

PEA SEEDS PRODUCTION AS AFFECTED BY FOLIAR APPLICATION WITH CITRINE AND NOFATREIN

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ABSTRACT

Two field experiments were carried out during seasons of 2000/2001 and 2001/2002 in Kaha Farm of Horticultural Research Institute Kaluebia Governorate to study the effect of Citrine (5, 7 and 9 cm/L), Nofatrein (1,3 and 5 cm/L) and their combinations on vegetative growth characters, leaves chlorophylls content, green pods yield and its components, dry seed yield and its components as well as seed quality of pea (Master-B, cv). Obtained results revealed that all different concentrations of Citrine or Nofatrein as well as their different combinations were significantly increased all vegetative growth characters, i.e. plant height, number of branches/plant, number of leaves/plant, fresh and dry weight/plant, as well as chlorophyll content (a,b and total), green pods yield and its components i.e. number of fresh pods/plant, fresh pods yield/plant, fresh pods yield/plot, fresh pods yield/Fed, weight of 100 green seeds and netting percentage except the weight of fresh pod. In addition, dry seed yield and its components i.e. dry seed yield/plant, dry seed yield/plot, dry seed yield/Fed and seed index. As well as, seed quality except germination percentage and rate. The highest values were obtained from plants treated with Citrine at (9 cm/L), Nofatrein at (3 cm/L) and their combinations.

INTRODUCTION

Pea (*Pisum sativum* L.) is one of the main legumes grown in Egypt. It is grown for green pods and for dry seeds. It considered as a good source of protein, energy and other nutrients. It can be grown in a wide range of soils. Nowadays, attention is directed to use commercial folifertilizers for increasing and improving of vegetative growth characters, green pods yield and its components, dry seed yield and its components as well as its quality of pea plants.

From these compounds were Citrine and Nofatrein which usually used on a large scale to improve development of crop field and to minimize the chemical pollution injury. They contained macro and micro-nutrients beside, some organic acid, such as Citric Acid. It is well know that plant accumulate organic acids which include the intermediates of tricarboxylic acid cycle. Glycolysis and tricarboxylic acid cycle as the main source of respiratory, plant growth and nutritional process which reflect on plant growth and nutrient uptake are dependent on organic acid level in plant tissue (Givan, 1979). Citric Acid is one of the organic acids presented in the tricarboxylic acid cycle synthesized either from acetyle Co A, glycine and, ketoglutarate or malic acid conversion to citric acid (Miernyk and Trelease, 1981). Citric Acid also considered a physiological relevant factor leads to the activity of some plant enzymes such as iso-citric dehydrogenase which has a role of flow rate of intermediates through tricarboxylic acid cycle which affect the rate of the cycle (Reibstein *et al.*, 1986). It changes to ketoglutamic acid required for

protein synthesis (Mifflin and lea, 1980). In addition, citric acid as natural and organic antioxidant compound has auxinic action. This compound has synergistic effect on rooting and improving growth, flowering and productivity of fruits (Nishikimi, 1975). A few number of investigations were carried out on the effect of Citrine or Citric Acid on growth and productivity.

