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EFFECT OF COMPOST AND SOME BIOSTIMULANT TREATMENTS ON GUAR PLANTS
B- CHEMICAL CONSTITUENTS AND GUARAN PRODUCTIVITY

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ABSTRACT: This experiment was conducted at Abo Qurkas district, Minia Governorate during the two successive seasons of 2014 and 2015 to study the effect of compost and biostimulant treatments on chemical constituents and guaran productivity. The obtained results revealed that fertilizing guar plants with compost (2.5, 5.0 and 7.5 ton/fed) significantly increased guaran productivity (guaran % and guaran yield per plant and /fed), pigments (chl. a, b and carotenoids) and N, P , K, protein and total carbohydrates %. The medium level of compost (5.0 ton/fed) was much more effective than low and high level (2.5 and 7.5 ton/fed) in this concern. The plants treated with Vit. E or plant extracts (garlic, moringa, aloe, green tea) resulted significantly increases in guaran productivity and some chemical constituents (pigments and N, P and K %) in both seasons, except green tea extract (300 ppm) for guaran productivity. Among such treatments, either garlic extract (300 ppm) or green tea extract (150 ppm) gave the best results. It could be recommended to fertilize guar plants with compost (5.0 ton/fed) and spraying plants with garlic extract (300 ppm) or green tea extract (150 ppm) to achieve the maximum yield of guaran.

Key words: *Cyamposis tetragonoloba*, compost, vitamin E, garlic extract, moringa extract, aloe extract, green tea extract, chemical constituents, guaran.

INTRODUCTION

Guar *Cyamposis tetragonoloba*, L. Taub. (cluster bean vegetable), belongs to family Fabaceae (Vinizky and Ray, 1988). The seed contains 12.6% total lipids and the endosperm contains guaran gum (20-30%), a polymer of galactose (36%) and mannose (64%), known as galactomannan (Deraz, 1993). The gum is used in food industry as a stiffener in soft ice cream, stabilizer for cheese, instant pudding, whipped cream substituents and meat binders (El-Etriby *et al*., 1994). It can also be used for treating mellitus, hyperglycemia, glycosuria and hyperlippopropteinemia and the seeds are used as a laxative (Whistler and Hymowitz, 1980).

Organic manure are important for medicinal plants to produce the best product in both quantity and quality and its also very safe for human health and environment (Dauda *et al*., 2008). Organic manures had positive effect on guaran % and guaran content, as well as, chemical constituents of guar plant (Gomaa and Mohamed, 2007; Patel *et al*., 2010, Shehata, 2013 and Chavan *et al*., 2015).

Biostimulant materials enhanced nutrient uptake, protein content, photosynthetic pigments Shehata (2013) on guar mentioned that Vit. E increased guaran % and yield, photosynthetic pigments, NPK elements, carbohydrates and protein %. Spraying plants with plant extracts had positive effect and stimulated photosynthetic pigments, carbohydrates, protein, N, P and K % of many plants species such as marjoram (Mady, 2009 using garlic extract), rocket plants (Abdalla, 2013 using moringa extract) basil plant (Ahmed *et al*., 2014 using aloe extract) and keitte mango trees (Ahmed *et al*., 2014) using green tea extract.

The objective of this work was to investigate the effect of compost, and biostimulant treatments i.e. Vit. E and plant extracts (garlic, moringa, aloe and green tea) on guaran production and chemical constituents of guar plants.

MATERIALS AND METHODS

The present work was concluded at Abo Qurkas (Kafr Leps village), Minia governorate during 2014 and 2015 seasons. Guar seeds were obtained from floriculture, Faculty of Agriculture Nursery, Minia University. Seeds were sown at the end of March (25^{th} and 30^{th} in the first and second seasons, respectively). The experimental unit (plot) was 1.8×1.5 meters and containing 3 rows, 60 cm apart and seeds were sown in hills, 25 cm apart on one side of the row, each plot contained 8 hills and plants were thinned to two plants/hill after one month from sowing date. The experiment was arranged in a split plot design with three replicates. The main plots (A) included four levels of compost (0, 2.5, 5.0 and 7.5 ton/fed), while, the sub-plots were devoted to eleven treatments; control, alpha tocopherol (vit. E) at 10 and 20 ppm, garlic extract at 150 and 300 ppm, moringa extract at 150 and 300 ppm, aloe extract at 150 and 300 ppm and green tea extract at 150 and 300 ppm. Compost was added during soil preparation in both seasons. Table (a) and (b) shows the analysis of the used soil and compost, respectively.

Both Vit. E and plant extract were manually sprayed 3 times. The first one was added after 35 days from planting date and two weeks thereafter. The plants were harvested on the fourth of August in both seasons.

The plants were harvested on the fourth week of August in both seasons.

- Guaran determination: guaran % according to Anderson (1949),then guaran yield/plant (g) and /fed (kg) were calculated.
- Photosynthetic pigments (chlorophyll a, b and carotenoids) according to Moran (1982).
- Determining the percentage of nitrogen (Wilde *et al.*, 1985), phosphorus (Champan and Pratt, 1975) and potassium (Cotteine *et al.*, 1982) in the dry herb.

Table a. Physical and chemical analysis of the experimental soil according to (Jackson, 1973).

