Zagazig J. Agric. Res., Vol. 46 No. (6B) 2019 2193-2214

Plant Production Science

http:/www.journals.zu.edu.eg/journalDisplay.aspx?JournalId=1&queryType=Master

USING SOME HERBEL WATER EXTRACTS AS A NUTRIENT FOLIAR SPRAY IN THE PRESENCE OF DIFFERENT MINERAL FERTILIZER LEVELS FOR IMPROVING YIELD AND QUALITY OF TOMATO FRUITS AND BROAD BEAN PODS

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Received: 07/08/2019 ; Accepted: 15/10/2019

ABSTRACT: Tow field experiments were conducted during the two successive winter seasons of 2016/ 2017 and 2017/2018 in the Experimental Farm of Kaha Station, Qalubia Governorate on broad bean cv. luz de tout and during summer season of 2017- 2018 in the location of Vegetable Research Departments, Horticulture Research Institute, Agriculture Research Center, Dokki on tomato Alissa hybrid. The aiming of the experiments were to examine the effect of three rates of mineral fertilizers NPK, *i.e.*100% (as control), 75% and 50% either for broad bean or tomato and four safety materials, *i.e.* water (as control), seaweed extract (Tohlob gel) at 0.5 g/l, goosefoot extract and stinging nettle extract at two concentrations (10 and 20% of each) as foliar spray and their interactions on the vegetative growth, yield and its components of tomato and broad bean plants. Tomato fertilized with 75% of the recommended rate of NPK and sprayed with stinging nettle extract at 20% gave the highest value for each of vegetative growth parameters in both growing season. Moreover, as general the results showed that all treatments used, especially plants fertilized with 50% or 75% of the recommended rate of NPK and sprayed with goosefoot extract or stinging nettle extract at 20% of each, increased the total yield and its components, whereas decreased the percentage of infested fruits by blossom end rot disease compared with the control. The highest value of VC was obtained from using seaweed extract and fertilization by 50% of recommended NPK rate. On the contrary, the highest value of Juice acidity was recorded by the control treatment. Fertilizing with 100% of the recommended fertilization and foliar spray with goosefoot extract at 20% gave the highest value for each of total sugar (%) and K (%). All treatments had no significant impact on fruit length, fruit diameter, fruit shape, fruit firmness, flesh thickness and number of loculi. From forgoing results it could be concluded that, spraying tomato plants with goosefoot extract or stinging nettle extract at 20% of each gave the highest value for each of vegetative growth and total yield under fertilizing with 50% or 75% of the recommended fertilization. Regarding to broad bean, results indicated that, adding 75% followed by 50% of the recommended mineral fertilization and spraying by goosefoot extract at 20% concentration gave the highest values of all vegetative growth parameters, except plant length which showed favorable result under 100% from fertilization and spraying the plants with nettle extract at 20% concentration and leaf area which increased by adding 100% of recommended fertilizer level and spraying plants with goosefoot extract at 20% concentration. Spraying broad bean plants with stinging nettle extract at 20% concentration under 50% of the recommended fertilization gave the highest value for each of pod diameter and weight of 100 fresh seeds. Total pod yield/fed significantly increased by adding 100% then 75% of the recommended fertilization and spraying the plants by goosefoot extract at 20% then 10%, respectively while spraying broad bean plants with goosefoot extract at 20% concentration under 50% fertilization significantly increased P and K(%) but spraying broad bean plants with 20% concentration under 75% of the recommended fertilization gave the highest value for each of N and protein (%)in both seasons. Generally spraying broad bean plants with goosefoot or stinging nettle extract at 10% concentration under 75% or 50% of the recommended fertilization led to increase total green pod yield and its components, in addition saving 25% to 50% of the recommended fertilization.

Key words: Tomato, broad bean, recommended NPK rate, goosefoot extract, stinging nettle extract, yield.

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INTRODUCTION

Tomato (*Solanum Lycopersicon*) is one of the most popular and versatile vegetables in the world. It is an excellent source of vitamins, minerals (potassium, calcium, magnesium and phosphor) and antioxidants such as lycopin pigment which considered anti prostate cancer and contain salicylate compound. Broad bean (*Vicia faba* L.) is a famous winter leguminous crops in Egypt. It is considered as a good source of vegetarian protein for human consumption, and it is cultivated in crop rotations to improve soil properties (**Jasim, 2007**).

It is known that, chemical and organic fertilizers are essential nutrients in plant management. Adequate fertilizers led to increase the crop yields, improves the nutrient element concentration in plant tissue as well as soil macro and micro nutrient status. Nitrogen is essential for synthesis of chlorophyll, enzymes and proteins. Phosphorus is essential for root growth, phospho-proteins, phosphor-lipids and ATP, ADP formation. Potassium plays an important role on promotion of enzymes activity and enhancing the translocation of assimilates and protein synthesis (**Devlin and Witham, 1986**). Moreover, nutrients, when found at adequate quantity, increases fruit quality, fruit size, and fruit taste of tomato **(Azad, 2000)**. In this regard, **Devi *et al.* (2002)** obtained better fruit weight and fruit yield of eggplant with the application of 120 kg NPK per hectare. Moreover, **Abo El-Soud *et al.* (2003)** and **Mohammed (2004)** found that phosphorus application gave a highly significant increase in the vegetative growth, pods yield and pods quality as well as NPK content of cowpea and broad bean plants as compared to those obtained by rock phosphate. It also helps in increasing desirable acidic flavor. Excess potassium content on chemically over fertilized soil decreases Vitamin C, carotene content and antioxidant compounds in vegetables (**Toor *et al.*, 2006**). Many investigators reported that increasing the amount of NPK-fertilizer caused an increase in the vegetative growth, yield and its quality (**Meniutiu, 2006; Balliu *et al.*, 2007** on eggplant, **Adekiya and Agbede, 2009** on tomato, **Futuless *et al.*, 2011** on soybean, **Kehinde *et al.*, 2011)** on eggplant, **Suge *et al.*, 2011** on eggplant, **Jayasinghe *et al.*, 2016** on tomato, **Jasim *et al.*, 2016** on broad bean and **Toungos, 2017** on sweet pepper).

There are many reports concerning blossom-end rot (BER) which considered as a serious physiological disease in tomato, and the main cause is due to Ca deficiency in the fruit, especially the distal part **(De-Freitas *et al.*, 2011; Yoshida *et al.*, 2013)**.

Recent studies highlight that organic food is related with important benefits for human health and environmental (**Kahl and Rembiałkowska, 2014; Gomiero, 2017**). Organic food consumption is associated with health beliefs and subjective well-being, which involves higher market values and demand (**Apaolaza *et al.*, 2018**). Moreover, in the next few years, agriculture will be pushed to become more sustainable as a global response to climate change.

It is known now that, combined use of organic and inorganic fertilizer reduced costs and amount of fertilizer required by crops (**Krupnik *et al.*, 2004**). It also produced the highest plant growth (**Alam, 2006**). The reason for more requiring is due to the role of organic matter in the processing and supply of good nutrient for the plants, which appears in the growth characteristics of the crop, and these results are consistent with the findings of the researchers that the addition of organic matter had caused significant increases in the yield of leguminous crops (**Shaaban and Okasha, 2007; El-Desuki *et al.*, 2010**). The increase is attributable to the role of organic matter in the release of notably nitrogen which is necessary for the cell division cell elongation, growth and development of plant. This is consistent with that found by **Arjumand *et al.* (2013**) on broad bean plants. In this regard, **Ogundare *et al.* (2015)** found that, using of inorganic and organic fertilizers had better effects on growth (plant height, leaf number, branch number, stem diameter), fruit number per plant, fruits weight and yield of tomato. Therefore, for good yield and better productivity of tomato, it was obtained from combination of 125 kg/ha NPK fertilizer + 3 ton/ha poultry waste which is recommended for tomato production.

It is noticed nowadays that, several plant extracts showed superior results as a natural feeding nutrients for the vegetable plants and

considered as will more enhance than the mineral fertilizers. The wonderful information in this regard showed that, some kinds of weeds extract had obvious results on enhancing growth and yield of some vegetable crops. In this concern some investigators reported that, goosefoot and stinging nettle (*Urtica dioica*) are the best two such weeds with more benefit of using its as nutrient source as a medicinal treatment to stinging nettle garden fertilizer. Nettle water, an aqueous extract of stinging nettle (*Urtica dioica*). Various positive effects, such as increased growth, deep green leaves and better resistance against parasites, as mentioned by **Dlouhy (1981)**. As a first step towards an understanding of the physiological effects of stinging nettle water on plants determining its contents from macro and micro mineral composition as well as stimulants, physical and chemical properties and bacterial content (**Petersona and Jensena, 1985**). In this regard **Petersona and Jenséna (1986)** indicated that, extract of stinging nettles (*Urtica dioica*) was evaluated for potential growth stimulating effects on tomato. It is found also that, using of stinging nettle water resulted in about 20% higher shoot fresh weight and about 15% higher nitrogen levels in shoots compared with the nutrient solution treatment. Chlorophyll levels were also higher in the stinging nettle water treatment. Moreover, compared with nutrient solution, stinging nettle water seemed to have a growth-stimulating effect on plants. Quite often several positive effects are attributed to stinging nettle slurry (fermented extract), but it had based on very little scientific evidence. One of the main attributed effects is its ability to stimulate plant growth and to, therefore, improve yield and this due to its higher nutrient concentrations (nitrogen and others). Nitrogen is a major element in plants and is assimilated in free amino acids, proteins, and other nitrogenous compounds that are related to growth and development as mentioned by **Ruamrungsri *et al.* (2010)**.

Nettle water contains a high amount of nitrogen mainly in the form of ammonium. Stinging nettle is a powerhouse of nutrients. It contains an average 33.8% protein, 3.6% fats, 37% non-nitrogen extracts, 9.1% fiber, and 16.2% ash. The leaves contain about 4.8 mg chlorophyll per gram of dry leaves., The fresh leaves contain vitamins A, C, D, E, F, K, P, and b-complexes as well as thiamin, riboflavin, niacin, and vitamin B-6, all of which were found in high levels, and act as antioxidants. The leaves are also noted for their particularly high content of the metals selenium, zinc, iron, and magnesium. It is contain also boron, sodium, iodine, chromium, copper, and sulfur. Sixteen free amino acids have been found in the leaves, as well as high silicon levels in the leaves, stems and roots (**Rutto *et al.*, 2013; Adhikari *et al.*, 2016).**

Goosefoot extract acts as an anti-inflammatory agent. It contains alanine, ascorbic acid, beta carotene, campesterol, ferulic acid, imperatorin, methionine, niacin, oleanolic acid, phosphorus, vanillic acid and xanthotoxin (**Rothkranz, 2013**).