Malik and Singh, (1982) and Nafal *et al.* (1990) on cotton, corn, bean, pea and sunflower reported that growth was increased by organic acid external treatments especially succinic, malic and citric acid. Ghourab (2000) on cotton showed that spraying cotton plant with the different concentrations of Citrine or Citric Acid increased significantly plant height and number of fruiting branches per plant in one season only. On the other hand, Anton and Bassiem (1998) on peanut, Anton *et al.* (1999) on barley, Saeed (2000) on cotton and El-Sabbagh *et al.* (2002) on wheat, they evident that Citric Acid had no significant effect on plant height and number of branches per plant. Concerning, the effect of Citrine or Citric Acid on yield and its components, Genaidy *et al.* (1995) found that remarkable response in growth and yield of some crops with applied some organic acid, Ghourab (2000) reported that both weight and seed cotton yield were significantly increased as well as seed index and earliness of yield were significantly increased, similar results were obtained by Saeed (2000) on cotton. Foliar application of the macro and micro-nutrients as an aqueous solution could be up taken from these compounds was Nofatrein. Many investigators reported that commercial folifertilizers had an important effect on plant growth and dry weight of plant, Hammouda and Shirbini, (1973), El-Sirafy *et al.* (1986), El-Zawily *et al.* (1993), Mohamed *et al.* (1999) and Fawzia and Soad (2000) all working on cowpea, As well as, El-Shakweer *et al.* (1982) on *Vicia faba*, El-Mansi *et al.* (1991) on broad bean, Hewedy *et al.* (1994) on common bean and Mohamed (1998) on pea. Regarding the chlorophylls content, Gabal (1984), Gabal *et al.* (1988) on artichoke and Hewedy *et al.* (1994) on common bean they found that chlorophyll content increased by application of compound solutions. Regarding the effect of stimulant compounds on green pods yield and its components and seed yield and its components, Hewedy *et al.* (1994) on common bean found that significant effect on number of fruits per plant, fresh fruit yield, weight of seed of fruit, total seed yield and seed index. Moreover, Mohamed *et al.* (1999) work on number of pods per plant, seed index and dry seed yield per feddan. Similar results were obtained by Faris and Mahasen (1991); Fayad (1997), Kandeel and Mohamed (1998) and Fawzia and Soad (2000) all working on cowpea. In addition, germination test, seedling vigor, seedling dry weight and protein content were affected by treatments of commercial folifertilizers.

The aim of this study is to investigate the effect of Citrine, Nofatrein and their combinations on vegetative growth, green pods yield and its components, dry seed yield and its components and seed quality of pea.

MATERIALS AND METHODS

This investigation was carried out at Kaha Research Farm of Horticultural Research Institute, Kalubia Governorate, during the two successive winter

seasons of 2000/2001 and 2001/2002 to study the effect of foliar application with commercial foliofertilizers (Citrine and Nofatrein) on vegetative growth characters, green pods yield and its components, dry seed yield and its components and seed quality of pea (*Pisum sativum*, L.). The soil in this farm is clay loam with PH of 7.8. Pea seeds cv. Master-B were sown on October 14th and 17th in both seasons of study.

Seeds were sown in hills 10 cm apart on one side of ridges 4 0 m long and 60 cm. width. The experimental unit was consisted of 9 ridges, i.e 4 ridges were used for green pods yield, 4 ridges were used for seed yield and one ridge was used for vegetative growth characters. The plot area was about 21.6 m². Each experiment included 16 treatments combinations arranged in randomized complete block design with 4 replicates. All the conventional agricultural practices specific to pea plant were achieved. The treatments combinations for Citrine and Nofatrein were as follows :

- | | |
|--------------------------|---------------------------|
| (1) control (unsprayed). | (9) Cit. (1) + Nof. (2). |
| (2) Citrine (1). | (10) Cit. (1) + Nof. (3). |
| (3) Citrine (2). | (11) Cit. (2) + Nof. (1). |
| (4) Citrine (3). | (12) Cit. (2) + Nof. (2). |
| (5) Nofatrein (1). | (13) Cit. (2) + Nof. (3). |
| (6) Nofatrein (2). | (14) Cit. (3) + Nof. (1). |
| (7) Nofatrein (3). | (15) Cit. (3) + Nof. (2). |
| (8) Cit. (1) + Nof. (1). | (16) Cit. (3) + Nof. (3). |

Citrine was used at (5,7 and 9 cm/L) and Nofatrein was used at (1,3 and 5 cm/L). Plants were sprayed twice at 30 and 37 days after planting. Since, the Citrine and Nofatrein were separately sprayed whereas Nofatrein was sprayed two days after application of Citrine. Table (1) illustrated the compositions of Citrine and Nofatrein.

Table (1): Show the composition of Citrine and Nofatrein compounds.

Compound	Composition
Citrine	15% citric acid + 18% microelements (Fe, Mn and Zn) + 64 organic materials + 3% sugar materials .
Nofatrein	5% N, 5% P ₂ O ₅ , 5% K ₂ O, 0.05% B 0.02% Mo and chelated from 0.15% Fe, 0.10% Mn and 0.15% zn.

