

## RESPONSE OF PEA PLANTS TO FOLIAR APPLICATION OF YEAST EXTRACT

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### ABSTRACT

Two field experiments were conducted during the two successive winter season of 2004/2005 and 2005/2006 at EL-Hoda farm in Wady EL-Mollak, Ismlia Governorate to study the effect of spraying pea plants with yeast extract on growth, yield and quality of produced pods.

Results show that the vegetative growth of pea plants i. e., leaves area, plant height, number of leaves and branches as well as fresh and dry weight of leaves and branches per plant were improved by spraying pea plants with yeast extract as compared with the control. Results also clarified that the vegetative growth parameters were gradually increased with increasing the concentration of yeast in spraying solution from 1% up to 3% .

Respecting, leaves content of photosynthetic pigments, free amino acids, carbohydrates and cytokinins as well as pods yield , pods quality and nutritive value were show the same trend as vegetative growth aspects.

### INTRODUCTION

Pea (*Pisum sativum* L.) is one of the most important leguminous vegetable crops grown in Egypt during winter season for local consumption and exportation. The green seeds of pea contain a great amount of protein and carbohydrates, which make it one of the most important sources in human food nutrition.

Yeast extract are the natural components contains many of the nutrient elements and cytokinins, which is safe and non-pollutant. It has a considerable amounts of amino acids (Abou Zaid, 1984), mineral elements, carbohydrates, reducing sugars, enzymes and vitamins B1,2,3,12 (Castelfranco and Beale, 1983; Spencer *et al.*, 1983; Somer, 1987; Fathy and Farid, 1996 ; Khedr and Farid, 2000 and Mahmoud, 2001). Also it is a source of cytokinins and protein that enhance cell division and enlargement of cells (Barnett *et al.*, 1990). Moreover, Yeo *et al.*, (2000) found that yeast extracts contain trehalose-6-phosphate synthesis which is a key enzyme for trehalose bio synthesis. He suggested that the production of trehalose not only affects plant development but also improves drought tolerance.

Many investigators reported that, spraying plants with yeast extract improved plant growth, yield and quality of many vegetable crops i. e. pea, tomato, potato, pepper and cucumber (EL-Ghamriny *et al.*, 1999; Mohamed *et al.*, 1999; Yeo *et al.*, 2000; Abd-El-Hafez and Shehata, 2001; Tartoura, 2001 and Mahmoud, 2004).

This work aimed to study the response of pea to spraying with yeast extract.

## MATERIALS AND METHODS

Two field experiments were conducted during the two successive winter season of 2004/2005 and 2005/2006 at EL-Hoda farm in Wady EL-Mollak, Ismilia Governorate. This work aimed to study the effect of spraying pea plants with yeast extract on growth, pods yield and quality of pea (*Pisum sativum L.*).

The experiment included 4-treatments which were the control (without spraying), spraying pea plants with yeast extract at 1%, 2% and 3%. Treatments were distributed in a complete randomize design with three replicates. Yeast extract were prepared by mixing 1 kg. yeast to 2 kg. Molase for a period of 24 h. and then 10 cm<sup>3</sup> of this mixture was added to 1 L. of water which gave yeast concentration equal 1% or adding 20 cm<sup>3</sup> to 1 L. water which gave yeast concentration equal 2% or adding 30 cm<sup>3</sup> to 1 L. water which gave yeast concentration equal 3% . Pea plants were sprayed with yeast extract solution two times; the first one was at 30 days after sowing and second at 45 days after sowing .

Seeds of pea (*Pisum sativum L.*) cv. Master-B were sown in the first weak of November in the two growing seasons. After preparing the soil for cultivation, ditches of 20 cm width were performed. Organic manure (8 ton compost/fed.) and fertilizers (100, 150 and 100 kg of ammonium sulphate, calcium super phosohate and potassium sulphate fertilizers, respectively) were added through the ditches and then it were covered by sand. Laterals of drip irrigation system were spread over the ditches. Pea seeds were sown as two seeds per hill which were 15 cm apart on one side of the irrigation lines. The experimental unit area was 16 m<sup>2</sup> , it contains four dripper line with 5 m length for each with 80 cm width. The normal agricultural practices of pea production under the conditions of this area were followed according to the recommendations of Egyptian ministry of agriculture.

