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DRY MATTER PARTITIONING OF SESAME AND NUTRIENT DYNAMICS WITH ORGANIC AND INORGANIC FERTILIZERS

[DISTRIBUCIÓN DE LA MATERIA SECA Y DÍNAMICA DE NUTRIENTES DEL AJONJOLÍ CON FERTILIZACIÓN ORGÁNICA E INORGANICA]

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SUMMARY

The dry matter partitioning of sesame with organic and inorganic fertilizers was assessed in a pot experiment. Treatments consisted of sole and combined applications of poultry manure and NPK 16-16-16. Complementary application enhanced dry matter yield. Shoot yield ranged from 1.2 to 2.8kg while root dry matter yield ranged from 0.5 to 0.9 kg. Total dry matter yield ranged from 1.7 to 3.5kg. Highest K content of 0.36% occurred in plants treated with sole 100 kg NPK ha^{-1} and the lowest of 0.03% from the control plants. Calcium content increased from 0.09% in control plants to 0.37% in plants treated with 5 tons ha^{-1} PM. Magnesium content ranged from 0.01% in the control plants to 0.04 % in plants treated with application of 100kg NPK ha^{-1}. Sodium ranged from 0.07% to 0.13%. Phosphorous increased from 0.33 % to 0.83 % in plants treated with 50kg NPK ha^{-1}.

Key words: Beniseed; biomass yield; nutrient content; poultry manure.

RESUMEN

Se evaluó la distribución de la materia seca (MS) y la dinámica de nutrientes con fertilización orgánica e inorgánica mediante un experimento de maceta. Se empleó como tratamiento pollinaza, NPK 16-16-16 y combinación de ambos. La aplicación complementaria de ambos fertilizantes mejoró la producción de MS. El rendimiento del tallo fluctuó de 1.2 a 2.8 kg MS y la raíz de 0.5 a 0.9 kg MS. El total de MS varió de 1.7 a 3.5 kg. El mayor contenido de K (0.36%) se encontró en plantas fertilizadas con 100 kg NPK ha^{-1} y el menor contenido (0.03%) se encontró en las plantas control. El contenido de Ca se incremento de 0.09% a 0.37%, para los tratamientos control y pollinaza (5 ton ha^{-1}) respectivamente. El contenido de Mg fluctuó de 0.01% a 0.04 % para los tratamiento control y NPK (100 kg ha^{-1}). El contenido de Na fluctuó de 0.07% a 0.13%. El fósforo se increment de 0.33 % a 0.83 % en plantas fertilizadas con 50kg NPK ha^{-1}.

Palabras clave: Sesamo; producción de biomasa; contenido de nutrientes; pollinaza.

INTRODUCTION

Sesame (*Sesamum indicum* L.) is a crop highly valued for production of high quality oil. It is also grown in many parts of the world for its insecticidal and medicinal properties as well as for its cosmetic and ornamental values. Sesame can also be grown as a spice or as green manure. In Nigeria, sesame is widely grown in the middle belt. This area accounts for about 90% annual export of sesame in Nigeria (Anon., 2002).In most African countries, sesame is usually sown after a main crop, on relatively poor soils, resulting in low yields of about 350 kg ha^{-1}. Seed yields can be as low as 300 kg ha^{-1} (Okpara et. al., 2007) compared with 1960 kg ha^{-1} in Venezuela; 1083 kg ha^{-1} in Saudi Arabia and 517 kg ha^{-1} in Ivory Coast (Abubuakar et al., 1998) depending on management, variety and soil nature. Soil degradation and nutrient depletion have become serious threats to agricultural productivity in Nigeria (Mbagwu and Obi, 2003). Nutrients supply is essential for plant growth. However, on smallholders' farms, an inadequate supply is a key impediment to sustainable food production. The green revolution technologies, based purely on mineral fertilizers have failed in Nigeria. Approaches based purely on organic inputs cannot provide the required increment in agricultural production (Tandon, 1992). An efficient use of organic resources, supplemented with mineral fertilizer may be an optimal strategy for smallholder farmers. Complementary use of organic manures and inorganic fertilizers has proved a sound soil fertility management strategy in many countries in the world. The practice enhances crop yields and maintains a greater beneficial residual effect on soil fertility and crop yield (Adetunji, 1991; Adediran *et al*., 2004; Akanbi *et al*., 2005; Makinde and Ayoola, 2008). The superior effect of integrated use of organic and inorganic nutrient supply, as opposed to their sole application has been reported to improve maize performance (Eneji *et al.*, 1997; Ojeniyi and Adeniyan, 1999), melon (Makinde *et al*., 2001); tomato yield (Giwa and Ojeniyi, 2005) and generally, cereals, vegetables and root crops production (Adoun et *al*., 1978).

