# Yield response of pearl millet and soil nutrients to time of planting and fertilizer application on an alfisols in Makurdi, Nigeria.

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## ABSTRACT

The influence of time of planting and fertilizer application on yield of Pearl millet (Pennsetum typhoides) and soil nutrients content was studied at the Teaching and Research Farm of the University of Agriculture, Makurdi, Benue State, Nigeria. The experiment was a 10 x 2 randomized complete block design (RCBD) with three replications. The factors and levels were control (no application), 40 -20 – 20 Kg NPK/ha, 40 -20 – 20 Kg NPK/ha + 1.5 t/ha PM, 40 -20 – 20 Kg NPK/ha + 3.0 t/ha PM, 60 -30 – 30 Kg NPK/ha, 60 -30 – 30 Kg NPK/ha + 1.5 t/ha PM, 60 -30 – 30 Kg NPK/ha + 3.0 t/ha PM, 80 -40 – 40 Kg NPK/ha, 80 -40 – 40 Kg NPK/ha + 1.5 t/ha PM, 80 -40 – 40 Kg NPK/ha + 3.0 t/ha PM. Millet was planted April and August. Soil properties were determined prior to experimentation and after harvest. Seed yield and panicle length were taken at harvest. The result indicated that early planting gave significantly (< 0.05) higher grain yield than the late planted one. Application of 60 – 30 – 30 Kg NPK/ha gave higher seed yield of 1,516.5 and 1,250.0 Kg/ha in 2008 and 2009 respectively than other treatments. The yield obtained however, was not statistically different from application of 40 – 20 – 20 Kg NPK/ha + 3 t/ha of PM. Combination of poultry manure and NPK fertilizer raised the level of soil pH, total N, available P, K, Na, Ca and ECEC. Early planting of millet and application of 60 – 30 – 30 Kg/ha or 40 – 20 – 20 Kg NPK/ha + 3 t/ha of PM is hereby recommended for millet in Makurdi.

**Key words:** Millet, Yield, organic manure, inorganic fertilizer, panicle length.

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## INTRODUCTION

Pearl Millets **(**Pennisetum typhoids) is a warm weather annual cereal, grown most especially for its edible seeds (Onwueme and Sinha, 1991). In Nigeria, millet is produced largely in the Sahel Sudan and in the northern Guinea Savanna zones. Yield increase for millet as it is for many other crops has been marginal whereas the area cultivated has substantially increased. The decline in yield is attributed mainly to low fertility status of the soil resulting from continuous cropping, incidence of pests and unfavorable weather. The soil is characterized by low levels of activity clay, organic matter, nitrogen, phosphorus and exchangeable cations (Adenle, 2010). Food production however, is dependent of soil fertility, hence there is need for proper management of soil fertility for enhanced food production and its sustainability.

In recent time, many soil fertility improvement techniques have been recommended, which include adoption of appropriate and adequate fertility packages, involving the use of organic and inorganic fertilizer. Combined application of inorganic manure with inorganic fertilizer reduces both the quantities of organic manure and inorganic fertilizer that is required (Parr *et al*., 1990).

Previous studies have demonstrated significant effect of combined application of organic and inorganic fertilizer as well as time of application on yields of maize and other crops and soil nutrients (Kemper, 2010). Adequate research has not been accorded response of pear millet and soil nutrient to combined and time of organic and inorganic application in Makurdi, Nigeria. In

addition, the need to enhance the productivity of millet, a key staple food in Benue state of Nigeria necessitated this research work. This work was therefore designed to investigate the effect of varying combinations of poultry manure and NPK fertilizer and time of application on yield of pearl millet and on soil nutrients of an Alfisol.

## MATERIALS AND METHODS

### Experimental Site

The field experiment was conducted at the Teaching and Research Farm of the University of Agriculture Makurdi during the 2008 and 2009 cropping reason. Makurdi falls within latitude $7^0.41^1$ N and longitude $8^0.37^1$ E at an elevation of about 97 meters above sea level in the Southern Guinea Savanna agro ecological zone of Nigeria and has two distinct seasons; wet and dry; the wet season starts from April and ends in October with mean annual rainfall of 1,250 mm and mean temperature of $28^0$C. The textural class of the soil is sandy loam and it is generally coarse textured, especially in the surface horizons and well to moderately drain.

