RESPONSE OF OKRA TO DIFFERENT LEVELS OF NPK 20:10:10 FERTILIZER IN AN EXPERIMENTAL FARM IN ASABA, DELTA STATE, NIGERIA.

Ojobor, S.A.

Department of Agronomy, Delta State University, Asaba Campus. Asaba, Delta State, Nigeria.
E-mail: ojoborsmart@yahoo.com, 08065938821

ABSTRACT

The field experiment assessed the influence of different levels of NPK 20:10:10 on the growth and yield of okra. The study was carried out on experimental site close to low rice Experimental Field (Fadama), Department of Agronomy, Delta State University, Asaba Campus in 2009 cropping season. Five levels of NPK 20:10:10 were applied (0, 150, 200, 250 and 300 kg/ha), replicated four times. The okra variety used was lady finger. Both the fertilizer and okra seeds were obtained from ADP, Ibusa, Asaba. Parameters considered were: plant height, number of leaves, plant girth, total leaf area, number of pods per plant and pod yield per hectare. Pre planting soil analysis was also conducted. The growth and yield data collected were subjected to analysis of variance, differences among treatments mean were separated using DMRT at 5% level probability. The result of the soil analysis shows that the experimental site was deficient in some major nutrient elements (N, K and Mg). There were significant differences among the levels of NPK 20:10:10 application. Growth parameters increases with age of plant. The highest number of pod was observed at 300 kg/ha and it was significantly higher than the lower levels. Also, 300 kg/ha had the highest pod yield per hectare, though it was not significantly different from 250 kg/ha but was significantly different from the other lower levels. Therefore, 250 kg/ha is recommended to farmers in Asaba and its environs for optimum okra production.

Keyworks – Inorganic fertilizer, Okra, Soil fertility

INTRODUCTION

With increased pressure on land for agriculture and non agricultural activities, shifting cultivation is no longer sustainable and bush fallow period of maintaining soil fertility has become shorten or no longer practiced. The problems of soil fertility in the tropics are compounded by high degree of weathering, rapid depletion of organic matter, heavy precipitation and increased intensity of cropping (Okigbo, 1990). As a result, the tropical soils get degraded quickly and this has become a serious threat to crop production in the tropics (Nigeria) (Ojeniyi, 2000; ICRISAT, 1991).

The demand for food as a result of population increase has imposed great pressure on farmers to seek for ways of increasing crop production through the use of fertilizer (Doramola *et al*., 2004). The two options of fertilizers are organic and inorganic fertilizers, the organic fertilizer is bulky and difficult to convey and when large hectares are cultivated, it mineralize slowly over a long period of time (Akinfusoye and Olufola, 1998). It is now clear that the prospect of obtaining enough organic manure to meet the required amount for the teaming farming population is remote (Anon, 2000). Inorganic fertilizer has a role to play in order to remedy this problem, since its nutrients are easily available for plant use, it is not bulky and is also easy to convey.

Okra (Abelmoscus esculentus) is important vegetable crop commercially produced throughout the world. They are produced in all the agro-ecological zones in Delta State. Despite the increasing importance of okra in the country, its production is still low. This is attributed to decline in fertility status of the soil and non location specific fertilizer recommendation. The effects of different levels of NPK 20:10:10 on okra production in different zones

has received attention (Awe *et al*., 2007; Abdulsalam and Ogunsola, 2007) but no information is available on Asaba soils and its environs. Hence the objective of the study was to assess the effects of different levels of NPK 20:10:10 fertilizer on the growth and yield of okra in Asaba, Delta State, Nigeria.

MATERIALS AND METHODS

The field experiment was conducted in 2009 planting season, at the Teaching and Research Farm, close to low rice experimental site (Fadama), Delta State University, Asaba Campus. Located at latitude 06^0 14'N and 06^0 49'E of the equator. The annual temperature and rainfall are 23.8^0 C-37.3^0 C and 1500mm-2000mm respectively (Meteorological bulletin, 2009). Clearing of the site was done manually with hoe and cutlass. All the grasses and shrubs were removed from the field. The field was then marked out after tilling with hoe and spade. Okra seed (lady finger) and fertilizer were obtained from ADP, Ibusa, Delta State. The inorganic fertilizer was applied at five levels 0; 150; 200; 250 and 300 kg/ha. The experiment was laid out in randomized complete block design (RCBD) with four replicates.

