

## EFFECT OF DIFFERENT CONCENTRATION OF HUMIC ACID ON VEGETATIVE GROWTH AND GREEN PODS ON TWO CULTIVARS OF PEAS (*Pisum sativum L.*)

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### ABSTRACT

The study was carried out during 2017 at the College of Agriculture, University of Duhok, Kurdistan region, Iraq, to study the effects of humic acid on the growth of two peas (cv. Wolar and Izolda) on growth and green pods yield of Pea plant, were grown in plastic bags. Results showed that cv. (Izolda) gave highest yield/plant (21.58g/plant), compared with cv. Wolar (17.76g/plant). Total green pods was from cv. Izolda which gave 142.98 g/plant at level of 18ml/l of Humic acid compared with cv. Wolar (131.33g/plant) table (6). The interactions between Izolda and Humic acid at level (18ml/L<sup>-1</sup>) gave the best green pods yield (137.15g) compared with control (92.56g).

**KEY WORD:** Humic acid, pea cultivars, green pods,.

### INTRODUCTION

Pea (*Pisum sativum L.*) is a one of the most vital plants that belong to the Fabaceae family amongst the most critical and mainstream harvest of leguminosae family developed and growth in Iraq and numerous nations everywhere throughout the world. Pea originates from the Mediterranean and India. It contains numerous nutritional values like high content of protein, phosphorus, carbohydrates, iron, calcium and vitamins A and B (Hassan, 1997). Peas help settle the nitrogen levels in the soil. The territory of planted leguminosae plant was roughly 12-15% from the region of earth, the world production of pea was 27% from the seeds of the world (Vance *et al.*, 2000). The area planted in Iraq is 900 donum that create 15584.4 kg., and the total yield was 1500 ton (Statistic Organization. 2012).

The use of Humic acids has several advantages and agriculturists everywhere throughout the world are tolerating Humic acids as an essential piece of their compost program. It can be connected specifically to the plant foliage in fluid frame the soil or as granules alone or as manure blend. Humic corrosive is one of the significant parts of humus. Humates are common natural substances, high in humic destructive and

containing the vast majority of known follow minerals important to the development of vegetation.

To improve the organic contents of soils for organic crops there are some applications like planting rotation, numerous plough techniques, green fertilizer application and animal manure application. In addition to these practices, utilization of organic-mineral fertilizers in agriculture has increased in recent years (Doran, 2003). Humic acids have been shown to stimulate plant growth and therefore yield by acting on mechanisms involved in: cell respiration, photosynthesis, protein synthesis, water and nutrient uptake, enzyme activities (; Albuzio, 1986; Chen and Aviad, 1990;). One of the used organic -mineral fertilizers is humic acid, (Anonymous, 2010). Under water stress, foliar fertilization with humic molecules increased leaf water retention and the photosynthetic and antioxidant metabolism (Fu Jiu, 1995). Adani, (2006) showed that all humic substances are composed for chemically complex, non-biological organic components, which are largely hydrophilic, dark coloured fluid, or powder and resistant to chemical and biological degradation. Improvement of soil circumstances and establishing equilibrium among plant nutrients are likewise important for soil productivity and plant production. Studies of the effects of humic

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substances on plant growth, showed improved effects on growth, independent of nutrition (Chen and Aviad, 1990; Dursun, 1999).

Organic fertilizers which include humic materials are one of the natural amendments which are applied to increase the rate of organic matter in the soil related to improving the physical, chemical and biological properties of the soil and therefore improve the plant growth and development (Suganya and Sivasamy, 2006)

Humic acid is a commercial product that has many elements which advance the soil fertility and increase the availability of nutrients and thus increased plant growth and yield. Humic acid is particularly used to ameliorate or reduce the negative effects of chemical fertilizers and some soil chemicals. Many investigators have reported that humic application led to a noteworthy increase in oil of the organic matter improving plant growth and crop production (Hafez and Mejda, 2003)

Humic acid application promotes root growth and increase cell elongation in pea seedlings (Hartwigsen and Evans., 200) Kaya et al (2005) reported spraying snap bean plants (*Phaseolus vulgaris* L.) at three - six leaf stage significantly increased plant growth. Zaky *et al.* (2006) reported that application of humate acid ether as a foliar or injection application ( at 50g/m<sup>3</sup> trough the irrigation water, gave a noteworthy increase in the entire chlorophyll of the pods of the common bean plants(*phaseolus vulgaris* L.)