**Experimental Treatments and Design**

The experiment consisted of ten fertilizer treatments and two time of planting as follows:

1. control
2. NPK 40 : 20 : 20 + 0 tonnes PM/ha
3. NPK 40 : 20 : 20 + 1.5 tonnes PM/ha
4. NPK 40 : 20 : 20 + 3.0 tonnes PM/ha
5. NPK 60 : 30 : 30 + 0 tonnes PM/ha
6. NPK 60 : 30 : 30 + 1.5 tonnes PM/ha
7. NPK 60 : 30 : 30 + 3.0 tonnes PM/ha
8. NPK 80 : 50 : 50 + 0 tonnes PM/ha
9. NPK 80 : 50 : 50 + 1.5 tonnes PM/ha
10. 10. NPK 80: 50: 50: + 3.0 tonnes PM/ha

PM= (Poultry Manure).

Planting was carried out two times: First in April (early planting) and the second one in August (late planting). The treatments were laid in a Randomized Complete Block Design (RCBD) and replicated three times on a land area of 686$M^2$. Land preparation was carried out manually with a hoe. The land was cleared and ridges constructed at a spacing of 1.0 m apart. Poultry manure was mixed with half the rates of the inorganic fertilizer and incorporated in the soil one week before planting. Five seeds of millet were planted per hole at a spacing of 0.75 x 1.0 m. and were later thinned to two (2) seedlings per hole at two weeks after planting giving a plant population of 26,667 stands per hectare. Planting was carried out in May (early planting) and in July (late planting)

Weeding was done at 2 WAP and 7 WAP in each of the cropping year. The remaining part of the inorganic fertilizer was applied 2 WAP. Plant height, leaf area and panicle length were collected at 3, 6, 9 and 12 WAP while seed weight was measured at harvest.

A bulked soil sample was collected at 0 – 15 cm before plating. Bulked soil samples were also collected in each of treatment plot after harvest analyzed for; pH, organic matter (OM), total nitrogen (N), available phosphorus (P), exchangeable cations (CEC), effective cation exchange capacity (ECEC) particle size distribution (PSD)and organic carbon (OC). The pH was determined in water (1:2) and in 0.01m calcium chloride ($CaCl_2$) solution (1:2.) Particle size distribution was determined by the hydrometer method. Total nitrogen was determined by macro- Kjedahl method (Black, 1965). The organic carbon (0C) was determined using Walkey – Black (1934) method. Bray-1 method was used to determine available phosphorus (P). The exchangeable bases: calcium (Ca) potassium (K) magnesium (Mg) and sodium (Na) were determined using the EDTC titration method (Black, 1965). The Effective Cation Exchange Capacity (ECEC) was calculated as the sum of the exchangeable bases (Black, 1965)

Crop data collected were subjected to analysis of variance and the means that were statistically different were separated using Fisher's least significant difference (F-LSD) (Obi, 1986).

## RESULTS AND DISCUSSION

### Rainfall Distribution in Makurdi

The rainfall distribution in Makurdi during the 2008 and 2009 cropping seasons are presented in Table 1. The result indicates that rainfall commenced in April even though there were little drops in January. In 2008, the highest rainfall was recorded in August (280.2 mm) while the months of February and November did not record any rainfall. The highest frequency was recorded in August (22.) In 2009, the highest rainfall was recorded in October (284.1 mm) while the highest frequency was recorded in October (22). The months of February and December, 2009 did not record any rainfall. The period of commencement and ending of rainfalls in both years satisfied early and late cropping of millet in Makurdi.

