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Effect of Moringa Extract Foliar Spray with Different Nitrogen Fertilization Levels on Growth, Yield and Its Quality of Pea Plants Grown Under Sandy Soil With Drip Irrigation System.

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Abstract

This study was conducted during the winter seasons of 2014 and 2015 at El-Adlia Farm, Sharkia Governorate, Egypt, to improving the green seeds quality of pea plants grown under sandy soil with drip irrigation conditions and reach to the optimum nitrogen fertilizer rate under using foliar spray treatment with moringa extract. This experiment included twelve treatments which were the combinations between three rates of mineral nitrogen fertilizer (50, 75 and 100% of the recommended mineral N rate) and four concentrations of moringa extract (0, 2, 4 and 6% W/V). The results showed that the fertilizing pea plants with 75 or 100 % of the nitrogen recommended rate (NRR) in the presence of foliar spray with moringa extract enhanced significantly plant growth, yield and its components as well as the quality of green seeds compared to fertilizing with 50% of NRR. Also the spraying pea plants with moringa extract at 4or 6% increased significantly the vegetative growth characters, yield and its components as well as the green seed contents from nitrogen, phosphorus and protein. The recommended 75 and 100 % NRR combined with foliar application with 4 or 6% moringa extract were the favorable interaction treatments for maximizing the yield and improving the green seeds quality without significant differences among them. This mean that it can obtain the highest pods yield by using the treatments of fertilizing the plants with 75% from the recommendation of N fertilizer and spraying the plants by moringa extract 4% or 6% and saving 25% from N fertilizer recommendation

Key words: Peas, moringa extract, nitrogen fertilizer, seeds quality, yield.

Introduction

Pea (*Pisum sativum* L.) is one of the most important legumes vegetable crops which being widely consumption on many countries and it is consider export crop either as green pods or dry seeds according to its eating customs.**(Baloch, 1994)**. Nowadays, increasing productivity of pea green pods and its quality is considered an important aim that could be achieved through by using the foliar application of some natural stimulant materials. Nitrogen has many functions in plant life if adding at the suitablerate, being responsible for the biosynthesis encourages cell division **(Ayub*et al*., 2011 on bean)**. In this respect, nitrogen fertilizer increased plant growth of pea plants, leaf chlorophyll content and yield as well as its components**. (Achakzai and Bangulzai, 2006; Erman *et al*., 2009; El-Desuki *etal*., 2010).**Once nitrogen fertilizers are applied to agricultural systems; the fertilizers are absorbed directly by plants or converted into various forms through the oxidation process. Excess nitrogen is lost in ionic or gaseous form through leaching, volatilization, and gentrification **(Brady and Weil 2008).** If nitrate is not absorbed by plant roots, it is carried away by runoff or leaches into the soil causing underground water pollution. There are close relationships between the excessive application of nitrogen fertilizers and environmental problems such as increasing nitrogen % in the atmosphere which it can effect ton human health and acid rain **(Gastal and Lemaire 2002 and Wang et al 2002).** Consuming contaminated groundwater or crops with a high concentration of nitrate has negative effects on human health (Ikemoto **et al 2002)**.

Moringa (*Moringaoleifera*) is an important plant belongs to Morigaceae family having tremendous allelopathic potential. There are about 13 species of genus Moringa, it is reported that the importance one of them*M. Oleifera* which it is the most known and widely cultivated species throughout the world **(Fuglie, 1999)**. Moringa is known as a miracle plant due to its multiple uses, which it is rich in amino acids, ascorbate, zeatin, protein, vitamin E, phenolics , essential amino acids , minerals and many other compounds as mentioned by **Emongor (2012)**. moringa has several roles in agriculture which promote the plant growth and defense mechanisms against the biotic stresses. Some articles and research studies reported that the dry leaves of *M. oleifera* contain vitamin C. seven times more than the orange, 10 times vitamin A more than the carrot, calcium 17 times than milk, 15 times potassiummor than the bananas, 25 times iron more than spinach and 9 times proteins than found in yogurt **(Fuglie, 1999)**. In addition, it contains vitamin B complex, chromium, copper, magnesium, manganese, phosphorus and zinc **(Fuglie, 2000). Thurber and Fahey (2009)** stated that M. oleifera leaves as rich from protein source, which can be used in several cases for, nutritionists and community health conscious persons to solve worldwide malnutrition or under nutrition problem.

