Sub-Sahara African Academic Research Publications
December, 2021, Editions

JAAT
Journal of Agriculture & Agricultural Tech.
Vol. 22, No.1, ISSN 2318-9315

DETERMINATION OF THE EFFECTS OF VARYING PROPORTIONS OF ORGANO-MINERAL FERTILIZER AS SOIL AMENDMENTS FOR OKRA IN A DERIVED SAVANNAH

ADEYOLANU, A.S.
Agricultural and Bio-Environmental Engineering Department, The Oke Ogun Polytechnic, Saki, Nigeria

Abstract

Although okra is very popular in Nigeria, the yield is still low due to biotic and abiotic factors. The low yield has been attributed to poor soil fertility and deficiency in important mineral nutrients. This is because fertilizers have become a scarce commodity and even when available; it is beyond the reach of the poor resource farmers due to high costs. This study determined the effects of varying proportions of organo-mineral fertilizer as soil amendment for the cultivation of okra. The study was carried out on a plots layout located on the research and demonstration farm of Agricultural and Bio-Environmental Engineering Department of The Oke-Ogun Polytechnic, Saki (TOPS), Oyo State in South Western Nigeria. This research work was carried out by using field experimental plots. The four treatments are employed in this study are plots amended with 25% Organic fertilizer + 75% Inorganic fertilizer composition of organo-minerals, plots amended with 50% Organic fertilizer + 50% Inorganic fertilizer composition of organo-minerals, plots amended with 75% Organic fertilizer + 25% Inorganic fertilizer composition of organo-minerals and Control experiments (plots with no amendment). Okra can be cultivated without the application of fertilizers as seen in the control treatment, it was observed from the study that combination of 75%

organic fertilizer with 25% inorganic fertilizer produced the tallest plants, while combination of 50% organic fertilizer with 50% inorganic fertilizer gave the highest number of leaves at eight weeks after sowing. For yield components, combination of 75% organic fertilizer with 25% inorganic fertilizer gave the highest mean fruit weight followed by combination of 50% organic fertilizer with 50% inorganic fertilizer and then combination of 25% organic fertilizer with 75% inorganic fertilizer while the least value was got from the control experiment. Generally, combination of organic manure and inorganic fertilizer greatly boost the production of okra in terms of fruit weight and number and this is economical for peasant farmers lacking means to obtain inorganic fertilizers.

Keywords: *Fertilizer, Organo-mineral, Soil, Amendment, Savannah.*

Introduction

Okra (*Abelmoschus esculentus L.*), a member of the Malvacea family, is a widely cultivated vegetable crop and very important in the diet of Africans (Omotoso and Shittu, 2008). It is a valuable crop that provides an excellent income and generates other opportunities for small-scale farmers (Selleck and Opena, 1985). The approximate nutrient content of the edible okra pod is as follows: water, 88%; protein, 2.1%; fat, 0.2%; carbohydrate, 8.0%; fibre, 1.7% and ash, 0.2% (Tindall, 1983). However, the nutritional quality of okra can be influenced by the application of organic fertilisers, such as liquid seaweed, with the following composition, according to Zodape et al. (2008): carbohydrate, 7.39%; protein, 28.04%; and dietary fibre, 35.55%. The oil content in the seeds could be as high as that in poultry eggs and soybeans (Akinfasoye and Nwanguma, 2005). The young leaves from okra plants, when prepared together with perfectly ground melon, become a delicious delicacy called 'ilasa', a local soup mostly eaten with 'amala', another local food prepared from yam flour, which is very popular among the Yorubas in Nigeria.

Fertilizer provides nutrients and contributed to the quality of soil by improving the structure, chemistry, and biological activities of soil. It

releases nutrient to the soil, which increases soil organic matter content. The improvement to soil by organic matter is favoured when decomposition is slow. However, decomposition of organic material is strongly affected by temperature and soil moisture. Inorganic fertilizers are known for their high cost and their negative environmental effect of it is not managed well (Moris *et al*, 2007). The use of inorganic fertilizer has been observed to cause destruction of soil texture and structure, which often leads to soil erosion and acidity as a result of leaching effect of nutrients. All these give rise to reduced crop yields as a result of soil degradation and nutrients imbalance. Because of the issue of nutrient content in organic fertilizer, along with the reality of higher pricing in the purchase of inorganic fertilizers, some small resource farmers create a "mix" of both organic and inorganic fertilizers (Ojeniyi, 2000).

