

YIELD RESPONSES OF WATERMELON (*Citrullus lunatus*) TO PIG MANURE UNDER IRRIGATED PRODUCTION SYSTEM IN OWERRI, SOUTH EAST, NIGERIA.

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Abstract

The study was conducted to examine the Responses of watermelon to pig manure rates under irrigated production system in Owerri Imo State, Nigeria. The study was carried out in a Randomized Complete Block Design (RCBD). The pig manure was applied at the rates of 0t/ha, 4t/ha, 6t/ha and 8t/ha, serves as treatments which was replicated three times. Six parameters were assessed to achieve the research objectives, leaf number, vine length, number of branches, Total Leaf number, Number of Fruits per vine and weight of fruit at harvest. Data collected were subjected to Analysis of Variance (ANOVA), while treatment means were separated from using Least Significant Difference (LSD). The Results indicated that assessed parameters increased bad manure level increased. Plants that received 8t/ha of pig manure had the highest improvement in growth parameters and yield, followed by plants that received 6t/ha and 4t/ha. The control (0t/ha) have the least improvement. It was recommended that farmers in the study area should apply pig manure at 8t/ha for increased growth and yield of watermelon.

Keywords: Irrigated production system, Pig manure, Yield, Watermelon

1. INTRODUCTION

Irrigation (also referred to as watering) is the practice of applying controlled amounts of water to land to help grow crops, landscape plants, and lawns. Irrigation has been a key aspect of agriculture for over 5,000 years and has been developed by many cultures around the world. Irrigation helps to grow crops, maintain landscapes, and revegetate disturbed soils in dry areas and during times of below-average rainfall. In addition to these uses, irrigation is also employed to protect crops from frost,^[1] suppress weed growth in grain fields, and prevent soil consolidation. It is also used to cool livestock, reduce dust, dispose of sewage, and support mining operations. Drainage, which involves the removal of surface and sub-surface water from a given location, is often studied in conjunction with irrigation.

There are several methods of irrigation that differ in how water is supplied to plants. Surface irrigation, also known as gravity irrigation, is the oldest form of irrigation and has been in use for thousands of years. In sprinkler irrigation, water is piped to one or more central locations within the field and distributed by overhead high-pressure water devices. Micro-irrigation is a system that distributes water under low pressure through a piped network and applies it as a small discharge to each plant. Micro-irrigation uses less pressure and water flow than sprinkler irrigation. Drip irrigation delivers water directly to the root zone of plants. Subirrigation has been used in field crops in areas with high water tables for many years. It involves artificially raising the water table to moisten the soil below the root zone of plants.

Watermelon (*citrullus lunatus*(thumb) is A tropical fruit that belongs to the family cucurbitaceae and consists of nearly 100 genera and over 750 species (Enujeke, 2014). The crop is believed to originate in the dese4rts of Kalahari in South Africa From where it got spread to other parts of the world including: Nigeria (Shagyfta, 2011). The rinds of watermelon are characteristically light green or pale green in colour and the fruit is relished for its delicate flavor and thirst quenching properties (Kim, 2008). Watermelon has been nutritionally and medically evaluated to be a very rich source of carotenoids which was said to have antioxidant activity due to free radical scavenging property (Arora et al, 2011, Kim, 2008). It is also

known to be very rich in lycopene, a known antioxidant that gives the crops its characteristics colour. The fruit crop is considered to be free of fat and contains about 92% water and 8% sugar (Mangila et al, 2007). The seeds have been identified to be a source of protein which is about 35% rich in protein 50% oil and 5% dietary fiber and also rich in macro and micro nutrients of magnesium, calcium, potassium, iron, phosphorus and zinc (Kim, 2008). It grows favourably in alluvial soil and does not require excessive soil moisture (Ndubizu, 2008, Alquaah, 2006). Thus, in Nigeria the largest production of the crop is in the drier northern parts of the country where it is usually cultivated at the onset of the rains and towards the end of the rains in the much humid Southern part of the country (De Lannoy, 2011, Toth et al, 2007).

In the tropics, watermelon grows and matures within 75- 80 days of planting from seed to mature fruit and the aggressive vines can attain up to 30-60cm in length in a well spaced environment. Before this time in Nigeria, watermelon was generally perceived to grow and do very well in the drier parts of the country with less moisture concentration. Recent trials by Oluloye et al (2015), Nduksa and Ike (2017), in the rainforest zone of Nigeria showed that the crop can thrive well in the environment but the production will be well timed towards the early and the end of rainy season with guided fertilizer application. It is of much importance to assess the effects of water stress on production, yield and quality of certain crops both at experimental level as well as integrate new knowledge with the traditional farmers knowledge through participating, research and extension (Kadayife, et al. 2004).