Seaweed are marine macro algae, which considered as an important component of the marine living resources of the world. They are available in shallow coastal waters of sea, estuaries and backwaters. The seaweed extract has been found to contain growth stimulators such as auxins, gibberellins and cytokines. The extract also comprises growth promoting hormones (IAA and IBA), trace elements (Fe, Cu, Zn, Mo, Mn and Ni), vitamins and amino acids (**Crouch and Staden, 1992**). Some researchers reported that spraying with seaweed extract was encouraged growth and delay aging (**Khan *et al.*, 2009**). And also have been reported to stimulate the growth and yield of plants. seaweed extract with 20% as foliar application increased shoot dry weight, fruit number, fruit yield total soluble solids and total acidity content of fruit., while seaweed extract with 100% of foliar application reduced the above mentioned parameters (**Sutharsan *et al.*, 2014**).

The aim of this study was to evaluate the effect of integrated use of weeds extracts (goosefoot or stinging nettle) as organic and natural fertilizer and source of some stimulants on growth and yield of tomato and broad bean as well as minimizing the chemical fertilizer application which, organic production with a high yield and desirable quality is a target of many producers.

MATERIALS AND METHODS

Two experiments were used in this study, which contain two different vegetable crops, *i.e*. tomato and broad bean. The first experiment was carried out in the location of Vegetable Research Departments, Horticulture Research Institute, Agriculture Research Center, Dokki, Giza Government, Egypt, for tomato plants. Soil was clay in texture with 8.25 pH, 2.80 EC dS/m, 31.36 ppm N, 5.14 ppm P, 481.62 ppm K, 116 ppm Ca and 55 ppm Mg (average of two seasons). While the second experiment was conducted at the Experimental Farm of Kaha Station, Qalubia Governorate, Egypt for broad bean plants; Soil was clay in texture with 7.5 pH, 3.47 EC m mhos, 1.23% organic matters, 113 ppm N, 49 ppm P and 103 ppm K (average of two seasons).

The present investigation was conducted during two successive seasons of 2016/2017 and 2017/2018 for broad bean as winter crop and 2017 and 2018 for tomato as summer crop. A split plot design with three replicates was adopted. Eighteen treatments, *i.e.,* the combination among three levels from the recommended mineral fertilization (50%, 75% and 100%) were distributed in the main plots .In addition, aqueous extract of the two species of weeds (stinging nettle and goosefoot) with two concentration (10% or 20%), seaweed gel 0.5 gm/l and the control (without any addition) which was arranged in the sub plots.

The plants were sprayed four times with aqueous solution of the used materials; the first spray was conducted at vegetative stage (30 days after transplanting for tomato, and at the three true leaves stage for broad bean (at 30 days after sowing), whereas the second, third and fourth sprays were preformed 15 days intervals for both crops.

Preparing Weeds Extract

Stinging nettle or goosefoot extract was made by filling bucket with (1 kg leaves, stems and roots from stinging nettle or goosefoot to 10 L water) and set the bucket in a semi-sunny area. Leave the mix for two weeks to ferment, stirring every couple days until it stops bubbling. Finally, strain out the stinging nettles or goosefoot and dilute the concoction at 10% or 20% for direct foliar application. Chemical analyses of the materials used in this study are presented in Table 1.

The present investigation was conducted at two parts:

The First Experiment on Tomato Plants

Seeds of tomato (hybrid Alissa) were sown under plastic house in nursery on the first week of February during both seasons of 2017 and 2018 and received agricultural practices. At 50 days after sowing, healthy seedlings were selected and transplanted to the field plots at 50 cm between each other. The plot area was 8.4m² and includes 3 ridges each of 0.7m width and 4.0 m length. The plants fertilized with three levels (50, 75, 100%) of the recommended mineral fertilization *i.e.,* 100kg N + 60kg P_2O_5 +72 kg K_2O and the other agricultural practices were followed according to the recommendation for tomato plantation.

The Recorded Data

Vegetative growth parameters

Three plants were randomly chosen from each treatment in the three replicates at the beginning of fruiting stage at 66 days after transplanting in order to determine the following: Plant length (the length of main stem cm), stem diameter, leaf number/plant and No. of brunches/plant.

Dry weight (g/plant)

Different plant parts were dried at 70ºC till constant weight and the dry weight of whole plant was determined using the standard methods as illustrated by **AOAC (1990)**.

The leaf area was calculated at fruiting stage at 66 days after transplanting from the fourth upper leaves according to the following formula of **Wallace and Munger (1965)**.

Leaf area (cm^2) = Leaf dry weight (g) x disk area/disk dry weight (g).

Total fruit yield and its components

Fruit number/plant, average fruit weight (g), early fruit yield (ton/fed.) as the first and second pickings, total fruit yield (ton/fed), marketable yield (ton/fed.) and blossom end-rot (%) were determined.

Table 1. Chemical analysis of the materials used in this study

Natural extract	Chemical analysis
Stinging nettle extract	3.1% N, 4.1% K,2.27 P%,1.21 Ca%,10.85 Mg, Amino acids 0.33%, 0.007% cytokinines, EC 1.9mlmos, pH 7.9
Goosefoot extract	3.3% N, 4.9% K,1.3 P %,1.01 Ca%, 11.52 Mg, Amino acids 0.31% 0.01% cytokinines, EC 1.8mlmos, pH 7.8
Seaweed gel	1% N, 12% K, 0.5% P%,0.1% Mg, amino acids 0.5%, cytokinines 0.001%,

The physical characters of tomato fruits

Five tomato fruits were randomly selected from each plot at the second picking to determine the following data: Fruit length (cm), fruit diameter (cm), fruit shape, flesh thickness cm (by using a caliper) and fruit firmness was measured using a needle type pocked penetro-meter and number of loculi.

The chemical properties

Total leaf chlorophyll content was measured at fruiting stage (at 66 days after transplanting) from the fourth upper leaves using Minolta chlorophyll meter SPAD- 501 as SPAD units.

Total Soluble Solids (TSS)

Randomly picked sample fruits from each tagged plants were used to determine the TSS of the fruits by hand held refractometer (ATAGO-S 28 E model). TSS value was expressed in degree Brix

Total acidity of fruits juice was determined using a pH meter.

100 g from fruits was taken and dried at 70ºC till constant weight to determine some chemical characters as the following:

Ascorbic acid: (Vitamin C mg/100g fresh weight) content was determined by using the die 2, 6 dichlorophenol indophenols, method as described by **Ranganna (1979)**. Total sugars was determined calorimetrically on the basis of fruit dry matter, using spectrophotometer with the phenol sulphuric acid method described by **Dubois *et al.* (1956)**. Phosphours, potassium and calcium were determined in dry fruit on the basis of dry weight according to the methods described by **Bremner and Mulvaney (1982), Olsen and Sommers (1982) and Jackson (1967)**, respectively.

The Second Experiment on Broad Bean

Seeds of broad bean (*cv.* Luz de tout) were sown on October 25th and 30th in 2016/2017 and 2017/2018, respectively. A split plot design with three replicates was adopted. The plot area was 8.4 m² and includes 3 ridges each of 0.7 m width and 4.0m length. A guard ridge was left between each experimental unit to avoid drift spray. The plants fertilized with three levels (50, 75,100%) of the recommended mineral fertilizers *i.e.,* 60kg N + 30 kg P_2O_5+24 kg K_2O and the other agricultural practices were followed according to the recommendation for broad bean plants.

The Recoded Data

Vegetative growth parameters

Three plants were randomly chosen from every treatment in the three replicates at flowering stage and beginning of fruiting stage at 72 days after sowing in order to determine the following:

- Plant length (the length of main stem cm), stem diameter, No. of leaves/plant and No. of brunches/ plant.
- Dry weight (g/plant): A random sample of three plants from each plot was dried at 70ºC till constant weight and the dry weight of whole plant was determined.

The leaf area was calculated at flowering stage and beginning of fruiting stage (at 72 days after sowing) from the fourth upper leaves according to the following formula of **Wallace and Munger (1965)**.

Leaf area (cm^2) = Leaf dry weight (g) x disk area/disk dry weight (g)

Green pod yield and its characteristics

A random sample of 10 fresh pods (in green mature stage at edible stage) from each plot at the second picking was taken to determine pod length (cm), pod diameter (cm), average of fresh pod weight (g) number of seeds/pod, fresh weight of 100 seeds (g), dry weight of 100 seeds (g) and total pod yield (ton/fad.)

Chemical properties

Total leaf chlorophyll reading was measured using Minolta chlorophyll meter SPAD- 501 as SPAD units at flowering stage and beginning of fruiting stage at 72 days after sowing from the fourth upper leaves.

Total nitrogen, phosphorus and potassium were determined in dry seed (dried green seeds at edible stage) on the basis of dry weight according to the methods described by **Bremner and Mulvaney (1982), Olsen and Sommers (1982)** and **Jackson (1967)**, respectively.

Total protein (%)

It was determined as nitrogen in dry seeds content and converted to its equivalent protein content by multiplying N content x 6.25 **(AOAC, 1975)**

Statistical Analysis

Data obtained from the two experiments were subjected to the proper analysis of variance (split-plot design) as described by **Snedecor and Cochran (1980)** using M. stat program. Averages between treatments were differentiated by using LSD at 5% level.

RESULTS AND DISCUSSION

The First Experiment on Tomato Crop

Plant Growth

Effect of fertilizer levels

The vegetative growth parameters of tomato plants, *i.e.,* plant length, number of leaves/plant, number of branches/plant, stem diameter, leaf area, dry weight and chlorophyll concentration of plant as affected by different levels of the recommended mineral fertilizers are shown in Table 2. The results revealed that fertilizing with 100% of the recommended rate of NPK gave the highest values of all vegetative growth parameters, except number of leaves/ plant. The maximum leaf number per plant was recorded by using 50% of the recommended mineral NPK, Regarding stem diameter, results indicated that there was no significant effect due to use all treatments, these results were true in both growing seasons. Many investigators reported that, increasing the amount of NPK-fertilizer caused an increase in the vegetative growth (**Meniutiu, 2006; Balliu *et al*., 2007** on eggplant, **Adekiya and Agbede**, **2009** on tomato, **Kehinde *et al*., 2011** on eggplant, **Suge *et al*., 2011** on eggplant, **Jayasinghe *et al*., 2016** on tomato and **Toungos, 2017** on sweet pepper).

