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EFFECT OF ORGANIC FERTILIZATION ON GROWTH, YIELD AND QUALITY Of *Momordica charantia* UNDER DAMIETTA CONDITIONS.

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ABSTRACT

Two field experiments were carried out at a Private Farm near Elzarka city, Damietta Governorate, during the two successive summer growing seasons from march to November 2013 and 2014 to study the effect of organic manure treatments (control, 25 m^3/fed, 50 m^3/fed) on growth, yield and quality of bitter gourd (*Momordica charantia* L.). The field experiment was laid out in a Randomized Complete Block Design with three replicates. The most important resulted obtained from this investigation can be summarized as follows :

Organic fertilization of bitter melon plants with cattle manure at the rate of 50 m^3/fed significantly increased growth, yield, and its components, thus the highest values of these characters were resulted from adding the highest rate of cattle manure (50 m^3/fed) in both seasons.

It can be recommended that organic fertilizing bitter gourd with 25 m^3/fed in order to increase bitter melon yield over the control treatment and reduce the environment pollution and production costs under the environmental conditions of Damietta Governorate, Egypt .

Keywords: Bitter melon (*Momordica charantia*), organic fertilization, growth, quality, yield.

INTRODUCTION

Cucurbits are the popular name of the family Cucurbitaceae , commonly known as gourd family. A family of about 117 genera and 825 species Jeffery (1967).

Bitter gourd (*Momordica Charantia* L.) is one of the most important and round the year cultivated popular vegetable crops. Some common names of *M.charantia* include bitter melon, papilla, bitter gourd, salsamino, corrila or karela, hanzal, assorossie, ampalaya, nigauri or goya, pare, khogua, sora, balsam apple, pear or balsamina, and several other common names see Taylor (2002) for extensive review and technical data.

The east Asian bitter gourd plant is one of the newly introduced vegetables crops in Egypt. It has been successfully grown in Mansoura area Hamaiel (2004).The plant is adapted to wide variation of climates although production is best in hot areas Binder *et al*. (1989), So it has been successfully grown in Damietta area.

For a very long time ago, bitter melon has been widely utilized in traditional medicine for many treatments. Recently, many phytochemicals in the herb have been identified and clinically demonstrated, which exhibit many medicinal activities such as antibiotic, antimutagenic, antioxidant, antileukemic, antiviral, antidiabetic, antitumor, aperitive, aphrodisiac,

astringent, carminative, cytotoxic, depurative, hypotensive, hypoglycemic, immunomodulatory, insecticidal, lactagogue, laxative, purgative, refrigerant, stomachic, styptic, tonic and vermifuge (http://www.ran.tree.com).

It is one of the most nutritious gourds and many medicinal properties. A compound known as "Charantin" present in the bitter gourd is has a rich amount of vitamin A, vitamin C, iron, phosphorus and carbohydrates, especially that of high carotenoid pigments and minerals Bose and Som (1986). The plant also used in the treatment of diabetes to lower blood sugar levels.

Plant nutrition is one of the most important factors that increase plant production. Nitrogen (N) is one of the most important nutrients affecting the growth, development, yield and fruit quality of plants Gerendas *et al*. (1997). Bitter gourd has a high nutrient requirement particularly macro and micronutrient such as nitrogen, phosphorus, zinc, ,potassium and iron.

But intensive use of only chemical fertilizers to achieve high production has created a various problems. Continuous application of heavy doses of chemical fertilizers without organic manures or bio-fertilizers has lead to a deterioration of soil health in terms of chemical and physical, properties of soil, reduction in soil humus, declining of soil microbial activities, increased pollution of soil, air and water. Hence, integrated supply of nutrients through organic, inorganic and bio-fertilizers is the need of the hour forsustainable productivity and to maintain better soil health. Hence, there is a need to standardize the integrated nutrient management practices for growing under open condition to get early yield and quality of produce and higher productivity under Egyptian conditions.