The organic materials contain the humus fraction which improves the soil's physical condition. Addition of materials such as compost improves soil structure, texture and tilth (Biswas et al. 2001) which further provides better environment for root development and aeration. A large population of micro organisms is added to the soil through organic materials. This increases the Nitrogen fixation and the Phosphorus solubilization due to improved microbiological activity in organic matter - amended soils. However when mineral fertilizers are added as a supplement, the effects on soil fertility and crop yields become tremendous. Integration of organic and inorganic fertilizer materials has been found to be promising not only in maintaining higher productivity but also for providing stability in crop production. The effect of the integration has been found to be pronounced on acid soils (Oluwatoyinbo et al., 2009). Integrated use of mineral N, organic N with P- solubilising microorganisms can provide a stable fertilization programme that ensures sustenance of crop productivity under intensive farming. Also the quantity of organic materials required for optimum growth and yield is reduced when supplementation with inorganic fertilizer is done. The mineralization of the organic compound is hastened through increased activities of microorganisms. Integrated use of chemical and organic fertilizer in balanced proportion for sustainable production of sesame was emphasized by Duhoon et al., (2002). This study was conducted to determine the dry matter accumulation capacity and distribution pattern of sesame with sole and complementary application of poultry manure and inorganic NPK fertilizer.

MATERIALS AND METHODS

A pot experiment was conducted at Anyigba, Nigeria (Lat. 7^0 6' N and Long. 6^0 43' E) within the south eastern guinea savanna agro-ecological zone. Surface soil was collected, within the rooting zone of the crop at 0-15 cm depth. The soil was air-dried and sieved, using 2mm mesh sieve. Bulk soil sample was collected for analysis to determine the physical and chemical properties of the soil sample. 12 kg soil was weighed per pot into 36 pots. The experiment was arranged in Completely Randomized Design (CRD) with three replicates. There were twelve treatments which consisted of control (no fertilizer); 2.5 t ha^{-1} poultry manure (PM); 5.0 t ha^{-1} PM; 50kg NPK; 75 kg NPK; 100 kg NPK; 2.5 t ha^{-1} PM + 50 kg NPK; 2.5 t ha^{-1} PM + 75 kg NPK; 2.5 t ha^{-1} PM +100 Kg NPK; 5.0 t ha^{-1} PM +50 kg NPK; 5.0 t ha^{-1} PM +75 kg NPK; 5.0 t ha^{-1} PM + 100 kg NPK ha^{-1}. NPK 16-16-16 compound fertilizer was applied as the mineral fertilizer while cured poultry manure was used as the organic manure. The poultry manure had a pH (H_2O) of 7.3 with N, P, K contents of 1.18%, 33.92% and 0.48%, respectively. It was mixed with the soil, watered and incubated by leaving unworked to stabilize for one week before planting. Five seeds were planted per pot and later thinned to two stands per pot. The inorganic fertilizer was applied a week after planting when new seed germinations were no more observed. Watering was done by supplying plants with 500 ml water per pot every other day. Weeding was done by hand picking at 3 and 6 weeks after planting (WAP). At 6 WAP, plant height was determined using a meter rule. Stem girth at 5 cm to the ground level was measured with a vernier caliper, while the number of leaves per plant was a visual count. The shoots and roots were harvested and enveloped separately. They were oven dried at 60^0C until constant weight. The shoot was ground using a ceramic pestle and mortal for chemical analysis. The dry matter partitioning was calculated as the ratio of either the root or the shoot to the total plant dry weight.

