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Effects of Organo-mineral Fertilizer Application on the Growth and Yield of 'Egusi' Melon

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Abstract: The growth and yield of Egusi melon in response to application of an Organo-mineral fertilizer was investigated. The Organo-mineral fertilizer was Cow-dung generated from an Abattoir fortified with inorganic Nitrogen. The fertilizer had a pH of 6.1; 61.2 g kg^{-1} Organic Matter; 35.5 g kg^{-1} Organic Carbon; 3.6g kg^{-1} Nitrogen; 372.54 mg kg^{-1} Available Phosphorus and 14.8cmol kg^{-1} Exchangeable Potassium. It was applied at 0, 1.0, 2.0, 3.0 and 4.0 tons ha^{-1}. Fertilizer application level increased the vine length and the leaf area, although not significantly. At 8 weeks after planting (WAP), application of 3.0 tons ha^{-1} gave the longest vine lengths about 241cm long and an average leaf area of 99cm^2, which were not significantly higher than 223cm long vine length, and 84cm^2 average leaf area got from plants treated with 4 tons ha The control treatment had vines 215cm long and an average leaf area of 73cm^2. Average number of leaves per plant was however significantly affected. At 2WAP, the control treatment had about 39 leaves per plant when application of 4.0 tons ha^{-1} had the highest of 68 leaves per plant. This increased to 132 and 280 leaves per plant, respectively at 8WAP.Melon seed yield was only significantly higher with an application rate of 4 tons ha^{-1} which gave a yield of 812 kg ha^{-1}. Lower application rates gave comparable yields as the control treatment that gave a yield of 347 kg ha^{-1}.

Key words: Organic/Inorganic Fertilizer, Egusi Melon,

INTRODUCTION

Melon (*Citrullus vulgaris L*) is one of the most neglected vegetables in Tropical Agricultural Research. It is one of the first crops sown when the rains begin in Nigeria. It is usually grown for its seeds, which provide a popular condiment in stew and soup in the diet. The seeds are rich in essential nutrients when compared to other oil seeds. Maintenance of high crop yields under intensive cultivation is possible only through the use of fertilizers. The use of mineral fertilizers has not been helpful as it is associated with increased soil acidity and nutrient imbalance (Kang and Juo, 1980). The inorganic fertilizers are usually not available and are always rather expensive for the low-income, small-scale farmers. Organic manures can be used as an alternative for the inorganic fertilizers. They release nutrients rather slowly and steadily over a longer period and also improve the soil fertility status by activating the soil microbial biomass (Ayuso *et al*., 1996; Belay *et al*., 2001). Organic manure application sustains cropping system through better nutrient recycling and improvement of the soil physical attributes (El-Shakweer *et al*., 1998). They are however, required in rather large quantities to meet up with crops' nutrient supply. They are rarely available to small-scale farmers in the required quantities (Nyathi and Campbell, 1995). A complementary use of organic and mineral fertilizers has been recommended for sustenance of long-term cropping in the tropics (Palm *et al*., 1997; Ipimoroti *et al*., 2002). High and sustained crop yields can be obtained with judicious and balanced NPK fertilization combined with organic matter amendment (Kang and Balasubramanian, 1990; Makinde *et al*., 2001). Organo-mineral fertilizer application will give the benefits of applying an organic fertilizer as well as applying a little dose of inorganic fertilizer. The optimal rate of combining the organic and the inorganic fertilizers as well as the optimal rate of application is however, still not highly investigated.

This study was conducted to assess the growth and yield of "Egusi" melon with different levels of an Organo -mineral fertilizer

MATERIALS AND METHODS

The experiment was conducted at the Institute of Agricultural Research and Training, Ibadan on latitude $7^0$22½'N and longitude $3^0$50½'E in the degraded rainforest vegetation zone of Nigeria. The town is characterized

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by a bimodal rainfall pattern with a long rainy season, which usually starts in late March while the short rainy season extends from September to early November after a short dry spell in August. The soil of the experimental site was a Plinthic Luvisol. The site was under continuous cultivation with arable crops such as yam, cassava and maize for about four years prior the establishment of the experiment. The top 30cm of the soil had a pH (H_20) of 5.4; 21.6 g kg^{-1} Organic Matter; 12.5 g kg^{-1} Organic Carbon; 1.4 g kg^{-1} Nitrogen; 4.96 mg kg^{-1} Available P (Bray P_1) and 0.51 cmol kg^{-1} Exchangeable K (Table 1).

