growth (Fagnao, 2011).

Magnesium levels were highest in the GU+P&K+FYM treatments, at 2.52cmol kg-1, followed by PU+P&K+FYM treatments, at 2.44cmol kg-1, and lowest in the control, at 0.36cmol kg-1. According to Amalu, the initial sodium levels was higher than the essential value of 0.02cmol kg-1 (1991). Sodium levels increased significantly in plots where GU+P&K+FYM (1.39cmol kg-1) was used, followed by PU+P&K+FYM (1.33cmol kg-1) and the lowest in the control group (0.03cmol kg-1). The ECEC values were lower than Udo et alcrucial .'s value of 15 cmol kg-1 (2009). The use of granular urea did not result in a significant rise in ECEC. The percentage base saturation in plots with GU application was 85.73 percent, with PU+P&K+FYM having the highest percentage base saturation (94.03 per cent).

In August and September, no significant changes in plant height among treatments used in both locations, however in October, GUPK considerably ($p>0.05$) boosted rice height (Table 3 & 4). The application of a complete dose of P&K + 75 percent N via Indorama granular urea in August resulted in a considerable increase in the number of leaves. In both Ujemen and Emaudo, fertiliser application considerably ($p>0.05$) enhanced the quantity of rice leaves than control in September and October. The application of fertiliser increased the number of tillers significantly when compared to the control; however, granular base fertiliser improved rice growth more than prilled base fertiliser. In the Ujemen location, the quantity of panicles per rice did not change significantly between treatments. The quantity of panicles was positively influenced by fertiliser application, with the maximum number coming from the application of a full dose of P&K + 75 percent N via Indorama granular urea at the Emaudo site. It was discovered that fertiliser application raised rice height at all stages of growth. These findings corroborated the findings of Azam et al. (2012), who found that using an N-based fertiliser greatly enhanced rice height.

In both locations, soil supplemented with GU + P&K + FYM and PU + P&K + FYM produced considerably more dry matter and grain yield (Table 5). According to Kyi et al. (2019), the use of organomineral fertiliser enhanced cereal crop yields smore than the use of straight or mineral fertiliser alone. Sagaye et al. (2020) also found that combining inorganic and organic fertilisers considerably boosted the yield of grain crops. The yield of rice obtained from the application of granular urea was found to be higher than that obtained from the application of prilled urea. However, both yields were considerably higher than the control yield. Rice yield response to applied nitrogen varies dramatically across agro-ecological settings and across time in Nigeria. Nitrogen is important nutritional elements in crop production, and it has an impact on rice growth and yield (Upendra et al., 2018).

Table 1. Initial Physicochemical properties of Ujemen and Emaudo soil, compost and Organo-mineral fertilizer

Parameter	pH	OM (G Kg⁻¹)	N	P (Mgkg⁻¹)	Ca^{2+} (Cmol Kg⁻¹)	Mg^{2+}	K^{+}	Na^{+}	E.A	CEC	ECEC	E.B	Mn	Fe^{2+}	Cu^{2+} (mg Kg⁻¹)	Zn^{+}	Particle size (g Kg⁻¹) Sand	silt	clay	Textural class
Ujemen soil	5.83	9.56	1.34	9.20	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	94.0	-	-	-	-
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	23.3	-	-	-	-
Emaudo Soil	5.68	7.88	1.31	8.01	2.03	0.40	0.18	0.24	0.99	2.85	3.84	80.55	57.10	28.21	1.14	1.11	810	70	120	Sandy loam

Table 2. Growth parameter of rice as affected by bio-urea fertilizer in Ujemen location