The following data were recorded :

(1) Vegetative growth characters.

- a-Plant height (cm).
- b-Number of branches/plant.
- c-Number of leaves/plant.
- d-Fresh weight/plant (gm).
- e-Dry weight/plant (gm).

(2) Photosynthetic pigments [chlorophyll content (a, b and total) as mg/100 gm fresh weight].

Green pods yield and its components.

- a-Fresh pod weight (gm).
- b-Number of fresh pods/plant.

- c-Fresh pods yield/plant (gm).
- d-Fresh pods yield/plot (Kg).
- e-Fresh pods yield/Fed (Ton).
- f- Weight of 100 green seed (gm).
- g-Netting percentage (%) = $\frac{\text{weight of green seed}}{\text{Weight of green pods}} \times 100$

(4) Dry seed yield and its components.

- a-Seed yield/plant (gm).
- b-Seed yield/plot (Kg).
- c-Seed yield/Fed (Ton).
- d-Seed index (weight of 1000 dry seeds/gm).

(5) Seed quality .

5-a. Germination tests :

Germination percentage and rate according to ISTA. Rules (1993).

5-b. Seedling vigour :

- (1) Radical length (cm).
- (2) Plumule length (cm).
- (3) Seedling dry weight (mg).

5-c. Protein content percentage (gm/100 gm dry weight), by using
Micro-Kjeldahle method according to Piper (1947).

All collected data were exposed to statistical methods according to Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

I- Vegetative growth characters :

Data in Table (2) revealed that vegetative growth characters i.e plant height, number of branches per plant, number of leaves per plant, fresh and dry weight per plant were significantly increased by spraying pea plants with Citrine and Nofatrein as well as their combinations. The highest values were obtained from plants treated with Citrine at (9 cm/L), Nofatrein at (3 cm/L) and their combinations between them comparing with control and others ones of combinations in both growing seasons of study. The values could be arranged as following : The combinations between Citrine at (9 cm/L) with Nofatrein at (3 cm/L) > Nofatrein at (3 cm/L) > Citrine at (9 cm/L). Such finding in agreement with Malik and Singh (1982) and Nafal *et al.* (1990) on cotton, corn, bean, pea and sunflower they reported that the growth was increased by organic acid external treatments especially Citric Acid, as well as Ghourab (2000) on cotton showed that spraying cotton plant with different concentrations of Citrine or Citric Acid increased plant height and number of fruiting branches per plant. Regarding the effect of Nofatrein, Hammouda and El-Shirbini (1973); El-Sirafy *et al.* (1986); El-Zawily *et al.* (1993); Mohamed *et al.* (1999) and Fawzia and Soad (2000) all working on cowpea. They cleared that such commercial folifertilizers had an important effect on plant growth and dry weight of plant. El-Shakweer *et al.* (1982); El-Mansi *et al.* (1991) on broad bean; Hewedy *et al.* (1994) on common bean and Mohamed (1998) on pea.

Table (2): Vegetative growth characters of pea plants as affected by foliar application with Citrine, Nofatrein and their combinations during seasons of 2000-2001 and 2001-2002.