The experiment was laid out in a Randomized Complete Block design (RCBD) with three replicates. Plot size was 4 x 3m with a 2m margin round each plot. The Organo-mineral fertilizer was a commercial fertilizer of Cow dung from an Abattoir in Ibadan, Nigeria fortified with inorganic Nitrogen. It had a pH (H_20) of 6.1; 61.2 g kg^{-1} Organic Matter; 35.5 g kg^{-1} Organic Carbon; 3.6 g kg^{-1} Nitrogen; 372.5 mg kg^{-1} Available P (Bray P_1) and 14.77cmol kg^{-1} Exchangeable K (Table 1). It was uniformly spread on the plots and manually worked into the soil with West-African hoe, two weeks before planting .The Organo-mineral fertilizer was applied at 0; 1.0; 2.0; 3.0 and 4.0 tons ha^{-1} to supply 4.0 to 16.0 kg N; 0.40 to 1.60 kg P and 6.0 to 24.0 kg K ha^{-1} (Table 2). Seeds of a local melon variety were established at a spacing of 1 x 1m; 2plants per stand, to have a population of 20,000 plants ha^{-1}.

Melon growth characters were assessed fortnightly from 2-8 weeks after planting (WAP). Melon vine length was measured using a flexible tape rule. Leaf area was estimated from relationship with the mid-rib length of the central lobe as described by Wahua (1985), using the linear model:

Area = -30.53 + 7.41 X

Where X is the mid-rib length of the central lobe.

The number of leaves per plant was a visual count of the green leaves. Weight of air-dried seed was used to assess melon yield. The average of the pooled data for two plantings was analyzed using the analysis of variance (ANOVA). The significantly different mean values were separated using the Duncan Multiple Range Test.

RESULTS AND DISCUSSIONS

Characteristics of Soil and Organo-mineral Fertilizer:

The soil was a loamy soil with a pH of 5.4, which was slightly acidic due to the previous continuous cropping for about four years. The organic matter content and the Nitrogen content were low. The soil available P and the exchangeable K were also not high (Table 1).

The organo-mineral fertilizer had an almost neutral pH. The Organic matter content was just adequate. The N content was a little higher than normally found in sole organic manures but still not adequate. The Available P and the Exchangeable K were also low (Table 1).

Table 1: Soil and Fertilizer Chemical Analysis.

	Soil Sample	Organo- mineral Fertilizer
pH (H_20)	5.4	6.1
Organic Matter	21.6 g kg^{-1}	61.2 g kg^{-1}
Organic Carbon	12.5 g kg^{-1}	35.5 g kg^{-1}
Nitrogen	1.4 g kg^{-1}	3.6 g kg^{-1}
Available P	4.96 g kg^{-1}	372.5 mg kg^{-1}
Exchangeable K	0.51 cmol kg^{-1}	14.77 cmol kg^{-1}

Table 2: Estimated N, P and K contents of Organo-mineral Fertilizer amounts applied.

	Estimated amount supplied (kg ha^{-1})		
	N	P	K
1.0 ton ha^{-1}	4.0	0.4	6.0
2.0 tons ha-1	8.0	0.8	12.0
3.0 "	12.0	1.20	18.0
4.0 "	16.0	1.60	24.0

Fertilizer Concentration: 0.40 %N; 0.04 %P; 0.60 %K

Vine Length:

Melon vine length was generally increased by Organo-mineral fertilizer application, although, not significantly. At 4 WAP, application of 3 tons ha^{-1} had the longest vines of 82cm when application of 1 ton ha^{-1} had vines 81cm long while the control treatment had vines 60cm long (Table 3). At 6WAP, application of 3 tons ha^{-1} had vines 177cm long while application of 1ton ha^{-1} had vines 166cm long.

Application of 2 tons and 4 tons ha^{-1} had vines slightly shorter than vines from the unfertilized plots. At 8WAP, application of 3 tons ha^{-1} still had the longest vines 242cm long when application of 4 tons ha^{-1} had vines 224cm long. Plants from the control treatment had the shortest vines 216cm long (Table 3).

Table 3: Effect of Organo-mineral Fertilizer Application on Melon Vine Length (cm) - Pooled data for two plantings.

	Melon Vine Length (cm)		
	4WAP*	6WAP	8WAP
0.0 tons ha^{-1}	60.56	166.66	215.88
1.0 "	80.67	166.53	216.89
2.0 "	74.89	157.88	220.67
3.0 "	82.22	177.56	241.86
4.0 "	62.57 NS	153.66 NS	223.56 NS

Mean values followed by same letters within a column are statistically similar at P =0.05
WAP* = Weeks After Planting.

Leaf Area:

The leaf area was also increased with fertilization, but not significantly (Table 4). At 4WAP, the widest leaves (94cm^2) were observed from plants treated with 3 tons ha^{-1} while the smallest leaves were got with an application rate of 1ton ha^{-1} and from the control plots that had no fertilizers, At 6WAP, the leaf areas were significantly different, with application of 4 tons ha^{-1}giving the widest leaves of 90cm^2 which was significantly wider than leaves from the control treatment. At 8WAP, the leaves were all comparable again, although application of 4 tons ha^{-1} gave the widest leaves of 99cm^2. The control treatment had leaves 73cm^2 wide (Table 4).

