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INFLUENCE OF CASSAVA PEEL MANURE AND NPK FERTILIZER INTEGRATIONS ON PERFORMANCE OF SESAME (*Sesamum indicum* Linn.) IN OGBOMOSO, OYO STATE

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ABSTRACT

The performance of most arable crops had been reported to be grossly limiting by soil fertility, particularly under tropical soil conditions. However, chemical fertilizers which are commonly applied by the local farmers to reverse such undesirable soil conditions had been reported to be very harmful to plants, as well as the beneficial soil microbes and man, apart from being highly priced and mostly hoarded. Meanwhile, in recent times, the mountainous deposits of cassava peels around the processing areas in both the urban and rural centres are now a great concern, as they are undesirably imposing environmental pollution and health threats. Meanwhile, such wasteful cassava peels could eventually become useful as potential organic fertilizer materials, when allowed to properly decompose. Field experiment was conducted at the Teaching and Research Farm, Ladoke Akintola University of Technology, Ogbomoso, to evaluate the performance of sesame under sole and combined applications of NPK fertilizer and the cassava peel manure (CPM). Six fertilizer treatments investigated were: T0 = (the control or Zero fertilizer application), T1 = 100% NPK fertilizer application @ 300 kg NPK ha-^{1}), T2 = 100% (CPM @ 4 tons ha^{-1}), T3 = (50% NPK + 50% CPM), T4 = (75% NPK + 25% CPM), T5 = (25% NPK + 75% CPM). The field trial was laid out in Randomized Complete Block Design (RCBD). Data collected on growth and yield parameters were analyzed using Analysis of Variance (ANOVA). T he treatment means were separated using Duncan Multiple Range Test (DMRT), at 5% level of probabil ity. The results of the pre-planting soil analyses showed the soil sample used was texturally sandy loam and slightly acidic (pH 6.12). Also, the soil was grossly low in essential nutrient concentrations particularly total N (0.29 g kg^{-1}), Available P (2.94 mg kg^{-1}) and exchangeable K (0.29 cmol kg^{-1}). Sesame responded well to improved soil nutrition, irrespective of the sources and growing conditions, as the growth and yield parameters significantly improved with fertilizer applications. Although, the sesame growth and yield parameters obtained from the cassava peel integrations were significantly higher at 50% NPK + 50% CPM while the other integrations above 50% CPM were insignificantly higher than the 50% CPM integration. Therefore, CPM is a potential organic fertilizer material, which is highly compatible with NPK 15-15-15 integrations. Hence, combined application of either 50% NPK + 50% Cassava peel manure or 25% NPK fertilizer + 75% CPM (particularly to reduce excess chemical loads on the soil), is therefore recommended for optimum performance of sesame in the study area.

Keywords: Sesame, Soil fertility, Cassava Peel manure, Sesame Meal, NPK

INTRODUCTION

Sesame (*Sesamum indicum Linn.*), commonly referred to as benni seed, is an annual flowering plant in the genus sesamum. It belongs to the family Pedaliaceae. It is believed to be the most popularly known and cultivated amongst the genus sesamum, which consists of about thirty-six (36) plant species. Sesame is commonly referred to as benniseed in Nigeria (Alegbejo *et al.,* 2003). Its utilization includes human consumption, pharmaceuticals, health treatments, beautification, livestock feeding and industrial uses (Sharma, 2005). Its seeds are sources of oil for cooking and cosmetics. Sesame is known to be well adaptable to many soil types, but it thrives best on well-drained, fertile soils of medium texture such as silt loams or sandy loams, provided there is adequate moisture during seedling establishment of about thirty -six

(36) plant species. The leaves are cooked and eaten in stews as 'morogbo' and 'miyar taushe' in some parts of southwestern and northern Nigeria respectively (Alegbejo *et al.,* 2003). Dried stems of the plant can be burnt as fuel with the ash used for making local soap. In addition, sesame meal (obtained after oil extraction), can be used to feed livestock, due to its appreciable content of methionine and tryptophan (Anon, 2002). Sesame is usually propagated by seeds and matures 70-150 days after sowing (Weiss, 2000).