Soil and plant analyses

Soil particle size distribution was determined by Bouyoucos hydrometer method, with sodium hexametaphosphate (Calgon) as the dispersing agent (Bouyoucos, 1962). Soil pH was determined in distilled water at soil to water ratio 1:1 using electrometric method. Exchangeable bases (Na, Ca, Mg and K) were extracted using 1N ammonium acetate pH 7.0 and measured in flame photometer. Available P was determined by Bray P-1 extraction (Bray and Kurtz; 1945) and determined colorimetrically at 660nm after the development with molybdenum. Total N was determined by the kjedahl digestion method and soil organic carbon content was determined by dichromate oxidation procedure (Walkley and Black, 1934).

Chemical analysis of plant tissue sample was carried out in the laboratory using standard procedures. The tissue samples were ashed in a muffle furnace at a temperature of 550^0C. The nutrients in the ash were extracted using 0.1 N HCl. Phosphorus was determined colorimetrically by the vanadomolybdate (yellow) method. Potassium and sodium were determined by flame photometry while magnesium and calcium were determined by atomic absorption spectrophotometer. Data were subjected to statistical analysis of variance (ANOVA) and means were separated by Duncan Multiple Range Test (SAS 2004).

RESULTS

Soil and Manure Analysis

The soil was sandy clay loam and slightly acidic. Total N, available P and the exchangeable bases were low, indicating that the soil was low in fertility (Table 1). The manure had almost a neutral pH of 7.3 but a high available P content of 33%. The N content of 1% was also low. It was however rich in Ca and Mg (Table 1).

Table 1: Chemical properties of the soil (pre-planting) and poultry manure used

	Soil Sample	Poultry manure
pH (H_2O)	6.3	7.3
Ca (cmol Kg^{-1})	1.64	10.14
Mg (cmol Kg^{-1})	3.10	36.9
Na (cmol Kg^{-1})	0.24	2.08
K (cmol Kg^{-1})	0.04	4.8
CEC (cmol Kg^{-1})	5.02	-
Organic matter (%)	1.58	2.04
Nitrogen (%)	0.05	1.18
Avail. P (mg kg^{-1})	6.38	339.23
Sand (%)	74.24	-
Silt (%)	6.00	-
Clay (%)	19.76	-

Plant height

Application of organic and inorganic fertilizers had significant effects on height of Sesame plant (Table 2). Complimentary application of organic and inorganic fertilizers gave plants significantly taller than plants treated with sole application of inorganic fertilizer but comparable with plants treated with sole organic fertilizer (Table 2). The tallest plants were produced by treatment with 50 kg NPK+ 2.5 tons ha^{-1} PM. Plants treated with combinations of organic and inorganic fertilizers were generally taller (33 to 40 cm) than plants treated with sole inorganic fertilizer (23 to 33 cm).

Stem girth

Stem girth was significantly affected by the type of fertilizer. Thickest stems of 44 mm were observed from plants treated with either a mixture of 2.5t/ha PM + 50 kg NPK or 2.5 t ha^{-1} PM + 100 kg NPK ha^{-1} or a mixture of 5.0 t PM + 100 kg NPK ha^{-1}. This was closely followed by application of 5.0 t ha^{-1} PM that had plants with a stem girth of 41 mm. The control treatment had plants with the least stem girth of 23 mm (Table 2).

Table 2. Effect of fertilizer type on plant height and stem girth of Sesame.

