



## EFFECT OF ALGAE AND YEAST EXTRACTS AS FOLIAR APPLICATION ON THE PRODUCTIVITY OF SNAP BEAN GROWN UNDER SANDY SOIL CONDITIONS

M.M.A. Ramadan

Hort. Res. Inst. Agric. Res. Center, Egypt

Received: Nov. 28, 2019

Accepted: Dec. 16, 2019

---

**ABSTRACT:** A field experiment was carried out during the two successive summer seasons of 2017 and 2018 under sandy soil conditions at El-Khattara Experimental Farm, Fac. Agric., Zagazig University, to study the effect of algae extract at 0, 1 and 2 ml/l, and yeast extract at 0, 5 and 10 g/l as foliar application and their interactions on growth, chemical constituents, yield and pod quality of snap bean cv, Bronco. The most important findings could be summarized as follows: The interaction treatment between spraying snap bean with algae extract at 2 ml/l, and yeast extract at 10 g/l increased plant height, number of leaves, number of branches, shoot dry weight, chlorophyll a, b and total chlorophyll (a+b) in leaf tissues, N,P and K contents in shoots and its uptake by shoots, average pod length, pod weight, yield / plant, and total pods yield/fed., total carbohydrates, TSS and total protein in green pods and lowest total fiber content in green pods. However, this treatment recorded a high relative increases in total yield/fed. were about 69.5% over the control as average of two seasons.

**Key word:** Snap bean, algae, yeast extract, chemical constituents, yield and pod quality.

---

### INTRODUCTION

Snap bean (*Phaseolus vulgaris* L.) is one of the important vegetable crops in Egypt for both local consumption and exportation. As well as It is one of the important food crops in Egypt and consumed as a cooked vegetable either as dry seeds or green pods. It plays an important role in human nutrition as a cheap source for protein, carbohydrates, vitamins and minerals.

Algae are natural bio active materials rich in minerals, protein, lipids, carbohydrates, vitamins and microelements (B, Mo, Zn, Cu). In addition, seaweed fertilizer aunique combination of N, P, K, trace elements and simple sugar that are in dissolved forms that are easily absorbed through roots and leaves, besides releasing trace elements bound to the soil and it is safe to human, animals and the environment (Sathya *et al.*, 2010).

The beneficial effect of seaweed extract spraying on plants was demonstrated in terms of increase in growth (Salah El Din *et al.*, 2008 on broad bean, Boghdady *et al.*, 2016 on chickpea and Salama *et al.*, 2019 on snap bean), leaf pigments and mineral contents (Byan 2014 and Abu Seif *et al.*, 2016 on snap bean), yield and its components (Fawzy *et al.* 2010, Abou El-Yazied *et al.*, 2012 on snap bean, Latique *et al.* 2013 on snap bean, Nawar and Ibraheim 2014 on pea, Kocira *et al.*, 2017 and Salama *et al.* 2019 on snap bean) and pod quality (Salah El Din *et al.*, 2008 on broad bean).

Yeast is a natural source of cytokinins and has stimulatory effects on bean plants (Amer, 2004). It has a beneficial role during vegetative and reproductive growth through improving the flower formation and their set in some plants due to its high auxin and cytokinins

contents and enhancement the carbohydrates accumulation. In addition, it participates in a beneficial role during stress due to its cytokinins content (Barnett *et al.*, 1990).

Many researchers showed that spraying plants with yeast extract increased plant growth (Shokr and Fathy, 2009, Nassar *et al.*, 2011, Abdel-Hakim *et al.*, 2012, Kamal and Ghanem 2012, Abd-Elrhem 2017 on snap bean), plant chemical constituents (El-Tohamy and El-Greadly, 2007 on snap bean, Shokr and Abd El- Hamid 2009 on pea and Abd-Elrhem 2017 on snap bean), yield and its components (El-Desuki and El-Greadly 2006, Ali and Abd-Allah, 2010, Nassar *et al.*, 2011, Marzauk *et al.*, 2014 and Khattab *et al.*, 2015 on broad bean) and Marhoon *et al.*, 2018, pod quality (Abou El-Yazied and Mady, 2012 and Abd-Elrhem, 2017 on snap bean and Al-Ashry, 2019 on sugar pea).

The objective of this study was to evaluate the effect of algae and yeast extracts at different concentrations as foliar application on growth, yield and pod quality of snap bean plants grown in sandy soil.

## MATERIAL AND METHODS

A field experiment was carried out during the two successive summer seasons of 2017 and 2018 under sandy soil conditions at El-Khattara Experimental Farm, Fac. Agric., Zagazig University, to study the effect of algae and yeast extracts rates as foliar spray

on growth, chemical constituents, yield and pod quality of snap bean cv, Bronco.

The soil physical and chemical of the used experimental properties site in sandy soil for the two experimental seasons, had 0.14 and 0.15 % organic matter, 8.01 and 7.99 pH, 2.05 and 2.16 mmhos/cm EC, 3.93 and 3.71 ppm available N, 3.92 and 3.97 available P and 12.15 and 13.12 available K in the 1<sup>st</sup> and 2<sup>nd</sup> seasons, respectively.

This experiment included 9 treatments, which were the combination between three rates of algae extracts (0, 1 and 2 ml/l) and three rates of yeast extract (0, 5 and 10 g/l). These treatments were arranged in a split plot design with three replications. Algae extract rates were randomly assigned in the main plots, while, yeast extract rates were devoted in sub plots.

Algae extract was produced at the Algae Production Station of the National Research Centre (NRC, Giza, Egypt). Major components of algae extract is shown in Table, (1).

Yeast extract was prepared from active dry yeast (*Saccharomyces cerevisiae*), dissolved in water, followed by adding sugar at a ratio of 1: 1 and kept 24 hours in a warm place, for reproduction according to the methods described by Morsi *et al.* (2008). Chemical analysis of activated yeast extract is shown in Table (2).