Benitez *et al.* (2013) noticed that vegetative growth and herbage yield of bitter gourd were significantly enhanced by the application of different organic fertilizersinterval. Rekha and Gopalarishnan (2001) reported that it was clearly revealed the possibility of achieving a reasonably good yield of bitter gourd by basal application of dry cattle manure.

Zhu *et al.* (2005) reported that because of higher yields and income, use of organic fertilizer and irrigation are increasing, the highest fertilizer inputs can lead to marked deterioration in soil and groundwater quality and the systems are clearly unsustainable. Esawy *et al.* (2009) confirmed that the combination of organic and inorganic fertilizers could increase plant growth, yield, quality and soil fertility. It also confirmed that composted organic wastes can be used to substitute for around 25% of chemical nitrogen fertilizers.

MATERIALS AND METHODS

Field Study Experimental Condition

Two field experiments were carried out at a Private Farm near Elzarka city, Damietta Governorate, during the two successive summer growing seasons from march to November 2013 and 2014 to study the effect of organic manure treatments on the chemical content of *Momordica charantia*. The field which located at 31°13'52.0"N latitude and 31°37'07.9"E longitude with an elevatiation of 1.57 m above the sea level.

The Experimental Design

The field experiment were carried out in a Randomized Complete Block Design with three replicates . In this study the organic manure were applied before sowing. Seeds of bitter gourd obtained from Saudi Arabia kingdom. Seedlings were transplanted in March 31th and April 2nd in first and second season respectively and harvested at mid-November in both seasons, respectively . There were 18 experiment units. every plot unit was (5x 3.5 m). Each experimental unit containing 9 plants in three terracing. Plant area were 1.5X1 m. Some chemical and physical properties of soil are show in table (1 and 2).

Table 1: Physical characteristics of experimental soil in the two season:

Physical characteristics	Coarse sand%	Fine sand%	Silt %	Clay %	Texture class
1st season	٣.٧٥	٢٦.٧٠	٣٧.٠٢	٣٢.٥٣	Sandy clay loamy
2nd season	٣.٨٧	٢٧.٩٩	٣٨.٧٢	٣٤.٢	

Table 2: chemical characteristics of experimental soil in the two seasons.

Chemical properties	Electrical conductivity (1:5)ds.m^{-1}	PH	$CaCO_3$ %	Organic matter %	Sp %	Available N (mg/kg)	Available P (mg/kg)	Available K (mg/kg)
1st season	١.١٣	٧.٨٦	٢.٩٨	١.١٤	٥٦.٥	٤٨.٩	٤.٧٥	١٩٥
2nd season	١.١٥	٧.٩٥	٣.٥٣	١.٩٥	٥٧.٢	٥٠.٧	٥.١٢	٢٣١

Organic manure

Organic manure (cattle manure) was added at three levels of zero, 25 m^3/fed and 50 m^3/fed. Experimental soil was mixed with cattle manure at previously mentioned level 15 days before transplanting bitter gourd seedlings to elucidate the damage of seedlings and their roots from the heat of decomposition. Chemical analysis of cattle manure used in the experiment during the two seasons is presented in (Table3)

During the growing seasons, all agriculture practices were performed . The experimental field was well prepared, through two perpendicular ploughs. After plough and good leveling, the field area was divided into experimental units (Randomized Complete Block Design) during experimental field preparation. Plants were fertilized with Calcium-super phosphate at the rate of 30kg and 7.5 kg potassium sulphate during during experimental field preparation.Other cultural practices for commercial production were done as the recommendation of the ministry of agriculture.

Table 3: Chemical analysis of cattle manure used in the experiment during the two seasons.