Results of several investigations showed that moringa extract increased growth dry matter, yield,

root dry matter and plant height of tomato in both greenhouse and the open field **(Mvumi Culver *etal.*, 2012)**. Other reports have been showed that moringa extract play as a plant hormone which enhances seed germination, growth and yield of several crops. MLE(Moringe Leaf Extract) foliar spray improved crop performance, resulting from its role on vigorous plant growth, maintained optimum tissue water status, improved membranes stability, enhanced antioxidant content, as mentioned by **Anwar and Bhanger (2003)** on moringa **(Yasmeen *et al.* (2012), Yasmeen *et al.* (2013)** on wheat and **Rehman *et al.* (2014)** on linola (*LinumusitatissimumL.*). **Muhammad *et al.* (2013)** on tomato found that tomato plant height, plant dry weight and fruit yield were significantly affected with aqueous moringa extract. Also, **Bashir *et al.* (2014)** revealed that moringa leaf extract significantly increased the average plant height, leaves number, number of branches and yield of tomato plant. **Oluwagbenga and Odeghe (2015)** mentioned that sweet bell pepper plant height; number of leaves, fruit weight and yield were significantly influenced by the application of moringa leaf extract. **Aluko (2016)** reported that the highest values of pepper plant growth and yield parameters were obtained with MLE foliar application at concentration of (1:20). In this respect **Hala and Nabila(2017)** on pepper revealed that soaking pepper seeds in MLF solution at concentrate of 4% for 6h enhancing the germination percentage and seedling characteristics. Also spraying the seedling and pepper plants with MLF at concentration of 4% increased average fruit weight, length and diameter**.** The present work was undertaken to minimize the mineral nitrogen fertilizer application rates by using foliar application of natural moringa extract, in addition maximizing yield and improving seed quality of pea plants under sandy soil conditions.

Materials and Methods

This experiment was carried out during the two successive winter seasons of 2014and 2015atEl-Adliaprivet farm, Sharkia Governorate, Egypt, to study the effect of foliar spray with different moringa extract concentrations and nitrogen fertilizer rates on growth, yield andits quality of pea plants. The experimental soil was sandy in texture and the chemical properties are shown in **(Table 1)**

Table 1. Physical and chemical analysis properties of the experiment soil at El- Adlia Farm during the winter season of 2014 and 2015**.**

Components	Concentration
Soil type	Sandy soil
PH	8.1
E.C.(m mhos/ cm)	1.07
Organic matter %	0.07
Total $CaCo_3$ %	13.00
Total N %	0 .03
Available P %	3.8
Available K%	0.24

This experiment included twelve treatments which were the combinations between three levels of nitrogen fertilizer rates; i.e., (50, 75 and 100% of recommended N rate) and four concentrations of moringa extract (0, 2, 4 and 6%). The treatments were arranged in a split plot design with three replicates. Whereas, the nitrogen fertilizer rates were randomly arranged in the main plots and the concentrations of moringa extract were randomly distributed in the sub plots. The area of each plot was (14.4 m^2) contained four dripper lines with 6 m length and 60cm between each two dripper lines. Pea seeds (Entsarone cv.) were inoculated with root nodules bacteria(*Rhizobium leguminosarum*) and sown on 30th October in both seasons on the two sides of the dripper lines on hills at 7 cm between each two hills.

Preparation of moringa leaf extract:

For preparation of moringa leaf extract(MLE) fresh young shoots (leaves and tender branches) were collected from the trees .Aqueous extract of moringa at the ratio 1:10(w/v) was prepared by mixing 30 g of fresh material(immediately after collection) with 300 ml of distilled water in household blender for 15 min **(Phiriand Mbewe 2010)**.The obtained solution was filtered through muslin cloth and diluted with distilled water for reaching the concentration of 2%, 4% and 6%respectively immediately before application. The mineral contents and the chemical composition in moringa leaf extract were shown in (**Table 2, 3**)

Table 2. The mineral contents in Moringa Leaf Extract (MLE**).**

Mineral contents (mg/100g.d.wt)							
Essential macro-elements					Essential micro-elements		
N(g/100g)	P(g/100g)	K(g/100g)	Mg(g/100g)	Ca(g/100g)	Fe(g/100g)	Cu(g/100g)	Zn(g/100g)
1.78	9.7	2.8	3.5	1.28	1.18	0.87	2.46

Table 3. Chemical composition analysis of moringa leaf extract according to **Abdelnaser et al, (2016).**