Table (1). Major constituents of the used algae extract

Constituents (D.W)	(%)	Macronutrients		Micronutrients (ppm)	
		(%)			
Crude protein	50.56	N	8.09	Fe	2057
Ether extract	7.39	P	2.69	Zn	722
Crude fiber	9.83	K	0.65	Mn	747

***Effect of algae and yeast extracts as foliar application on the productivity .....***

Ash	9.18		Cu	93
Moisture	4.51			

**Table (2): Chemical analysis of yeast extract according to Morsi *et al.* (2008).**

Amino acids mg /100g dry weight	Mineral mg /100g dry weight	Vitamins mg /100g dry weight
Arginine	Total N 7.23	Vit.B <sub>1</sub> 2.23
Histidine	P <sub>2</sub> O <sub>5</sub> 51.68	Vit.B <sub>2</sub> 1.33
Isoleucine	K <sub>2</sub> O 34.39	Vit. B <sub>5</sub> 19.56
leucine	MgO 5.76	Vit.B <sub>6</sub> ) 1.25
Lysine	CaO 3.05	Vit. B <sub>7</sub> 0.09
Methionine	SiO <sub>2</sub> 1.55	Vit. B <sub>8</sub> 0.26
Phenyl alanine	SO <sub>2</sub> 0.49	Vit. B <sub>9</sub> 4.36
Threonine	NaCl 0.30	Vit B <sub>12</sub> 0.15
Tryptophan	Fe 0.92	Nicotinic acid 39.88
Valine	Ba 157.5	Pamino benzoic acid 9.23
Glutamic acid	Pd 438.6	Carbohydrates 23.2
Serine	Mn 81.3	Glucose 13.33
Aspartic acid	Zn 335.6	
Cystine		
Proline		
Tyrosine		

The experimental unit area was 10.8 m<sup>2</sup> (three drippers lines with 6m length for each and 60cm width), and the distance between drippers was 25cm. The middle dripper line was used for data collection and others were used for yield determination. One dripper line were left between spraying treatments, and 50cm was left between plots as a guard space to avoid the overlapping of spraying concentrations.

Seeds of snap bean were obtained from the Hort. Res. Instit., Agric. Res. Center, Egypt. Seeds were sown on 1<sup>st</sup> and 4<sup>th</sup> March in the 1<sup>st</sup> and 2<sup>nd</sup> seasons, respectively, in hills 15 cm apart on one side of dripper and two seeds per hill and

then thinned after completely emergency to leave one plant/ hill.

The plants were sprayed with algae and yeast extracts using hand pressure sprayer three times at 15, 30 and 45 days after sowing in both growing seasons

All plots received equal amounts of nitrogen, phosphorus and potassium and added in the form of ammonium sulphate (20.5 % N), calcium superphosphate (15.5% P<sub>2</sub>O<sub>5</sub>) and potassium sulphate (48% K<sub>2</sub>O) at the rates of 80 kg N, 37 kg P<sub>2</sub>O<sub>5</sub> and 50 kg K<sub>2</sub>O, respectively. On third of N, K and all P fertilizers were added at the time of soil preparation with 20 m<sup>3</sup>/fad. FYM (farmyard manure). The rest two third of N and K were divided

into 10 equal portions and added through water irrigation (fertigation) 3 days intervals, beginning 15 days after sowing. The other normal agricultural treatments for growing snap bean plants were practiced.

#### **Data Recorded**

A random sample of ten plants from every plot was taken after 60 days from sowing and plant height (cm), number of leaves/plant, and number of branches/plant were recorded.

1. **Dry weight:** the shoots of plant were oven dried at 70 °C till constant weight, and then dry weight of shoots were recorded.
2. **Photosynthetic pigments:** Disk samples from the fourth upper leaf were obtained after 60 days from sowing in all plots to determine chlorophyll a and b, as well as carotenoids in both seasons according to the method described by Wettstein (1957).
3. **Plant chemical composition:** The dry matter of branches and leaves which taken at 60 days after sowing in the both seasons were finely ground and wet digested with sulfuric acid and perchloric acid (3:1). Nitrogen, phosphorus and potassium contents were determined according to the methods described by Bremner and Mulvaney (1982), Olsen and Sommers (1982) and Jackson (1970), respectively. Nitrogen, phosphorus and potassium uptake (mg/plant) were calculated by element (%) in shoot x dry weight /shoot x 10.
4. **Pod yield and its components:** Green pods of each plot were harvested at the proper maturity stage, counted and weighted in each harvest and number of pods/ plant , yield / plant and total pod yield (ton /fed.) were determined. Ten plants were randomly marked from each plot for determining the number of

pods/plant. Twenty pods were randomly chosen from each treatment to determine; pod length (cm) and average weight of pod (g) .

5. **Pod quality;** Randomly samples of pods from each treatment were taken to assay the following characters: Total carbohydrate (%): was determined in pods dry matter according to the method described by Dubois *et al.* (1956). Total soluble solids contents (TSS) as brix°: total soluble solids content using the hand refractometer. Total crude fibers were determined as percentage according to Maynard (1970). Pod protein: pod protein percentage, pod total N was determined and a factor of 6.25 was used for conversion of total N to protein percentage (Kelly and Bliss, 1975).

#### **Statistical analysis:**

The data of these experiments were subjected to proper statistical analysis of variance according to Snedecor and Cochran (1980) and the differences among treatments were compared using LSD at 0.05 level.

## **RESULTS AND DISCUSSION**

### **1. Plant growth**

#### **1.1. Effect of algae extract**

Data in Table (3) revealed that foliar application of algae extract at different rates ( 1 or 2 ml/L) had a significant effect on plant growth, i.e., plant height, both number of leaves and branches, as well as dry weight of shoots of snap bean compared with unsprayed plants, in both seasons, however spraying snap bean plants with 2 ml/l recorded the highest values of all plant growth parameters, in both seasons.

The relative increases in dry weight of shoots due to spraying with algae extract at 2 ml/l were about 21.00 and 18.00 over

**Effect of algae and yeast extracts as foliar application on the productivity .....**

the unsprayed treatment in the 1<sup>st</sup> and the 2<sup>nd</sup> seasons, respectively.

The enhancement snap bean plant growth characteristics due to algae extract spraying may be attributed to the auxins content of the algae extract which

**Table 3**

has an effective role in cell division and enlargement, this leads to increase the shoot growth, leaves number, and plant dry weight (Gollan and Wright 2006). It also contains macronutrients (N, P and K) which are very essential for growth and development of the plant (Attememe, 2009).

These results are harmony with those reported by Salah El Din *et al.* (2008) on broad bean, Boghdady *et al.* (2016) on chickpea and Salama *et al.* (2019) on snap bean

### 1.2. Effect of yeast extract

Data in the same Table (3) illustrated that plant height, both number of leaves and branches, as well as dry weight of shoots were significantly increased with increasing yeast extract rates up to 10 g/L, in both seasons without any significant differences with the treatment of 5 g/L as respect to both number of leaves and branches/ plant in the 1<sup>st</sup> season and dry weight of shoots in both seasons.

