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Physiological and Chemical Variations in Producing Roselle Plant (*Hibiscus Sabdariffa. L.*) by Using Some Organic Farmyard Manure

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Abstract: Two pot experiments were carried out during 2004/2005 and 2005/2006 seasons under greenhouse condition to study the growth and the productivity of Roselle plant by using different rates of chicken manure and peanut compost wastes. Physical and chemical analysis was done on both composts in addition to the used soil as initial fertility status. Plant height, number of branches and fruits/plant extra to calyces fresh and dry weights were recorded as indicators for the effectiveness of the applied treatments on plant growth. Total chlorophyll, soluble sugars in Roselle leaves, extra to anthocyanins and flavones in Roselle calyces were determined as physiological and biochemical parameters. Some macro-and micro-nutrients content (N, P, K, Fe, Mn, Zn and Cu) in leaves and calyces were determined. Results can be summarized as follows: Effective values in Roselle plant height as a result of chicken manure was recorded by levels of 120 and 160 g pot^{-1} respectively, while Peanut waste showed a maximum increase with 240g pot^{-1} followed by 320g pot^{-1}. Same trend with fresh and dry weights of calyces, which their increment raised up to 2 folds. Results indicate that Chicken manure (120 &80 g pot^{-1}) and peanut waste (240 g pot^{-1}) had the capacity to increase Roselle yield. Maximum values were obtained from Chicken manure (120 g pot^{-1}). Plants leaves grown under both organic compost treatments had more chlorophyll and sugar (as glucose) content. The applied organic compost induced a significant increment in anthocyanins and flavons content in Roselle sepals. Application of Chicken manure slightly increased N, K and P content in plant tissues. Application of Chicken manure (120 g pot^{-1}), peanut waste (240 g pot^{-1}) and Chicken manure (160 g pot^{-1}) caused a significant increase in Fe, Mn, Zn and Cu in Roselle leaves and calyces, the detected heavy metals were around the normal levels in plant tissues. The specific characteristics of the used composts determine how and in which applications it can be best utilized.

Key words: Roselle · growth parameters · organic manure · pigments · anthocyanin · flavones · macro · micro nutrients

INTRODUCTION

Roselle plant is said to be antiseptic, aphrodisiac, astringent, calyces are made into a pro-health drink rich in vitamin C and anthocyanins. Roselle drink is a mild diuretic and purgative among many uses. The drink made of calyx is said to be folk remedy for cancer. The red beverage is also used in jams, tea, ice cream, pies, deserts, jellies, sauces. Restored Roselle drink had no bacterial isolate. Its seeds are a good source of lipid-soluble antioxidants, particularly γ-tocopherol. The traditional use of Roselle sepals is the elaboration of *karkadé* tea (common name in Egypt and most Arab countries) [1, 2].

Roselle (*Hibiscus sabdariffa. L.*) belongs to plants of the mallow family (Malvaceae); its fiber is one of the best fiber groups. It grows best in loamy, well-drained soil, mainly in tropical and subtropical climates as one of the important medical plant. Somewhat acid calyxes dried fleshly. In Egypt Roselle is cultivated through from north to south; the southern region is more suitable. The red calyces are increasingly exported to America and Europe, where they are used as food colourings, but production is mostly used domestically. The green leaves are used like a spicy version and give flavor [3-5].

Roselle calyces contain organic acids (*Tartaric,* Oxalic, *Malic* and Succinic acids), glucose, ascorbic acid, β-carotene and lycopene in addition to individual

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anthocyanin pigments (Delphinidin-3-sambubioside and cyanidin-3-sambubioside), two types of anthocyanins (*delphinidin* and *cyanidin*), that used in conjunction with natural base for colourin syrups and liquors, High ascorbic acid and anthocyanins contents can be easily destroyed during hot water extraction processing [6-8].

