

Manure on the dry matter components of cucumber varieties

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Abstract: The effects of farmyard manure on the dry matter content of two cucumber varieties (Ashley and Palmetto) was evaluated at the Teaching and Research Farm of the Ambrose Alli University, Ekpoma, Nigeria Lat $6^{\circ}45^1$ N and Long $6^{\circ}08^1$ E. The farmyard manure was applied at the rates of 0, 5 and 10t/ha. The layout was a 2 x 3 factorial scheme with three replicates. The result of the study showed that increasing the farmyard rates led to an increase in the dry matter weights of the two varieties of cucumber. Farmyard manure at 10t/ha increased the dry matter content of cucumber. Palmetto was however more responsive to FYM application, with the rate of 10t/ha out yielding the control by 60% in contrast to Ashley, in which 10t/ha of FYM out yielded the control by only 30 %. [Nature and Science. 2010;8(5):16-22]. (ISSN: 1545-0740).

Keywords: Farmyard manure, two cucumber varieties, dry matter accumulation and yield

Introduction

Cucumber (*Cucumis sativus* L [2n = 24]) is a high nutrient demanding crop and performs poorly on nutrient deficient soils leading to low yields, bitter and misshapen fruits (Grubben and Denton, 2004). The fruits that result are not marketable hence farmers' income is reduced. Farmyard manure which is a source of plant nutrition has been used as a soil conditioner since ancient times and its benefit has not been fully harnessed due to large quantities required in order to satisfy the nutritional needs of crops (Makinde *et al.*, 2007). The need for renewable forms of energy and reduced cost of fertilizing crops, have revived the use of organic manures worldwide (Ayoola and Adeniran, 2006). Improvement in environmental conditions and public health are important reasons for advocating increased use of organic materials (Ojeniyi, 2000; Maritus and Vleic, 2001). Also because it is bulky, the cost of transportation and handling constitute a constraint to its use by peasant farmers. Farmyard manure acts as an alternative source of fertility enhancement for inorganic fertilizers as they release nutrients slowly and steadily over longer periods of time and also improve the soil fertility status by activating the soil microbial biomass (Ayuso *et al.*, 1996; Belay *et al.*, 2001).

Dry matter is one of the measures of plant growth (Noggle and Fritz, 1983) and it reflects the relative growth rate as regards to net assimilation rate (Ibeawuchi, 2004). Jones (1976) stated that dry matter can be influenced by farmyard manure application and this is a function of crop species and soil fertility. Silva *et al.* 2004 verified that manure increased green ear yield and grain yield in two corn cultivars. Ramamurthy and Shivashankar (1996) in

their experiment found that organic matter improved the plant height, dry matter production at different stages of crop growth and yield attributing characters of corn like number of cobs per plant, shelling percentage, 100 grain weight, protein content of grains and yield per hectare.

The objective of this study was to determine the effects of farmyard manure on the dry matter components and yield of two cucumber varieties.

Materials and Methods

The experiment was conducted at the Teaching and Research farm of the Ambrose Alli University Ekpoma on Lat. $6^{\circ}45^1$ N and Long. $6^{\circ}08^1$ E in a forest, savanna transition zone of Edo State, Nigeria. The area is characterized by a bimodal rainfall pattern with a long rainy season which starts in late March and the short rainy period extends from September to late October after a dry spell in August. The soil order is a ultisol and the site is classified locally as kulfo series (Moss, 1957).

The site was left fallow for three years after it was cropped to maize, yam and cassava for two years prior to the establishment of the experiment. A composite soil sample was collected from 0-30 cm depth prior to planting before the incorporation of farmyard manure to determine the pH and the nutrient status of the soil. Soil pH was analyzed by 1:2 in H₂O, total N content was determined by Kjeldahl method (Bremner, 1965); available phosphorus was analyzed using the modified method of Walkley and Black (Nelson and Sommers, 1982). The farmyard manure was collected from a deep litter pen of the Poultry Unit of the Teaching and Research Farm of Ambrose Alli University Ekpoma and left to decompose for three months.

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August, Ashley and Palmetto were sown at 75cm by 75cm and later thinned after two weeks to one seedling per stand to give a population of 17,777.8 plants per hectare. The organic fertilizer treatments imposed were three levels of farmyard manure, (0, 5 and 10t/ha).

The experiment was laid out in a 2 x 3 factorial scheme with three replicates. The plot size was 3.75 x 3.75 metres with 2 - metre pathways. The farmyard manure was uniformly spread on the plots and a West Indian hoe was used to turn the manure into the soil two weeks before planting. Hoe weeding was carried out at 3 and 5 weeks after planting. Insect pests were controlled with lamdacyhalothrin as Karate at biweekly intervals for effective insect control.