The relative increases in total dry weight / plant were about 16.3 and 15.2 for the treatment of 10g /l and 15.5 and 13.2 % for the treatment of 5g/ l yeast extract over the control treatment ( unsprayed ) in the 1<sup>st</sup> and the 2<sup>nd</sup> seasons, respectively.

The superiority of plant growth as response to the foliar application of yeast extract may be attributed to its contents of different nutrients, i.e. P, K, Mg, Ca, Fe, Ba, Mn and Zn, higher percentage of proteins, higher values of free amino

acids and vitamins (Table 1) which may play an important role in improving growth parameters.

These results are in agreement with those reported by Shokr and Fathy (2009), Nassar *et al.* (2011) , Abdel-Hakim *et al.* (2012), Kamal and Ghanem (2012) and Abd-Elrhem (2017) on snap bean, they concluded that, application of yeast extract caused a significant increase in plant growth characters of snap bean.

### 1.3. Effect of interaction

The interactions between algae extract and yeast extract had a significant effect on plant growth of snap bean, i.e., plant height, both number of leaves and branches as well as dry weight of shoots (Table 3). Spraying snap bean plants with algae extract at 2 ml/L and yeast extract at 10 g/L recorded the highest values of plant height, both number of leaves and branches / plant, while the interaction between algae extract at 2 ml/L and yeast extract at 5 g/L recorded the highest values of dry weight of shoots, in both seasons.

The relative increases in total dry weight / plant were about 45.7 and 39.3 % for the interactions between 2 ml/L algae extract and 5 g/L yeast extract over the control treatment (unsprayed) in the 1<sup>st</sup> and the 2<sup>nd</sup> seasons, respectively.

## 2. Leaf pigments

### 2.1. Effect of algae extract

Data in Table (4) indicated that, The algae extracts rates had a significant effect on chlorophyll a, total chlorophyll and carotenoides in leaf tissues and had insignificant effect on chlorophyll b, in both seasons.

Spraying snap bean plants with algae extract at 2 ml/L recorded the highest concentrations of chlorophyll a, total

**Effect of algae and yeast extracts as foliar application on the productivity .....**

chlorophyll and carotenoides in leaf tissues, in both seasons.

Algae extract have a great role in cell division and enlargement and induce the photosynthesis, consequently in turn reflected on a great shoot growth (Lopez *et al.* 2008).

These results are in accordance with those obtained by Byan (2014) and Abu Seif *et al.* (2016) on snap bean.

Table 4

## **2.2. Effect of yeast extract:**

Data in Table (4) showed that, concentrations of chlorophyll a, b, total chlorophyll and carotenoides in leaf tissues were significantly increased due to plants foliar spray with yeast extract compared with the unsprayed plants in both seasons. The highest values of all leaf pigments concentration were produced by the plants received 10 g/L yeast extract in both seasons.

These results could be attributed to the great role of yeast extract in stimulate the cell division, elongation, enlargement, protein and nucleic acid synthesis and chlorophyll formation (Spencer *et al.*, 1983).

These results are agree with Abd-Elrhem (2017) on snap bean. He showed that foliar spray of plants with yeast extract increased photosynthetic pigments in the leaf tissues.

## **2.3. Effect of interaction**

The interactions between spraying snap bean plants with 2 ml/L algae extract and 5g/L yeast extract significantly increased chlorophyll a, b, total chlorophyll (a+b) and carotenoides in leaf tissues than the other interactions treatments, in both seasons (Table, 4).

## **3. N, P and K contents and its uptake**

### **3.1. Effect of algae extract**

The obtained results in Table (5) showed that spraying snap bean plants with algae extract at 2 ml/L significantly increased N,P and K contents and its uptake in shoots without significant differences between algae extract at 1ml/L for N and P content in shoots in the 2<sup>nd</sup> season and K content in both seasons.

This increase in N content in shoots may be due to that the high protein content (50.56 % on dry basis of the algae extract which split natural plant amino acids involved directly in the metabolism (Table 1). Also, algae extract is a rich source of potassium and contains considerable amounts of Ca, Cu, Fe, Mg, Mn, P and Zn. These results may explain the great benefits of algae extract on supplementing pea plants with their requirements from organic and mineral nutrients (Marrez *et al.*, 2014).

These results are in harmony with those reported by Abou El-Yazied *et al.* (2012) on snap bean.

### **3.2. Effect of yeast extract**

Data in Table (5) showed clearly that foliar spray with yeast extract at different rates had a significant effect on N, P and K contents and its uptake by shoots compared to the control treatment (sprayed with tap water), in both seasons.

Spraying snap bean plants with yeast extract at 10 g/l recorded the maximum values of N,P and K contents in shoots and its uptake in both seasons , with no significant differences as a result of yeast extract of 5 g/l in P content of shoot in the 1<sup>st</sup> season.

These results are in accordance with those obtained by y El-Tohamy and El-Greadly (2007) on snap bean and Shokr and Abd El- Hamid (2009) on pea, they stated that spraying plants with yeast



**Effect of algae and yeast extracts as foliar application on the productivity .....**

extract increased N, P and K contents and uptake by plants.

**3.3. Effect of interaction**

The interactions between algae extract and yeast extract rates had a significant effects on N, P and K in shoots and its uptake, in both seasons, except P and K contents in leaves in the 1<sup>st</sup> season only (Table 5).

**Table 5**

Regarding N, P and K contents in shoots data showed that spraying plants with the combinations of 2 ml/L algae extract and 10 g/L yeast extract increased N and P contents in shoots in both seasons. While the interactions between the treatment of algae extract at 1 ml/l and yeast extract at 10 g/l increased K content in shoots in both seasons. As for N, P and K uptake by shoots, the same data showed that the interactions between spraying bean plants with algae extract at 2 ml/l and yeast extract at 5 g/l increased N, P and K uptake by shoots, in both seasons.

#### 4. Yield and its components

##### 4.1. Effect of algae extract

Data in Table (6) showed that, pod yield and its components of snap bean plants had significantly affected by the two rates of algae extracts than unsprayed plants, in both seasons.