El-Keltawi *et al.* [9] reported that in Sohag and Assuit, the application of organic wastes in Sohag field conditions (sugarcane wastes), resulted in a slight increase in plant sepals content of protein and Phosphorus, whereas it has no distinct effects in Assuit. Plants from Sohag recorded higher content of protein and lower in anthocyanin than from Assuit, so organic farmyard manure enhanced Roselle plant growth, fruit and sepal yield. Ahmed *et al* [3] studied the effect of active dry yeast, farmyard chicken and animal manure on Roselle plants during the vegetative, flowering and fruiting stages; application significantly improved growth, yield of calyces and active substances. Chicken and animal manure enhanced growth and calyx quality, particularly at the low rates.

Nabila and Ali [10] found that both chicken and animal manure also foliar application of micronutrients at flower initiation and fruit setting, enhanced plant height, number of branches, fruits and mass production as well as fresh and dry weights of sepals per plant or per feddan.

Many studies have shown that the fertilizing power of organic farmyard manure is due to its content of stabilized organic matter and due to the amount of nutritive elements contained therein. Most researches with chicken manure has been directed to its use as a Nitrogen source with subsequent evaluation of mineralization and nitrification processes, it may increase soil organic matter, exchangeable Mg and K and available P. Fertilization with increasing exchangeable Potassium in the soil [11, 12]. Recently, with increasing mineral fertilizers cost in addition to their future availability and their environmental systems pollution, there is renewed interest in organic recycling, which can play an important role in reducing socio-economic and environmental problems to improve soil fertility and productivity [13].

Kandil *et al.* [12] found that increasing compost application to sandy soil significantly increased both dry matter production (in sepals) and fruits number. Compost is used to increase anthocyanin and ascorbic acid content in addition to reduce the acidity and glucose in sepals as mentioned by Postma *et al.* [14]. Intercropping (Roselle & Groundnut) increased crops yields, Roselle would be better intercropped with either legumes or cereals, but it is more compatible with annual legumes than cereals [15, 16].

Above El-Seoud *et al.* [17] showed that organic waste compost and combinations of biosolids, municipal solid wastes, water hyacinth composts and tafla shale deposits were incorporated into sandy soil, significantly increased both dry matter production (in sepals) and the number of fruits. Results indicated that organic composts are valuable organic fertilizers, particularly for poor sandy soils.

The main objective of this study was to find out whether sufficient and high quality yields can be produced with the sources allowed by organic farming rules (different levels of chicken manure and peanut compost waste) under Egyptian conditions, especially for medicinal and aromatic plants (Roselle plant). Coupled to this, most of the new reclaimed land in Egypt is sandy soils which are normally poor in essential plant nutrients.

MATERIALS AND METHODS

Two pot experiments were carried out during two seasons 2004/2005 and 2005/2006 under greenhouse of National Research Center, Dokki, Cairo, Egypt.

Experiment: The design of the experiment was complete randomized block with three replicates. The seeds of Roselle were sown on May, 15th, 40 cm diameter porous pots filled with 10 Kg soil.

Three weeks after sowing, the seedlings were thinned to one seedling per pot and directly treated once with chicken manure or peanut compost of different concentrations as follows:-

- Control
- Chicken manure 4 ton/feddan (40 g pot^{-1})
- Chicken manure 8 ton/feddan (80 g pot^{-1})
- Chicken manure 12 ton/feddan (120 g pot^{-1})
- Peanut compost waste 8ton/feddan (80 g pot^{-1})
- Peanut compost waste 16ton/feddan (160 g pot^{-1})
- Peanut compost waste 24ton/feddan (240 g pot^{-1})

Soil analysis: Physical and chemical analysis of soil used is shown in Table 1

Particle size distribution along with soil moisture of the soil samples was determined as desorbed by Blackmore [19]. Soil organic matter $CaCO_3$, EC, pH as well as soluble cations and anions were determined according to Black *et al.* [19]. Determination of macro and micro nutrients were according to Cottenie *et al.* [20]. Seeds of

Table 1: Some physical and chemical analysis of the chicken manure and peanut compost waste

						Available nutrients (%)		DTPA. extractable (ppm)			
	Organic carbon (%)	Total N (%)	C/N ratio	pH 1: 25	EC ds m^{-1}	P	K	Fe	Mn	Zn	Cu
Chicken manure	27.60	2.8	9.85	6.34	1.01	1.7	1.4	17.6	17	28.0	31.7
Peanut compost wastes	36.18	1.4	25.84	6.50	0.62	1.6	2.7	30.0	9	11.6	21.1