Organic manure											
E.C 1:10	pH 1: 5	OM %	O.C %	T.N %	C/N ratio	Total P %	Total K %	Fe ppm	Mn ppm	Zn ppm	Cu ppm
4.03	6.64	42.97	24.98	1.21	1:20.6	0.45	0.67	61.27	26.19	18.03	5.72

Data recorded:

1. Vegetative growth :

At 60 days after transplanting 3 plants were randomly chosen from every plot to determine the following characters:

1- Plant height (cm).
2- Number of branches/plant.
3- Number of leaves/plant.
4- Fresh weight of leaves plant (g).
5- Dry weight of leaves plant (g).

2. Yield and its components:

Fruits harvesting was done according to the standard characteristics for marketing.

All harvested fruits from each unit were used to calculate the following characters:

1- Fresh weight of fruits (g)
2- Number of fruits/plant.
3- Diameter of fruits (cm)
4- Fresh weight of fruits/plant (g)
5- Fruits yield /unit (kg)
6- Total fruit yield/fed (ton).

3. Chemical analysis:

During the growing period and after harvesting some measurements of the plant were done to determine the fruit and leaves mineral content, trace element, acidity, vitamin C, carotenoids and total soluble solids (TSS%).

Randomly 3 plants were selected for each plot pre harvesting to evaluate the chemical composition of plant leaves. Content of total chlorophyll a and b were determined in the upper leaves by extraction in 80% acetone and measured calorimetrically according to method of Kirk and Allen (1965).

Nitrogen analysis: samples were digested and total nitrogen content was determined using Kjeldhal method according to the method of page *et al*. (1982)

Phosphorus content: was determined using the method of Jackson (1967), which is calorimetrically determined using 350 Corning colorimeter.

Potassium content : was determined according to the method of Knudsen and Pratt (1982) by PFP Jenway flame photometer. For trace elements analysis, the method described by Edward (1999) was applied using 2380 Perkin-Elmer atomic absorption spectrophotometer.

The content of nitrogen, phosphorus and potassium were also determined in the soil Page *et al*. (1982).

Determination of vitamin C: was performed applying the A.O.A.C (1990) method using 350 Coming colorimeter. By the end of the season, fruits and leaves were sampled, oven dried at 70°C and crushed into powder form. Protein content was determined according to the improved method of Kjeldahl .

Total soluble solids (TSS%): was measured in the juice of bitter melon fruits by using a hand refract meter.

Total acidity percentage: was determined in fruit juice as percentage of citric acid by titration with standard 0.01 N sodium hydroxyl solutions and phenolphthalein 1% as indicator according to A.O.A.C (1990)

Total carotenoids (mg /100g FW): were determined according to the procedure described by Mazumadar and Majumdr (2003).

Statistical analysis

The recorded data on different parameters were statistically analyzed using statistical analysis Gomez and Gomez (1984) to find out the significance of variation resulting from the experimental treatments. The mean for the treatments was calculated and analysis of variance for each of the characters was performed by F (variance ratio) test. The differences between the treatment means were evaluated by LSD test at 5% probability.

RESULTS AND DISCUSSION

1. Effect of organic manure on vegetative growth characters:

The effect of organic fertilization treatment on vegetative growth characters (plant height, number of branches/ plant, both fresh and dry weights) of bitter melon plant in both seasons are shown in (Table 4). It can be noticed that plant height, number of branches/ plants, both fresh and dry weight of bitter gourd plant in both season were increased significantly with fertilization with cattle manure at 50 and 25 m^3/fed. comparing with control.

It is also show that 50 m^3/fed. gave better values of plant height, number of branches/ plants, both fresh and dry weight of bitter gourd plant than 25 m^3/fed.

The favorable effect of treatments on plant height, number of branches and leaves/plant and plant fresh/dry weights may be due to that the high concentration of nitrogen fertilization and the cattle manure improved physical conditions of soil, providing energy necessary for microorganisms activity and increasing the availability and uptake of nutrients control.

The positive impact of organic manure on physical and chemical properties of soil such as the other organic fertilizer, where it improves soil drainage, ventilation and increases the soil ability to water retain and it improves holding capacity of soil and increases availability of elements, for these reasons the experimental units received cattle manure gave an incurement in vegetative growth parameters which reflected positively on bitter melon fruits yield and its components.