Table 1: Rainfall distribution in Makurdi during 2008 and 2009

| | Rainfall (mm) | | | |
|---|---|---|---|---|
| Months | 2008 | | 2009 | |
| | Rainfall | Frequency | Rainfall | Frequency |
| Jan | 3.0 | 1 | 2.3 | 1 |
| Feb. | 00.0 | 00 | 00 | 00 |
| Mar. | TR | 1 | 3.0 | 1 |
| Apr. | 186.1 | 12 | 180.1 | 10 |
| May | 147.4 | 15 | 190.3 | 9 |
| Jun | 186.1 | 16 | 139.6 | 15 |
| Jul. | 81.6 | 12 | 86.1 | 16 |
| Aug. | 280.2 | 22 | 275.3 | 21 |
| Sept. | 83.0 | 12 | 140.5 | 17 |
| Oct. | 81.5 | 9 | 284.1 | 22 |
| Nov. | 00.0 | 00 | 1.2 | 1 |
| Dec. | 01.6 | 1 | 0 | 00 |

TR = Trace Rainfall; Frequency is the no. of rainfall per month *Source: NAF Base Meteorological Station, Makurdi.*

**Soil Properties of the study site**

Data summarizing the properties of soil used for the field study are shown in Table 2. The soil of the experimental site before fertilizer application was sandy loam. The soil was adequate in pH (6.4), low cation exchange capacity (2.29) and high available phosphorus. The values for total N and organic matter all fall within the critical low range in soils of southern guinea savanna (Donahue *et al*., 1990). With low N, organic matter and low CEC, it is obvious that the soil is inherently low in fertility and therefore, expected to exhibit response to fertilizer application. This results not with standing, the soil was considered suitable for cultivation of millet which according to Onwueme and Sinha (1991) can be grown on all types of soil and does not strikingly respond to fertilizer treatment.

Table 2: Some physical and chemical properties of the soil used for the filed experiment

| Parameters | Values |
|---|---|
| Sand (%) | 85.0 |
| Silt (%) | 11.70 |
| Clay (%) | 3.30 |
| pH ($H_2O$ 1:1) | 6.40 |
| pH(0.01N $CaCl_2$ 1:2) | 5.60 |
| Organic Matter (%) | 2.08 |
| Organic carbon (%) | 1.04 |
| Total Nitrogen (%) | 0.07 |
| Available $P_{(ppm)}$ | 22.65 |
| Mg (c mol $Kg^{-1}$) | 0.43 |
| Ca (c mol $Kg^{-1}$) | 1.20 |
| Na (c mol $Kg^{-1}$) | 0.30 |
| K (c mol $Kg^{-1}$) | 0.16 |
| ECEC (meq 100 $g^{-1}$) | 2.09 |

## Effect of applied fertilizer on nutrient content of the soil

The chemical properties of soil as influenced by fertilizer application during the 2008 and 2009 cropping seasons are presented in Tables 3 and 4 respectively. The pH of soil after 2008 harvest decreased in the control (T1) and NPK 60: 30: 30 (T5) by 0.10 % while application of NPK 40:20:20 + 3.0 t/ha of poultry manure ($T_4$) increased the soil pH by 0.20 %. Similarly, the soil organic matter (SOM) increased in all manure applied treatments and decreased in non-manure treatments. Total nitrogen decreased in control (T1) but increased in all the other treatments. The exchangeable bases decreased in the control (T1) but increased in both manure and no manure treatments.

In 2009, a slight decrease in soil pH with application of NPK 60:30:30 and NPK 80:50:50 was observed. The SOM decreased in control, NPK 40:20:20, NPK 40:20:20 + 1.5 t/ha of poultry manure per hectare, NPK 60:30:30 and NPK 60:30:30 + 3.0 t/ha of poultry manure per hectare but increased in NPK 40:20:20 + 3.0 t/ha poultry manure, NPK 60:30:30 + 3.0 t/ha poultry manure per hectare and NPK 80:50:50 + 3.0 t/ha. Total nitrogen was higher with application of NPK 80:50:50 + 3.0 t/ha poultry manure per hectare. The lowest percentage was recorded in the control. Available P increased remarkably with application of NPK 40:20:20 + 3.0 t/ha poultry manure per hectare, NPK 60:30:30 + 3.0 t/ha poultry manure per hectare and NPK 80:50:50 + 3.0 tonnes of poultry manure per hectare but decreased in control and application of NPK 60:30:30. The exchangeable bases and ECEC decreased in the control treatment. However, at all the rates of manure treatments and inorganic fertilizer, K and Na increased by over 100%. Mg and Ca levels increased with increase in the rate of

manure application. Similarly, ECEC increased with increase in the rate of manure application.