Although okra is very popular in Nigeria, the yield is still low due to biotic and abiotic factors (FAOSTAT, 2013). The low yield has been attributed to poor soil fertility and deficiency in important mineral nutrients (Sanchez and Jama, 2002). This is because fertilizers have become a scarce commodity and even when available; it is beyond the reach of the poor resource farmers due to high costs (Farinde and Owolarafe, 2007). Both inorganic fertilizers and organic manures have a potential role in crop growth and development (Eghball *et al*, 2004). Animal and plant manure provide a source of all necessary macro and micro nutrients in available forms, thereby improving the physical and biological properties of the soil (Abou El Magd *et al*, 2006).

Despite the numerous advantages of okra and the influence of fertilizers on its productivity and quality, there is a dearth of information on the effects of varying proportions of combination of organic and inorganic fertilizers when applied to okra cultivation. As earlier stated that inorganic fertilizers are not readily available to peasant farmers and when available, the costs are on the high side, there is therefore a great need for an alternative that will be readily available and cheaper to acquire.

This study therefore, sought to profer solution to the inadequacy brought about by the situation whereby inorganic fertilizers are beyond the reach

of the poor resource farmers due to high costs by determining the effects of varying proportions of organo-mineral as soil amendment for the cultivation of okra in a derived savannah region like ours.

The specific objectives include:

- To determine some growth parameters of okra under application of varying proportions of organo-mineral.
- To determine the yield of okra as affected by these treatment.
- To recommend the alternative soil amendment that gave the optimum output.

Materials and Methods

Study Area Description

The study was carried out on plots layout in the Research and Demonstration farm of Agricultural and Bio-Environmental Engineering Department of The Oke-Ogun Polytechnic, Saki (TOPS), Oyo State in South Western Nigeria. The soil samples were taken from the research and demonstration farm for pre-cropping analysis at the Institute of Agricultural Research and Training, Moor Plantation, (I.A.R.&T.), Ibadan to ascertain the preliminary nutrient's level of the soil. The study area is situated between $7^{0}24^{1}N3^{0}53^{1}E$ and ----------. The vegetation is a derived savannah with a mean annual rainfall of about 1289.2mm. Soil depth from 0-30cm (root zone) was considered for planting in this experimentation.

Experimental Procedures and Planting Operations

This research work was carried out using field experimental plots. After ascertaining the preliminary nutrient's level of the soil taken to the laboratory at Institute of Agricultural Research and Training, Moor Plantation, Ibadan for analysis for pre-planting analysis, the experimental field was divided to give three replicates of the four treatments in a random manner to cater for the heterogeneity of the soil thus giving a total of twelve plots. The four treatments are employed in this study are plots amended with 25% Organic fertilizer + 75% Inorganic fertilizer composition of organo-minerals, plots amended with 50% Organic

fertilizer + 50% Inorganic fertilizer composition of organo-minerals, plots amended with 75% Organic fertilizer + 25% Inorganic fertilizer composition of organo-minerals and Control experiments (plots with no amendment).

Three seeds of okra (*A. esculentus*) were planted on each experimental plot that have been pulverized to aid germination and sprouting of the test crop at 2cm depth and later thinned to two after four weeks of planting on each plot. The plots are always irrigated with the same quantity of water whenever there were not enough precipitation to moisten the soil. The selected growth parameters were measured at two weeks interval after planting for a totatal of eight weeks. The yields were also measured for each treatment.

Growth Indicators for Assessment

i. **Plant Height:** Plant height was measured from ground to the tip of terminal bud every two weeks after planting using measuring tape. The heights of plants in each replicates on an experimental plot were measured and their average values were determined.

ii. **Number of Leaves:** The plants were selected from each experimental plot and numbers of leaves were counted for each experimental pot and the average number of leaves was determined for each experimental plot. This was done two weeks after planting and subsequently.

iii. **Stem Girth:** The plants were selected for the determination of width of stem girth of each plant on an experimental plot. The width of the stem girth of each experimental plot was measured at the average value for each for each experimental plot was determined.

