African Journal of Food Science Research ISSN 2375-0723 Vol. 3 (2), pp. 160-166, February, 2015. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Full Length Research Paper

Comparison of different types of fertilizers on growth, yield and quality properties of watermelon (*Citrullus lanatus*)

Mohammed Massri[1] and Louay Labban[2]

[1]Department of Food Sciences, Faculty of Agriculture, Al-Baath University, Syria.
[2]Department of Nutrition and Food Sciences, Faculty of Health Science, University of Kalamoon, Syria.

Accepted 24 July, 2015

Watermelon is a very important crop because it has many nutritional and economical values. This crop has been known to human for ages and has been cultivated for centuries in many Middle Eastern countries including Syria. Several types of fertilizers are being used in order to increase the productivity of this crop but some fertilizers have shown to have adverse effect on the environment. Therefore, the aim of this study was to examine the effect of several types of organic fertilizers (cow's, sheep, poultry and pigeon manure) and to compare their effect on growth, productivity and quality parameters with chemical fertilizers (NPK) and control group. Two local cultivars spherical and cylindrical (Audrey and Shapah) were used to examine the effect of cow's manure (8m/Donum), Sheep manure (6 m/Donum), poultry manure (3 m/Donum) and pigeons (2 m/Donum) and were compared with chemical fertilizer (N 20: P 40: K 25). The number of fruits on each vine, length of each vine (cm), fruit weight (kg), and estimated yield (kg/Donum) were measured and recorded as well as some quality parameters such as rind thickness (cm) and heart color. Cows manure proved to be superior to other types of fertilizers (organic and inorganic) in many traits but chemical fertilizer gave the highest yield (kg/Donum) in Audrey cultivar but in Shapah cultivar there was no significant difference in productivity between chemical fertilizer compared with control group. Using organic fertilizers to cultivate watermelon does affect quality watermelon and the productivity was too close to chemical fertilizer. On the other hand, organic fertilizer can reduce the harmful effect of chemical fertilizers on environment and human health alike.

Key words: Audrey, shapah, manure fertilizers, chemical fertilizers, productivity, watermelon.

INTRODUCTION

Human have known watermelon (*citrullus lanatus*) for centuries and have noticed the nutritional importance of its fruits. Watermelon is a herbaceous creeping plant that belongs to the botanical family *curcurbitaceous* or gourd family which thrive in the tropical region and has been cultivated for thousands of years in the Middle East (Syria, Egypt, Jordan, Tunisia, Lebanon….etc) and south East Asia (Koocheki *et al*., 2007). Watermelon is a very rich source of nutrients such as photochemical and lycopene (Perkins-Veazie *et al.,* 2001; Perkins-Veazie; Collins 2004) and often used as an appetizer or healthy snack, depending on the way it is prepared (Erukanure *et*