Fertilizer Type	Height (cm)	Stem girth (mm)
Control	20.7e	23e
2.5t ha^{-1} manure (a)	33.0abc	41ab
5.0t ha^{-1} manure (b)	30.7bcd	29de
50Kg ha^{-1} NPK (c)	22.7e	31cd
75Kg ha^{-1} NPK (d)	26.3cde	35bcd
100Kg ha^{-1} NPK (e)	23.7de	33cd
a + c	40.0a	44a
a + d	32.7abc	32cd
a + e	37.7ab	44a
b + c	30.0bcd	37abc
b + d	33.7abc	42ab
b + e	33.7abc	44a

Mean values having same letters within a column are not significantly different according to DMRT ($p<0.05$).

Dry matter partitioning

Application of organic and inorganic fertilizers had significant effects on root, shoot dry matter yield of Sesame plant (Table 3). The highest shoot dry matter yield of 2.8 kg per plant was obtained in the plants treated with a mixture of 2.5 t ha^{-1} PM + 50 kg NPK ha^{-1}. This was comparable with 2.4 kg per plant observed from application of 2.5 t ha^{-1} PM + 100 kg NPK ha^{-1} and with 2.1 and 2.2 kg per plants observed from applications of 5.0 t ha^{-1} PM + 100 kg NPK ha^{-1} and 5.0 t ha^{-1} PM + 75 kg NPK ha^{-1}, respectively. The lowest shoot dry matter of 1.2 kg per plant was obtained from the control plants (Table 3).

Highest root dry matter yield of 0.9 kg per plant was obtained from application of either 2.5 t ha^{-1} PM + 50 kg NPK ha^{-1} or 5.0 t ha^{-1} PM + 50 kg NPK ha^{-1} or with sole application of 100 kg NPK ha^{-1}. They were significantly higher than 0.5 kg per plant yield from the control treatment but comparable with yields from other fertilized treatments (Table 3).

The dry matter partitioning was most favoured with application of 2.5 t ha^{-1} PM + 50 kg NPK ha^{-1}. Increasing the mineral fertilizer to 100 kg ha^{-1} did not have any additional benefit (Table 4). Sole mineral fertilizer application did not favour partitioning to the shoot but rather, more to the roots. More dry matter was partitioned to the roots with increasing rates of mineral fertilization. Sole poultry manure application at 2.5 t ha^{-1} also had a low dry matter of 67% portioned to the shoot. Increasing the rate to 5.0 t ha^{-1} however, increased the ratio to 72% (Table 4).

Table 3. Effect of fertilizer type on dry matter yield of sesame

Fertilizer Type	Shoot dry matter (kg plant^{-1})	Root dry matter (kg plant^{-1})	Total dry matter (kg plant^{-1})
Control	1.2^{c}	0.5^{b}	1.7^{bc}
2.5t ha^{-1} manure (a)	1.4^{bc}	0.7^{ab}	2.1^{b}
5.0t ha^{-1} manure (b)	1.8^{abc}	0.7^{ab}	2.5^{ab}
50Kg ha^{-1} NPK (c)	1.5^{bc}	0.6^{ab}	2.1^{b}
75Kg ha^{-1} NPK (d)	1.4^{bc}	0.7^{ab}	2.1^{b}
100Kg ha^{-1} NPK (e)	1.7^{bc}	0.9^{a}	2.6^{ab}
a + c	2.8^{a}	0.7^{ab}	3.5^{a}
a + d	1.4^{bc}	0.9^{a}	2.3^{ab}
a + e	2.4^{ab}	0.6^{ab}	3.0^{a}
b + c	1.8^{abc}	0.6^{ab}	2.4^{ab}
b + d	2.1^{ab}	0.7^{ab}	2.8^{ab}
b + e	2.2^{ab}	0.9^{a}	3.1^{a}

Mean values having same letters within a column are not significantly different according to DMRT ($p<0.05$).

Sesame plant nutrient content

Application of organic and inorganic fertilizer had significant effect on nutrient content in shoot of Sesame (Table 5). Poultry manure application increased plant N content with increased rate. Mineral fertilizer application increased plant N content more than poultry manure. However, complementary applications made more nitrogen available than either of the sole applications.