The increase in number and height of leaves as organic mineral rates increased confirmed the role of organic minerals in endorsing vital vegetative growth in fruits of melons and tomato (Olaniyiet *al.*, 2006; Olaniyi and Ajibola, 2008)

Patillet *al.* (2010) carried out a plot experiments to show the effects of potassium humate salt of the humic acid of protein contents and vegetative growth of (*Phaseolus mungo* L.). The results obtained during this investigation clearly indicated that the plant treated with potassium humate show significant increase on

vegetative growth characters and protein contents than control plants.

#### MATERIALS AND METHOD

The experiment was carried out on 22 February, to 25 June 2017 on research farm, college of Agriculture, University of Duhok. Seeds were planted in black plastic bags (21.5 cm<sup>2</sup> diameters). Combination of soil and animal manure was used (1:2). As temperature increased, the soil was put around the black plastic bags to reduce the high temperature effects on roots. Two factors in randomized Complete Block Design (RCBD) was used with 3 replications, the first factors was humic acid at four levels (0, 6,12 and 18 ml/L<sup>-1</sup>),- the second was two pea cultivars from Poland ( (Walor) and (Izolda) , so the experiment consist of 8 treatments (2\*4). Humic acid added three times at 15 days intervals. First adding was after plant reaching five leaves, second was after 15 days of the first and third adding after 15 days of second one. The data were analysed by using SAS program. The experimental traits were (plant length (cm), branch number, stem diameter (mm) and fresh weight (g/plant) and quality characteristic of pea, that include: pods weight (gm), number of seed/ pod , , pods number/plant, pods length, and green yield of pea ,that include: early and total green pods yield as describe by [Al-Ashraf.(1989)].

#### RESULTS AND DISCUSSION

Table (1) shows the data regarding the number of branch/plant Indicates significant differences between cultivars, the maximum number obtained from (Izolda) cultivar (4.15) compared with ( Valor) cultivar (4.05, at level of (18ml/L<sup>-1</sup>) humic acid recorded the highest value of branches number (4.67) which was different significantly from other concentration especially the control. Concerning the fresh weight of pea shows that cultivar (Izolda) gave a significant increase in fresh weight which reached (52.33gm) in cultivar (Izolda) compared with ( walor ) cultivar that

**Table ( 1):** Effect of different concentration of Humic Acid on Branches number and fresh weight (g) on two Peas cultivars and their interaction Means followed by different letters were significantly different based on Duncan's Multiple 5%

Cultivars	Branch number.plant <sup>-1</sup>				Effect of cultivars	Fresh weight(gm)				Effect of cultivars
	humic acid (ml.L-1)					humic acid (ml.L-1)				
	0	6	12	18		0	6	12	18	
Valor	3.54c	4.11b	4.00b	4.55a	4.05b	36.30d	56.37b	48.50c	48.20c	38.03b
Izolda	3.30d	4.33ab	4.33ab	4.67a	4.15a	36.80d	55.22ab	58.44a	58.88a	52.33a
Effect of H.A	3.42c	4.22b	4.16b	4.61a		36.55c	55.74a	53.47a	53.54b	

gave lower value of fresh weight (38.03gm) .The interaction between cultivar and application of Humic acid, remarked significant deference amid concentration of Humic acid, best result obtain at level of 6ml/L<sup>-1</sup> 55.74 g, compared with control, significant increase in stem diameter as a result of the humic acid concentration that significantly.