### **Data recorded:**

#### **A - Vegetative growth:**

At full blooming stage (55 days from seeds sowing) representative samples of 5 plants were taken by random from each experimental plot for measuring the plant growth characters expressed as leaves area (cm), plant height (cm), number of both leaves and branches per plant as well as fresh and dry weight of leaves, branches and whole plant (gm).

#### **B – Chemical constituents:**

Photosynthetic pigments (chlorophyll a, b, total chlorophyll and carotenoids), free amino acids, carbohydrates and sytokinins were determined in fresh leaves which were taken at 55 days old plants.

Photosynthetic pigments were determined by spectrophotometric method recommended by Metzner *et al.*, (1965). Cytokinins fractions were extracted according to the methods adopted by Badr *et al.*, (1971) mentioned and were detected by HPLC. Free amino acids and carbohydrates were determined according to Rosen (1957) and Dubois *et al.*, (1956) respectively.

**C - Yield and its components:**

At the harvest stage (85 days from seeds sowing) the mature green pods were collected along the harvest season and the following data were recorded:

- 1 – Early yield (ton/fed.).
- 2 – Total yield (ton/fed.).

**D– Pods quality:**

A random sample of green pods were taken from the 2<sup>nd</sup> picking and the following data were recorded:

- 1 – Average pod length (cm).
- 2 – Average pod diameter (cm).
- 3 – Average pod weight (gm/pod).
- 4 – Average weight of fresh seeds (gm/pod).
- 5 – Netting % (percentage of fresh seed weight / pods weight).

**C - Nutritive value:**

A random sample of green pods were taken from the 2<sup>nd</sup> picking. Green seeds were dried at 70 c° and the total carbohydrates, nitrogen content and total proteins were determined in dry powder material of green seeds according to Dubois *et al.*, (1956) and Black (1983) respectively .

**Statistical analysis:**

All collected data were subjected to statistical analysis using the normal (F, test). Means were compared using Least Significant Difference (LSD) according to the method described by Gomez and Gomez (1984)

## **RESULTS AND DISCUSSION**

**Vegetative growth:**

Data in Table (1) show the effect of spraying pea plants with yeast extract on vegetative growth parameters i.e. leaves area, plant height, number of leaves and branches as well as fresh and dry weight of leaves and branches of pea plants. Results show that the vegetative growth parameters were significantly increased by spraying pea plants with yeast extract as compared with the control. Data also clarified that all vegetative growth parameters were gradually increased with increasing the yeast extract concentration from 1% up to 3%. This result may be due to the yeast extract contains many of nutrient elements, amino acids, enzymes, vitamins and sytokinins which enhance cell division and enlargement. These results are in harmony with those reported by Mohamed *et al.*,1999 and Tartoura, 2001 on pea plant. Abd-El-Hafez and Shehata, 2001 on tomato, potato, pepper and cucumber ; Yeo *et al.*, 2000 and Mahmoud, 2004 on potato .