Cucumber vine length was measured by using a flexible tape rule. Number of leaves was assessed by visual count of the green leaves and the leaf area was assessed by the use of dry weight disc method based on the work of Rhoads and Bloodworth (1964).

For dry matter determination, two plants were cut from their bases at each sampling period of 4, 6 and 8 weeks after planting and separated into leaves, stems and reproductive parts (flowers and fruits). These parts were enclosed in labelled envelopes and oven dried at 70⁰C until a constant weight was attained. These parts were then weighed and recorded (leaf, stem and fruit and total dry matter weights). At every harvest, the fruit girth was assessed by using a vernier calliper, the fruit length was measured by using a flexible tape before the fruits were weighed using a 10kg scale. The cumulative weights of the entire harvests (10 times) were summed up and extrapolation made of total yield /ha.

Results

The soil of the experimental site was a loamy soil with a pH of 5.8. The organic matter content was medium and the Nitrogen content was moderate. The soil available P was moderate and the exchangeable K was low (Table 1).

The farmyard manure had an almost neutral pH.. The organic matter content was adequate and the N and P contents were high and the K content was medium

The mean vine length of two cucumber varieties at 4, 6 and 8 WAP as affected by farmyard manure rates are shown in Table 2a. At 4 WAP, the mean vine length of two cucumber varieties ranged from 20.28 to 41.83cm. The Palmetto variety produced the longest vine when 10t/ha of FYM was applied and Ashley variety, the shortest. The differences between the various rates of FYM were

significant ($P<0.05$). The mean vine length for the two cucumber varieties at 6 WAP ranged from 88.26 to 173.66cm. The Palmetto variety produced the longest vines when 10t/ha of FYM was applied and Ashley variety, the shortest and there were significant differences between the various rates of FYM ($P<0.01$). The mean vine length of two cucumber varieties assessed at 8 WAP ranged from 191.51 - 287.50cm. The Palmetto variety produced the longest vine when 10t/ha of farmyard manure was applied which was similar to the Ashley variety at the same rate of application and the shortest vine was recorded in control plots of Ashley variety.

The mean number of leaves for the two cucumber varieties as affected by the application of farmyard manure at 4, 6, and 8 WAP are shown in Table 2a. At 4 WAP, the number of leaves ranged from 5.74 to 13.81. The highest number of leaves was recorded in the Palmetto variety at the 10t/ha FYM rate and the control of both varieties, the lowest and there were significant differences between the treatment means ($P<0.05$). The mean number of leaves at 6 WAP, ranged from 26.69 to 51.77. The Palmetto variety had the highest number of leaves at 10t/ha FYM rate that was significantly different ($P<0.05$) from the same rate for the Ashley variety. Applying FYM rate at 5t/ha resulted in similar number of leaves for both varieties. At 8 WAP, the number of leaves ranged from 31.60 to 55.79. The Palmetto variety had the highest number of leaves at the 10t/ha FYM rate which was similar to the Ashley variety at the same level of farmyard manure application. At 5t/ha rate both varieties were not significantly different from each other.

The mean number of branches as affected by farmyard manure rate (FYM) is shown in Table 2b. At 4 WAP, the mean number of branches of two cucumber varieties ranged from 0.68 to 1.95. The Palmetto variety had the highest number of branches at 10t/ha rate of FYM, which was however similar to the Ashley variety at the same rate of application. At 5t/ha FYM rate, both varieties had similar mean number of branches, which were significantly different from the control ($P<0.05$). At 6 WAP, the mean number of branches ranged from 9.52 to 18.56. The Palmetto variety had the highest number of branches which was significantly different from Ashley variety ($P<0.05$) at 10t/ha of FYM application. At 5t/ha rate of FYM, both varieties had similar mean number of branches which was significantly different from the control ($P<0.05$). The mean number of branches at 8 WAP ranged from 10.32 to 19.04. The highest number of branches was recorded at 10t/ha for both varieties, which was significantly different ($P<0.05$) from the other rates of FYM application. At 5t/ha, both varieties had

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control ($P<0.05$).

The mean leaf area per plant of two cucumber varieties at 4, 6 and 8 WAP as affected by farmyard manure rates are shown in Table 2b. At 4 WAP, the mean leaf area ranged from 531.45 to 1017.56cm². Applying FYM at the rate of 5t/ha and 10t/ha for both varieties resulted in values which were similar but were significantly different from the control ($P<0.05$). The mean leaf area per plant at 6 WAP ranged from 3025.93 to 4210.30cm². The Palmetto variety produced the highest leaf area at 10t/ha which was similar to the Ashley variety at the same rate and the lowest value was observed in the control of both varieties. The differences between the various farmyard manure rate were significant ($P<0.05$). The mean leaf area at 8 WAP ranged from 3458.14 to 5035.68 cm². The Palmetto variety had the highest leaf area at 10t/ha and the Palmetto control, were the lowest. There were significant differences between the various treatments ($P<0.05$).