Pre-soil planting analysis was done; the soil pH was on a ratio of 1:2 soil/water suspensions (IITA, 1979). Organic carbon was determined using the Walky Black Method (IITA, 1979). Exchangeable bases were determined using 1N ammonium acetate extracting solution (Jackson, 1964). Potassium and Na were read with flame photometer while Mg and Ca were measured with the Atomic Absorption Spectrophotometer (AAS). The available P was extracted using Bray-1 extracting solution and further reading was carried out Calorimetrically (Nzewi,1979). Total N was determined by the Kjeldhal distillation method (Anderson and Ingram, 1993). Effects of the fertilizer on okra were assessed by taking plant height, number of leaves, plant girth, leaf area and number of pods, while weight of pods were taken after harvests. Analysis of variance was done for the data collected using linear model (GLM) routine of SAS Institute, Inc. (1996). Differences among means were analysed using DMRT at 5% level of probability

RESULTS AND DISCUSSION

The nutrient level of the soil before cropping is shown on Table 1. The nutrients content of the study area were low, this has been reported as a major characteristics of tropical soils (Tolessa, 1999). The soil was sandy loam in texture, slightly acidic and had low organic matter content, low total N, available P and exchangeable bases. The soil is poor for crop production; especially okra. The organic matter and total N of 1.31gkg^{-1} and 0.7 gkg^{-1} of soil is less than the critical level of 2 gkg^{-1} and 1.5 gkg^{-1} respectively (Enwezor *et al.,* 1988), while the available P of 13.78 mg kg^{-1} is less than the critical level of 15 mg kg^{-1} (Agboola, 1982). The pH of 6.22 was moderate for okra production; there is need for improvement on organic matter to support sustainable okra production. However, the low nutrient content of the soil indicate that the soil can not support crop production without fertilizer application.

The effects of five levels of NPK 20:10:10 on plant height 3 to 12 WAP are shown on Table 2. There were significant differences among the levels of application, also plant height increases with age of okra. Increased fertilizer application led to increase in plant height up to 250 kg/ha, thereafter, plant height decreases with increase of application level.

Table 3 shows the effects of five levels of NPK 20:10:10 on number of leaves 3 to 12 WAP. There were significant differences among the levels of application, but there were no significant differences between 250 and 300 kg/ha 9 to 12 WAP. Also there were increases of number of leaves 3 to 10 WAP, thereafter number of leaves decreases with age.

Table 4 reflects the influence of five levels of NPK 20:10:10 on plant girth 3 to 12 WAP. Plant girth increase with age and there were significant differences among the levels of application. 300 kg/ha treated plant had the fattest plant girth, though there were no pronounced difference between 300 and 250 kg/ha.

Pronounced differences existed among the levels of application with regard to total leaf area (Table 5). Leaf area increases with

age, but as from 10 WAP leaf area start decreasing. Plant leaves rhat cover the largest area were from the 250 kg/ha treated plants. All the levels of NPK application were significantly higher than the control treatment.

Table 6 shows the influence of NPK 20:10:10 on number of pods after harvest 10 to 12 WAP. There were significant differences among the levels of application, increase of fertilizer led to increase in number of pods. The highest number of pods were from plants treated with 300 kg/ha of fertilizer. Okra yield per hectare were also shown on Table 6. There were significant differences among the levels of application, 300 kg/ha treated plant produced the highest yield, though it was not significantly higher than 250 kg/ha. The control treated plant had the least yield.

The results of the study shows that plant height, number of leaves, plant girth and total leaf area increases with weeks after planting. The tallest plants were those treated with 250 kg/ha of fertilizer while 250 and 300 kg/ha treated plants had equal number of leaves after 10 to 12 weeks. Numbers of leaves and leaf area increases with weeks after planting up to 8 weeks before decreasing from 9 weeks after planting. The sizes of the leaves and number start decreasing at the onset of fruiting and this led to decline in leaf area from 9 weeks after planting. Smaller leaves were produced while the older ones that are bigger dried and fell off. This result correlates with that of Muoneke and Aliyu (1997) that showed that leaf area increased as a result of crop growth up to about 10 weeks after planting and declining thereafter. The result also shows that there were no significant differences between the yield of 250 and 300 kg/ha, but 300 kg/ha treated plants produced the highest pod yield. This finding compliments the earlier study by Phillip (1999), Babatola