The wide diversity of climate, soils, relief, topography and anthropogenic changes cause numerous problems in rain irrigation farming. According to Rashid et al, (2004), today most areas are farmed using the old, traditional and primitive soil and crop management practices. In tropical region like Owerri, South Eastern Nigeria, which have a long raining season, too much rainfall cause soil erosion thereby leading to nutrient depletion, other major constraints include moisture stress and rain uncertainty.

Due to rain uncertainty, agriculture on the non-irrigated areas remains a high risk and low input enterprise for resource poor farmers. Low yields on the areas could be attributed to factors like poor quality seed and poor crop management. Excessive losses of water as runoff, old traditional land and water management practices and fragmented land holdings can cause low efficiency of water use (Rashid et al, 2004, Shah et al, 2011).

On the non-irrigated, soil crusting remains a deleterious phenomenon causing soil erosion and making crop husbandry and agronomic practices difficult to accomplish. Generally low organic matter and high proportion of fine silt, sand sodium in the areas result in the formation of surface soil crusts (Zia et al, 2006, Rashid et al, 2004). Excessive ploughing and high intensity rains further accentuate the problem. Soil crusting and compaction are known to reduce water infiltration and increase runoff and cause soil erosion in non-irrigated areas and at the same time could minimize gas exchange between soil and atmosphere and restrict seed germination.

Purpose of the study

The general purpose of the study is to assess the response of watermelon (*Citrullus lunatus*) to pig mature under irrigation production system in Owerri, south Eastern, Nigeria.

Specific purposes of the study were to determine

- Leaf number per plant at weekly interval
- Vine length at weekly interval
- Number of branches at weekly interval

- Total leaf Area per plant
- Number of fruits per vine at harvest

2. METHODOLOGY

Location of the experiment

The experiment was conducted at the department of Agricultural Teaching and Research Farm, School of vocational and Technical Education, Alvan Ikoku Federal College Of Education Owerri in the late cropping season of 2022, Owerri is located in the South eastern rainforest, Agro ecological zone of Nigeria latitude 4° 45'N and 7° 15'N, longitude 6° 50' E and 7° 25' E with annual rainfall in the range of 280/mm and mean annual temperature of 27°C and relative humidity of 75%.

Cropping Site History

The site had been under cultivation of various vegetable crops for considerable number of years. Some of the cultivated vegetables include; fluted pumpkin (*tefaira occidentalis*) and water leaf (*Talinum Triangulare*).

The experimental site was cleared using conventional implement, machete, hoe and shovel. The watermelon seeds were purchased from the Agricultural Developmental Programme (ADP) Office in Owerri Imo State. The pig manure used was obtained from a nearby pig farm.

Two seeds of watermelon were planted per hole at spacing of 1m x 1m and after establishment stands were thinned down to one seedling per stand. Pig manure was applied just before planting by broadcasting and incorporation. There were three (3) manure treatments and control (no manure). The pig manure was applied at the rates equivalent to 4, 6, 8, tons/ha.

Prior to the commencement of the experiment, samples were collected, using auger from the depth of 0-15cm from the study sight. This was bulked, dried, crushed and sieved to pass through a 2mm sieve mash preparatory for physiochemical properties using standard laboratory procedure outlined by Mylavapus and Kenelly (2002).

Experimental Design and Treatments

The experimental design used for this research work was a randomized complete block design (RCBD) consisting of four (4) treatments in three (3) replicates. Pig manure was applied at the rate of 4 tons, 8tons/ha respectively as the treatments.

Agronomic Measurements.

During this experiment, different parameters were considered and data was collected at different intervals on the following:

- ✓ **Leaf area (LA):** The data was collected from plants beginning at 4WAP; this parameter was achieved using a standard formula for calculating leaf area of watermelon, i.e. $L \times W \times 0.75$. The length was measured from the petiole to the apex of the leaf. All data was collected using a measuring tape.
- ✓ **Vine Length (VL):** This data on plant length was collected from 4WAP. The vine length was measured from the base of the main plant to its growing point. This was done using a measuring tape for an accurate measurement.
- ✓ **Leaf Number (LN):** Leaf number per plant at weekly intervals was collected by counting all the fully expanded leaves from the selected plants/ plot.
- ✓ **Fresh Fruits Weight at Harvest:** This data was taken from the plants after harvesting. Fresh fruit weight at harvest will be measured using a weighing balance.
- ✓ **Number of Branches at Weekly Interval:** The number of branches was counted at the end of every week.
- ✓ **Number of Fruits Per Vine at Harvest:** This data was collected at the end of the experiment during harvesting.

Data Analyses

All data collected were subjected to analysis of variance (ANOVA) test while treatment means was separated using LSD at 5% level of probability using the SPSS (Statistical Package for Social Sciences).

3. RESULTS AND DISCUSSIONS

The results of yield response of watermelon to pig manure under irrigated production system are presented in this chapter.

The parameters that were measured were as follows:

- Leaf number at weekly intervals
- Vine length at weekly intervals
- Number of branches at weekly intervals
- Total leaf Area per plant at 2, 4, 6 and 10 weeks after planting.
- Number of fruits per Vine
- Fruit weight per plants at maturity/harvest.

