EFFECT OF FOLIAR SPRAY WITH SOME PLANT NATURAL EXTRACTS ON GROWTH AND YIELD OF (*Phaseolus vulgaris* L.) PLANTS

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ABSTRACT

A field experiment was designed in two successive seasons of 2017 and 2018 at the Experimental Farm, El-Khatara, Faculty of Agriculture, Zagazig University, Egypt. Plants were foliar sprayed with moringa leaves extract (MLE), garlic extract (GE) and their combination in addition to control treatment (plants were sprayed with tap water) to examine its effects on growth and yield of bean plants grown under sandy soil conditions. Results revealed that spraying plants with MLE, GE and their combinations had significant effects in growth traits; i.e., (plant height, number of leaves/plant, number of branches/plant, plant fresh weight) seeds protein content, yield and its components and photosynthetic pigments compared to control. The most favorable treatments reflected the highest values of the above-mentioned traits was foliar spray of bean plants with 4% MLE + 2% GE followed by 2% MLE + 4% GE.

Keywords: Common bean (*Phaseolus vulgaris* L.), garlic extract, moringa leaves extract, vegetative growth, Photosynthesis, yield.

INTRODUCTION

Common bean (*Phaseolus vulgaris* L.) is one of the most popular legumes; it is considered as a good source of vegetable protein, fibers, complex carbohydrates and folic acid. One cup of *P. vulgaris* provides 25 to 30 % of the daily recommended levels of iron. It meets 25 % of requirements of magnesium and copper, and 15 % of potassium and zinc. The yearly global production is around 18,335 thousand tons, whereas in Egypt it is estimated around 50 thousand tons (FAO, 2004). It is considered as the second important export crop. The yield of common bean in Egypt is estimated to be the most efficient among Arab countries, as its yield around one ton seeds per Fedan.

Fresh *Moringa oleifera* leaves have high zeatin concentrations (up to 200 mcg/g of leaves), antioxidants and macro-micro nutrients (Fuglie, 2000). Moreover, moringa leaves are a potential source of vitamin A and C, iron, calcium and B-carotene (Siddhuraju and Becker, 2003). It is rich in purine and adenine as derivatives of plant hormone group of cytokinin. Zeatin enhances the antioxidant properties of many enzymes and protects the cells from aging effects of different reactive oxygen species (Zhang and Ervin, 2004).

Since the major fraction of plant hormones in moringa leaf extract MLE is cytokinin, it was assessed with growth enhancement, it is mainly attribute to cytokinins or its a cumulative effect on plant hormones and mineral nutrients present in moringa leaf (Wahid *et al*., 2007). This natural plant hormone has increased the yield of many crops even when applied in small concentration. This fact was revealed by Foidle *et al*. (2001) who reported that foliar spray with the

MLE showed a significant enhancement in yield despite the fact that it was applied in very small amounts. Also, Fuglie (2000) reported that MLE accelerated the growth of young plants, improved plant resistance, increased leaf area, number of roots, produced more and larger pear fruits and generally increased yield by 20 to 35%.

In addition, fresh *Moringa oleifera* also contains proteins, vitamins (such as A, B1, B2, B3, ascorbic acid and E), β carotene, amino acids, phenolic compounds, sugars, and minerals (such as calcium, magnesium, sodium, iron, phosphorus and potassium) and several flavonoid pigments. Furthermore, foliar application has been reported to be growth and yield improving tools in various crops (Jyotsna and Srivastava, 1998; Fuglie, 2000; Foidle *et al.,* 2001 and Nagar *et al.,* 2006). So it is a good source of natural antioxidants (Jacob and Shenbagaraman, 2011). In addition, Mona (2013) found that spraying rocket (*Eruca vesicaria* subsp. sativa) plants with the aqueous extracts of leaves and twigs of *M. oleifera* at rates of 1, 2 and 3% increased all measured growth criteria plant height, the amounts of each of chlorophyll a and b, total sugars, ascorbic acid and nutrients N, P and K.

Effect of garlic extract: garlic extract has been reported to positively affect different plant characters. In addition, Ahmed *et al*. (2005) confirmed that greater increase in number of pods of pea (cv. Meteor) was obtained with post inoculation treatment with garlic extract at 10g/8 liters.