These results are in harmony with those obtained by Orowski and kawasniewska (1991), El- Nagar (1996), Patil *et al.* (1998), Upadhyaya and Sharma (2002), Umamaheshwarappa *et al.* (2005), Esawy *et al.* (2009), Kandil and Gad (2010), Shahata *et al.* (2011), Lindani and Brutsch (2012) and Abdel Nabi *et al.* (2014) in cucumber, Yadav and Luthra (2004) in water melon, , Naidu *et al.* (1999) in okra and Benitez *et al*. (2013) in bitter gourd.

Table 4:Effect of organic manure rates on plant height, number of branches and leaves/ plants, both fresh and dry weight of bitter melon plant during 2013 and 2014 seasons.

Char.	Plant height (m)		Number of leaves/plant		Number of branches/plant		Fresh weight of plant (kg)		Dry weight of plant (g)	
Treat.	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Control	3.17	3.43	381.96	368.58	21.27	20.31	1.39	1.36	218.10	214.06
25 m^3/fed	3.48	3.81	419.43	409.82	23.36	22.58	1.53	1.51	239.49	237.34
50 m^3/fed	3.59	3.94	433.18	422.93	24.13	23.30	1.58	1.56	247.35	243.82
LSD at 5%	0.01	0.01	2.03	0.97	0.11	0.05	0.01	0.01	1.16	0.61

2. Effect of organic manure on chemical constituents of leaves

Chlorophyll a, b and total in leaves and fruits

Data in Table (5) show that using organic manure caused a significantly increase in the chlorophyll a, b and total in leaves and fruits comparing to control. The heightest value of chlorophyll a was obtained by 50 m^3/fed (0.590 and 0.605 $mg.g^{-1}$) while Chlorophyll b (0.406 and 0.400 $mg.g^{-1}$) and total Chlorophyll (0.995 and 1.005 $mg.g^{-1}$) in leaves, while in fruits chlorophyll a was (0.654 and 0.672 $mg.g^{-1}$) while Chlorophyll b (0.477 and 0.485 $mg.g^{-1}$) and total chlorophyll (1.131 and 1.158 $mg.g^{-1}$) in the first and second seasons, respectively. It is observed that using of both cattle manure fertilizer caused a significantly increase in the chlorophyll and the 50 m^3/fed gave the first rank compared with other treatments.

The higher yield were probably responsible for better development of fruit, increased uptake of nutrients in the plants leading to enhanced chlorophyll content and carbohydrate synthesis, higher accumulation of photosynthesis and their distribution to the developing ovules. These results are in conformity with findings of Lal (1992).

Table 5: Effect of organic manure rates on chlorophyll a, b and total in leaves and fruits of bitter gourd plants during 2013 and 2014 seasons.

	Leaves						Fruits					
Char. Treat.	Chlorophyll a ($mg.g^{-1}$)		Chlorophyll b ($mg.g^{-1}$)		Total chlorophyll ($mg.g^{-1}$)		Chlorophyll a ($mg.g^{-1}$)		Chlorophyll b ($mg.g^{-1}$)		Total chlorophyll ($mg.g^{-1}$)	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Control	0.521	0.535	0.366	0.349	0.887	0.884	0.607	0.624	0.427	0.439	1.034	1.063
25 m^3/fed	0.574	0.589	0.399	0.388	0.973	0.977	0.641	0.657	0.461	0.470	1.102	1.128
50 m^3/fed	0.590	0.605	0.406	0.400	0.995	1.005	0.654	0.672	0.477	0.485	1.131	1.158
LSD at 5%	0.003	0.004	0.004	0.005	0.006	0.006	0.005	0.004	0.006	0.006	0.002	0.004

N, P and K percentage in dry matter of leaves and fruits

Concerning the effect of organic manure on nitrogen, phosphorus and potassium percentage in leaves and fruits, data presented in Table (6) show that N,P and K percentages in leaves and fruits were significantly increased after the application of organic manure levels in the two seasons compared to the control treatment (without organic fertilization in two season). The highest values were obtained from plants treated with 50 m^3/fed followed by plants treatment with 25 m^3/fed.