Effect of natural extracts as foliar spray

Results recorded in Table 2 show that, all studied plant growth parameters, *i.e.,* plant length, number of leaves, number of branches/plant, stem diameter; leaf area and dry weight of foliage per plant were significantly increased by all foliar spray treatments compared to control. Spraying plants with higher concentration (20%) of the goosefoot extract or the stinging nettle extract, significantly increased plant length and number of branches/plant in comparison to the control plants ($P<0.05$), while spraying plants with higher concentration (20%) of the stinging nettle extract or lower concentration (10%) of the goosefoot extract were the best effective treatments on number of leaves, leaf area and dry weight of foliage per plant.

Total chlorophyll concentration in leaf tissues were also higher with foliar spray by the two concentrations of the goosefoot extract (10% or 20%), respectively in both growing seasons. Moreover, results showed that the plants sprayed with stinging nettle extract at (10% or 20%) gave the highest values of stem diameter in both growing season.

In this regard **Petersona and Jenséna (1986)** indicated that, extract of stinging nettles was evaluated for potential growth stimulating effects on tomato. They reported that, useing of stinging nettle water resulted in about 20% higher shoot fresh weight and about 15% higher

Table 2. Effect of fertilizer levels, natural extracts and their interactions on vegetative growth and leaf chlorophyll concentration of tomato plants at 66 days after transplanting during the two seasons of 2017 and 2018

Treatment		Plant length (cm)		No. of leaves / plant		No. of brunches / plant		Stem diameter (cm)		Leaf area (cm²)		Dry weight (g/plant)		leaf chlorophyll SPAD	
		2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Fertilizer levels															
100% (control)		88.75	88.09	55.33	56.31	18.65	18.66	1.31	1.27	2413.60	2389.00	87.28	100.18	46.90	46.78
75%		87.83	85.50	62.00	63.58	17.30	17.72	1.35	1.20	1818.50	1691.60	73.59	84.43	45.76	44.86
50%		87.58	87.41	65.58	68.63	17.88	17.66	1.35	1.36	2064.20	2127.80	76.20	86.50	45.36	45.08
LSD at 5% level		**0.67**	**0.33**	**0.84**	**0.53**	**0.21**	**NS**	**NS**	**NS**	**45.81**	**37.78**	**0.65**	**0.37**	**1.15**	**0.75**
Natural extracts															
Water (control)		80.00	75.86	45.00	44.80	13.83	12.83	1.16	0.96	1364.50	1287.20	46.79	46.46	42.83	41.60
Seaweed extract		77.33	78.83	51.33	55.16	15.97	15.33	1.10	1.09	1762.30	1679.40	69.62	82.32	45.70	44.76
Goosefoot extract at 10%		85.33	82.83	71.83	76.10	18.88	19.00	1.36	1.29	2394.20	2491.30	87.40	100.43	48.00	47.90
Goosefoot extract at 20%		100.67	98.00	67.33	67.76	19.94	20.00	1.45	1.40	2242.90	2137.10	83.48	103.33	46.90	47.50
Nettle extract at 10%		88.83	88.50	61.66	61.56	17.61	18.95	1.48	1.50	1949.00	2290.90	77.53	86.73	46.36	46.83
Nettle extract at 20%		96.17	98.00	68.66	71.66	21.44	22.00	1.46	1.44	2879.50	2531.10	109.35	122.95	46.25	44.86
LSD at 5% level		**0.59**	**0.96**	**0.69**	**0.51**	**0.22**	**0.71**	**0.22**	**0.14**	**57.09**	**68.83**	**0.46**	**0.86**	**0.75**	**0.73**
Fertilization levels X Natural extracts															
100%	**Water (control)**	84.50	76.58	44.00	43.90	14.00	15.50	1.30	1.05	1589.70	1460.40	50.24	50.37	44.90	43.60
	Seaweed extract	76.00	82.00	49.00	54.00	19.60	18.00	1.10	1.10	2139.70	2029.00	81.33	100.00	47.10	46.60
	Goosefoot extract at10%	86.00	84.00	74.00	73.00	19.00	19.00	1.30	1.20	3465.50	3189.30	110.65	110.00	48.60	48.00
	Goosefoot extract at 20%	100.0	98.00	53.00	53.00	19.33	19.00	1.40	1.50	2341.30	2294.50	68.95	98.20	47.00	48.80
	Nettle extract at 10%	95.00	92.00	62.00	61.00	19.00	19.50	1.60	1.60	2620.20	3096.80	97.96	115.90	46.90	48.30
	Nettle extract at 20%	91.00	96.00	50.00	53.00	21.00	21.00	1.20	1.19	2325.00	2264.00	114.59	126.60	46.90	45.40
75%	**Water**	80.00	77.00	44.00	44.50	13.50	13.00	1.30	0.95	1570.70	1500.80	48.65	48.00	42.00	40.20
	Seaweed extract	78.00	76.50	58.00	63.50	15.00	15.00	1.10	1.08	1836.80	1646.00	80.27	98.70	44.60	43.00
	Goosefoot extract at 10%	75.00	71.00	66.00	65.00	16.66	15.00	1.20	1.03	1621.60	1742.20	63.37	67.90	47.7	47.90
	Goosefoot extract at 20%	103.00	100.00	53.00	53.30	17.00	18.00	1.40	1.20	1231.90	1290.90	65.48	79.79	47.30	47.00
	Nettle extract at 10%	86.00	84.50	56.00	56.20	17.33	19.35	1.30	1.30	1034.80	1079.60	54.51	60.90	46.40	45.70
	Nettle extract at 20%	105.00	104.00	95.00	99.00	24.33	26.00	1.80	1.68	3615.00	2890.20	129.26	151.30	46.56	45.40
50%	**Water**	75.50	74.00	47.00	46.00	14.00	10.00	0.90	0.88	933.10	900.40	41.47	41.00	41.60	41.00
	Seaweed extract	78.00	78.00	47.00	48.00	13.33	13.00	1.10	1.10	1310.40	1363.20	47.26	48.25	45.40	44.70
	Goosefoot extract at 10%	95.00	93.50	75.50	90.30	21.00	23.00	1.60	1.65	2095.60	2542.30	88.17	123.40	47.70	47.80
	Goosefoot extract at 20%	99.00	96.00	96.00	97.00	23.50	23.00	1.55	1.52	3155.60	2825.80	116.02	132.00	46.40	46.70
	Nettle extract at 10%	85.50	89.00	67.00	67.50	16.50	18.00	1.55	1.60	2191.90	2696.20	80.11	83.40	45.80	46.50
	Nettle extract at 20%	92.50	94.00	61.00	63.00	19.00	19.00	1.40	1.45	2698.40	2439.20	84.19	90.95	45.30	43.80
LSD at 5% level		**0.35**	**0.57**	**0.41**	**0.30**	**0.13**	**0.42**	**0.13**	**0.86**	**34.24**	**41.28**	**0.27**	**0.52**	**0.45**	**0.43**

nitrogen levels in shoots compared with the nutrient solution treatment. This increment might be due to the presence of macro nutrients, amino acids and cytokinines as shown in Table 1, growth promoting substances, free amino acids as well as some vitamins. Nitrogen is a major element in plants and is assimilated in free amino acids, proteins, and other nitrogenous compounds that are related to growth and development (**Ruamrungsri *et al*., 2010**).

Effect of the interaction between fertilizer levels and natural extracts

Results in Table 2 show that, plants fertilized by 75% of the recommended rate of NPK and sprayed by stinging nettle extract at 20% followed by 50% of the recommended rate of NPK and sprayed by goosefoot extract at 20% gave the highest value for each of leaf number, number of branches/plant stem diameter, and dry weight in both growing seasons. Generally, the results revealed that, plants fertilized by 75% of recommended rate of NPK and sprayed by stinging nettle extract at 20% gave the highest values of all vegetative growth parameters in both growing seasons except leaf area in the second season.

Regarding to total chlorophyll content in leaf tissues, it was noticed that, the plants fertilized by 100% of recommended rate of NPK and sprayed by goosefoot extract at 10% or 20% gave the highest values in the first season and the second season, respectively. **Alam (2006)** reported that, combined use of organic and inorganic fertilizer reduced amount of fertilizer required by crops, it also produced highest plant growth. The increase is attributable to the role of organic matter in the release of notably nitrogen which is necessary for the cell elongation, cell division, growth and development of plant. This is consistent with that found by **Futuless *et al.* (2011)** on soybean, **Arjumand *et al.* (2013**) on broad bean plants and **Ogundare *et al*. (2015)** on tomato.

Yield Components and Blossom End Rot

Effect of fertilizer levels

Results in Table 3 show that, the highest value for each of fruit number/plant, average of fruit weight, early yield ton/fed., total yield ton/fed., and marketable yield ton/fed., were obtained in the plots fertilized by adding 50% of recommended rate of mineral NPK in both growing seasons. These results may be due to the high levels from nitrogen push the plants for vegetative growth than flowering and fruit yield. These results are in the same line with those obtained by **Adekiya and Agbede (2009)** on tomato, **Kehinde *et al*. (2011)** on eggplant, **Suge *et al*. (2011)** on eggplant, **Jayasinghe *et al*. (2016)** on tomato and **Toungos (2017)** on sweet pepper.

As shown in Table 3 the results reveal that adding 100% of the recommended mineral NPK decreased fruits injury with blossom end rot disease. There are many reports concerning blossom-end rot (BER), and the reason of that due to be Ca deficiency in the fruit, especially the distal part (**De-Freitas *et al*., 2011; Yoshida *et al*., 2013**).

Effect of natural extracts as foliar spray

As shown in Table 3, there were significant differences in the values of total yield and its components of tomato fruits among the different foliar spray treatments. Spraying with stinging nettle extract or the goosefoot extract at 20% of each increased total yield and its components of the treated plants in comparison to the control plants. This might be due to the presence of macro and micro nutrients, growth promoting substances, free amino acids as well as some vitamins as shown in Table 1. One of the main attributed effects is its ability to stimulate plant growth and reflect of that in improve yield and this due to its higher nutrient concentrations (nitrogen and others). Nitrogen is a major element in plants and is assimilated in free amino acids, proteins, and other nitrogenous compounds that are related to growth and development (**Ruamrungsri *et al*., 2010**).

