

Full Length Research Paper

## Study on the dry matter components of two cucumber varieties using farm yard manure

Eifediyi E. K., S. U. Remison and V. B. Okaka

Department of Crop Science, Ambrose Alli University, P. M.B. 14, Ekpoma, Nigeria.

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A field experiment was conducted at the Teaching and Research Farm of the Ambrose Alli University, Ekpoma, Nigeria Lat 6° 45' N and Long 6° 08' E. during the 2008 planting season to evaluate the effects of farmyard manure on the dry matter content of two cucumber varieties (Ashley and Palmetto). The farmyard manure was applied at the rates of 0, 5 and 10t/ha two weeks before the commencement of the experiment to the plots and worked into the soil using hoes. The experiment was laid out in 2 x 3 factorial scheme fitted into a randomized complete block design (RCBD) with three replicates. Data were collected on vegetative traits – vine length, number of leaves, leaf area and number of branches; dry matter weight – leaf, stem, fruits and total dry matter and yield characters – fruit length and fruit girth, fruit number per plant, fruit weight per plant and yield per hectare. Analysis of variance (ANOVA) was carried out by using Genstat version 12 software. 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 %.

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

### INTRODUCTION

Cucumber (*Cucumis sativus* Linn [2n = 24] is the second most important vegetable crop after tomato in Western Europe (Phu, 1998). It is thought to be one of the oldest vegetables to be cultivated by man with historical records dating back 5000 years (Wehner and Guner, 2004). In tropical Africa, the place of the crop has not been ranked because of limited use.

The crop 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 that 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

\*Corresponding author. E-mail: [kevineifediyi@yahoo.com](mailto:kevineifediyi@yahoo.com). Tel: +234 – 8056500881.

**Table 1.** Chemical analysis of Soil and farmyard manure.

Properties	Soil sample	Farmyard manure
pH (in 1 : 2 H <sub>2</sub> O)	5.80	6.00
Organic matter content g/kg	24.15	53.73
Organic carbon g/kg	14.0	31.13
Nitrogen g/kg	1.290	2.23
Ca (cmol/kg)	8.80	39.08
Mg (cmol/kg)	0.96	4.32
Available P mg/kg	10.40	61.29
Exchangeable K (cmol/kg)	0.29	2.53

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° 45' N and Long. 6° 08' 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 kulfu 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 H<sub>2</sub>O, 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.

The experiment commenced on the 23<sup>rd</sup> of August, 2008 with the planting of two seeds of Ashley and Palmetto varieties of cucumber at a spacing of 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 × 3 factorial scheme with three replicates. The plot size was 3.75 × 3.75 m with 2 m 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 lamdacyahalothrin 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 70°C 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 10 kg 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 2. At 4 WAP, the mean vine length of two cucumber varieties ranged from 20.28 to 41.83 cm. The Palmetto variety produced the longest vine when 10t/ha of FYM was applied and Ashley, 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 173.66 cm. The Palmetto variety produced the longest vines when 10 t/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 to 287.50 cm. 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 highest number of leaves was recorded in the 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 2. At 4 WAP, the number of leaves ranged from 5.74 to 13.81.

**Table 2.** 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)	Vine length (cm)			No of leaves/plant			No of branches/plant			Leaf area (cm <sup>2</sup> )/plant		
		WAP			WAP			WAP			WAP		
		4	6	8	4	6	8	4	6	8	4	6	8
Ashley	0	20.28	88.26	191.51	5.74	26.69	31.61	0.71	9.80	12.00	531.45	3076.47	3540.66
	5	26.25	132.53	235.57	10.36	39.74	44.52	1.23	13.24	13.64	944.90	3793.50	4440.65
	10	33.97	143.01	286.14	12.84	46.04	52.78	1.79	16.84	17.70	994.92	4208.23	4640.20
	Mean	26.84	121.25	237.25	9.65	37.49	42.97	1.24	13.28	14.40	823.76	3692.94	4192.08
Palmetto	0	20.52	101.92	201.88	5.74	27.80	33.93	0.68	9.52	10.32	688.48	3025.93	3458.14
	5	40.15	140.91	257.93	10.81	39.91	46.85	1.54	12.88	13.44	914.64	3685.74	4783.41
	10	44.38	173.66	287.50	13.81	51.77	55.97	1.95	18.56	19.04	1017.56	4210.30	5035.68
	Mean	34.17	138.83	249.10	10.12	39.83	45.52	1.39	13.64	14.28	873.56	3640.66	4425.51
LSD FYM means		3.176*	13.151**	20.181*	1.168*	3.352*	3.788*	0.192*	1.501*	1.728*	100.192*	433.263*	342.174*
Variety means		2.593	10.738	16.477	0.954	2.737	3.093	0.156	1.228	1.412	81.807	353.758	279.384
Interaction means		4.491	18.599	28.540	1.652	4.740	5.356	0.270	2.124	2.444	141.693	612.726	483.906