Soil character	Values		Soil character	Values	
	1st season	2nd season		1st season	2nd season
Sand %	29.00	30.00	**Available P %**	14.98	15.00
Silt %	30.00	30.00	**Exchangeable K^+ mg/100 g soil**	2.16	2.16
Clay %	41.00	40.00	**Exch. Ca^{++} mg/100 g soil**	31.55	31.50
Soil type	Clay loam		**Exch. Na^+ mg/100 g soil**	2.39	2.40
Organic matter %	1.68	1.71	**Fe**	7.54	7.50
$CaCO_3$ %	2.08	2.10	**Cu-**	2.16	2.20
pH 1:2.5	7.85	7.78	**Zn**	2.65	2.64
E.C. m mhose/cm	1.04	1.08	**Mn**	7.35	7.39
Total N %	0.09	0.10			

Table b. Physical and chemical properties of the used compost according to Arid Land Agricultural Research Unit, Fac. of Agric. Ain Shams Univ.

Properties	Value	Properties	Value
Dry weight of 1 m^3	450 kg	**C/N ratio**	14.1-18.5
Fresh weight of 1 m^3	650-700 kg	**NaCl %**	1.1-1.75
Moisture (%)	25-30	**Total P %**	0.5-0.75
pH (1:10)	7.5-8	**Total K %**	0.8-1.0
E.C. (m mhose/cm)	2-4	**Fe ppm**	150-200
Total N %	1-1.4	**Mn ppm**	25.56
Org. matter %	32-34	**Cu ppm**	75-150
Org. carbon %	18.5-19.7	**Zn ppm**	150-225

Table c. Some chemical constituents of garlic according to Arid Land Agricultural Research Unit, Fac. of Agric. Ain Shams Univ.

Components	GA_3	IAA	ABA	Ca^{+2}	Mg^{+2}	SO_4^{-2}	Zn^{+2}	Mn^{+2}
Concentration	16.33 mg/100 g f.w.)	Trace	Trace	1.36 %	1.23 %	0.18 %	66.5 ppm	94.4 ppm

Table d. Determination of phytohormones (GA_3, IAA and ABA) in *Aloe vera* plant according to Arid Land Agricultural Research Unit, Fac. of Agric. Ain Shams Univ.

Component	GA_3	IAA	ABA	Carbohydrates
Concentration (mg/100 g fresh weight)	16.00	0.63	3.06	10.01 %

Table e. Analysis of Moringa fresh leaves according to Arid Land Agricultural Research Unit, Fac. of Agric. Ain Shams Univ.

Component	Leaves	Component	Leaves	Amino acids	Leaves
Calories/100 g leaves	91	Sulfur (mg) /100 g leaves	137	Arginine (mg) /100 g leaves	402
Protein (g)/ 100 g leaves	6.7	Selenium (mg) /100 g leaves	0	Histidine(mg) /100 g leaves	141
Fat (g) /100 leaves	1.8	Zinc (mg) /100 g leaves	0	Isoleucine(mg) /100 g leaves	422
Carbohydrate (g) /100 g leaves	13.4	Oxalic Acid (mg) /100 g leave	101	Leucine (mg) /100 g leaves	623
Fiber (g) /100 g leaves	0.8	Vitamin A (mg) /100 g leaves	6.8	Lysine (mg) /100 g leaves	288
Calcium (mg) /100 g leaves	435	Vitamin B (mg) /100 g leaves	423	Methionine(mg) /100 g leaves	134
Copper (mg) /100 g leaves	1.1	Vitamin B_1 (mg) /100 g leaves	0.21	Phenylalanine(mg) /100 g leaves	429
Iron (mg) /100 g leaves	8	Vitamin B_2 (mg) /100 g leaves	0.05	Threonine(mg) /100 g leaves	328
Potassium (mg) /100 g leaves	261	Vitamin B_3 (mg) /100 g leaves	0.8	Tryptophan(mg) /100 g leaves	127
Magnesium (mg) /100 g leaves	25	Vitamin C (mg) /100 g leaves	220		
Phosphorus (mg) /100 g leaves	71	Vitamin E (mg) /100 g leaves	0		

- Total carbohydrates percentage : Total carbohydrates including poly-saccharides in dry leaves of each experiment unit were colorimetrically determined with the anthrone sulphuric acid method (Fales, 1951)
- Protein percentage: Protein percentage was estimated by multiplying nitrogen percent by 6.25. This was based on the assumption that the protein contains 16 % nitrogen, according to the method of Ranganna (1978).

The plant extracts (garlic, moringa, aloe, green tea) were prepared according to (El-Desouky *et al.*, 1998; Phiri and Mbewe, 2010; Wilfred *et al*., 1990 and Nie *et al.*, 2002).

Statistical analysis: the data of the two seasons were subjected to the statistical analysis of variance using MSTAT-C (1986). L.S.D. test at 0.05 was used to compare the average means of treatments.

RESULTS AND DISCUSSION

Guaran productivity:

Data presented in Table (1) revealed that guaran % and guaran yield (g/plant and kg/fed) in the dry seeds of *Cyamposis tetragonoloba* were significantly increased as a result of fertilizing plants with the three levels of compost (2.5, 5.0 and 7.5 ton/fed) over the control in the two seasons. The highest values were obtained due to the treatment of compost at the medium level (5.0 ton/fed). The enhancement of guaran % and yield obtained in the present work due to using organic manure was also, reported by Gomaa and Mohamed (2007); Patel *et al.* (2010) and Shehata (2013) on guar plants. The increment in all aforementioned characters of guar plants due to compost treatments reflected the positive biological and physiological roles of organic manure on the guaran % which were concluded by many authors as follows: adding organic manure in the soil improves soil permeability and releases carbon dioxide and certain organic acids during decomposition, prevention of nitrogen losses, maintenance and improvement of manural value, increasing the biological activity of soils, positive influence on quality (Saber, 1997; Judais and Rinaldi, 2001 and Taiwo *et al.*, 2001). Applying organic manure not only relieved material inhibition an autotoxic substance in the root exudates by cinnamic acid but also promoted growth, increased the content and composition of plant secondary metabolites (essential oils or alkaloids), improved root dehydrogenase, ATP ase and microorganism activities and nutrients uptake (Lu *et al*., 2002; Reuveni *et al*., 2002 and Zheljazkov, 2005).