Spraying plants with algae extract at 2 ml/L increased pod length, number of pods / plant, average pod weight, yield/ plant and total green yield of pods/fed., in both seasons, without any significant differences with the treatment of algae extract at 1ml/L regarding pod length and number of pods / plant, in both seasons and average pod weight in the 2<sup>nd</sup> season.

The relative increases in total yield /fed. were about 24.6 and 32.6 % for algae extract at 2 ml/L and 14.9 and 21.4

% for algae extract at 1 ml/L over the control treatment (unsprayed plants) in the 1<sup>st</sup> and the 2<sup>nd</sup> seasons, respectively.

The increases of total yield /fed might be due to the increases in average pod weight (Table 6). Also, this might be due to the favorable effect of algae extract on dry weight (Table 3), leaf pigments (Table 4) and mineral uptake (Table 5).

These results are in harmony with those obtained by Fawzy *et al.* (2010), Abou El-Yazied *et al.* (2012) on snap bean, Latique *et al.* (2013) on snap bean, Nawar and Ibraheim (2014) on pea, Kocira *et al.* (2017) and Salama *et al.* (2019) on snap bean

##### 4.2. Effect of yeast extract

Data in Table (6) indicated that, the foliar application of yeast extract increased pod traits and yield components comparing to the control treatment. Pod length, number of pods/ plant, average pod weight, yield/plant and total green yield /fed. were significantly increased with increasing yeast extract up to the highest rate, i.e. 10 g/L, in both seasons without any significant differences with the treatment of 5g/L concerning average pod length in the 1<sup>st</sup> season and number of pods/ plant in both seasons.

The relative increases in total yield /fed. were about 33.2 and 31.2 for 10g /L and 18.7 and 17.3 % for 5g/ L yeast extract over control treatment in the 1<sup>st</sup> and the 2<sup>nd</sup> seasons, respectively.

These results may be attributed to yeast extract containing amino acids and vitamins (Table 2). Also, yeast extract naturally (contains many compounds, i.e. cytokinins and proteins that enhance cell division and its enlargement which are safe and non-pollutant (Barnett *et al.*, 1990).

**Effect of algae and yeast extracts as foliar application on the productivity .....**

The increase of total yield /fed. might be due to the increase in average pod weight (Table 6). Also, this might be due to the favorable effect of yeast extract on dry weight of shoots (Table 3) , leaf pigments (Table 4) and mineral contents and its uptake (Table 5).

The obtained results are in accordance with those of Ali and Abd-Allah (2010), Nassar *et al.* (2011), Marzauk *et al.* (2014) and Marhoon *et al.* (2018) on snap bean. They stated that yield and its components were increased with increasing yeast extract rates.

**Table 6**

### 4.3. Effect of the interaction

It is clear from data in Table (6) that the interactions between spraying snap bean plants with algae extract at 2ml/l and yeast extract at 10 g/l was the best effective interactions treatment for increasing the average pod length, number of pods/ plant average pod weight, yield / plant and total yield /fed., followed by the interaction between 2 ml/L algae extract and 5 g/L yeast extract

The increases in total yield/fed., were about 62.9 and 76.1 % for the interaction between spraying with algae extract at 2 ml/L, and yeast extract of 10 g/L and 60.0 and 64.1 % for the interaction between spraying with algae extract at 2 ml/l and yeast extract at 5 g/L over the control (sprayed with tap water ) in the 1<sup>st</sup> and the 2<sup>nd</sup> seasons, respectively.

## 5. Pod quality

### 5.1. Effect of algae extract

Data in Table (7) illustrated that, total carbohydrates %, TSS %, and total protein (%) in pods were significantly increased due to spraying the plants with algae extract at 2 ml/L in both seasons, with no significant differences with algae extract at 1 ml/L with respect to total protein in both seasons, on the other hand, unsprayed plants gave the highest

percentage of total fiber in pods, in both seasons.

The stimulative effect of algae extract on total protein in bean pods might be due to the increases in TSS in its pods (Table 7). These increases might be ascribed to the fact that yeast extract contains proteins and amino acids (Table 1).

These results are in harmony with those reported by Salah El Din *et al.* (2008) on broad bean.

### 5.2. Effect of yeast extract

Data in Table (7) evidently showed that the yeast extract as foliar application had a significant effect on total carbohydrates %, TSS %, and total protein % in bean pods than unsprayed plants, in both seasons. All tested pervious parameters were significantly increased with increasing the yeast extract up to 10g/L, while total fiber (%) was decreased, in both seasons.

The stimulative effect of yeast extract on total carbohydrates in pods might be due to the increases in TSS in pods (Table 7). These increases might be ascribed to the fact that yeast extract contains sugars, proteins and amino acids, as well as several vitamins (Eata, 2001).

Similar results were obtained by Abou El-Yazied and Mady (2012) on broad bean and Abd-Elrhem (2017) on snap bean and Al-Ashry (2019) on sugar pea.

### 5. 3. Effect of interaction

It is clear from data in Table (7) that, there were a significant effect between algae extract and yeast extract as foliar application on pods quality, in both seasons. The interactions between 2 ml/ L algae extract and 10 g/L yeast extract recorded the maximum total carbohydrates, TSS, in both seasons and

**Effect of algae and yeast extracts as foliar application on the productivity .....**

total protein (%) in the 1<sup>st</sup> season and recorded the minimum total fiber contents in these pods.

**CONCLUSION**

It could be concluded that, under the same conditions, spraying snap bean plants cv, Bronco with both of algae extract at 2 ml/L and yeast extract at 10 g/L three times after 15, 30 and 45 days from sowing was the best treatment for improving snap bean plants productivity and its pods quality and this treatment recorded highest values of total yield/fed. were about 69.5 % over the control (sprayed with water ).

