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Effects of Organic and Inorganic Fertilizers on Sesame Yield and Oil Content in Okene, Nigeria.

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Abstract
Nutrient mining in tropical soils due to continuous cropping necessitates the use of fertilizers of various forms to replenish depleted soil and improve crop yield. The choice of cultivars and nutrient supplementation are critical factor determining yield.An experiment was conducted at the college farm, Federal College of Education, Okene to determine the influence of four levels of fertilizer $V_{iz.}$ NPK 15:15:15 applied at 200 kg/ha, l0t/ha of poultry manure, 100 kg/ha NPK + 5t/ha poultry manure and control on three improved sesame varieties released by the National Cereal Research Institute, Badeggi, NCRIBEN 01M, NCRIBEN 02M and NCRIBEN 03M (Goza 25). The experiment was split-plot in randomized complete block design with three replications.The use of fertilizer significantly improved yield. 200kg/ha NPK supported the highest sesame grain yield which was 126% higher than control with 100kg/ha of poultry manure and l0t/ha of poultry manure increasing yield by 100% and 64% respectively above control. The three sesame cultivar did not differ significantly in yield, however, the mean yield of NCRIBEN 03M (Goza 25) of 0.52 kg/ha, perform better than NCRIBEN 01M and NCRIBEN 02M with 0.48 and 0.44 kg/ha respectively. Fertilizer type has significant effect on oil content of all the three varieties.

Keywords*: Sesame, varieties, manure,fertilizer,yields.*

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I. Introduction

Nigeria is a major exporter of sesame, which rated second to cocoa in export volume, Sesame from Nigeria is exported to markets in North America, Europe and East Asia, Benue and Nasarawa States are the highest sesame producers in Nigeria, with an annual outputs of not less than an average of 40,000 metric tons each per anum (Raw Materials Research and Development Council, 2004). Sesame seeds (approximately 50% oil and 25% protein) are used in baking, candy making, and other food industries. Oil from the seed is used in cooking and salad oils and margarine. The oil can also be used in the manufacture of soaps, paints, perfumes, pharmaceuticals and insecticides. Sesame meal, left after the oil is pressed from the seed, is an excellent high protein (34-50%) feed for poultry and livestock (Oplingeret at; 2007). As a raw export commodity, sesame seed from Nigeria is enjoying a rising profile on the world market where overall global demand has risen to 3.3 million tons. Sesame like other raw agricultural commodities has over 15% margin in terms of value – added products compared to other crops. For instance, in the year 2000, while a tone of sesame raw seed was selling for about $720 (₦72,000), the processed oil of the same quantity was selling for $3,500 (₦350,000) (RMRDC, 2004).

Statement of the Problem

Sesame is one of Nigeria's export crops that can be grown in commercial quantities in Okene locality by small farmers. There has not been any documentary experimental work on how to improve yield in the area through the use of improved varieties with fertilizer application (Organic and Inorganic) to improve present average yield of less than 300kg/ha. Small scale farmers grow the crop without any external resources or (use of fertilizers in inorganic or organic form). This research is therefore set out to provide quantitative data using both the farmer's practices and external input such as poultry manure and NPK fertilizers under conventional soil management practices. The research will also determine if fertilizer source have effect on seed oil content.

The Objectives of the Project are:

1. To determine the most suitable improved variety of sesame for large scale cultivation in Okene agro ecological zone.
2. To determine the effects of organic manure and inorganic fertilizer on yield and oil content of sesame seed.

Common Sesame Varieties in Nigeria

Several local varieties and genotypes of different characteristics existed in different ecological zones of Nigeria and were being planted by farmers in smallholder scales for generations. Most of these varieties were low yielding dehiscent varieties with low harvest index values and responses poorly to fertilizers and other agro inputs (Uzun and Cagirgan 2006). However, the National Cereals Research Institute Badeggi developed and release some improved varieties to attract premium price in the world market (NCRI 2002). Some of these varieties include the following:

1. NCRIBen001M. A medium duration variety maturing between 102 to 125 days. The seed colour is essentially white and contain about 45% oils. This variety is capable of yielding between 800-1000kg per hectare. The 100 seed of this variety weight about 3.3g.

2. NCRIBen002M. A medium duration variety maturing between 102 to 125 days. The seed colour is white and contain about 45% oil. This variety is capable of yielding up to 750kg per hectare. The 1000 seed of this variety weight about 3.0g.

3. NCRIBen003L. A long duration variety maturing above 125 days. The seed colour is white and contain about 40% oil. This variety is capable of yielding up to 600kg per hectare. This variety is small seeded, 1000 seed of this variety weight only about 2.5g.

4. Ex – Sudan. A short duration variety maturing under 90 days. The seed colour is white and contain about 50% oil. This variety is capable of yielding up to 1200kg per hectare and 1000 seed of this variety weight about 3.0g.