Corresponding author. E-mail: drlouay@gmail.com

al., 2010).
There are many local names for watermelon in the Middle East region such as Bateekh in Syria, Habhab in Saudi Arabia, Raki in Iraq, Jah in UAE. Watermelon is considered a summer crop and it has good economical importance because it is a highly marketed crop in the local markets and for export. Watermelon is among the most widely cultivated crops in the world and the acreage of watermelon increased in the past years (FAO, 2007). According to FAO 2011, Syria produces 670559 tons and the cultivated area was 31044 hectares.
Watermelon not only tolerates hot weather but for best growth requires more heat than any other vegetables. Watermelon seeds germinate well and plants thrive at 25°C – 30°C. Fruits mature best at 30°C. Watermelon *Citrullius lanatus* plant is a herbaceous creeping plant which produces from 3 to 5 fruits weighing from 3 to 10 kilogram. Some cultivars such as the ‘Florida Giant’ may weigh up to 20 kilogram, (Pamplona-roger, 2008).
In order to improve the yield of watermelon, the soil content of nutrients should be increased to boost the fertility which can be achieve by either using organic fertilizer such as cattle manure, poultry manure, animal waste and use of compost (Dauda et al., 2005) or by using chemical fertilizers mainly Potassium and Nitrogen compounds.
Scientists have been interested in studying organic materials especially for its benefits for the plant, soil and recently for the environment. Modern farming system is heavily dependent on chemical fertilizers and reducing the number of farmers who use organic fertilizers which created a wide range of problems mainly depleting the soil fertility and thus reducing the yield year after year putting some farmers out of business not to mention the effect on the soil texture since organic fertilizers can improve the soil texture especially the clay and sandy soils (Mahmoud et al., 2009).
Over-use of chemical fertilizer can be harmful to the environment by polluting water and increasing the volumes of farm crops which proved to be hazardous to human health. In organic farming, the soil becomes rich in nutrients therefore, crops grow healthy and resistant to pest and diseases making the quality of the products more nutritious, tastier and contain substances that are good for health (Wakui, 2009).
John et al. (2004) had advocated for an integral use of organic manure and inorganic fertilizers for the supply of adequate quantities of nutrients to improve crop productivity while minimizing environmental impact from fertilizer use.
Large quantities of animal wastes are produced each year in Syria, and mismanagement of organic wastes, have impacted public health and environment.
The aim of the study was to assess the effect of different types of organic fertilizers (cow’s manure, sheep manure, poultry manure and pigeon manure) and one type of chemical fertilizer (NPK) on the characteristics of watermelon (growth parameters, yield and quality) of two local cultivars in Syria.

MATERIALS AND METHODS

Four different types of fermented (for one year) organic fertilizers (cows, sheep, poultry, and pigeons) were used in addition to one chemical fertilizer as shown in table (1).

*1 Donum= 1000 Square meters
The fertilizer is added to the soil prior to cultivation, and then seedlings are brought from nursery and planted in the soil after irrigation at a distance of 1.5 meter of each other.
Two local cultivars were used; Audrey round (spherical shape) and Shapah oblong (cylindrical shape). The experiment was replicated for three times and the average was calculated.
Physical properties of watermelon: the physical properties were determined for each cultivar including width and length circumference of the fruits (cm), thickness of the rind (cm) and weight of the fruits (kg), percentage of the seeds, vine length and number of the branches in each plant were measured.
Estimated productivity was calculated by multiplying the number of fruits in each plant by the average fruit weight. Three fruits were left to grow in each plant.

METHODS OF ANALYSIS

The following measurements were taken after 75 days of transplantation:
-The number of branches in each plant, the length of each vine (cm), the number of fruits in each vine. The weight of fruit (kg), estimated yield (kg/Donum) and the rind thickness (cm) were taken 75 days after plantation.
1. Moisture determination: Was determined by drying the flesh in an oven at 105°C until a constant weight according to (A.O.A.C. 2002).
2. Ash content determination: Was determined in muffle at 525 °C according to the (A.O.A.C. 2002).
3. pH measurement: By using Jenway pH meter 3510 according to(AOAC, 2002).
4. Texture measurement: A Stable Micro System TA.XT computerized digital texture analyzer equipped with (P/10) cylindrical probe and Cell (5Kg) and speed 2.0 mm/sec to depth 10mm, were used. It was measured for the heart and rind (Xisto, *et al*., 2012).
5. Color determination: Heart color (CIE *L**, *a**, *b**

Table 1. Type of fertilizers and the amount used in the experiment.

Treatment	Type of organic fertilizer(amount used)
1	Cow's manure (8 m^3/ Donum)*
2	Sheep manure (6 m^3/ Donum)
3	Poultry manure (3 m^3/Donum)
4	Pigeon's manure (2 m^3/ Donum)
5	Chemical fertilizer (NPK) 20-40-25 kg/ Donum
6	Control (no fertilizers)

units) was measured on the cut surface of heart tissue using a Konica Minolta (model CM-3500d, Japan) calibrated with a white tile. *L** degree of lightness (100=white, 0=black) , a* degree of redness or greenness (+red; -green), and b* degree of yellowness or blueness (+yellow; -blue). One reading was taken from each of six slices of each replicate sample. (Saftner *et al*., 2007 & Nadzirah *et al*., 2013).