Characters	2000 / 2001						2001 / 2002					
	Plant height (cm)	No. of branches/plant	No. of leaves/plant	Fresh weight/plant (gm)	Dry weight/plant (gm)	Plant height (cm)	No. of branches/plant	No. of leaves/plant	Fresh weight/plant (gm)	Dry weight/plant (gm)		
Control	48.8	1.7	16.5	93.1	13.3	50.1	1.7	16.7	93.7	13.6		
Citrine (1)	51.9	2.8	18.2	96.3	15.5	52.3	2.2	18.5	96.4	15.7		
Citrine (2)	53.3	2.5	18.8	98.3	16.7	53.7	2.3	19.2	96.9	17.1		
Citrine (3)	56.2	3.4	19.5	100.1	17.7	56.6	2.7	19.9	97.3	18.1		
Nofatrein (1)	51.1	2.2	18.3	99.2	17.9	51.6	2.0	18.8	99.6	18.4		
Nofatrein (2)	57.2	3.0	19.7	101.6	18.6	57.7	2.8	20.2	102.1	19.1		
Nofatrein (3)	54.6	2.4	18.5	100.0	18.1	55.1	2.2	19.0	100.4	18.6		
Cit.(1) + Nof.(1)	52.2	2.4	18.1	100.1	18.3	52.8	2.3	18.6	100.6	18.9		
Cit.(1) + Nof.(2)	54.7	2.7	19.4	101.4	18.9	55.3	2.6	20.0	102.0	19.5		
Cit.(1) + Nof.(3)	54.3	2.5	18.7	100.5	18.7	54.9	2.4	19.3	101.1	19.3		
Cit.(2) + Nof.(1)	55.2	2.6	19.1	99.9	18.9	55.9	2.5	19.8	100.6	19.5		
Cit.(2) + Nof.(2)	56.9	2.5	19.9	102.0	19.5	57.6	2.9	20.6	102.7	20.2		
Cit.(2) + Nof.(3)	56.2	2.7	19.7	99.9	19.0	56.9	2.7	20.4	100.8	19.8		
Cit.(3) + Nof.(1)	57.0	2.4	19.8	102.5	20.0	57.7	2.5	20.6	103.3	20.8		
Cit.(3) + Nof.(2)	58.5	3.9	20.6	105.4	20.5	59.2	3.4	21.4	106.2	21.4		
Cit.(3) + Nof.(3)	57.8	2.7	20.0	104.6	20.3	58.5	2.8	20.7	105.5	21.0		
L.S.D. at 5%	0.41	0.11	0.54	0.66	0.32	0.53	0.13	0.55	0.82	0.37		

The promoting effect of commercial folifertilizers on vegetative growth could be attributed to its encouragement of plant metabolism which may be due to its constituents of macro and micro-nutrients besides the organic acids, Givan (1979) mentioned that plant accumulate organic acids which include the intermediates of tricarboxylic acid cycle, whereas, glycolysis and tricarboxylic acid cycle as the main source of respiratory, plant growth and nutritional process which reflect on plant growth and nutrient uptake are dependent on organic acid level in plant tissues. As well as, Miernyk and Trelease (1981) cleared that Citric Acid is one of the organic acids presents in the tricarboxylic acid cycle synthesized either from Acetyl co.A; glycine and ∞ -Ketoglutarats or malic acid conversion to citric acid. In addition, Niskikimi (1975) mentioned that organic acids play as natural and organic antioxidant compounds has auxinic action. This compound has synergistic effect on rooting and improving growth.

2- Photosynthetic pigments :

Obtained results from data in Table (3) showed that chlorophylls content i.e a,b and total of leaves pea plant were significantly increased by applied the commercial folifertilizers.

Table (3): Leaf pigments of pea plants as affected by foliar application with Citrine, Nofatrein and their combinations during seasons of 2000-2001 and 2001-2002 .

Seasons	2000 / 2001			2001 / 2002		
Characters	Chlorophyll content (mg/100 gm F.W)			Chlorophyll content (mg/100 gm F.W)		
Treatments	(a)	(b)	Total	(a)	(b)	Total
Control	60.5	46.3	106.8	61.6	47.5	109.1
Citrine (1)	63.0	48.1	111.1	64.1	49.3	113.4
Citrine (2)	64.5	49.3	113.8	65.6	50.5	116.1
Citrine (3)	66.3	51.1	117.4	67.4	52.3	119.7
Nofatrein (1)	68.1	53.5	111.6	69.2	54.6	123.8
Nofatrein (2)	70.1	55.7	125.8	71.3	56.9	128.2
Nofatrein (3)	69.0	54.6	123.6	70.1	55.8	125.9
Cit.(1) + Nof.(1)	70.6	55.6	126.2	71.7	56.7	128.4
Cit.(1) + Nof.(2)	72.4	57.3	129.7	73.5	58.5	132.0
Cit.(1) + Nof.(3)	71.3	56.2	127.5	72.4	57.4	129.8
Cit.(2) + Nof.(1)	72.2	55.3	127.5	73.3	56.5	129.8
Cit.(2) + Nof.(2)	74.5	59.4	133.9	75.6	60.5	136.1
Cit.(2) + Nof.(3)	73.9	58.7	132.6	75.0	59.9	134.9
Cit.(3) + Nof.(1)	73.6	58.5	132.1	74.7	59.8	134.5
Cit.(3) + Nof.(2)	75.7	60.6	136.3	76.8	61.7	138.5
Cit.(3) + Nof.(3)	74.6	59.7	134.3	75.7	60.9	136.6
L.S.D. at 5%	0.55	0.31	0.44	0.61	0.43	0.53