Data indicated also that all ten examined treatments of Vit. E and plant extracts significantly increased guaran % and guaran yield/plant and /fed in both seasons, except the treatment of green tea extract (300 ppm) for guaran % and yield in both seasons and the treatment of vit. E (10 ppm) for guaran % in the second season. Among such treatments, garlic extract (300 ppm) followed by green tea extract (150 ppm) then vit. E (20 ppm) resulted the highest values in this concern. Shehata (2013) mentioned that vit. E had positive effect on guaran % and yield in the dry seeds of guar.

The interaction between main and sub plots (A×B) was significant for guaran % and guaran yield/plant and /fed in both seasons. In the first season, compost at 5 ton/fed in combination with garlic extract (300 ppm) or green tea extract (150 ppm) or Vit. E (20 ppm) and compost at 2.5 ton/fed with 300 ppm garlic extract resulted the highest % of guaran. In the second season, either used compost at 5.0 or 2.5 ton/fed with any spraying of garlic extract (300 ppm), green tea extract (150 ppm) and Vit. E (20 ppm) gave the best interaction treatments for guaran (Table, 1). The best interaction for guaran yield/plant and /fed in both seasons were obtained with compost (5.0 ton/fed) plus garlic extract (300 ppm) or green tea extract (150 ppm) as shown in Table (1).

Table 1. Effect of compost, vitamin E and some plant extracts (garlic, moringa, aloe and green tea) treatments on guaran percentage, guaran yield/plant and /fed of guar (*Cyamopsis tetragonoloba*, L.) plants, during the first and second seasons.

Vitamin E and some plant extracts treatments (B)	Compost levels (ton/fed) (A) 1st season (2014)					2nd season (2015)				
	0.0	2.5	5.0	7.5	Mean (B)	0.0	2.5	5.0	7.5	Mean (B)
Guaran %										
Control	11.02	11.78	12.18	11.42	11.60	10.82	11.66	11.69	11.11	11.32
Vitamin E at 10 ppm	11.63	12.12	12.52	11.84	12.03	11.45	12.01	12.16	11.66	11.82
Vitamin E at 20 ppm	13.19	14.37	14.83	14.06	14.11	13.04	14.03	14.48	13.53	13.77
Garlic extract 150 ppm	11.85	12.39	12.73	12.28	12.31	11.60	12.22	12.44	12.04	12.08
Garlic extract 300 ppm	13.83	14.86	15.31	14.41	14.60	13.70	14.67	15.02	13.94	14.33
Moringa extract 150 ppm	12.79	13.82	13.92	13.61	13.54	12.64	13.57	13.67	13.13	13.25
Moringa extract 300 ppm	12.98	14.12	14.31	13.84	13.81	12.81	13.77	14.21	13.33	13.53
Aloe extract 150 ppm	12.02	12.73	12.97	12.57	12.57	11.84	12.61	12.67	12.36	12.37
Aloe extract 300 ppm	12.39	13.44	13.58	13.17	13.15	12.30	13.14	13.39	12.90	12.93
Green tea extract 150 ppm	13.66	14.68	15.02	14.28	14.41	13.50	14.46	14.79	13.74	14.12
Green tea extract 300 ppm	11.28	11.93	12.33	11.68	11.81	11.05	11.83	11.97	11.47	11.58
Mean (A)	12.42	13.29	13.61	13.01		12.25	13.09	13.32	12.66	
L.S.D. at 5 %	A: 0.23		B: 0.30	AB: 0.60		A: 0.22		B: 0.56	AB: 1.12	
Guaran yield/plant (g)										
Control	0.91	1.27	1.43	1.10	1.17	0.87	1.20	1.35	1.02	1.10
Vitamin E at 10 ppm	1.14	1.53	1.80	1.30	1.44	1.13	1.44	1.68	1.25	1.37
Vitamin E at 20 ppm	2.21	2.99	3.34	2.63	2.78	2.12	2.81	3.20	2.45	2.63
Garlic extract 150 ppm	1.35	1.70	1.91	1.52	1.62	1.28	1.60	1.85	1.45	1.54
Garlic extract 300 ppm	2.62	3.38	3.82	2.99	3.19	2.50	3.24	3.63	2.79	3.03
Moringa extract 150 ppm	1.88	2.46	2.66	2.26	2.31	1.80	2.32	2.59	2.12	2.20
Moringa extract 300 ppm	2.09	2.71	2.92	2.48	2.54	2.02	2.59	2.83	2.30	2.43
Aloe extract 150 ppm	1.53	1.86	2.13	1.70	1.80	1.45	1.76	2.03	1.61	1.71
Aloe extract 300 ppm	1.72	2.19	2.43	2.10	2.10	1.63	2.08	2.36	1.97	2.00
Green tea extract 150 ppm	2.44	3.21	3.60	2.80	3.00	2.33	3.13	3.44	2.65	2.88
Green tea extract 300 ppm	1.03	1.37	1.62	1.22	1.30	0.97	1.31	1.55	1.16	1.24
Mean (A)	1.69	2.20	2.47	1.97		1.61	2.09	2.36	1.85	
L.S.D. at 5 %	A: 0.25		B: 0.20	AB: 0.40		A: 0.08		B: 0.16	AB: 0.32	
Guaran yield/fed (kg)										
Control	48.66	67.60	76.13	58.41	62.42	46.51	63.74	72.01	54.34	58.92
Vitamin E at 10 ppm	61.03	81.51	95.82	69.46	76.67	60.03	76.86	89.56	66.85	73.13
Vitamin E at 20 ppm	117.76	159.26	178.28	140.30	148.17	113.08	149.73	170.59	130.68	140.42
Garlic extract 150 ppm	72.11	90.60	102.04	81.02	86.20	68.42	85.57	98.86	77.12	82.34
Garlic extract 300 ppm	139.70	180.38	203.89	159.24	170.14	133.49	172.75	193.54	148.92	161.57
Moringa extract 150 ppm	100.21	131.20	141.72	120.49	123.12	95.93	123.69	138.30	112.88	117.31
Moringa extract 300 ppm	111.59	144.36	155.62	132.35	135.52	107.81	138.21	151.12	122.56	129.53
Aloe extract 150 ppm	81.61	99.12	113.44	90.77	96.00	77.17	93.62	108.46	86.09	91.11
Aloe extract 300 ppm	91.65	116.55	129.43	112.10	112.14	86.85	111.15	125.69	104.92	106.82
Green tea extract 150 ppm	130.12	171.31	192.02	149.58	160.16	124.27	166.96	183.71	141.21	153.40
Green tea extract 300 ppm	55.17	72.85	86.15	65.03	69.54	51.68	70.03	82.42	61.72	66.21
Mean (A)	90.09	117.16	131.60	105.05		86.11	111.63	126.10	98.92	
L.S.D. at 5 %	A: 9.81		B: 9.99	AB: 19.98		A: 4.09		B: 8.18	AB: 16.36	