Treatments	Height (cm) Aug.	Sept.	Oct.	No. of Leaves Aug.	Sept.	Oct.	No. of Tillers Aug.	Sept.	Oct	NOP	DMW	GY (tha⁻¹)
Control	11.57	18.97	23.52c	22.83e	48.67d	61.17b	7.17b	9.33c	14.00b	10.17	4.27c	3.02d
Granular Urea	14.36	19.12	34.92b	31.00c	80.83ab	108.22a	9.33a	11.67b	20.67a	10.83	7.26b	5.58c
Prilled Urea	13.50	19.62	32.00b	27.17d	72.33b	90.50a	7.83b	12.33b	22.33a	11.00	7.18b	5.61c
Granular Urea + P&K	14.67	20.87	49.00a	47.67a	55.50c	108.33a	11.67a	15.25a	23.33a	12.83	9.34b	7.07ab
Prilled Urea + P&K	13.50	18.82	32.00b	27.83d	77.17b	91.17a	7.33b	12.33b	20.67a	12.00	9.60b	6.75b
Granular Urea + P&K. + F.Y.M	14.22	20.33	30.92b	41.17b	87.17a	111.00a	10.50a	15.83a	20.67a	11.83	13.53a	8.42a
Prilled Urea + P&K + F.Y.M	14.12	20.77	32.97b	34.33c	98.67a	111.50a	11.00a	16.33a	22.33a	11.33	12.55a	8.09a
LSD	NS	NS	6.30	3.31	19.11	26.25	4.04	2.13	5.97	NS	2.26	1.19

Table 3. Growth and yield Parametersf Rice as Affected by Bio-Urea Fertilizer in Emaudo site

Treatments	Height (cm)			No. of Leaves			No. of Tillers			NOP	DMW	GY (t ha^{-1})
	Aug.	Sept.	Oct.	Aug.	Sept.	Oct.	Aug.	Sept	Oct			
Control	12.10	16.20	19.51^{b}	20.58^{b}	46.10^{c}	52.42^{b}	5.33^{b}	10.42^{c}	12.17^{c}	11.08^{c}	4.83^{c}	3.14^{d}
Granular Urea	14.10	19.60	31.81^{a}	32.25^{a}	81.40^{b}	106.00^{a}	9.00^{a}	13.80^{b}	19.50^{ab}	13.17^{c}	8.29^{b}	6.21^{c}
Prilled Urea	13.45	19.60	29.55^{a}	25.67^{b}	68.80^{b}	92.72^{a}	6.25^{b}	12.20^{b}	18.25^{b}	16.58^{ab}	8.04^{b}	5.83^{c}
Granular Urea + P&K	14.52	20.10	34.71^{a}	29.42^{a}	71.10^{b}	109.42^{a}	7.75^{a}	15.25^{a}	21.75^{ab}	19.17^{a}	9.93^{b}	7.90^{ab}
Prilled Urea + P&K	13.75	20.60	29.72^{a}	30.17^{a}	88.80^{b}	102.25^{a}	7.08^{a}	14.67^{a}	18.08^{b}	14.17^{ab}	9.86^{b}	7.14^{ab}
Granular Urea + P&K. + F.Y.M	13.52	19.10	34.90^{a}	31.75^{a}	67.70^{b}	110.25^{a}	8.17^{a}	17.08^{a}	25.42^{a}	14.58^{ab}	13.63^{a}	8.90^{a}
Prilled Urea + P&K + F.Y.M	14.12	18.80	35.22^{a}	28.92^{a}	103.70^{a}	122.62^{a}	8.33^{a}	16.40^{a}	22.58^{a}	15.25^{ab}	13.63^{a}	8.54^{a}
LSD	NS	NS	2.81	3.31	19.11	46.25	1.25	2.13	3.51	6.87	3.56	1.29

Table 4. Growth and yield Parameters of Rice as Affected by Bio-Urea Fertilizer in Ujemen site

