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PERFORMANCE OF MAIZE VARIETIES (*Zea mays* L.) WITH DIFFERENT RATES OF NITROGEN FERTILIZER AND COWDUNG IN MUBI, NORTHERN GUINEA SAVANNA, NIGERIA

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Abstract

The aftermath of insurgency, climate change and poor soil fertility, necessitated the search for crops that can perform better within a short duration under the vagaries of environment. Thus, field experiments were conducted in 2014 and 2015 rainy reasons at the FAO/TCP farm, Adamawa State University Mubi, Nigeria to study the Performance of maize varieties (Zea mays L.*) with different rates of Nitrogen fertilizer and cowdung. Treatments consisted of maize varieties [(Quality Protein Maize (QPM) and Extra Early White (EEW)], Nitrogen rates (0, 60 and 120 kg N ha^{-1}) and cowdung rates (0, 1 and 2 t ha^{-1}). In an experiment laid out in a split plot design, the varieties were assigned to the main plots and nitrogen with cowdung in a factorial combination assigned to the subplots and replicated three times. Data were collected on plant height, leaf area index, plant dried weight, days to 50% maturity and grain yield per hectare and analyzed using SAS system for windows. Result showed that EEW had the highest plants height, leaf area index and plant dried weight. Nitrogen at 120 kg ha^{-1} produced highest plant dry weight and grain yield. Similarly, cowdung at 1 t ha^{-1} gave highest plant height, leaf area index and early days to 50 % maturity. There were interactions between treatments on parameters measured. Base on the results, varieties were observed to perform very well, with EEW manifesting higher characteristics. Thus, Nitrogen at 120 kg ha^{-1} should be use in the cultivation and be complimented with 1 t ha^{-1} cowdung.*

Key words: *cowdung, maize varieties, nitrogen fertilizer, performance.*

INTRODUCTION

Maize (*Zea mays* L) is the most important cereal crop in the farming systems of the savanna zone of Nigeria (Tarfa et al., 2003). Maize is also widely believed to have the greatest potential among food crops for attaining technological breakthrough that will improve food production (Kamara and Sanginga, 2001). Of upmost importance is the protein component of quality protein maize which contains double amount of nutrients found in other varieties (Kamara, Sanginga, 2001). Because of the climate change, poor soil fertility and scarcity of inorganic fertilizer as well as its contribution to environmental consequences research focused has been shifted towards the combined application of organic and inorganic fertilizers as a way to arrest the anomaly in sub-Saharan Africa (Van Lauwe et al., 2001). The utilization of cattle manure as a soil amendment has been in existence with the Nigerian poor resource farmers (Haris, Yusuf, 2001, Iwuofor et al., 2002). However, information that is lacking is the management practices and rate of application for optimum crop production, more especially, to compliment inorganic fertilizers.

Thus, this research aimed at studying the effects of organic and inorganic fertilizers, their complimentary role on improved varieties of maize in Mubi and similar environments.

MATERIALS AND METHODS

Field experiments were conducted in 2014 and 2015 rainy reasons at the FAO/Tree Crops Plantation farm, Faculty of Agriculture, Adamawa State University Mubi, Nigeria (Latitude 10^0 15' N, and Longitude 13^0 16' E at an altitude of 696 m above sea level) to study the Performance of maize varieties (*Zea mays* L.) with different rates of Nitrogen fertilizer and cowdung. Treatments consisted of maize varieties [(Quality Protein Maize (QPM) and Extra Early White (EEW)], nitrogen rates (0, 60 and 120 kg N ha^{-1}) and cowdung rates (0, 1 and 2 t ha^{-1}). These treatments were arranged in an experiment laid out in a split plot design; with varieties assigned to the main plots and nitrogen with cowdung in a factorial combination assigned to the subplots and was replicated three times. Land for the experiment was ploughed and harrowed using tractor. Soil Samples were randomly collected at a depth of 0-15 cm and 15-30 cm and their physco-chemical properties determined. Total land area used was 945.5 m^2 with gross plot size of 13.5 m^2 and net plot size of 4.5 m^2, path ways of 0.5 m between plots and 1 m between replications were also created. Sowing for 2014 and 2015 raining season were done on 9th July, 2014 and 3rd July, 2015, respectively. Two seeds were sown per hole at a spacing of 0.75 m x 0.25 m and were later thinned to one plant per stand at 2 weeks after sowing (WAS). Nitrogen fertilizer rates were applied in two split doses; first dose from NPK (15-15-15) was applied together with cowdung at land preparation. The NPK (15-15-15) also supplied the recommended 26 kg ha^{-1} P and 50 kg ha^{-1} K. The second dose of N was applied at 5WAS using Urea. Weeds in the fields were controlled by applying pre – emergence herbicides on the sowing date, Primextra (290 g/liter S - metolachlor and 370 g/litre atrazine) at 4 L ha^{-1} were applied. Spraying of the herbicides were done using 20 L knapsack sprayer. This were then supplemented by hand hoe at 3 and 9 WAS to keep the plots free from weeds. Data were collected at 3 and 6 WAS and at harvest on plant height, leaf area index (LAI) and Plant dried weight, days to 50% maturity and grain yield ha^{-1}. Data generated were subjected to analysis of variance using SAS system for windows (SAS v8 2000). Means showing significant F - test were separated using DMRT at 5% level of probability.