In the present study, the obtained data showed that vitamin E treatments had significant and positive effects on the guaran % and guaran yield (g/plant and kg/fed) and chemical constituents of guar plants. The improving influences of vitamins on guar plants could be attributed to the following biological and physiological roles of these compounds. Tocopherol are a group of compounds synthesized only by photosynthetic organisms. The best characterized and probably most important function of α-tocopherol is to act as recyclable chain reaction terminators of polyunsaturated fatty acids, free radicals generated by lipids oxidation. In plants, tocopherol are believed to protect chloroplast membranes from photooxidation and help to provide an optimal environment for the photosynthetic machinery (Munne-Bosch and Algere, 2002), and added that tocopherol accumulation also occurs in response to variety of a biotic stresses including high light, drought, salt and could provide an addition line of protection from oxidative damage. Ayad *et al.* (2009) proved that chemical constituents of medicinal plants positively responded to foliar application of α-tocopherol. It might be due to that α-tocopherol can be considered a major antioxidant protecting membrane lipids from photo-oxidation especially those of chloroplast (Hess, 1983; Zhang *et al.,* 2000; Havaux *et al.,* 2000).

Photosynthetic pigments:

The contents of chlorophyll a, b and carotenoids (mg/g F.W.) were significantly enhanced by using compost at 2.5, 5.0 and 7.5 ton/fed compared with control. The maximum contents were obtained by 5.0 ton/fed of compost (Table, 2).

Similar results were obtained with those, Shehata (2013) and Fernandez *et al.* (2010) and Shehata *et al.* (2011) on snap bean.

Data in the same Tables, also indicated that all spraying treatments (vit. E and plant extract) significantly increased the three photosynthetic pigments over the control in both seasons, except the treatment of green tea (300 ppm) for carotenoids in the first season. The highest contents of the three tested characters by garlic extract (300 ppm) followed by green tea extract (150 ppm). The positive effect of plant extracts on the contents of pigments were reported were obtained by El-Shayeb (2009) on *Oenothera biennis* and Ahmed *et al.* (2014) on keitte mango regarding the effect of garlic extract and Abada (2014) on Thompson seedless grapevines concerning the effect of green tea extract.

The interaction between main and sub plots (A×B) treatments was significant for chlorophyll a, b and carotenoids in both seasons, except for chlorophyll b during the first season. In the first season, the highest contents of chl. a and carotenoids were obtained by the use of compost at 5.0 or 2.5 ton/fed in combination with garlic extract (300 ppm) or green tea extract (150 ppm) or compost at 5.0 ton/fed plus vit. E (20 ppm) for carotenoids (Table, 2). In the second season, the highest contents of chl. a, b and carotenoids were obtained by used compost at 5.0 ton/fed in combination with garlic extract (300 ppm) or green tea extract (150 ppm) (Table, 2). Also, compost (2.5 ton/fed) plus garlic extract (300 ppm) gave the maximum values of chl. a and b (Table, 2). The positive effect of the garlic extract on guar plants could be examined in the light of biological and physiological roles of garlic extract which was conducted by many researches as follows, The garlic extract has many effects due to its hormonal (Auxin-like) nature, which has an important role in lateral extension and elongation of cells (Abou Hussein *et al*., 1975 a and b).,Garlic extract contains enzymes and more than 200 chemical compounds, some of its volatiles are more important i.e. Allicin that gives garlic its antibiotic properties, it is not only rich in nutrient substance, it is possesses a natural strength of combating against different bacterial and other microbial disease infections (antibacterial, antifungal and insecticide) (Faghihi *et al*., 2014).

Table 2. Effect of compost, vitamin E and some plant extracts (garlic, moringa, aloe and green tea) treatments on photosynthetic pigments (chlorophyll a, b and carotenoids) of guar (*Cyamopsis tetragonoloba*, L.) plants, during the first and second seasons.