A bioactive compound in garlic that has antibacterial activity is allicin, which is volatile compound containing sulphur (Benkeblia and Lanzotti, 2007). Alliin, when crushed, converts to allicin which is an antibiotic. Garlic also contains enzymes, B vitamins, proteins, minerals, saponins, flavonoids, and maillard reaction products, which are non sulphur-containing compounds. Furthermore, a phytoalexin (allixin) has been found (Pandya *et al.,* 2011). El-Desouky *et al.,* (1998) found that the natural extract of garlic cloves improve the growth, sex expression and fruit yield and quality of squash plant. Since, these extracts contain many growth materials and essential requirements at vegetative and reproductive growth. It is rich in phytohormones, vitamins, Abd El-Razek *et al.* (2011). Similar results were reported in previous studies stated that garlic extract (*Allium sativum* L.). In addition Chowdhury *et al.* (2007) found that "extracts from garlic improved number of fruits, TSS and yield of mango trees.

The objective of the current study is to improve the growth, yield, quality, and marketing tolerance of common bean (*Phaseolus vulgaris* L.) grown under sandy soil conditions by using new natural and safe substrates such as extract of moringa leaves and garlic clovers.

MATERIALS AND METHODS

Field experiment was designed in two successive seasons of 2017 and 2018 at the experimental farm, El-Khatara, Faculty of Agriculture, Zagazig University, Egypt. Plants were sprayed with moringa leaves extract (MLE), garlic extract (GE) and their combinations as well as control treatment (plants sprayed with tap water)

to examine their effects on growth and yield of common bean plants grown under sandy soil conditions.

Seeds of common bean 'Giza 6' were secured from Department of Vegetable Researches, Horticulture Research Institute, Agricultural Research Center, Giza, Egypt. The experimental soil was sandy in texture and its chemical properties were: organic matter 0.07 and 0.09%; available N(ppm) 8.6 and 8.8; available P(ppm) 6.01 and 4.8; available K(ppm) 13 and 11; pH(1:2.5) 7.0 and 7.4 and E.C. (1:5) 2.36 and 2.19 dSm^{-1} in the first and second seasons, respectively. Seeds were sown in rows at the rate of 60 kg seeds/fed. on 12th and 15th May in the two consecutive seasons, respectively. Plot area was $10.5m^2$ contained three rows (5m long and 0.7m wide). Seeds were sown at 15cm in hills on one side, and plants then thinned to one plant per hill. These treatments were arranged in a complete randomized block design consisting of four replicates per treatment.

This experiment included 9 treatments as follow:

1- Foliar sprays with tap water (control).
2- Foliar sprays with MLE at 2%.
3- Foliar sprays with MLE at 4%.
4- Foliar sprays with GE at 2%.
5- Foliar sprays with GE at 4%
6- Foliar sprays with MLE at 2%+ GE at 2%.
7- Foliar sprays with MLE at 2%+ GE at 4%.
8 Foliar sprays with MLE at 4%+ GE at 2%.
9- Foliar sprays with MLE at 4%+ GE at 4%.

Preparation of Moringa Leaf Extract (MLE):

Moringa oleifera leaves were brought from Desert Research Institute of Ismailia branch, Egypt. 1kg of moringa leaves were air-dried under shade for two weeks and subsequently grounded to reach powder case then mixed with 1 liter ethyl alcohol (80% aq.) using a blender. The extract was purified by filtering twice through (Whatman No. 1) filter paper. After purification the extract was subjected to a rotary evaporator to fully evaporate the alcohol and get the crude extract. The concentrations were prepared from the crude extract. 20 and 40ml from the crude extract were taken and diluted with 980ml and 960ml distilled water for reaching the concentration to 2% and 4% according to (Bashir *et al.,* 2014), in addition the control treatment, i.e., tap water foliar spray. Some chemical constituents of moringa leaves ethyl alcohol extract were determined by Rady and Mohamed (2015) as shown in Table (1).

Table 1: Some chemical constituents of moringa leaves extract on dry weigh basis.