RESULTS AND DISCUSSION

Result of the physico - chemical properties of the experimental sites in the seasons indicated that the soil textural class was sandy - loam, soil pH (H_2O), organic carbon (g kg^{-1}), organic matter (g kg^{-1}), Total N (g kg^{-1}), available P (mg kg^{-1}) and CEC (cmol kg^{-1}) in 2014 at 0 - 15 cm were 6.4, 3.5, 6.2, 1.0 and 5.3, respectively and at 15 - 30 cm were 6.2, 1.1, 2.2, 1.5 and 5.2, respectively. Similarly, in 2015 at 0 - 15 cm were 6.0, 10.4, 17.1, 2.2 and 6.1, respectively. While at 15 - 30 cm were 6.3, 9.1, 15.3, 2.2 and 6.2, respectively. The variation in the physico - chemical properties in the seasons may be due to the residual soil nutrient which made that of 2015 rainy season higher than that of the 2014 rainy season. The effect of variety, nitrogen and cowdung on plant height of maize in 2014 and 2015 raining seasons and combined (Table 1) shows highly significant ($P \leq 0.01$) differences between varieties; at 3 WAS in 2014 raining season and combined, QPM produced taller plants, 21.97 cm and 19.21 cm, respectively. However, plant heights were taller in EEW in the seasons and combined at harvest (190.77 cm in the combined seasons). Similarly, in Table 1 no significant ($P > 0.05$) effect of nitrogen on plant height recorded at 3 WAS. Highly significant effect was recorded at 6 WAS and at harvest. Application of 120 kg N ha^{-1} produced taller plants of 92.72 cm at 6 WAS and 193.01 cm at harvest in the combined seasons. Shorter plants were recorded with 0 kg N ha^{-1}. Also in Table 1 no significant effect of cowdung on plant height of maize was recorded except in 2015 raining seasons (17.14 cm) at 3 WAS and in 2014 raining season (95.00 cm) and combined (88.80 cm) at 6 WAS where 1 ton ha^{-1} cowdung had taller plants. There were no interactions between variety with nitrogen except in 2014 raining season and combined at 3 WAS; QPM with 120 kg N ha^{-1} had taller plants (23.46 cm and 22.93 cm, respectively) (Table 2). No interaction between varieties with cowdung except in 2014 raining seasons at 3 WAS. QPM with 2 ton ha^{-1} cowdung had the tallest plant (34.15 cm) (Table 2). No interaction between nitrogen with cowdung except in 2014 raining seasons and combined at 6 WAS and in 2014 raining season at harvest (Table 1). At 6 WAS in 2014 raining season 120 kg N ha^{-1} with 0 t ha^{-1} cowdung (103.17 cm) and 120 kg N ha^{-1} with 1 t ha^{-1} cowdung (101.60 cm) were statistically similar and had taller plants (Table 2). The interaction between variety, nitrogen with cowdung was significant only in the combined seasons at harvest; EEW, 120 kg N ha^{-1} with 1 t ha^{-1} cowdung gave the tallest plants (Table 2). The significant differences between varieties might be due to genetic characteristics. Some varieties are dwarf and others tall, some maize varieties with stand environmental stress more than others.

Table 1. Effect of variety, nitrogen and cowdung on plant height (cm) of maize (*Zea mays* L.)