6. Total soluble solids content: From juice extracts (tissue purees) were analyzed using an ABBE refractmeter, according to (AOAC, 2002).
7. Fruits Weight: Was done by using electric scale (Jenaway), weighs up to 30 kg with accuracy of 0.01 kg**.**
8. Dimensions: Were measured by using regular measuring tape (100 cm)**.**
9. Rind thickness was measured by using vernier thickness caliper.
10. Soil analysis data: The soil in the planting sites was analyzed and the results are shown in table (2).

STATISTICAL ANALYSIS

Collected data were presented as mean ± SD and statistically analyzed using one way analysis of variance (ANOVA). Student t-test repeated measure was used for significance. Differences were considered significant at $p<0.05$ according to Artimage and Berry (1987).

RESULTS AND DISCUSSION

With regard to Audrey cultivar, cow's manure fertilizer was superior to other treatments regarding the number of fruits on each vine, number of vines and length of vine. The difference was statistically significant between cow's manure, sheep manure and poultry manure and between chemical fertilizer and control sample ($P<0.05$) as shown in table 3. Dauda *et al*., 2008 studied the efficacy of different levels of poultry manure at the rates of 0, 3.3, 6.6 and 9.9 t ha^{-1} on growth and yield of *Citrullus lanatus,* in Nigeria. They found that application of poultry manure significantly enhance growth parameter vigor and number of fruits during the two seasons.

When looking at Shapah cultivar, cow's manure was the best in producing more fruits on each vine and other treatments: sheep manure, poultry manure, pigeons manure and chemical fertilizer. There was a significant difference among these treatments and control group but the difference was highly significant ($P<0.05$) between cow's manure and control group. These results are demonstrated in table 4.

Data collected from this study have shown that in Audrey cultivar, cow's manure had the highest length circumference compared with control group ($P=0.02$) followed by chemical fertilizer ($P=0.03$). Sheep and pigeon manure were similar in their effect on length circumference (85±20.8 and 87±19.3) and the difference was significant ($P=0.04$) but the difference was not significant between poultry manure and control group ($P=0.05$) as shown in table 5. With regard to width circumference in Audrey cultivar, control group and chemical fertilizer had the highest width circumference but there was no significant difference between chemical fertilizer and control group regarding width circumference ($P = 0.05$) but the difference was significant between control group and all other treatments. Sheep and poultry manure (85±14.8 and 80±13.9 cm respectively) and the difference was significant ($P=0.02$) followed by Pigeon manure and cow's manure which were similar in their width circumference (78±14.1 and 75±13.3 cm) and the difference was highly significant ($P=0.01$).

Rind thickness was the highest in sheep and cow's manure (2.16±0.3 cm and 1.92±0.2 cm respectively) and the difference was significant compared with control group ($P=0.02$), followed by poultry manure 1.78±0.2 cm and pigeon manure 1.74±0.2 cm ($P=0.04$). There was no significant difference between control group and chemical fertilizer ($P = 0.05$). The weight of fruit was the highest in chemical fertilizer 18.37±4.9 kg ($P=0.01$) followed by cow's manure 16.29±4.3 kg ($p=0.02$), sheep manure

Table 2. Soil analysis data for planting sites.

Soil analysis data							
PPM				g/100g of soil		Millimose	pH
Calcium	K	P	Mineral N	Calcium carbonate	Organic matter	EC 1/5	
18%	213.4	11	9.42	42.66	1.4	0.29	5.9

Table 3. Number of fruits, vines and length of vine in Audrey cultivar.