The parameters were measured at weekly intervals (WAP)- Weeks after planting.

Results obtained on the responses of Watermelon to pig manure at 2WAP revealed that there were no significant differences among the treatments- T1, T2, T3 and T4.

However, T1 (4tons/ha) and T3 (8tons/ha) gave the height value and T2 (6tons/ha) and T4 (0 tons/ha) gave the lowest value [Table 1].

Table 1- Response of watermelon to pig manure terms of leaf number at 2 weeks after planting (2WAP to 7WAP)

NS= no sig.

Blocks/ Treatment s	Leaf number per treatment																							
	T1(4t/ha)	T1(4t/ha)	T1(4t/ha)	T1(4t/ha)	T1(4t/ha)	T1(4t/ha)	T2(6t/ha)	T2(6t/ha)	T2(6t/ha)	T2(6t/ha)	T2(6t/ha)	T2(6t/ha)	T3(8t/ha)	T3(8t/ha)	T3(8t/ha)	T3(8t/ha)	T3(8t/ha)	T3(8t/ha)	T4(0t/ha)	T4(0t/ha)	T4(0t/ha)	T4(0t/ha)	T4(0t/ha)	T4(0t/ha)
B1	2	6	8	8	8	13	3	6	7	8	8	13	2	6	6	8	8	15	3	5	7	7	7	12
B2	3	6	7	7	7	13	3	7	8	7	7	12	3	7	7	8	8	14	3	5	7	7	7	11
B3	2	6	8	8	8	14	3	6	7	8	8	13	2	16	8	9	9	15	3	4	5	8	8	10
Total	7	18	23	23	23	40	9	19	22	23	23	38	7	19	21	28	28	44	9	14	19	22	22	33
Mean	2.3	6	7.6	7.6	7.6	13.3	3	6.3	7.3	7.6	7.6	12.6	2.3	6.3	7	8.3	8.3	14.6	3	4.6	6.3	7.3	7.3	11
LSD	NS	NS	NS	NS	NS	0.72	NS	NS	NS	NS	NS	0.3	NS	NS	NS	NS	NS	0.9	NS	NS	NS	NS	NS	0.7

Analysis of data on response of watermelon to pig manure in terms of leaf number at 3 weeks after planting (3WAP) revealed that there were no significant differences among the treatments- T1, T2, T3 and T4 gave the lowest value (Table 1).

Responses of watermelon to pig manure in terms of leaf number at 3weeks after planting (3WAP)

Responses of watermelon to pig manure in terms of leaf number at 4 weeks after planting (4WAP)

Data obtained on the responses of watermelon to pig manure in terms of leaf number revealed that were high significant differences (p=0.010) among the treatments -T1, T2, T3 AND T4 in terms of number of leaves. T2 significantly differed from T4

It was observed that in the responses of watermelon to pig manure in terms of leaf number at 5 weeks after planting (5wap) there were no significant difference among the treatments - t1, t2, t3 and t4. Such that t3 (8t/ha) gave the highest value and t4 (0t/ha) gave the lowest value.

Responses of watermelon to pig manure in terms of leaf number at 6 weeks after planting (6WAP) reveled that were very high significant difference (p=0.004) among the treatments-T1, T2, T3 AND T4 in terms of number of leaves, such that T3 and T4 significantly differed from each other while T1 and T2 are not different.

Responses of watermelon to pig manure in terms of leaf number at 7 weeks after planting (7WAP) revealed that there were significant differences (p=0.002) among the treatments – T1, T2, T3 and T4. Such that T1 (4t/ha), T2(6t/ha) andT3(8t/ha) are highly significantly different from T4(0t/ha).(Table 1)

Analysis of data on responses of watermelon to pig manure in terms of leaf number at 8 weeks after planting (8WAP) revealed that there were very high significant differences (p=0.000) among the treatments-T1, T2, T3 and T4. Treatment three T3 (8t/ha) gave the highest value and T4 (0t/ha) gave the lowest value. T1, T2, T3 significantly differed from T4 while T3 is significantly different from T1 (Table 1)

Table 2-Responses of watermelon to pig manure in terms of leaf number at 8 weeks after planting (8WAP to 11WAP)

Leaf number per treatment

Blocks/ Treatments	T1(4t/ ha)	T1(4t/ ha)	T1(4t/ ha)	T1(4t/ ha)	T2(6t/ ha)	T2(6t/ ha)	T2(6t/ ha)	T2(6t/ ha)	T3(8t/ ha)	T3(8t/ ha)	T3(8t/ ha)	T3(8t/ ha)	T4(0t/ ha)	T4(0t/ ha)	T4(0t/ ha)	T4(0t/ ha)
B1	20	26	30	36	22	26	31	38	24	29	33	39	18	22	22	25
B2	20	25	29	35	21	27	30	36	23	28	32	32	17	20	20	23
B3	21	25	30	36	23	27	31	38	24	29	33	39	16	19	20	23
Total	61	76	89	107	66	80	92	112	71	86	98	115	51	61	62	71
Mean	20.3	25.5	29.6	35.6	22	26.6	30.6	37.3	23.6	28.6	32.6	38.3	17	20.3	20.6	23.
																6
LSD				0.72				0.52				0.62				0.7
																7