Component	Value (mg/g DW)	tComponen	Value (mg/g DW)
Amino acids	١٢٤.٧	Zinc	٠.٤٥٣
Proline	٢٦.٠٩	Copper	٠.٢٠٨
Total soluble sugars	١٥١.٤	Solubule phenols	٢.٢٥٢
Ash	١١١.٣	Total carotenoids	٢.٢٤٣
calcium	٨.٧٥٦	Total chlorophyll	٤.٦٢٥
Magnesium	٦.٠٣٥	Ascorbic acid	٣.٢٤٧
Potassium	٢٧.٦٨	Phytohormones	Value (mg/g DW)
Phosphorus	٦.١٢٢	Indole 3 acetic acid	٠.٨٧٣
Sodium	٠.٦٧٤	Gibberellins	٠.٨٠٢
Iron	١.٨٧٣	Zeatin	٠.٩٣٦
Manganese	٠.٩٦٦	Abscisic acid	٠.٢٩٢

Garlic extract: The 2% and 4% garlic aqueous extract was prepared by blending 20g and 40g of fresh mature cloves in one liter of distilled water, frozen and thawed two times, and then filtered and diluted by distilled water to one liter (El-Desouky *et al.*, 1998). Some components in *Allium sativum* (Garlic) were determined by Duke (1992) as shown in Table (2).

Table 2. Some components in *Allium sativum* (Garlic) bulbs as Duke (1992) mentioned.

Components
Terpens and their derivatives
Citral- Geraniol Linalol
Growth regulators
Gibberellin-A3 and 7
Amino acids
Arginine 6,340-15,216ppm Glutamic-acid 8,050-19,320ppm
Aspartic acid 4,890-11,736 ppm.
Methionine 760-1, 824 ppm.
Phenylalanine 1830-4,392ppm.
Proline 1,000-2,400 ppm.
Thireonine 1,570-3,768 trm.
Nicotinic-acid 4.8 ppm
Thiamin 2-8 ppm.
Minerals
Potassium 3,730-13,669 ppm.
Magnesium 240-1,210 ppm.
Calcium 180-4, 947 ppm.
IRon 15-129 ppm.
Zinc 15.3 ppm
Manganese 5.4-15.3 ppm
Boron 3-6 ppm
Chromium 2.5-15 ppm.
Silicon
Iodine
Prostaglandins
Prostaglandin-A-1, 2 and B-1.
Sugars
Glucose Fructose
Vitamin
Ascorbic-acid 100-788 ppm.

All agricultural practices were carried out according to the recommendation of Ministry of Agricultures, Egypt.

Data Recorded:

1. Morphological Characters of Vegetative Growth:

A random sample of 4 plants from each experimental unit was taken at 60 days from sowing. The following data were recorded in both growing seasons:

- Plant height (cm)
- Number of branches per plant.
- Number of leaves per plant.
- Fresh and dry weight of shoot per plant (g).
- Total leaf area per plant (cm^2). Leaf area was measured by means of LI-3000 A portable area meter, LI-3050 A Transparent belt conveyer- of LI-Cor, Inc., Lincoln, Nebraska, U.S.A.

2. Photosynthetic pigments: Chlorophyll a, b, chlorophyll a+b and carotenoids were determined in 80% acetone extracts according to Saric *et al.* (1967).

Chlorophyll was extracted by grinding the small pieces of leaves from fully expanded photosynthesing leaves at mid flowering period obtained from randomly selected plants in the middle row of each plot. The pieces were weighed and about 0.1 g of material was left for grinding. The total fresh weight of each sample was recorded. The pieces were ground in 10 ml of 80% acetone (acetone: water, 80:20 V:V). The leaf homogenate was then filtered through a filter paper. The retentate was removed by the filter paper and discarded while the extract was collected in a test tube.

3- Yield of Seeds and its Components:

At harvesting stage (15 weeks from sowing) the following components were recorded:

- Number of pods per plant.
- Number of seeds per pod.
- Number of seeds per plant.
- Yield of seeds (g) per plant.
- Specific weight of seeds (average weight of 100-seeds, g).
- Seed yield/fed. (Kg).

4- Chemical Analysis of Seeds (Seed Quality):

- Percentages of nitrogen, phosphorus, potassium, crude protein and carbohydrates were determined in mature dried seeds, at harvest time of common bean 'Giza 6' as affected by spraying different levels of MLE, GE and their combinations as well as control treatment (plants sprayed with tap water). Samples resembling various treatments beside the seeds of control plants were finely ground.
- Total carbohydrates was determined as glucose after acid hydrolysis and spectrophotometrically determined using phenol sulphuric acid reagent (Dubois *et al.*, 1960).
- **The percentage of N, P, K and protein in common bean seeds:** Content of potassium was determined by flame-photometer method (Schwarzenbach and Biedermann, 1948) and phosphorus calorimetrically (Woods and Mellon, 1985). Determination of total nitrogen in dry powdered grains was carried out with Micro-Kjeldahel method (A.O.A.C., 1990). Crude protein was determined according to the formula: Crude protein = Total N × 6.25 as the method described by (Anon, 1990).