Table 4: Effect of fertilizer type on dry matter partitioning of sesame

Fertilizer Type	Root / Shoot Dry Matter Ratio
Control	29 : 71
2.5t ha^{-1} manure (a)	33 : 67
5.0t ha^{-1} manure (b)	28 : 72
50Kg ha^{-1} NPK (c)	29 : 71
75Kg ha^{-1} NPK (d)	33 : 67
100Kg ha^{-1} NPK (e)	35 : 65
a + c	20 : 80
a + d	39 : 61
a + e	20 : 80
b + c	25 : 75
b + d	25 : 75
b + e	29 : 71

Mean values having same letters within a column are not significantly different according to DMRT ($p<0.05$).

Nitrogen contents generally ranged from 1.02% to 1.32% with complementary organic and inorganic fertilization. NPK fertilizer application had N contents that ranged between 0.86% and 0.98% while poultry manure application had a N content of 0.58% and 0.76%, respectively, with 2.5 and 5.0 t ha^{-1} PM.

The high Potassium content of the manure was not reflected in the plant K contents. It increased slightly with increasing manure rate (0.12 and 0.15 %). The increase was however higher with combined manure and NPK application (0.16- 0.21 %). The content was even higher with increasing sole NPK application (0.24-0.36 %). The K contents were also highest with mineral fertilizer application.

The Ca content was highest (0.37 %) from sole poultry manure applied at 5.0 t ha^{-1}. This was closely followed by same rate applied complemented with NPK. Magnesium content ranged from 0.01% in the control treatment to 0.04 % in plants treated with sole application of 100 kg N ha^{-1}. Percentage Na ranged from 0.07 - 0.13. Percentage P increased from 0.33 – 0.83 in plants treated with sole use of 50 kg N ha^{-1} (Table 5).

Post – cropping soil chemical propertie

Sesame cropping, without fertilizer application increased the soil acidity. Sole organic manure application limited the acidification. Mineral fertilizer application, either solely or complemented with organic manure significantly increased the soil acidity (Table 6). The nitrogen content was generally reduced to almost same level, with all the treatments. Soil calcium content increased under sole application of poultry manure. However, significant reduction of soil calcium content was observed in the mixture treatments. There was an increase in the Mg and K contents of the soil at harvesting relative to the initial chemical status of the soil, with the exception of the control plants that had the least magnesium content (Table 6). Soil organic matter reduced across the treatments. However, sodium and available P varied across the treatments after harvesting (Table 6).

DISCUSSION

Optimum and sustainable crop productivity is usually affected by soil fertility, among other factors. Continuous cropping due to limited farm land under teeming population has been found to reduce soil productivity, especially when soil nutrient uptake by arable crops is not replenished. The soil used in this study was marginal in nutrient contents and so, showed a significant positive response to sesame growth. The manure had a rather low N content and so needed fortification to support crop cultivation.

In this study, sesame growth was found significantly improved with fertilizer application. The fertilized crops had better growth as a result of higher nutrients availability, although, to varying levels. The observed generally taller plants and thicker plant stems with complementary application of poultry manure (PM) and NPK fertilizer was an indication of availability of more nutrients for plant growth. This agrees with earlier observations with other similar cereal crops (Makinde et al., 2001: Akanbi et al., 2000; Adediran et al., 2004) that complementary application of organic and inorganic fertilizers perform better than sole applications. Application of 2.5 tons PM complemented with 50 kg NPK^{-1} most favoured sesame growth. Higher dose of 5 tons poultry manure or increasing the NPK to 100 kg/ha either maintained the sesame growth or slightly reduced it, indicating no marginal advantage. The growth pattern was also reflected in the total plant dry matter yield. The unfertilized plants had lower yields because required nutrients for optimal growth and yield could not be supplied and the soil was not rich in nutrients enough to supply adequately for comparable growth and yield performance, with the fertilized plants. Fertilizing sesame with 2.5 tons poultry manure ha^{-1} or with 50 or 75 kg NPK ha^{-1} could not supply enough nutrients to support growth and total plant yield as well as the mixture of 2.5 tons PM and 50 kg NPK ha^{-1}. The significant increase in the dry matter of Sesame with the mixture of 2.5 t ha^{-1} + 50 kg NPK ha^{-1} suggested it a fertilizer mixture for optimum sesame growth. It also supported the highest apportioning of 80% of the dry matter to the shoot. This is consistent with the findings of Makinde *et al*., (2001).