Table 2: Chemical and physical characteristics of the used soil and its initial fertility status

Particle size distribution (%)				Soil moisture content (%)			
Sand	Silt	Clay	Texture	Saturation	FC	WP	AW
13.40	25.00	61.60	Clay	75.30	42.60	12.30	30.30
		%					
pH	EC ds m^{-1}	$CaCO_3$	OM				
8.40	3.10	3.27	0.87				
Soluble cations (mg l^{-1})				Soluble anions (mg l^{-1})			
Ca^{++}	Mg^{++}	K^{+}	Na^{+}	$CO_3^{=}$	HCO_3^{-}	Cl^{-}	$SO_4^{=}$
7.50	5.00	0.60	22.70	0.00	9.20	21.60	5.00
Nutrients content							
%				Ppm			
N	P	K		Fe	Mn	Zn	Cu
13.20	3.80	0.48		45.40	22.82	19.46	13.60
Nicle (ppm)				Cobalt (ppm)			
Soluble	Available	Total		Soluble	Available	Total	
0.56	3.74	13.50		0.49	4.43	15.00	

Soil pH was measured in 1:2.5 soil water suspension, EC was measured as ds m^{-1} in soil, FC = Field Capacity, WP = Wilt Point, AW = Available water

Roselle (*Hibiscus, sabdariffa L.*) were obtained from Medical and Aromatic Plants Research, Ministry of Agriculture.

Basic dressing was applied to all plants and consisted of Nitrogen (Ammonium sulphate 20.5% N), Phosphorus (Superphosphate 15.5% P_2O_5) and Potassium (Potassium sulphate 48% K_2O) at the ratio 2 : 2 : 1 added twice, the first after a month from emergence and the second at beginning of the flowering. The samples from plants were taken at fruiting stage. The data were recorded as follows:-Plant height (cm), number of branches and fruits/plant, fresh and dry weights of calyces and epicalyces g/plant.

Chemical analysis: Chlorophyll content during vegetative stage was determined according to AOAC [21]. Soluble sugars (as glucose) during vegetative stage determined by the method [22], through adding anthron reagent, the color read at 630 nm by spectrophotometer.

Representation samples of leaves, calyces and epicalyces of flowers were dried under shading and then dried again at 70°C until constant weight. Anthocyanin was colorimetrically determined in dried calyces and epicalyces of flowers according to the method described by Fahmy [23]. Flavons content in calyces were estimated according to Delosse [24]. Macronutrients (N, P and K) as well as micronutrients (Fe, Mn, Zn and Cu) content were determined according to Jackson [25].

RESULTS AND DISCUSSION

From the economic viewpoint, morphological traits in addition to fresh and dry weights are the most interesting parameters for studying and recommending the more

Table 3: Effect of organic matter application on morphological parameters of Roselle plants in two seasons

		Plant height (cm)		Number of branches		Number of fruits/plant	
Treatment	g pot^{-1}	1st season	2nd season	1st season	2nd season	1st season	2nd season
Chicken manure	Control	65.5	63.8	5	4	9	8
	40	80.8	78.5	8	7	15	14
	80	98.0	95.6	10	10	20	18
	120	115.7	111.0	14	13	24	22
	160	104.8	101.2	9	8	18	17
Peanut waste	80	77.8	74.6	7	6	13	12
	160	91.0	87.7	9	8	17	15
	240	105.3	102.0	11	12	21	20
	320	95.8	90.9	8	9	18	15
LSD 5%	10.3	5.2	3.0	3	5	4	

Table 4: Effect of organic matter application on fresh and dry weights of Roselle calyces in two seasons