Statistical Analysis of Data

The deviations between the average values of the growth parameters for the four treatments were considered. One-way Analysis of Variance was also used to test for significant differences in the growth parameters for the treatments using IBM SPSS 21 as the statistical tool.

Results and Discussions

Effects of varying Proportions of Organo-mineral on the Growth Parameters

The results showing the effects of varying proportion of organo-mineral on the plant heights, stem girths and number of leaves at two weeks after planting (2 WAP), four weeks after planting (4 WAP), six weeks after planting (6 WAP) and eight weeks after planting (8 WAP) are presented in Figures 1, 2, 3 and 4 respectively. At 2 WAP, the number of leaves is 15 for 75%/25% treatment while the remaining three treatments have the same number of leaves of 11. The plant heights ranged from3.33cm for 50%/50% to 4.18cm for 75%/25% while the stem girths followed the same trend ranging from 2.38cm for 50%/50% to 3.31cm for75%/25%. At 4 WAP, the trend remained the same for the plant heights with that of 2WAP ranging from 6.53cm for 50%/50% to 7.43cm for75%/25%. There was a change in the values of stem girths at 4WAP as the least value of 4.50cm was found for 50%/50% while the peak value of 5.88cm was found for 25%/75%. The number of leaves ranged from 15 for control to 20 for 25%/75%. At 6 WAP, the trends of both the plant heights and stem girths remained the same with 4WAP. Plant heights ranged from 7.48cm for 50%/50% to 8.47cm for 75%/25% while the stem girths ranged from 5.80cm for 50%/50% to 6.49cm for 25%/75%. The number of leaves ranged 17 for control to 20 for 50%/50%. The trend for 8 WAP follows suit 6 WAP as the values for the plant heights ranged from 12.58cm for 50%/50% to 13.83cm for 75%/25%, stem girths ranged from 9.91cm for 75%/25% to 11.00cm for 25%/75% and number of leaves ranged from 23 for 75%/25% to 28 for 50%/50%.

The test for significant differences between the four treatments for the plant growth parameters was done using least square difference of the mean values with IBM SPSS 21 as the statistical tool.. At 2 WAP, the mean difference is significant at the 0.05 level for plant heights only between 25%/75% treatment with the 50%/50% and the control experiment. There is no significant difference between the four treatments for all the growth parameters at 4WAP. The same trends were followed

statistically between the four treatments for the all the growth parameters as for 4 WAP at both 6 WAP and 8 WAP.

Effects of varying Proportions of Organo-mineral on the Yield of Okra

The yields from the four treatments of varying proportions of organo-mineral from nine weeks after planting was taken by weighing the harvested okra fruits from the three replicated plots for each treatment This was done for a period of two weeks at 3 days interval. The average values of the yield per stand (containing two plants) for the four treatments were found to be 461.5g for the 75%/25%, 412.6g for 25%/75%, 415.4g for 50%/50% and 397.2g for the control experiment as presented in Figure 5. According to Seed Savers Exchange (2021), the minimum spacing was given as 30.5cm while the maximum spacing was given as 45cm. Planting two seeds planted per stand, minimum spacing gave 32,787 stands / ha and the maximum spacing gave 22,222 stands / ha. For the minimum spacing, the yield for the 75%/25% organo-mineral gave 13.66 tons / ha, 25%/75% gave 13.53 tons / ha, 50%/50% gave 13.62 tons / ha and 13.02 tons / ha for control experiment. For the maximum spacing, 75%/25% organo-mineral gave 10.26 tons / ha, 25%/75% gave 9.17 tons / ha, 50%/50% gave 9.23 tons / ha while the control experiment gave 8.83 tons/ha.

Conclusions

Although, okra can be cultivated without the application of fertilizers as seen in the control treatment, this study shows that the growth and yield of okra is enhanced by the application of varying proportion of organo-mineral (combination of organic and inorganic fertilizers). It was also observed from the study that combination of 75% organic fertilizer with 25% inorganic fertilizer produced the tallest plants, while combination of 50% organic fertilizer with 50% inorganic fertilizer gave the highest number of leaves at eight weeks after sowing.

For yield comparison, combination of 75% organic fertilizer with 25% inorganic fertilizer gave the highest mean fruit weight followed by combination of 50% organic fertilizer with 50% inorganic fertilizer and then combination of 25% organic fertilizer with 75% inorganic fertilizer while the least value was got from the control experiment.

