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RESPONSE OF CASSAVA PLANT TO WATER REQUIREMENTS AND THE LEVELS OF ORGANIC MANURE.

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ABSTRACT

Two field experiments were carried out during the two successive seasons of 2009 and 2010 at south El-Tahrir Research Station, (Ali Moubarak) Horticulture Research Institute to study the response of cassava plants to the combination between three rates of water requirements and compost manure at three rates of application. Obtained results were as follows:

1- The longest plants, highest leaves and largest length and diameter of branches as well as the heaviest total cassava yield and its best physical (tuber length and diameter) and chemical characters expresed as N,P and K contents of tuber tissues were recorded with cassava plants received 35 ton/fed. of compost followed in descending order by the addition of compost manure at 30 ton/fed. and the finally the application of 25 ton/fed. of compost manure.
2- The medium and high level of irrigation water (100 and 120%) encouraged the vegetative growth of cassava plants expresed as number of leaves, stem length, number of later branches and branches diameter and total tuber yield and the highest values of physical and chemical tuber quality i.e. tuber length and diameter as well as N,P and K contents of tuber tissues.
3- In spite of the non significant effect of the interaction of water requirements and the levels of compost manure application in the two seasons.

INTRODUCTION

Cassava is one of the most important staple foods in the human diet in the tropics and ranked as the sixth most important source of calories in the human diet worldwide (FAO 1996 and Alfredo *et al*., 2000). Cassava leaves and tender shoots are consumed, because the leaves contain about 7% of protein and high level of lysine Mabrouk *et al.* (1987). Cassava is a competitive crop, espicially for the production of starch, animal feed and alcohol production (Fuglie 2002 and Oguntunde 2005). Cassava is well known as a resistant crop, especially to climate and soil conditions. It cangrow in places where cereals and other crops do not grow well. It can tolerate drought and can grow in low nutrient soil.

Water is a major constituent of living plant tissues, which consists of about 90% water. Whereas, all biological processes within the living plants depend on it. Further, the optimal moisture conditions for any crop vary depending on many factors such as soil type, climate conditions, growth rate and habit …..etc. The favourable soil moisture tension should be maintained throughout the entire growth period of plants due to the relationship between evapotranspiration and biomass production Singh and Alderfer (1966). Moreover, non stable irrigation schedule widely affected vegetative growth, yield and crop quality Singh, (1989). On the other hand, Egytion water resources are limited, so it is advised to evaluate new possible approaches to minmize the plant water consumption and hence to rationalize irrigation water use. Many investigation were carried out to determine the best irrigation regime for cassava plants. Some of them reported that irrigation regimens influenced tuber yield and the highest tuber yield was registered for 30% irrigation regimen Erdem *et al* (2006). On the same respect, Hair and Lameberts (1995) and El-Khatib *et al* (2007) found that evaluate irrigation water requirements and determine an irrigation schedule for cassava crop. Two quantities of applied irrigation water (100% of the ET and 80% of the ET). The results indicated that, yield components of cassava, i.e. was increased the total number of tubers per plant, the average length and diameter of tubers and the weight of fresh tubers/ plant when used two days interval irrigation associated with 100% ET. Moreover, Ghuman (2003), Amanullah *et al* (2006), Olanrewaju *et al* (2009) and Obafemi *et al* (2011) indicated that 100% availabe water produced the higest stem diameter, average leaf number, mean tuber yield and tuber quality on cassava plants.