5. Statistical Analysis:

All recorded data were subjected to the analysis of variance procedures and treatment means were compared using the L.S.D. at 0.05 as described by Gomez and Gomez, 1984. The statistical analysis was done by using the computer program M-STATC software version 4.

RESULTS AND DISCUSSION

Plant growth:

Data in Table 3 show that foliar spray of common bean plants grown in sandy soil with moringa leaves extract MLE at 2 and 4% and garlic extract GE at 2 and 4% alone or in combinations significantly increased plant height, number of branches and leaves/plant, Leaf area, shoot fresh weight and shoot dry weight compared to control (spraying with tap water). Spraying common bean plants with

MLE at 4% + GE at 2% followed by MLE at 2% + GE at 4% gave the tallest plants and recorded the maximum values of above-mention traits in both seasons. Similar trend was obtained over both 2017 and 2018 seasons. Consequently, it expected to affect growth attributes of plant height, number of branches and leaves/plant, Leaf area, shoot fresh weight and shoot dry weight in a positive way. Moringa leaf extract is rich with growth hormones, especially Zeatin that has been enhancing plant growth parameters (Muhammad, 2014). MLE also contains micronutrients in sufficient amounts and suitable proportions that increase the growth and yield of a variety of crops ranging from cereals to oil crops, from fiber to sugar crops and from forages to tuber crops (Price, 2007; Muhamman *et al.*, 2013). Rehman *et al.* (2017) reported that MLE when applied to wheat plants increased plant height, number of tillers, increased grain yield and delayed leaf senescence. Similar results were obtained by (Mishra *et al.*, 2013), on pea. They recorded significant enhancement by MLE foliar application on growth criteria plant height, fresh and dry weight. The MLE induced increase in vegetative growth of common beans was attributed to the role of cytokinins in promoting cell division and elongation. It has been reported that MLE contains zeatin, dihydrozeatin and isopentyladenine which are endogenous cytokinins (Andrews, 2006).

Table 3. Effect of spraying with MLE and GE on plant growth of common bean plants at 60 days after sowing during 2017 and 2018 seasons.

Treatments	Plant height (cm)		No. of branches/plant		No. of leaves/plant		Shoot fresh weight (g)		Shoot dry weight (g)		Leaf area (cm^2)	
	1st Season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Control	49.83g	49.7g	5.0ab	5.3bc	22.3e	23.3e	48.5f	52.9g	7.2f	8.1e	527.67h	539.33 h
MLE 2%	55.26ef	55.4ef	5.7ab	6.0ab	27.0c	27.7cd	51.9de	58.7e	7.9e	8.9d	708.00c	718.33c
MLE 4%	58.73c	58.9c	5.7ab	6.0ab	30.3b	30.7b	56.5b	62.8c	8.6c	9.5bc	608.67f	620.33f
GE 2%	56.36de	56.3de	5.7ab	5.3bc	27.3c	28.7c	52.3d	61.1d	8.2d	9.3c	623.0e	633.33f
GE 4%	54.4f	54.4f	5.7ab	5.0bc	25.0d	26.0d	51.3e	57.2f	7.4f	8.8d	594.67g	600.67g
MLE 2 %+GE 2 %	57.13d	57.3d	4.7b	6.0ab	30.0b	31.0b	54.4c	62.3cd	8.2d	9.6b	737.00a	744.67a
MLE 2%+GE 4%	61.93b	62.0b	5.0ab	5.7ab	34.3a	34.7a	60.6a	66.1b	9.2b	10.2a	724.0b	734.67b
MLE 4%+GE 2%	63.66a	64.3a	5.3ab	6.7a	34.7a	35.7a	61.2a	68.5a	9.7a	10.3a	679.0d	691d
MLE 4%+GE 4%	49.36g	49.9g	4.7b	4.3c	22.0e	22.0e	47.6f	51.7h	7.3f	7.9e	526.67h	537.3h
LSD at 0.05	1.36	1.27	1.07	1.16	1.79	1.87	0.87	1.15	0.30	0.29	10.3	6.72