It is noticed that all different concentrations of Citrine and Nofatrein as well as the combinations between them caused significant increases in chlorophylls content comparing with control in both seasons of study. The highest values

were obtained from plants treated with Citrine at (9 cm/L), Nofatrein at (3 cm/L) and the combination between them Citrine at (9 cm/L) and Nofatrein at (3 cm/L) respectively. Such finding were in agreement with Gabal (1984); Gabal *et al.* (1988) on artichoke; Hewedy *et al.* (1994) on common bean; Ghourab (2000) and Saeed (2000) on cotton. These results may be attributed to that these compounds delayed leaf senescence thus producing more photo pigments (Brar *et al.*, 1985; Dhopte and Lall, 1987 and Ghourab, 2000) they found that Citrine and Citric acid had a good effect on decreasing leaf reddening and increasing photosynthetic and respiration rate.

3- Green pods yield and its components :

The results in Table (4) show clearly that green pods yield and its components except fresh pod weight i.e number of pods per plant; fresh pods yield per plant (gm), fresh pods yield per plot (Kg), fresh pods yield per Fed (ton); weight of 100 green seed (gm) and netting percentage were significantly increased by spraying pea plants with all different concentrations of Citrine, Nofatrein and their combinations between them comparing with check plants in both seasons of study. The highest values were achieved from plants treated with Citrine at (9 cm/L), Nofatrein at (3 cm/L) and their combinations between them i.e (9 cm/L of Citrine and 3 cm/L of Nofatrein). Such results were concided with those reported by Ghourab (2000); Saeed (2000) on cotton and El-Sabbagh *et al.* (2002) on wheat. Such results may be attributed to the differences in the extent of transport assimilates among the different organs (Ulrich and Gersper, 1985). As well as Reibstein *et al.* (1986) depicted that Citric Acid considered a physiological relevant factor leads to the activity of some plant enzymes such as iso-citric dehydrogenase

4- Seed yield and its components :

Obtained results from data in Table (5) revealed that all different concentration of Citrine, Nofatrien and their combinations between them were significantly increased seed yield and its components of pea plants comparing with check plants in both seasons of study. The highest values were realized from plants treated with Citrine at (9 cm/L), Nofatrein at (3 cm/L) as well as their combinations between them i.e Citrine at (9 cm/L) with Nofatrein at (3 cm/L) which had got the highest values than other ones. Such results concided with those reported by Faris and Mahasen (1992), Fayad (1997), Kandeel and Mohamed (1998), Mohamed *et al.* (1999) and Fawzia and Soad (2000) all working on cowpea. Such finding may be due to the enhancing effect of these substances in producing high dry matter content as shown in Table (2), maximum number of pods per plant as shown in Table (4) as well as seed index in Table (5). Also, may be due to the increasing in photosynthetic activity which lead to increasing number of pods per plant.

5- Seed quality :

5-A. Germination tests:

Data in Table (6) indicated that germination percentage and rate were not affect by spraying pea plants with all different concentrations of Citrine, Nofatrein and their combinations comparing with untreated plants in both seasons of study. Similar results were obtained by Sharma *et al.* (1992) on soybean and Hewedy (1994) on common bean.

Table (4): Green pods yield and its components of pea plants as affected by foliar application with Citrine, Nofatrein and their combinations during seasons of 2000-2001 and 2001-2002.