Complementary application of organic and inorganic fertilizers also had a boosting effect on plant Nitrogen content. Applications of organic manures have been reported to influence nutrients availability through mineralization – immobilization process and also by reducing the P – sorption ability of the soil (Cheryl et. al., 1997). Consequently, the lower P and K plant contents from sole PM application would be a result of low plant uptake which is an indication of chelating of some of the P ions to form complexes, to break down the manure and a late release of the K ions from the organic manure.

The observed increase in the soil acidity level with the unfertilized cropping was a result of depletion of base ions by the crop, without a concomitant replacement. The acidity was higher with the fertilized crops due to higher base ions removal enabled with better crop growth, especially more, with mineral fertilization compared to poultry manure application. Similar observation had earlier been made with Okra (Oluwatoyinbo et al., 2009). All the fertilizer rates and types studied seemed not able to supply enough N, to have an appreciable soil post – cropping content. Combined fertilizer application had complementary effects on P and K release in the soil. The general improvement in the levels of post – cropping soil Ca, K, Na and P contents with complementary application is consistent with earlier report of Heathcote, (1969).

Table 5: Effect of fertilizer type on nutrient concentration of sesame plant.

Fertilizer Type	N (%)	K (%)	Ca (%)	Mg (%)	Na (%)	P (%)
Control	0.44d	0.03d	0.09d	0.01bc	0.07b	0.33d
2.5t ha^{-1} manure (a)	0.58c	0.12c	0.26b	0.02b	0.10ab	0.62b
5.0t ha^{-1}manure (b)	0.76bc	0.15bc	0.37a	0.02b	0.10ab	0.48c
50Kg ha^{-1} NPK (c)	0.86b	0.24ab	0.14c	0.03ab	0.13a	0.83a
75Kg ha^{-1} NPK (d)	0.96b	0.26ab	0.19bc	0.03ab	0.13a	0.71ab
100Kgha^{-1}NPK (e)	0.98b	0.36a	0.24b	0.04a	0.13a	0.49c
a + c	1.02ab	0.17bc	0.28b	0.02b	0.08b	0.47c
a + d	1.11ab	0.16bc	0.27b	0.02b	0.10ab	0.62b
a + e	1.21ab	0.19b	0.26b	0.02b	0.09b	0.49c
b + c	1.25ab	0.19b	0.28b	0.02b	0.10ab	0.58b
b + d	1.30a	0.21b	0.30ab	0.02b	0.10ab	0.47c
b + e	1.32a	0.20b	0.33ab	0.02b	0.12ab	0.48c

Mean values having same letters within a column are not significantly different according to DMRT ($p<0.05$).

Table 6: Effect of fertilizer type on post - harvest soil constituents.