The mean dry weight of leaves per plant of two cucumber varieties as affected by farmyard manure rate at 4, 6 and 8 WAP are presented in Table 3a. At 4 WAP, the mean dry weight of leaves ranged from 4.04 to 10.74g. The application of 5t/ha of farmyard manure on the two cucumber varieties significantly ($P<0.05$) produced more leaf dry weight than the control. The 10t/ha rate of farmyard manure significantly produced the highest mean leaf weight per plant for the two varieties. The application of farmyard manure to the cucumber varieties at 6 WAP produced a mean leaf dry weight of 18.50 - 25.18g. The Palmetto variety produced the highest mean leaf dry weight, which was significantly different ($P<0.05$) from the Ashley variety when 10t/ha FYM was applied. The 8 WAP sampling period witnessed a range of 34.95 to 48.54g of leaf dry weight. The highest mean dry weight was recorded at the 10t/ha farmyard manure rate for both varieties. The Palmetto variety at 5t/ha produced leaf dry weight that was significantly different ($P<0.05$) from the Ashley variety and the control.

The mean stem dry weight per plant of two cucumber varieties as affected by farmyard manure rate is presented in Table 3a. At 4 WAP, the mean dry weight ranged from 1.97 to 2.38g. The application of farmyard manures at 10t/ha produced the highest stem dry weight for the two varieties. At lower FYM rate of 5t/ha, the weights of the two varieties were similar but significantly different from the control ($P<0.05$). At 6 WAP, the stem dry weight of two varieties ranged from 5.17 to 8.10g. The highest mean stem dry weight was recorded at 10t/ha

FYM for the two varieties and they were significantly different ($P<0.05$) from lower rate of 5t/ha and the control. At 8 WAP, the mean stem dry weight ranged from 13.07 to 15.13g. The highest stem dry weight was recorded in the Ashley variety at 10t/ha FYM rate which was similar to the Palmetto variety at the same rate of FYM application. At lower rate of 5t/ha, the two varieties had values, which were similar but was significantly different ($P<0.05$) from the control.

The mean fruit dry weights per plant as affected by farmyard manure rate are shown in Table 3b. At 6 WAP, the fruit dry weight ranged from 2.42 - 3.368g. Increasing FYM rate increased the cucumber fruit dry weight. The application of farmyard manure at 5t/ha and 10t/ha was similar for both varieties but was significantly different from the control ($P<0.05$). At 8 WAP, the fruit dry weight of two cucumber varieties ranged from 16.87 to 31.09g. The application of farmyard manure at 10t/ha rate resulted in the highest fruit dry weight that was similar for the two varieties.

The mean total dry weight of two cucumber varieties at 4, 6 and 8 WAP as affected by farmyard manure rate are shown in Table 3b. At 4 WAP, the mean total dry weight ranged from 6.01 to 13.12g. The use of farmyard manure at the rate of 10t/ha resulted in total dry weight which had similar values for both varieties and significantly different ($P<0.05$) from the rate of 5t/ha and 0t/ha. At 6 WAP, the response of two cucumber varieties to varying rates of farmyard manure ranged from 26.11 - 36.96g. The highest total dry weight was observed in the Palmetto variety when 10t/ha of FYM was applied and the control had the lowest. The differences between the treatment means was significant ($P<0.05$). At 8WAP, the total dry weight ranged from 64.89 to 94.73g. As the rates of application increased, the total dry weight also increased. The Palmetto variety at 10t/ha FYM rate produced the highest total dry weight while the control of Palmetto produced the lowest. The differences between the treatment means was significant ($P<0.05$).

The mean number of fruits per plant as affected by varying rates of farmyard manure is presented in Table 4. The fruit number per plant ranged from 5.05 to 11.51. The Ashley variety produced the highest mean fruit number per plant at the 10t/ha of FYM application rate and the lowest number was from the control plots.

The mean fruit length and mean fruit girth of the two cucumber varieties as affected by farmyard manure rate are presented in Table 4. The fruit length ranged from 15.07 to 15.95cm. The application of 5t/ha and 10t/ha of farmyard manure produced longer fruits which were significantly different ($P<0.05$) from the control. Data on the fruit girth ranged from

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10t/ha
10t/ha
were significantly different ($P < 0.05$) from the control.