Treatments	Height (cm)			No. of Leaves			No. of Tillers			NOP	DMW	GY (t ha^{-1})
	Aug.	Sept.	Oct.	Aug.	Sept.	Oct.	Aug.	Sept.	Oct.			
Control	10.93^{b}	19.00	40.00^{b}	11.87^{b}	18.20^{b}	32.67^{c}	3.90^{c}	8.66^{b}	11.67^{b}	8.17^{c}	3.18^{c}	2.74^{c}
Granular Urea	12.99^{ab}	19.62	53.77^{ab}	15.20^{b}	23.70^{ab}	37.77^{b}	4.89^{ab}	9.66^{b}	13.00^{ab}	10.83^{b}	6.21^{b}	5.20^{b}
Prilled Urea	13.32^{ab}	18.56	39.90^{b}	15.10^{b}	23.43^{ab}	39.57^{b}	5.23^{ab}	8.46^{b}	12.43^{ab}	10.00^{b}	6.02^{b}	5.06^{b}
Granular Urea + P&K	14.50^{a}	21.73	55.87^{b}	18.10^{a}	27.57^{a}	46.00^{a}	5.57^{ab}	9.46^{b}	14.33^{a}	12.83^{a}	6.49^{b}	6.01^{b}
Prilled Urea + P&K	14.56^{a}	20.70	54.33^{b}	18.80^{a}	26.23^{a}	42.67^{ab}	6.23^{a}	9.66^{b}	13.13^{ab}	12.00^{a}	6.61^{b}	5.92^{b}
Granular Urea + P&K. + F.Y.M	14.61^{a}	21.77	53.23^{ab}	18.23^{a}	27.33^{a}	48.33^{a}	5.80a	11.77^{a}	13.23^{ab}	11.83^{a}	10.97^{a}	7.21^{a}
Prilled Urea + P&K +F.Y.M	15.20a	21.97	64.10^{a}	17.77^{a}	27.33^{a}	51.67^{a}	5.23^{ab}	13.73^{a}	15.10^{a}	11.33^{a}	9.89^{a}	6.89^{a}
LSD	2.77	NS	17.94	3.21	7.24	9.27	1.37	2.13	5.97	1.50	3.34	0.64

Table 5. Growth and yield Parameter of Rice as Affected by Bio-Urea Fertilizer in Emaudo site (second season)

Treatments	Height (cm)			No. of Leaves			No. of Tillers			NOP	DMW	GY (t ha^{-1})
	Aug.	Sept.	Oct.	Aug.	Sept.	Oct.	Aug.	Sept	Oct			
Control	10.58^{b}	21.91^{b}	29.42^{b}	12.24^{c}	45.75^{c}	65.83^{d}	3.40^{b}	13.67^{c}	27.58^{c}	6.75^{c}	2.89^{c}	2.89^{c}
Granular Urea	12.42^{ab}	24.91^{b}	31.75^{b}	17.75^{b}	53.75^{b}	78.00^{c}	6.29^{a}	17.23^{b}	30.92^{b}	15.00^{ab}	3.07^{b}	5.22^{ab}
Prilled Urea	13.08^{ab}	27.20^{ab}	37.08^{b}	16.58^{b}	56.33^{b}	74.91^{c}	6.25^{a}	19.79^{b}	30.42^{b}	16.50^{ab}	3.76^{b}	4.59^{c}
G U + P&K	12.25^{ab}	25.50^{b}	36.83^{b}	19.83^{ab}	54.43^{b}	85.67^{ab}	7.17^{a}	18.17^{b}	32.50^{b}	18.25^{ab}	3.79^{b}	6.13^{b}
P U + P&K	12.92^{ab}	27.02^{ab}	35.17^{b}	20.27^{ab}	56.66^{b}	86.66^{ab}	6.92^{a}	21.42^{ab}	39.67^{a}	20.00^{a}	3.90^{b}	5.99^{b}
G U + P&K + FYM	14.33^{a}	32.37a	45.54^{a}	23.51^{a}	77.41^{a}	102.66^{a}	7.83^{a}	23.59^{a}	43.50^{a}	21.75^{a}	6.34^{a}	7.55^{a}
PU +P&K + FYM	12.75^{ab}	29.03^{ab}	41.95^{a}	21.34^{ab}	76.25^{a}	98.67^{a}	7.50^{a}	24.50^{a}	39.45^{a}	20.77^{a}	6.23^{a}	7.01^{a}
LSD	2.31	6.54	6.43	5.27	12.52	15.04	1.70	3.47	4.78	6.87	1.01	0.91

Table 6. Nutrient uptake of rice in both locations (t ha^{-1})