Data on responses of watermelon to pig manure in terms of leaf number at 9 weeks after planting (9WAP) revealed that there were very high significant difference ($p=0.000$) among the treatments-T1, T2, T3 and T4. Such that T3 is significantly different from T1, T2, T3 and T4. They followed the trend $T2>T1$, $T3>T4$ (Table 2)

It was observed that in the responses of watermelon to pig manure in terms of leaf number at 10 weeks after planting (10WAP) there were very high significant differences ($p=0.000$) among the treatments -T1, T2 T3 and T4. However, T1, T2, T3 and T4 significantly differed from T4, were as T3 is significantly different From T1 and T2. (Table 2)

Results obtained on the responses of watermelon to pig manure in terms of leaf number at 11 weeks after planting (11WAP) revealed that there were very high significant difference ($p=0.000$) among the treatments-T1, T2, T3 and T4. Such that T3 gave the highest value while T4 gave the lowest value, T2 significantly differed from T1, while T3 significantly differed from T5 (Table 2).

Yield response of watermelon to pig manure in terms of leaf number under irrigated production system.

Higher number of leaves/plants was observed by watermelon stands that received 8t/ha of pig manure possibly because the manure established and maintained soil physical condition for plant growths. In a research carried out by Enujeke Emmanuel, Chukudinife, Egbuchua Collins on effects of pig manure on the growth and yield indices of watermelon in Asana area of Delta State, Nigeria. Plants that received highest rates of pig manure was superior, this may not be unconnected to release nitrogen contained in pig manure which enhanced vegetative growth of watermelon-an implication of effective utilization of applied manure by the crops. This is similar to the observation of Akanbi et Al (2005), Olaniyi etah (2008) and Steven et Al (2018) who reported increased vegetative growth of vegetables due to addition of nitrogen, which confirmed the role of organic fertilizers in promoting vigorous growth of fruit vegetables (Olaniyi and Ajibola, 2008, Eifediyi and Remison, 2010). Similar results were also obtained by Aduloju et al (2010), Dada and Fayinminny (2010) who reported improved supply of plant nutrients to cucumber by applied, better utilization of carbon and subsequent synthesis of assimilates.

Responses of watermelon to pig manure in terms of vine length at weekly intervals.

Analysis of data on responses of watermelon to pig manure in terms of vine length at two weeks after planting (2WAP) revealed that there were high significant difference ($p=0.000$) naming the treatments-T1, T2, T3 and T4. However, T3 (8t/ha) gave the highest value while T4 (0t/ha) gave the lowest value. T1, T2, T3 were highly significantly different From T4. (Table 3).

Table 3-Responses of watermelon to pig manure in terms of vine length per plant at 2 weeks after planting (2WAP) - 7 weeks after planting (7WAP)-

Leaf number per treatment																								
Blocks/ Treatments	T1(4t/ ha)	T1(4t/ ha)	T1(4t/ ha)	T1(4t/ ha)	T1(4t/ ha)	T1(4t/ ha)	T2(6t/ ha)	T2(6t/ ha)	T2(6t/ ha)	T2(6t/ ha)	T2(6t/ ha)	T2(6t/ ha)	T3(8t/ ha)	T3(8t/ ha)	T3(8t/ ha)	T3(8t/ ha)	T3(8t/ ha)	T3(8t/ ha)	T4(0t/ ha)	T4(0t/ ha)	T4(0t/ ha)	T4(0t/ ha)	T4(0t/ ha)	T4(0t/ ha)
B1	6	12	17	20	26	39	7	14	18	22	28	35	9	14	20	27	31	39	3	6	10	13	15	19
B2	5	10	15	20	24	29	6	12	16	22	25	30	7	14	19	25	30	37	3	6	8	13	17	23
B3	6	13	15	21	21	26	7	14	18	20	21	30	9	14	20	24	27	35	2	8	7	10	15	22
Total	17	35	47	61	71	84	25	14	52	64	74	95	25	445	39	74	88	111	8	20	25	36	47	64
Mean	5.3	11.6	15.6	20.3	23.6	28	6.6	13.3	17.3	21.3	24.6	31.6	8.3	14.6	19.6	25.3	29.3	37	2.6	6.6	8.3	12	15.6	21.3
LSD	Ns	Ns	Ns	Ns	Ns	1.20	Ns	Ns	Ns	Ns	Ns	0.92	Ns	Ns	Ns	Ns	Ns	1.01	Ns	Ns	Ns	Ns	Ns	0.75

Ns= no sig.