Table 4: Effect of Organo-mineral Fertilizer Application on Average Leaf Area of Melon (cm^2) - Pooled data for two plantings.

	Average Leaf Area of Melon (cm^2)		
	4WAP	6WAP	8WAP
0.0 tons ha^{-1}	73.19	78.15b	73.19
1.0 "	73.19	81.36ab	76.42
2.0 "	78.97	83.09ab	79.71
3.0 "	93.79	84.57ab	98.73
4.0 "	79.78 NS	89.61a	84.33 NS

Mean values followed by same letters within a column are statistically similar at P =0.05
WAP* = Weeks After Planting.

***Average Number of Leaves per Plant*:**

Average number of leaves per plant was significantly affected by fertilizer application. 4 tons ha^{-1}had an average of 68 leaves per plant at 4 WAP, which was significantly higher than the 39 leaves per plant, observed from the control plots (Table5). At 6 WAP, 3 tons ha^{-1} had the highest average number of 170 leaves per plant, which was not significantly higher than from 2 and 4 tons ha^{-1} but significantly higher than from application of 1ton ha^{-1}and from the unfertilized plots. At 8WAP, the number of leaves per plant increased with the level of fertilizer application. They were all significantly different. Application of 4 tons ha^{-1} had the highest average number of 280 leaves when 1 ton ha^{-1} had 142 leaves per plant which was significantly higher than the 132 leaves observed from the control plots (Table5).

Table 5: Effect of Organo-mineral Fertilizer Application on Average Number of Leaves of Melon - Pooled data for two plantings.

	Average Number of Melon Leaves per Plant		
	4WAP	6WAP	8WAP
0.0 tons ha^{-1}	39.56b	148.09bc	132.00e
1.0 "	54.67ab	140.66c	142.00d
2.0 "	56.33ab	157.78ab	168.00c
3.0 "	56.33ab	170.11a	232.00b
4.0 "	67.99a	158.78ab	280.11a

Mean values followed by same letters within a column are statistically similar at P =0.05
WAP* = Weeks After Planting.

Seed Yield:

Melon seed yield was increased with Organo-mineral fertilizer application. The yields were comparable up to 3 tons ha^{-1} (Table 6). Application of 4 tons ha^{-1} however gave a yield increase of 134% over the control treatment. It had a yield of 812 kg ha^{-1}, which was significantly higher than yields from the other treatments.

Table 6: Effect of Organo-mineral Fertilizer Application on Melon Seed Yield (kg ha^{-1}) - Pooled data for two plantings.

	Melon Seed Yield (kg ha^{-1})
0.0 tons ha^{-1}	347.22b
1.0 "	388.70b
2.0 "	421.39b
3.0 "	463.05b
4.0 "	812.50a

Mean values followed by same letters within a column are statistically similar at P =0.05
WAP* = Weeks After Planting.

Melon growth was most supported with application rates of 3 and 4 tons ha^{-1}. Enough nutrients were released early enough by these rates to have better plant development. The Nitrogen applied with application rates of 1 ton and 2 tons ha^{-1} was low, coupled with the fact that the organic component of the fertilizer will not release the nutrients early enough to effect optimum plant development. The nutrients supplied with the rate of 3 tons ha^{-1} were just enough to support the growth. The higher the nutrients supplied, the higher the number of leaves produced per plant. Application of 4 tons ha^{-1} however, could supply enough nutrients to give a significantly high seed yield.

The increased seed yield obtained with application of 4 tons ha^{-1} of the Organo-mineral fertilizer agrees with reports on many crops. Makinde *et. al.* (2001) reported a comparable melon seed yield when melon sown with 150kg N + 50kg P ha^{-1} was compared with a combined application of 5 tons ha^{-1} Domestic Waste + 75kg N + 25kg P ha^{-1}. The highest grain yield of Rice has been obtained with Farmyard Manure (FYM) applied at 10 tons ha^{-1} combined with 120: 60: 45 N; P_2O_5 and K_2O ha^{-1} (Satyanaraya *et. al,* 2002). Bayu *et. al.*(2006) have reported that Sorghum yield from 5 tons ha^{-1} FYM combined with 20kg N + 10kg P ha^{-1} was optimally comparable with either 15 tons ha^{-1} FYM or application of inorganic 41 kg N + 20 kg P ha^{-1}.

Conclussion:

Melon growth is well supported with Organo-mineral fertilizer application rate of 3 tons ha^{-1}.This rate is however insufficient for optimum yield. An optimum seed yield is given by an application rate of 4 tons ha^{-1} that supplies 16.0kg N, 1.60kg K and 24.0 kg K ha^{-1}.

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