Treatments	Emaudo Campus					Main Campus				
	N	Av. P	Ca	Mg	K	N	Av.P	Ca	Mg	K
Control	4.32^{c}	1.18^{d}	0.38^{d}	0.38^{d}	4.78^{d}	6.24^{c}	1.71^{c}	0.54^{b}	0.55^{c}	15.92^{d}
GU	9.68^{ab}	1.95^{c}	4.26^{c}	2.38^{c}	11.70^{c}	19.58^{b}	1.93^{c}	4.27^{a}	5.19^{b}	19.65^{c}
PU	9.98^{ab}	1.52^{c}	4.70^{c}	3.72^{c}	11.46^{c}	20.79^{b}	1.94^{c}	4.03^{a}	5.08^{b}	18.62^{c}
GU+PK	11.25^{b}	2.62^{b}	4.56^{c}	5.50^{ab}	18.41^{b}	20.18^{b}	2.35^{b}	4.78^{a}	5.88^{b}	24.61^{b}
PU+PK	10.47^{b}	2.49^{b}	6.67^{b}	5.56^{ab}	17.65^{b}	20.29^{b}	4.15^{a}	4.83^{a}	5.96^{b}	22.30^{b}
GU+PK+FYM	16.33^{a}	4.98^{a}	9.23^{a}	6.64^{a}	25.15^{a}	37.66^{a}	4.69^{a}	5.21^{a}	6.90^{a}	31.13^{a}
PU+PK+FYM	15.86^{a}	5.01^{a}	8.89^{a}	6.48^{a}	26.01^{a}	37.01^{a}	4.67^{a}	5.07^{a}	6.87^{a}	30.94^{a}
LSD	2.84	0.69	1.23	1.85	4.67	9.29	0.66	0.87	0.81	2.05

Table 7. Nutrient uptake of rice in both locations (t ha^{-1})

	Emaudo Campus					Main Campus				
Treatments	N	Av. P	Ca	Mg	K	N	Av.P	Ca	Mg	K
Control	16.58	1.07	0.43	0.54	9.09	14.66	1.83	0.38	0.47	13.34
GU	26.13	3.57	1.70	6.93	16.73	22.38	3.42	3.00	3.06	19.06
PU	25.34	3.25	1.03	1.76	19.46	13.18	2.55	3.68	1.15	18.92
GU+PK	28.35	3.01	18.53	3.44	22.41	28.80	4.46	3.93	4.01	24.61
PU+PK	27.63	3.89	19.80	3.15	27.65	24.21	3.20	3.83	1.34	22.30
GU+PK+FYM	38.73	7.29	32.32	5.36	28.15	34.12	4.51	5.40	1.89	32.13
PU+PK+FYM	36.19	7.11	28.79	5.73	30.00	22.84	4.27	6.48	1.95	32.94

The use of a well-managed nitrogen fertiliser boosted rice yield considerably (p>0.05). Rice yields were higher with granular + P&K than with prilled urea + P&K. When compared to solo urea, the administration of GUPK and PUPK resulted in significantly better yields (p>0.05). This indicated that the soil was similarly low in these important soil nitrogen components, which were supplemented with NPK. According to Kyi et al. (2019), NPK treatment outperformed solo granular urea and Prilled Urea in terms of yield efficiency.

Both straight and combination applications (inorganic and organic) were found to boost nutrient uptake in rice at both locations than the control (Table 6 & 7). The application of a full dose of P&K + 75% N through Indorama Granular urea + 25 % N through FYM and a full dose of P&K + 75% N through prilled urea +% percent N through FYM increased nitrogen, phosphorus, and other nutrient uptake when compared to other treatments used in the experiment, and these findings were consistent with Fagbola's earlier report (2005). The use of NPK to rice improved nutrient absorption more than granular and prilled urea. In comparison to the control, single urea administration boosted nutrient absorption considerably (p0.05).

According to the findings, granular fertiliser yielded a better yield than prilled fertiliser on rice. When compared to granular and prilled fertiliser, NPK fertiliser treatment considerably increases rice growth and yield. Furthermore, compared to solitary application of chemical fertiliser, integrated application of inorganic and organic fertiliser boosted rice growth, yield, and nutrient uptake.

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