Table (6) Effect of organic manure rates on N,P and K percentage in dry matter of leaves/fruits of bitter melon plant during 2013 and 2014 seasons.

Char.	Leaves						Fruits					
	N%		P%		K%		N%		P%		K%	
Treat.	1st	2na	1st	2na	1st	2na	1st	2na	1st	2na	1st	2na
Control	2.959	2.812	0.200	0.215	1.777	1.757	2.105	2.085	0.174	0.133	1.557	1.433
25 m^3/fed	2.916	3.127	0.230	0.245	2.137	2.043	2.373	2.302	0.214	0.240	1.795	1.640
50 m^3/fed	3.356	3.227	0.241	0.256	2.281	2.112	2.466	2.382	0.217	0.219	1.874	1.709
LSD at 5%	0.016	0.008	0.008	0.005	0.080	0.016	0.008	0.005	0.019	0.006	0.008	0.006

Fe, Zn, Mn and Cu percentage in dry matter of leaves and fruits

Data in Table (7) declare that organic manure treatment increased Fe, Zn, Mn and Cu contents in bitter gourd leaves and fruits in both seasons. The richest leaf and fruit micro elements contents were recorded by 50 m^3/fed organic manure treatment followed by 25 m^3/fed organic manure treatment in both seasons as compared with control. This result is in harmony with this obtained by Tianyih and Jenhshuan (2004) in bitter gourd.

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3. Effect of organic manure on yield and its components

- Fruit weight, fruit length, total number of fruits/plant, fruit diameter and total fruit yield

Data in Tables 8,9,10,11,12 disclosed that fruit weight, fruit length and fruit diameter plant/fruit pick, as well as, Total number of fruits/plant/pick were significantly increased due to both organic manure treatments over control of the six picks in both seasons. The highest values for all these characters were obtained when organic manure applied at 50 m^3/fed.

The performed higher number of fruits/plant, plant yield and total yield from organic fertilization treatments may be due to their higher contents, particularly Fe, Zn in cattle manure. These elements can encourage vegetative growth, total chlorophyll and photosynthetic rate, which enhance flowering and fruiting leading to an increase in early fruit maturity. These results agree with previous studies Abdulraheem (2009); Ozores-Hampton *et al.* (1994), Aly (2002) they showed that applying of organic manure treatments increased total yields compared to using chemical fertilizers.

The increased fruit length, fruit number and diameter could be attributed to balanced nutrition which influence the increased vine length, number of leaves and branches per vine and increased chlorophyll content in leaf resulting in higher photosynthesis leading to increased fruit length fruit diameter intern increased the fruit uptake and synthesis of more carbohydrates by plants when volume and fruit cavity. The results are in conformity with the findings of Patil *et al.* (1998) and Umamaheshwarappa *et al.* (2005),Orowski *et al.* (1991), Upadhyaya and Sharma (2002) in cucumber. Yadav and Luthra (2004) in water melon and Naidu *et al.* (1999) in okra.

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- Fruits yield/unit (kg) and Fruits yield/fed (kg)

Data in Table (13,14) disclosed that fruits yield/unit (kg) and fruits yield/fed (kg) were significantly increased due to both organic manure treatments over control in the six picks of both seasons. The highest values for the two characters were obtained when organic manure applied at 50 m^3/fed.