Seasons Characters Treatments	2000 / 2001						2001 / 2002							
	Fresh pod weight (gm)	No. of fresh pods/plant	Fresh pods yield/plant (gm)	Fresh pods yield/plot (Kg)	Fresh pods yield/Fed (Ton)	Weight of 100 green seeds (gm)	Netting %	Fresh pod weight (gm)	No. of fresh pods/plant	Fresh pods yield/plant (gm)	Fresh pods yield/plot (Kg)	Fresh pods yield/Fed (Ton)	Weight of 100 green seeds (gm)	Netting %
Control	5.3	7.1	37.63	6.021	2.383	17.2	45.3	5.2	7.5	3.900	6.240	2.470	17.5	45.5
Citrine (1)	5.4	9.5	51.30	8.208	3.249	19.1	47.6	5.5	9.7	53.35	8.536	3.379	19.4	47.8
Citrine (2)	5.5	9.6	52.80	8.448	3.344	19.7	48.1	5.5	9.8	53.90	8.624	3.414	19.9	48.3
Citrine (3)	5.6	10.5	58.80	9.408	3.724	20.3	49.5	5.7	10.6	60.42	9.667	3.827	20.5	49.6
Nofatrein (1)	5.3	9.5	50.35	8.056	3.189	19.7	48.2	5.4	9.6	51.84	8.924	3.283	19.9	48.3
Nofatrein (2)	5.5	10.7	58.85	9.416	3.727	20.5	49.7	5.6	10.9	61.04	9.766	3.866	20.7	49.9
Nofatrein (3)	5.6	10.0	56.0	8.960	3.547	19.9	48.3	5.6	10.2	57.12	9.139	3.618	20.1	48.5
Cit (1) + Nof (1)	5.3	10.6	56.18	8.989	3.558	19.8	48.4	5.4	10.8	58.32	9.331	3.693	20.0	48.6
Cit (1) + Nof (2)	5.5	10.7	58.85	9.416	3.727	20.4	49.5	5.5	11.0	60.50	9.680	3.832	20.6	49.7
Cit (1) + Nof (3)	5.6	10.6	58.30	9.328	3.692	19.9	48.4	5.6	11.2	62.72	10.035	3.972	20.1	48.5
Cit (2) + Nof (1)	5.3	10.7	56.71	9.074	3.592	19.9	48.3	5.4	11.0	59.40	9.504	3.762	20.2	48.5
Cit (2) + Nof (2)	5.5	10.9	59.95	9.592	3.797	20.6	49.8	5.5	11.3	62.15	9.944	3.936	20.7	50.0
Cit (2) + Nof (3)	5.6	10.8	60.48	9.677	3.830	20.1	49.3	5.7	11.0	62.70	10.032	3.971	20.4	49.3
Cit (3) + Nof (1)	5.4	10.6	57.24	9.158	3.625	20.8	50.1	5.5	10.9	59.95	9.592	3.797	20.9	50.3
Cit (3) + Nof (2)	5.5	11.7	64.35	10.296	4.076	21.1	51.5	5.5	12.0	66.00	10.560	4.180	21.5	51.7
Cit (3) + Nof (3)	5.6	10.8	60.48	9.677	3.830	20.9	50.1	5.5	11.2	61.60	9.856	3.901	21.0	50.3
L.S.D. at 5%	N.S.	0.20	0.110	0.130	0.101	0.30	0.31	N.S.	0.30	0.250	0.151	0.106	0.36	0.34

Table (5): Seed yield and its components of pea plants as affected by foliar application with Citrine, Nofatrein and their combinations during seasons of 2000-2001 and 2001-2002 .