Vitamin E and some plant extracts treatments (B)	Compost levels (ton/fed) (A) 1st season (2014) 0.0	2.5	5.0	7.5	Mean (B)	2nd season (2015) 0.0	2.5	5.0	7.5	Mean (B)
Chlorophyll a (mg/g F.W.)										
Control	2.386	2.415	2.458	2.399	2.415	2.365	2.405	2.442	2.388	2.400
Vitamin E at 10 ppm	2.442	2.501	2.526	2.465	2.484	2.419	2.460	2.501	2.439	2.455
Vitamin E at 20 ppm	2.847	2.946	2.967	2.928	2.922	2.832	2.946	2.963	2.864	2.901
Garlic extract 150 ppm	2.473	2.519	2.605	2.501	2.525	2.449	2.498	2.565	2.475	2.497
Garlic extract 300 ppm	2.913	3.022	3.044	2.960	2.985	2.932	3.012	3.036	2.916	2.974
Moringa extract 150 ppm	2.656	2.705	2.741	2.681	2.696	2.622	2.699	2.733	2.648	2.676
Moringa extract 300 ppm	2.690	2.742	2.784	2.702	2.730	2.650	2.730	2.740	2.680	2.700
Aloe extract 150 ppm	2.510	2.559	2.628	2.531	2.557	2.490	2.543	2.605	2.520	2.540
Aloe extract 300 ppm	2.600	2.622	2.650	2.609	2.620	2.586	2.614	2.623	2.588	2.603
Green tea extract 150 ppm	2.878	3.008	3.034	2.951	2.968	2.863	2.995	3.009	2.891	2.940
Green tea extract 300 ppm	2.403	2.470	2.495	2.442	2.453	2.386	2.447	2.484	2.420	2.434
Mean (A)	2.618	2.683	2.721	2.652		2.599	2.668	2.700	2.621	
L.S.D. at 5 %	A: 0.01		B: 0.02		AB: 0.04	A: 0.01		B: 0.02		AB: 0.03
Chlorophyll b (mg/g F.W.)										
Control	0.797	0.809	0.824	0.801	0.808	0.790	0.803	0.817	0.798	0.802
Vitamin E at 10 ppm	0.816	0.836	0.848	0.824	0.831	0.808	0.821	0.836	0.814	0.820
Vitamin E at 20 ppm	0.952	0.984	0.993	0.976	0.976	0.946	0.941	0.990	0.957	0.959
Garlic extract 150 ppm	0.827	0.842	0.873	0.834	0.844	0.818	0.834	0.854	0.826	0.833
Garlic extract 300 ppm	0.973	1.009	1.020	0.988	0.998	0.970	1.005	1.014	0.974	0.991
Moringa extract 150 ppm	0.887	0.903	0.916	0.895	0.900	0.876	0.901	0.913	0.884	0.894
Moringa extract 300 ppm	0.898	0.916	0.934	0.902	0.913	0.885	0.912	0.915	0.894	0.902
Aloe extract 150 ppm	0.839	0.856	0.879	0.846	0.855	0.831	0.849	0.870	0.842	0.848
Aloe extract 300 ppm	0.867	0.876	0.887	0.872	0.876	0.863	0.873	0.876	0.864	0.869
Green tea extract 150 ppm	0.962	1.004	1.014	0.986	0.992	0.956	0.983	1.004	0.966	0.977
Green tea extract 300 ppm	0.803	0.825	0.834	0.815	0.819	0.797	0.817	0.832	0.809	0.814
Mean (A)	0.875	0.896	0.911	0.885		0.867	0.885	0.902	0.875	
L.S.D. at 5 %	A: 0.01		B: 0.01		AB: N.S.	A: 0.01		B: 0.01		AB: 0.01
Carotenoids (mg/g F.W.)										
Control	0.726	0.774	0.804	0.749	0.763	0.718	0.767	0.795	0.739	0.755
Vitamin E at 10 ppm	0.754	0.802	0.818	0.774	0.787	0.746	0.790	0.808	0.769	0.778
Vitamin E at 20 ppm	0.917	0.961	0.997	0.936	0.953	0.906	0.950	0.990	0.925	0.943
Garlic extract 150 ppm	0.774	0.812	0.836	0.795	0.804	0.763	0.801	0.826	0.785	0.794
Garlic extract 300 ppm	0.949	0.997	1.011	0.975	0.983	0.943	0.989	1.005	0.970	0.977
Moringa extract 150 ppm	0.860	0.915	0.910	0.897	0.896	0.848	0.905	0.903	0.888	0.886
Moringa extract 300 ppm	0.882	0.944	0.966	0.916	0.927	0.873	0.940	0.959	0.907	0.920
Aloe extract 150 ppm	0.793	0.825	0.863	0.813	0.824	0.784	0.813	0.856	0.800	0.813
Aloe extract 300 ppm	0.836	0.880	0.889	0.866	0.868	0.829	0.869	0.884	0.855	0.859
Green tea extract 150 ppm	0.934	0.986	1.004	0.957	0.970	0.922	0.982	0.998	0.946	0.962
Green tea extract 300 ppm	0.741	0.785	0.808	0.761	0.774	0.727	0.775	0.801	0.752	0.764
Mean (A)	0.833	0.880	0.901	0.858		0.824	0.871	0.893	0.849	
L.S.D. at 5 %	A: 0.02		B: 0.01		AB: 0.03	A: 0.01		B: 0.01		AB: 0.01

N, P and K %:

Data in Table (3) indicated that all used compost treatments significantly increased N, P and K % in the dry leaves as compared with control in both seasons. The medium level of compost (5.0 ton/fed) gave significantly the highest N, P and K % over the two tested levels of compost. These results are agreed with those obtained by Patel *et al.* (2010); Shehata (2013) and Chavan *et al.* (2015) on cluster bean plants.