		Calyces weight (g/plant)			
		Fresh weight		Dry weight	
Treatment	g pot^{-1}	1st season	2nd season	1st season	2nd season
Chicken manure	Control	16.60	14.80	3.40	3.04
	40	23.30	21.50	4.71	4.36
	80	29.50	29.10	5.97	4.77
	120	34.00	31.90	7.22	6.72
	160	27.80	25.60	5.89	5.39
Peanut waste	80	21.60	19.50	4.61	4.19
	160	27.50	25.60	5.80	5.36
	240	31.10	31.90	6.57	6.11
	320	25.40	22.90	5.35	4.80
LSD 5%	5.32	3.71	1.22	0.27	

suitable compost applications. However, our findings could be summarized as follows:-

Effect of organic matter applications on growth parameters of Roselle plants: Growth parameters of Roselle plants as affected by different types or levels of compost applications are shown in Table 3 and 4. Regarding plant height (Table 3), it could be easily detected that all used treatments had the capacity to increase plant height significantly. Chicken manure (120 g pot^{-1}) exhibited the most promising effect (115.7 cm) followed by peanut waste (240 g pot^{-1} recorded 105.3 cm) and chicken manure (recorded 104.8 cm by 160 g pot^{-1}). It is obvious that the increase magnitude in plant height was increased gradually by raising the level of application. That holds for the most effective compost applications. For example the obtained increase in Roselle plant height as a result of chicken manure was 104.8 and 115.78 cm with regard to level of 120 and 160 respectively. Peanut waste showed a maximum increase with 240 g pot^{-1} followed by 320 g pot^{-1}.

Numbers of branches and fruits/plant had a same trend in response to the used organic composts. The maximum increment in number of branches was obtained from Chicken manure (120 g pot^{-1}) followed by peanut waste (240 g pot^{-1}) and (160 g pot^{-1}) applications, while promising № of fruit/plant increment was in response to the used organic composts recorded by Chicken manure (120 g pot^{-1}) followed by peanut waste (240 g pot^{-1}), Chicken manure (80 g pot^{-1}), (160 g pot^{-1}), peanut waste (160 g pot^{-1}), (320 g pot^{-1}) and ended by Chicken manure (40 g pot^{-1}).

In this regard, as illustrated in Table 4 both Chicken manure (120 g pot^{-1}) and peanut waste (240 g pot^{-1}) treatments increased fresh and dry weights of calyces up to 2 folds. Comparing the obtained results from the two seasons indicate that Chicken manure (120 &80 g pot^{-1}) and peanut waste (240 g pot^{-1}) had the capacity to increase Roselle yield and maximum value was obtained from Chicken manure (120 g pot^{-1}).

The above mentioned growth parameters reveal that the studied compost treatments had the function to stimulate Roselle plant growth and in turn to increase its economic productivity. This beneficial effect is attributed to the higher nutritional value of the tested compost extra to its capacity to improve the hydro-physical properties

Table 5: Effect of organic matter application on Chlorophyll, Soluble sugars of Roselle leaves & anthocyanin pigments contents of Roselle calyces (mg g^{-1} dry weight)

		Chlorophy II		Soluble sugars		Anthocyanins		Flavones	
Treatment	g pot^{-1}	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Chicken manure	Control	5.92	5.88	60.2	61.6	2.80	2.69	14.1	12.9
	40	6.62	6.58	62.6	63.5	2.34	2.5	19.3	18.1
	80	8.20	8.22	77.5	76.2	2.42	2.51	22.6	21.4
	120	9.18	9.15	82.2	80.8	2.87	2.69	26.8	25.3
	160	8.61	8.43	78.9	77.7	2.63	2.58	23.0	21.9
Peanut waste	80	6.43	6.70	63.2	64.2	2.59	2.43	18.2	17.1
	160	7.06	7.11	64.6	65.7	2.02	2.21	21.3	20.2
	240	8.80	8.83	80.7	82.5	2.71	2.77	25.6	24.3
	320	7.41	7.64	72.3	73.8	2.33	2.72	21.7	20.5
LSD 5%		0.91	0.71	6.11	7.20	0.60	0.48	3.0	2.9

of soil under such conditions. Numbers of branches and fruits, fresh and dry weights reveal that the application of different composts significantly increased reproduction organs. The present results and conclusion could be supported by previous relevant work Abou El-Seoud *et al.* [26], Babatunde [15], Nabila and Ali [10] and Fbabatunde [16] and Postma *et al.* [14].