Table 1: Pre-cropping Soil Physical and Chemical Properties

Parameters	Value obtained
pH (H_20)	6.22
Organic matter (g/kg)	1.31
Total Nitrogen (g/kg)	0.07
Available P (mg/kg)	13.78
Exchangeable bases (cmol/kg)	
Potassium	0.84
Magnesium	0.76
Calcium	1.82
Sodium	0.75
Particle size (%)	
Sand	77.0
Silt	12.0
Clay	11.0
Textural class	Sandy loam

Table 2: Effects of the five levels of NPK 20:10:10 on plant height (cm)

Levels of application	weeks after planting									
	3	4	5	6	7	8	9	10	11	12
0.0 kg/ha	6.2b	8.0b	14.8c	24.5c	27.9e	31.0d	42.0e	52.9d	60.1e	67.2e
150 kg/ha	6.6b	8.3b	15.1c	21.8d	35.2d	50.3c	70.1d	114.0c	132.3d	157.3d
200 kg/ha	7.3ab	9.2ab	19.1b	29.2b	44.1c	62.5b	78.0c	118.1b	144.7b	168.7b
250 kg/ha	8.1a	10.0a	23.2a	36.3a	53.2b	73.9a	92.1a	120.1a	150.4a	180.5a
300 kg/ha	8.4a	10.7a	24.0a	37.4a	57.0a	74.9a	89.7b	117.6b	140.5c	160.7c

Table 3: Effects of the five levels of NPK 20:10:10 on number of leaves

Levels of application	weeks after planting									
	3	4	5	6	7	8	9	10	11	12
1.0 kg/ha	5.0a	6.0b	6.0c	6.0d	6.3d	6.0c	6.0d	6.0d	6.0d	6.0c
150 kg/ha	5.0a	6.0b	7.0b	8.0c	9.0c	10.0b	10.0c	10.0c	9.0c	8.0b
200 kg/ha	5.0a	6.0b	7.0b	8.0c	10.0b	10.0b	11.0b	12.0b	11.0b	9.0a
250 kg/ha	5.0a	7.0a	8.0a	9.0b	10.0b	11.0a	12.0a	14.0a	12.0a	9.0a
300 kg/ha	5.0a	7.0a	8.0a	10.0a	11.0a	10.0b	12.0a	14.0a	12.0a	9.0a

Table 4: Effects of the five levels of NPK 20:10:10 on plant girth (cm)

Levels of application	weeks after planting									
	3	4	5	6	7	8	9	10	11	12
2.0 kg/ha	1.2b	1.8b	2.3b	2.9c	3.1c	3.2d	3.4d	3.6d	3.7d	3.8d
150 kg/ha	1.9a	2.3a	2.8b	3.3b	4.0b	4.4c	4.8c	5.3c	5.7c	5.9c
200 kg/ha	1.9a	2.3a	3.1a	3.8b	4.5b	5.4b	5.9b	6.2b	6.7b	6.9b
250 kg/ha	1.9a	2.3a	3.3a	4.3a	5.4a	6.2a	6.8b	7.3a	7.6a	7.8b
300 kg/ha	2.0a	2.4a	3.4a	4.5a	5.5a	6.1a	7.0a	7.7a	7.9a	8.0a

Table 5: Effects of the five levels of NPK 20:10:10 on total leaf area (cm^2)

Levels of application	weeks after planting									
	3	4	5	6	7	8	9	10	11	12
1.0 kg/ha	194.8e	240.5e	324.6e	408.6d	429.3e	450.3e	475.7e	501.2e	532.5e	321.9e
150 kg/ha	196.3b	249.0c	408.5d	567.5c	1088.2d	1609.1b	1504.5d	1400.2d	1035.4c	670.7d
200 kg/ha	150.2d	281.3a	472.1b	675.8b	1365.5c	2055.1d	1820.8b	1586.3b	1261.8b	928.3b
250 kg/ha	201.1a	287.8a	535.6a	784.2a	1642.7a	2501.2a	2137.1a	1773.3a	1488.2a	1204.5a
300 kg/ha	184.1c	260.6b	453.2c	674.1b	1388.2b	2102.2c	1651.1c	1200.0c	1000.1d	801.8c

Table 6: Effects of the five levels of NPK 20:10:10 on number of pods per plant and pod yield per hectare

Levels of application	Number of pods per plant	Pod yield tons per hectare
1.0 kg/ha	1.25d	1.12d
150 kg/ha	2.43c	2.55c
200 kg/ha	2.51c	3.42b
250 kg/ha	2.72b	3.94a
300 kg/ha	3.04a	3.99a

In conclusion, the different levels of NPK 20:10:10 application significantly improved the growth and pod yield of okra. Though, 300 kg/ha had the highest pod yield, it was not statistically higher than 250 kg/ha. So 250 kg/ha could be recommended for farmers in Asaba and its environs for optimum production.