In general, combination of organic manure and inorganic fertilizer greatly boost the production of okra in terms of fruit weight and number and this is economical for peasant farmers lacking means to obtain inorganic fertilizers.

References

Abou EL-Magd M.M., A.M., El-Bassiony and Z.F. Fawzy. 2006. Effect of organic manure with or without Chemical fertilizer on growth yield and quality of some varieties of Broccoli plants. Journal of Applied science Research 2(10):791-790.

Akinfasoye, J. A., Nwanguma, E. I. 2005. Vegetative growth of *Telfaria occidentalis* Hoof (F.) and staking pattern in Telfaria/Okra intercrop in a valley bottom dry season cultivation. In: Proceedings of the Horticultural Society of Nigeria Annual Conference held at Rivers State College of Education, Portharcourt, pp: 67-71.

Eghball, B., Gintin, D. and Giley, J.E. (2004). Residual Effects of Manure and Compost Applications on Corn Production and Soil Properties.

FAOSTAT (2013). Food and Agricultural Organization of the United Nations. Online and Multilingual Database, http://faostat.fao.org/faostat/.

Farinde A.O. and Owalarefe L.B. (2007) Nigeria fertilizer sector, present situation and future prospects. IFDC. Technical Bulletin 12(1) P.18.

Morris, M., V.A. Kelly, R.J. Kopicki and D. Byelec. (2007). Fertilizer use in African Agriculture: Learned and Good practice Guidelines. Washing ton, DC: The World Bank.

Ojeniyi S.O. (2000), "Effect of Goat manure on soil Nutrients and Okra yield in the Rain forest Area of Nigeria". "Applied Tropical Agriculture 5:20-23.

Omotoso, S. O., Shittu, O. S. 2008. Soil properties, leaf nutrient composition and yield of okra (*Abelmoschus esculentus* (L.) Moench) as affected by broiler litter and NPK 15:15:15 sfertilizers in Ekiti State, Nigeria. Int. J. Agric Res. 3, 140-147.

Sanchez, P., & B. Jama. (2002). Soil fertility replenishment takes off in east and southern Africa. p. 23–46. In B. Vanlauwe, J. Diels, N. Sanginga, and R. Merckx (ed.) Integrated plant nutrient management in sub-Saharan Africa: From concept to practice, CABI, Wallingford, UK.

Seed Savers Exchange (2021). Grow and save Okra Seeds. 3094 North Winn Road Decorah, Iowa 52101.

Selleck, G.W., Opeña, R. T. 1985. National programs: the need for increased emphasis on the development of vegetables and legumes. In: National agricultural programs

and future needs. J.B. Petersen and P.W. Macgregor (eds.). FFTC Book Series No. 30. Food and Fetilizer Technology Centre, Taipei, Taiwan, 184 p.

Tindall, H. D. 1983. Vegetables in the Tropics. Macmillan Education Limited. Houndmills Hampshire, 533 p.

Zodape, S. T., Kawarkhe, V. J., Patolia, J. S., Warade, A. D. 2008. Effect of liquid seaweed fertilizer on yield and quality of okra *(Abelmoschus esculentus* L.*)*. Journal of Scientific & Industrial Research 67, 1115-1117.