Treatment	**No. of fruits on each vine**	***P* value**	**No. of branches**	***P* value**	**Length of vine (cm)**	***P* value**
1	4±0.26	0.03*	15±4	0.03*	98±20.4	0.02*
2	3±0.12	0.04*	5±1	0.10	66±19.9	0.04*
3	3±0.12	0.04*	8±2	0.07	82±20.69	0.03*
4	2±0.09	0.06	8±2	0.07	68±20.4	0.04*
5	2±0.09	0.06	6±1	0.2	42±10.76	0.07
6	1±0.03		6±1		33±9.94	

*Significant difference $P < 0.05$

Table 4. Number of fruits, vines and length of vine in Shapah cultivar.

Treatment	No. of fruits on each vine	*P* value	No. of branches	*P* value	Length of vine (cm)	*P* value
1	3±0.12	0.02*	17±4	0.007*	70±19.84	0.02*
2	2±0.09	0.04*	8±2	0.06	97±25.33	0.002*
3	2±0.09	0.04*	10±2	0.04*	100±25.11	0.001*
4	2±0.09	0.04*	12±3	0.02*	88±22.85	0.02*
5	2±0.09	0.04*	10±2	0.04	96±24.85	0.002*
6	1±0.02		8±2		44±11.23	

*Significant difference $P<0.05$

15.5±4.2 kg (P =0.03), poultry and pigeon manure 14.26±3.9 kg and 13.26±3.6 kg (P =0.04). The lowest fruit weight was in the control group 10.62±2.1 kg. This also applies to estimated yield (kg/Donum). The highest yield was in the chemical fertilizer 11026.2±343.3 kg/Donum and the difference was highly significant (P =0.007) when compared with the control group which had the lowest yield (6370.2±132.1 kg/Donum). Cow's manure came in the second place with 9970.4±250.4 kg/Donum (P =0.01) followed by sheep manure 9300±233.3 kg/Donum (P =0.02) , poultry and pigeon manure (8558.6±243.5 and 7956.6±222.4 kg/Donum respectively (p=0.04). Control group had the lowest yield (6370.2±132.1 kg/Donum). These data are shown in table 5.

The results are in total agreement with those obtained by Olson and Simonne, 2010 who found that chemical fertilizers (NPK) had positive impact on watermelon productivity. In their study, chemical fertilizer gave around 90 tons/ ha which are very close to our result.

With regard to length circumference in Shapah cultivar, there was no significant difference between control group and treatment 6 but there was a significant difference between control group and other treatment (P <0.05). Treatments 2 and 3 came in the first and second place whereas treatment 1 and 4 were equal with regard to this trait. The difference was significant between control group and all treatments with regard to width circumference. Treatments 4 and 5 were equal (p=0.03) whereas treatments 1, 2 and 3 were equal (P =0.04).

Table 5. Fruit dimensions, rind thickness, fruit weight and estimated yield of Audrey cultivar

Treat.	Length circumference (cm)	*P* value	Width circumference (cm)	*P* value	Rind thickness (cm)	*P* value	Weight kg	*P* value	Estimated yield (kg/Donum)	*P* value
1	97±23.3	0.02*	75±13.3	0.01*	1.92±0.2	0.02*	16.29±4.3	0.02*	9970.4±250.4	0.01*
2	85±20.8	0.04*	85±14.8	0.02*	2.16±0.3	0.02*	15.5±4.2	0.03*	9300±233.3	0.02*
3	81±18.9	0.05	80±13.9	0.02*	1.78±0.2	0.04*	14.26±3.9	0.04*	8558.6±243.5	0.04*
4	87±19.3	0.04*	78±14.1	0.01*	1.74±0.2	0.04*	13.26±3.5	0.04*	7956.6±222.4	0.04*
5	93±22.8	0.03*	91±15.3	0.05	1.62±0.1	0.05	18.37±4.9	0.01*	11026.2±343.3	0.007*
6	77±17.4		94±15.9		1.58±0.1		10.62±2.1		6370.2±132.1	

Significant difference *P* <0.05

Table 6. Fruit dimensions, rind thickness, fruit weight and estimated yield of Shapah cultivar.