The pH of the soil was expected to rise with the addition of poultry manure due to the alkaline nature and the Ca level of poultry manure (Hileman, 1972. There was decrease in soil pH in the control treatment (T1), NPK 60:30:30 (T5) and NPK 80:50:50 (T8) during 2008 cropping season probably because of absence of organic. The increase in soil pH adduced to addition of poultry manure agree with analysis of Boateng *et al*., (2006) and Samuel *et al.,* (2003) who reported that application of poultry manure to soil increase soil pH. The increase in the levels of soil organic matter observed in manure treated plots may be attributed to the application of poultry manure. The organic matter content of the soil was consistently low in non manure treatments. This finding is agree with that of Kihanda, *et al.,* (2005) who reported that application of manure increased soil organic matter

The increase in N content with the addition of poultry manure might be due to release of N from its decomposition and increased microbial activities as a result of increased concentration of nutrients which would have enhanced decomposition of organic form of N and hence increased total N (Brady and Well, 2007). Similar results were reported by Maerere *et al* (2001) and Agbede *et al* (2008) that total N of soil was significantly ($P<0.05$) increased with the application of poultry manure. The depletion in total N observed in the control treatment may be attributed to nutrient up take by millet. Padwick (1983) had reported that many African soils have nutrient deficiency problem after a short period of cultivation, with N being most depleted. The depletion in the level of P

in the control treatment may be attributed to uptake of the nutrient by millet and probably due to fixation of the element by soil particles (Brady and Well, 2007). The increase in P probably resulted from the application of poultry manure which might have undergone mineralization to release P. Mineralization of organic manure usually lead to the release of organic P and production of organic acid which have solubilizing effect on soil P and the organic anions which retard fixation of P in soil (Narwal and Antil, 2005). The release of nutrients to the soil by poultry manure most probably explains the increases in Mg, Ca, Na and K. The increases in Mg, Ca, Na and K upon application of poultry manure have been reported by Hileman, (1970), Pool *et al* (2000), and Boateng et *al* (2006). This observation agree with Awodum *et al* (2007) who reported that organic manure significantly ($P<0.05$) increased ECEC of soil over treatments with sole NPK application at Akure south western Nigeria.

Table 3: Some physical and Chemical Properties of the soil at harvest during 2008 cropping season

| Properties | Treatments | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $T_1$ | $T_2$ | $T_3$ | $T_4$ | $T_5$ | $T_6$ | $T_7$ | $T_8$ | $T_9$ | $T_{10}$ |
| Sand (%) | 84.2 | 83.9 | 82.6 | 78.4 | 85.30 | 84.0 | 79.9 | 80.4 | 79.7 | 80.4 |
| Silt (%) | 12.5 | 12.0 | 11.0 | 14.8 | 11.7 | 11.0 | 15.0 | 13.6 | 14.1 | 13.2 |
| Clay (%) | 3.3 | 4.1 | 6.4 | 6.8 | 3.0 | 5.0 | 5.1 | 6.0 | 6.2 | 6.4 |
| pH ($H_2O$ 1:1) | 6.3 | 6.4 | 6.5 | 6.6 | 6.3 | 6.6 | 6.6 | 6.3 | 6.5 | 6.5 |
| pH(0.01N$CaCl_2$ 1:2) | 5.1 | 5.5 | 5.7 | 5.8 | 5.6 | 5.4 | 5.8 | 5.4 | 5.7 | 5.8 |
| Organic Matter (%) | 1.90 | 1.90 | 2.63 | 2.88 | 1.92 | 2.80 | 2.87 | 2.00 | 2.82 | 2.86 |
| Total Nitrogen (%) | 0.05 | 0.07 | 0.07 | 0.08 | 0.08 | 0.10 | 0.12 | 0.10 | 0.12 | 0.12 |
| Available $P_{(ppm)}$ | 20.03 | 22.67 | 23.72 | 24.80 | 23.60 | 24.47 | 24.89 | 24.51 | 24.84 | 25.60 |
| Mg (c mol $Kg^{-1}$) | 0.38 | 0.41 | 1.20 | 1.33 | 0.42 | 0.65 | 1.40 | 0.43 | 1.30 | 1.24 |
| Ca (c mol $Kg^{-1}$) | 0.96 | 1.03 | 1.47 | 1.80 | 1.65 | 1.26 | 1.81 | 1.60 | 2.10 | 2.43 |
| Na (c mol $Kg^{-1}$) | 0.28 | 0.25 | 1.60 | 1.62 | 0.20 | 0.55 | 1.46 | 0.24 | 1.34 | 1.61 |
| K (c mol $Kg^{-1}$) | 0.04 | 0.20 | 0.24 | 0.40 | 0.23 | 0.24 | 0.38 | 0.22 | 0.28 | 0.36 |
| ECEC (meq 100 $g^{-1}$ ) | 1.66 | 1.89 | 4.51 | 5.15 | 2.50 | 2.70 | 5.05 | 2.49 | 5.02 | 5.64 |