Treatment	3 WAS			6 WAS			At harvest		
	2014	2015	CMD	2014	2015	CMD	2014	2015	CMD
Varieties (V)									
Extra early white	20.58_b	16.25	18.41_b	91.36	79.74	85.55	193.63_a	187.91_a	190.77_a
Quality Protein Maize	21.97_a	16.45	19.21_a	90.84	80.48	85.68	176.66_b	175.38_b	176.02_b
Level of significance	**	NS	**	NS	NS	NS	**	**	**
SE ±	2.486	0.755	1.299	2.669	5.608	3.106	2.901	8.959	4.709
Nitrogen (N) kg ha^{-1}									
0	13.16	16.07	14.62	81.76_c	$67.8b_b$	74.79_b	177.12_c	164.77_b	170.95_b
60	20.36	16.58	18.47	92.89_b	86.58_a	89.74_a	187.39_b	189.83_a	188.61_a
120	24.31	16.40	20.36	99.51_a	85.92_a	92.72_a	195.68_a	190.33_a	183.01_a
Level of significance	NS	NS	NS	**	**	**	**	**	**
SE ±	1.982	0.427	1.014	2.317	1.969	1.520	2.325	3.595	2.141
Cowdung (C) t ha^{-1}									
0	16.96	15.45_b	16.18	83.63_b	76.38	80.01_b	181.54	182.85	182.19
1	19.90	17.14_a	18.52	95.00_a	82.60	88.80_a	186.36	179.41	182.89
2	20.82	16.45_b	18.64	94.72_a	81.35	88.04_a	187.55	182.67	185.11
Level of significance	NS	**	NS	**	NS	**	NS	NS	NS
SE ±	1.982	0.427	1.014	2.317	1.969	1.520	2.325	3.595	2.141
Interactions									
V x N	*	NS	**	NS	NS	NS	NS	NS	NS
V x C	**	NS	NS	NS	NS	NS	NS	NS	NS
N x C	NS	NS	NS	**	NS	**	**	NS	NS
V x N x C	NS	NS	NS	NS	NS	NS	NS	NS	**

Means in the same column followed by the same letter are not significant at 5% using DMRT. CMD = combined
* = $P \leq 0.05$, ** = $P \leq 0.01$, NS = $P > 0.05$

Table 2. Interactions of variety, nitrogen and cowdung on plant height (cm) of maize (*Zea mays* L.)

Treatment	At 3 WAS in 2014 rainy season		At 3 WAS in the Combined seasons	
Variety	EEW	QPM	EEW	QPM
Nitrogen kg ha^{-1}				
0	20.29c	21.02b	18.25c	20.97b
60	20.28c	22.43a	18.21c	21.73b
120	21.16b	23.46a	18.78c	22.93a
SE ±	2.80		1.43	
Cowdung t ha^{-1}				
0	19.82d	23.99b		
1	20.42a	29.72ab		
2	21.49c	34.15a		
SE ±	2.80			

	At 6 WAS in 2014 rainy season			At 6 WAS in the combined seasons			At harvest in 2014 rainy season		
Nitrogen kg ha^{-1}	0	60	120	0	60	120	0	60	120
Cowdung t ha^{-1}									
0	56.90c	90.83ab	103.17a	61.93e	81.74cd	80.71d	154.33e	193.12b	196.67a
1	95.10a	88.30ab	101.60a	87.04c	88.61c	92.36b	182.60c	179.10d	197.37a
2	93.27a	97.13a	98.77a	91.04b	96.06a	91.04b	179.23d	190.4bc	193.0b
SE ±		4.01			2.63			4.03	

Combined seasons at harvest						
Variety	EES			QPM		
Nitrogen kg ha^{-1}	0	60	120	0	60	120
Cowdung t ha^{-1}						
0	154.72e	206.30a	198.97a	165.22c	182.44b	185.51b
1	181.95b	191.34ab	203.38a	165.08c	173.97c	181.56b
2	185.49b	195.71a	199.05a	158.21d	182.65b	189.53b
SE ±			5.24			

EEW = extra early white; QPM = quality protein maize

Table 3. Effect of variety, nitrogen and cowdung on leaf area index of maize (*Zea mays* L.)