Treat.	Length circumference (cm)	*P* value	Width circumference (cm)	*P* value	Rind thickness (cm)	*P* value	Weight kg	*P* value	Estimated yield (kg/Donum)	*P* value
1	105±23.8	0.04*	64±15.3	0.03*	1.29±0.2	0.05	10.51±2.11	0.03*	6309.6±1521	0.04*
2	112±24.2	0.02*	65±15.7	0.03*	1.5±0.3	0.02*	11.39±2.53	0.02*	6836.4±1543	0.03*
3	111±21.6	0.03*	64±14.5	0.03*	1.26±0.2	0.04*	11.9±2.43	0.02*	7140±1642.4	0.02*
4	109±23.9	0.04*	70±15.9	0.02*	1.38±0.2	0.03*	10.6±2.12	0.03*	6360±1584.3	0.04*
5	99±20.8	0.05	66±13.5	0.02*	1.38±0.2	0.03*	9.79±1.78	0.06	5874.4±1320.3	0.05
6	103±23.4		64±13.8		1.18±0.1		9.47±1.33		5685.2±1273.2	

Significant difference *P* <0.05

Rind thickness was the highest in sheep manure (1.5±0.3 cm) and the difference was significant (*P* =0.02), followed by pigeon manure and chemical fertilizer 1.38±0.2 cm (*P* =0.03). There was no significant difference between control group and cow's manure (*P* = 0.05). The weight of fruit was the highest in poultry manure 11.9±2.43 kg (*P* =0.02) followed by sheep manure 11.39±2.53 kg (*P* =0.02), pigeon manure 10.6±2.12 kg (*P* =0.03), cow's manure 10.51±2.11 kg (*P* =0.03). The lowest fruit weight was in chemical fertilizer and control group and 9.79±1.78 kg and 9.47±1.33 kg (*P* =0.06). The highest yield (kg/Donum) was in poultry manure 7140±1642.4 kg/Donum and the difference was significant (*P* =0.02) when compared with the control group which had the lowest yield (5685.2±1273.2 kg/Donum). Sheep manure came in the second place with 6836.4±1543 kg/Donum (*P* =0.03) followed by pigeon manure 6360±1584.3 kg/Donum and cow's manure 6309.6±1521 (p=0.04), Control group had the lowest yield (5685.2±1273.2kg/Donum).There was no significant difference between control group and chemical fertilizer (*P* =0.05). The results are similar to those obtained by Olson *et al*., 2010.

Poultry manure is relatively resistant to microbial degradation. However, it is essential for establishing and maintaining optimum soil physical condition and important for plant growth. PM is also very cheap and effective as a good source of N for sustainable crop production, but its availability remains an important issue due to its bulky nature, while inorganic fertilizer is no longer within the reach of poor-resource farmers due to its high cost (Rahman, 2004). However, John *et al*. (2004) had advocated for an integral use of organic manure and inorganic Fertilizers for the supply of adequate quantities of plant nutrients required for sustaining maximum crop productivity and profitability, while minimizing environmental impact from nutrient use.

With regard to seed percentage, chemical fertilizer and poultry manure had the highest percentage of seed (1.16 and 1.12% respectively) followed by control group (0.98%), sheep manure (0.72%), pigeon manure (0.63%) and finally cow's manure that produced 0.57% seeds. As for moisture percentage in Audrey cultivar, control group had the highest moisture percentage (93 %), followed by chemical fertilizer (91.1%) and then sheep, pigeon and poultry manure (90.96, 90.95 and 90.13% respectively). Cow's manure gave the lowest moisture percentage 89.75%.

Chemical fertilizers had the highest ash percentage (0.44%) followed by poultry manure (0.37%), control group

Table 7. Seeds, moisture, ash percentage, pH and TSS of Audrey cultivar.