Under tropical soil conditions, where top soil is mostly missing, soil infertility is a major constraint to achieving sustainable vegetable crop production. Soils are majorly marginal and the major attributes of depleted / eroded soils are well manifested (Babajide *et al.,* 2012). Synthetic fertilizers application becomes the commonest sources of fertilizer application for local farmers option, for quick replenishment of depleted soil nutrients and improvement of crop performance, on various tropical farmlands. However, due to scarcity, residual effects and high cost of purchasing synthetic fertilizer, farmers are now advancing their interests towards using organic and low technology fertilizer inputs as soil amendments, particularly for improving the growth and yield of common and indispensable vegetables. Wasteful plant and animal residues are now commonly exploited for improving soil productivity. Although, cases of successful utilization of some agro-wastes such as livestock manures and composted plant materials were earlier reported for improving the performance of tropical arable crops, conscious exploration and integration of commonly available and relatively cheap agro-industrial wastes like cassava peel manure with varying rates of chemical fertilizer like NPK had not been adequately studied and reported on versatile arable crop like sesame. This research was therefore designed to evaluate the response of sesame to sole and combined applications of cassava peel manure and NPK fertilizer, so as to determine the most suitable proportion(s) of the fertilizer materials, for optimum performance of sesame in the study area.

Experimental site

Field experiment was conducted at the Teaching and Research Farm, Ladoke Akintola University of Technology, Ogbomoso, Oyo State. The climate of Ogbomoso is mostly influenced by the North East trade wind and south monsoon wind. The temperature of the area ranges from 28-33^{o}C.

Soil sampling and analysis

After land preparation, pre planting collection of soil samples was carried out using soil auger at a depth of 0-20cm. The samples were bulked into a composite sample and taken to the laboratory for analysis of the soil physical and chemical properties.

Treatments and Experimental Design

The six (6) fertilizer treatments investigated were: T0 = (the control or Zero fertilizer application), T1 = 100% NPK fertilizer application @ 300 KgNPK ha-^{1}), T2 = 100% (CPM @ 4 tons ha^{-1}), T3 = (50% NPK + 50% CPM), T4 = (75% NPK + 25% CPM), T5 = (25% NPK + 75% CPM). The field experiment was laid out in Randomized Complete Block Design (RCBD). The plot size was 2.5 by 1.0m^{2} = 2.5m^{2}, at a spacing of 0.50cm by 0.25m = 0.125m^{2}.

Data collection and Statistical Analysis

Data were collected on growth and yield parameters. The growth parameters determination commenced at 6WAS. The growth parameters measured were plant height using measuring tape placed at the base of the main stem of the plant to the tip, number of branches was determined at 10WAS by direct counting of all developed branches per plant and the number of leaves was also determined by direct counting of all fully opened leaves per plant. Fully ripe capsules were carefully plucked. Number of capsules per plant was then determined by direct counting. All data collected were subjected to analysis of variance (ANOVA). Means were separated using Duncan's multiple range test (DMRT) at $p \leq 0.05$.

The Results

Soil physical and chemical properties of sample used.

The table shows that the soil is slightly acidic with pH 6.12and grossly low in essential nutrients particularly N (0.29 g kg^{-1}), P (4.86 mg kg^{-1}) and K (4.94 cmol kg^{-1}). Also, the soil was texturally sandy loam (Table 4.1) The results is in line with the finding of (Babajide *et al.,* 2008) which shows that the soil samples in the study area were grossly low in essential nutrients and thereby require the addition of fertilizer.

Effects of NPK and Cassava peel manure on Plant Height of Sesame

Table 4.2 shows the effects of NPK and cassava peel manure on plant height of sesame. At 6 weeks T1 (100% NPK fertilizer) treated sesame has the highest value of 42.1cm which was not significantly different from other treatments applied but significantly different from the control which has the least value of 21.0cm. At 8

weeks T3 (50% NPK fertilizer + 50% CPM) treated sesame had the highest value of 68.8 cm which is not significantly different from other treatments applied but significantly different from control which had the least value of 26.1 cm. At 10 weeks T3 (50% NPK fertilizer + 50% CPM) treated sesame had the highest value of 89.8 cm which was not significantly different from other treatments applied but significantly different from control which had the least value of 30.8 cm.