Chemical composition	(mg/100g. d.wt)
Water	5.90
Protein	27.20
Fiber	19.20
Total sugar	38.60
Lipids	17.10
Ascorbic acid	3.26
Total carotenoids	2.24
Soluble phenols	2.24
Gibberellins	0.802
Zeatin	0.936

The nitrogen recommended rate (NRR) for pea plants was 200 kg ammonium sulphate per fed (40kg N/fed). The three tested rates of nitrogen fertilizer were 50,75 and 100%of the recommended N rate. The potassiumsulphate fertilizer was added at a rate of 100 kg (48-52% K_2O).The calcium superphosphate (16-18% P_2O_5) fertilizer was added at a rate of 300 kg/ fed, half of the amount was addedduring soil preparation with farmyard manure (at a rate of 20m^3/fed), the rest amount of phosphate fertilizer as added in the form of phosphoric acid (22.5 kg P_2O_5/ fed) with irrigation water through drip irrigationsystem at the same time of nitrogen and potassium fertilizer application. Plants were fertilized every three days through the drip- irrigation system. The normal agricultural practices werefollowed in this district. The physical and chemical analyses of the experimental soil are presented in **Table (3).**After sowing the plants were sprayed three times with moringa leaf extract by the different treatments, i.e., 2%, 4%, and6%.the first one after 30days from sowing the second after 15 days from the first and the third after 15 days from the second.

Data Recorded:

I-**Vegetative Growth parameters**:

A random sample of five plants from each experimental unit was taken at 60 days after (before the first picking) sowing form easuring the vegetative *growth parameters; i.e.*

I.1. Plant length(cm.),

I.2. leaves number/plant.

I.3. branches number /plant.

I.4. dry weight/plant (g): A random sample of other three plants from each plot was taken and dried at 70°C until constant weight and the dry weight of whole plant was determined using the standard methods as illustrated by **A.O.A.C (1990).**

II-Yield and Its Components:

A random sample of twenty pods from each experimental unit, from the second harvest, was takento determine;

II.1. Pod length (cm).

II.2. Pod diameter (cm).

II.3.Pod weight (g).

II.4. weight of 100 green seeds (g).

II.5.Total green pods yield.

Green pods of each plot were continuously harvested at suitable maturity stage, counted and weighted then Green pod yield/ feddan (it was calculated as sum of all harvests per plot, then converted to yield/ feddan).

III-Chemical Components:

III.1.Leaf Chlorophyll Content (reading)

At 60 days after sowing, total chlorophyll (reading) was determined in the fourth upper leaf (three readings per leaf at different places) using Minolta chlorophyll meter (SPAD -501 as SPAD units (**Yadava, 1986**).

III.2.Total nitrogen, phosphorus and potassium were determined in dry leaves according to the methods described by **Bremner and Mulvaney (1982), Olsen and, Sommers(1982),** and **Jackson(1967)** respectively.

III.3. Total protein (%) in green seeds: It was determined as nitrogen content and converted to protein % by multiplying N% by 6.25.

V. Statistical Analysis

All obtained data were subjected to statistical analysis of variance according to **Snedecor and Cochran(1980)** and means separation were done by new L.S.D.at 0.05 level of probability.

Results and Discussion

I. Vegetative Growth:

I.1.Effect of nitrogen rates:

It is appear from data in (Table 4) that different nitrogen rates influenced significantly the plant growth characters; i.e., plant length, number of leaves and branches/plant as well as the total dry weight of peaplant during the two seasons of study compared to the control treatment, Application of 100 % nitrogen from the recommended rate (NRR) recorded the highest values of the above mentioned traits and proved superior than 75 and 50 % NRR.

The simulative effect of nitrogen on different plant growth parameters may due to that nitrogen is an essential element for building up protoplasm,

amino acids and protein which promote cell division. Also, nitrogen plays a vital contribution in several biochemical processes related to plant growth **(Marschner, 1995),** and that reflect on number of leaves/plant and total dry weight**. El-Desuki *et al*., 2010**.It can concluded that application of nitrogen to pea plants increased significantly vegetative growth characters.

I.2.Effect of moringa extract:

Data presented in **Table (4)** showed that all foliar application treatments significantly increased all studied vegetative growth characters, i.e., plant length, number of branches and leaves/plant and dry weigh/plant compared with the control treatment. The best concentration in all studied characters was foliar moringa leaf extract concentration at 6%.These results are in harmony with those reported by **Culver *et al.* (2012);on tomato Yasmeen *et al.* (2012) on wheat and Muhamman *et al.* (2013)** on tomato by using moringa extract.