In regard to the effect of Vit. E and plant extract treatments, all ten used treatments significantly increased N, P and K %, in both seasons, over the control. The highest percentages for the three elements resulted from the treatment of garlic extract (300 ppm) followed by green tea extract (150 ppm). Regarding the positive effect of plant extracts on nutrients %, these results are in agreement with those obtained by Ahmed *et al.* (2014) on keitte mango and Abd El-Hamied and El-Amary (2015) on pear trees concerning garlic extract, also, Al-Wasfy *et al.* (2013) on orange trees, Abada (2014) on grapevine regarding green tea extract. The interaction between compost and vit. E and plant extracts treatments was significant for N, P and K % in both seasons. The highest percentages were obtained due to compost (5.0 ton/fed) in combination with garlic extract (300 ppm) as shown in Table (3).

Total carbohydrates %:

Data in Table (4) indicated that all used compost treatments significantly increased total carbohydrates % as compared with control in both seasons. The medium level of compost (5.0 ton/fed) gave significantly the highest total carbohydrates % over the two tested levels of compost. These results are agreed with those obtained by Shehata (2013) on guar plants, Shafeek *et al*. (2004) on pigeon pea, El-Leithy *et al.* (2007) on *Origanum syriacum*, Abd El-Aziz *et al.* (2007) and Gendy *et al.* (2012) on Roselle plant.

It was obvious that, total carbohydrates % significantly increased by the all used treatments (Vit. E and plant extracts) as compared to control in both seasons. The highest values in this concern were recorded when plant sprayed with garlic extract (300 ppm) and green tea extract (150 ppm) as shown in Table (4). Plants extract had positive effect in carbohydrate content as emphasized by Noor El-Deen (2005) and Mady (2009) on marjoram plants. El-Shayeb (2009) on *Oenothera biennis*, Hanafy *et al.* (2012) on *Schefflera arboricola*, Ahmed *et al.* (2014) on basil and Abd El-Hamied and El-Amary (2015) on pear regarding the effect of garlic extract, and Abdalla (2013) on rocket plants and Abd El-Hamied and El-Amary (2015) on pear concerning the effect of moringa extract. Also, Youssef (1997) on *Delphinium ajacis*, Mady (2009) on sage plant, Hanafy *et al.* (2012) on *Schefflera arboricola* and Ahmed *et al*. (2014) on basil concerning the effect of aloe extract. Moreover, vit. E had positive effect on carbohydrate content on guar plants (Shehata, 2013).

The interaction between main and sub plots was significant for total carbohydrates %in both seasons. The highest values were obtained with compost at 5 ton/fed in combination of garlic extract (300 ppm) or green tea extract (150 ppm) or compost at 2.5 ton/fed with garlic extract (300 ppm) as clearly shown in Table (4) .

Total protein %:

Data in Table (4) indicated that all used compost treatments significantly increased total protein % as compared with control in both seasons. The medium level of compost (5.0 ton/fed) gave significantly the highest total protein % over the two tested levels of compost. These results are agreed with those obtained by Gomaa and Mohamed (2007); Patel *et al.* (2010) and Shehata (2013) on guar plants, Shafeek *et al.* (2004) on pigeon pea, Mohamed and Gomaa (2005) and Gomaa *et al.* (2010) on faba bean,

Table 3. Effect of compost, vitamin E and some plant extracts (garlic, moringa, aloe and green tea) treatments on nitrogen, phosphorus and potassium percentages of guar (*Cyamopsis tetragonoloba*, L.) plants, during the first and second seasons.