Effects of NPK and Cassava peel manure on Number of leaves of Sesame

Table 4.3 shows the effects of NPK and cassava peel manure on number of leaves of sesame. At 6 weeks T1 (100% NPK fertilizer) treated sesame had the highest number of leaves of 49.0 which was not significantly different from other treatments applied but significantly different from control which has the least value of 13.0. At 8 weeks T1 (100% NPK fertilizer) and T2 (100% cassava peel manure) had the highest number of leaves of 56.0 which was not significantly different from other treatments applied except for the control which has the least value of 18.0. At 10 weeks T4 (75% NPK fertilizer + 25% CPM) had the highest number of leaves of 69.0 which was not significantly different from other treatments applied but significantly different from control which has the least value of 27.0

Effects of NPK and Cassava peel manure on the yield parameters of Sesame

Numbers of capsules

T3 (50% NPK fertilizer + 50% CPM) has the highest value of 81 per plant which is not significantly different from other treatments applied but significantly different from control which has the least value of 18 per plant.

Biomass Yield

T3 (50% NPK fertilizer + 50% CPM) has the highest value of 8.2 tons/ha which is not significantly different from other treatments applied but significantly different from control which has the least value of 0.6 ton/ha

Seed Yield Weight

T3 (50% NPK fertilizer + 50% CPM) has the highest value of 6.0 tons/ha which is not significantly different from other treatments applied but significantly different from the control which has the least value of 0.7 ton/ha.

Effect of NPK and Cassava peel manure on Nutrient Uptake of Sesame

Amongst all the treatments introduced, T3 (50% NPK fertilizer + 50% CPM) significantly enhanced Nitrogen uptake with the value of 27.7 and not significantly different from others but significantly different from control which had the least value of 5.6. In terms of phosphorus (P), T4 (75% NPK fertilizer + 25% CPM) had the highest of 17.4 and significantly not different from others but significantly different from control which had the least value of 0.9 Potassium (K) uptake, T5 (25% NPK fertilizer + 75% CPM) was observed to have the highest value of 21.4 which was not significantly different from others but significantly different from control which has the least value of 0.8. The uptake of Ca was enhanced in T5 (25% NPK fertilizer + 75% CPM) with the value of 8.3 and not significantly different from T3 (50% NPK fertilizer + 50% CPM) but significantly different from others while control had the least value of 0.8. T3 (50% NPK fertilizer + 50% CPM) enhances the uptake of Mg with the value of 5.2 which is significantly different from others while control has the least value of 0.7. The uptake of Na was significantly enhanced in T1 (100% NPK) with the value of 2.2 which is significantly not different from T2 (100% CPM) but significantly different from others where control has the least value of 0.6. Zn was influenced in T1 (100% NPK) with the value of 36.6 which was significantly not different from control but significantly different from others while T5 (25% NPK fertilizer + 75% CPM) has the least value of 16.5. The Mn uptake was influenced in T1 (100% NPK) with the value of 90.8 which was significantly not different from control but significantly different from others while T5 (25% NPK fertilizer + 75% CPM) has the least value of 35.3.

4.1: Physical and chemical Analysis of the soil sample used

Soil characteristics	Values
pH (H_20)	6.12
Organic Carbon (gkg^{-1})	3.26
Total N (gkg^{-1})	0.29
Available P ($mgkg^{-1}$)	4.86
Fe ($mgkg^{-1}$)	11.84
Cu ($mgkg^{-1}$)	2.86
Zn ($mgkg^{-1}$)	2.84
Exchangeable K ($cmolkg^{-1}$)	4.94
Exchangeable Na ($cmolkg^{-1}$)	0.24
Exchangeable Ca ($cmolkg^{-1}$)	24.10
Exchangeable Mg ($cmolkg^{-1}$)	3.25
Sand (gkg^{-1})	800.8
Silt (gkg^{-1})	90.2
Clay (gkg^{-1})	109

4.2 Effects of NPK and Cassava peel manure on Plant Height of Sesame

Treatment	6	8	10
V1T0	21.0c	26.1c	30.8b
V1T1	42.1a	66.2a	86.2a
V1T2	40.2a	65.8a	88.4a
V1T3	40.5a	68.8a	89.9a
V1T4	40.0a	66.0a	84.5a
V1T5	36.8ab	50.9ab	82.6a

Means followed by the same letter are not significantly different using analysis of variance (Anova).