Characters Treatments	Seasons 2000 / 2001				2001 / 2002			
	Seed yield/plot (gm)	Seed yield/plot (Kg)	Seed yield/Fed (Ton)	Seed index (weight of 1000 dry seed) (gm)	Seed yield/plot (gm)	Seed yield/plot (Kg)	Seed yield/Fed (Ton)	Seed index (weight of 1000 dry seed) (gm)
Control	9.4	1.500	0.593	230.1	10.6	1.700	0.673	233.3
Citrine (1)	10.3	1.650	0.653	233.5	11.5	1.846	0.731	235.1
Citrine (2)	11.1	1.770	0.701	235.3	12.3	1.975	0.782	237.3
Citrine (3)	12.5	1.999	0.791	236.4	13.8	2.205	0.873	238.5
Nofatrein (1)	11.1	1.780	0.706	234.3	12.4	1.985	0.786	236.4
Nofatrein (2)	12.8	2.050	0.811	237.5	14.1	2.251	0.891	238.6
Nofatrein (3)	11.3	1.800	0.712	235.7	12.4	1.998	0.791	237.4
Cit.(1) + Nof.(1)	12.9	2.070	0.819	237.0	14.2	2.271	0.899	238.7
wCit.(1) + Nof.(2)	13.1	2.100	0.831	240.5	14.4	2.304	0.912	241.6
Cit.(1) + Nof.(3)	13.1	2.090	0.827	238.1	14.3	2.291	0.907	239.3
Cit.(2) + Nof.(1)	13.2	2.115	0.837	238.2	14.5	2.316	0.917	239.5
Cit.(2) + Nof.(2)	13.4	2.140	0.847	242.3	14.6	2.341	0.927	243.6
Cit.(2) + Nof.(3)	13.3	2.125	0.841	239.5	14.6	2.329	0.922	240.6
Cit.(3) + Nof.(1)	13.4	2.145	0.849	240.4	14.7	2.349	0.930	241.5
Cit.(3) + Nof.(2)	13.6	2.170	0.859	244.2	14.8	2.374	0.940	245.3
Cit.(3) + Nof.(3)	13.5	2.155	0.853	242.5	14.7	2.357	0.933	243.6
L.S.D. at 5%	0.11	0.043	0.011	0.15	0.13	0.044	0.012	0.11

Table (6): Seed quality of pea plants as affected by foliar application with Citrine, Nofatrein and their combinations during seasons of 2000-2001 and 2001-2002 .

Seasons Characters Treatments	Germination		Seedling vigor				Germination		Seedling vigor			
	%	Rate (day)	Radical length (cm)	Plumule length (cm)	Seedling dry weight (mg)	Crude protein %	%	Rate (day)	Radical length (cm)	Plumule length (cm)	Seedling dry weight (mg)	Crude protein %
Control	98.1	7.1	11.1	14.1	97.5	16.7	98.1	6.9	11.5	15.0	100.1	18.1
Citrine (1)	98.2	7.1	12.8	16.9	100.1	19.3	98.2	7.1	13.1	17.6	102.6	20.9
Citrine (2)	98.2	7.2	13.2	17.4	100.8	20.0	98.2	7.1	13.6	18.1	103.3	21.5
Citrine (3)	98.2	7.2	13.5	17.4	101.3	22.5	98.1	7.2	13.8	18.3	103.8	22.9
Nofatrein (1)	98.1	7.2	14.5	18.4	102.9	21.9	98.2	7.1	14.8	19.3	105.4	21.8
Nofatrein (2)	98.2	7.3	15.2	19.3	104.2	22.9	98.2	7.2	15.6	19.1	106.7	23.1
Nofatrein (3)	98.1	7.2	14.8	18.9	103.1	22.1	98.2	7.2	15.2	19.7	105.6	22.5
Cit.(1) + Nof.(1)	98.2	7.3	14.7	18.6	104.0	22.1	98.2	7.2	15.1	19.6	106.5	21.8
Cit.(1) + Nof.(2)	98.2	7.3	15.0	19.1	105.9	23.0	98.2	7.3	15.4	19.9	108.4	22.7
Cit.(1) + Nof.(3)	98.2	7.3	14.8	18.9	104.6	22.5	98.2	7.2	15.2	19.7	107.1	22.0
Cit.(2) + Nof.(1)	98.1	7.3	15.8	19.2	105.6	22.3	98.1	7.2	15.8	20.3	108.1	21.9
Cit.(2) + Nof.(2)	98.1	7.3	16.0	20.1	107.3	23.3	98.2	7.3	16.5	21.0	109.8	23.1
Cit.(2) + Nof.(3)	98.2	7.3	15.7	19.6	105.9	22.8	98.1	7.2	16.2	20.7	108.4	22.5
Cit.(3) + Nof.(1)	98.2	7.3	15.8	19.7	107.3	22.7	98.2	7.2	16.3	20.9	109.8	22.9
Cit.(3) + Nof.(2)	98.2	7.4	16.6	20.5	110.8	24.8	98.2	7.3	17.0	21.6	113.3	24.9
Cit.(3) + Nof.(3)	98.2	7.3	16.0	20.0	107.9	23.0	98.2	7.3	16.3	20.8	110.4	23.6
L.S.D. at 5%	N.S.	N.S.	0.08	0.06	0.11	0.12	N.S.	N.S.	0.09	0.07	0.13	0.14