Yield per plant of the treatments with cattle manure were significantly high. The quality of tomato fruit with organic fertilizers was better than other treatments, The quality of tomato fruit in cattle manure was the best. Liu *et al.* (2007). Benitez *et al.* (2013) and Bage *el al*. (2000) reported that the cultivation of bitter gourd requires an ample supply of plant nutrient. Use of organic manures and fertilizers is essential for its proper growth and development. Organic manure improves soil structure as well as increases its water holding capacity Moreover, it facilitates aeration in soil. Vegetable consumers appreciate recently organic farming as it enhances quality of the produce Rashid (2004). Similar resulted were found by Esawy *et al.* (2009). Also Zhu *et al*. (2005) and Mulani *et al*. (2007) reported that because of higher yields and income, use of organic fertilizer are increasing, the highest fertilizer inputs can lead to marked deterioration in soil and groundwater quality and the systems are clearly unsustainable.

4. Fruit quality (T.S.S, Acidity, Vitamin C and Carotenoids):

As shown in Table (15) organic manure fertilization treatments had a significant effect on vitamin C concentration obtained from 50 m^3/fed treatment (87.96 and 88.29mg/100g), total soluble solids (T.S.S) percentage(7.07 and 7.17%) and carotenoids concentration(5.336 and 5.043mg/100g) in bitter gourd fruits in both seasons compared to control, expect Acidity percentage in bitter gourd fruits which had the highest values in control treatment (1.01 and 0.96 %) of both seasons.

Heinonen (1990) reported that the organically grown carrots contained higher carotene content than the plants grown with inorganic fertilizers. Increased yield was also related to balanced nutrition, better uptake of nutrients by the plants which helped for better fruit set and fruit yield. Production of nucleoproteins, enzymes and high-energy bonds due to application of phosphorus as well as more auxin production in the presence of higher dose of nitrogen might have resulted in higher fruit weight of cucumber. Thompson *et al.* (1949), Pandey and Singh (1973) and Leclerc et *al.*(1991) reported similar results.

Table 15: Effect of organic manure on T.S.S, Acidity, Vitamin C and Carotenoids in fruits of bitter melon plant during 2013 and 2014 seasons.

Fruits								
Char.	V.C (mg/100g)		T.S.S.%		Acidity %		carotenoids (mg/100g)	
Treat.	1st	2nd	1st	2nd	1st	2nd	1st	2nd
control	84.61	85.28	6.71	6.78	1.01	0.96	4.366	4.104
25 m^3/fed	86.98	87.30	6.97	7.05	0.86	0.82	5.031	4.750
5، m^3/fed	87.96	88.29	7.07	7.17	0.80	0.73	5.336	5.043
LSD at 5%	0.40	0.58	0.04	0.04	0.03	0.02	0.045	0.064

CONCLUSION

It can be recommended that organic fertilization bitter gourd with (25 m^3/fed and 50 m^3/fed cattle manure) in order to maximize its growth and productivity. Meanwhile, organic fertilizing bitter gourd with 25 m^3/fed increased bitter gourd yield over the control (without organic manure). Hence, this treatment is recommended where this is turn decrease the environment pollution and production costs under the environmental conditions of Damietta governorate, Egypt.

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تأثير التسميد العضوي على النمو والمحصول لنبات الشمام المر تحت ظروف محافظة دمياط

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أجريت تجربتان حقليتان على نبات الشمام المر في مزرعة خاصة بالقرب من مدينة الزرقا, محافظة دمياط خلال موسمي الزراعة ٢٠١٣- ٢٠١٤ لدراسة تأثير التسميد العضوي (بدون ، ٢٥ م٣/فدان ، ٥٠ م٣/فدان) على النمو الخضري والثمري وصفات الجودة والمحصول لنبات الشمام المر تحت ظروف محافظة دمياط.