Vitamin E and some plant extracts treatments (B)	Compost levels (ton/fed) (A) 1st season (2014)					2nd season (2015)				
	0.0	2.5	5.0	7.5	Mean (B)	0.0	2.5	5.0	7.5	Mean (B)
					N %					
Control	1.59	2.19	2.47	1.90	2.04	1.55	2.15	2.40	1.87	1.99
Vitamin E at 10 ppm	1.88	2.36	2.60	2.09	2.23	1.81	2.27	2.55	2.05	2.17
Vitamin E at 20 ppm	2.69	3.16	3.27	2.88	3.00	2.60	3.11	3.23	2.83	2.94
Garlic extract 150 ppm	1.99	2.42	2.66	2.18	2.31	1.90	2.37	2.59	2.15	2.25
Garlic extract 300 ppm	2.89	3.30	3.48	3.09	3.19	2.81	3.26	3.41	3.01	3.12
Moringa extract 150 ppm	2.28	2.80	3.01	2.45	2.64	2.20	2.70	2.95	2.40	2.56
Moringa extract 300 ppm	2.43	2.87	3.08	2.59	2.74	2.37	2.79	2.99	2.53	2.67
Aloe extract 150 ppm	2.08	2.51	2.70	2.28	2.39	1.99	2.48	2.69	2.20	2.34
Aloe extract 300 ppm	2.16	2.69	2.88	2.35	2.52	2.09	2.60	2.80	2.29	2.45
Green tea extract 150 ppm	2.78	3.20	3.35	2.99	3.08	2.69	3.16	3.31	2.96	3.03
Green tea extract 300 ppm	1.70	2.27	2.55	1.99	2.13	1.69	2.19	2.49	1.92	2.07
Mean (A)	2.22	2.71	2.91	2.44		2.15	2.64	2.86	2.38	
L.S.D. at 5 %	A: 0.01		B: 0.01		AB: 0.02	A: 0.01		B: 0.01		AB: 0.02
					P %					
Control	0.243	0.283	0.303	0.267	0.274	0.240	0.277	0.297	0.263	0.269
Vitamin E at 10 ppm	0.280	0.330	0.357	0.320	0.322	0.277	0.327	0.347	0.317	0.317
Vitamin E at 20 ppm	0.363	0.403	0.460	0.380	0.402	0.357	0.397	0.437	0.377	0.392
Garlic extract 150 ppm	0.297	0.350	0.377	0.330	0.339	0.293	0.343	0.367	0.323	0.332
Garlic extract 300 ppm	0.400	0.437	0.487	0.423	0.437	0.397	0.433	0.463	0.420	0.428
Moringa extract 150 ppm	0.333	0.377	0.423	0.360	0.373	0.330	0.373	0.410	0.353	0.367
Moringa extract 300 ppm	0.347	0.393	0.437	0.367	0.386	0.340	0.383	0.423	0.363	0.377
Aloe extract 150 ppm	0.313	0.367	0.390	0.340	0.353	0.303	0.353	0.383	0.337	0.344
Aloe extract 300 ppm	0.320	0.373	0.403	0.347	0.361	0.317	0.363	0.393	0.343	0.354
Green tea extract 150 ppm	0.377	0.417	0.473	0.393	0.415	0.373	0.413	0.447	0.390	0.406
Green tea extract 300 ppm	0.267	0.317	0.340	0.307	0.308	0.263	0.313	0.333	0.303	0.303
Mean (A)	0.322	0.368	0.405	0.349		0.317	0.361	0.391	0.344	
L.S.D. at 5 %	A: 0.003		B: 0.004		AB: 0.008	A: 0.005		B: 0.004		AB: 0.008
					K %					
Control	1.227	1.277	1.293	1.257	1.264	1.223	1.273	1.287	1.250	1.258
Vitamin E at 10 ppm	1.267	1.323	1.357	1.300	1.312	1.257	1.317	1.347	1.297	1.305
Vitamin E at 20 ppm	1.437	1.503	1.527	1.470	1.484	1.430	1.497	1.520	1.467	1.479
Garlic extract 150 ppm	1.317	1.353	1.387	1.337	1.349	1.313	1.347	1.377	1.333	1.343
Garlic extract 300 ppm	1.483	1.557	1.593	1.510	1.536	1.477	1.553	1.583	1.507	1.530
Moringa extract 150 ppm	1.377	1.437	1.467	1.403	1.421	1.373	1.433	1.463	1.397	1.417
Moringa extract 300 ppm	1.400	1.463	1.497	1.427	1.447	1.397	1.457	1.487	1.423	1.441
Aloe extract 150 ppm	1.337	1.383	1.410	1.357	1.372	1.333	1.377	1.403	1.353	1.367
Aloe extract 300 ppm	1.357	1.400	1.433	1.377	1.392	1.350	1.397	1.427	1.373	1.387
Green tea extract 150 ppm	1.457	1.530	1.563	1.487	1.509	1.447	1.527	1.553	1.480	1.502
Green tea extract 300 ppm	1.247	1.300	1.327	1.283	1.289	1.240	1.297	1.323	1.277	1.284
Mean (A)	1.355	1.411	1.441	1.383		1.349	1.407	1.434	1.378	
L.S.D. at 5 %	A: 0.01		B: 0.01		AB: 0.02	A: 0.01		B: 0.01		AB: 0.02

Table 4. Effect of compost, vitamin E and some plant extracts (garlic, moringa, aloe and green tea) treatments on total carbohydrates and protein percentages of guar (*Cyamopsis tetragonoloba*, L.) plants, during the first and second seasons.

Vitamin E and some plant extracts treatments (B)	Compost levels (ton/fed.) (A) 1st season (2014)					2nd season (2015)				
	0.0	2.5	5.0	7.5	Mean (B)	0.0	2.5	5.0	7.5	Mean (B)
Total carbohydrates %										
Control	28.87	32.03	32.50	29.70	30.78	28.63	31.83	32.43	29.50	30.60
Vitamin E at 10 ppm	30.60	33.57	34.13	31.73	32.51	30.53	33.50	34.07	31.60	32.43
Vitamin E at 20 ppm	33.10	34.93	35.27	33.57	34.22	32.90	34.87	35.17	33.37	34.08
Garlic extract 150 ppm	31.00	33.77	34.37	31.90	32.76	30.90	33.70	34.33	31.83	32.69
Garlic extract 300 ppm	33.77	35.43	35.80	34.17	34.79	33.67	35.37	35.77	34.03	34.71
Moringa extract 150 ppm	32.30	34.47	34.83	32.77	33.59	32.17	34.33	34.77	32.60	33.47
Moringa extract 300 ppm	32.80	34.73	35.07	33.13	33.93	32.73	34.60	35.00	33.30	33.91
Aloe extract 150 ppm	31.60	33.97	34.57	32.17	33.08	31.50	33.93	34.37	32.10	32.98
Aloe extract 300 ppm	31.87	34.20	34.67	32.43	33.29	31.80	34.13	34.53	32.37	33.21
Green tea extract 150 ppm	33.57	35.17	35.50	33.83	34.52	33.47	35.00	35.47	33.77	34.43
Green tea extract 300 ppm	30.23	33.33	33.93	31.43	32.23	30.13	33.30	33.93	31.33	32.17
Mean (A)	31.79	34.15	34.60	32.44		31.68	34.05	34.53	32.35	
L.S.D. at 5 %	A: 0.41		B: 0.45		AB: 0.89	A: 0.13		B: 0.15		AB: 0.31
Protein %										
Control	9.94	13.68	15.44	11.88	12.74	9.69	13.44	15.00	11.69	12.46
Vitamin E at 10 ppm	11.75	14.75	16.25	13.06	13.95	11.31	14.19	15.94	12.81	13.56
Vitamin E at 20 ppm	16.81	19.75	20.44	18.00	18.75	16.25	19.44	20.19	17.69	18.39
Garlic extract 150 ppm	12.44	15.13	16.00	13.63	14.30	11.88	14.81	16.19	13.44	14.08
Garlic extract 300 ppm	18.06	20.63	21.75	19.31	19.94	17.56	20.38	21.31	18.81	19.52
Moringa extract 150 ppm	14.25	17.50	18.81	15.31	16.47	13.75	16.88	18.44	15.00	16.02
Moringa extract 300 ppm	15.19	17.94	19.25	16.19	17.14	14.81	17.44	18.69	15.81	16.69
Aloe extract 150 ppm	13.00	15.69	16.88	14.25	14.96	12.44	15.50	16.81	13.75	14.63
Aloe extract 300 ppm	13.50	16.81	18.00	14.69	15.75	13.06	16.25	17.50	14.31	15.28
Green tea extract 150 ppm	17.37	20.00	20.94	18.69	19.25	16.81	19.75	20.69	18.50	18.94
Green tea extract 300 ppm	10.63	14.19	15.94	12.44	13.30	10.56	13.69	15.56	12.00	12.95
Mean (A)	13.90	16.92	18.15	15.22		13.47	16.25	17.84	14.89	
L.S.D. at 5 %	A: 0.41		B: 0.51		AB: 1.03	A: 0.34		B: 0.46		AB: 1.00