Moreover, the results revealed that seaweed foliar application had remarkable effect on the total yield and its components, whereas it contain higher amount of potassium and growth regulators probably stimulated flower initiation and hence total yield, these results are in agreement with those obtained by **Sutharsan *et al*. (2014)**.

As shown in Table 3 the results reveal that all the foliar spray treatments decreased fruits injury with blossom end rot disease and this due to its higher nutrient concentrations especially Ca as shown in Table 1.

Table 3. Effect of fertilizer levels, natural extracts and their interactions on total yield and its components and blossom end rot of tomato fruits during the two seasons of 2017 and 2018

Treatment		Average of fruit weight (g)		Fruit number/plant		Early yield (ton/fed.)		Total yield (ton/fed.)		Marketable yield (ton/ fed.)		Blossom end rot (%)	
		2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Fertilizer levels													
100% (control)		113.20	110.52	17.82	18.92	7.99	8.06	34.19	34.93	33.90	34.03	0.85	0.85
75%		101.44	109.02	18.71	19.23	9.28	8.80	34.42	33.30	33.25	31.57	0.98	1.11
50%		113.04	113.47	22.93	21.46	11.63	10.71	41.82	42.12	40.73	40.97	1.39	1.36
L.S.D at 5 % level		**0.43**	**0.78**	**0.44**	**0.79**	**0.87**	**0.43**	**1.25**	**1.96**	**1.21**	**1.47**	**034**	**021**
Natural extracts													
Water (control)		85.07	87.42	16.50	15.21	5.26	5.24	21.05	23.44	21.50	22.78	2.97	3.11
Seaweed extract		100.18	103.88	19.60	19.03	8.04	7.45	36.70	34.23	34.74	32.08	1.29	1.36
Goosefoot extract 10%		104.26	110.47	18.91	19.54	9.45	9.94	38.28	38.27	37.15	36.03	0.90	0.91
Goosefoot extract 20%		111.46	116.37	19.15	19.84	12.41	10.77	38.32	36.39	37.86	35.94	0.14	0.15
Nettle extract 10%		120.49	118.67	20.94	21.69	11.28	10.41	38.96	39.55	37.76	38.35	0.94	0.92
Nettle extract 20%		133.89	129.20	23.83	23.88	11.38	11.34	47.57	48.83	46.74	47.98	0.20	0.19
LSD at 5 % level		**0.64**	**0.82**	**0.64**	**0.82**	**0.57**	0.64	**1.59**	**2.27**	**0.87**	**1.57**	**0.51**	**0.58**
Fertilization levels X Natural extracts													
	Water (control)	84.80	84.70	16.00	16.89	5.48	5.36	23.84	27.43	25.88	26.13	2.94	2.99
	Seaweed extract	103.96	109.80	16.59	17.32	6.41	6.43	29.50	27.16	29.50	26.92	0.27	0.29
100%	**Goosefoot extract at 10%**	101.10	108.80	16.43	17.16	7.53	8.38	29.69	31.55	28.55	30.41	0.17	0.16
	Goosefoot extract at 20%	100.50	101.70	17.38	19.50	8.83	8.69	29.00	29.51	28.82	29.33	0.00	0.00
	Nettle extract at 10%	138.16	123.21	21.87	22.38	12.91	12.44	42.51	43.58	40.31	41.38	1.53	1.49
	Nettle extract at 20%	150.66	134.90	18.66	20.25	6.80	7.08	50.64	50.37	50.34	50.05	0.18	0.19
	Water	81.02	87.16	18.55	16.69	5.25	5.27	20.14	22.20	19.60	21.66	2.14	2.80
	Seaweed extract	88.03	94.24	20.45	20.44	8.02	8.00	34.20	30.85	31.92	28.57	1.00	1.11
75%	**Goosefoot extract at 10%**	109.19	118.00	17.31	18.50	8.54	8.08	37.05	37.56	35.69	32.87	1.34	1.33
	Goosefoot extract at 20%	100.97	118.10	16.38	17.43	8.94	8.23	37.52	30.13	36.71	29.3	0.17	0.20
	Nettle extract at 10%	109.32	110.40	16.58	17.81	10.16	8.79	31.29	31.36	30.79	30.86	0.81	0.81
	Nettle extract at 20%	120.10	126.20	23.01	24.49	14.78	14.45	46.37	47.74	44.77	46.14	0.41	0.39
	Water	89.40	90.40	14.95	12.05	5.050	5.10	19.17	20.70	19.02	20.55	3.82	3.53
	Seaweed extract	108.54	107.60	21.76	19.32	9.69	7.9	46.41	44.68	42.81	40.74	2.59	2.69
50%	**Goosefoot extract at 10%**	102.50	104.60	22.99	22.96	12.27	13.37	48.11	45.71	47.21	44.81	1.18	1.25
	Goosefoot extract at 20%	132.90	129.30	23.70	22.59	19.45	15.39	48.44	49.55	48.05	49.17	0.24	0.23
	Nettle extract at 10%	114.00	122.40	24.36	24.90	10.77	10.00	43.10	43.73	42.18	42.81	0.48	0.47
	Nettle extract at 20%	130.90	126.50	29.82	26.91	12.57	12.49	45.71	48.38	45.10	47.77	0.00	0.00
LSD at 5% level		**0.38**	**0.49**	**0.38**	**0.49**	**0.34**	**0.39**	**0.95**	**1.36**	**0.52**	**0.94**	**0.31**	**0.34**

Effect of the interaction between fertilizer levels and natural extracts

The results in Table 3 show in general that the all treatments used led to obvious increment in the total yield and its components in the two seasons compared with control (foliar spray with water and fertilization with 100% of the recommended rate of NPK). The results illustrated that, plants fertilized by 50% of the recommended rate of NPK and sprayed with goosefoot extract or stinging nettle extract at 20% of each gave the highest value for each of average fruit weight and number of fruits/plant. Moreover, it noticed that these two treatments under fertilization by 50% of the recommended rate of NPK and foliar spray by high concentration 20% of goosefoot extract or fertilization undef level 75% and foliar spray by stinging nettle extract at 20% gave the highest value of early fruits yield. While, the total yield and marketable yield were increased by using fertilization level of 100% of the recommended rate of NPK and foliar spray by stinging nettle extract at 20% followed by fertilization level at 50% of the recommended rate of NPK and foliar spray by goosefoot extract at 20%. It can said that these treatments as shown in Table 2 whereas, led to increasing in plant growth and this reflect on fruit yield and also the role of stinging nettle or goosefoot extracts which contain macro elements (Table 1), simulative substances, free amino acids as well as some vitamins. In this regard, **Ogundare *et al.* (2015)** on tomato found that, use of inorganic and organic fertilizers had better effects on fruit number per plant, fruit weight and yield of tomato. On the other hand the results illustrated that, plants fertilized by 50% of the recommended fertilization and sprayed by water gave the highest values of blossom end rot.

Physical Characters of Tomato Fruits

Effect of fertilizer levels

Results in Table 4 reflected that, all treatments registered insignificant values of the physical parameters (fruit length, fruit diameter, fruit shape, fruit firmness, flesh thickness and number of loculi of tomato fruits) and this may be that, the physical characters of tomato fruits controlled by genetic factors, expect on flesh thickness. The results revealed that, fertilization by 50% of recommended rate of NPK was the best treatment for flesh thickness in both growing seasons. In this regard, nutrients, when added in adequate quantity, increases fruit quality, fruit size, and fruit taste of tomato **(Azad, 2000)**.

Effect of natural extracts as foliar spray

As shown in Table 4, there were significant differences in all the physical characters of tomato fruits among the different natural extract treatments expect on fruit length and fruit firmness wherein the differences did not reach to the significant level. On the contrary, the highest value of fruit shape was recorded by the control treatment (foliar spray with water) or by seaweed extract, respectively. These results were true in the two seasons of the study. The positive effect of applying stinging nettle, goosefoot as well as seaweed extracts could be expected because they have favorable conditions for increasing tomato vegetative growth as shown in Table 2. These results are in agreement with those obtained by **Khan *et al.* (2009) and Sutharsan *et al.* (2014**).

Effect of the interaction between fertilizer levels and natural extracts

Obtained results in Table 4 illustrated that, all treatments gave non significant values of the physical parameters, expect on flesh thickness, whereas spraying the plants by natural extracts such as stinging nettle extract at 10% and fertilization level at 100% of NPK or with 20% concentration and fertilization level at 50% were the best treatments for flesh thickness. These results were true in the two seasons of the study.

Chemical Characters of Tomato Fruits

Effect of fertilizer levels

Regarding fruit chemical characters, the results in Table 5 show that, the highest fruit VC concentration was obtained from fertilization by 50% of the recommended fertilization of mineral NPK while the highest value of Juice acidity, total sugar (%), P (%) and K (%) were obtained from fertilization by 100% of recommended fertilization but these increases did not reach to the significance level for fruit TSS or Ca (%). These results were true in the two seasons of the study. These results are in agreement with those obtained by **Toor *et al.* (2006**).