In the same time there was differed compared to untreated plant which gave poorer weight of plant (36.55g).Concerning the interaction among treatments there were significant increase among treatments the highest weight of plant were when plant treated with (12ml/L<sup>-1</sup>) humic acid with cultivar (Izolda) that gave (58.44gm) as compared with other interactions

specially untreated interaction with humic acid in both cultivars that gave lower weight (36.3 respective 36.8 g).

Data in Table (2) show significant difference between cultivars (Izolda) cultivar gave (42.91cm) compared with (Walar) cultivar (36cm) regarding plant high. The interaction among cultivars and concentration of Humic acid remarked at cultivar (Izolda) 53.97cm at level of (12ml/L<sup>-1</sup>) compared by control (22.67.67cm)

Concerning the effect of cultivars on stem diameter remarked cultivar (Izolda) raised significant (4.00mm) over cultivar (Wolar) by ( 17.98%)

**Table (2):** Effect of different concentration of Humic Acid on stem diameter(mm) and plant height on two Peas cultivars and their interaction Means followed by different letters were significantly different based on Duncan's Multiple 5%

Cultivars	Stem diameter (mm)				Effect of cultivars	Plant length (cm)				Effect of cultivars
	humic acid (ml.L-1)					humic acid (ml.L-1)				
	0	6	12	18		0	6	12	18	
Walor	2.33d	3.68b	4.11a	4.00ab	3.53b	22.67d	41.00bc	34.00c	46.33b	36.00b
Izolda	3.67c	4.33a	4.00a	4.00ab	4.00a	23.67c	50.67a	53.97a	44.33b	42.91a
effect of H.A	3.00c	4.00a	4.17a	4.00b		23.17b	45.83a	43.98a	45.33a	

Regarding the effect of interaction between cultivars and level of humic acid, showed significant differences between (Walor) and (Izolds) cultivars, ( Izolda ) significantly increased reaching (4.33mm) compared with (2.33 mm) in (Walor) cultivar.

**Table (3):** Shows the effect of Humic acid on leaves area of two peas cultivar, the cultivar (Izolda) caused a significant increase (3.00cm<sup>2</sup>) compared with cultivar(Walor) 2.66cm<sup>2</sup>. The interaction between cultivars and Humic acid cause significant effect at rate of 6ml/l<sup>-1</sup> (Izlods) cultivar (4.33cm<sup>2</sup>) compared by untreated 2.33 ml/L<sup>-1</sup>

Cultivars	Leaf area (cm)				Effect of cultivars	Chlorophyll (SPAD)				Effect of cultivars
	humic acid (ml.L-1)					humic acid (ml.L-1)				
	0	6	12	18		0	6	12	18	
Walor	2.33d	3.68b	4.11a	4.00ab	2.66b	33.30c	41.83b	40.22b	40.12ab	37.90b
Izolda	3.67c	4.33a	4.00a	4.00ab	3.00.a	33.13c	45.6ab	48.78a	40.13b	41.91a
Effect of H.A	3.00	4.00	4.17	4.00		33.28	43.71	44.50	40.12	
	c	a	A	b		c	a	a	b	

The same table shows the effect of Humic acid on chlorophyll% in leaves, concerning the chlorophyll content; the best result was obtained in cultivar (Izolda.) 41.91 compared with cultivar (Walor) 37.90. Regarding the interaction between cultivars and Humic acid concentration, observed significant increasing in cultivar (Izolda) at 12ml/l Humic 48.78 compared by untreated 33.13, increasing by 47.23% about the chlorophyll content.

Data illustrated at Table (4) shows that there are noteworthy differences between cultivars regarding the seed number/pod with (Izolda)

cultivar ( 6.53), in cultivar (Walor 6.07) increasing by 7.57%

Regarding the effect of cultivars on pods length, observer the cultivar (Izolda) was significant different over cultivar (Walor) 7.28 cm 6.00 cm respectively.