Table 4: Some physical and Chemical Properties of the soil at harvest during 2009 cropping season

| Properties | Treatments | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $T_1$ | $T_2$ | $T_3$ | $T_4$ | $T_5$ | $T_6$ | $T_7$ | $T_8$ | $T_9$ | $T_{10}$ |
| Sand (%) | 76.8 | 77.2 | 78.0 | 82.2 | 80.2 | 80.0 | 81.1 | 80.0 | 78.4 | 82.6 |
| Silt (%) | 19.7 | 18.8 | 19.3 | 16.0 | 11.0 | 16.0 | 12.9 | 14.6 | 14.8 | 11.4 |
| Clay (%) | 3.5 | 4.0 | 2.7 | 6.8 | 4.0 | 3.8 | 6.0 | 5.4 | 6.8 | 6.0 |
| pH ($H_2O$ 1:1) | 6.3 | 6.3 | 6.5 | 6.6 | 6.2 | 6.5 | 6.6 | 6.2 | 6.5 | 6.0 |
| pH(0.01N $CaCl_2$ 1:2) | 5.0 | 5.4 | 5.5 | 5.7 | 5.4 | 5.5 | 5.6 | 5.3 | 5.4 | 5.5 |
| Organic Matter (%) | 1.70 | 1.73 | 2.62 | 2.80 | 1.08 | 2.42 | 2.68 | 1.83 | 2.60 | 2.80 |
| Total Nitrogen (%) | 0.05 | 0.06 | 0.08 | 0.10 | 0.08 | 0.09 | 0.10 | 0.08 | 0.08 | 0.11 |
| Available $P_{(ppm)}$ | 18.74 | 22.20 | 22.23 | 22.46 | 22.22 | 22.26 | 23.07 | 22.24 | 23.01 | 24.13 |
| Mg (c mol $Kg^{-1}$) | 0.54 | 0.56 | 0.66 | 0.80 | 0.58 | 0.58 | 0.80 | 0.55 | 0.68 | 0.82 |
| Ca (c mol $Kg^{-1}$) | 1.79 | 1.73 | 2.03 | 2.44 | 1.80 | 2.06 | 2.63 | 1.89 | 2.14 | 2.66 |
| Na (c mol $Kg^{-1}$) | 0.28 | 0.31 | 0.40 | 0.62 | 0.33 | 0.50 | 0.60 | 0.30 | 0.62 | 0.64 |
| K (c mol $Kg^{-1}$) | 0.14 | 0.40 | 0.62 | 0.80 | 0.46 | 0.66 | 0.84 | 0.31 | 0.80 | 0.88 |
| ECEC (meq 100 $g^{-1}$) | 2.75 | 3.0 | 3.71 | 4.66 | 3.17 | 3.80 | 4.87 | 3.05 | 4.24 | 5.0 |

