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THE EFFECTS OF DIFFERENT TYPES OF FERTILIZERS ON THE GROWTH AND YIELD OF SESAME (*Sesamum indicum* L) IN MAKURDI

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ABSTRACT
A field experiment was conducted at the Teaching and Research Farm of the University of Agriculture, Makurdi, Benue State, Nigeria during the 2012 cropping season to determine the effects of different fertilizer types on growth and yield of Sesame. The experiment was laid out in a Randomized Complete Block Design and replicated three times. There were six treatments which included NPK – 15-15-15, Urea Super Granules (USG), Compost Plus, Foliar fertilizer, Rice Husk Ash and control. Data Collected were subjected to Analysis of Variance (ANOVA) and means were separated using LSD test at (P = 0.05). Results show that all data on growth and yield parameters were significantly influenced by Urea Super Granules, Compost Plus and NPK – 15-15-15. Urea treated plots had significantly higher ($p \leq 0.05$) number of primary branches per plant (9.77), number of capsules per plant (76.47), capsule height (56.37 cm) and plant height (149.8 cm) compared to the plots that received other treatments. Compost plus treated plots are next after urea treated plots in terms of their impact on growth parameters and control had the least values of the parameters. The highest yield (0.63 t/ha) was obtained with Urea Super Granules and the least (0.35 t/ha) was from foliar fertilizer.

INTRODUCTION

One of the major ways of addressing the food security challenge faced by sub-Saharan Africa is through the judicious use of fertilizers. The importance of fertilizer as agricultural imput cannot be over emphasized, particularly in Nigeria where the nutrient levels of the soils are low (Agbede, 2009). The use of fertilizers has increased rapidly in Nigeria in the last two decades (Agbede, 2009). The most obvious effect of fertilizers is that they avert crop failures especially in areas of low soil fertility. Broadly, fertilizers could be either organic or inorganic (chemical) and these supply the crops with the essential nutrients needed for proper growth and development.

Unfortunately, fertilizers required by the resource – poor farmers in Nigeria are expensive and often inaccessible. This therefore results in a reduction in the levels of chemical fertilizers applied by these farmers. Generally, excessive or long term use of chemical fertilizers has been reported to induce harmful effects such as soil acidity, toxicity, nitrate pollution of underground waters, eutrophication and undesired soil properties (Teljade *et al.*, 2005).

Sesame (*Sesamum indicum* L.) production is an important component of Nigeria's food security strategy. It is quite extensively grown in Nigeria and according to Alegbejo *et al.* (2003) it is more widely grown in states like; Nasarawa, Jigawa, Benue, Yobe, Kano, Taraba, Katsina, Kogi, Gombe, Kebbi, Zamfara, Niger. Therefore it has the potential to generate employment for the teeming unemployed youths and also generate income from exports. Sesame utilization includes human consumption, health treatments, beautification, livestock feeding and industrial uses (Sharma, 2005; El-Habbasha *et al.*, 2007).

Sesame responds very well to most nutrients supplied to it. Therefore in order to increase the output per unit area, adoption of improved technology in fertilizer management becomes very crucial. One key approach in this regard will be to determine the most effective type of fertilizer in terms of cost and sesame output. The objective of this study therefore was to determine the response of sesame to the application of different types of fertilizers.

MATERIALS AND METHODS

The experiment was conducted during the 2012 cropping season at the Teaching and Research Farm University of Agriculture, Makurdi, Benue State, Nigeria. Makurdi is located within the Guinea Savannah Agro-Ecological Zone of Nigeria.

Surface soil samples (0 – 15 cm) were taken at the experimental field using the soil auger and bulked. The sample was air dried for 24 hours and sieved through a 2 mm sieve for laboratory analysis. It was thereafter, analyzed for physical and chemical characteristics.

Soil pH was determined by the glass electrode methods in a 1:2 soil- water ratio. Particle size analysis was determined by the hydrometer method of Bouyoucos (1951) while organic carbon was by the wet oxidation procedure of Walkley and Black (1934). Na and K in the extracts were determined using the flame photometer while Ca and Mg were determined on the Atomic Absorption Spectrophotometer (AAS). Total nitrogen in the soil sample was determined by the regular Macro–Kjeldahl method. P in the sample was determined by Olsen's method (Jackson, 1967).

The experimental site was ploughed and harrowed. The size of each plot was 5m x 6m or (30 m^2) with plot boundaries of 0.5m and alleys of 1m as block boundaries. The gross experimental plot measured 36 m x 17 m (612 m^2). Six (6) treatments were administered and replicated 3 times. The experiment was laid out in a Randomized Complete Block Design (RCBD). The treatments included: Rice Husk Ash, Urea, Compost plus, NPK 15:15:15, Foliar fertilizer and Control. Planting was done by drilling method and thinned two weeks after planting (WAP) to give within row spacing of one stand per 0.1m which gives a plant population of 133.333 stands/ha. Two hoe weedings were done to control weeds at 3 and 6 weeks after planting (WAP). Generally weeds, pests and diseases were kept under control by use of appropriate practices.