Effect of organic matter application on chlorophyll, soluble sugars, anthocyanin and flavones in roselle plants: It is well known that pigment content and consequently resulted reducing sugar served as criteria to monitor any stimulatory effect on plant growth. Data in Table 5 demonstrate that plants leaves grown under both organic compost treatments had more chlorophyll and sugar (as glucose) content. That holds the true for any compost type or rate. This positive impact should be attributed to the promising role of the used composts to supply the growing plants with the required micro and macro-nutrients. Naturally, these compounds play an important role in the metabolic processes like photosynthesis, respiration and as a result, carbohydrate synthesis. In this regard, Abou-El-Seoud *et al.* [26] confirmed that K-fertilization stimulates carbohydrate synthesis in Roselle plant leaves. In addition, some heavy metals may accumulate in plant tissues, grown on soil treated with organic composts and affect plant metabolism [14]. In this connection, Abo-El-Seoud *et al.* [26] added that the positive impact of low levels of some heavy metals enhances chlorophyll and carbohydrate content in the treated plants. Our finding was in coincident with Okosun *et al.* [27].

Concerning anthocyanins, it is well known that they are directly related to flavonoids, which can be found as free aglycons (anthocyanidins) or, more often, as heterosides (anthocyanosides). They are coloured compounds; their colour varying with the pH, the applied organic compost induced a significant increment in flavons content in Roselle sepals expressed as mg g^{-1}. DW due to the significant increase in sepals yield.

The effective capacity of the tested organic composts to increase total anthocyanins and flavons content is in the following descending order: Chicken manure (120 g pot^{-1})>peanut waste (240 g pot^{-1})>Chicken manure (160 g pot^{-1})>Chicken manure (80 g pot^{-1})>peanut waste (320 g pot^{-1})>peanut waste (160 g pot^{-1})>Chicken manure (40 g pot^{-1}) peanut waste (80 g pot^{-1}). Thus, the most superior effect was exerted by the Chicken manure (120 g pot^{-1}) treatment. Consequently this positive impact is due mainly to the effectiveness of the applied composts to increase sepals yield rather than affecting the coloring matter content. Similar results were obtained by Abo-El-Seoud *et al.* [26] and Tsaipi and Huang [28] on Roselle plants treated with organic waste composts with K-fertilizers. They stated that increasing total anthocyanin content reflecting the importance of organic compost mineral nutrition content and fertilizers.

To support the physiological and biochemical effect of organic farmyard manure on the Roselle plant yield, it was important to study the effect of all studied treatments on total content of macro-and micro-nutrients in leaves and calyces.

Effect of organic matter application on some macro-nutrients content in leaves and calyces of Roselle plants: Plants require mineral nutrients in all metabolic processes, e.g. K is essential for the formation of starch, protein synthesis, photosynthate partitioning, normal stomatal function and above all as an activator to a number of monovalent-cation requiring enzyme [29]. It is well documented that all mineral elements are essential for growth and development. Some elements have specific

Table 6: Effect of organic matter application on some macronutrients content (%) in leaves and calyces of Roselle plants in two seasons

		Leaves			Calyces		
Treatment	g pot^{-1}	N	P	K	N	P	K
		(Macronutrients%) 1st season					
Chicken manure	Control	2.09	0.18	0.82	1.87	0.26	2.89
	40 g	2.31	0.23	0.94	1.94	0.32	2.98
	80 d	2.47	0.27	1.01	2.06	0.40	3.64
	120 a	2.56	0.33	1.06	2.18	0.47	4.15
	160 c	2.50	0.32	0.98	1.97	0.54	3.89
Peanut waste	80 h	2.27	0.21	0.87	1.86	0.30	2.93
	160 f	2.38	0.24	0.94	1.90	0.36	3.66
	240 b	2.45	0.28	1.01	2.01	0.43	4.21
	320 e	2.18	0.21	0.93	1.92	0.34	3.81
LSD 5%	0.10	0.06	0.07	0.04	0.03	0.01	
		(Macronutrients%) 2nd season					
Chicken manure	Control	2.13	0.21	0.85	1.92	0.31	2.93
	40	2.37	0.27	0.97	1.00	0.36	3.00
	80	2.51	0.34	1.08	2.10	0.43	3.71
	120	2.60	0.32	1.13	2.22	0.50	4.31
	160	2.42	0.31	0.99	2.03	0.41	3.95
Peanut waste	80	2.28	0.25	0.92	1.98	0.35	2.96
	160	2.39	0.29	0.96	1.95	0.41	3.72
	240	2.46	o.33	1.11	2.09	0.48	4.44
	320	2.28	0.26	1.02	1.98	0.40	3.06
LSD 5%	0.12	0.05	0.05	0.06	0.03	0.12	