The fruit weight per plant and fruit yield per hectare of the two cucumber varieties as affected by farmyard manure rate are presented in Table 4. The fruit weight per plant ranged from 1.39 to 2.24kg. The application of farmyard manure at 10t/ha for the two varieties produced the highest number of fruits per plant which was significantly different ($P < 0.05$) from the 5t/ha and the control. The fruit yield per hectare of two cucumber varieties ranged from 24,881.46 to 39,853.18kg/ha. The Palmetto variety had the highest fruit yield per hectare at 10t/ha of farmyard manure application and the control of Palmetto produced the lowest. Fruit weight and yield increased significantly ($P < 0.05$) with increase in the rate of FYM applied. There was no significant difference in the fruit weight and the yield of the two varieties. Palmetto was however more responsive to FYM application, with the rate of 10t/ha out yielding the control by 60%, in contrast to Ashley, in which 10t/ha of FYM out yielded the control by only 30 % (Table 4).

Discussion

The two varieties of cucumber responded significantly to the applied farmyard manure in terms of growth parameters, dry matter accumulation and yield and yield components. This is in line with Jones (1976) who stated that dry matter can be influenced by farmyard manure application and this is a function of crop species and soil fertility. The growth characters and dry matter of two cucumber varieties at 4, 6 and 8 weeks after planting and the number of fruits per plant, fruit weight per plant and yield per hectare were influenced by the application of farmyard manure and this is in line with the findings of Raramurthy and Shivashankar (1996) who stated that organic matter improved the plant height, dry matter production at different stages of crop growth

and yield attributing characters of corn like number of cobs per plant, shelling percentage, 100 grain weight, protein content of grains and yield per hectare.

The application of farmyard manure increased the dry matter and yield. This increase could be attributed to nutrient availability and its uptake by the plants. This dry matter accumulation is a result of nutrient uptake and one of the measures of plant growth (Noggle and Fritz, 1983). The result of the study has shown that farm yard manure at any rate increased dry matter accumulation of the two varieties of cucumber and response was up to the highest level applied (10t/ha). This dry matter accumulation affected the number of fruits per plant, fruit length and fruit girth and the yield per hectare. This is in agreement with the findings of Badaruddin *et al.* (1999) who posited that the application of farmyard manure resulted in significant increase in final above ground biomass in wheat. Increasing the farmyard manure rates for the two varieties resulted in an increase in the dry matter accumulation and an increase in the number of fruits per plant, fruit weight per plant, fruit length and fruit girth and yield per hectare. This is in line with Jarvan and Edesi (2009) who opined that the use of FYM on cultivated crops have higher dry matter content than those grown conventionally and hence increased yield.

The nutrients absorbed by the cucumber plants were effectively utilized in the formation of fruit, leaf and stem tissues and this is in agreement with Ibeawuchi *et al.* (2007) who posited that dry matter accumulation affected the grain yield and 1000 maize grain and dry matter accumulation is a measure of relative yield.

Conclusion

Farmyard manure had a clear and consistent effect on dry matter accumulation and yield of the two varieties of cucumber. Increasing the farmyard manure resulted in the increase of growth, dry matter accumulation and yield of cucumber.

Table 1. Chemical analysis of soil and farmyard manure

	Soil sample	Farmyard manure
pH (in 2: 1 water)	5.80	6.0
Organic matter content	24.15g/kg	53.73g/kg
Organic carbon	14.0g/kg	31.13g/kg
Nitrogen	1.290g/kg	2.23g/kg
Ca	8.80mg/kg	39.08cmol/kg
Mg	0.96mg/kg	4.32cmol/kg
Available P	10.40cmol/kg	61.29mg/kg
Exchangeable K	0.29cmol/kg	2.53cmol/kg

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the vegetative traits of two cucumber varieties evaluated at 4, 6 and 8

Varieties	FYM Applied (t/ha)	Vine length (cm)			Number of leaves/plant		
		WAP			WAP		
		4	6	8	4	6	8
Ashley	0	20.28	88.26	191.51	5.74	26.69	31.61
	5	26.25	132.53	235.57	10.36	39.74	44.52
	10	33.97	143.01	286.14	12.84	46.04	52.78
	Mean	26.84	121.25	237.25	9.65	37.49	42.97
Palmetto	0	20.52	101.92	201.88	5.74	27.80	33.93
	5	40.15	140.91	257.93	10.81	39.91	46.85
	10	44.38	173.66	287.50	13.81	51.77	55.97
	Mean	34.17	138.83	249.10	10.12	39.83	45.52
LSD (P<0.05)FYM means		3.176*	13.151*	20.181*	1.168*	3.352*	3.788*
Variety means		2.593	10.738	16.477	0.954	2.737	3.093
Interaction means		4.491	18.599	28.540	1.652	4.740	5.356