About the interaction between cultivar and Humic acid which caused a significant increase in seed number at rate 12ml/L<sup>-1</sup> of 7.00 in cultivar (Izolda) compared with cv.Walor control 5.23 rises by 25.28.45 %

**Table (4):** Effect of different concentration of Humic Acid on seed number/pod and pods length(cm) on two Pea cultivars and their interaction Means followed by different letters were significantly different based on Duncan's Multiple 5%

Cultivars	Seed number.pod-1				Effect of cultivars	Pods length (cm)				Effect of cultivars
	humic acid (ml.L-1)					humic acid (ml.L-1)				
	0	6	12	18		0	6	12	18	
Walor	5.23d	6.2b	6.67ab	6.2b	6.07b	4.33c	6.93b	6.19bc	6.8bc	6.06b
Izolda	5.67c	6.68ab	7.00a	6.8b	6.53a	6.1b	7ab	7.53ab	8.5a	7.28a
Effect of H.A	5.45c	6.44b	6.83a	6.50ab		5.21b	6.96c	6.86ab	7.65a	

Concerning the interaction between cultivars and level of Humic acid remarked a significant difference at cultivar (Izolda) 8.5cm at level of 18ml/l compared by cv. Walor control 4.33 cm.

Table (5) show the effect of cultivars on pods weight (g), cultivar (Izolda) gave (2.51g) significant increasing compared with (Walor) cultivar (1.82g) riseaning by 39.44%.

Concerning effect of interaction among cultivars and Humic acid on pods weight, at level

of 18 ml/l its significant (2.92)g compared with control (1.88)g rise by 21.80%.

In table (5) regarding the pods number remarked increasing significantly cultivar (Izolda) 11.44 over (Walor) cultivar (10.02) rising by 14.17%.

Concerning the interaction between cultivars and level of Humic acid concentration on pods number showed at level of 18ml/l cultivar (Izolda) was significant (13.67) compared with control (9.90) increase with 38.08%.

**Table (5):** Effect of different concentration of Humic Acid on Wt. of pods(gm) and pods number on two pea cultivars and their interaction Means followed by different letters were significantly different based on Duncan's Multiple 5%

Cultivars	Wt of pods(gm)				Effect of cultivars S	Pods number				Effect of cultivars
	Humic acid (ml.L-1)					humic acid (ml.L-1)				
	0	6	12	18		0	6	12	18	
Walor	1.78b	1.83b	1.45b	2.25a	1.82b	8.01d	11b	10c	11..1b	10.02b
Izolda	1.88c	1.74b	2.73a	2.92a	2.51a	9.90d	12b	10.2c	13.67a	11.44a
effect of H.A	1.83c	1.78b	2.09ab	2.58a		9.65c	11.5b	10.1b	12.38a	

Table (6) showed early and total yield g/plant, the early yield taken from first three harvested. Cultivar (Izolda) caused significant increasing 21.58 g/plant compared with (Walor) cultivar 17.76g/plant.

Concerning the interaction among cultivars and rate of Humic acid on early yield, remarked

significant difference in cultivar (Izolda) at level of 12ml/L by 23.80 g/plant, compared with control 15.77g

In the same table regarding the total yield g/plant remarked significant increase cultivar Izolda 123.65g compared with Walor 109.4g.

**Table (6):** Effect of Humic acids, cultivars and their interactions on early and total green pods yield of pea.

Cultivars	Early yield(gm.plant-1)				Effect of cultivars	Total yield (gm.plant-1)				Effect of cultivars
	humic acid (ml.L-1)					humic acid (ml.L-1)				
	0	6	12	18		0	6	12	18	
Walor	15.77c	20.00ab	15.17b	20.12b	17.76b	89.80c	94.60c	122.00b	131.33ab	109.40
Izolda	19.70b	22.45a	23.80a	21.58a	21.58a	95.33c	115.30b	141.00a	142.98a	123.65a
effect of H.A	17.73c	21.22a	19.48b	20.26b		92.56c	104.95b	132.00ab	137.15a	

Means followed by different letters were significantly different based on Duncan's Multiple 5%

In table(6) the interaction among cultivars and Humic acid application on total yield(g/plant),cultivar (Izolda) at level of 18ml/L caused significant effect on yield 142.98 g/plant compared with control, increased by 49.98%.