5-B. Seed vigour:

As shown in Table (6) obtained results cleared that seed vigour i.e radical length, plumule length and seedling dry weight were significantly increased when pea plants treated with all different concentrations of Citrine, Nofatrein and their combinations comparing with check plants. It was noticed that the highest values were achieved from plants treated with Citrine at (9 cm/L), Nofatrein at (3 cm/L) and their combinations between them comparing with other treatments and control in both growing seasons of study. Such finding are in agreement with Fawzia and Soad (2000) on cowpea. These results may be attributed to the effect of these substances on some physiological functions such as metabolism, translocation of starch and activation of many enzymes which in turn may affect plant growth (Zhunusov and Baimaganora, 1976).

5-C. Crude protein percentage:

Data in Table (6) indicated that protein percentage was significantly increased by foliar applications of all different concentrations of Citrine, Nofatrein and their combinations between them. It is noticed that the highest values were achieved from plants treated with Citrine at (9 cm/L), Nofatrein at (3 cm/L) as well as, their interaction between them comparing with check plants in both seasons of study. Fawzia and Soad (2000) on cowpea were obtained the similar results.

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تأثير الرش بالسترين والنوفترين على إنتاج تقاوى البسلة
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أقيمت تجربتان حقليتان خلال موسمي الزراعة ٢٠٠٠/٢٠٠١، ٢٠٠١/٢٠٠٢ بمزرعة
الخضرا بقها محافظة القليوبية بهدف دراسة تأثير رش نباتات البسلة صنف (ماستر بي) بالسترين
بتركيزات ٥،٧، ٩ (سم/لتر) والنوفترين بتركيزات ٥،٣،١ (سم/لتر) وكذلك التأثيرات المشتركة
لكل منهما على صفات النمو ومحتوى الأوراق من الكلورفيل وكذا التأثير على محصول القرون
الخضراء ومكوناته ومحصول البذور الجافة ومكوناته بالإضافة إلى جودة البذور وقد تبين من
النتائج المتحصل عليها الآتي :

(١) أدى الرش بكل التركيزات المختلفة لكل من السترين والنوفترين بالإضافة إلى التأثيرات
المشتركة لكل منهما إلى زيادة معنوية واضحة في صفات النمو الخضري ممثلا في طول النبات
- عدد أفرع النبات - عدد أوراق النبات وكذلك الوزن الطازج والجاف للنبات كما زاد محتوى
الأوراق من الكلورفيل (أ، ب والكلية) وبالنسبة لمحصول القرون الخضراء فقد زاد عدد قرون
النبات ومحصول النبات من القرون الخضراء - محصول القطعة التجريبية من القرون -
محصول الفدان بالإضافة إلى زيادة نسبة التصافي في حين لم يتأثر الوزن الطازج للقرون
الأخضر . بالنسبة للمحصول البذري الجاف فقد زاد زيادة معنوية ممثلا في المحصول البذري
للنبات والمحصول البذري للقطعة التجريبية ومحصول الفدان وأيضا وزن ١٠٠ بذرة جافة كما
زادت جودة البذور معنويا ممثلة في قدرة النمو الجيد وزيادة نسبة البروتين في البذور في حين
لم يتأثر نسبة ومعدل الإنبات للبذور .

(٢) تلاحظ أن أعلى القيم في كل الصفات المدروسة السابقة سواء صفات النمو الخضري أو
محصول القرون الخضراء ومكوناته ، وأيضا محصول البذور الجافة ومكوناته وكذلك جودة البذور
تم الحصول عليها من استخدام السترين بمعدل ٩سم/لتر ، والنوفترين بمعدل ٣سم/لتر أو التأثير
المشترك بينهما على التوالي .