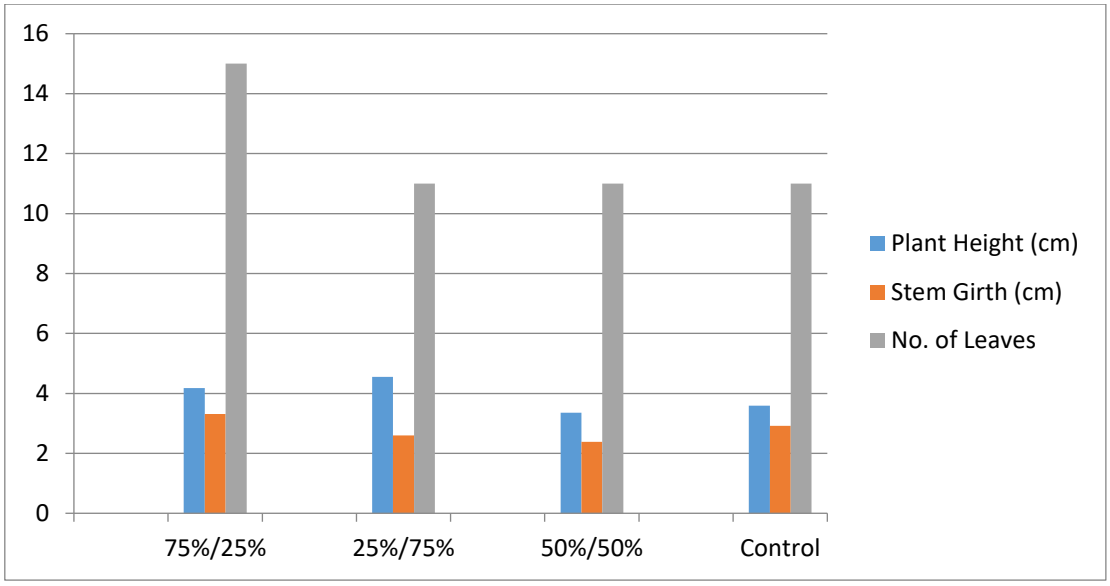

Figure 1 Plant Growth Parameters at 2WAP

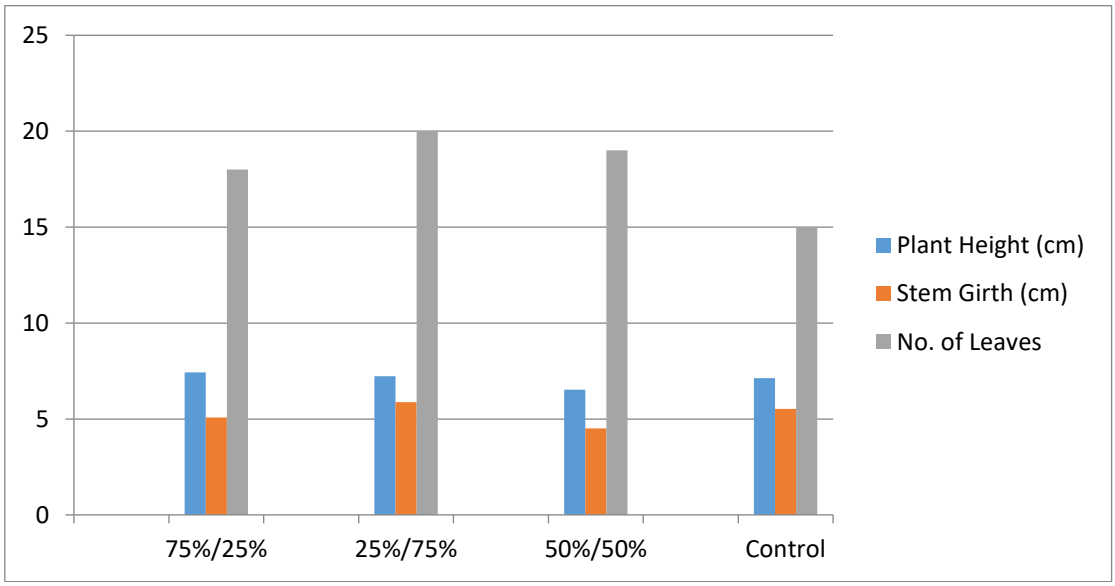

Figure 2 Plant Growth Parameters at 4WAP

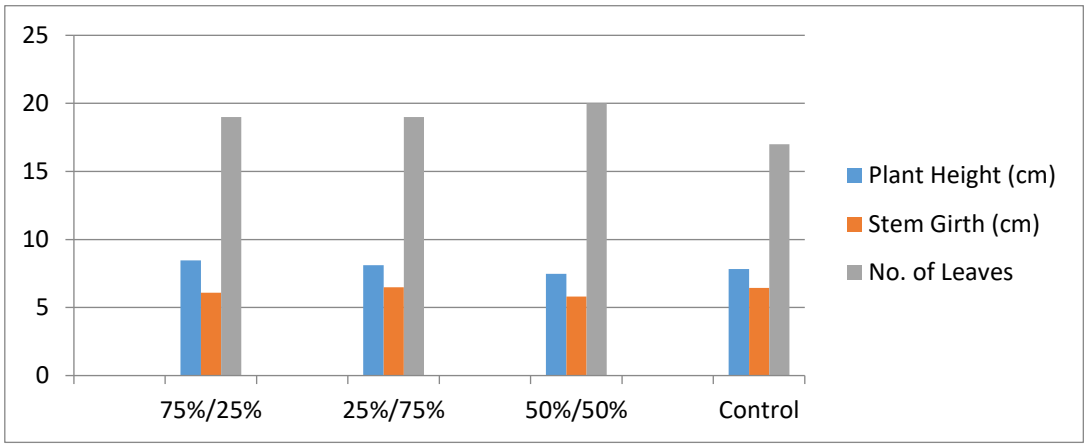