Treatment	Seed %	Moisture %	Ash %	pH	TSS
1	0.57[d]	89.75[c]	0.23[c]	5.5[b]	10.24[ab]
2	0.72[c]	90.96[b]	0.22[c]	5.7[ab]	7.85[c]
3	1.12[a]	90.13[b]	0.37[ab]	5.7[ab]	8.02[b]
4	0.63[cd]	90.95[b]	0.3[b]	5.8[a]	10.4[a]
5	1.16[a]	91.1[ab]	0.44[a]	5.7[ab]	10.35[a]
6	0.98[b]	93[a]	0.33[b]	5.5[b]	7.25[d]

[a ab b] significant difference.
[c d] insignificant difference.

Table 8. Seeds, moisture, ash percentage, pH and TSS of Shapah cultivar.

Treatment	Seed %	Moisture %	Ash %	pH	TSS
1	1.08[b]	89.39[c]	0.45[a]	5.4[b]	10.1[b]
2	0.87[d]	92.4[a]	0.36[b]	5.5[ab]	8.1[bc]
3	1.68[a]	91.43[ab]	0.35[b]	5.6[a]	7.1[c]
4	1.4[ab]	90.99[b]	0.36[b]	5.3[b]	10.6[a]
5	0.99[c]	92.16[a]	0.41[ab]	5.6[a]	10.4[ab]
6	1.06[b]	90.58[b]	0.41[ab]	5.4[b]	7.9[bc]

[a ab b] significant difference.
[bc c d] insignificant difference.

and pigeon manure (0.33% and 0.3% respectively) and finally cow's manure and sheep manure (0.23 and 0.22% respectively). pH values for Audrey cultivar for all treatment were very close, but pigeon manure had the highest (pH=5.8) followed by sheep manure, poultry manure and chemical fertilizer (pH=5.7) then control group and cow's fertilizer (pH=5.5) were the lowest.

When it comes to Total Soluble Solids (TSS), pigeon manure and chemical fertilizer had the highest (10.4 and 10.35 respectively) followed by cow's manure (10.24), poultry manure (8.02), sheep manure (7.85) and finally control group (7.25). The results are presented in table 7.

Shapah cultivar had different values for seeds, moisture and ash percentage, also had different values for pH and TSS for all treatments. Poultry manure had the highest seed percentage (1.68%), followed by pigeon manure (1.4%) then cow's manure and control group (1.08 and 1.06 % respectively) and then chemical fertilizer (0.99%) and finally sheep manure (0.87%). Moisture percentage was the highest in sheep manure and chemical fertilizer (92.4 and 92.16% respectively) followed by poultry manure (91.43%), pigeon manure and control group (90.99 and 90.58% respectively) whereas cow's manure had the lowest moisture percentage for a value of 89.39%. In the contrary, the highest ash percentage was in cow's manure (0.45%) followed by control group and chemical fertilizer (0.41%) whereas sheep manure, poultry manure and pigeon manure had almost the same ash percentage (0.36%).

Poultry manure and chemical fertilizer had the highest pH values (pH=5.6) followed by sheep (5.5) and then cow's manure, control group and pigeon manure (pH= 5.3-5.4). Pigeon manure had the highest TSS (10.6) followed by chemical fertilizer (10.4), cow's manure (10.1) followed by sheep manure and control group (8.1 and 7.9 respectively). Poultry manure had the lowest TSS in Shapah cultivar for 7.1 as shown in table 8. The results obtained from this study especially pH values and poultry manure was similar to those obtained by Duda *et.al.,* 2005 in which he found that chemical fertilizer increased pH values of soils.

The superficial appearance and color of food are the first parameters of quality evaluated by consumers, and are thus critical factors for acceptance of the food item by the consumer (Leon *et al*., 2006).

The aspect and color of the food surface is the first quality parameter evaluated by consumers and is critical in the acceptance of the product, even before it enters the mouth. The color of this surface is the first sensation that the consumer perceives and uses as a tool to accept or reject food (Du & Sun, 2004).