nutritional or toxic effects on plants and that may also depress growth and yield, thus the effect of organic compost treatments on Roselle plant nutrition may substantially differ among their composition Table 1. Moreover different growing media appears to affect the distribution pattern of nutrient elements within various plant organs. Accordingly, Table 6 illustrates macronutrients content in Roselle (leaves and calyces).

Since chicken manure and peanut compost wastes contained 1.7 and 1.6% total P respectively (Table 1) resulted in excessive high levels of available phosphorus in the soil. Chicken manure contained 1.4% total K and peanut compost wastes contained 2.7% total K, while N 2.8% Chicken manure and 1.4% for peanut compost wastes (Table 1), therefore application of chicken manure slightly increased N, K and P content in plant tissues. Our findings are in good agreement with Bevacqua and Mellano [11] and Kandil *et al.* [12].

Effect of organic matter application on some micro-nutrients content in leaves and calyces of Roselle plants: Roselle leaves or calyces were analyzed for their content of Fe, Mn, Zn and Cu in two seasons as demonstrated in Table 7. Heavy metals tend to accumulate in different concentrations. Application of Chicken manure (120 g pot^{-1}), peanut waste (240 g pot^{-1}) and Chicken manure (160 g pot^{-1}) caused a significant increase in Fe, Mn, Zn and Cu, however, the observed increase in Fe and Mn for peanut waste (240 g pot^{-1}) was statistically non-significant. On the other hand, the chicken manure treatment induced a significant enhancement in all elements concentrations.

It is worthy to mention that the detected heavy metals in Roselle leaves and calyces were around the normal levels in plant tissues as assumed by Abo-El-Seoud *et al.* [26]. That means, no risks of heavy metals pollution can result from the application of tested organic waste composts. Thus we recommended the application of the composts of tested organic wastes to maximize sandy soils and its productivity of Roselle plant. Although chicken manure compost and peanut compost contain N, P and K, the plots chicken manure was more effective in increasing the Roselle growth. Our findings are in good agreement with those obtained by Kandil *et al.* [12].

Table 7: Effect of organic matter applications on some micronutrients content (%) in leaves and calyces of Roselle plants in two seasons

		Leaves				Calyces			
Treatment	g pot^{-1}	Fe	Mn	Zn	Cu	Fe	Mn	Zn	Cu
		(Micronutrients ppm) 1st season							
Chicken manure	Control	132	65.2	51.2	42.2	148	52.5	40.4	31.7
	40	140	72.5	58.0	50.0	155	60.0	51.5	37.8
	80	144	83.3	65.5	55.3	154	58.5	52.2	41.0
	120	160	91.6	72.0	61.9	171	73.4	61.6	46.8
	160	149	85.0	66.5	57.1	165	67.6	53.9	40.1
Peanut waste	80	123	57.5	51.8	46.0	138	43.5	44.2	30.5
	160	132	63.0	59.0	51.3	146	50.6	47.6	36.6
	240	141	72.3	67.1	56.1	163	66.7	57.2	42.0
	320	135	64.0	60.4	49.2	147	52.0	45.9	35.1
LSD 5%	3	2.4	3.4	2.3	5	3.1	2.7	2.6	
		(Micronutrients ppm) 2nd season							
Chicken manure	Control	126	60.2	46.3	35.1	140	45.0	33.0	28.2
	40	134	66.0	53.0	41.2	146	53.6	38.6	34.5
	80	142	73.3	60.6	47.4	152	59.5	45.4	39.0
	120	155	81.0	68.7	60.6	160	65.7	52.8	46.0
	160	140	75.4	62.0	52.3	152	58.6	45.5	40.2
Peanut waste	80	118	51.1	45.1	38.1	131	36.7	39.0	26.6
	160	127	58.0	52.3	43.3	138	41.8	43.4	41.5
	240	136	65.0	58.0	48.5	143	49.5	48.8	47.1
	320	128	54.0	50.1	41.7	137	43.0	45.1	40.3
LSD 5%	4	2.9	3.3	2.6	4	2.9	2.4	2.5	