Table 4. Effect of fertilizer levels, natural extracts and their interactions on some physical characters of tomato fruits during the two seasons of 2017 and 2018

Treatment		Fruit length (cm)		Fruit diameter (cm)		Fruit shape		Fruit firmness (Kg/cm^2)		Flesh thickness (cm)		Number of loculi	
		2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Fertilizer levels													
100% (control)		5.65	5.63	5.83	5.81	0.97	0.99	2.70	2.73	0.68	0.66	4.13	4.18
75%		5.63	5.73	5.93	5.91	0.95	0.97	2.70	2.66	0.66	0.65	4.01	3.81
50%		5.67	5.81	5.83	5.83	1.00	0.99	2.71	2.75	0.69	0.67	4.08	3.95
LSD at 5 % level		**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**0.01**	**0.01**	**NS**	**NS**
Natural extracts													
Water (control)		5.46	5.23	5.10	5.20	1.07	1.05	2.56	2.56	0.58	0.56	3.53	3.43
Seaweed extract		5.73	5.73	5.46	5.36	1.05	1.06	2.66	2.63	0.67	0.67	4.06	4.03
Goosefoot extract at 10%		5.65	5.70	5.96	5.86	0.94	0.96	2.73	2.76	0.65	0.64	4.36	4.40
Goosefoot extract at 20%		5.43	5.76	6.20	6.20	0.92	0.94	2.66	2.73	0.66	0.64	4.06	3.90
Nettle extract at 10%		5.72	5.90	6.23	6.20	0.92	0.95	2.76	2.76	0.77	0.74	4.20	3.96
Nettle extract at 20%		5.92	6.03	6.23	6.30	0.95	0.96	2.83	2.83	0.72	0.71	4.16	4.16
LSD at 5 % level		**NS**	**NS**	**0.73**	**0.64**	**0.04**	**0.02**	**NS**	**NS**	**0.01**	**0.01**	**0.08**	**0.09**
Fertilization levels X Natural extracts													
	Water (control)	5.56	5.20	5.10	5.50	1.09	1.09	2.60	2.60	0.62	0.58	3.50	3.60
	Seaweed extract	5.67	5.70	5.5	5.30	1.04	1.07	2.70	2.60	0.69	0.66	4.50	4.20
100%	**Goosefoot extract at 10%**	5.68	5.70	6.00	5.80	0.94	0.97	2.70	2.80	0.63	0.63	4.50	4.60
	Goosefoot extract at 20%	5.60	5.70	5.70	5.60	0.97	1.02	2.60	2.80	0.63	0.63	3.40	3.80
	Nettle extract at 10%	5.66	5.60	6.60	6.70	0.85	0.83	2.80	2.80	0.88	0.83	4.60	4.60
	Nettle extract at 20%	5.75	5.90	6.10	6.00	0.95	0.99	2.80	2.80	0.65	0.65	4.30	4.30
	Water	5.43	5.40	5.10	5.10	1.06	1.06	2.60	2.60	0.60	0.58	3.50	3.30
	Seaweed extract	5.57	5.60	5.30	5.30	1.05	1.04	2.60	2.60	0.64	0.65	3.80	4.00
75%	**Goosefoot extract at 10%**	5.81	5.90	6.10	6.00	0.95	0.98	2.70	2.60	0.64	0.63	4.20	4.20
	Goosefoot extract at 20%	5.59	5.50	6.20	6.30	0.90	0.88	2.70	2.70	0.62	0.63	4.10	4.10
	Nettle extract at 10%	5.71	6.00	6.40	6.20	0.89	0.97	2.60	2.60	0.73	0.72	4.30	3.30
	Nettle extract at 20%	5.72	6.00	6.50	6.60	0.87	0.89	3.00	2.90	0.75	0.72	4.20	4.00
	Water	5.40	5.10	5.10	5.00	1.06	1.01	2.50	2.50	0.54	0.54	3.60	3.40
	Seaweed extract	5.95	5.90	5.60	5.50	1.06	1.07	2.70	2.70	0.68	0.70	3.90	3.90
50%	**Goosefoot extract at 10%**	5.48	5.50	5.80	5.80	0.93	0.93	2.80	2.90	0.70	0.68	4.40	4.40
	Goosefoot extract at 20%	5.10	6.10	6.70	6.70	0.90	0.91	2.70	2.70	0.74	0.67	4.70	3.80
	Nettle extract at 10%	5.80	6.10	5.70	5.70	1.01	1.06	2.90	2.90	0.70	0.69	3.90	4.00
	Nettle extract at 20%	6.30	6.20	6.10	6.30	1.03	0.99	2.70	2.80	0.78	0.78	3.99	4.20
LSD at 5% level		**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**0.01**	**0.01**	**NS**	**NS**

Table 5. Effect of fertilizer levels, natural extracts and their interactions on some chemical characters of tomato fruits during the two seasons of 2017 and 2018

Treatment		Vit C (mg/100g)		Juice acidity (%)		TSS		Total sugar (%)		K (%)		P (%)		Ca (%)	
		2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Fertilizer levels															
100% (control)		49.01	50.33	4.32	4.31	4.38	4.38	7.00	7.29	3.15	2.99	0.60	0.59	1.33	1.27
75%		50.33	51.25	3.96	4.10	4.13	4.10	6.74	6.73	2.79	2.76	0.59	0.58	1.39	1.35
50%		53.25	52.88	4.15	4.18	4.00	4.02	6.81	6.64	2.52	2.47	0.52	0.52	1.37	1.33
LSD at 5% level		**0.65**	**0.38**	**0.10**	**0.04**	**NS**	**NS**	**0.06**	**0.13**	**0.06**	**0.05**	**0.02**	**0.04**	**NS**	**NS**
Natural extracts															
Water (control)		53.10	53.60	4.43	4.30	4.03	4.00	4.15	4.38	1.83	1.70	0.42	0.40	1.26	1.24
Seaweed extract		57.76	57.00	4.00	4.08	4.03	4.03	8.01	8.06	2.83	2.82	0.50	0.51	1.25	1.30
Goosefoot extract at 10%		45.67	46.66	4.16	4.19	4.30	4.33	7.81	7.63	3.02	2.93	0.56	0.56	1.40	1.31
Goosefoot extract at 20%		48.94	51.66	4.00	4.15	4.23	4.27	7.83	7.91	3.31	3.16	0.63	0.60	1.35	1.34
Nettle extract at 10%		53.00	51.66	4.27	4.45	4.20	4.10	6.72	6.71	2.90	2.78	0.65	0.63	1.51	1.40
Nettle extract at t 20%		46.70	48.33	4.00	4.01	4.23	4.27	6.59	6.64	3.03	3.06	0.66	0.66	1.39	1.32
LSD at 5 % level		**0.98**	**0.79**	**0.08**	**0.06**	**NS**	**NS**	**0.04**	**0.14**	**0.04**	**0.07**	**0.02**	**0.02**	**0.08**	**0.07**
Fertilization levels X Natural extracts															
	Water (control)	47.60	45.00	4.80	4.60	4.20	4.00	5.18	5.97	2.25	2.21	0.51	0.49	1.28	1.24
	Seaweed extract	47.30	52.00	4.00	4.04	4.30	4.10	6.31	6.18	3.06	2.96	0.51	0.52	1.26	1.20
100%	**Goosefoot extract at 10%**	47.33	50.00	4.60	4.30	4.50	4.80	8.27	8.29	3.18	3.01	0.59	0.54	1.32	1.22
	Goosefoot extract at 20%	53.33	55.00	4.10	4.40	4.30	4.60	9.19	9.60	3.75	3.40	0.64	0.60	1.32	1.34
	Nettle extract at 10%	56.00	55.00	4.40	4.50	4.50	4.30	6.96	6.77	3.29	3.09	0.67	0.67	1.47	1.34
	Nettle extract at 20%	42.50	45.00	4.00	4.00	4.50	4.50	6.11	6.98	3.37	3.28	0.67	0.71	1.32	1.28
	Water	55.00	57.50	4.20	4.00	4.00	4.10	3.99	3.96	2.28	2.00	0.40	0.38	1.27	1.24
	Seaweed extract	58.00	55.00	3.90	3.99	4.00	4.10	9.08	9.10	2.58	2.50	0.50	0.50	1.27	1.38
75%	**Goosefoot extract at 10%**	43.00	45.00	3.78	4.16	4.30	4.00	7.38	7.38	3.04	3.06	0.58	0.60	1.50	1.35
	Goosefoot extract at 20%	46.00	50.00	3.80	3.98	4.30	4.10	7.07	7.03	3.08	3.10	0.68	0.64	1.41	1.39
	Nettle extract at 10%	56.70	55.00	4.20	4.55	4.10	4.10	6.09	6.04	2.72	2.87	0.70	0.66	1.53	1.46
	Nettle extract at 20%	43.30	45.00	3.90	3.97	4.10	4.20	6.83	6.85	3.03	3.01	0.72	0.71	1.35	1.29
	Water	56.70	58.30	4.30	4.31	3.90	3.90	3.28	3.22	0.98	0.87	0.37	0.34	1.24	1.23
	Seaweed extract	68.00	64.00	4.10	4.21	3.80	3.90	8.63	8.89	2.85	3.01	0.50	0.52	1.22	1.34
50%	**Goosefoot extract 10%**	46.70	45.00	4.10	4.10	4.10	4.20	7.77	7.20	2.83	2.71	0.53	0.55	1.38	1.36
	Goosefoot extract 20%	47.50	50.00	4.10	4.07	4.10	4.10	7.24	7.11	3.09	2.97	0.58	0.56	1.32	1.27
	Nettle extract 10%	46.30	45.00	4.20	4.31	4.00	3.90	7.12	7.31	2.70	2.38	0.59	0.58	1.54	1.41
	Nettle extract 20%	54.30	55.00	4.10	4.06	4.10	4.10	6.83	6.09	2.68	2.90	0.60	0.58	1.50	1.38
LSD at 5 % level		**0.59**	**0.48**	**0.05**	**0.04**	**NS**	**NS**	**0.02**	**0.08**	**0.04**	**0.03**	**0.02**	**0.01**	**NS**	**NS**

Effect of natural extracts as foliar spray

The results in Table 5, in general, show that the all treatments used led to obvious increment in the all fruit chemical characters in the two seasons compared to foliar spray with water as a control, but had no significant effect on fruit TSS. These results may due to all natural extract under this study contain higher nutrient concentrations (nitrogen and others) as shown in Table 1, simulative substances, free amino acids as well as some vitamins **(Khan *et al*., 2009**, **Sutharsan *et al*., 2014; Ruamrungsri *et al*., 2010**).

Effect of the interaction between fertilizer levels and natural extracts

Results in Table 5 notice that, the highest value of VC was obtained from using seaweed and fertilization by 50% of the recommended rate of NPK treatment. On the contrary, the highest value of Juice acidity was recorded by the control treatment (foliar spray with water) combined with fertilization by 100% of the recommended rate of NPK. Moreover, it noticed that fertilization by 100% of the recommended rate of NPK and foliar spray by the highest concentration 20% of goosefoot extract gave the highest value for each of total sugar (%) and K (%). It is clear that, plants fertilized by 75% of the recommended rate of NPK and foliar spray by stinging nettle extract at 20% gave the highest values of P (%). On the other hand the results illustrated that, all treatments gave insignificant value on TSS or Ca (%). These results were true in the two seasons of the study.