Table 4. Effect of nitrogen rates and moringa extract levels on vegetative growth characters of pea plants during the two winter seasons 2014 and 2015.

Treatments	plant Length (cm)	Branches number /plant	Leaves number /plant	Dry weigh /Plant (g)	plant Length (cm)	Branches Number /plant	Leaves number /plant	Dry weigh /Plant (g)
	First season 2014				Second season 2015			
Nitrogen rates								
100%	63.13	2.5	27.42	4.48	59.92	2.5	26.58	4.02
75%	51.08	2.25	24.58	3.59	50.08	2.25	24.33	2.67
50%	35.92	2.00	18.75	2.7	35.42	2.00	18.5	2.23
L.S.D at 5%	2.70	0.12	1.00	0.26	0.79	0.12	1.16	0.12
Moringa extract levels								
0(control)	40.78	2.00	17.44	2.58	38.33	2.00	17.44	2.38
2%	44.83	2.22	20.89	3.17	44.50	2.22	20.11	2.63
4%	55.72	2.33	25.78	3.94	52.89	2.33	25.44	3.13
6%	58.83	2.44	30.22	4.69	58.17	2.44	29.56	3.74
NewL.S.D at 5%	1.24	0.19	1.59	0.28	1.36	0.19	1.38	0.11

The favorable effect of moringa leaf extract on vegetative growth might be due to the role of plant growth stimulators which it is one of the main contents in moringa extract such as contains zeatin, whereas cytokinin plays a role in delaying leaf senescence, in addition to other growth-enhancing-compounds such as ascorbate, phenolics and minerals **(Yasmeen *et al*., 2012)**. Also, **Hussain *et al*. (2013)** reported that moringa extract accelerate the growth of plants, strengthen plants and improve resistance against pests and diseases.

I.3.Effect of the interaction between nitrogen rates and moringa extract:

Data in **(Table 5)** reveal that the interaction treatments between different nitrogen rates and moringa extract reflected significant effect on plant length, number of leaves and branches/ plant as well as total dry weight per plant. Application of 100% NRR along with 6 % of moringa extract recorded the maximum plantlength; number ofLeaves /plant and total dry weight/ plant, followed by 75% NRR with 6% concentrate.These results were similarly of that reported by **Anyaegbu 2014**on egg plant. which explained that the result on plant height as influenced by the various treatments of moringa were similar to that of number of branches per plant. Hence the highest number of branches produced per plant was obtained from the plants received the aqueous leaf extract supplemented with NPK fertilizer at the rate of 100 %. **Oluwagbenga and Odeghe 2015** reported that the mean number of leaves were increased significantly which influenced by the application of moringa leaf extract and orengano bio- degradable fertilizer(OBD) this might be attributed to the release of nutrients from the OBD+ and the growth hormone stimulant in the moringa leaf.

II. Yield and Its Components:

II.1.Effect of nitrogen rates:

Data in **(Table 6)** show that nitrogen rates caused a significant increase in all yield and yield components traits of pea plants. Application of100 or 75% NRR increased significantly pod length, pod diameter, average weight of ten green pods, average weight of 100 green seeds and thetotal pod yield/ fed without significant differences between them. The increase in total pod yield of peaplant supplemented with nitrogen fertilizer may be due to the availability of mineral nitrogen on increase No. of leaves and branches of pea plants**(Tables 4 and5)** as well as roots growth which reflected on number ofpods/plant and this in turn for increased total yield.These results are in harmony with those obtained by **Ngwu, 2005** on cowpea; **Achakzai and Bangulzai,2006; Erman*et al*., 2009 and El-Desuki*et al*., 2010** on pea; **Ayub*et al*., 2011**.on bean and **Danesh*et al*., 2012** oncucumber plants.

Table 5. Effect of the interaction between nitrogen rates and moringa extract levels on vegetative grow characters of pea plants during the two winter seasons of 2014 and 2015.