MLE: Moringa leaves extract; GE: Garlic extract

Cytokinins have been reported to stimulate cell division and growing cell tissues (Emongor, 2002). A combination of benzyladenine and gibberellins (GA4+7) at 5, 15 or 25 mg/L (Accel) has been reported to increase vegetative growth of common bean plants (Emongor, 2008). The results from the current study showed that MLE increased the number of leaves of common bean plants and the response was quadratic to increasing MLE concentration. This was attributed to the role of cytokinins in reducing the plastochron and/or increasing cell division of common bean plants resulting in higher leaf number. The decrease in vegetative growth above 4% MLE + 4% GE concentrations was attributed to toxicity of ethanol in the extract, suggesting that distilled water could be used as the solvent in MLE process. On the other hand, Garlic extract contains enzymes and more than 200 chemical compounds. Its higher contents of volatile and sulphur compounds put it in the top (Pons, 2003). Similar results were reported by

Ahmed *et al.* (2005) and El-Saadony *et al*. (2017) on pea plants treated with garlic extract.

Photosynthetic pigments:

Data in Table 4 show that foliar spray of common bean plants grown in sandy soil with MLE at 2 and 4% and GE at 2 and 4% alone or in combinations significantly increased the concentration of Chlorophyll a, Chlorophyll b, Chlorophyll a+b as well as carotenoids compared to control (spraying with tap water). Spraying common bean plants with MLE at 4% + GE at 2% gave the high concentration of Photosynthetic pigments in leaves. The same trend was true in both seasons.

Fresh *Moringa oleifera* also content proteins, vitamins (such as A, B1, B2, B3, ascorbic acid and E), β carotene, amino acids, phenolic compounds, sugars, and minerals (such as calcium, magnesium, sodium,
iron, phosphorus and potassium) and several flavonoid pigments. Furthermore, ascorbic acid and foliar application have been reported to be growth and yield improving tools in various crops (Jyotsna and Srivastava, 1998; Fuglie, 2000; Foidle *et al.,* 2001 and Nagar *et al.,* 2006). So it is a good source of natural antioxidants (Jacob and Shenbagaraman, 2011). Calcium and potassium play essential roles in crop growth and development through osmoregulation, enzyme activation, photosynthesis, and various other physiological processes (Hasegawa *et al.,* 2000; Epstein and Bloom, 2005).

Table 4. Effect of spraying with MLE and GE on photosynthetic pigments content in leaves of common bean plants at 60 days after sowing during 2017 and 2018 seasons.

Treatments	Chlorophyll a (mg/gm F.Wt)		Chlorophyll b (mg/gm F.Wt)		Chlorophyll a + b (mg/gm F.Wt)		Carotenoids (mg/gm F.Wt)	
	1st season	2nd Season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Control	1.87g	1.82f	1.18f	1.15e	3.05h	2.97f	1.77f	1.73e
MLE 2%	2.04c	2.00c	1.36c	1.31b	3.40d	3.31c	1.95bc	1.91b
MLE 4%	2.01d	1.99c	1.35c	1.29bc	3.37e	3.29c	1.94c	1.90b
GE 2%	1.97e	1.94d	1.31d	1.27c	3.28f	3.21d	1.87d	1.84c
GE 4%	1.92f	1.9e	1.28e	1.25d	3.20g	3.15e	1.82e	1.81d
MLE 2 %+GE 2 %	2.06b	2.04b	1.41b	1.37a	3.47c	3.41b	1.97a	1.93a
MLE 2%+GE 4%	2.09a	2.07a	1.44a	1.39a	3.54a	3.46a	1.97a	1.94a
MLE 4%+GE 2%	2.08a	2.04b	1.43a	1.37a	3.51b	3.41b	1.96ab	1.93a
MLE 4%+GE 4%	1.83h	1.81f	1.15g	1.12f	2.98i	2.93g	1.77f	1.73e
LSD at 0.05	0.01	0.01	0.014	0.27	0.019	0.03	0.016	0.016

MLE: Moringa leaves extract; GE: Garlic extract

Similar results were obtained by Mona (2013) who found that spraying rocket (*Eruca vesicaria* subsp. sativa) plants with the aqueous extracts of leaves and twigs of *M. oleifera* at rates of 1, 2 and 3% increased the amounts of each of chlorophyll a and b. on the other hand similar results were reported by Ahmed *et al.* (2005) and El-Saadony *et al*. (2017) on pea plants treated with garlic extract.