The Second Experiment on Broad Bean Crop

Plant Growth

Effect of fertilizer levels

The vegetative growth parameters of broad bean plants *i.e.,* plant length, No. of leaves, No. of branches, stem diameter, plant dry weight ,as well as leaf area affected by different percentages of the recommended mineral fertilization are shown in Table 6. The results revealed that adding 75% of the recommended mineral fertilization followed by 50% gave the highest values of all vegetative growth parameters, except plant length and leaf area which showed favorable result under 100% fertilization, these results were true in both growing seasons.

Regarding total chlorophyll concentration in leaf tissues, adding 75% followed by 50% significantly increased total chlorophyll compared with 100% of the recommended mineral NPK in the first season, but in the second season, adding 100% followed by 75% increased chlorophyll concentration. These results disagree with some investigators whose reported that increasing the amount of NPK-fertilizer caused an increase in the vegetative growth **(Abo El-Soud *et al*., 2003** on broad bean, **Mohammed, 2004** on broad bean and cowpea **Futuless *et al.,* 2011** on soybean **Jasim *et al.*, 2016** on broad bean)

Effect of natural extracts as foliar spray

Obtained results in Table 6 indicate that foliar spray with stinging nettle or goosefoot extract at 10% or 20% of each and seaweed extract at 0.5g/l increased all vegetative growth parameters, *i.e.,* plant length, leaf number, branch number, stem diameter, plant dry weight and leaf area in both seasons compared with the control (spraying with water). Broad bean plants sprayed with goosefoot and stinging nettle extract at 10% or 20% concentration significantly increased the plant length and No. of leaves. Regarding the number of branches, spraying the plants with goosefoot extract at 20% concentration and stinging nettle extract at 10% concentration then goosefoot extract at 10%, stinging nettle extract at 20% concentration and seaweed extract at 0.5g/l increased number of branches/plant. Spraying plants with stinging nettle extract at 10% and 20% concentration followed by goosefoot extract at 10% and 20% concentration gave the highest value of stem diameter. Moreover, it is noticed also that the plants sprayed by goosefoot extract at 20% concentration followed by stinging nettle extract at 20% concentration gave the highest value of leaf area/plant in both growing seasons. Concerning plant dry weight, spraying the plants by goosefoot extract at 10% concentration and 20% concentration then stinging nettle extract at 10% and 20% which gave the highest means. As for chlorophyll concentration in leaves of broad bean plant, spraying the plants with goosefoot extract at 20% then 10% in the first season and spraying the plants with goosefoot extract at 20%

Table 6. Effect of fertilizer levels, natural extracts and their interactions on vegetative growth and leaf chlorophyll content of broad bean plants during the two seasons of 2016/2017 and 2017/2018

Treatment		Plant length (cm)		No. of. leaves / plant		No. of. brunches / plant		Stem diameter (cm)		Leaf area (cm²)		Dry weight (g/plant)		leaf chlorophyll SPAD	
		2016/ 2017	2017/ 2018	2016/ 2017	2017/ 2018	2016/ 2017	2017/ 2018	2016/ 2017	2017/ 2018	2016/ 2017	2017/ 2018	2016/ 2017	2017/ 2018	2016/ 2017	2017/ 2018
Fertilizer levels															
100% (control)		65.47	63.27	107.23	103.56	9.39	9.72	1.31	1.27	1209.8	1210.0	39.46	42.30	38.11	40.51
75%		61.72	62.97	124.92	124.52	9.72	9.88	1.35	1.20	1158.2	1117.6	42.37	43.05	40.13	41.32
50%		59.20	59.12	113.64	114.57	8.94	9.16	1.35	1.36	1133.7	1127.3	42.13	41.41	38.96	38.95
LSD at 5% level		**0.24**	**0.44**	**1.49**	**2.34**	**0.48**	**0.29**	**NS**	**NS**	**NS**	**61.16**	**1.47**	**NS**	**0.04**	**0.08**
Natural extracts															
Water (control)		57.33	54.33	71.67	75.39	7.66	7.33	1.16	0.96	904.7	741.5	25.83	27.58	35.35	36.40
Seaweed extract		56.54	56.97	102.89	105.67	8.44	8.22	1.10	1.09	1188.7	1161.8	36.58	37.10	37.33	38.48
Goosefoot extract at 10%		62.77	64.33	117.67	115.94	9.22	9.61	1.36	1.29	1054.1	1123.6	47.11	47.70	40.93	40.91
Goosefoot extract at 20%		65.00	64.94	154.80	145.32	11.00	11.94	1.45	1.40	1366.6	1406.2	51.08	50.20	41.72	43.31
Nettle extract at 10%		64.22	63.00	120.72	119.37	10.07	10.44	1.48	1.50	1150.4	1223.2	43.87	44.03	40.96	42.48
Nettle extract at 20%		66.92	67.16	123.83	123.61	9.72	10.00	1.46	1.44	1338.7	1253.6	43.47	46.93	38.13	39.98
LSD at 5 % level		**0.23**	**0.78**	**1.29**	**2.64**	**0.74**	**0.32**	**0.23**	**0.14**	**65.99**	**78.90**	**1.36**	**0.89**	**0.03**	**0.05**
Fertilization X Foliar nutrition															
	Water (control)	68.00	58.00	74.00	74.50	8.00	8.33	1.30	1.05	1099.8	931.5	26.90	31.83	36.62	41.60
	Seaweed extract	59.50	57.00	104.00	107.33	9.00	9.00	1.10	1.10	1369.4	1418.9	35.15	38.80	36.66	38.67
100%	**Goosefoot extract at 10%**	63.33	63.33	119.50	108.50	9.33	9.50	1.30	1.20	1019.3	1184.0	41.23	44.91	37.76	39.40
	Goosefoot extract at 20%	68.33	65.00	124.39	114.67	10.00	11.50	1.40	1.50	1451.4	1420.2	43.10	46.40	40.15	41.10
	Nettle extract at 10%	64.33	66.33	113.00	109.67	10.88	11.00	1.60	1.60	1102.0	1049.0	43.53	43.80	39.26	42.06
	Nettle extract at 20%	69.33	70.00	108.50	106.67	9.16	9.00	1.20	1.19	1216.6	1256.0	46.90	48.10	38.23	40.23
	Water (control)	54.33	56.66	73.67	81.00	8.00	7.67	1.30	0.95	878.4	665.6	24.80	29.10	34.63	35.20
	Seaweed extract	55.66	58.66	104.33	106.00	8.00	7.67	1.10	1.08	1129.6	1044.4	32.50	32.20	37.37	37.00
75%	**Goosefoot extract at 10%**	63.00	66.33	118.00	125.67	9.66	10.33	1.20	1.03	999.3	1001.7	47.90	42.70	45.80	45.600
	Goosefoot extract at 20%	64.66	65.66	187.00	167.78	12.66	12.33	1.40	1.20	1509.0	1421.1	53.56	52.95	41.26	42.50
	Nettle extract at 10%	64.33	63.00	128.50	127.00	10.00	10.33	1.30	1.30	1078.2	1348.8	52.20	52.50	41.63	44.26
	Nettle extract at 20%	68.33	67.50	138.00	139.67	10.00	11.00	1.80	1.68	1354.5	1223.9	43.30	48.90	40.13	43.40
	Water (control)	49.66	48.33	67.33	70.67	7.00	6.00	0.90	0.88	736.0	627.3	25.80	21.83	34.80	32.40
	Seaweed extract	54.46	55.25	100.33	103.67	8.33	8.00	1.10	1.10	1067.1	1022.0	42.10	40.30	37.96	39.76
50%	**Goosefoot extract at 10%**	62.00	63.33	115.50	113.66	8.66	9.00	1.60	1.65	1143.7	1185.1	52.20	55.50	39.23	37.73
	Goosefoot extract at 20%	62.00	64.16	153.00	153.50	10.33	12.00	1.55	1.52	1139.6	1377.1	56.60	51.26	43.76	46.35
	Nettle extract at 10%	64.00	59.66	120.66	121.43	9.33	10.00	1.55	1.60	1271.0	1271.7	35.90	35.80	42.00	41.13
	Nettle extract at 20%	63.11	64.00	125.00	124.50	10.00	10.00	1.40	1.45	1444.8	1280.8	40.23	43.80	36.03	36.33
LSD at 5% level		**1.39**	**0.47**	**0.77**	**1.58**	**0.44**	**0.19**	**0.14**	**0.86**	**39.58**	**47.32**	**0.81**	**0.53**	**0.02**	**0.03**

then stinging nettle extract at 10% in the second season, respectively gave the highest content of chlorophyll in the plant leaves. One of the main attributed effects is led to improve all vegetative growth parameter due to its higher nutrient concentrations in the natural extract used in this experiment, *i.e.* (nitrogen and others). This might be due to the presence of macro nutrients, free amino acids, and cytokines, as shown in Table 1. Nitrogen is a major element in plants and is assimilated in free amino acids, proteins, and other nitrogenous compounds that are related to growth (**Ruamrungsri *et al*., 2010**). These results are in the same line with **Arjumand *et al.* (2013)** on broad bean plants and **Ogundare *et al*. (2015**) on tomato.

Effect of the interaction between fertilizer levels and natural extracts

The interaction between fertilizer levels and all foliar spray treatments had significant effect on plant length, leaf number, branches number, stem diameter, plant dry weight, leaf area and chlorophyll. Result presented in Table 6 reveal that, adding 75% followed by 50% of the recommended mineral fertilization and spraying with goosefoot extract at 20% concentration gave the highest values of all vegetative growth parameters, except plant length which showed favorable result under 100% from fertilization and spraying with stinging nettle extract at 20% concentration. Whereas adding 100% of recommended fertilizer level and spraying the plants with goosefoot extract at 20% concentration increased leaf area/plant and these results were true in both growing seasons.