The foliar fertilizer was applied at the rate of 3 liters/ha mixed in 250 litres of water. The spraying was done using hand sprayers. The soil applied NPK fertilizer was at the rate of 200 kg/ha while compost plus was applied at the rate of 0.5 t/ha. Sesame variety E8 was planted on the 11th of August, 2012. Data taken included plant height, number of leaves and leaf area as well as the number of capsules, capsule height and grain yield. The crop was harvested from the field when about 80 – 90 % of the capsules turned yellow. It was harvested, dried and threshed before taking data on grain yield. The produce from each plot was dried, threshed, winnowed, and grains from each plot were weighed.

All data collected were subjected to the Analysis of Variance (ANOVA) and the means were separated using Duncan's New Multiple Range Test (DNMRT) at 5% level of probability.

RESULTS AND DISCUSSION

Soil Properties of the Experimental Site

Soil properties of the experimental location before the experiment are presented in Table 1 below. Data obtained shows that the soil is sandy loam in texture. The pH was found to be 6.09 indicating that the soil was slightly acidic and had low levels of residual nutrients with nitrogen at 0.80 %, available P at 60 ppm, organic carbon at 0.72 % and CEC of 3.88. The exchangeable cations were equally low and gave the following values, K 0.28 cm;/kg, Na 0.39 cmol/kg, Ca 2.06 cmol/kg. Mg 0.95 cmol/kg. However, these values were considered adequate for crop germination (Ojeniyi and Adejobi, 2005) but cannot support high crop yields. The low nutrients levels of the experimental site indicate that there is need for external nutrients supply to support good crop production, including sesame.

Effects of Different types of Fertilizers on growth parameters

The effects of different types of fertilizers on primary branches, number and height of capsule and plant height is shown in Table 2.

Table 1: Soil Properties of the Experimental Site

Parameters	Values
Sand, gkg^{-1}	775.2
Silt, gkg^{-1}	132.8
Clay, gkg^{-1}	92.0
Textural Class	Sandy Loam
pH (H_2O)	6.09
Bray-1 P, (ppm)	60
Organic C, (%)	0.72
O. M. (%)	1.33
Total N, (%)	0.08
K (cmol/kg)	0.28
Na(cmol/kg)	0.39
Ca(cmol/kg)	2.06
Mg(cmol/kg)	0.95
CEC(cmol/kg)	3.88

Urea-treated plots had significantly higher ($P < 0.05$) number of primary branches per plant (9.77), number of capsules per plant (76.47), capsule height (56.37) and plant height at 5, 7, 9 and 11 weeks of evaluation compared with the plots treated with the other fertilizers. Compost plus-treated plots are next in terms of their impact on growth parameters. However, foliar treated plots gave the lowest number of primary branches per plant (5.43), number of capsules per plant (52.87), capsule height (41.37cm) and plant height at 5, 7, 9 and 11 weeks of evaluation. Similarly, the control produced the least number of primary branches (5.43), and number of capsules per plant (44.88) as well as the lowest capsule height (39.90) and shorted plants at the 9 and 11 WAP.

The significantly higher values obtained for growth parameters in urea-treated plots could be attributed to its gradual release during the vegetative period. Nitrogen is an essential component of chlorophyll, protoplasm, protein and nucleic acids, and its deficiency could cause yellowing of leaves and stunted growth of plants (Adetunji, 1995). It is therefore involved in high vegetative growth which could translate to higher yield if it is supplied at the right time.

Plots that received foliar fertilizer gave the lowest values of growth parameters. This may not be unconnected to the fact that the applied fertilizer might not have been fully absorbed into the plant due to environmental factors such as high termperatures, etc.

Effects of Different types of Fertilizers on leaf growth of Sesame

The data on effects of different types of fertilizers on number of leaves per plant and leaf area is presented in Table 3. Urea-treated plots had significantly higher ($P < 0.05$) number of leaves per plant at 5 WAP (16.47), 7 WAP (95.87), 9 WAP (176.33), 11WAP (181.53) compared to all the other treatments including the control. Result of leaf area also follows the same trend with urea-treated plots reaching 95.07cm^2, compared to 64.63cm^2 for the control. Foliar treated plots had similar values as those of control; for example 115.90 as against 113.80 for control at 9WAP.