Treatments		plant Length (Cm)	Number of branches /plant	Number of leaves /plant	Dray weight /plant (g)	Plant Length (cm)	Number of branches /plant	Number of leaves /plant	Dray weight /plant (g)
Nitrogen rat	Moringa extract levels								
		First season 2014				Second season 2015			
100%N	0 (control)	10.5	2.00	21.67	3.10	9.83	2.00	20.67	3.17
	2 %	10.63	2.67	25.00	3.83	10.93	2.67	24.00	3.77
	4 %	11.33	2.67	29.00	5.10	11.03	2.67	28.33	4.10
	6 %	12.43	2.67	34.00	5.90	11.67	2.67	33.33	5.03
75%N	0 (control)	9.0	2.00	18.33	2.53	9.13	2.00	19.00	2.20
	2 %	9.47	2.00	22.33	3.17	9.73	2.00	21.33	2.17
	4 %	9.97	2.33	26.00	3.90	9.73	2.33	26.00	2.80
	6 %	10.67	2.67	31.67	4.77	10.33	2.67	31.00	3.50
50%N	0(control)	8.17	2.00	12.33	2.10	7.63	2.00	12.67	1.77
	2 %	9.07	2.00	15.33	2.50	8.50	2.00	15.00	1.97
	4 %	9.57	2.00	22.33	2.83	9.27	2.00	22.00	2.50
	6 %	9.7	2.00	25.00	3.40	9.73	2.00	24.33	2.70
	New L.S.D at 5%	1.52	0.23	1.95	0.34	1.66	0.23	1.70	0.13

Table 6. Effect of nitrogen rates and moringa extract levels on total green pods yield and green pods characters during the two winter seasons 2014 and 2015.

Treatments	Pod length (cm)	Pod diameter (cm)	Avaredg green pod weight(g)	Avaredg weigh 100 green seeds(g)	Total green pods yield on/fed)	Pod length (cm)	Pod diameter (cm)	Avaredg green pod weight(g)	Avaredg weigh 100 green seeds(g)	Total green pods yield (ton/fed)
	First season 2014					Second season 2015				
Nitrogen rates										
100%	11.23	1.49	89.59	66.24	3.59	10.87	1.49	90.02	72.56	5.07
75%	9.78	1.34	74.97	52.26	4.19	9.73	1.34	77.98	58.26	4.15
50%	9.13	1.07	68.95	45.65	4.41	8.78	1.07	67.12	48.86	3.47
Newl.s.d at 5%	0.11	0.03	3.22	2.55	0.13	0.26	0.03	0.63	3.31	0.14
Moringa extract levels										
0 (control)	9.22	1.17	67.16	49.38	3.13	8.87	1.20	67.68	51.07	3.53
2 %	9.72	1.24	77.83	49.95	3.88	9.72	1.27	75.99	56.57	4.16
4 %	10.29	1.32	78.90	57.95	4.49	10.01	1.34	82.10	63.35	4.36
6 %	10.33	1.42	87.46	61.58	4.76	10.58	1.39	87.70	68.51	4.87
New L.S.D at 5%	0.14	0.03	3.70	2.33	0.09	0.27	0.03	0.12	1.52	0.16

II.2.Effect of moringa extract:

Spraying pea plants with moringa extract at different concentrations increased significantly all studied yield parameters; i.e., pod length and diameter, average weight of ten green pods, average weight of 100 green seeds and total green pods yield per fed as shown in **(Table 6).** Since pea plants received 6 or 4 % moringa extract were characterized by the highest values, compared to the less value of these traits which obtained from the control treatment. **El Awady (2003)** pointed out that in moringa containzeat in hormone at very high concentrations ranging between 5 mcg and 200 mcg/g of material. **Fuglie (2000)** confirmed that this cytokinin (CK) consider stimulation hormone which causing increases in crop yieldswhen sprayed as an extract from fresh moringa leaves. The increasing of pea plant yield may be due to the increase in plant vegetative growth parameters (Table 4) which leadto increase the total yield /fed. The increase in thetotal yield /fedwhich sprayed with moringa extract might be due to its role in increasing leaves andbranches number per plant and total dry weight per plant (Table 4) as well as its contents from stimulation substances and some macroand micro elements. These results are in accordance with those obtained by **Culver *et al.* (2012)** they found that moringa leaf extract increased the yield of tomato by 20 – 150 %. Also, **Hussain*et al.* (2013)** reported that moringa leaf extract application enhanced the productivity of several arable crops such as soybean, sugarcane, corn, sorghum, black bean, coffee, bell pepper and onion ranging from increment by 6.57 to 47.88 %. The effect of moringa leaf extract on yield might be

connected with the role of plant growth regulators in improving crop growth and hence yield **(Muhamman *et al*., 2013).**