Fertilizer Type	pH	OM (%)	N (%)	P (mg/kg)	K (cmol/kg)	Ca (cmol/kg)	Mg (cmol/kg)	Na (cmol/kg)
Control	6.1^{ab}	0.9*	0.02*	4.3^{c}	0.02^{c}	1.4^{cd}	2.3^{a}	0.13^{abc}
2.5t ha^{-1} manure (a)	6.3^{a}	0.9	0.02	5.9^{bc}	0.06^{c}	1.7^{ab}	7.6^{a}	0.13^{abc}
5.0t ha^{-1} manure (b)	6.3^{a}	0.7	0.02	6.8^{b}	0.08^{a}	1.9^{a}	9.2^{a}	0.13^{abc}
50Kg ha^{-1} NPK (c)	5.1^{d}	0.8	0.02	5.3^{bc}	0.09^{a}	1.5^{bcd}	7.4^{a}	0.17^{abc}
75Kg ha^{-1} NPK (d)	5.5^{cd}	1.0	0.03	7.7^{ab}	0.09^{a}	1.3^{d}	8.8^{a}	0.13^{abc}
100Kg ha^{-1} NPK (e)	5.1^{d}	1.0	0.02	8.7^{ab}	0.07^{abc}	1.3^{d}	8.5^{a}	0.13^{abc}
a + c	5.6^{bcd}	1.0	0.03	6.3^{b}	0.07^{abc}	1.4^{cd}	9.9^{a}	0.10^{c}
a + d	5.1^{d}	0.9	0.03	6.2^{b}	0.11^{a}	1.3^{d}	9.3^{a}	0.11^{bc}
a + e	5.4^{d}	0.9	0.03	9.6^{a}	0.09^{a}	1.3^{d}	8.6^{a}	0.12^{abc}
b + c	5.8^{abc}	1.0	0.03	6.6^{b}	0.08^{a}	1.4^{cd}	8.9^{a}	0.18^{a}
b + d	5.7^{abc}	1.0	0.03	7.5^{ab}	0.09^{a}	1.5^{bcd}	9.7^{a}	0.17^{ab}
b + e	5.4^{cd}	1.1	0.03	8.6^{ab}	0.11^{a}	1.4^{cd}	9.6^{a}	0.12^{abc}

Mean values having same letters within a column are not significantly different according to DMRT ($p<0.05$).
* No Significant difference

CONCLUSION

Sesame growth is significantly increased with fertilization. Application of 2.5 t ha^{-1} poultry manure in combination with 50 kg ha^{-1} NPK 16-16-16 most enhanced the growth and plant dry matter yield. It gives the optimum shoot dry matter ratio and a comparable N and K contents with mineral fertilizer application.

REFERENCES

Abubakar, S.S., Onyibe, J. E., Tologbonshe, E. B. 1998. The role of extension research and information dissemination in enhancing beninseed production, marketing of resources poor farmers**.** Proceeding of First National Workshop on Beniseed. National Cereals Research Institute, Badegi Nigeria. March 3 - 5, pp 86- 99.

Adediran, J.A., Taiwo, L.B., Akande, M.O., Sobulo, R.A. Idowu, O. J. 2004. Application of organic and inorganic fertilizer for sustainable Maize and Cowpea yields in Nigeria. Journal of Plant Nutrition. 27: 1167 – 1181.

Adetunji, M.T. 1991. An evaluation of the soil nutrient status for maize production in south western Nigeria. Samaru Journal of Agricultural Research 101 – 113.

Adoun, D .S., Sweker, J., Falaiye, A. B., Aaron, A. A., Sodola, M., Odeyemi, A. G., Awoniyi, J. I., Komolafe, M. F., Olorunsola, J. 1978. Agricultural Science, Macmillan Nigeria Publisher Ltd Lagos pp10 – 20

Akanbi, W.B., Akande, M.O., Baiyewu, R.A., Akinfasoye, J.O. 2000. The effect of Maize stover compost and Nitrogen fertilizer on growth, yield and nutrient uptake of Amaranth. Moor Journal of Agricultural Research 1: 6 – 15.

Akanbi, W.B., Akande, M.O., Adediran, J.A. 2005. Suitability of composted Maize straw and mineral nitrogen fertilizer for Tomato production. Journal of Vegetable Science. 11: 57 – 65

Anonymous, 2002. Overview of the Nigerian Sesame Industry. Prepared for the United States Agency for International Development (USAID), Nigeria. Chemonic International Incorporation. Washington, USA. Pp.34.

Biswas, T.K, Sana, N. K., Badal, R, K., Huque, E. M. 2001. Biochemical study of some oil seeds (Brassica, Sesame and Linseed). Pakistan Journal of Biological Science 4: 1002- 1005.