In Table 3, the high number of leaves obtained

Table 2: **Effects of different types of fertilizers on growth of sesame at Makurdi, Benue state, Nigeria**

Treatment	Number of primary branches per plant	Number of capsules per plant	Capsule height (cm)	Plant height (cm)			
				5 WAP	7 WAP	9 WAP	11 WAP
Control (0kgha^{-1})	5.43d	44.88d	39.90d	19.33c	51.93bc	121.83d	121.53d
Ash (1750kgha^{-1})	5.87cd	55.63c	45.90c	19.80b	48.13cd	133.70b	130.97c
Urea (67kgha^{-1})	9.77a	76.47a	56.37a	24.77a	62.57a	148.20a	149.80a
Compost (500kgha^{-1})	8.87b	72.10a	53.67b	18.77d	53.53b	134.57b	145.07b
NPK (200kgha^{-1})	6.07c	65.57b	45.50c	18.73d	52.87b	130.07c	133.97c
Foliar (1.5kgha^{-1})	5.43d	52.87c	41.37d	19.27c	45.83d	120.30d	121.93d
CV (%)	4.50	3.96	3.10	1.09	4.49	1.41	1.53

Means are values of three replicates
Mean values followed by the same letter in a column are not significantly different from each other (DMRT: $P \leq 0.05$)
CV = Coefficient of variation

Table 3: **Effects of different types of fertilizers on some growth parameters of sesame at Makurdi, Benue State, Nigeria.**

Treatment	Number of Leaves per Plant				Leaf Area (cm^2)			
	5 WAP	7 WAP	9 WAP	11 WAP	5 WAP	7 WAP	9 WAP	11 WAP
Control (0kgha^{-1})	12.00d	46.33e	113.80e	95.30e	45.80d	51.13e	64.63d	57.20c
Ash (1750kgha^{-1})	12.40d	53.50d	117.87d	117.53d	59.07c	56.03c	67.10d	67.17b
Urea (67kgha^{-1})	16.47a	95.87a	176.33a	181.53a	84.87a	88.97a	95.07a	82.67a
Compost (500kgha^{-1})	15.50b	83.03b	162.07b	154.60b	64.87b	73.73b	89.40b	81.67a
NPK (200kgha^{-1})	13.50c	74.80c	124.70c	125.97c	61.20bc	56.50c	83.33c	80.73a
Foliar (1.5kgha^{-1})	12.40d	44.17e	115.90de	115.70d	47.60d	53.60d	65.10d	66.17b
CV (%)	2.13	3.66	0.92	2.13	4.92	2.12	3.70	3.07

Means are values of three replicates
Mean values followed by the same letter in a column are not significantly different from each other (DMRT: $P \leq 0.05$)
CV = Coefficient of variation

in the treatment that received urea (181.53) at 11 WAP may be due to ability of nitrogen to support vegetative growth and subsequently influence yield positively. Both the number of leaves and leaf area are crucial to the interception of light and intensity of photosynthesis as they affect yield.

Effects of Different types of Fertilizers on Grain Yield of Sesame

The results on the effect of different types of fertilizers on seed yield are presented in Table 4. The highest yield was obtained from plots treated with urea (0.63 kg/plot) and this is followed by yield from plots treated with compost plus 0.5 kg/plot and these values are significantly higher than those for control (0.27 kg/plot).

The positive effects of sulphur coated urea fertilizer on sesame production is probably related to the synergistic effects of nitrogen and sulphur on the growing crop. These favourable effects of urea on plant performance had been reported by Juang (1993) and Adetunji (1995).

CONCLUSIONANDRECOMMENDATIONS

Conclusion

Results obtained from the experiments show that coated urea gave the highest yield and it may be considered as the best fertilizer for increasing output of sesame out of those tried out in this research. This may be as a result of the fact that this urea is coated with sulphur and releases its nutrients (nitrogen and sulphur) slowly throughout the growth period of the crop.

Recommendations

In order to avert the declining soil fertility and enhance profitable farming activities in Guinea Savannah Agro–ecological zone of Nigeria, application of coated urea fertilizer should be advocated. Agricultural extension services should be brought to both urban and rural areas of Guinea Savannah agro – ecologi-

Table 4: **Effect of Different types of Fertilizers on Seed Yield of Sesame at Makurdi, Benue State, Nigeria.**

Treatments	Seed weight per plot (kg)
Control (0kgha^{-1})	0.27^{d}
Ash (1750kgha^{-1})	0.37^{cd}
Urea (67kgha^{-1})	0.63^{a}
Compost (500kgha^{-1})	0.53^{ab}
NPK (200kgha^{-1})	0.47^{bc}
Foliar (1.5kgha^{-1})	0.35^{cd}
CV (%)	14.45

Means are values of three replicates
Mean values followed by the same letter in the column are not significantly different from each other (DMRT: $P \leq 0.05$)
CV = Coefficient of variation

cal zone of Nigeria to create awareness on the benefits of coated urea fertilizers. These benefits include but are not limited to the gradual release of nutrients over the growth period of the plants, thereby minimizing the loss of nitrogen from urea through leaching and increasing farmer's return on investment. This also reduces the likelihood of nitrates to pollute ground water and cause eutrophication in nearby water bodies after repeated applications.

The use of rice husk ash should also be advocated as this has the dual benefits of enriching the soil with exchangeable bases for crop uptake as well as buffering the soil acidity. In addition, removal of rice husk ash from our rice mills will help to sanitize the environment and more so its use as fertilizer may be more cost effective than inorganic fertilizers that continue to increase in price.

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