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 10 t/ha FYM rate which was similar to the Ashley variety at the same level of farmyard manure application. At 5 t/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 2. 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 5 t/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 similar values and the number of branches for the control of Ashley variety was similar to the 5 t/ha rate, but was significantly different from the Palmetto 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 2. At 4 WAP, the mean leaf area ranged from 531.45 to 1017.56 cm<sup>2</sup>. 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 4210.30

**Table 3.** 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 WAP			Dry weight of stem (g)/plant WAP			Dry weight of fruits (g)/plant WAP		Total dry matter (g)/plant WAP		
		4	6	8	4	6	8	6	8	4	6	8
Ashley	0	4.16	18.61	36.59	1.98	5.30	13.22	2.42	16.96	6.14	26.33	68.03
	5	8.55	21.41	41.47	2.27	7.23	14.33	3.15	26.50	10.82	31.79	84.30
	10	10.64	23.60	48.04	2.36	8.03	15.13	3.62	30.54	13.00	35.25	93.76
	Mean	7.78	21.21	42.03	2.20	6.85	14.24	3.06	24.67	9.99	31.12	82.02
Palmetto	0	4.04	18.50	34.95	1.97	5.17	13.07	2.44	16.87	6.01	26.11	64.89
	5	8.74	22.13	44.24	2.26	7.15	14.52	3.25	27.25	11.00	32.53 <sup>c</sup>	85.34
	10	10.74	25.18	48.54	2.38	8.10	15.09	3.68	31.09	13.12	36.96	94.73
	Mean	7.84	21.94	42.58	2.20	6.81	14.23	3.12	25.07	10.05	31.87	81.65
LSD (P<0.05)FYM means		0.633*	0.993*	1.247*	0.058*	0.490*	0.582*	0.625*	1.550*	0.645*	1.147*	2.613
Variety means		0.517	0.811	1.018	0.048	0.400	0.475	0.510	1.266	0.527	0.936	2.133
Interaction means		0.895	1.404	1.764	0.080	0.694	0.823	0.884	2.192	0.912	1.622	3.695

cm<sup>2</sup>. 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 cm<sup>2</sup>. The Palmetto variety had the highest leaf area at 10 t/ha and the Palmetto in control plot, 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 3. At 4 WAP, the mean dry weight of leaves ranged from 4.04 to 10.74 g. 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 to 25.18 g. 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 48.54 g 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 5 t/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 3. At 4 WAP, the mean dry weight ranged from 1.97 to 2.38 g. 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 15.13 g. 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

**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

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 3. At 6 WAP, the fruit dry weight ranged from 2.42 to 3.368 g. 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 31.09 g. The application of farmyard manure at 10 t/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 3. At 4 WAP, the mean total dry weight ranged from 6.01 to 13.12 g. The use of farmyard manure at the rate of 10 t/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 to 36.96 g. The highest total dry weight was observed in the Palmetto variety when 10 t/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 94.73 g. 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 10 t/ha of FYM application rate and the lowest number were 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 15.95 cm. 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 4.64 to 5.44 cm. The application of 5t/ha and 10t/ha farmyard manure for Palmetto variety and the 10 t/ha for the Ashley variety produced values which were significantly different ( $P<0.05$ ) from the control. 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).

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 2.24 kg. 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 39,853.18 kg/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 10 t/ha out - yielding the control by 60%, in contrast to Ashley, in which 10t/ha of FYM out - yielded the control by only 30%.

## 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 (10 t/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 utilised 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.

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