## Effect of Time of Planting and Fertilizer Application on Panicle length and Grain yield of Millet

Table 5 summarized the main effect of time of planting and fertilizer application on panicle length and grain yield of millet. Late planted millet produced statistically shorter panicle length in 2008 and 2009. Similarly, grain yield was lower when millet was planted late (July). Panicle length performance in year 2008 was significantly better than year 2009. Significant year effect was however not observed with respect to grain yield. Application of NPK 60:30:30 gave the highest grain yields in 2008 (11,516.5 Kg/h) and 2009 (1,250 Kg/h). The lowest grain yields were obtained following application of NPK 80:50:50 +3.0 (t/h) of PM both in 2008 and 2009 cropping seasons. The interaction effect of time of planting and fertilizer application is summarized in Table 6. The grain yield of millet showed significant interaction with respect to time of planting and fertilizer rate during the two cropping seasons. For the panicle length, the interaction effect was only observed in 2009. Application of 60 – 30 – 30 Kg NPK/ha gave significantly higher seed yields both in 2008 and 2009 at the early planting opportunity than the late planting period. For the panicle length, application of 80 – 40 – 40 Kg NPK/ha significantly gave higher length of panicle in 2009 at the early date than the late period of planting. The control (no application) gave the least result. This may be inferred that panicle length of pearl millet does not strikingly, respond to fertilizer application.

Grain yield of pearl millet was significantly increased ($P<0.05$) with fertilizer application. The yield obtained from application of NPK 40:20:20 plus 3 tonnes poultry manure per hectare was statistically the same with the

application of NPK 60:30:30 alone. This is an indication that organic manure can be enriched with inorganic fertilizer to have millet yield similar to that from sole application of inorganic fertilizer. Plant nutrient use efficiency can be enhanced by combined application of organic and inorganic fertilizer (Agboola, 1975), such responses have been reported on several crops. Murwira and Kirchmann (1993) had observed that the nutrient use efficiency of crop is increased through a combined application of organic manure and mineral fertilizer. This study has also revealed that although peal millet was able to efficiently utilize nutrients in the combined application of poultry manure and NPK fertilizer, this does not go on indefinitely as can be observed from the Table 5. The low grain yield recorded with application of NPK 60:30:30 + 3.0 t/ha, NPK 80:50:50, NPK 80:50:50 + 1.5 t/ha and NPK 80:50:50 + 3.0 t/ha poultry manure can be attributed to "excess" N., over – supply of which often result to excessive vegetative or foliar growth at the expense of reproductive development there by affecting grains yield.

Table 5: Effect of Time of Planting and Fertilizer Application on Panicle Length and Grain Yield of Millet at Makurdi, Nigeria.

| Treatment | **Panicle Length** | | **Grain Yield (Kg/h)** | |
|---|---|---|---|---|
| Time of planting | **2008** | **2009** | **2008** | **2009** |
| Early | 31.07 | 29.70 | 1080.5 | 984.3 |
| Late | 27.30 | 24.83 | 732.8 | 630.3 |
| Mean | 29.20 | 27.27 | 906.7 | 807.3 |
| LSD (0.05) | 0.94 | 0.52 | 123.1 | 121.9 |
| T- test (0.05) | 5.18 | | $0.15^{ns}$ | |
| Fertilizer Rate | | | | |
| $T_1$ | 23.8 | 22.7 | 858.0 | 812.5 |
| $T_2$ | 26.0 | 24.9 | 929.5 | 905.9 |
| $T_3$ | 27.9 | 26.2 | 1064.0 | 1006.5 |
| $T_4$ | 28.1 | 26.6 | 1400.5 | 1171.9 |
| $T_5$ | 29.2 | 26.9 | 1516.5 | 1250.0 |
| $T_6$ | 29.6 | 27.6 | 1315.0 | 1165.0 |
| $T_7$ | 30.6 | 28.4 | 696.5 | 676.5 |
| $T_8$ | 31.3 | 28.8 | 479.0 | 454.2 |
| $T_9$ | 31.6 | 29.6 | 396.0 | 357.0 |
| $T_{10}$ | 32.1 | 30.5 | 284.8 | 236.6 |
| LSD (0.05) | 2.70 | 2.15 | 275.2 | 262.6 |
| T-test (0.05) | $1.47^{ns}$ | | $0.54^{ns}$ | |

Table 6: Interaction Effect of Time of Planting and Fertilizer Application on Plant Height of Millet at Makurdi, Nigeria.