Data obtained on the responses of watermelon to pig manure in terms of vine length at 3 weeks after planting (3WAP) below revealed that there were high significant differences (p=0.000) among treatments-T1, T2, T3 and T4. Such that T3 significantly differed from T1 and T2 (Table 3)

It was observed that in the responses of watermelon to pig manure in terms of vine length at 4 weeks after planting (4WAP) there were no significant difference among treatments-T1, T2, T3 and T4 in terms of vine length. Such that T3 (8t/ha) gave the highest value while T4 (0t/ha) gave the lowest value.(Table 3)

Responses of watermelon to pig manure in terms of vine length at 5 weeks after planting (WAP) revealed that there were high significant difference (p=0.000) among the treatments-T1, T2, T3 and T4.However, T1, T2 and T3 significantly differed from T4 (Table 3)

Data obtained on the responses of watermelon to pig manure in terms of vine length at 6 weeks after planting (6WAP) below revealed that there were very high significant differences (p=0.000) among the treatments-T1, T2, T3 and T4. Such that T3 gave the highest value while T4 gave the lowest value. T1, T2 and T3 are statistically different From T4 (Table 3)

Analysis of data on the responses of watermelon to pig manure in terms of vine length at 7 weeks after planting (7WAP) revealed that there were no significant difference (p=0.000) among the treatments-T1, T2, T3 and T4 in terms of vine length. However, T3 is significantly different From T1.They follow the trend T2>T1, T3>T4 (Table 3)

Responses of watermelon to pig manure in terms of vine length at 8 weeks after planting (8WAP) revealed that there were high significant difference among treatments-T1, T2, T3 and T4 in terms of vine length. Such that T2 significantly differed from T1, while T3 is statistically different From T4 (Table 3)

Table 4- Responses of watermelon to pig manure in terms of vine length at 8 weeks after planting (8WAP) - 11 weeks after planting (11WAP)

Leaf number per treatment																
Blocks/ Treatments	T1(4t/ ha)	T1(4t/ ha)	T1(4t/ ha)	T1(4t/ ha)	T2(6t/ ha)	T2(6t/ ha)	T2(6t/ ha)	T2(6t/ ha)	T3(8t/ ha)	T3(8t/ ha)	T3(8t/ ha)	T3(8t/ ha)	T4(0t/ ha)	T4(0t/ ha)	T4(0t/ ha)	T4(0t/ ha)
B1	42	55	60	71	46	57	64	75	51	60	70	81	25	29	33	41
B2	37	50	58	70	45	50	60	70	50	57	68	79	22	28	30	38
B3	45	52	55	69	44	55	58	72	50	62	58	79	20	24	24	40

Total	124	157	173	210	135	162	182	217	151	179	182	239	66	81	87	119
Mean	41.3	52.3	57.6	70	45	54	60.6	72.3	50.3	59.6	60.6	79.6	22	27	29	39.6
LSD	Ns	Ns	Ns	0.65	Ns	Ns	Ns	0.72	Ns	Ns	Ns	1.20	Ns	Ns	Ns	0.92

Ns = no sig.

Results obtained on the responses of watermelon to pig manure in terms of vine length at 9 weeks after planting (9WAP) revealed that there were high significant difference (p=0.000) among treatments -T1, T2, T3 and T4 in terms of vine length. However, T3 and T2 are significantly different from each other; T2 and T1 are significantly different (Table 4)

It was observed that in responses of watermelon to pig manure in terms of vine length at 10 weeks after planting (10WAP), there were high significant difference (p=0.000) among the treatments-T1, T2, T3 and T4 in terms of vine length. However, T2 and T1 are significantly different. (Table 4)

Responses of watermelon to pig manure in terms of vine length at 11 weeks after planting (11WAP) revealed that there were very high significant differences (p=0.000) among the treatments-T1, T2, T3 and T4 in terms of vine length, such that T3 (8t/ha) gave the highest value while T4 (0t/ha) gave the lowest value. T2 and T1 are significantly different. (Table 4)

Yield response of watermelon to pig manure in terms of vine length under irrigated production system.

Plants that received that received 8tons/ha if pig manure had higher vine length than other plants possibility because higher rate of manure improved moisture availability which enhanced nutrient release to the plants for increased vine length. This is similar to the findings in the responses of watermelon to five different rates of poultry manure in Asaba Area of Delta State, Nigeria by Enujoke E.C. Plants that received the highest poultry rate was superior to other plants in terms of vine length. This is in agreement to the findings of Adekiya and Ojeniyi (2002), and Ewulo et al (2008) who reported that higher rates of poultry manure increase moisture availability which leads to release of more nutrients for increased plant growths. It is also constituent with the findings of Home et al (2004) who reported that organic manure released essential elements associated with high photosynthetic activities which promoted growth and yield of watermelon.

Responses of watermelon to pig manure in terms of number of branches at weekly intervals.