Generally organic matter supplies nutrients, acts as buffer against pH change, protects against heavy metal and salt toxicity, it can increase water holding and cation exchange capacity especially in sandy soil. It adds structure, stability and permeability to soils high in clay, as a source of nutrients, which usually slow released as organic matter is decomposed. It is well known that compaction and many other soil problems are mainly due to loss of soil organic carbon. In addition organic fertilization gave similar effects on macro-and micronutrients in the soils. In case of chicken manure, it gave higher extractable nutrients, as confirmed by Bevacqua and Mellano [11], Kandil *et al*. [12]. So growing conditions and Roselle requirements vary from region to another, used compost can benefit from information that accurately characterizes the compost products. This data can improve the utilization of compost in ways to best meet particular needs and to fit a specific situation. The specific characteristics of the used composts determine how and in which applications it can be best utilized. So characterization data helps the compost user obtain product that is appropriate for use.

REFERENCES

1. Bola, O. and O.O. Aboaba, 2004. Microbiological and Physico-chemical Evaluation of Some Non-alcoholic Beverages. Pak. J. Nutr., 3: 188-192.
2. Mohamed, R., J. Fernandez, M. Pineda and M. Aguilar, 2007. Roselle *(Hibiscus sabdariffa)* Seed Oil is a Rich Source of γ-Tocopherol. J. Food Sci., 72: S207-S211.
3. Ahmed, S.K., E.O. El-Ghawas and A.F. Aly, 1998. Effect of dry yeast and organic manure on Roselle plant. Egyp. J. Agric. Research. Agric. Research Center Ministry of Agric. and Land Reclamation, Giza, Egypt, 76: 1115-1142.
4. Pau, L.T., Y. Salmah and M. Suhaila, 2002. Antioxidative properties of roselle (*Hibiscus sabdariffa* L.) in linoleic acid model system. Nutr. Food Sci., 32: 17-20.
5. Osuntogun, B. and O.O. Aboaba, 2004. Microbiological and physico-chemical evaluation of some non-alcoholic beverage. Pak. J. Nutr., 3: 188-192.