Soil fertility maintenance is very essential in achieving and maintaining high crop yields over a period of time. There is the need to apply fertilizers to maintain soil fertility. Nutrients contained in organic manures are released more slowly and are stored for a longer time in the soil, thereby ensuring a long residual effect Sharme and Mittra (1991). Supporting better root development, leading to higher crop yields AbouEl-Magd *et al* (2005). Improvement of environmental conditions as wellas need to reduce costs of fertilizing crops are also important reasons for advocating increased use of organic materials Bayu *et al* (2006). They improve the soil fertility status by activating the soil microbial biomass Ayuso *et al* (1996). They are required in rather large quantities to meet up with crops nutrient supply. Application of organic manures sustains cropping system through better nutrient recycling El-Shakweer *et al* (1998). They play a direct role in plant growth as a source of all necessary macro and micronutrients in available forms during mineralization, thereby improving both the physical and the biological properties of the soil AbouEl-Magd *et al* (2006). Organic manure decompose to give humus which plays an important role in the chemical behaviour of several metals in soils through the flavonic and humic acid contents, which have the ability to retain the metal in complex and chelate forms. Organic manures also improve the water holding capacity of the soil, improve the soil structure, the soil aeration and a positive influence on the growth, yield and the best results of cassava tubers (Belay *et al* 2001, Amanullah *et al* 2006 and Makinde and Ayoola 2008). However, high and sustained crop yield could be obtained with balanced NPK fertilization combined with organic matter amendments Bayu *et al* (2006). On the other hand, Ayoola and Makinde (2007) indicated that, sole organic fertilizer had a significantly lower cassava root yield in the first year of experiment bot, the second year however, yields under the various fertilizer treatments were statistically similar.

This investigation aimed to investigate the effect of varios combination of levels of compost manure (0, 25, 30 and 35 t/fed.) with water use effeciency to limited irrigation water supply (from 80%, 100% and 120% of ET) on the growth, yield and tuber quality of cassava under sandy soil conditions.

MATERIALS AND METHODS

The present study was performed under sandy soil conditions at south El-Tahrir Research Station, (Ali Moubarak) Horticulture Research Institute, during the two successive seasons, 2009 and 2010. Cassava stem cuttings of Indonesian cultivar and were planted on 24 / 3 /2009 and 10 /4 /2010 in the two seasons. A drip irrigation system was adapted for irrigation.

Soil analysis was carried out according to Wiled *et al* (1985); the obtained data are shown in Table (1 and 2). And Table (3) shows the chemical analysis of the compost manure, which used in this study.

Table (1): Physical properties of the experimental soil.

Depth (cm)	Particle size distribution %				F.C .%	W.P .%	Texture class
	sand	Fine sand	silt	clay			
0-30	52.00	40.27	4.40	3.33	9.4	4.3	sandy
30-60	48.00	42.53	4.80	4.67	8.5	4.4	sandy

Table (2): some chemical properties of the experimental soil.

Depth (cm)	pH	Ec ds/m	Soluble actions meg/ l				Soluble anions meg/ l		
			Ca^{++}	Mg^{++}	Na^{+}	K^{+}	HCO_3	So_4	Cl
0-30	7.83	1.49	5.75	4.60	3.60	0.2	4.60	2.75	6.80
30-60	7.91	1.27	5.75	4.20	3.40	0.3	4.70	2.80	6.90

Table (3): The chemical analysis of the used compost manure.

characters	Plant compost manure
Ph	8.55
Ec	6.05
Organic carbon%	30.2
Total nitrogen%	1.76
C/N ratio	17.2/1
Total phosphorus%	1.30
Total potassium%	1.28
Fe mg/ kg	7900
Mn mg / kg	190
Copper mg / kg	20
Zink mg/ kg	4.75

The experimental treatments can be illustrated as follows:

1- 80% irrigation + 0 (ton/fed.) compost.
2- 80% irrigation + 25 (ton/fed.) compost.
3- 80% irrigation + 30 (ton/fed.) compost.
4-80% irrigation + 35 (ton/fed.) compost.
5- 100% irrigation + 0 (ton/fed.) compost.
6-100% irrigation + 25 (ton/fed.) compost.
7- 100% irrigation + 30 (ton/fed.) compost.
8- 100% irrigation + 35 (ton/fed.) compost.
9- 120% irrigation + 0 (ton/fed.) compost.
10- 120% irrigation + 25 (ton/fed.) compost.
11- 120% irrigation + 30 (ton/fed.) compost.
12- 120% irrigation + 35 (ton/fed.) compost.