It was observed that in the responses of watermelon to pig manure in terms of number of branches at 2 weeks after planting (2WAP) there were significant difference (p=0.009) among treatments-T1, T2, T3 and T4 in terms of number of branches at such that T1,T2 and T3 have same value and T4 gave no value. T1, T2 and T3 significantly differed from T4. (Table 21)

Table 5-Responses of watermelon to pig manure in terms of number of branches at 2 weeks after planting (2WAP) - 7 weeks after planting (7WAP)

Blocks/ Treatments	Leaf number per treatment																							
	T1(4t/h a)	T1(4t/h a)	T1(4t/h a)	T1(4t/h a)	T1(4t/h a)	T1(4t/ ha)	T2(6t/ha)	T2(6t/h a)	T2(6t/h a)	T2(6t/h a)	T2(6t/h a)	T2(6t/h a)	T3(8t/h a)	T3(8t/h a)	T3(8t/h a)	T3(8t/ha)	T3(8t/h a)	T3(8t/h a)	T4(0t/h a)	T4(0t/h a)	T4(0t/h a)	T4(0t/h a)	T4(0t/h a)	T4(0t/h a)
B1	2	3	4	6	8	10	2	3	4	6	7	10	2	4	5	6	8	14	0	1	2	2	2	5
B2	2	3	4	6	8	9	2	3	4	6	8	10	2	3	4	7	9	10	0	0	2	2	3	2
B3	2	3	4	5	8	9	2	3	4	6	8	8	2	3	4	7	8	10	0	0	2	2	2	2
Total	6	9	12	17	24	28	6	9	12	18	23	28	6	10	13	18	25	34	0	1	6	6	6	9
Mean	2	3	4	5.6	8	9.3	2	3	4	6	7.6	9.3	2	3.3	4.3	6.6	8.3	11.3	0	0.3	2	2	2	3
LSD	Ns	Ns	Ns	Ns	Ns	0.83	Ns	Ns	Ns	Ns	Ns	6.95	Ns	Ns	Ns	Ns	Ns	1.01	Ns	Ns	Ns	Ns	ns	1.20

Ns = no sig.

Results obtained on the responses of watermelon to pig manure in terms of number of branches at 3 weeks after planting(3WAP) revealed that there were very high significant differences (p=0.000) among the treatments-T1, T2, T3 and T4. T3 significantly differed from T1, T2 and T3. T1 and T2 are not different while T3 and T4 are significantly different. (Table 5)

Responses of watermelon to pig manure in terms of number of branches at 4 weeks after planting (4WAP) revealed that there were very highly significant difference (p=0.000) among the treatments-T1, T2, T3, and T4. However, T3 and T4 are statistically different while there is no difference between T1 and T2. (Table 5)

Data obtained on the responses of Watermelon to pig manure in terms of number of branches at 5 weeks after planting (5WAP) below revealed that there was very highly significant difference (p=0.000) , among treatments-T1, T2, T3 and T , such that T3 (8tons/ha) gave the highest value and T4 (0tons/ha) gave the lowest value. T1 and T2 are significantly different while T3 and T4 are significantly different (Table 5)

Analysis of data on responses of Watermelon to pig manure in terms of number of branches at 6 weeks after planting (6WAP) revealed that there were very high significant difference (p=0.000) among the treatments-T1, T2, T3, and T4 in terms of number of branches. However, T1 and T2 significantly different while T3 and T4 are significantly different (Table 5)

It was observed that in the responses of Watermelon to pig manure in terms of number of branches at 7 weeks after planting (7WAP) revealed that there were very highly significant differences (p=0.001); among the treatments-T1, T2, T3 and T4 such that T3 and T4 are significantly different while T1 and T2 are not significantly different as they have some values.(Table 5)

Data obtained on the responses of Watermelon to pig manure in terms of number of branches at 8 weeks after planting (8WAP) below revealed that there were very highly significant difference (p=0.000) among the treatments-T1, T2, T3 and T4. However, T3 (8tons/ha) gave the highest value and T4 (0tons/ha) gave the lowest value. T2 and T4 are significantly different.

Table 6- Responses of watermelon to pig manure in terms of number of branches at 8 weeks after planting (8WAP) - 11 weeks after planting (11WAP)

Blocks/ Treatme nts	Leaf number per treatment															
	T1(4t/ ha)	T1(4t/ ha)	T1(4t/ ha)	T1(4t/ ha)	T2(6t/ ha)	T2(6t/ ha)	T2(6t/ ha)	T2(6t/ ha)	T3(8t/ ha)	T3(8t/ ha)	T3(8t/ ha)	T3(8t/ ha)	T4(0t/ ha)	T4(0t/ ha)	T4(0t/ ha)	T4(0t/ ha)
B1	12	14	19	21	12	16	19	20	15	17	19	23	7	10	13	17
B2	10	13	18	20	11	16	19	20	14	18	20	22	4	6	12	14
B3	10	13	18	19	12	18	20	22	14	20	20	24	4	6	12	14
Total	32	40	55	60	35	50	58	62	43	55	59	69	15	22	37	45
Mean	10.6	13.3	18.3	20	11.6	16.6	19.3	20.6	14.3	18.3	19.6	23	5	7.3	12.3	15
LSD	Ns	Ns	Ns	2.00	Ns	Ns	Ns	2.23	Ns	Ns	Ns	1.87	Ns	Ns	Ns	2.5
																4

Ns = no sig.