Treatment	3 WAS			6 WAS			At Harvest		
Variety (V)	2014	2015	CMD	2014	2015	CMD	2014	2015	CMD
Extra early white	0.08	0.05	0.06	0.32	0.29	0.31	0.40a	0.34	0.37a
Quality protein maize	0.08	0.04	0.07	0.30	0.28	0.29	0.36b	0.32	0.34b
Level of significance	NS	NS	NS	NS	NS	NS	**	NS	**
SE±	0.0062	0.0024	0.0033	0.0094	0.013	0.008	0.0042	0.029	0.0146
Nitrogen (N) kg ha^{-1}									
0	0.07	0.05	0.06	0.25b	0.23b	0.27b	0.37a	0.28	0.33b
60	0.07	0.05	0.06	0.34a	0.31a	0.32a	0.39a	0.36a	0.38a
120	0.08	0.05	0.07	0.36a	032a	0.34a	0.37b	0.36a	0.37a
Level of significance	NS	NS	NS	**	**	**	**	**	**
SE ±	0.004	0.0033	0.0024	0.0150	0.099	0.009	0.0089	0.092	0.064
Cowdung (C) t ha^{-1}									
0	0.07	0.05	0.06b	0.29	0.28	0.29	0.37	0.33	0.35b
1	0.08	0.05	0.07a	0.32a	0.29a	0.31a	0.39	0.35	0.37a
2	0.08	0.05	0.07a	0.33	0.28	0.31	0.39	0.32	0.36a
Level of significance	NS	NS	**	NS	NS	NS	NS	NS	**
SE ±	0.036	0.033	0.0024	0.0150	0.0099	0.009	0.089	0.092	0.064
Interaction									
V x N	NS	NS	NS	NS	NS	NS	NS	NS	NS
V x C	NS	NS	NS	NS	NS	NS	NS	NS	NS
N x C	NS	NS	NS	**	NS	NS	**	NS	NS
V x N x C	NS	NS	NS	NS	NS	NS	NS	NS	**

Means in the same column followed by the same letter are not significant at 5% using DMRT. * = $P \leq 0.05$, ** = $P \leq 0.01$, NS = $P > 0.05$, CMD = combined

This result agreed with that of Azeez and Adetunji (2003) that, improved crop varieties exhibitgenetic characteristics and/or influence of the environment. And that of Yahaya (2008) and Olakanle (2009) that maize varieties varies in their performance. Also Jama et al. (2000) reported an increased in the growth of maize due to cow manure. The effect of cowdung may be due to its ability to improve water holding capacity, soil aeration, soil structure, nutrient retention and microbial activity. The significant interactions of some of the parameter might be due to varietal response to nutrient. The effect of variety, nitrogen and cowdung on LAI of maize in 2014 and 2015 raining seasons and combined (Table 3) shows no significant differences between varieties on LAI at 3 and 6 WAS and at harvest in 2015 rainy season.

Highly significant effect was recorded at harvest in 2014 raining season and combined, EEW had the highest LAI (0.40 and 0.37, respectively) (Table 3). No significant effect of nitrogen at 3 WAS. Highly significant effect was recorded at 6 WAS and at harvest. 120 kg N ha^{-1} had the highest LAI at 6 WAS and at harvest 60 kg N ha^{-1} took over (Table 3). Except in the combined seasons at 3 WAS and at harvest where cowdung at 1 t ha^{-1} had higher LAI no significant effect of cowdung recorded (Table 3). No interactions recorded except in 2014 rainy season at 6 WAS and at harvest (Table 3). Also in Table 3 no interaction between variety, nitrogen with cowdung except in 2014 raining season at 3 WAS and combine at harvest. In Table 4 the interaction that had higher LAI in 2014 raining season at 6WAS was 120 kg N with 1 t ha^{-1} cowdung (0.37) and at harvest was 60 kg N ha^{-1} with 2 t ha^{-1} cowdung (0.43). The significant differences between varieties might be due to genetic characteristics which could have affected plant height and number of leaves per plant, which might have in turn affected LAI. Environmental factors might have also contributed to the variation in LAI. Earlier, Aziz et al. (2014) reported that, nitrogen increase leaf area of maize. Increase in LAI can also be due to the application of cowdung. Table 5 shows the effect of nitrogen and cowdung on plant dried weight of maize in the seasons. No significant differences between varieties recorded except in 2015 rainy season at 6 WAS and in 2014 rainy season at harvest, EEW produced higher plant dried weights of 335.21g and 905.93g, respectively. Similarly, highly significant effect of nitrogen was recorded in the seasons and combined except in 2014 rainy season and the combined at 6 WAS (Table 5); 120 kg had the highest effect producing 805.66 g in the combined seasons at harvest. Also in Table 5, no significant effect of cowdung on plant dried weight in the seasons, except in 2014 rainy season at 3 WAS and the combined seasons at harvest; 2 t ha^{-1} cowdung produced maximum plant dried weight of 706.32 g in the combined seasons at harvest. Furthermore, there were no interactions except in the combined seasons at harvest (Table 5).