The experimental desion was split plot with three replicates, the irrigation levels occupied the main plots and the level of compost manure treatments were dustributed in the sub-plots. The experimental plot area was ($8.33m^2$) consisted of 1 rows, 1m width and 8.33m length for each one. All other agricultural practices for cassava plant were carried out according to the recommendation of Egytion Ministry of Agriculture. Calculation of potential evaporanspiration (ET) was made according to the original method of Penman (1948) and the amount of irrigation water was calculated according to Doormbos and Pruitt (1977).

Recorded data:

A- Vegetative growth:

Three plants of each plot were chosen randomly at 180 days after planting in order to determine the vegetative growth parameters, i.e., number of leaves, number of main branches, main branches diameter, height of branches, branches diameter, number of later branches as well as the laterel branches diameter.

B- Total yield of tubers:

At harvestting time at 180 days after planting the yield traits, i.e., yield of tuber/ plant and per fed., average weight of tuber kg and number of tubers per plant were measured.

C- Tuber quality:

Six plants within each treatment at 180 days after planting as samples for determining the tuber length and diameter and nitrogen, phosphorus and potassium concentrations of tubers according to the methods of **Black (1965)** for N%, Trough and Meyer (1939) for P%, Brown and Lilleland (1958) for K% and Dubais *et al* (1951) for Carbohydrate.

D- Statistical analysis:

Obtained data were subjected to statistical analysis of variances of the split plot design according to the procedure outlined by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Growth characters:

a) Effect of irrigation water requirements:

The effect of irrigation water requirements on growth characters of cassava plant is presented in Table (4). It is clear that irrigation with water requirements at 100% and 120% increased number of leaves, stem length, number of later branches and branches diameter compared with those received 80% of the water requirements. These findings were true in both experimental seasons. On the other hand, number of branches in the second season and stem diameter in the first season it was not significant. The improvement of cassava plants vegetative growth with increasing irrigation water requirements may be due to the proper balance of moisture in plant, which creates favorable conditions for nutrients uptake, photosynthesis and metabolites translocation, which ultimately accelerated the rate of vegetative growth Ghuman (2003), Amanullah *et al* (2006), El-Khatib *et al* (2007), Olanrewaju *et al* (2009) and Obafemi *et al* (2011) came to similar results.

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Effect of compos levels:

The compost treatments significantly increased all the previous mentioned growth parameters compared to that without compost. Results demonstrated clearly that using compost had a positive effect on the aforementioned growth characters of cassava plants which were significantly increased by the different levels of compost fertilization (Table 4). Composting application at a level of 35 ton/ fed. gave the highest values of number of leaves, stem length, number of later branches and branches diameter followed by 0 and 25 ton compost / fed. In the two studied seasons, except those of stem diameter in the first season it was not significant. However, the differences between 30 and 35 ton compost / fed. were not significant in both seasons. Obtained results suggest that the best vegetative cassava plant growth could be gained under this investigation within 30 to 35 ton compost/ fed. it might be concluded that addition of compos manure to the cassava plant caused an increase of the nutritional elements in rooting zone, consequently the more nutrients were absorbed so more and enhancement of growth plant. and also due to increased availability of nutrients especially N, P, K, Zn, Fe and Mn even from the early stage of crop growth. Many investigations studied the behavior of many vegetable crops to the addition of organic compost manure fertilization and obtained a data supported that mentioned here (Belay *et al* 2001, Amanullah *et al* 2006 and Makinde and Ayoola 2008).

Effect of the interaction:

The interaction effect of irrigation water quantity with compost levels. On the cassava plant growth characters Table (4) recorded a significant value in both seasons except number of branches, branches diameter and number of later branches in both season and stem length and stem diameter in second season. Generally, in spite of the non-significant response of the above characters the best plant growth, i.e., the longest plants, highest leaves and largest length and diameter of branches were recorded with that cassava plants which received 35 ton/fed. of compost with 100% irrigation water quantity. On the contrary, the poorest cassava plant growth was associated with that plants received the lowest rate of compost manure 0 ton/fed. of compost with 80% irrigation water quantity. These results were consequently similar in both experimental seasons.