**Table 7**

## REFERENCES

- Abdel-Hakim, W. M., Y. M. M. Moustafa and R. H. M. Gheeth, (2012). Foliar application of some chemical treatments and planting date affecting snap bean (*Phaseolus vulgaris* L.) plants grown in Egypt. *J. Hort. Sci., and Ornament. Plants*, 4 (3): 307-317.
- Abd-Elrhman, E. M. M. (2017). Response of some snap bean cultivars to foliar application with some antioxidant substances for increasing productivity under local environments at early summer season. M.Sc. Thesis, Fac. Agric., Mansoura Univ., Egypt.
- Abou EL-Yazied, A. and M.A. Mady (2012). Effect of boron and yeast extract foliar application on growth, pod setting and both green pod and seed yield of broad bean (*Vicia faba* L.). *J. Appl. Sci. Res.*, 8(2): 1240-1251
- Abou El-Yazied, A., M. El-Gizawy, M.I. Ragab and E.S. Hamed (2012). Effect of seaweed extract and compost treatments on growth, yield and quality of snap bean. *J. Amer. Sci.*, 8 (6): 1–20.
- Abu Seif, Y. I., S. M. El-Miniawy, N. A.I. Abu El-Azm and A. Z. Hegazi (2016). Response of snap bean growth and seed yield to seed size, plant density and foliar application with algae extract. *Ann. Agric. Sci.*, 61(2): 187–199.
- Al-Ashry M. T. M. (2019). Improving sugar pea growth and quality by using some natural substances. MSc. Thesis, Fac. Agric. Mansoura Univ.
- Ali, T. B. and A. A. A. Abd-Allah (2010). Influence of certain bio and chemical treatments on sugar pea productivity and protection of some insect pests. *Egypt. J. Agric. Res.*, 88 (1): 167- 191.
- Amer, S.S.A. (2004). Growth, green pods yield and seeds yield of common bean (*Phaseolus vulgaris* L) as affected by active dry yeast, salicylic acid and their interaction, *J. Agric. Sci. Mansoura. Univ.*, 29 (3): 1407-1422.
- Attememe, J.Y.A. (2009). The effect of humic acid and seaweed extracts on the growth, chemical characteristics of *Rosmarinus officinalis* L. The 6<sup>th</sup> scientific conference, Biology Dept., College of Education, University of Tikrit. *Plant Sci.*, 1-17.
- Barnett, J.A., R.W. Payne and D. Yarrow (1990). Yeasts characteristics and identification. Cambridge. Camb. CBZBR, p. 999.
- Boghdady M. S., D. A. H. Selim, R. M. A. Nassar and A. M. Salama (2016). Influence of foliar spray with seaweed extract on growth, yield and its quality, profile of protein pattern and anatomical structure of chickpea plant (*Cicer arietinum* L.). *Middle East J. Appl. Sci.*, (6): 207–221.
- Bremner, J. M., and C. S. Mulvaney (1982). Total nitrogen In: Page, A. L., R. H. Miller, and D. R. Keeney (Eds). *Methods of Soil Analysis. Part 2*, Amer. Soc. Agron. Madison, W. I. USA. pp. 595- 624.
- Byan U. A.I. (2014). Effect of Foliar Spraying by Some Natural Extracts for Improving Snap Bean Production. *Egypt. J. Hort.*, 41(1): 109 – 119.

- Dubois, M., K. A. Gilles, J. Hamillon, P. A. Rebers and F. Smith (1956). Colorimetric methods for determination of sugars and related substances. *Anal. Chem.*, 28:350.
- Eata, A.M. (2001). Response of some tomato cultivars to natural soil salinity and use of some treatments to reduce salt injury. Ph. D Thesis, Fac. Agric. Mansoura Univ., Egypt.
- El-Desuki, M. and N. H. M. El-Greadly (2006). Response of pea plants to foliar application of yeast extract. *J. Agric. Sci., Mansoura Univ.*, 31(10): 6667-6674.
- El-Tohamy, W. A. and N. H. M. El-Greadly (2007). Physiological responses, growth, yield and quality of snap beans in response to foliar application of yeast, vitamin E and zinc under sandy soil conditions. *Aust. J. Basic and Appl. Sci.*, 1(3): 294-299.
- Fawzy, Z. F., A.M. El-Bassiony, A.G. Behairy and Y.I. Helmy (2010). Effect of foliar spraying by some bio and organic compounds on growth, yield and chemical composition of snap bean plants. *J. Applied. Sci. Res.*, 6 (12): 2269-2274.
- Gollan, J.R. and J.T. Wright (2006). Limited grazing by native herbivores on the invasive seaweed caulerpa. *Taxifolia in a temperate. Australia Estuary Marine and Fresh Water Res.*, 57(7): 685-694.
- Jackson, M. L. (1970). *Soil Chemical Analysis*. Prentic Hall, Englewood Ceiffs, N. J.
- Kamal, A. M. and K. M. Ghanem (2012). Impact of some bio-stimulants on organically cultivated snap bean plants. *Egypt. J. Appl. Sci.*, 27(2): 89-104.
- Kelly, I.D. and F.A. Bliss (1975). Heritability estimates of percentage seed protein and available methionine and correlations with yield in dry bean. *Crop Sci.*, 15: 753-757.
- Khattab, E. A., C. Y. El-Dewiny, M. H. Afifi and R. Kh. M. Khalifa (2015). Response of some varieties of faba bean to yeast and alga and their impact on yield and its components. *Middle East J. Agric. Res.*, 4(4): 907-913.
- Kocira S., A. Kocira, R. Kornas, M. Koszel, M. Szmigielski, M. Krajewska, A. Szparaga and Z. Krzysiak (2017). Effects of seaweed extract on yield and protein content of two common bean (*Phaseolus vulgaris* L.) cultivars. *Legume Res., Agric. Res. Communication*, 1-5.
- Latique, S., H. Chernane, M. Mansori and M. El Kaoua (2013). Seaweed liquid fertilizer effect on physiological and biochemical parameters of bean plant (*Phaseolus vulgaris* var. Paulista) under hydroponic system. *Eur. Sci. J.*, 9 (30): 174-191.
- Lopez, R., F. Cabrera, E. Madejan, F. Sancho and M. Alvares, (2008). Urban compost as an alternative for peat in forestry nursery growing media. *Dynamic soil. Dynamic plant*, 1 : 60-66.
- Marhoon, I. A., W. Y. Lahmood and S. Saleh (2018). Effect of nanocarbon and yeast suspension on some vegetative growth and yield characters of *Vinga unguiculatal* under salt water stress. *Eurasia J. Biosci.*, 12: 9-12.
- Marrez, D. A., M. M. Naguib, Y. Y. Sultan, Z. Y. Daw and A. M. Higazy (2014). Evaluation of chemical composition for *Spirulina platensis* in different culture media. *Res.J. Pharmaceutical, Biol. and Chem. Sci.*, 5(4): 1161-1171.
- Marzauk, N. M., M. R.Shafeek, Y. I. Helmy, A. A. Ahmed and M. A. F. Shalaby (2014). Effect of vitamin E and yeast extract foliar application on growth, pod yield and both green pod and seed yield of broad bean (*Vicia faba* L.). *Middle East J. Appl. Sci.*, 4(1): 61-67.