**Table (1): Vegetative growth parameters of pea plants as affected by spraying with yeast extract**

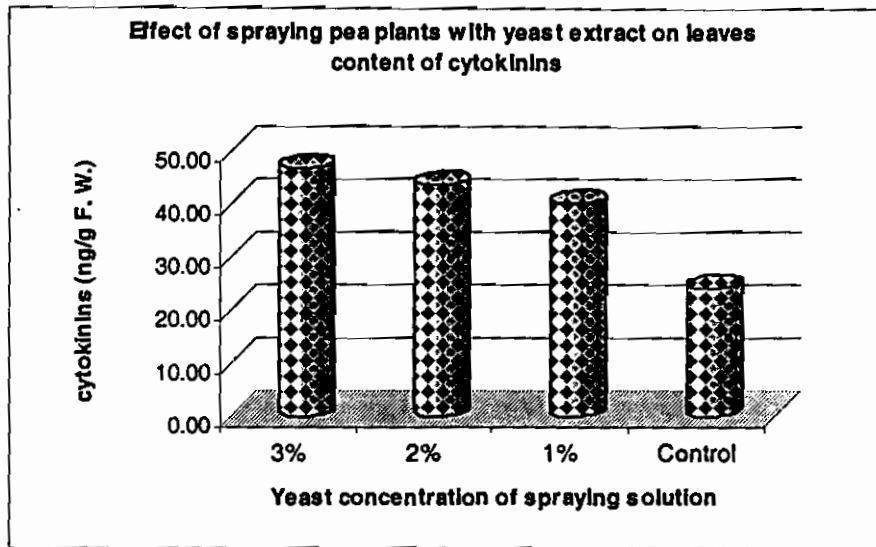
Yeast treatments	Plant height (cm)	Leaves area (cm <sup>2</sup> )	Number of		Fresh weight (g)			Dry weight (g)		
			Leaves	Branches	Leaves	Branches	Total	Leaves	Branches	Total
<b>First season (2004/2005)</b>										
Control	60.33	51.75	30.00	3.67	48.64	21.90	70.54	9.57	4.01	13.59
1%	65.00	53.14	31.67	4.00	51.44	23.86	75.30	10.07	4.61	14.68
2%	74.33	54.50	33.67	5.33	57.75	24.34	82.09	12.24	5.00	17.23
3%	76.67	55.36	34.67	4.67	57.04	27.04	84.08	12.00	5.05	17.05
L. S. D.	7.01	1.06	2.00	0.81	4.59	1.58	5.61	1.03	0.50	0.98
<b>Second season (2005/2006)</b>										
Control	67.72	57.48	32.60	4.08	54.33	23.20	77.53	10.71	4.50	15.21
1%	74.75	60.05	34.80	4.63	56.44	26.01	82.44	11.35	5.28	16.63
2%	84.48	62.25	37.71	5.95	64.10	27.53	91.63	13.41	5.65	19.05
3%	86.83	62.89	37.83	5.35	63.98	28.81	92.79	13.80	5.81	19.60
L. S. D.	8.08	2.61	2.60	0.48	4.11	2.32	5.47	1.41	0.56	1.29

**Organic constituents:**

Data in Table (2) and Fig. (1) show that chlorophyll a, b, carotenoids and total photosynthetic pigments as well as free amino acids, carbohydrates and cytokinins were significantly increased by spraying plants with yeast extracts as compared with the control. Results also show that photosynthetic pigments, free amino acid, carbohydrates and cytokinins were gradually increased with increasing the concentration of yeast on spraying solution from 1%, 2% up to 3% except for chlorophyll, a which increased with increasing yeast concentration from 1% up to 2% and then decreased at 3% yeast concentration. This result were true in both growing seasons.

**Table (2): Photosynthetic pigments, total free amino acid and total carbohydrates as affected by spraying pea plants with yeast extracts.**

Yeast treatments	Photosynthetic pigments (mg/g dry weight)				Free amino acids (mg/g D.W.)	Total carbohydrates (mg/g D.W.)
	Chlo, A	Chlo, B	Carotenods	Total		
<b>First season (2004/2005)</b>						
Control	2.63	1.55	0.83	5.01	36.40	129.53
1%	3.12	2.08	1.14	6.34	43.21	131.54
2%	3.43	2.20	1.15	6.78	47.73	135.40
3%	3.07	2.21	1.21	6.50	48.80	137.53
L. S. D.	0.15	0.09	0.11	0.27	0.87	1.58
<b>Second season (2005/2006)</b>						
Control	2.91	1.81	1.02	5.74	42.53	144.70
1%	3.56	2.36	1.26	7.18	49.02	149.31
2%	3.84	2.53	1.31	7.68	55.22	152.90
3%	3.54	2.61	1.42	7.57	56.79	155.74
L. S. D.	0.27	0.12	0.10	0.31	2.25	2.49



**Fig (1): Effect of spraying pea plants with yeast extract on cytokinins contents.**

**Pods yield and its quality:**

Data in Table (3) show the effect of spraying pea plants with yeast extracts on pods yield and pod quality i. e. pods length, diameter, weight, seed weight and netting% as well as seed content of carbohydrate and protein. Result show that all studied parameters were improved by spraying pea plants by yeast extract. Results clear that early and total pods yield as well as pods quality were gradually and significantly increased with increasing the concentration of yeast extract solution.