6. Peng-Kong, W., S. Yusof, H.M. Ghazali and Y.B. Che Man, 2002. Physico-chemical characteristics of roselle (*Hibiscus sabdariffa* L.). J. Nutr. Food Sci., 32: 68-73.
7. Wong, P.K., S. Yusof, H.M. Ghazali and Y.B.C. Man, 2002. Physico-chemical characteristics of roselle (*Hbiscus sabdariffa* L.). Nutr. Food Sci., 32: 68-73.
8. Peng-Kong, W., S. Yusof, H.M. Ghazali and Y.B. Che Man, 2003. Optimization of hot water extraction of roselle juice using response surface methodology: A comparative study with other extraction methods. J. Sci. Food Agric., 83: 1273-1278.
9. El-Keltawi, N.E., A.A. Tawfik and A.M. Ahmed, 2003. Roselle (*Hibiscus sabdariffa L.*) production as affected by two natural alternatives to farmyard manure: II-Chemical assessment of sepal quality. Assuit J. Agric. Sci., 34: 307-321.
10. Nabila, Y.N. and M.S. Aly, 2002. Variations in productivity of (*Hibiscus sabdariffa L.*) in response to some agricultural supplementation. Ann. Agric. Sci., Faculty of Agric. Ain Shams Univ., Cairo, Egypt, 47: 875-892.
11. Bevacqua, R.F. and V.J. Mellano, 1993. Sewage sludge compost, cumulative effects on crop growth and soil properties. Compost Sci. Util., 1: 34-37.
12. Kandil, M., S. Ahmed, C. Sator and E. Schnug, 2002. Effect of organic and inorganic fertilisation on fruit and essential oil yield of fennel (*Foeniculum vulgare* Mill.) grown in Egypt. In: Proceeding Fachtagung für Heil-und Gewuerzpflanzen Ahrweiler (im Druck).
13. Parr, J.F. and S.B. Hornick, 1990. Recent development in alternative agriculture in the United States. In proc. of In thl. Conf. on kyussei Nature Forming. October 17-21, 1989, Khankean Univ. Tailand.
14. Postma, J., M. Montanari, P. Vanden and H.J.F. Boogert, 2003. Microbial enrichment to enhance the disease suppressive activity of compost. Euro. J. Soil Biol., 39: 157-163.
15. Babatunde, F.E., 2000. Effect of intercroping and cropping sequence on the marketable yield and productivity of Celosia and Okra. J. Agric. Environ., 1: 55-61.
16. Fbabatunde, F.E., 2003. Intercrop productivity of Roselle in Nigeria. Afr. Crop Sci. J., Afr Crop Sci. Soc., 11: 43-47.
17. El-Seoud, M.A.A., M.F. Abdel-Sabour and E.A. Omar, 1997. Productivity of Roselle (*Hibiscus sabdariffa L.*) plant as affected by organic waste composts addition to sandy soil. Bull. Natl. Res. Center, Cairo, 22: 495-505.
18. Blackmore, J.T., 1972. Ernst Mach. His Work, Life and Influence. Berkeley: University of California Press, pp: 213-216.
19. Black, C.A., D.D. Evans, L.E. Ensminger; G.L. White and F.E. Clark, 1982. Methods of soil Analysis, Agron. Inc. Madison, Wisc., Part 2, pp: 487-490.
20. Cottenie, A., M. Verloo, L. Kiekens, G. Velgh and R. Camelynk, 1982. Chemical Analysis of plants and soils, State Univ., Gheat, Belgium, pp: 44-45.
21. AOAC, 1990. Official Methods of Analysis of Association of Official Analytical Chemists. Pub. By the Association of Official Analytical Chemists, Inc., Arling West Virginia, USA.
22. Sadawivam, S. and A. Manickan, 1996. Biochemical methods, Second Edition, New Age International Limited, Publication. ISBN 81:224-0976-8, India.
23. Fahmy, R., 1970. Different quantitative estimation of some organic compounds in plants. (in Arabic) Anglo Egypt, Press, Cairo, Egypt, pp: 156.
24. Delosse, I., 1970. Quantitative determination of flavons in Plants. Springer, New York, pp: 354.
25. Jackson, M.L., 1973. Soil chemical analysis. New Delhi, India: Prentice Hall of India Pvt. Ltd., pp: 498.
26. Abou El-Seoud, M.A., M.F. Abd El-Sabour and E.A. Omer, 1997. Productivity of Roselle (*Hibiscus sabdariffa L.*) plant as affected by organic waste composts addition to sandy soil. Bull. Natl. Res. Center, Cairo, Egypt, 22: 495-505.
27. Okosun, L.A., M.D. Magaji and A.I. Yakubu, 2006. The Effect of Nitrogen and Phosphorus on Growth and Yield of Roselle (*Hibiscus sabdariffa* var. *sabdariffa* L.). In a Semi Arid Agro-Ecology of Nigeria. J. Plant Sci., 1: 154-160.
28. Tsaipi J. and H.P. Huang, 2004. Effect of polymerization on the antioxidant capacity of anthocyanins in Roselle. Food research international (Food res. int.) ISSN 0963-9969 Taiwan, Province de Chine, 37: 313-318.
29. Sarwat, M.I. and M.H. El-Sherif, 2007. Inducing salt tolerance in some rice varieties (*Oryza sativa L.*) by using some growth regulators. J. Biol. Chem. Environ. Sci., 2: 189-215.