Yield and its components:

Data in Table 5 show that foliar spray of common bean plants grown in sandy soil

with MLE at 2 and 4% and GE at 2 and 4% alone or in combinations significantly increased number of pods/plant, number of seeds/pod, number of seeds/plant, 100-seeds weight and Seeds weight/ plant(g) compared to control in both seasons. In general, spraying common bean plants with MLE at 4% + GE at 2% gave the highest values of above-mention traits in both seasons. Both growing seasons collected the same trends. Several researchers found similar results with different crops: Emongor (2015) on onion and kidney beans, Muhamman *et al.* (2013) on tomato and Mohammed *et al.* (2013) on onions. As cytokinins are considered to be regulators of leaf senescence (Davis, 2007), therefore we hypothesized that with rich in Zeatin type of cytokinins and other regulators (Rady and Mohamed, 2015), Moringa leaf extract can play a role to maintain photosynthetic area by delaying senescence and affecting source-sink strength to increase yield. *Moringa* leaf extract increased pod yield of common bean and the response was quadratic to increasing MLE concentration. The increase in pod yield was explained by the role of cytokinins in promoting cell division at pod set.

Table 5. Effect of spraying with MLE and GE on yield components of common bean plants during 2017 and 2018 seasons.

Treatments	No. of Pods/ Plan		No. of seeds/Pod		No. of seeds/Plant		100-seeds weight (g)		Seeds weight/ plant (g)		Seed yield /fed.(Kg)	
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Control	21.3f	23.0e	4.0cd	4.0cd	85.3de	92.0ef	31.2c	32.0d	26.6fg	29.5ef	793.2fg	880.1ef
MLE 2%	24.3d	25.7d	4.3bc	4.3bc	105.3cd	111.0de	33.5b	33.9b	35.2de	37.6de	1301.0c	1500.4bc
MLE 4%	27.7b	29.0bc	4.7abc	5.0ab	129.0b	145.0bc	33.7b	34.6b	43.5c	50.1bc	1051.3de	1124.5d
GE 2%	26.0c	27.7c	4.7abc	4.7abc	121.3bc	129.0cd	33.8b	34.0b	41.1cd	43.8cd	1225.6cd	1309.6cd
GE 4%	23.0e	25.0d	4.3bc	4.3bc	99.7cd	108.3de	32.9b	33.0c	32.7ef	35.8de	975.5ef	1070.0de
MLE2%+GE 2 %	27.3b	29.3bc	5.0ab	5.0ab	136.7b	146.7bc	33.5b	34.2b	45.7bc	50.2bc	1711.3a	1858.3a
MLE 2%+GE 4%	28.3b	30.7ab	5.0ab	5.3a	141.7ab	163.0ab	35.6a	35.7a	50.4ab	58.1ab	1506.5b	1740.3ab
MLE 4%+GE 2%	30.0a	32.0a	5.3a	5.3a	160.0a	171.0a	35.8a	36.3a	57.2a	62.0a	1367.0bc	1503.3bc
MLE 4%+GE 4%	21.0f	22.7e	3.3d	3.3d	70.0e	83.0f	30.7c	31.6d	21.5g	26.2f	641.6g	781.1f
LSD at 0.05	1.11	1.82	0.86	0.85	22.03	23.5	1.31	0.82	6.80	8.13	203.73	243.90

MLE: Moringa leaves extract; GE: Garlic extract

Gibberellins (GA4+7) and benzyladenine (BA) have been shown to increase pod set and subsequently pod number per branch in leguminous crops (Dybing and Westgate, 1996). Application of *Moringa* leaf extract to common beans increased pod yield. The results of the current study are in agreement with the findings that the juice from fresh moringa leaves increased yield by 25-30% for nearly any crop (Price, 2007). Plants that were treated with *Moringa* leaf extracts produced more fruits that consequently resulted in higher yield (Makkar and Becker, 1996).This fact was revealed by Foidle *et al*., (2001) who reported that foliar spray with the moringa leaf extract showed a significant enhancement in yield. Similar results were reported by Ahmed *et al.* (2005) and El-Saadony *et al*. (2017) on pea plants treated with garlic extract.