Figure 3 Plant Growth Parameters at 6WAP

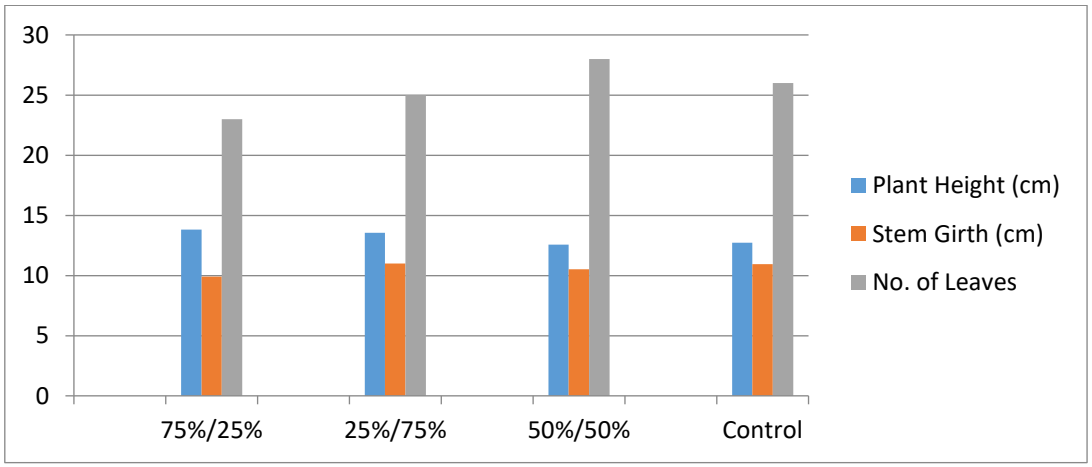

Figure 4 Plant Growth Parameters at 8WAP

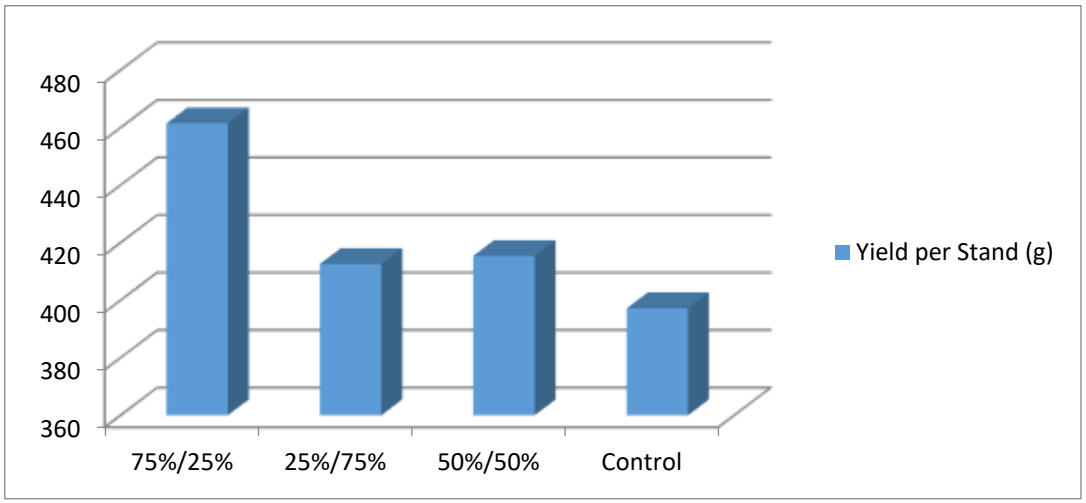

Figure 5 The average values of the yield per stand