REFERENCES

Abdulsalam, R. A. and Ogunsola, O. A. (2007). Response of okra (*Abelmoschus esculentus*) to N and P fertilization under wet and dry conditions in Bauchi. *Proceeding of the 31th Annual Conference of the soil society of Nigeria.* p312-319.

Agboola, A. A. (1982). Organic manuring in tropical Africa. Symposium paper 1. *International Conference on Soil Science.* New Delhi India, Pp 8-16.

Akinfosoye, J. A. and Olufaloji, A. O. (1998). Performance of pepper (Capsicum frutescen) under varying levels of poultry manure. *Proceedings of 16th Annual Conference of Horticultural Science.* p112-115.

Anderson, J. M. and Ingram, J. S. I. (1993). *Tropical Soil Biology and Fertility*. A hand book of methods 2nd (ed). CAB International Information Press Ltd, Eiynsham.

Anonymous (2000). Okra, a multiple crop for the temperate and tropics. *Economy Botany*, **50:** 279-283.

Meteorological Bulletin (2009). Asaba Meteorogical Report, National Meteorological Agency, Lagos.

Awe, O. A., Abdulsalam, R. A. and Ogunsola, O. A. (2007). Effects of NPK 20:10:10 fertilizer on the pod and yield root growth of okra in the Humid Tropics. *Proceeding of the 31th Annual Conference of the soil society of Nigeria.* p275-279.

Babatola, I. A. and Olaniyi, M. A. (1999). Effects of NPK fertilizer levels and plant spacing on performance and shelf life of okra. In: *Proceedings of the 15th Annual Conference of Horticultural Society of Nigeria* (Adejoro, M. A. and Aiyelaagbe, I. O. eds). p46-48.

Bouyoucous, G.H. (1951). A recalibration of the hydrometer for making mechanical analysis of soils. *Agronomy Journal* **43:** 434-438.

Daramola, D. S., Nwangburuka, C. C. and Dada, S. O. (2004). Synergism of combined inorganic and organic starter nitrogen application on cowpea growth and nodulation. *Proceeding of the 29th Annual Conference of the soil society of Nigeria.* p193-195.

Enwezor, W. O., Udo, E. J., Ayotade, K. A., Adepetu, J. A. and Chude, V. O. (1988). Literature Review on Soil Fertility Investigations in Nigeria (in five volumes). Federal Ministry of Agriculture and Natural Resources, Lagos, Nigeria.

Nzewi, G.I. (1979). *Methods for Routine Soil Analysis in Nigeria,* Federal Department of Agriculture, Abuja.

Federal Department of Agriculture (2000). *Fertilizer use and management practices for crop in Nigeria,* Federal Fertilizer Department, Ministry of Agriculture and Rural Development, Abuja.

ICRSAT (International Crop Research Institute for Arid and Semi-Arid Tropics) (1991). Annual Report and Research Highlights for West Africa programs, Patancheru, p78.

International Institute of Tropical Agriculture (1979). *Selected Methods for Soil and Plant Analysis*. Manual series, International Institute of Tropical Agriculture, Ibadan, 1:53.

Jackson, M. L. (1941). *Soil Chemical Analysis.* Pergaman Press, New York.

Muoneke, C. O. and Aliyu, E. C. (1997). Responses of Okra (Abelmoschus esculentus) to plant density and pattern of plant arrangement in Nigeria. *Indial Journal of Agricultural Science*. **61:** 726-730.

Ojeniyi, S. O. (2000). Effect of Poultry Manure and NPK Fertilizer on Soil Fertility and Maize Nutrient Contents and Yield at Akure, Southwestern Nigeria. *Proceedings of 25th Annual Conference of Soil Science Society of Nigeria.* pp185-191.

Okigbo, B.N. (1991). *The development* of *Sustainable Agricultural Systems in Tropical Africa.* International Institute of Tropical Agriculture, Ibadan.

Phillips, T. A. (1997). *An Agricultural Note-Book* (With Special Reference to Nigeria) London Group Ltd, London.

SAS Institute, Inc. (1996). SAS/STAT users guide. Version 64th ed. SAS institute, Inc., Cary, NC.

Tollessa, D. (1999). Effects of organic and inorganic fertilizers on maize grain yield in western Ethiopia. Africa Crop Science Conference Proceedings. **4:** 229-232.