### DISCUSSION

The effect of cultivars on all parameters(Number of branch, plant length, lives area, chlorophyll content, stem diameter, fresh weight, seeds number/pod, pods length, pods number/plant, early yield, total yield). Remarkd significant increasing. The cultivar (Izolads) overcame cultivar (Walor), the increase might be due to the differences in genotype characteristics of the root growth and nutrient absorption and photosynthesis procedure (Jordao, et al, 1999). Also response of cultivars to local environmental state according to the genetic difference among cultivars (Gaafar and Saker, 2006)

Regarding the effect of humic acid on vegetative parameter, studies indicate that concentration of 12ml/l of Humic acid gave a significant differences in leaf area, chlorophyll content, early total yield, stem diameter, seeds number/pods. The concentration of 18ml/l gave a significant affect in pods length, number of branch and pod s length compared with untraded cultivars. The reason for the positive effect might be due to role of Humic acid to stimulated plant growth, cell respiration, protein synthesis, photosynthesis and enzyme activities(Nardi, *et al* 1996, Chen *et al* 2004 and Ali, *et al* 2007) .

Concerning the interaction between cultivars and level of Humic acid, remarked best result in number of branch at level of 18ml/l and fresh weight at rate of 12ml/l.

In this study cv. Izolda overcame cv. Walor in early and total green pod at level of 12m/l and 18m/l humic acid

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(*Pisum sativum L.*)

پوخته

نهف فهكولينه يا هاتيه كرن لسالا 2017 كوليذا چاندني زانكوياد هوك، هه رنما كوردستان-ئيراق. بوديار كرنا كارتكرنا خه سنيت ترشي هيوميك لسه ركه سكاتي و كه ليكت كه سك يئت دوو جورنت به زاليا (وولهر ئوئيزولدا) يئت هاتينه چاندن دكيسكت نايونيدا. نه جامت فهكولينئ ديار كرجوري ئيزولدا به ره هه مهكئ باش دامه (21,08 گم/رووهك) بجوداهي دگهل جورئ وولهر (17,76 گم/رووهك) نه وئنت هاتينه ره شاندن بترشي هيوميكي (18 مل/ليتر) هه روهسا توخمئ ئيزولدا پترتئين به ره هه مئ كه ليكت كه سك بدهست فه هات (142,98 گم/رووهك) دگهل خه ستيا هيوميكي (18 مل/ل) بجوداهي لگهل توخمئ وولهر هه روهسا توخمئ ئيزولدا دگهل ترشي هيوميكي بخه ستيا (18 مل/ل) پترتئين به ره هه دامه (137,10 گم) بجودا هي دگهل توخم و خه ستيا ديتر.

تأثير تراكيذ مختلفه لحامض الهيوميك على الصفات الخضرية و كمية القرون (*Pisum Sativum L*) الخضراء لصنفين من البزاليا

الخلاصة

أجريت هذه الدراسة في سنة 2017 في حقل الخضراوات التابعة لكلية الزراعة جامعة دهوك أقليم كوردستان العراق لبيان تأثير تراكيذ حامض الهيوميك على الصفات الخضرية و كمية القرون الخضراء لصنفين من البزاليا (ولرو ازولاده) مزروعه في أكياس بلاستيكية تبين من الدراسة ان الصنف ازولاده أعطت نتائج معنويه (21.58 غم) مقارنة بصنف ولرو (17.76 غم) عند إضافة حامض الهيوميك (18 مل ليتر) وكذلك الصنف ازولاده أعطت أكبر ناتج من القرون الخضراء (142.98 غم نبات) عند إضافة 18 مل ليتر مقارنة مع الصنف الثاني (137.15 غم مقارنة بمعامل المقارنه) (92.56 غم)