Total tuber yield:

Effect of irrigation water quantity:

Data in Tables (5) showed that the lowest values of total yield of tuber per plant and per ton/fed. as well as, average weight of tuber were recorded with the plants which received low water requirements (80 % of the calculated water requirements). On the other hand, the highest total tuber yield per plant, total tuber yields per fed. and average tuber weight were achieved when cassava plants were irrigated by 120 % of the calculated water requirements. Obtained results showed the same trend in both growing seasons. The high level of irrigation water requirements (120 %) encouraged the vegetative growth of cassava plants as shown in Table (3) this in turn reflected its effect on total yield of tuber and tuber quality (average tuber weight). These results are in agreement with those found by Hair and

Lameberts (1995) and El-Khatib *et al* (2007) they found that, yield was more negatively affected by high water supply and the tuber quality was the best with continuous water supply. Also, our results are in agreement with Olanrewaju *et al* (2009) and Obafemi *et al* (2011). Data also cleared that there were insignificant between the two levels 100% and 120 % of water requirements.

Table (5): Effect of water requirements and compost manure application on total yield of cassava plants during two experimental seasons.

Irrigation	Compost (ton/fed.)	Yield of tuber /plant kg	Yield (ton/fed.)	Average wt. of tuber (kg)	No. of tuber /plant	Yield of tuber /plant kg	Yield (ton/fed.)	Average wt. of tuber (kg)	No. of tuber /plant
		2009/2010				2010/2011			
80 %	0	1.986	7.94	0.633	3.16	1.992	7.97	0.617	2.94
	25	1.952	7.81	0.671	3.31	1.904	7.62	0.671	2.84
	30	2.390	9.56	0.673	3.31	2.313	9.25	0.686	3.16
	35	2.540	10.16	0.702	3.27	2.621	10.49	0.699	3.42
Mean		**2.217**	**8.87**	**0.670**	**3.26**	**2.208**	**8.83**	**0.668**	**3.09**
100%	0	2.143	8.57	0.735	3.15	2.195	8.78	0.738	3.25
	25	2.505	10.02	0.770	3.25	2.398	9.59	0.760	3.32
	30	2.611	10.11	0.743	3.55	2.573	10.29	0.740	3.47
	35	2.605	10.42	0.770	3.38	2.466	9.87	0.761	3.24
Mean		**2.466**	**9.78**	**0.755**	**3.33**	**2.408**	**9.63**	**0.750**	**3.32**
120%	0	2.550	10.20	0.754	3.40	2.541	10.17	0.792	3.25
	25	2.577	10.31	0.789	3.26	2.610	10.44	0.731	3.40
	30	2.624	10.50	0.813	3.22	2.621	10.48	0.793	3.30
	35	2.741	10.97	0.786	3.49	2.733	10.93	0.778	3.52
Mean		**2.623**	**10.49**	**0.785**	**3.34**	**2.626**	**10.51**	**0.774**	**3.37**
Averages	0	2.226	8.91	0.707	3.23	2.243	8.97	0.716	3.15
	25	2.345	9.38	0.743	3.27	2.304	9.22	0.720	3.19
	30	2.541	10.06	0.743	3.36	2.502	10.01	0.740	3.31
	35	2.629	10.52	0.752	3.38	2.607	10.43	0.746	3.40
L.S.D. at 5%	Irrigation	**0.202**	**0.54**	**0.046**	**N.S.**	**0.064**	**0.26**	**0.038**	**0.28**
	Compost	**0.157**	**0.56**	**N.S.**	**N.S.**	**0.129**	**0.52**	**0.033**	**0.28**
	Interaction	**0.210**	**0.74**	**N.S.**	**N.S.**	**0.173**	**0.69**	**0.044**	**N.S.**

Effect of compos levels:

Data in Table (5) showed clearly that the addition of organic fertilizer which produced from recycling the agricultural residues (compost) caused an increase in total yield of fresh tubers of cassava and its some yield properties (average weight of tubers). Moreover, obtained data revealed that increasing the rate of organic compost up to 35 ton /fed. resulted in the highest total yield of tuber weights per plant (2.623 kg/plant in the first season and 2.626 kg/plant in the second season respectively). Also total yield of tuber per fed. recorded its highest weight (10.49 ton/fed. in the first season and 10.51 ton/fed. in the second season respectively). In other words, addition of 35 ton of organic compost fertilizer for each feddan had superiority in total tuber yield which amounted to 18.26% and 19.02% over control treatment (without compost addition) in the first and second seasons respectively. Regarding the average weight of tuber, the presented data Table (4) showed that their response to different rate of organic compost fertilizer was completely similar to the response of total tuber yield as previously mentioned. It might be concluded that addition of organic compost manure fertilizer to the cassava plants caused an increase of the nutritional elements in rooting zone consequently the more nutrients were absorbed, so more and enhancement of growth plant which caused an increase the tuber yield. Many investigators studied the behavior of many vegetable crops to the addition of organic fertilizer and obtained a data supported that mentioned here (Belay *et al* 2001, Amanullah *et al* 2006 and Makinde and Ayoola 2008).

Effect of the interaction:

Table (5) presented the effect of the interaction between water requirements with compost manure at three rates of the application in the two seasons. Whereas the highest yield of tubers of cassava which had the biggest average weight of tuber were associated with using 120% of water requirements with compost fertilizer at 35 ton/ fed. On the contrary, the lowest values of the previous criteria obtained when cassava plant were resaved 80% of water requirements and without compost fertilizer. These findings are in good accordance in both seasons.

Physical and chemial tuber quality:

Effect of irrigation water quantity:

Data in Table (6) showed that the lowest values of physical and chemical tuber quality were recorded with the plants which received low water level (80% of the calculated water requirements). The highest values of physical and chemical tuber quality i. e. tuber length and diameter as well as N, Pand K were achieved when cassava plants were irrigated by 120% of the calculated water requirements. These results showed the same trend in both growing seasons. The high level of irrigation water (120%) encouraged the vegetative growth of cassava plants as shown in Table (4) this in turn reflected its effect on tuber quality. These results are in agreement with those found by Olanrewaju *et al* (2009) and Obafemi *et al* (2011) they added that tuber quality of cassava was the best with continuos water supply. Data also cleared that there were significant differences between the tow levels 100% and 120% of water requirements.

Effect of compos levels:

The tabulated data Table (6) show that the cassava plants treated with defferent levels of compost manure indicated that, increasing the addition rate of compost manure up to 35 ton/ fed. caused an increment in physical tuber quality i. e. tuber lemgth and diameter and the all elemental nutrition values i.e. N, P, and K compared to the low rate addition. These results are completely similar in both two experimental seasons. Generally, it could abstracted that, the adding of highest rate of compost manure (35 ton/ fed.) gained the highest nutritional values, followed in descending order by the addition of compost manure at 30 ton/ fed., and finally, the application of 25 ton/fed. of compost manure. The highest rate of compost manure (35 ton/fed) caused more vigour plant growth, i.e., a strong rooting system consquently the uptakes of these elements were increased. Concerning to the superiority in the elemental values in tissues of cassava by increasing the compost manure rate, may be attributed to rich of this kind of fertilizer and when added at higher rate, the macro and micro elements are found in an enough quantity which required for a good plant growth, consequantly higher yield and more better tuber quality. The obtained results are in good agreement with that obtained by Belay *et al* 2001, Amanullah *et al* 2006 and Makinde and Ayoola 2008).

Table (6): Effect of water requirements and compost manure application on tuber quality of cassava plants average of two seasons.