5. Pbtil.A short duration of this variety maturing under 90 days. The seed colour is whitish to yellow and contain about 45% oil. This variety is capable of yielding up to 1000kg per hectare and 1000 seed of this variety weight about 3.0g.

6. E-8.A short duration variety maturing under 90 days. The seed colour is white and contain about 50% oil. This variety is capable of yielding up to 800kg per hectare and 1000 seed of this variety weight about 3.4g.

7. Yandev 55. A long duration variety maturing above 125 days. The seed colour is white contain about 40% oil. This variety is capable of yielding up to 800kg per hectare. It is a small seeded variety, 1000 seed of this variety weight about 2.6g.

Climatic and Soil Requirements of Sesame

Sesame is a crop of tropical, sub-tropical and warm temperate regions. Optimum temperatures for growth are between 20 and 24^0 C during vegetative growth and about 27^0 C during flowering and fruiting. The crop is drought tolerant and can grow in areas with annual rainfall of between 500 to 1500mm and soil of medium texture that is well drained and free from salt, with neutral to alkaline P^H (Anon 2004). In Nigeria the production areas are located between latitude 7^0 to 14^0, with a dry season that last about 4 to 5 month, and annual rainfall of about 500 to 1500 mm, a vegetation of open savanna woodland and a top soil of sandy, loam texture .(Federal Ministry of Agriculture and Rural Development)FMARD,2017.Okene lies within, this latitude, and has its temperature ranges and rainfall pattern suitable for the cultivation of sesame.

Economic Importance of Sesame

World production of sesame was estimated at 3.7 million tonnes in the year 2005, of which Asia of Africa produced 2.4 and 1.1 million tones respectively. The world export volume in the year 2000 to 2005 was estimated at about 1 million tonnes of which export an estimated 463,000 or 46% (FAO 2005). The crop production in most African countries has been increasing steadily due to the crop short duration cycle and the good liquidity in the global market (Anon. 2004). In Nigeria annual production stood at about 110,000 tonnes in the year 2007, of which about 50,000 tonnes was exported (Anon 2008). Sesame seed contains approximately 50% oil and 25% protein and is used baking, candy making, and in other food industries. Oil from the seed, which contain about 47% oleic and 39% linoleic acid, is used in cooking, salad and in making margarine. Sesame oil and food fried in sesame oil have long shelf life because the oil contains an antioxidant called sesamol. The oil can be used in the manufacture of soap, paints, perfumes, pharmaceuticals and insecticides. Sesame meal left after oil extraction is an excellent high protein (35 to 50% crude protein) feed for poultry and livestock (Oplinger 1990).

Justification for the Study

Soils of the savanna regions are known to contain low nitrogen but are inadequate to sustained good growth and development of some crop plants. This was as a result of their sandy nature, continuous cropping and intensive grazing by livestock that left little or no crop residues to be incorporated into these soils. The low organic carbon and low caution exchange capacities characteristics of these soils must have been responsible for their low water and nutrients holding capacities (Anon 2010). Application of fertilizers especially inorganic fertilizer and manure become absolutely necessary for good growth and development of crop plants growing in these regions. However, most crop plants recover only 25-35% of the nitrogen applied as fertilizers, as losses occur by ammonia volatization, de-nitrification, and immobilization to organic forms, leaching and run of (Anon. 2010).

Studies conducted in savanna area of Nigeria shows that there is no definite fertilizer recommendation for sesame as a sole crop as most crop are grown in mixture other crops mostly cereals (Olowe, 2004). Survey reports by various researchers in Nigeria have shown that fertilizers are not applied to sesame even in major sesame growing areas. (Idowu, et al., 2002; Ugbani, et al., 2008 Babaji et al., 2005 and Hamman, 1998). These coupled with the low fertility status of the savanna soils and low levels of management are responsible for low yield of sesame in Nigeria. Sesame nutrition remained very controversial for long time, while some researchers are of the opinion that sesame does not require fertilization; others believe that the crop needed to the fertilized (Okpara et al., 2007). However, researches conducted earlier have shown great yield improvement for fertilized sesame crop compared to unfertilize ones (Anon. 2006; Malik 2003). FAO (2009) compared Nigeria's low sesame yield of 367 kg/ha with Egypt's 1323 kg/ha, Ethiopias 825 kg/ha and Uganda's 609 kg/ha and attributed this to lack of improved seed and improper agronomic practices, such as under or over planting densities and lack or low fertilizer usage by Nigerian farmers. Farmers have not adequately adopted improved recommendations on seed rate, spacing or plant population densities, which lead to under or over population that ultimately resulted in low yield.