**Table(3): pods yield and its quality as affected by spraying pea plants with yeast extract.**

Yeast treatments	Pods yield (ton/fed.)		Pods quality					Nutritive value	
	Early	Total	Length (cm)	Diameter (cm)	Weight (gm)	Seed weight (gm)	% seed/pod weight	Carbohydrate (%)	Protein (mg/100 g)
<b>First season (2004/2005)</b>									
Control	0.45	4.91	6.33	1.28	5.11	2.09	40.98	26.47	24.56
1%	0.57	5.12	6.83	1.45	5.23	2.40	45.95	29.34	26.41
2%	0.70	6.64	7.33	1.63	5.86	2.47	42.17	30.15	27.91
3%	0.69	6.70	7.46	1.69	6.15	2.55	41.54	30.86	28.24
L. S. D.	0.03	0.73	0.47	0.11	0.23	0.07	2.16	0.42	0.41
<b>Second season (2005/2006)</b>									
Control	0.51	5.27	7.12	1.41	5.77	2.50	43.35	28.91	26.75
1%	0.65	6.52	7.82	1.65	6.08	2.88	47.32	33.15	29.84
2%	0.79	7.34	8.29	1.79	6.67	3.05	45.81	34.74	32.20
3%	0.81	7.43	8.37	1.90	7.07	3.03	42.96	35.21	32.24
L. S. D.	0.06	1.00	0.40	0.09	0.32	0.09	2.13	1.54	1.90

This result may be due to that, the yeast extract contains many of nutrient elements, amino acids, enzymes, vitamins and cytokinins which improved the vegetative growth of pea plants (Table,1), photosynthetic pigments as well as increasing leaves content of free amino acids, carbohydrates and cytokinins (Table,2 and Fig.,1) which in turn affect on increasing pods yield and its quality as well as nutritive value. These results are in harmony with those reported by Yeo *et al.*, 2000 on potato; Abd-El-Hafez and Shehata, 2001 on tomato, potato, pepper and cucumber; Mahmoud, 2004, on potato; Mohamed *et al.*, 1999 and Tartoura, 2001 on pea plant.

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استجابة نباتات البسلة للرش بمستخلص الخميرة  
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أجريت تجربتان حقليتان خلال موسمي ٢٠٠٤/٢٠٠٥ ، ٢٠٠٥/٢٠٠٦ في مزرعة  
الهدى - بوادي الملاك - محافظة الاسماعيلية . و ذلك لدراسة تأثير الرش بمستخلص  
الخميرة علي نمو و محصول و جودة قرون البسلة صنف ماستر- بي و كانت المعاملات  
كما يلي:

- (١) كنترول (بدون رش).
  - (٢) الرش بمحلول مستخلص الخميرة بتركيز ١%.
  - (٣) الرش بمحلول مستخلص الخميرة بتركيز ٢%.
  - (٤) الرش بمحلول مستخلص الخميرة بتركيز ٣%.
- و تم رش النباتات مرتين " الأولى بعد ٣٠ يوم من الزراعة و الرشة الثانية بعد ٤٥ يوم  
من الزراعة.

\* أوضحت النتائج أن النمو الخضري لنباتات البسلة ممثلا في " طول النبات - مساحة  
الأوراق - عدد الأوراق - عدد الأفرع - الوزن الطازج و الجاف للأوراق و الأفرع"  
قد تحسن نتيجة لرش نباتات البسلة بمحلول مستخلص الخميرة مقارنة بالكنترول.  
\* كذلك زادت كل قياسات النمو الخضري تدريجيا بزيادة تركيز الخميرة في محلول  
الرش من ١% إلي ٣%.

\* كما أوضحت النتائج أيضا أن محتوى الأوراق من الكلوروفيل و الأحماض الأمينية و  
الكربوهيدرات و السيتوكينين و كذلك محصول و جودة قرون البسلة زادت تدريجيا  
بزيادة تركيز الخميرة في محلول الرش إلي اعلي تركيز مستخلص (٣%).