- Maynard, A.J. (1970). *Methods in food analysis*. Academic Press New York, London, 176 pp.
- Morsi, M.K., B. El-Magoli, N.T. Saleh, E.M. El-Hadidy and H.A. Barakat (2008). Study of antioxidants and anticancer activity licorice *Glycyrrhiza glabra* extracts. *Egyptian J. Nutr. And Feeds*, 2(33): 177-203.
- Nassar, R. M. A., Y. M. Ahmed and D. M. A. Nassar (2011). Effect of foliar spray with active yeast extract on morphological, anatomical and yield characteristics of kidney bean (*Phaseolus vulgaris* L.). *Australian J. Basic and Appl. Sci.*, 5(5): 1071-1079.
- Nawar, D. A. S. and S. Kh. A. Ibraheim (2014). Effect of algae extract and nitrogen fertilizer rates on growth and productivity of peas. *Middle East J. Agric. Res.*, 3(4): 1232-1241.
- Olsen, S. R. and L. E. Sommers (1982). Phosphorus. In: Page. A. L., R. H. Miller, and D. R. Keeney (Eds). *Methods of Soil Analysis. Part 2* Amer. Soc. Agron. Madison, W. I. USA. pp. 403-430.
- Salah El Din R. A., A. A. Elbakry, S. M. Ghazi and O. M. Abdel Hamid (2008). Effect of seaweed extract on the growth and yield of faba bean (*Vicia faba* L.). *Egyptian J. Phycol.*, 9: 25-38.
- Salama A. M., S. N. Azoz and A. M. El-Taher (2019). Influence of foliar spray by algae extract and amino acid on botanical characters and seed chemical composition of common bean plant (*Phaseolus vulgaris* L.). *Int. J. Adv. Res.*, 7(4): 264-271.
- Sathya, B., H. Indu, R. Seenivasan and S. Geetha (2010). Influence of seaweed liquid fertilizer on the growth and biochemical composition of legume crop, *Cajanus cajan* (L.) Mill sp. *J. Phytology.*, 2 (5): 50-63.
- Shokr, M. M. B. and M. T. Abd El-Hamid (2009). Using some antioxidant substances for enhancing the root tolerance and improving productivity of pea (*Pisum sativum* L.) plants under local environment of early summer season. *Agric. Res. J. Sues Canal Univ.*, 9(1): 69-76.
- Shokr, M. M. B. and E. L. E. Fathy (2009). Some foliar applications for improving snap bean (*Phaseolus vulgaris* L.) quality and yield at Fall season. *J. Agric. Sci. Mansoura. Univ.*, 34(5): 5089-5106.
- Snedecor, C.W. and W.G. Cochran (1982). *Statistical Methods. 7th ed.* The Iowa state Univ. Press., Ames. Iowa, USA, pp. 325-330.
- Spencer, T.F.T., S.M. Dorothy and A.R.W. Smith (1983). *Yeast genetics "fundamental and applied aspects"* pp 16- 18, Springer. Verlag. New York., U.S.A.
- Wettstein, D. (1957). Chlorophyll. Lethale unter submikroskopische formwechsel der plastiden. *Exptl. Cell Reso.* 12:427-506.



## تأثير الرش الورقى بمستخلصات الطحالب والخميره على إنتاجية نباتات الفاصوليا تحت ظروف الأراضى الرملية

محمد محمد عبد اللطيف رمضان

معهد بحوث البساتين - مركز البحوث الزراعيه

### المخلص العربى

أجريت هذه التجربة خلال موسمى صيف 2017 ، 2018 تحت ظروف الأراضى الرملية وذلك بمزرعة التجارب بالخطارة- كلية الزراعة - جامعة الزقازيق بهدف دراسة تأثير الرش الورقى بمستخلصات الطحالب ( 0 ، 1 ، 2 مل / لتر) ومستخلص الخميرة ( 0 ، 5 ، 10 جم / لتر) والتفاعل فيما بينهما على النمو ، المحتوى الكيماوى للعرش ، محصول القرون ، وجوده القرون للفاصوليا صنف برونكو . ويمكن تلخيص أهم النتائج كمايلى:

سجل التفاعل بين رش نباتات الفاصوليا بمعدل 2سم<sup>3</sup>/لتر من مستخلص الطحالب مع رش النباتات من مستخلص الخميرة بمعدل 10 جم / لتر الى زيادة ارتفاع النبات، عدد الأوراق والأفرع على النبات ، الوزن الجاف للعرش وزيادة محتوى الورقة من كلوروفيل أ ، ب ، الكلورفيل الكلى ( أ+ب) فى أنسجه الورقة ، محتوى العرش من النيتروجين والفوسفور والبوتاسيوم والممتص منهم بواسطة العرش ، متوسط طول ووزن القرن ، محصول النبات ومحصول الفدان الكلى من القرون ، وكذلك محتوى القرون من المواد الكربوهيدراتية ، المواد الصلبه الكليه والبروتين الكلى ، أقل محتوى للقرون من الالياف. علاوة على ذلك كانت الزيادة النسبية فى المحصول الكلى لهذه المعاملة هى 69.5 % متوسط موسمى الدراسة أعلى من معاملة المقارنة ( الرش بالماء فقط ) .