Irrigation	Compost	Tuber length cm	Tuber diameter cm	%			
				N	P	K	Carbohydrate
80 %	0	34.00	4.50	0.33	0.02	0.47	46.77
	25	24.00	3.25	0.45	0.04	0.50	90.00
	30	35.67	3.87	0.46	0.05	0.57	89.50
	35	38.00	4.50	0.50	0.09	0.60	87.10
Mean		**29.25**	**4.03**	**0.44**	**0.05**	**0.54**	**78.34**
100 %	0	41.50	4.50	0.42	0.04	0.47	69.40
	25	28.50	4.25	0.44	0.07	0.50	31.90
	30	36.00	3.95	0.47	0.08	0.57	90.30
	35	27.00	3.97	0.48	0.08	0.81	90.30
Mean		**33.25**	**4.17**	**0.45**	**0.07**	**0.59**	**70.48**
120 %	0	31.50	4.25	0.44	0.05	0.51	47.70
	25	31.50	4.75	0.47	0.06	0.55	94.10
	30	28.00	4.00	0.48	0.07	0.70	91.10
	35	26.00	4.67	0.51	0.11	0.72	90.00
Mean		**29.25**	**4.42**	**0.48**	**0.07**	**0.62**	**80.73**
Averages	0	35.67	4.42	0.42	0.05	0.54	54.62
	25	28.00	4.08	0.44	0.05	0.55	72.00
	30	33.22	4.94	0.47	0.07	0.59	90.30
	35	30.33	4.38	0.49	0.08	0.64	89.13
L.S.D. at 5%	Irrigation	NS	NS	NS	NS	NS	NS
	Compost	6.00	NS	NS	NS	NS	NS
	Interaction	8.01	NS	NS	NS	NS	NS

Effect of the interaction:

In spite of the non-significant effect of the interaction of water requirements and compost manure at three rates of the application in the two seasonsTable (6), it could be concluded that, the highest values of bulb lemgth , diameter as well as N, P and K in cassava bulb tissues were associated with that plants received higher water requirement (120% of water requirement) and higher level of compost manure (35 ton/fed.). On the contrary, the lowest values from the above mentioned elements were obtained with adding cassava plant were resaved 80% of water requirements and without compost fertilizer. These findings are in good accordance in both seasons.

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استجابة نمو ومحصول الكسافا لمعدلات الرى والتسميد العضوى بالكومبوست فى الاراضى الرملية.

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اجريت تجربتان حقليتان بمحطة بحوث جنوب التحرير(على مبارك) خلال موسمى 2009/2010 و 2010/2011 وذلك لدراسة استجابة نمو ومحصول الكسافا لمعاملات الرى المختلفة مع المعدلات المختلفة للتسميد بسماد الكومبوست وتأثير ذلك على نمو وانتاجية نبات الكسافا فى الاراضى الرملية ، وتتلخص اهم النتائج المتحصل عليها فى الآتى:

1- كان اطول النباتات واكثرها اوراقا وسيقانا واعلاها محصولا وجودة طبيعية للدرنات (طول وقطر الدرنة) واكثرها احتواء على النتروجين والفوسفور والبوتاسيوم ناتج عن تسميد نباتات الكسافا بمعدل 35 طن للفدان من سماد الكومبوست.
2- رى نباتات الكسافا بالمعدل المتوسط والعالى من المياة (100 و 120%) قد شجع من نمو نباتات الكسافا معبرا عنة بعدد الاوراق وطول النباتات وعدد الافرع الرئسية والثانوية وقطر الافرع الثانوية وكذلك المحصول الكلى للدرنات وصفاتها الطبيعبة والكيماوية ممثلا فى طول وقطر الدرنة ومحتواها من النتروجين والفوسفور والبوتاسيوم.
3- لم يكن للتفاعل بين مستويات الرى ومعدلات الاضافة لسماد الكومبوست اى تأثير معنوى على نمو ومحصول وجودة الدرنات.

قام بتحكيم البحث

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Table (4): Effect of water requirements and compost manure application on growth characters of cassava plants during two experimental seasons.