This study has also examined the degree of lightness (L), the degree of redness or greenness (a) and the degree of yellowness or blueness (b) in both cultivars.

In Audrey cultivar, chemical fertilizer had the highest lightness degree (L=41.44) followed by poultry manure and control group (32.08 and 32.07 respectively) whereas sheep manure and pigeon manure had 30.19 and

Table 9. Heart color measurement (units) of both Audrey and Shapah cultivars.

Treatment	Audrey cultivar			Shapah cultivar		
	L*	a*	b*	L*	a*	b*
1	31.63^{b}	28.5^{b}	14.25^{bc}	32.78^{a}	30.29^{b}	17.04^{a}
2	30.19^{bc}	28.15^{b}	13.43^{c}	29.47^{b}	31.94^{ab}	16.39^{b}
3	32.08^{ab}	29.15^{ab}	15.58^{b}	29.98^{b}	32.53^{a}	16.48^{b}
4	30.18^{bc}	30.95^{a}	16.76^{a}	30.81^{ab}	31.14^{ab}	16.75^{ab}
5	41.44^{a}	29.23^{ab}	16.26^{a}	30.36^{ab}	30.62^{b}	16.02^{bc}
6	32.07^{ab}	28.84^{b}	14.44^{bc}	30.36^{ab}	30.63^{b}	15.45^{c}

$^{a\ ab\ b}$ significant difference.
$^{bc\ \ c\ d}$ insignificant difference.

30.18 respectively. Pigeons manure had the highest score with regard to redness (30.95) followed by chemical fertilizer and poultry manure (29.23 and 29.13 respectively) and then control group (28.84), cow's manure (28.5) and finally sheep manure for a value of 28.15. Yellowness score was the highest pigeon manure and chemical fertilizer (16.76 and 16.26 respectively) followed by poultry manure (15.58), control group and cow's manure (14.44 and 14.23 respectively) whereas the sheep manure was the lowest (13.43). These results are shown in table 9 and are similar to the results found by Pedreschi *et al*., 2000.

Table 9 has shown that the highest lightness score in Shapah cultivar was in cow's manure (32.78) followed by pigeon manure, chemical fertilizer and control group (30.81 and 30.36 respectively). Poultry manure and sheep manure had the lowest lightness score 29.98 and 29.47.

Redness score in Shapah cultivar was the highest in poultry manure (32.53) maybe was due to increase lycopene content of the flesh (Perkins-Veazie *et al.,* 2001) followed by sheep manure and pigeon manure (31.94 and 31.14) whereas control group, chemical fertilizer and cow's manure scored the lowest in redness scores (30.63,30.62 and 30.29 respectively). Yellowness score was the highest in cow's manure (17.04) followed by pigeons manure (16.75). Poultry manure and sheep manure had almost the same value (16.48 and 16.39 respectively) and then chemical fertilizer (16.02) whereas the lowest was control group (15.45).

The results obtained from this study are parallel to those results reported by Vimala *et al.,* 2001 and Abdullah *et al.,* 2004 who found the chemical fertilizer has a great effect on the color of the flesh and heart of watermelon, this eas due by increasing lycopene content of the flesh.

CONCLUSION

As a conclusion for this study, organic fertilizers mainly cows, sheep and poultry manure had the highest results with regard to quality parameters such as redness and rind thickness whereas chemical fertilizer had a slight advantage for the productivity (kg/Donum) compared with control and organic fertilizer but quality parameters were lower than organic fertilizers especially in those cows, sheep and poultry manure.

REFERENCES

Abdullah MZ, Guan LC, Lim KC, Karim AA (2004). The applications of computer vision and tomographic radar imaging for assessing physical properties of food. J. Food Eng. 61: 125–135.

AOAC (2002). Official Methods of Analysis of AOAC, INTERNSTIONAL 17th Addition, current through revision #1.