السادة المحكمين

أ.د/ عصام أبوالصالحين معهد بحوث البساتين - مركز البحوث الزراعية - الجيزة  
أ.د/ فتوح أبوالميزيد على كلية الزراعة - جامعة المنوفية

Table (3): Effect of spraying with algae and yeast extracts and their interactions on plant growth of snap bean plants during summer seasons of 2017 and 2018

Treatments	Plant height (cm)		Number of leaves/plant		Number of branches/plant		Dry weight of shoots (g)		Relative increases in dry weight of shoots (%)	
	2017 season	2018 season	2017 season	2018 season	2017 season	2018 season	2017 season	2018 season	2017 season	2018 season
<b>Effect of algae extract</b>										
0	33.44	33.55	21.22	27.77	6.22	5.89	11.62	12.08	00.0	00.0
1 ml/L	34.78	36.77	21.78	22.33	6.66	6.33	11.88	12.49	02.2	03.4
2 ml/L	38.47	40.49	26.48	26.81	7.02	7.09	14.06	14.25	21.0	18.0
LSD at 0.05 level	1.30	1.74	1.01	0.87	0.43	0.29	0.57	0.49	--	---
<b>Effect of yeast extract</b>										
YE 0	32.89	33.22	18.88	20.55	6.00	5.78	11.32	11.82	00.0	00.0
YE at 5 g/l	35.72	37.10	25.32	26.95	6.83	6.46	13.07	13.38	15.5	13.2
YE at 10 g/l	38.08	40.50	25.26	29.42	7.08	7.07	13.16	13.62	16.3	15.2
LSD at 0.05 level	1.02	1.36	0.79	0.68	0.34	0.22	0.43	0.38	---	----
<b>Effect of interaction</b>										
0	30.66	26.66	14.66	23.66	5.00	5.00	10.83	11.13	00.0	00.0
YE at 5 g/L	33.00	35.33	23.66	29.66	6.33	5.66	11.7	12.42	08.0	11.6
YE at 10 g/L	36.66	38.66	25.33	30.00	7.33	7.00	12.32	12.69	13.8	14.0
1 ml/L	32.00	33.66	17.33	24.00	6.33	6.33	11.19	11.84	03.3	06.4
YE at 5 g/L	36.00	36.00	26.00	19.00	7.00	6.33	11.74	12.23	08.4	09.9
YE at 10 g/L	36.33	40.66	22.00	24.00	6.66	6.33	12.7	13.39	17.3	20.3
2 ml/L	36.00	39.33	24.66	14.00	6.66	6.00	11.93	12.48	10.2	12.1
YE at 5 g/L	38.15	39.96	26.31	32.18	7.15	7.38	15.78	15.5	45.7	39.3
YE at 10 g/L	41.25	42.18	28.46	34.25	7.26	7.89	14.46	14.77	33.5	32.7
LSD at 0.05 level	1.77	2.37	1.38	1.18	0.59	0.39	0.78	0.67	--	--

YE= Yeast extract

Table (4): Effect of spraying with algae and yeast extracts and their interactions on leaf pigments (mg/g DW) of snap bean leaves tissues during summer seasons of 2017 and 2018

Treatments	Chl. a		Chl. b		Total (a+b)		Carotenoides	
	2017 season	2018 season	2017 season	2018 season	2017 season	2018 season	2017 season	2018 season
Effect of algae extract								
0	2.99	3.14	1.17	1.24	4.15	4.38	1.17	1.19
1 ml/L	3.28	3.37	1.20	1.34	4.48	4.71	1.30	1.36
2 ml/L	3.47	3.63	1.37	1.51	4.84	5.14	1.64	1.51
LSD at 0.05 level	0.06	0.08	NS	NS	0.17	0.20	0.12	0.09
Effect of yeast extract								
0	3.00	3.13	1.09	1.27	4.10	4.40	1.31	1.32
1 ml/L	3.32	3.43	1.28	1.41	4.60	4.84	1.25	1.28
2 ml/L	3.41	3.59	1.37	1.41	4.78	4.99	1.55	1.45
LSD at 0.05 level	0.04	0.06	0.08	0.07	0.13	0.16	0.09	0.07
Effect of interaction								
YE 0	2.82	2.73	1.05	1.19	3.87	3.92	1.04	1.07
YE at 5 g/L	3.00	3.19	1.19	1.29	4.19	4.48	1.07	1.08
YE at 10 g/L	3.14	3.51	1.26	1.23	4.4	4.74	1.39	1.42
1 ml/L	3.06	3.25	1.12	1.21	4.18	4.46	1.29	1.38
2 ml /L	3.11	3.31	1.10	1.37	4.21	4.68	1.10	1.21
LSD at 0.05 level	3.66	3.56	1.39	1.43	5.05	4.99	1.50	1.48
YE 0	3.13	3.42	1.11	1.40	4.24	4.82	1.59	1.52
YE at 5 g/L	3.86	3.79	1.55	1.56	5.41	5.35	1.58	1.55
YE at 10 g/L	3.42	3.69	1.46	1.56	4.88	5.25	1.76	1.46
LSD at 0.05 level	0.08	0.11	0.15	0.12	0.23	0.28	0.17	0.12

YE= Yeast extract

Table (5): Effect of spraying with algae and yeast extracts and their interactions on N, P and K contents and its uptake by snap bean shoots during summer seasons of 2017 and 2018

Treatments	Contents (%)						Uptake ( mg/ plant)					
	N		P		K		N		P		K	
	2017 season	2018 season	2017 season	2018 season	2017 season	2018 season	2017 season	2018 season	2017 season	2018 season	2017 season	2018 season
Effect of algae extract												
0	2.38	2.76	0.310	0.330	1.99	2.18	278.99	334.57	35.89	39.77	232.62	265.39
1 ml/L	3.08	3.16	0.400	0.450	2.49	2.70	366.80	395.86	47.78	56.95	297.62	338.36
2 ml/L	3.27	3.18	0.450	0.470	2.55	2.69	461.85	453.70	63.50	67.13	360.83	384.73
LSD at 0.05 level	0.10	0.20	0.039	0.030	0.13	0.20	7.41	8.72	1.30	0.95	3.49	4.36
Effect of yeast extract												
YE 0	2.60	2.80	0.340	0.370	2.05	2.31	295.95	331.79	38.94	44.13	233.14	273.93
YE at 5 g/l	2.96	3.03	0.400	0.420	2.36	2.52	392.33	406.85	52.73	56.81	312.50	340.12
YE at 10 g/l	3.17	3.27	0.420	0.460	2.62	2.75	419.36	445.49	55.51	62.91	345.42	374.43
LSD at 0.05 level	0.08	0.15	0.030	0.024	0.10	0.16	5.82	6.84	1.02	0.76	2.73	3.42
Effect of interaction												
0	2.01	2.46	0.260	0.270	1.65	1.89	217.68	273.80	28.16	30.05	178.70	210.36
YE at 5 g/L	2.25	2.73	0.290	0.310	1.91	2.05	263.25	339.07	33.93	38.50	223.47	254.61
YE at 10 g/L	2.89	3.08	0.370	0.400	2.40	2.61	356.05	390.85	45.58	50.76	295.68	331.21
1 ml/L	2.78	2.89	0.320	0.390	2.18	2.55	311.08	342.18	35.81	46.18	243.94	301.92
YE at 5 g/L	3.24	3.19	0.440	0.483	2.52	2.70	380.38	390.14	51.66	59.07	295.85	330.21
YE at 10 g/L	3.22	3.40	0.440	0.490	2.78	2.86	408.94	455.26	55.88	65.61	353.06	382.95
2 ml /L	3.01	3.04	0.443	0.450	2.32	2.48	359.09	379.39	52.85	56.16	276.78	309.50
YE at 5 g/L	3.38	3.17	0.460	0.470	2.65	2.81	533.36	491.35	72.59	72.85	418.17	435.55
YE at 10 g/L	3.41	3.32	0.450	0.490	2.68	2.77	493.09	490.36	65.07	72.37	387.53	409.13
LSD at 0.05 level	0.14	0.27	0.053	0.041	0.18	0.28	10.08	11.86	1.77	1.29	4.74	5.93