Green Pod Yield and its Components of Broad Bean Plants

Effect of fertilizer levels

Results in Table 7 show that fertilizers levels had significant effect on pod length, pod diameter, average of fresh pod weight**,** number of seeds/pod, weight of 100 fresh seeds, weight of 100 dry seeds and total pod yield/fed. The highest values of the total green pod yield were obtained from the plant fertilized by adding 100% of recommended mineral fertilization in both growing seasons. Many investigators reported that increasing the amount of NPK-fertilizer caused an increase in yield **(Abo El-Soud *et al*., 2003** on broad bean, **Mohammed, 2004** on broad bean and cowpea **Futuless *et al.*, 2011** on soybean **Jasim *et al.*, 2016** on broad bean). It is noticed that pod length, pod diameter and number of seeds/pod were increased but did not give significant value and this may be that characters (pod length and pod diameter) controlled by genetic factors. Concerning to average of fresh pod weight, weight of 100 dry seeds in both growing seasons and weight of 100 fresh seeds in the second season increased significantly by adding 50% from recommended mineral fertilization

Effect of natural extracts as foliar spray

As shown in Table 7, broad bean plants which sprayed with stinging nettle extract at 20% concentration gave the highest value for each of pod length, average of fresh pod weight**,** number of seeds/pod and weight of 100 dry seeds in the two seasons. Concerning pod diameter and weight of 100 fresh seeds in both growing season, the best treatment was obtained with spraying the plants with stinging nettle extract at 10% concentration. Regarding the total green pod yield/fed., spraying the plants with goosefoot extract at 10% concentration followed by stinging nettle extract at 10% concentration then stinging nettle extract at 20% concentration increased significantly the total green pod yield. It is clear that, all used treatments gave positive effect on yield and its component, whereas the yield increment reached to 3.70 and 3.68 (ton/ fed.) at the two seasons comparing with the control (without treating) which produced 2.02 and 2.19 (ton/fed.) at the two seasons, respectively. One of the main attributed effects is led to improve pod yield due to its higher nutrient concentrations in the natural extract used in this experiment, *i.e.* (nitrogen and others). This might be due to the presence of macro nutrients, free amino acids, and cytokines, as shown in Table 1. Nitrogen is a major element in plants and is assimilated in free amino acids, proteins, and other nitrogenous compounds that are related to growth and development (**Ruamrungsri *et al*., 2010**).These results are in the same line with **Arjumand *et al.* (2013)** on broad bean plants and **Ogundare *et al*. (2015**) on tomato.

Table 7. Effect of fertilizer levels, natural extracts and their interactions on total green pod yield and its components of broad bean during the two seasons of 2016/2017 and 2017/2018

Treatment		Pod length (cm)		Pod diameter (cm)		Average of fresh pod weight (g)		No. of seeds /pod		Fresh weight of 100 seeds (g)		Dry weight of 100 seed (g)		Total yield (ton/fed.)	
		2016/ 2017	2017/ 2018	2016/ 2017	2017/ 2018	2016/ 2017	2017/ 2018	2016/ 2017	2017/ 2018	2016/ 2017	2017/ 2018	2016/ 2017	2017/ 2018	2016	2017
Fertilizer levels															
100% (control)		15.45	16.24	1.76	1.80	21.52	21.29	4.45	4.58	186.06	187.53	49.36	50.17	3.37	3.34
75%		15.49	15.98	1.76	1.79	21.65	21.91	4.36	4.40	177.32	173.51	48.27	43.74	3.01	3.05
50%		15.62	16.16	1.81	1.82	21.95	22.50	4.54	4.47	194.42	184.75	54.32	55.90	3.07	3.09
LSD at 5% level		**NS**	**NS**	**NS**	**NS**	**0.03**	**024**	**NS**	**NS**	**5.41**	**1.77**	**1.06**	**3.06**	**0.04**	**0.11**
Natural extracts															
Water (control)		12.83	13.15	1.52	1.60	14.66	15.08	3.68	4.14	141.47	146.62	35.31	35.13	2.02	2.19
Seaweed extract		14.68	15.20	1.73	1.72	19.72	20.04	4.18	4.31	169.26	176.77	49.13	45.62	3.01	3.11
Goosefoot extract at 10%		16.12	17.03	1.85	1.85	23.35	22.68	4.76	4.44	199.13	193.80	57.46	55.35	3.70	3.68
Goosefoot extract at 20%		16.11	16.82	1.82	1.88	21.46	23.76	4.58	4.51	194.67	182.50	50.52	49.84	3.23	3.20
Nettle extract at 10%		16.46	17.10	1.91	1.90	25.48	24.49	4.59	4.68	220.93	198.67	55.62	54.37	3.45	3.56
Nettle extract at 20%		16.91	17.46	1.84	1.88	25.55	25.33	4.91	4.82	190.14	193.22	55.87	59.31	3.48	3.22
LSD at 5% level		**0.06**	**0.07**	**0.03**	**0.03**	**0.06**	**0.22**	**0.13**	**0.06**	**4.83**	**1.74**	**1.10**	**2.77**	**0.09**	**0.08**
Fertilization X Foliar nutrition															
	Water (control)	13.51	13.33	1.59	1.69	16.98	15.96	3.80	4.26	163.67	156.86	36.60	37.00	2.15	2.48
	Seaweed extract	14.68	16.14	1.74	1.75	21.17	21.24	4.26	4.73	181.02	194.60	55.00	51.22	3.49	3.53
	Goosefoot extract at 10%	15.45	17.69	1.84	1.86	22.16	21.60	4.63	4.50	192.80	191.80	60.00	65.46	3.66	3.77
	Goosefoot extract at 20%	16.35	17.78	1.80	1.86	21.92	24.57	4.59	4.70	196.20	195.90	52.70	50.73	4.25	4.00
100%	**Nettle extract at 10%**	16.64	16.41	1.90	1.83	24.01	22.33	4.58	4.93	200.60	204.00	47.20	43.00	3.10	3.00
	Nettle extract at 20%	16.04	16.11	1.72	1.84	22.89	22.04	4.87	4.40	182.07	182.00	44.67	53.60	3.55	3.29
	Water (control)	12.51	12.90	1.51	1.58	13.30	15.10	3.56	4.23	136.80	140.40	35.33	31.93	1.92	1.91
	Seaweed extract	14.94	14.26	1.73	1.72	20.73	19.78	4.33	4.19	161.10	167.46	48.20	37.60	2.85	2.85
	Goosefoot extract at 10%	16.10	16.61	1.85	1.85	21.99	22.84	4.95	4.70	198.40	181.00	51.00	41.80	4.07	3.99
	Goosefoot extract at 20%	16.17	16.69	1.82	1.88	20.96	22.49	4.33	4.06	198.60	170.20	43.13	41.26	2.77	2.89
75%	**Nettle extract at 10%**	16.60	17.55	1.84	1.88	26.03	25.20	4.20	4.33	167.20	183.00	53.46	53.53	3.33	3.69
	Nettle extract at 20%	16.61	17.86	1.84	1.84	26.91	26.04	4.80	4.87	201.80	199.00	58.550	56.35	3.14	2.96
	Water (control)	12.46	13.21	1.48	1.54	13.69	14.16	3.70	3.93	123.93	142.60	34.00	36.46	2.00	2.19
	Seaweed extract	14.41	15.20	1.74	1.70	17.28	19.11	3.96	4.00	165.67	168.26	44.20	48.06	2.67	2.94
	Goosefoot extract at 10%	16.81	16.80	1.87	1.86	25.92	23.61	4.72	4.12	206.20	208.60	61.4	58.80	3.39	3.29
	Goosefoot extract at 20%	15.82	16.00	1.84	1.89	21.52	24.24	4.82	4.76	189.20	181.40	55.73	57.53	2.68	2.73
50%	**Nettle extract at 10%**	16.14	17.33	1.99	1.99	26.41	25.94	5.00	4.80	294.99	209.00	66.20	66.60	3.94	3.98
	Nettle extract at 20%	18.08	18.41	1.96	1.96	26.86	27.92	5.06	5.20	186.56	198.66	64.40	68.00	3.76	3.42
LSD at 5% level		**0.04**	**0.04**	**0.02**	**0.02**	**0.04**	**0.13**	**0.08**	**0.03**	**2.89**	**1.05**	**0.66**	**1.66**	**0.06**	**0.05**

Effect of the interaction between fertilizer levels and natural extracts

The interaction between fertilizers recommendation levels and foliar spray treatments had significant effect on pod length, pod diameter, average of fresh pod weight**,** number of seeds/pod, weight of 100 fresh seeds, weight of 100 dry seeds and total pod yield/fed. Moreover, the results presented in Table 7 reveal that, spraying broad bean plants by stinging nettle extract at 20% under 50% fertilization gave the highest value for each of pod length, pod diameter, weight of 100 fresh seeds, average of fresh pod weight and number of seeds/pod in both growing seasons. As for weight of 100 dry seeds, fertilizing broad bean plant with 50% of recommended rate of NPK and spraying the plants with stinging nettle extract at 10% concentration in the first season and stinging nettle extract at 20% in the second season significantly increased weight of 100 dry seeds. Regarding the total green pods yield spraying the plants by goosefoot extract at 20% then 10% and 100% then 75% of recommended rate of NPK, respectively followed by 50% of the recommended rate of NPK and spraying the plants with stinging nettle extract at 10% in both growing seasons significantly increased total green pods yield. The total pod yield of broad bean plants showed highly positively correlated with number of branches/ plant and leaf area as shown in Table 6. According to the obtained results, it can said that, adding 75% from the recommended rate of NPK and spraying plants with goosefoot extract at 10% produced the highest yield of broad bean, whereas the increment in pod yield/fad., were 1.92 and 1.51 ton/fad., at the two seasons, respectively. **Alam (2006)** reported that combined use of organic and inorganic fertilizer reduced amount of fertilizer required by crops it also produced highest plant growth. The increase is attributable to the role of organic matter in the release of notably nitrogen which is necessary for the elongation, cell division, growth and development of plant. This is consistent with that found by **Arjumand *et al.* (2013)** on broad bean plants.

Chemical Characters of Broad Bean Seeds

Effect of fertilizer levels

The chemicals properties of the broad bean seeds, *i.e.* N (%), P%, K (%) and protein (%) are shown in Table 8. The results revealed that, adding 100% of the recommended mineral fertilization gave the highest values of N (%), K (%) and protein (%) whereas P (%) increased with adding 75% of the recommended mineral fertilization. These results were true in the two seasons of the study. These results were in agreements with those obtained by **Abo El-Soud *et al.* (2003)** on broad bean, **Mohammed (2004)** on broad bean and cowpea and **Toor *et al.* (2006)**.

Effect of natural extracts as foliar spray

Results in Table 8 illustrat that, all materials under this study increased N, P, K and protein content in broad bean seeds in the both growing seasons comparing with control. It is clear that N(%) and protein were increased in the first season when the plants sprayed by goosefoot extract at 10% concentration then stinging nettle extract at 20% concentration in the second season. Concerning P (%) and K (%) spraying the plant by goosefoot extract at 20% concentration increased P (%) and K (%) compared with the other treatments in the both growing seasons. These results may due to all extract under this study contain higher nutrient concentrations (nitrogen and others), cytokines, amino acids as shown in Table 1, as well as some vitamins **(Khan *et al.*, 2009; Sutharsan *et al.*, 2014; Ruamrungsri *et al.*, 2010**).