| Treatment | | Panicle length | | Grain yield (kg/h) | |
|---|---|---|---|---|---|
| **Time of planting** | **Fertilizer rates** | **2008** | **2009** | **2008** | **2009** |
| **Early** | $T_1$ | 24.7 | 23.3 | 1035.0 | 998.0 |
| | $T_2$ | 29.7 | 26.8 | 1116.0 | 1089.0 |
| | $T_3$ | 29.7 | 28.8 | 1348.0 | 1268.0 |
| | $T_4$ | 29.8 | 29.4 | 1686.0 | 1519.6 |
| | $T_5$ | 31.3 | 30.0 | 1718.0 | 1532.0 |
| | $T_6$ | 31.6 | 30.2 | 1642.0 | 1402.0 |
| | $T_7$ | 32.5 | 31.0 | 943.0 | 808.9 |
| | $T_8$ | 33.5 | 31.5 | 541.0 | 499.8 |
| | $T_9$ | 33.8 | 32.5 | 436.0 | 431.0 |
| | $T_{10}$ | 34.1 | 33.0 | 340.0 | 295.0 |
| **Late** | | | | | |
| | $T_1$ | 22.8 | 22.1 | 681.0 | 627.0 |
| | $T_2$ | 26.9 | 23.0 | 743.0 | 722.8 |
| | $T_3$ | 26.0 | 23.6 | 780.5.0 | 745.0 |
| | $T_4$ | 26.5 | 23.6 | 1159.0 | 981.2 |
| | $T_5$ | 27.0 | 24.4 | 1315.0 | 1020.0 |
| | $T_6$ | 27.6 | 25.0 | 988.0 | 928.0 |
| | $T_7$ | 28.7 | 25.8 | 659.0 | 585.0 |
| | $T_8$ | 24.0 | 26.0 | 417.0 | 410.8 |
| | $T_9$ | 29.3 | 26.6 | 359.5 | 283.0 |
| | $T_{10}$ | 30.1 | 28.0 | 22.95 | 178.1 |
| LSD(0.05) | | NS | 1.63 | 189.2 | 185.5 |

## Relationship between seed yield and soil properties and panicle length as influenced by organic and inorganic fertilizer application

Table 7 present the correlation between seed yield and soil properties and panicle length as influenced by fertilizer application in the field. Seed yield of millet correlated negatively with all the soil properties and panicle length. This result agrees with the findings of Onwueme and Sinha (1991) that millet can be grown on all types of soil and does not strikingly respond to fertilizer treatment. The result further proves that the yield of millet is not dependent on the panicle length.

Table 7: Relationship between seed yield and soil properties and panicle length as influenced by fertilizer application

| Sources of comparison | Grain yield |
|---|---|
| pH | - 0.098 |
| OM | - 0.460 |
| N | - 0.373 |
| P | - 0.226 |
| Mg | - 0.206 |
| Ca | - .0.283 |
| Na | - 0.194 |
| K | - 0.164 |
| ECEC | - 0.348 |
| Panicle length | - 0.164 |

Correlation coefficient (r)

## CONCLUSSION

The influence of time of planting and fertilizer application on yield of Peal millet (Pennsetum typhoides) and soil nutrients content was studied at the Teaching and Research Farm of the University of Agriculture Makurdi, Benue State, Nigeria. The experiment was a 10 x 2 randomized complete block design with three replications. The result indicated that early planting gave significantly (< 0.05) higher grain yield than the late planted one. Application of 60 – 30 – 3-Kg NPK/ha gave higher seed yield of 1,516.5 and 1,250.0 Kg/ha in 2008 and 2009 respectively than other treatments. The yield obtain however, was not statistically different from application of 40 – 20 – 20 Kg NPK/ha + 3 t/ha of PM. Combination of poultry manure and NPK fertilizer raised the level of soil pH, total N, available P, K, Na, Ca and ECEC. Early planting of millet and application of 60 – 30 – 30 Kg/ha or 40 – 20 – 20 Kg NPK/ha + 3 t/ha of PM is hereby recommended for millet in Makurdi.

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