Table 4. Interactions of variety, nitrogen and cowdung on leaf area index of maize (*Zea mays* L.)

	At 6 WAS in 2014 rainy season			At harvest in 2014 rainy season		
Nitrogen kg ha^{-1}	0	60	120	0	60	120
Cowdung t ha^{-1}				0.31d	0.36c	0.37bc
0	0.16d	0.34b	0.37a	0.39b	0.38b	0.39b
1	0.29cd	0.32c	0.36ab	0.41a	0.43a	0.37bc
				SE ± 0.01		
2	0.31c	0.35ab	0.34b			
SE ±	0.026			0.01		
	At harvest in the combined seasons					
Variety	EEW			QPM		
Nitrogen kg ha^{-1}	0	60	120	0	60	120
Cowdung t ha^{-1}						
0	0.2926cd	0.3985a	0.421a	0.2840d	0.3440c	0.3647bc
1	0.3635bc	0.3958a	0.4045a	0.3188c	0.3733b	0.3728b
2	0.3520c	0.3493c	0.3695b	0.2842d	0.3763b	0.3597c
SE ±	0.016					

EEW = extra early white; QPM = quality protein maize.

Table 5. Effect of variety, nitrogen and cowdung on plant dried weight (g) of maize (*Zea mays* L.)

Treatment		3 WAS			6 WAS			12 WAS	
Varieties (V)	2014	2015	CMD	2014	2015	CMD	2014	2015	CMB
Extra Early white	36.19	69.69	52.94	197.71	335.21a	266.46	905.93a	487.07	696.50
Quality protein maize	40.33	73.19	56.77	185.04	297.08b	241.06	877.78b	435.54	656.66
Level of significance	NS	NS	NS	NS	**	NS	**	NS	NS
SE ±	1.867	2.995	1.765	3.211	4.441	2.741	10.965	22.096	12.333
Nitrogen (N) kg ha^{-1}									
0	32.82b	49.52c	41.17c	180.81	228.80b	204.81	721.11b	292.71b	506.91b
60	40.61a	68.09b	54.35b	198.24	257.32a	277.78	900.00a	534.35a	717.18a
120	41.36a	96.72a	69.04a	195.07	362.31a	278.69a	1055.44a	566.87a	805.66a
Level of significance	**	**	**	Ns	**	NS	**	**	**
SE ±	2.298	5.246	2.864	11.295	12.125	8.285	62.067	22.484	33.008
Cowdung (C) t ha^{-1}									
0	31.72b	68.37	50.05	177.48	314.07	245.78	816.22	446.18	631.2b
1	38.81a	75.41	57.11	187.21	306.67	246.94	952.22	431.77	691.99a
2	44.20a	70.54	57.37	209.38	327.69	268.54	106.67	505.97	706.32a
Level of significance	**	NS	NS	NS	NS	NS	NS	NS	*
SE ±	2.298	5.246	2.864	11.295	12.125	8.285	62.067	22.484	33.008
Interaction									
V x N	NS	NS	NS	NS	NS	NS	NS	NS	NS
V x C	NS	NS	NS	NS	NS	NS	NS	NS	NS
N x C	NS	NS	NS	NS	NS	NS	NS	NS	NS
V x C x N	NS	NS	NS	NS	NS	NS	NS	NS	**

Means in the same column followed by the same letter are not significant at 5% using DMRT.
* = $P \leq 0.05$, ** = $P \leq 0.01$, NS = $P > 0.05$, CMD = combined

Table 6. Interactions of variety, nitrogen and cowdung on plant dried weight of maize in the combined seasons

Variety	EEW			QPM		
Nitrogen kg ha^{-1}	0	60	120	0	60	120
Cowdung t ha^{-1}						
0	316.750g	820.75a	864.55a	393.15f	550.22d	843.12a
1	687.483c	807.10a	688.33c	513.65d	622.40c	833.02a
2	661.25c	655.27c	767.00b	469.17e	847.32a	837.92a
SE ±	80.85					