Responses of watermelon to pig manure in terms of number of branches at 9 weeks after planting (9WAP) revealed that there were very highly significant differences (p=0.000) among the treatments-T1, T2, T3 and T4 such that T1 and T4 are significantly different (Table 6)

Analysis of data on the responses of Watermelon to pig manure in terms of number of branches at 10 weeks after planting (10WAP) revealed that there were very highly significant difference(p=0.000) among the treatments-T1, T2, T3 and T4. However, T3 (8tons/ha) gave the highest value and T4 (0tons/ha) gave the lowest value. T1 and T4 are significantly different.(Table 6)

Responses of watermelon to pig manure in terms of number of branches at 11 weeks after planting (11WAP) revealed that there were very highly significant difference (p=0.000) among treatments-T1, T2, T3 and T4. Such that T1 and T3 are significantly different. (Table 6)

Yield response of watermelon to pig manure in terms of number branches under irrigated production system of Plants that received 8tons/ha of pig manure were superior with respect to higher number of branches over their counterparts, possibly because higher rates of manure supplied nutrient elements for vigorous growth. This finding is in conformity with results obtained by Enujoke Emmanuel who reported growth and yield indices of watermelon to pig manure. The higher the rates of pig manure, the higher the number of branches produced by the plants. This agrees to similar report of Enujoke (2013) who indicated that higher rates of poultry manure increased growth parameters of maize.

Responses of watermelon to pig manure in terms of Total Leaf Area per plant at 2, 4 6 and 10 weeks after planting.

Results obtained on the responses of Watermelon to pig manure in terms of Total Leaf Area at 2 weeks after planting (2WAP) revealed that there were very highly significant difference (p=0.000) among the treatments-T1, T2 T3 and T4. However, T1 and T4 are significantly different.(Table 31)

Table 7- Responses of watermelon to pig manure in terms of Total Leaf Area at 2 weeks after planting – 7 weeks after planting

Blocks/ Treatme nts	Leaf number per treatment															
	T1(4t/ ha)	T1(4t/ ha)	T1(4t/ ha)	T1(4t/ ha)	T2(6t/ ha)	T2(6t/ ha)	T2(6t/ ha)	T2(6t/ ha)	T3(8t/ ha)	T3(8t/ ha)	T3(8t/ ha)	T3(8t/ ha)	T4(0t/ ha)	T4(0t/ ha)	T4(0t/ ha)	T4(0t/ ha)
B1	15	40	168	244	18	44	143	260	24	50	195	284	10	28	49	90
B2	20	37	176	244	20	42	110	262	26	48	185	292	8	24	40	95
B3	24	38	168	234	18	40	234	260	20	46	255	288	12	22	40	87
Total	59	115	512	722	56	126	487	782	70	144	635	864	30	74	129	272
Mean	19.6	38.3	170.6	240.6	18.6	42	162.3	260.6	23.3	48	211.6	288	10	24.6	43	90.
LSD	Ns	Ns	Ns	1.67	Ns	Ns	Ns	3.08	Ns	Ns	Ns	1.20	Ns	Ns	Ns	3.2
																4

Ns = no sig.

Data obtained on the responses of Watermelon to pig manure in terms of Total Leaf Area per plant at 4 weeks after planting (4WAP) revealed that there were very highly significant difference ($p=0.000$) among the treatments-T1, T2, T3 and T4. Such that T3 (8tons/ha) gave the highest value and T4 (0tons/ha) gave the lowest value. (Table 7)

Analysis of data on responses of Watermelon to pig manure in terms of Total Leaf Area per plant at 6 weeks after planting (6WAP) revealed that there were very highly significant difference ($p=0.000$) among the treatments-T1, T2 T3 and T4. However, T3 (8tons/ha) gave the highest value and T4 (0tons/ha) gave the lowest value. T1 and T2 are significantly different (Table 7)

It was observed that in the responses of watermelon to pig manure in terms of Total Leaf Area per plant at 10 weeks after planting (10WAP) revealed that there were very highly significant difference ($p=0.000$) among the treatments - T1, T2, T3 and T4. Such that T1, T2, T3 and T4 are significantly different (Table 7)

Yield responses of Watermelon to pig manure in terms of Total Leaf Area under irrigated production system.

The plants that received 8tons/ha of pig manure had the highest improvement in terms of Total Leaf Area than other plants. This could be possibly because of manure improved moisture availability which enhanced nutrient release. This is in line with the work done by Ewulo et. al. (2008) who reported that higher rates of pig or other organic manures increase moisture availability for increased growth.