Table 2b. The effects of farmyard manure on the vegetative traits of two cucumber varieties evaluated at 4, 6 and 8 WAP

Varieties	FYM Applied (t/ha)	No of branches/plant			Leaf area (cm ²)/plant		
		WAP			WAP		
		4	6	8	4	6	8
Ashley	0	0.71	9.80	12.00	531.45	3076.47	3540.66
	5	1.23	13.24	13.64	944.90	3793.50	4440.65
	10	1.79	16.84	17.70	994.92	4208.23	4640.20
	Mean	1.24	13.28	14.40	823.76	3692.94	4192.08
Palmetto	0	0.68	9.52	10.32	688.48	3025.93	3458.14
	5	1.54	12.88	13.44	914.64	3685.74	4783.41
	10	1.95	18.56	19.04	1017.56	4210.30	5035.68
	Mean	1.39	13.64	14.28	873.56	3640.66	4425.51
LSD (P<0.05)FYM means		0.192*	1.501*	1.728*	100.192*	433.263*	342.174*
Variety means		0.156	1.228	1.412	81.807	353.758	279.384
Interaction means		0.270	2.124	2.444	141.693	612.726	483.906

Table 3a. The effects of farmyard manure on dry matter partition to plant parts of two cucumber varieties assessed at 4, 6 and 8 weeks after planting

Varieties	FYM Applied (t/ha)	Dry weight of leaves g/plant			Dry weight of stem (g)/plant		
		WAP			WAP		
		4	6	8	4	6	8
Ashley	0	4.16	18.61	36.59	1.98	5.30	13.22
	5	8.55	21.41	41.47	2.27	7.23	14.33
	10	10.64	23.60	48.04	2.36	8.03	15.13
	Mean	7.78	21.21	42.03	2.20	6.85	14.24
Palmetto	0	4.04	18.50	34.95	1.97	5.17	13.07
	5	8.74	22.13	44.24	2.26	7.15	14.52
	10	10.74	25.18	48.54	2.38	8.10	15.09
	Mean	7.84	21.94	42.58	2.20	6.81	14.23
LSD (P<0.05)FYM means		0.633*	0.993*	1.247*	0.058*	0.490*	0.582*
Variety means		0.517	0.811	1.018	0.048	0.400	0.475
Interaction means		0.895	1.404	1.764	0.080	0.694	0.823

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dry matter partition to plant parts of two cucumber varieties assessed at

Varieties	FYM Applied (t/ha)	Dry weight of fruits (g)/plant WAP				Total dry matter (g)/plant WAP	
		6	8	6	8	6	8
Ashley	0	2.42	16.96	2.42	16.96	2.42	16.96
	5	3.15	26.50	3.15	26.50	3.15	26.50
	10	3.62	30.54	3.62	30.54	3.62	30.54
	Mean	3.06	24.67	3.06	24.67	3.06	24.67
Palmetto	0	2.44	16.87	2.44	16.87	2.44	16.87
	5	3.25	27.25	3.25	27.25	3.25	27.25
	10	3.68	31.09	3.68	31.09	3.68	31.09
	Mean	3.12	25.07	3.12	25.07	3.12	25.07
LSD (P<0.05)	FYM means	0.633*	0.625*	1.550*	0.625*	1.550*	0.625*
	Variety means	0.517	0.510	1.266	0.510	1.266	0.510
	Interaction means	0.895	0.884	2.192	0.884	2.192	0.884

Table 4. Effects of farmyard manure application on yield and yield components of two varieties of cucumber.

Varieties	FYM applied (t/ha)	Fruit No/plant (kg)	Fruit length (cm)	Fruit girth (cm)	Fruit wt/plant (kg)	Yield kg/ha
Ashley	0	5.16	15.05	4.64	1.53	27278.33
	5	8.79	15.77	5.14	1.85	32823.61
	10	11.55	15.92	5.15	2.03	35353.25
	Mean	8.49	15.59	4.98	1.80	31818.40
Palmetto	0	5.05	15.24	4.87	1.39	24881.46
	5	8.47	15.78	5.42	1.86	32911.37
	10	11.35	15.95	5.44	2.34	39853.18
	Mean	8.29	15.66	5.24	1.83	32548.67
LSD (P<0.05)	FYM means	1.050	0.273	0.245	0.226	4055.481
	Variety means	0.858	0.223	0.200	0.184	3311.286
	Interaction means	1.485	0.386	0.347	0.318	5735.316

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