4.3 Effects of NPK and Cassava peel manure on Number of leaves of Sesame

Treatment	6	8	10
V1T0	13.0c	18.0b	27.0b
V1T1	49.0a	56.0a	68.0a
V1T2	41.0a	50.0a	61.0a
V1T3	38.0ab	56.0a	66.0a
V1T4	42.0a	50.0a	69.0a
V1T5	36.0ab	48.0a	60.0a

Means followed by the same letter are not significantly different using analysis of variance (Anova).

4.4 Effect of NPK and Cassava peel manure on yield parameters of Sesame.

Treatments	Number of capsules (plant^{-1})	Biomass yield (Dry weight tons/ha)	Seed Yield Tons/ha
T0	18.0c	0.6b	0.7b
	5		
T1	68.0ab	6.9a	5.5a
T2	73.0a	7.5a	5.4a
T3	81.0a	8.2a	6.0a
T4	80.0a	7.6a	5.4a
T5	72.0a	6.8a	5.3a

Means followed by the same letter are not significantly different using analysis of variance (Anova).

4.5 Effect of NPK and Cassava peel manure on Nutrient Uptakes of Sesame

	<.....gkg^{-1}.....>			<.....mgkg^{-1}.....>						
TRT	N	P	K	Ca	Mg	Na	Fe	Cu	Zn	Mn
T0	5.6c	0.9b	0.8b	0.8d	0.7d	0.6b	81.3c	1.8c	90.4a	30.9a
T1	17.6ab	16.3a	16.5a	2.9c	0.9d	2.2a	123.1b	6.5a	90.8a	36.6a
T2	18.7ab	15.7a	18.2a	5.8b	2.6bc	1.6a	145.7a	5.9a	44.9b	23.2b
T3	22.7a	16.6a	19.3a	8.2a	5.2a	0.7b	107.1ab	3.5b	40.7b	20.1b
T4	18.9ab	17.4a	17.9a	5.8b	3.5b	0.7b	108.0ab	4.6b	36.8bc	16.5bc
T5	18.4ab	17.2a	21.4a	8.3a	2.8bc	0.7b	113.9ab	4.5b	35.3bc	18.0b

Means with the same letter are not significantly different from each other at P > 0.05 using DRMT.

DISCUSSION

The results from the pre-cropping soil analyses showed that the soil was slightly acidic and grossly low in concentrations of essential nutrients, particularly N, P and K. These corroborated the earlier research finding which suggested regular supplementary fertilizer applications, since the soils in the study areas are grossly marginal and could not supply adequate nutrients for optimum growth and yield of most arable crops (Akanbi, 2002; Babajide *et al*., 2008; Babajide *et al.*, 2012). Sesame was found to be sensitive to improved soil nutrition via fertilizer application, as improved sesame performance was observed when different fertilizer types were applied compared to the control, which received no fertilizer application. These results are in agreement with the reports from research findings of Akanbi *et al*., (2000), Babajide *et al.,* (2017) and Babajide *et al* (2022), who reported improved growth and yield parameters of arable crops (sesame inclusive) as resulted from the applications of different fertilizer types. Control had the least value across all the parameters measured. The growth and yield parameters were also significantly enhanced through the application of T3 (50% NPK fertilizer + 50% CPM). Cassava peel manure which is seen mostly by local farmers as wasteful material is potentially dependable as organic manure, which could be integrated with the commonly used NPK fertilizer in the study area. This is a very good development in promoting organic agriculture, which prevents the utilization of any agro-chemical on agricultural fields. This is in line with the findings of Akanbi *et al* (2005), Akanni and Ojeniyi (2007), Ojeniyi (2000) and Babajide *et al.,* (2022) who reported improved arable crops performance through the applications of different types of organic wastes.

RECOMMENDATION AND CONCLUSION

The most suitable of the fertilizer combinations which supplied adequate nutrients for optimum performance of sesame is T3 (50% NPK fertilizer + 50% CPM). Although the values obtained were mostly not significantly different from those plants which received a fertilizer combination of 25% NPK fertilizer + 75% CPM), therefore, combined application of either 50% NPK and 50% Cassava peel manure or 25% NPK fertilizer + 75% CPM (particularly to reduce excess chemical loads on the soil), is therefore recommended for optimum performance of sesame in the study area.

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