Bouyoucos, G. J. 1962. Hydrometer methods improved for making particle size analysis of soils. Soils Science of America Proceeding 26: 464-465.

Bray, R. M., Kurtz, L. T. 1945. Determination of total organic P and available forms of Phosphorous in soils. Soil Science 59: 39 –45.

Cheryl, A., Palm, Robert, Myers, J. K. Stephen, M. Nandwa, M. 1997. Combined use of organic and inorganic nutrient sources for soil fertility maintenance and replenishment. In: Replenishing Soil Fertility in Africa. SSSA.

Special Publication, No. 51. American Society of Agronomy and Soil Science. WI. USA.

Duhoon, S.S., Deskmukh, M.R., Jain, H.C., Goswami, U. 2002. Integrated nutrient management in Sesame for Kymore plateau zone of Madhya Pradesh. Journal of Oil Seeds Research 19: 73 – 75.

Eneji, A. E., Agboola, A. A., Ibi, B. E. 1997. Effect of farmyard manure and NPK fertilizer on the growth and yield of intercropped maize and sweet potato in southwest Nigeria. Rivistadi Agricultural subtropical et tropical 91: 63 – 78

Giwa, D. D., Ojeniyi, S. O. 2005. Effect of integrated application of pig manure and NPK on soil nutrient content and yield of tomato (Lycopersicum *esculentum* Mill). Managing soil resources for food security and sustainable environment. Proceeding of the 29th annual conference of the Soil Science Society of Nigeria held at University of Agriculture Abeokuta, Nigeria. Pp164 – 169.

Heathcote, R. G.1969. Soil fertility under continuous cultivation in Northern Nigeria. 1. The role of organic manures. Experimental Agriculture 6:229-237.

Makinde, E.A., Akande, M.O., Agboola, A.A. 2001. Effects of fertilizer type on performance of melon in a Maize-melon intercrop. Asset Journal. Series A 2: 151 – 158.

Makinde, E.A., Ayoola, O. T. 2008. Residual influence of early season crop fertilization and cropping system on growth and yield of cassava American Journal of Agricultural and Biological Science 3: 712 – 715.

Mbagwu, J. S. C., Obi, M. E. 2003. Land degradation, agricultural productivity and rural poverty, environmental implication. Proceeding of the 28th annual conference of the Soil Science Society of Nigeria held at National Root Crop Research Institute Umudike, Nigeria 4 – 7 Nov. 2003. Pp 1 – 11.

Ojeniyi, S. O., Adeniyan, N. O. 1999. Effect of poultry manure and NPK fertilizer on soil fertility and maize nutrient contents and yield at Akure, Southwestern Nigeria. Proceeding of the 25th annual conference of the Soil Science Society of Nigeria. Benin. pp 185 – 191.

Okpara, D.A., Muoneke, C.O., Ojikpong, T.O. 2007 Effects of Nitrogen and Phosphorus fertilizer rates on the growth and yield of Sesame in the southeast rain forest belt of Nigeria. Nigerian Agricultural Journal 38: 1 – 11.

Oluwatoyinbo, F. I., Akande, M. O., Makinde, E. A., Adediran, J. A. 2009. Response of Okra to lime and Compost on an Acid Soil. Research Journal of Agricultural and Biological Science 5: 858 – 863.

Statistical Analysis System (SAS) 2004. SAS user's guide: Statistics 2004 ed. Statistical Analysis System Institute, Cary, CN.

Tandon, H.L.S., 1992. Components of integrated plant nutrition. In: Tandon H.L.S. (ed.) Organic manures, recyclable wastes and biofertilizers. Fertilizer Development and Consultation Organization 204, Bhanot Corner 1-2, Pamposh Enclave, New Delhi, India. 148p.

Walkley, A., Black, A. 1934. An examination of the degtrareff method for determining soil organic matter and a proposed modification of the chronic acid titration method. Soil Science. 37: 29-38.

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