YE= Yeast extract

Table (6): Effect of spraying with algae and yeast extracts and their interactions on yield and its components of snap bean plants during summer seasons of 2017 and 2018

Treatments	Pod characterizes				Yield and its components							
	Pod length (cm)		Number of pods / plant		Average pod weight (g)		Yield / plant (g)		Total yield (ton/fed.)		Relative increases in total yield	
	2017 season	2018 season	2017 season	2018 season	2017 season	2018 season	2017 season	2018 season	2017 season	2018 season	2017 season	2018 season
<b>Effect of algae extract</b>												
0	8.43	8.81	11.06	10.91	5.49	5.84	61.11	63.94	2.844	2.991	00.0	00.0
1 ml/L	10.78	10.17	11.91	11.91	6.08	6.89	70.26	78.11	3.267	3.632	14.9	21.4
2 ml/L	11.15	10.56	11.67	11.90	6.31	6.97	76.18	84.64	3.545	3.965	24.6	32.6
LSD at 0.05 level	0.51	0.44	0.07	0.10	0.09	0.21	3.05	3.66	0.130	0.200	--	---
<b>Effect of yeast extract</b>												
YE 0	9.72	9.48	11.32	11.24	5.76	6.31	59.11	65.11	2.743	3.038	00.0	00.0
YE at 5 g/l	10.21	9.75	11.67	11.92	5.94	6.56	69.95	76.56	3.257	3.565	18.7	17.3
YE at 10 g/l	10.43	10.31	11.64	11.56	6.18	6.82	78.48	85.02	3.655	3.985	33.2	31.2
LSD at 0.05 level	0.40	0.34	0.06	0.08	0.07	0.17	2.39	2.87	0.102	0.157	----	----
<b>Effect of interaction</b>												
0	7.18	7.48	10.18	10.25	4.93	5.10	50.17	52.18	2.320	2.460	00.0	00.0
YE at 5 g/L	8.20	8.30	11.03	11.26	5.22	5.44	57.58	61.25	2.687	2.858	15.8	16.2
YE at 10 g/L	9.90	10.66	11.96	11.23	6.32	6.98	75.59	78.39	3.524	3.655	51.9	48.6
1 ml/L	11.23	10.96	12.53	12.00	6.37	7.23	59.72	67.41	2.769	3.125	19.4	27.0
YE at 5 g/L	11.50	10.73	12.13	12.40	6.48	7.50	72.46	81.68	3.371	3.800	45.3	54.5
YE at 10 g/L	9.60	8.83	11.06	11.33	5.40	5.95	78.60	85.24	3.660	3.970	57.8	61.4
2 ml/L	10.75	10.00	11.26	11.46	5.99	6.61	67.45	75.75	3.141	3.528	35.4	43.4
YE at 5 g/L	10.92	10.23	11.86	12.10	6.11	6.75	79.82	86.76	3.713	4.036	60.0	64.1
YE at 10 g/L	11.78	11.45	11.89	12.13	6.82	7.54	81.26	91.42	3.780	4.331	62.9	76.1
LSD at 0.05 level	0.69	0.60	0.10	0.14	0.13	0.29	4.15	4.97	0.177	0.272	---	---

YE= Yeast extract

Table (7): Effect of spraying with algae and yeast extracts and their interactions on pod quality of snap bean during summer seasons of 2017 and 2018.

Treatments	Total carbohydrates (%)		TSS ( brix)		Total fiber (%)		Total protein (%)	
	2017 season	2018 season	2017 season	2018 season	2017 season	2018 season	2017 season	2018 season
<b>Effect of algae extract</b>								
0	41.62	44.02	3.59	3.83	7.69	8.77	13.92	16.92
1 ml/L	47.26	52.06	4.16	4.70	6.83	8.39	16.69	18.78
2 ml/L	50.46	55.44	4.65	4.91	6.74	7.90	16.81	18.64
LSD at 0.05 level	0.56	0.53	0.12	0.16	0.49	0.18	0.65	0.52
<b>Effect of yeast extract</b>								
YE 0	44.04	47.81	3.67	4.01	7.58	8.56	14.38	17.09
YE at 5 g/l	46.58	51.25	4.30	4.46	7.19	8.28	15.88	18.09
YE at 10 g/l	48.72	52.46	4.43	4.97	6.49	8.22	17.16	19.16
LSD at 0.05 level	0.47	0.40	0.08	0.11	0.38	0.12	0.53	0.38
<b>Effect of interaction</b>								
0	38.15	39.45	3.12	3.22	8.35	9.27	12.31	15.14
YE at 5 g/L	41.22	44.58	3.42	3.47	7.56	8.65	14.06	17.01
YE at 10 g/L	45.48	48.04	4.22	4.79	7.17	8.39	15.38	18.61
1 ml/L	45.44	50.60	3.89	4.17	7.36	8.37	15.32	18.04
YE at 5 g/L	47.82	53.38	4.59	5.01	6.99	8.18	16.82	18.37
YE at 10 g/L	48.52	52.20	4.00	4.92	6.15	8.61	17.94	19.93
2 ml /L	48.52	53.38	4.00	4.65	7.04	8.03	15.51	18.08
YE at 5 g/L	50.70	55.78	4.89	4.89	7.02	8.01	16.76	18.88
YE at 10 g/L	52.17	57.15	5.07	5.19	6.15	7.65	18.15	18.95
LSD at 0.05 level	0.82	0.69	0.14	0.20	0.67	0.21	0.92	0.67

YE= Yeast extract