Dauda, S.N.; Ajayi, F.A.; and Ndor, E. (2008). Growth and Yield of Watermelon (*Citrullus lanatus*) as Affected by Poultry Manure Application. J. Agric. Soc. Sci. 04-3:121-124.

Dauda SN, Aliya L, Chiezey UF (2005). Effect of variety, seedling age and poultry manure on growth and yield of garden egg (Solamun gilo L.). Nigerian Acad. Forum,9:88-95.

Du C, Sun D (2004). Recent developments in the applications of image processing techniques fro food quality evaluation. Trends Food Sci. Technol. 15: 230-249.

Erukainure OL, Oke OV, Daramola AO, Adenekan SO, Umanhonlen EE (2010). Improvement of the Biochemical Properties of Watermelon Rinds Subjected to *Saccharomyces cerevisae* Solid Media Fermentation. Pak. J. Nutr. 9 (8): 806-809.

FAO statistics (2011) . Food and Agriculture Organization of the United Nations, Production Yearbook 2003. Vol. 57" . Rome. Italy.

FAO (2007). FAOSTAT data 2007. FAO Statistical Database. Agriculture. 6 December 2007.

John LW, Jamer DB, Samuel LT, Warner LW (2004). Soil Fertility and Fertilizers: An Introduction to Nutrient Management, pp:106-53. Person Education, India.

Koocheki A, Razavi SMA, Milani E, Moghadan TM, Abedini M, Alamatiyan S, Izadikhah S (2007). Physical properties of watermelon seed as a function of moisture content and variety. Int. Agrophy., 21: 349-359.

Leon K, Mery D, Pedreschi F, Leon J (2006). Color measurement in L*a*b* units from RGB digital images. Food Res. Int. 39; 1084-1091.

Mahmoud E, Abd EL-Kader N, Robin P, Akkal-Corfini N, Abd El-Rahman L (2009). Effects of different organic and inorganic fertilizers on cucumber yield and some soil properties. World J. Agric. Sci. 5(4): 408-414.

Nadzirah KZ, Zainal S, Noriham A, Normah I, Siti Roha AM, Nadya H (2013). Physico- chemical properties of pineapple variety N36 harvested and stored at different maturity stages. Int. Food Res. J. 20(1): 225-231.

Olson SM, Simonne E (eds.). (2010). The Vegetable Production Handbook. Fla. Coop. Extension Service. Pamplona-roger, G. D, (2008). Healthy Foods. First Edition, San Fernando de Henares, Madrid, Spain: European Union.

Pedreschi F, Aguilera JM, Brown CA (2000). Characterization of food surfaces using scale-sensitive fractal analysis. J. Food Proc. Eng. 23: 127–143.

Perkins-Veazie P, Collins JK (2004). Flesh quality and lycopene stability of fresh- cut watermelon, Postharvest boil. Technol., 31: 159-166.

Perkins-Veazie P, Collins JK, Pair SD, Roberts W (2001). Lycopene content differs among red-fleshed watermelon cultivars, J. Sci. Food Agric. 81 (2001) 983-987.

Saftner R, Luo Y, McEvoy J, Abbott JA, Vinyard B (2007). Quality characteristics of fresh-cut watermelon slices from non-treated and 1-methylcyclopropene- and /or ethylene-treated whole fruit. Postharvest Biol. Tech. 44(1): 71-79.

Vimala P, Salbiah H, Zaharah T, Ruwaida M (2001). Yield responses of vegetables to organic feritilizers. J. Trop. Agric. Food. Sc. 29 (1).

Wakui Y (2009). Organic farming technology in Japan. Pilot Project for Better Farm Income By Organic-Based Vegetable Production. Koibuchi College of Agriculture and Nutrition. Japan.

Xisto ALRP, Vilas Boas EVB, Nunes EE, Vilas Boas EM, Mário César Guerreiro MC (2012). Volatile profile and physical, chemical, and biochemical changes in fresh cut watermelon during storage. Ciênc. Tecnol. Aliment., Campinas, 32(1): 173-178.