Maheshbabu *et al.* (2008) on soybean and Gendy *et al.* (2012) on Roselle plant.

Regarding the effect of vit. E and plants extract treatments, data in Table (4), showed that, all used ten spraying treatments of Vit. E and plants extract (garlic, moringa, aloe and green tea) significantly increased protein % as compared with control in both seasons. The best results were obtained with garlic extract (300 ppm) treatment followed by green tea extract (150 ppm) with significant differences between them in both seasons. These results are agreed with those obtained by, Abdalla (2013) on rocket plants found that moringa leaf (2 %) and twig extracts (3 %) increased total protein. Shehata (2013) on guar plants and Nour *et al.* (2012) on snap beans mentioned that vit. E (alpha-tocopherol) treatment had stimulative effect on protein content.

The interaction between main and sub plots (A×B) treatments was significant, in both seasons, for protein % as shown in Table (4). The best interaction treatment was obtained by used compost at 5 ton/fed in combination with garlic extract at 300 ppm during both seasons.

The improvement of guaran % , guaran yield (g/plant and kg/fed) and chemical constituents as a result of spraying green tea extract at 150 ppm could be explained in the light of the important physiological roles of

certain chemicals that are contained in green tea. These chemicals are found in the tannins released from the tea leaves when it is steeped in hot water. Tannis contain polyphenols and flavonoids which are subgroups that contain the antioxidant chemicals (Nie *et al*., 2002). Antioxidants with their protectant properties play an important role in plant defense against oxidative stress, as well as, biosynthesis of most organic foods and activation of cell division process (Oertli, 1987). Also, contains vitamins (A, C and E), minerals that protecting cells and their genetic material, DNA, from damage (Hanafy *et al*., 2012).

From the previous physiological and biological discussion, it might be concluded that the beneficial and unique role of compost, vitamin E and some plant extracts (garlic, moringa, aloe and green tea) treatments were responsible for enhancing the different physiological processes, which reflect on stimulating various guaran %, guaran yield and chemical constituents.

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تأثير معـــاملات الكمبوست وبعض المنشطات الحيوية على نباتات الجوار
ب- إنتاجية الجوران والمحتوى الكيماوي

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أجري هذا البحث في موسمين ٢٠١٤ و ٢٠١٥ بمدينة أبو قرقاص (قرية كفرلبس) محافظة المنيا لدراسة تأثير معاملات الكمبوست والمنشطات الحيوية على انتاجية الجوران والمحتوى الكيماوي. تشير النتائج المتحصل عليها بان تسميد نباتات الجوار بالكمبوست (٢,٥ ، ٥,٠ ، ٧,٥ طن/فدان) أدت إلى زيادة معنوية في إنتاجية الجوران (النسبة المئوية والمحصول للنبات وللفدان) والصبغات (كلوروفيل أ ، ب والكاروتينويدات) والنسبة المئوية لعناصر النتروجين والفوسفور والبوتاسيوم والنسبة المئوية لكل من البروتين والكربوهيدرات الكلية. المعدل المتوسط من الكمبوست (٥ طن/فدان) كان أكثر فاعلية من المعدل العالي أو المنخفض (٧,٥ أو ٢,٥ طن/فدان) في هذا الشأن.النباتات التي عوملت بثيتامين هـ أو المستخلصات النباتية (الثوم – المورنجا – الصبار – الشاي الأخضر) نتج عنها زيادة معنوية في إنتاجية الجوران وبعض المحتوى الكيماوي (الصبغات والنسبة المئوية لعناصر ن ، فو بو) في الموسمين عدا مستخلص الشاي الأخضر (٣٠٠

جزء/مليون) بالنسبة لإنتاجية الجواران. من بين المعاملات العشرة أما مستخلص الثوم (٣٠٠ جزء/مليون) أو مستخلص الشاي الأخضر (١٥٠ جزء/مليون) أعطى أفضل النتائج.يمكن التوصية بتسميد نباتات الجوار بالكمبوست (٥ طن/فدان) مع رش النباتات بمستخلص الثوم (٣٠٠ جزء/المليون) أو مستخلص الشاي الأخضر (١٥٠ جزء/مليون) للحصول على أعلى إنتاجية من الجواران.