ويمكن تلخيص النتائج المتحصل عليها فيما يلى :

أعطى التسميد العضوي لنبات الشمام المر باستخدام سماد روث الماشية بمعدل ٢٥ طن /فدان زيادة معنوية في النمو الخضري والمحصول ومكوناته والمحتوى الكيميائي للثمار مقارنة بمعاملة الكنترول إلا أن تقليل تكاليف الزراعة وتقليل التلوث البيئي وتحسن خواص الثمار والمحافظة على صحة الإنسان وتجنب استخدام التسميد المعدني قدر الإمكان تجعلنا نوصي باستخدام المعاملة (٢٥ م٣/فدان) وذلك لزيادة إنتاجية الشمام المر وتحسين صفات جودته.

Table (7) Effect of organic manure rates on Fe, Zn, Mn, Cu percentage in dry matter of leaves and fruits of bitter melon plant during 2013 and 2014 seasons.

Char.	Leaves								Fruits							
	Fe ppm		Zn ppm		Mn ppm		Cu ppm		Fe ppm		Zn ppm		Mn ppm		Cu ppm	
Treat.	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
control	2.775	2.808	5.014	4.981	0.579	0.622	0.244	0.246	1.826	1.817	3.354	3.259	0.403	0.391	0.178	0.167
25 m^3/fed	3.126	3.147	5.433	5.338	0.646	0.673	0.299	0.293	2.003	2.011	3.537	3.422	0.446	0.446	0.235	0.216
50 m^3/fed	3.241	3.261	5.489	5.454	0.670	0.690	0.322	0.309	2.057	2.081	3.593	3.486	0.463	0.470	0.251	0.235
LSD at 5%	0.010	0.013	0.137	0.010	0.007	0.006	0.004	0.006	0.010	0.005	0.006	0.004	0.005	0.016	0.003	0.004

Table 8: Effect of organic manure rates on fresh weight/fruit (g) of bitter gourd plant during 2013 and 2014 seasons.

Char / Treat.	Average weight/fruit (g)											
	Fruit pick 1		Fruit pick 2		Fruit pick 3		Fruit pick 4		Fruit pick 5		Fruit pick 6	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
control	129.13	136.15	133.65	150.63	170.49	165.98	285.06	238.06	284.44	276.31	94.45	88.48
25 m^3/fed	141.79	151.38	146.76	167.48	187.21	184.56	313.02	264.70	312.34	307.23	103.71	98.38
50 m^3/fed	146.44	156.22	151.58	172.84	193.35	190.46	323.28	273.17	322.58	317.05	107.11	101.52
LSD at 5%	0.68	0.47	0.71	0.83	0.91	0.85	1.51	0.44	1.51	0.79	0.50	0.23

Table 9: Effect of organic manure rates on total number of fruits/plant of bitter gourd plant during 2013 and 2014 seasons.

Char / Treat.	No. of fruit/plant											
	Fruit pick 1		Fruit pick 2		Fruit pick 3		Fruit pick 4		Fruit pick 5		Fruit pick 6	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Control	2.13	3.21	3.73	4.27	5.36	4.81	5.86	6.95	4.26	5.37	3.20	3.74
25 m^3/fed	2.34	3.56	4.09	4.75	5.88	5.35	6.43	7.72	4.68	5.97	3.51	4.16
50 m^3/fed	2.42	3.68	4.23	4.91	6.07	5.52	6.64	7.97	4.83	6.16	3.62	4.29
LSD at 5%	0.01	0.01	0.02	0.02	0.03	0.02	0.03	0.02	0.02	0.02	0.02	0.01

Table 10: Effect of organic manure rates on average length /fruit (cm) of bitter gourd plant during 2013 and 2014 seasons.

Char.	Average length /fruit (cm)											
	Fruit pick 1		Fruit pick 2		Fruit pick 3		Fruit pick 4		Fruit pick 5		Fruit pick 6	
Treat.	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Control	25.59	21.60	32.58	32.93	35.57	34.90	37.79	39.57	32.58	33.21	33.38	32.26
25 m^3/fed	28.10	24.02	35.77	36.62	39.05	38.81	41.49	44.00	35.77	36.93	36.65	35.87
50 m^3/fed	29.03	24.78	36.95	37.79	40.34	40.05	42.85	45.40	36.95	38.11	37.85	37.01
LSD at 5%	0.13	0.06	0.17	0.10	0.19	0.10	0.20	0.11	0.17	0.11	0.18	0.07

Table 11: Effect of organic manure rates on average diameter /fruit (cm) of bitter gourd plant during 2013 and 2014 seasons.