EEW = extra early white; QPM = quality protein maize

In Table 6, QPM with 60 kg N ha^{-1} and 2 t ha^{-1} cowdung had the highest plant dried weight (847.32 g). The significant differences between varieties, the effect of nitrogen and cowdung on plant height and leaf area index might have given the plants ability to accumulate more assimilates and thus, more dry matter per plant. The effect of variety, nitrogen and cowdung on days to 50% maturity of maize in the seasons is presented in Table 7. Highly significant differences existed between varieties on days to 50% maturity in 2014 rainy season and combined, QPM took longer days to 50% maturity; 87.07 and 89.65 days, respectively. Similarly, in Table 7 highly significant effect of nitrogen was recorded in the seasons 0 kg N ha^{-1} had longer days to 50% maturity. There was a highly significant effect of cowdung on days to 50% maturity in 2014 rainy season and combined, 0 ton ha^{-1}took longer days to 50% maturity (Table 7). No interactions recorded (Table 7). The significant differences between varieties on days to 50 % maturity may be due to varietal differences; early maturing and late maturing. Similarly, nitrogen is known to promote cell division, enlargement and overall plant growth and development. Where fertilizer is lacking maize undergoes abnormal growth.

Table 7. Effect of variety, nitrogen and cowdung on days to 50% maturity and grain yield of maize (*Zea mays* L.)

	Days to 50% maturity			Grain yield (kg ha^{-1})		
Treatment	2014	2015	Combined	2014	2015	Combined
Varieties (V)						
Extra Early White	79.11b	92.78	85.5b	3960.9	4240.8	4100.9
Quality Protein Maize	87.07$_a$	92.22	89.65$_a$	3706.8	4533.1	4119.9
Level of significance	**	NS	**	NS	NS	NS
SE ±	0.302	0.164	0.172	146.289	174.498	113.853
Nitrogen (N) kg ha^{-1}						
0	85.17$_a$	93.50$_a$	89.34$_a$	3454.6b	2662.5c	3058.6c
60	82.67$_b$	92.28$_b$	87.48$_b$	3946.9a	4902.6b	4424.8b
120	79.94$_c$	91.72$_b$	85.83$_c$	4100.0a	5658.3a	4879.2a
Level of significance	**	**	**	**	**	**
SE ±	0.424	0.314	0.264	155.994	223.453	135.885
Cowdung (C) t ha^{-1}						
0	84.22$_a$	92.55	89.33$_a$	3773.5	4366.0	4069.8
1	81.33$_b$	92.28	87.47$_b$	4084.7	4164.8	4123.8
2	82.22$_c$	92.66	87.44$_b$	3643.2	4609.6	4126.4
Level of significance	**	NS	**	NS	NS	NS
SE ±	0.424	0.314	0.264	155.994	223.453	135.885
Interaction						
V x N	NS	NS	NS	**	NS	NS
V x C	NS	NS	NS	NS	NS	NS
N x C	NS	NS	NS	NS	NS	NS
V x N x C	NS	NS	NS	NS	NS	NS

Means in the same column followed by the same letter are not significant at 5% using DMRT.
* = P ≤ 0.05, ** = P ≤ 0.01, NS = P > 0.05

The effect of variety, nitrogen and cowdung on grain yield of maize in the seasons (Table 7) shows no significant differences between varieties on grain yield. Highly significant effect of nitrogen on grain yield was recorded in the seasons. Application of 120 kg N ha^{-1} had highest grain yield (4878.20 kg ha^{-1}) in the combined seasons (Table 7).

No interaction between varieties with nitrogen on gain yield, except in 2014 rainy season where EEW with 120 kg N ha^{-1} had the highest grain yield of 4264.20 kg ha^{-1} (Table 8).

No other interactions on grain yield. As more dry matter accumulated by plant, harvest index (grain yield) increased. Yield varies with variety; some varieties are high yielding than others (Odeleye, Odeleye, 2001).

Table 8. Interactions of variety, nitrogen and cowdung on grain yield (kg ha^{-1}) of maize (*Zea mays* L.) in 2014 rainy season

Variety	Extra early white	Quality protein maize
Nitrogen		
0	3880.25b	3028.96d
60	4264.20a	3827.16c
120	3935.80b	4066.67a
SE ±	220.61	

CONCLUSIONS

Maize varieties (Quality protein maize and Extra early white) were found to respond positively to fertilizer application with nitrogen at 120 kg ha^{-1} and 1 t ha^{-1} cowdung produced optimum yield. Thus, should be use in the cultivation.

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