II.3. Effect of the interaction between nitrogen rates and moringa extract:

It is evident from the data in**(Table 7)** that the interaction between nitrogen rates and foliar spray by moringa extract was significant in its effect on total yield and yield traits in both seasons .The interaction treatments of 100 % or 75% NRR combined with 6 or 4 % moringa extract were the best inter action in the two seasons .Moreover, the all foliar spray treatments led to obvious increment in the yield and its components.**(Anyaegbu et al., 2014)**, showed that using moringa extracts increased significantly the yield and yield components of *T. occidentalis.* **Jason (2013)** also **reported** that Moringa leaf extract contains a plant growth hormone, called Zeatin which has been reported to increase yields by 25 to 30% for nearly at any crop. **Jason (2013)** recommended that the foliar spray should be used in addition to a balanced nutritional fertilizer program containing NPK and minerals.

Table 7. Effect of the interaction between nitrogen rates and moringa extract levels on total green pods yield and green pods characters during the two winter seasons 2014 and 2015.

Treatments Nitrogen Rates	Moringa extract levels	Pod Length (cm)	Pod diameter (cm)	Average green pod weigh (g)	Average green 100 seeds weight (g)	Total green pods yield (ton/ fed)	Pod Length (cm)	Pod diameter (cm)	Average green pod weigh (g)	Average green 100 seeds weight (g)	Total green pods yield (ton/ fed)
		First season 2014					Second season 2015				
	0(control)	10.50	1.33	80.88	62.46	3.48	9.83	1.40	81.00	61.34	4.24
100%N	**2 %**	10.63	1.40	84.72	60.80	4.01	10.93	1.46	86.03	71.05	5.16
	4 %	11.33	1.47	94.06	68.13	4.96	11.03	1.53	93.03	76.87	5.13
	6 %	12.43	1.6	98.70	73.57	5.20	11.67	1.57	100.00	80.97	5.77
	0	9.00	1.23	67.92	46.86	3.13	9.13	1.27	68.29	47.30	3.50
	(control)	9.47	1.30	78.55	46.68	4.13	9.73	1.27	76.73	53.19	4.02
75%N	**2%**	9.97	1.40	67.59	57.03	4.57	9.73	1.40	80.63	61.67	4.32
	4 %	10.67	1.47	85.83	58.45	4.94	10.33	1.43	86.27	70.60	4.74
	6 %										
	0	8.17	0.93	52.70	38.82	2.77	7.63	0.93	53.77	44.57	2.85
	(control)	9.07	1.03	70.22	42.37	3.51	8.50	1.07	65.20	45.47	3.30
50%N	**2 %**	9.57	1.10	75.04	48.70	3.93	9.27	1.10	72.63	51.50	3.64
	4 %	9.70	1.20	77.85	52.73	4.15	9.73	1.17	76.83	53.97	4.10
	6 %										
	New L.S.D at 5%	0.17	0.03	4.54	2.85	0.11	0.33	0.04	1.48	1.86	0.2

III. Chemical Composition:

III.1. Effect of nitrogen rates:

Data in **(Tables 8, 9)** show that application of nitrogen fertilizer at 75 or 100% and 50% of NRR to pea plants significantly increased nitrogen and protein in both green seeds and leaves as well as phosphorus and chlorophyll content in leaves. Whereas, potassium in the green seeds was not significantly affected by nitrogen fertilizer at 50, 75 and 100 % of NRR. Similar results were also obtained with those reported by **El-Desuki *et al*. (2010),** they found that the pea pod content from N, P and protein were significantly increased by increasing nitrogen rates.

III.2.Effect of moringa extract:

It was found that from the data in **table (8)** that foliar application of 2 or 4 and 6 % moringa extract significantly increased nitrogen, protein in both green seeds the leaves, phosphorus in leaves only. Also the data presented in Table 10 show that total chlorophyll content in the leaf tissues of pea plants was significantly increased with foliar spray moringa extract at 6%. On the increases on the other hand, application of different moringa extract concentrations to pea plants did not reflect any significant effect on potassium in the leaves in green seeds. when sprayed with fresh moringa leave sextrac**. Hala and Nabila(2017**)found that spraying pepper plants with moringa leaf extract at concentration of 4% was the superior treatment to obtain the maximum values of chemical constituents in the fresh fruits, i.e. K, Ca and carbohydrates as well as vitamin C content (%).