Chemical analysis of seeds (Seed quality):

Data in Table 6 show that foliar spray of common bean plants grown in sandy soil with MLE at 2 and 4% and GE at 2 and 4% alone or in combinations significantly increased total N,P,K, protein as well as total carbohydrate on seeds of common bean plants. In general, spraying common bean plants with MLE at 2% + GE at 2% gave the highest values of above-mention traits in both seasons.

Similar results were obtained by Mona (2013) who found that spraying rocket (*Eruca vesicaria* subsp. sativa) plants with the aqueous extracts of leaves and twigs of *M.*

oleifera at rates of 1, 2 and 3% increased all measured growth criteria total sugars, ascorbic acid and N, P and K.

Table 6. Effect of spraying with MLE and GE on N, P, K, total protein and total carbohydrate of seeds of common bean plants at harvest time during 2017 and 2018 seasons.

Treatments	N (%)		P (%)		K (%)		Total protein (%)		Total carbohydrate (%)	
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Control	3.2g	3.2fg	0.36bc	0.37bc	2.3a	2.3ab	20.0g	20.3fg	51.6b	52.6g
MLE 2%	3.3ef	3.4de	0.40ab	0.41ab	2.4a	2.5a	20.9ef	21.1de	52.5b	54.5e
MLE 4%	3.6bc	3.6b	0.39abc	0.40abc	2.4a	2.4a	22.6bc	22.8b	56.6a	57.3b
GE 2%	3.5de	3.5cd	0.36bc	0.37bc	2.3a	2.3ab	21.6de	21.8cd	51.4b	55.3d
GE 4%	3.3f	3.3ef	0.41ab	0.41ab	2.4a	2.5a	20.8f	20.9ef	52.4b	53.7f
MLE 2 %+GE 2 %	3.5cd	3.6bc	0.40ab	0.41ab	2.5a	2.5a	22.1cd	22.3bc	51.4b	56.2c
MLE 2%+GE 4%	3.7ab	3.8a	0.39abc	0.39abc	2.4a	2.5a	23.3ab	23.6a	56.5a	58.3a
MLE 4%+GE 2%	3.8a	3.8a	0.43a	0.43a	2.5a	2.5a	24.0a	24.0a	57.2a	58.4a
MLE 4%+GE 4%	3.1g	3.1g	0.35c	0.35c	2.1b	2.2b	19.4g	19.6g	51.4b	51.6h
LSD at 0.05	0.12	0.11	0.05	0.05	0.17	0.19	0.76	0.71	3.9	0.37

MLE: Moringa leaves extract; GE: Garlic extract

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تأثير الرش الورقي ببعض المستخلصات النباتية الطبيعية على نمو ومحصول نباتات الفاصوليا

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أجريت تجربة حقلية خلال موسمي النمو 2017 ، 2018 م بمزرعة التجارب بالخطارة، كلية الزراعة، جامعة الزقازيق، مصر. تم رش نباتات الفاصوليا بتركيزات مختلفة من مستخلص أوراق المورينجا، مستخلص الثوم، مخلوط من مستخلص أوراق المورينجا ومستخلص الثوم بالإضافة إلى مياه الصنبور (كنترول). وذلك لدراسة تأثير تلك المعاملات على النمو، المحصول لنبات الفاصوليا النامي تحت ظروف التربة الرملية. أظهرت النتائج أن معاملة نبات الفاصوليا بتركيزات مختلفة من مستخلص أوراق المورينجا، مستخلص الثوم، مخلوط من مستخلص أوراق المورينجا ومستخلص الثوم أدت إلى زيادة معنوية في معظم الصفات تحت الدراسة مثل: إرتفاع النبات، عدد الأوراق على النبات، عدد الأفرع على النبات، الوزن الرطب للمجموع الخضري، الوزن الجاف للمجموع الخضري ، نسبة البروتين في البذور، المحصول ومكوناته بالإضافة إلى تأثيرها على صبغات الكلوروفيل مقارنة بالكنترول. وبصفة عامة، كانت أفضل المعاملات والتي أعطت أعلى القيم للصفات تحت الدراسة عند رش نباتات الفاصوليا بمستخلص أوراق المورينجا بمعدل ٤ % + مستخلص الثوم بمعدل ٢% يليها رش نباتات الفاصوليا بمستخلص أوراق المورينجا بمعدل ٢ % + مستخلص الثوم بمعدل ٤%.