Irrigation	Compost	No. of leaves	No. of stems	Stem diameter	Plant length	Stem later diameter	No. of later stem	Diameter of later stem	No. of leaves	No. of stems	Stem diameter	Plant length	Stem later diameter	No. of later stem	Diameter of later stem
		2009/2010							**2010/2011**						
80 %	**0**	39.35	1.21	25.22	85.93	18.25	2.40	9.67	40.22	2.21	24.36	84.91	17.39	2.25	10.12
	25	44.83	1.58	24.89	85.82	18.26	2.40	9.30	43.89	2.14	25.00	87.23	18.53	2.57	9.87
	30	44.42	1.88	26.00	88.60	19.56	3.06	10.33	43.49	1.96	24.02	89.96	19.33	2.95	10.77
	35	46.03	2.02	25.43	91.44	20.47	3.03	11.88	46.24	2.38	25.55	93.58	20.19	3.21	11.57
Mean		**43.66**	**1.68**	**25.38**	**87.95**	**19.14**	**2.72**	**10.29**	**43.46**	**2.17**	**24.73**	**88.92**	**18.86**	**2.74**	**10.58**
100 %	**0**	45.77	1.33	24.99	87.26	18.39	2.83	9.53	45.23	1.51	23.22	86.26	18.63	2.73	9.16
	25	47.76	2.15	24.25	87.60	19.31	2.69	10.18	48.09	2.09	26.15	87.56	19.30	2.88	10.19
	30	48.85	2.35	26.07	90.29	20.10	3.09	10.26	48.92	2.20	26.14	90.40	20.19	2.96	10.29
	35	49.75	2.43	26.56	94.09	20.87	3.28	11.20	49.95	2.34	26.44	94.25	20.90	3.15	11.02
Mean		**48.03**	**2.07**	**25.47**	**89.81**	**19.67**	**2.97**	**10.29**	**48.05**	**2.03**	**25.49**	**89.62**	**19.75**	**2.93**	**10.17**
120 %	**0**	48.49	1.31	25.00	86.74	19.35	3.21	11.15	49.12	1.46	25.85	85.96	19.24	2.55	11.08
	25	49.53	1.93	25.85	87.06	20.20	3.44	11.36	49.13	1.83	25.81	86.24	20.24	3.47	11.17
	30	51.75	2.15	26.30	89.25	20.44	3.53	12.26	51.60	2.08	26.56	89.19	21.22	3.66	12.04
	35	51.63	2.11	26.07	91.00	686.46	3.30	12.19	51.08	2.12	26.07	91.11	21.16	3.46	12.32
Mean		**50.35**	**1.88**	**25.81**	**88.51**	**186.61**	**3.37**	**11.74**	**50.23**	**1.87**	**26.07**	**88.12**	**20.47**	**3.29**	**11.65**
Averages	**0**	44.54	1.29	25.07	86.64	18.66	2.81	10.12	44.85	1.73	24.48	85.71	18.42	2.51	10.12
	25	47.37	1.89	25.00	86.83	19.26	2.84	10.28	47.04	2.02	25.65	87.01	19.36	2.97	10.41
	30	48.34	2.13	26.12	89.38	20.03	3.23	10.95	48.00	2.08	25.58	89.85	20.25	3.19	11.03
	35	49.14	2.19	26.02	92.18	242.60	3.20	11.76	49.09	2.28	26.02	92.98	20.75	3.27	11.63
L.S.D. at 5%	**Irrigation**	**1.523**	**0.32**	**N.S.**	**1.32**	**N.S.**	**0.42**	**0.39**	**1.58**	**N.S.**	**1.40**	**0.16**	**0.28**	**0.54**	**0.45**
	Compost	**1.594**	**0.41**	**N.S.**	**1.51**	**N.S.**	**0.37**	**0.37**	**0.94**	**0.43**	**N.S.**	**0.62**	**0.37**	**0.47**	**0.46**
	Interaction	**2.127**	**N.S.**	**N.S.**	**N.S.**	**N.S.**	**N.S.**	**0.49**	**1.25**	**N.S.**	**N.S.**	**0.83**	**0.49**	**N.S.**	**0.62**