II. Material And Method

A field trial was conducted to evaluate the effect of inorganic and organic fertilizer on the sesame varieties (*Sesamumindicium* L.) seed yield and oil content in Federal college of Education, Okene college farm during the wet season of 2016. Okene is located in the southern Giunea savanna (Longitude 7^0 32' N and Longitude 6^0 11'E).

The treatments consisted of three improved sesame varieties NCRIBEN OIM, NCRIBEN 02, and NCRIBEN 03M, developed by the National Cereal Research Institute,Badeggi (NCRI), four nutrient sources NPK(15-15-15) 200 Kg/ha, Poultry manure 10t/ha, Mixture of 100kg/ha NPK+ 5t/ha Poultry manure) and control (no fertilizer application). The treatments were arranged in a split-plot in randomized complete block design (RCBD). The main plot was fertilizer type and sub-plots were sesame varieties. Each treatment was replicated three times; there were 12 treatments combinations, 36sub-plots, each 3 x 4m. Land preparation was done byploughing, harrowing and ridging using tractor mounted disc implementat the onset rain. Planting was done by hand drilling at a spacing of 75cm x 10 – 15cm on ridges. Poultry manure was applied before plantingwhile 200kg/ha NPK (15.15.15) was applied two weeks after sowing (2WAS)Hand weedingwas carried at 2 WAS and 6 WAS using hoe.No pest attack during the experiment that warrant spraying.

Plant growth data was collected at two weeks interval on plant weight, plant diameter, leaf area and fruit number. At maturity, stem was cut near the ground, then bound and strolled in the field to ripen the seed. After drying, threshing was done by beating with stick, seed yield was determined (kg/ha) while oil content was determined after the seed had been dried to moisture content of 10%. Data collected was analyzed by ANOVA and means separated by LSD.

III. Results And Discussion

The fertilizers requirements for sesame will depend on the fertility of the soil, which will in turn, vary with soil type and previous land use. However, the Analysis of varieties (ANOVA) in table1.below shows that there was significant difference in the yields of the three cultivars when fertilizer was applied.

This justifies the need to apply either organic or inorganic fertilizer or combination of both.

NPK gave yield increase of about 126%, followed by 100% for combined NPK and poultry manure, 64% for poultry manure compared with the control (no fertilizer).

The yield of the three (3) of varieties did not differ significantly this means that any of the varieties is suitable for Okene ecology.

However, the actual mean yield across the treatments shows that NCRI BEN 03 has the highest, yield of 0.53 kg/ha, followed by NCRI BEN 01M 0.48 kg/ha and NCRI BEN 02M, 0.44 kg/ha.

All though, seed damage during harvesting affect both the viability of the seed, storage and quality of the oil, in this study only oil content was determined. The result in table2.infers that fertilizer sources affect oil content and that the varieties have different oil content.
Further research work on the analysis of the oil qualities has affected by fertilizers typeis to be carried out later.

IV. Conclusion And Recommendations

The results obtained in this study shows that fertilizer application increased sesame yield and affect oil seed content of all the three varieties. Further research willrequired tofind out whether fertilizer affect oil quality.
Based on these results, it is recommended that,

1. Famers in Okene agro ecological can embark on large scale production of sesame using the recommended agronomic practices,and any of these cultivarsNCRIBEN03MorNCRIBEN 02MorNCRIBEN 01M

2. Apply200kg/ha NPK fertilizer (15.15.15) or (20.10.5) whichever available.

3. Use 10 t/ha poultry manure

4. Use combination of NPK and Poultry manure.

This practices will increase the present low average yield of 200-300 kg/ha to about 400- 650 kg/ha, which will attract more naira income for the farmer and more foreign exchange for the country.

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Table 1
Effects of fertilizers and Varieties on Yields

Source	*Sumof means*	*Df*	*Mean of Sum*	*F*	*Prob> F*
Fert.X var	0.4017	6	0.0803	24.34	0.0000
Fertilizers	0.4017	3	0.1339	40.57	0.0000
Varieties	0.2465	2	0.1233	0.00	1.0000
Residual	0.9900	24	0.0033		
Total	0.5007	35	0.1431		

There is significant difference between the yields of different varieties with different fertilizer
There is no significant difference between the yields of different varieties .

Table 2
Effects of fertilizers and Varieties on Oil content

Source	*Sum of means*	*Df*	*Mean of Sum*	*F*	*Prob> F*
Fert. X var	0.0065	6	0.0013	38.85	0.0000
Fertilizers	0.0015	3	0.0005	14.75	0.0000
Varieties	0.0050	2	0.0025	75.00	0.0000
Residual	0.0010	24	0.0003		
Total	0.0075	35	0.0002		

There is statistical significant difference between the oil content of different species with different fertilizer and varieties combinations .

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