Effect of the interaction between fertilizer levels and natural extracts

Results in Table 8 show clearly that, the interactions between fertilizers recommendation levels and foliar spray treatments had significant effect on chemical components, *i.e.* N, P, K and protein percentage. Results presented that, spraying broad bean plants by stinging nettle extract at 20% concentration under 100% of the recommended rate of NPK in the first season and 75% of the recommended rate of NPK in the second season which gave the highest value for each of N and protein percentage. While P and K percentage increased by spraying the plants by goosefoot extract at 20% concentration under 75% of the recommended rate of NPK in both growing seasons.

Table 8. Effect of fertilizer levels, natural extracts and their interactions on some chemical characters of broad bean seeds during the two seasons of 2016/2017 and 2017/2018

Treatment		N (%)		P (%)		K (%)		Protein (%)	
		2016/2017	2017/2018	2016/2017	2017/2018	2016/2017	2017/2018	2016/2017	2017/2018
Fertilizer levels									
100% (control)		2.869	2.849	0.553	0.541	1.567	1.653	17.931	17.807
75%		2.619	2.766	0.589	0.592	1.500	1.446	16.370	17.293
50%		2.521	2.557	0.539	0.529	1.437	1.401	15.756	15.983
L.S.D at 5 % level		**0.059**	**0.098**	**0.008**	**0.015**	**0.080**	**0.078**	**0.373**	**0.372**
Natural extracts									
Water (control)		2.107	2.088	0.434	0.432	0.877	0.753	13.169	13.054
Seaweed extract		2.723	2.875	0.503	0.498	1.280	1.121	17.019	17.973
Goosefoot extract at 10%		2.912	2.950	0.614	0.594	1.628	1.749	18.204	18.442
Goosefoot extract at 20%		2.816	2.808	0.647	0.628	2.031	1.928	17.600	17.552
Nettle extract at 10%		2.583	2.600	0.577	0.586	1.628	1.740	16.146	16.252
Nettle extract at 20%		2.876	3.023	0.586	0.587	1.563	1.711	17.977	18.894
L.S.D at 5 % level		**0.058**	**0.067**	**0.006**	**0.021**	**0.036**	**0.046**	**0.364**	**0.364**
Fertilization X Foliar nutrition									
	Water (control)	2.212	2.154	0.448	0.441	0.978	0.854	13.825	13.463
	Seaweed extract	3.180	3.097	0.491	0.446	1.674	1.672	19.875	19.356
100%	**Goosefoot extract at 10%**	3.270	3.207	0.533	0.543	1.687	1.846	20.438	20.044
	Goosefoot extract at 20%	2.801	2.665	0.572	0.578	1.674	1.869	17.506	16.656
	Nettle extract at 10%	2.433	2.654	0.621	0.613	1.723	1.862	15.206	16.587
	Nettle extract at 20%	3.318	3.318	0.652	0.627	1.669	1.820	20.738	20.738
	Water (control)	2.097	2.100	0.438	0.460	0.812	0.738	13.106	13.125
	Seaweed extract	2.488	2.654	0.582	0.588	1.379	0.851	15.550	16.587
75%	**Goosefoot extract at 10%**	2.825	2.991	0.635	0.633	1.749	1.803	17.656	18.694
	Goosefoot extract at 20%	2.658	2.769	0.689	0.633	1.987	1.882	16.613	17.306
	Nettle extract at 10%	2.658	2.769	0.601	0.628	1.610	1.759	16.613	17.306
	Nettle extract at 20%	2.989	3.318	0.588	0.611	1.463	1.644	18.681	20.738
	Water (control)	2.012	2.012	0.417	0.395	0.841	0.667	12.575	12.575
	Seaweed extract	2.501	2.876	0.436	0.461	0.789	0.841	15.631	17.975
50%	**Goosefoot extract at 10%**	2.643	2.654	0.674	0.606	1.449	1.598	16.519	16.587
	Goosefoot extract at 20%	2.989	2.991	0.679	0.674	2.433	2.033	18.681	18.694
	Nettle extract at 10%	2.659	2.378	0.509	0.518	1.551	1.601	16.619	14.863
	Nettle extract at 20%	2.322	2.433	0.518	0.523	1.559	1.669	14.512	15.206
LSD at 5 % level		**0.035**	**0.040**	**0.004**	**0.012**	**0.022**	**0.027**	**0.218**	**0.251**

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استخدام المستخلص المائي لبعض الحشائش كتغذية ورقية في وجود مستويات مختلفة من الأسمدة المعدنية لتحسين محصول وجودة ثمار الطماطم و قرون الفول الرومي

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نفذت هذه الدراسة في شتاء موسمين متتاليين ٢٠١٦/٢٠١٧ و٢٠١٧/٢٠١٨ لإنتاج محصول الفول الرومي صنف luz de tout في محطة التجارب لمحاصيل الخضر بقها محافظة القليوبية و محصول الطماطم (هجين أليسا) في صيف موسمي ٢٠١٧/٢٠١٨ في معهد بحوث البساتين شعبة بحوث الخضر بالدقي لدراسة استخدام ثلاث مستويات مختلفة من توصية التسميد المعدني بعناصر NPK (كنترول١٠٠% -٧٥% -٥٠% من التوصية السمادية لكل منهم)، وأربع معاملات رش ورقى ببعض المستخلصات الطبيعية وهى بدون رش (كنترول) رش بماء الصنبور، مستخلص الطحالب البحرية بمعدل٥ ,٠ جرام /لتر، مستخلص حشيشه الحُرّيقْ ومستخلص حشيشه الزربيح بتركيزي ١٠% و٢٠% والتداخل بينهم وتأثير ذلك على النمو الخضري والمحصول ومكوناته لكل من الطماطم و الفول الرومي كلا على حده في تجربة منفصلة لكل منهما، أوضحت البيانات أن تسميد نباتات الطماطم بنسبة ٧٥% من التسميد المعدني الموصى به والرش الورقي بمستخلص الحريق بمعدل٢٠% أعطت أعلى قيم لجميع قياسات النمو الخضري في كلا الموسمين، كما أظهرت البيانات أن جميع المعاملات المستخدمة أدت إلى زيادة واضحة في المحصول الكلى ومكوناته وانخفاض نسبة إصابة الثمار بالمرض الفسيولوجي عفن الطرف الزهري فى ثمار الطماطم وذلك بالموسمين مقارنة بالكنترول وخصوصا عند التسميد بمعدل ٥٠% من التسميد المعدني الموصى به والرش بالمستخلصات تحت الدراسة بالتركيزات المرتفعة، بينما زاد محتوي الثمار من فيتامين ج باستخدام مستخلص الطحالب البحرية والتسميد بنسبة ٥٠% من التسميد الموصى به، علاوة على ذلك أعطت معاملة التسميد ١٠٠% والرش بمستخلص الزربيح ٢٠% أعلى القيم من محتوى الثمار من السكريات والبوتاسيوم، كما أوضحت البيانات أن جميع المعاملات لم تؤثر معنويا على الصفات الفيزيقية للثمار (طول الثمرة وقطر الثمرة وشكل الثمرة وصلابتها وسمك اللحم وعدد الحجرات)، وقد أدى التسميد بنسبة ٥٠% إلى زيادة نسبه كل من الفسفور والبوتاسيوم لكن رش النباتات بمستخلص نبات الحريق بتركيز ٢٠% تحت التسميد الموصى به بنسبة ٧٥% أعطى أعلى قيم للنيتروجين ونسبة البروتين في كلا موسمي النمو، ومن هنا يتضح من النتائج إمكانية التوصية بتسميد الطماطم بمعدل٥٠% من التوصية السمادية المعدنية مع رش النباتات بمستخلص الحُرّيقْ أو الزربيح بتركيز ٢٠% حيث أدى إلى زيادة المحصول ومكوناته مع توفير٥٠% من معدل التسميد المعدني الموصي به، أما بالنسبة لنباتات الفول الرومي قد أوضحت النتائج المتحصل عليها أن الرش بمستخلص الزربيح بمعدل ٢٠% أعطى اعلي قيم لمعظم معاملات النمو الخضري تحت ٧٥ و٥٠% من التسميد المعدني الموصى به وذلك باستثناء طول النبات الذي اظهر نتائج ايجابية تحت ظروف التسميد١٠٠% المعدني والرش بمستخلص الحُرّيقْ بمعدل٢٠%، بينما سجلت مساحة الورقة نتائج معنوية تحت ظروف التسميد المعدني الموصى به ٥٠ % ورش النباتات بمستخلص الحُرّيقْ بمعدل ٢٠%، ومن الملاحظ انه عند رش نباتات الفول الرومي بمستخلص الحُرّيقْ ١٠% تحت ظروف التسميد المعدني ٥٠% من الموصى به أعطى أعلى قيم لطول القرن، قطر القرن، متوسط وزن القرن، وزن ١٠٠ بذرة طازجة بينما أدي التسميد بمعدل١٠٠% ثم ٧٥% من التسميد المعدني الموصى به مع الرش بمستخلص الزربيح ٢٠% ثم ١٠% إلى زيادة المحصول الكلى في كلا الموسمين تليهم معامله الرش بالحُرّيقْ بتركيز ١٠% تحت ٥٠% من التسميد المعدني الموصى به، وأدى رش نباتات الفول الرومي بمستخلص الزربيح بمعدل ٢٠% تحت مستوى التسميد المعدني المنخفض (٥٠%) إلى زيادة نسبة الفسفور والبوتاسيوم بشكل واضح لكن الرش بمستخلص الحُرّيقْ ٢٠% تحت ظروف التسميد المعدني ٧٥% من الموصى به أعطى أعلى قيم لنسبة النيتروجين والبروتين في البذور في كلا موسمي الزراعة، وبوجه عام أدى تسميد الفول الرومي بمعدل ٧٥% أو ٥٠% من التوصية السمادية المعدنية مع رش النباتات بمستخلص الزربيح أو الحُرّيقْ بتركيز ١٠% إلى زيادة محصول القرون الخضراء ومكوناته مع توفير من ٢٥% إلى ٥٠% من معدل التسميد المعدني الموصي به.

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