Table 8. Effect of nitrogen rates and moringa extract levels on the chemical constituents of leaves and green seeds during the two winter seasons 2014 and 2015.

Treatments	N% in green seeds	N% in leaves	P % in leaves	K% in leaves	N% in green seeds	N% in leaves	P% in leaves	K% in leaves
	First season 2014				Second season 2015			
Nitrogen rate								
100%	2.96	2.62	3.63	0.70	2.93	2.50	3.68	0.82
75%	2.76	2.36	3.20	0.75	2.86	2.23	3.21	0.74
50%	2.57	1.96	2.73	0.81	2.57	1.99	2.77	0.70
New L.S.D at 5%	0.03	0.07	0.02	N.S	0.11	0.07	0.06	N.S
Moringa extract levels								
0 control	2.31	1.67	2.70	0.66	2.43	1.71	2.79	0.67
2%	2.81	2.18	2.91	0.74	2.83	2.00	2.99	0.73
4%	2.90	2.47	3.34	0.78	2.89	2.38	3.36	0.72
6%	3.02	2.93	3.79	0.82	3.00	2.87	3.73	0.82
New L.S.D at 5%	**0.02**	**0.06**	**0.05**	**N.S**	**0.10**	**0.07**	**0.06**	**N.S**

Table 9. Effect of nitrogen rates and moringa extract levels on protein contents in the green seeds as well as total chlorophyll and protein in pea leaves during the twowinter seasons 2014 and 2015**.**

Treatments	Chlorophyll (SPAD)	Protein in green seeds%	Protein in leaves %	Chlorophyll (SPAD)	Protein in green seeds%	Protein in leaves %
	First season 2014			Second season 2015		
Nitrogen rate						
100%	54.81	18.52	14.42	53.49	18.16	15.61
75%	53.70	17.17	14.21	53.21	17.62	13.96
50%	53.65	16.04	13.11	54.37	16.30	12.43
L.S.D at 5%	0.81	0.20	0.53	0.35	0.66	1.25
Moringa extract levels						
0(control)	52.44	14.47	12.49	53.22	15.06	10.70
2%	53.34	17.54	14.57	52.83	17.72	12.50
4%	54.61	18.15	16.62	54.21	18.21	14.87
6%	55.81	18.82	11.96	54.49	18.46	17.94
New L.S.D at 5%	1.14	0.13	0.39	0.93	0.60	0.92

III.3.Effect of the interaction between nitrogen rates and moringa extract:

Data presented in (**Tables 10 and 11**) show that, nitrogen in the leaves and the green seeds, chlorophyll reading and phosphorus in the leaves, protein in the leaves and green pea seeds were Significantly influenced by the interaction between N rates and moringa extractConcentrations. While, potassium in the leaves was not significantly affected by the interaction treatments. It is obvious from the same data that application of 100% NRR to pea plants combined with 6 % moringa extract recorded the highest nitrogen and protein percentages in pea green seeds and leaves followed by fertilizing plants with 75 % NRR combined with moringa extract 6%.The interaction between N rate 100% and moringa extract at 6% showed significant effect on total chlorophyll content.

Conclusion

As a general from this study, it can said that, spraying pea plants with moringa leaf extract at concentration of 6% and fertilizing the plant with nitrogen rate 100%from the recommended rate which was the superior treatment to obtain the maximum values of vegetative growth,characters of green pea pods and highest green pods yield and its components as well as chemical constituents i.e. N, P and protein followed by the treatment 6% or 4% moringa extract foliar spray with fertilizing the plant with the rate of 75%from the recommendation.

Table 10. Effect of the interaction between nitrogen rates and moringa extract levels on the chemical constituents of leaves and nitrogen of seeds in pea plants during the two winter seasons 2014 and 2015.