Char	Average diameter/fruit (cm)											
	Fruit pick 1		Fruit pick 2		Fruit pick 3		Fruit pick 4		Fruit pick 5		Fruit pick 6	
Treat.	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
control	36.54	34.11	46.63	45.42	55.45	51.41	62.91	65.27	46.84	53.52	46.63	48.88
25 m^3/fed	40.13	37.93	51.21	50.50	60.89	57.16	69.08	72.58	51.43	59.51	51.21	54.35
50 m^3/fed	41.44	39.14	52.89	52.12	62.89	58.99	71.34	74.90	53.12	61.41	52.89	56.09
LSD at 5%	0.19	0.10	0.25	0.18	0.30	0.11	0.33	0.18	0.25	0.15	0.25	0.14

Table 12: Effect of organic manure rates on Average fresh weight of fruits /plant (g) of bitter gourd plant during 2013 and 2014 seasons.

Char	Average fresh weight of fruits /plant (g)											
	Fruit pick 1		Fruit pick 2		Fruit pick 3		Fruit pick 4		Fruit pick 5		Fruit pick 6	
Treat.	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
control	472.27	470.45	792.78	814.34	962.56	1020.23	1192.52	1382.43	945.16	941.65	852.43	832.51
25 m³/fed	518.59	523.08	870.53	905.45	1056.97	1134.38	1309.49	1537.11	1037.86	1047.01	936.04	925.65
5، m³/fed	535.60	539.81	899.08	934.41	1091.63	1170.66	1352.43	1586.26	1071.90	1080.50	966.73	955.26
LSD at 5%	2.51	1.20	4.21	2.33	5.10	2.92	6.33	3.96	5.02	2.53	4.52	2.12

Table 13: Effect of organic manure rates on fruits yield/unit (kg) and fruits yield/fed (kg) of bitter gourd plant during 2013 and 2014 seasons.

Char	Average fruits yield /unit (kg)											
	Fruit pick 1		Fruit pick 2		Fruit pick 3		Fruit pick 4		Fruit pick 5		Fruit pick 6	
Treat.	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
control	4.25	4.23	7.13	7.32	8.50	8.47	10.73	12.44	8.66	9.18	7.67	7.49
25 m^3/fed	4.66	4.70	7.83	8.14	9.34	9.42	11.78	13.83	9.51	10.20	8.42	8.33
5، m^3/fed	4.82	4.85	8.09	8.40	9.64	9.72	12.17	14.27	9.82	10.53	8.70	8.59
LSD at 5%	22.55	10.81	37.85	20.96	45.14	22.79	56.94	35.59	45.97	26.26	40.71	19.04

Table 14: Effect of organic manure rates on Total fruits yield /fed (ton) of bitter gourd plant during 2013 and 2014 seasons.

Char	Total fruits yield /fed (ton)											
	Fruit pick 1		Fruit pick 2		Fruit pick 3		Fruit pick 4		Fruit pick 5		Fruit pick 6	
Treat.	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
control	1.020	1.016	1.712	1.758	2.041	2.033	2.575	2.986	2.079	2.203	1.841	1.798
25 m^3/fed	1.120	1.129	1.880	1.955	2.241	2.261	2.828	3.320	2.283	2.450	2.021	1.999
5، m^3/fed	1.156	1.166	1.942	2.018	2.315	2.333	2.921	3.426	2.357	2.528	2.088	2.063
LSD at 5%	5.41	2.59	9.08	5.03	10.83	5.47	13.67	8.54	11.03	6.30	9.76	4.57