Responses of watermelon to pig manure in terms of number of fruit per vine.

Responses of watermelon to pig manure in terms of Fruits per vine at 9 weeks after planting (9WAP) revealed that there were very highly significant difference ($p=0.001$) among other treatments-T1, T2, T3 and T4 in terms of fruits per vine. However, T3 and T4 are significantly different while T1 and T2 are not as they gave same value (Table 35)

Table 8– Responses of watermelon to pig manure in terms of fruits per vine at 9 weeks after planting (9WAP) – 11 weeks after planting (11WAP)

Blocks/ Treatments	Leaf number per treatment															
	T1(4t/ ha)	T1(4t/ ha)	T1(4t/ ha)	T1(4t/ ha)	T2(6t/ ha)	T2(6t/ ha)	T2(6t/ ha)	T2(6t/ ha)	T3(8t/ ha)	T3(8t/ ha)	T3(8t/ ha)	T3(8t/ ha)	T4(0t/ ha)	T4(0t/ ha)	T4(0t/ ha)	T4(0t/ ha)
B1	3	4	3	800	3	3	3	800	4	4	5	1,000	1	2	2	400
B2	3	3	4	700	2	2	3	700	3	3	3	900	1	1	1	350
B3	2	2	3	700	3	2	2	800	4	3	3	1,000	0	1	1	300
Total	8	9	10	2,200	8	7	8	2,300	11	10	11	2,900	2	4	4	1,050
Mean	2.6	3	3.3	733.3	26.6	2.3	2.6	766.6	3.6	3.3	3.6	966.6	0.6	1.3	1.3	350
LSD	Ns	Ns	Ns	6.04	Ns	Ns	Ns	5.43	Ns	Ns	Ns	3.22	Ns	Ns	Ns	5.70

Ns = no sig.

Data obtained on the responses of Watermelon to pig manure in terms of fruits per vine at 10 weeks after planting (10WAP) revealed that there were very high significant difference ($p=0.036$) among the treatments-T1, T2, T3, and T4 in terms of fruits per vine such that T1, T2 and T4 are significantly different (Table 8)

Results obtained on the responses of Watermelon to pig manure in terms of fruits per vine at 11 weeks after planting (11WAP) revealed that there were very highly significant difference ($p=0.036$) among the treatments-T1, T2, T3 and T4 in terms of fruits per vine. However, T3 (8t/ha) gave the highest value and T4 (0t/ha) give the lowest value. T2 and T4 are significantly different (Table 8)

Pig manure in terms of fruits per vine under irrigated production system.

Fruits per vine increased as the level of the manure increased. Plants that received 8tons/ha of pig manure were superior with respect to higher number of fruits per vine over their counterparts, because higher rates of manure supplied more nutrient elements for vigorous growth. Organic manure has the enormous potentials of creating favourable environment for increased crop production by improving soil porosity, moisture content, bulk density, microbial activities and micrology (Stevenson et.al,2018, Ipulu et.al,2019).

Responses of watermelon to pig manure in terms of fresh fruit weight at harvest at 11 weeks after planting (11WAP)

Analysis of data on responses of Watermelon to pig manure in terms of fresh fruit weight at harvest at 11 weeks after planting (11WAP) revealed that there were very highly significant difference ($p=0.000$) among the treatments-T1, T2, T3 and T4 in terms of fresh fruit weight at harvest. However, T3 gave the highest value and T4 gave the least value. T2 and T4 are significantly different (Table 8)

Yield response of watermelon to pig manure in terms of fresh fruit weight at harvest under irrigated production system.

The highest rate of pig manure gave the highest weight of watermelon while plants that did not receive manure had the least value of the assessed parameter possibly because higher rates of manure not only improved the soil conditions for crop establishment, but also released adequate nutrient elements for yield enhancement. This is similar to observation made by Ipulu et al. (2019) who observed that the highest rate of pig manure gave a corresponding highest fruit of tomatoes. This is in harmony with reports from (Aliyu(2992),Adekiya and Ojeniyi (2002).

4. CONCLUSION AND RECOMMENDATION

This study was carried out to evaluate the responses of watermelon to pig manure under irrigated production system. Four different rates of pig manure were used. It was conducted in Randomized Complete Block Design (RCBD) to three replicates. Rates of pig manure in tons per hectare were 0,4,6,8. The parameters assessed to achieve the objective of the study were vine length, number of leaves/plants, and number of branches/plant, Leaf Area Index, Number of fruits per vine and Fruits weight of watermelon. The results of the study showed that plants that received 8tons/ha of pig manure performed better than other rate of applications. The rate of improvement increases with an increase in application.

Recommendations

Based on the study, it was recommended that farmers in the study area should apply 8tons/ha of pig manure for increased growth and yield of watermelon. It was also recommended that proper care and observation should be carried out during cultivation of watermelon in dry season to avoid pest attacks.

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