Treatments									
Nitrogen Rates	Moringa extract levels		N%in green seeds	N% in leaves	P% in leaves	K%in leaves	N% in green seeds	N% in leaves	P% in leaves	K%in leaves
			first season 2014				second season 2015			
nitrogen rates	100%	0(control)	2.45	1.98	2.94	0.71	2.47	1.91	3.13	0.72
		2 %	2.94	2.52	3.17	0.82	2.94	2.11	3.40	0.81
		4 %	3.08	2.87	3.88	0.83	3.04	2.84	3.90	0.86
		6 %	3.38	3.12	4.54	0.88	3.28	3.13	4.30	0.89
	75%	0(control)	2.34	1.68	2.63	0.67	2.70	1.70	2.72	0.67
		2 %	2.85	2.25	2.90	0.72	2.88	1.97	2.86	0.71
		4%	2.91	2.55	3.35	0.78	2.91	2.36	3.39	0.78
		6 %	2.93	2.95	3.90	0.81	2.94	2.91	3.85	0.81
	50%	0(control)	2.15	1.35	2.52	0.60	2.12	1.52	2.50	0.61
		2 %	2.63	1.77	2.66	0.68	2.66	1.93	2.72	0.67
		4 %	2.73	1.98	2.80	0.73	2.72	1.93	2.80	0.74
		6 %	2.77	2.71	2.94	0.78	2.78	2.58	3.05	0.77
		New L.S.D at 5%	0.03	0.07	0.06	7.43	0.14	0.09	0.08	9.81

Table 11. Effect of the interaction between nitrogen rates and moringa levels on protein content in the green seeds as well as total chlorophyll and protein in leaves of pea plants during the two winter seasons 2015 and 2016.

Treatments							
Nitrogen rates	Moringa extract levels	Chlorophyll (SPAD)	Protein in green seeds%	Protein leaves%	Chlorophyll (SPAD)	Protein in green seeds %	Protein in leaves %
100%		First season 2014			Second season2015		
	0(control)	50.80	15.33	12.37	53.13	18.00	11.96
	2 %	54.67	18.40	15.73	52.73	21.11	13.16
	4 %	55.47	19.23	19.07	53.50	21.09	17.77
	6 %	58.3	21.10	10.50	54.60	22.15	19.56
75%	0(control)	53.37	14.65	14.04	53.20	17.00	10.62
	2 %	52.27	17.79	15.94	53.27	18.11	12.29
	4 %	54.33	18.17	18.42	53.17	19.00	14.77
	6 %	54.83	18.08	8.44	53.20	13.23	18.16
50%	0(control)	53.17	13.42	11.06	53.33	15.12	9.52
	2 %	53.10	16.44	12.04	52.50	16.14	12.04
	4 %	54.03	17.04	12.38	55.97	17.00	12.08
	6 %	54.30	17.28	16.94	55.67	18.11	16.10
	New L.S.D 5%	1.39	0.16	0.48	1.14	0.14	0.53

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تاثير الرش بمستخلص المورينجا مع مستويات مختلفة من التسميد الازوتى على النمو والمحصول ومواصفاتة لنباتات البسلة المنزرعة بالاراضى الرملية مع نظام الرى بالتنقيط

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أجريت التجربه اثناء الموسم الشتوى لعامى 2014– 2015بمزرعة العادليه محافظة الشرقيه– مصر

لدراسة تأثير معدلات مختلفة من السماد الازوتى مع الرش بتركيزات مختلفة من مستخلص اوراق المورينجا على مدى خفض اضافة معدلات السماد الازوتى وزيادة محصول القرون الخضراء للبسلة وتحسين مواصفاتها تحت ظروف الاراضى الرملية والرى بالتنقيط .

اشتملت التجربة على اثنى عشر معاملة حيث كانت عبارة عن تداخل الفعل بين معدلات التسميد النيتروجينى المعدنى100%–75% و50% من التوصيات الموصى بها واربع تركيزات من مستخلص المورينجا هى صفر– 2% – 4% –6% .

واوضحت النتائج ان تسميد نباتات البسلة بمعدل 75 % أو 100% من معدلات التسميد النتروجينى الموصى به ادت الى زيادة معنويهللنمو الخضرى والمحصول ومكوناتة وكذلك ايضا جودة البذور مقارنة بالتسميد بمعدل 50% من المعدل الموصى به ايضا رش نباتات البسلة بمستخلص المورينجا بتركيز4أو6% ادت الزياده النمو الخضرى والمحصول زيادة معنوية وكذلك أيضا محتوى البذور الخضراء من النيتروجين والبروتين . لذلك يمكننا القول انه للوصول لاعلى محصول مع تحسين صفات جودة البذوريتم التسميد بمعدل 75% من السماد النتروجينى الموصى به مع الرش بمستخلص المورينجا 4% او 6% وتوفير 25% من السماد النروجينى حيث انها كانت افضل معاملة تفاعل مع عدم وجود أى اختلافات معنوية بين هذه المعاملة ومعاملة 100% من المعدل الموصى به من السماد النتروجينى .