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Response of Night-Blooming Jessamine (*Cestrum nocturnum* L.) Plants to Phosphorus-Zinc Relation.
1-Growth, Flowering and Uptake of Phosphorous and Zinc.

Ismail H. El-Sallami and Mohamed M. Gad*

Ornamental Plants Dept., Fac. Agric., Assiut University
*Mohamed.mohamed1@agr.au.edu.eg

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Abstract

Night blooming jessamine (*Cestrum nocturnum* L.) plants were grown in pots to study P-Zn relations as the behavior of both P and Zn affecting the absorption of each other by the plant that reflect on growth and flowering. Phosphorus was applied to soil at rates of 0 to 560 ppm with addition of Zn at rates of 0 to 48 ppm.

Greatest plant height, branch number, flowering (earliness and duration) and maximum dry weight accumulation in the different plant parts were occurred by the combination of 280 ppm P and 24 ppm Zn applied. In the absence of added P, shoot/root ratio was increased with increasing Zn level up to 24 ppm. Phosphorus at 70 and 560 ppm with Zn levels, this ratio was a nearly constant, while P at 140 and 280 ppm with low Zn level added, the ratio was decreased.

Total uptake of P and Zn indicated that P and Zn fertilization had altered the uptake of both nutrients by the plant. Total uptake of P was increased by high P and low Zn. Total Zinc uptake varied opposite to that of P. The maximum of P and Zn were obtained by P_{280} Zn_{24} as the greatest growth and flowering occurred.

Keywords: *Night-blooming jessamine, P applied, Zn applied, Growth and Flowering, P uptake, Zn uptake, P-Zn interaction.*

Introduction

Night-blooming jessamine (*Cestrum nocturnum* L.) plants are among the most useful of bright-flowering shrubby greenhouse plants grown as pot-plants for their heavy bright small tubular creamy yellow flowers very fragrant by night, they blossoms several times in the summer.

The favorable effects of P fertilization on growth and flowering were investigated by numerous researchers on many plants such as chrysanthemum (Kato and Takel, 1989), gerbera (Mohamed, 1992), violet and florists cineraria (El-Sallami, 1996 & 2001), prunus (Balal *et al.*, 2011) and strawberry (Mohamed *et al.*, 2011). Other works concluded that adequate Zn nutrition is essential for more vigorous plants and had better growth and quality than other plants severely Zn-deficient (Moraghan and Grafton, 2003; Mirvat *et al.*, 2006; Nasiri *et al.*, 2010; Carolina *et al.*, 2011 and Obaid and Al-Hadethi, 2013).

In early study it is found that supplying the large amounts of phosphorus to night-blooming jessamine plants led to deficiency-stunted growth of leaves associated with zinc deficiency symptoms. Phosphorus is the most important element interferes with Zn uptake by plants. Zinc absorption capacity is reduced by high

P fertilization and Zn in plant and soil has an antagonism state with phosphorus. About the interaction of P and Zn numerous studies have been done and most of them found that high P applications increase the severity of Zn deficiency symptoms in plants (Bukvicl *et al*., 2003; Das *et al*., 2005; Barben *et al*., 2010 and Mousavi, 2011). Effects of various treatments of P and Zn concluded that Zn is essential to phosphate utilization by the plants. Increase in phosphate concentration with low Zn level in the soil was considerable, particularly in the early stages of growth (Stukenholts *et al*., 1966; Sharma *et al*., 1968 and Khan and Zende, 1977). Applying Zn to plants grown under potentially Zn-deficient soils is effective in reducing uptake and accumulation of P in plants (Cakmak and Marschner, 1987 and Mousavi, 2011). Lu *et al.,* (1998) demonstrated that an increase in P availability did not cause a significant decrease in Zn concentration in oilseed rape (*Brassica napus*). Therefore, it remains unclear whether an increase in P availability in the growth medium can reduce Zn uptake by plant roots. Huang *et al.,* (2000) observed that Zn deficiency causes an increase in the expression of P uptake in barley roots.So the present experiment was undertaken to investigate the interactive effects of P and Zn supply at different rates on plant growth, flowering and plant uptakeof P and Zn in night-blooming jessamine that will define the optimum use of P and Zn fertilizers for balanced nutrition and consequently improvement in plant growth and flowering.

Materials and Methods

Night-blooming jessamine (*Cestrum nocturnum*, L.) plants were grown under saran house conditions (30% light) at the Experimental Farm of Assiut University, Egypt, during two successive seasons of 2012 and 2013.

On March 20th of both seasons, healthy and vigorous plants (one-year-old) were carefully selected as being uniform in their size (30-32 cm in height). Plants were grown singly in plastic pots, each pot (4.5 *l*) contained 4.2 kg air-dried clay soil, sieved through a 0.6 cm screen. Soil analysis showed; pH= 7.9 (1:1 soil to water suspension), $CaCO_3$= 3.86%, O.M.= 1.43%.C.E.C.= 56.4 mg/100g, Olsen-P= 28.6 ppm, and DTPA-extractable Zn, Fe and Mn were 1.1, 11.7 and 23.2 ppm, respectively.

Phosphorus was added as $NH_4H_2PO_4$ at 0, 70, 140, 280 or 560 ppm and thoroughly mixed into the soil. Zinc was applied as $ZnSO_4$ at 0, 6, 12, 24 or 48 ppm. All pots received applications of 300 ppm nitrogen as NH_4NO_3 and 200 ppm potassium as K_2SO_4 such amounts considered to be adequate. Potassium was mixed uniformly with the soil and the N and Zn were placed in a layer 5 cm below the surface of the soil. Pots were irrigated with sufficient water to bring the soil to its field capacity during the growth period.

The experiment had 25 treatments (5 P x 5 Zn) consisting of a factorial combination. The treatments were arranged in a randomized complete block design with four replications.

Data of plant height and number of branches per plant were recorded on October of both seasons. Days to anthesis were calculated from the date that plants were potted till the first flower opened. Flowering period was recorded when the first flower opened till the closing of flowering. On October 20th of both seasons, selected samples of plants from different treatments were cut 1-cm above soil surface and separated into leaves, stems and roots. All samples were thoroughly washed immediately, oven dried at 70°C for 24 hr., and dry weight recorded.Shoot/root ratio was calculated by dividing total dry weight of the aerial parts by the dry weight of roots. The dried plant parts were ground in a stainless steel Wiley mill preparatory to wet ashing with nitric-perchloric acid procedure. Phosphorus was determined colorimetrically as phosphomolybdate according to Jackson (1978). Zinc was estimated by atomic absorption spectrophotometer system, Perkin-Elmer Model 3100.

Phosphorus and zinc uptake by plant parts per unit dry weight were determined. Data were statistically analyzed using SAS software and the means were compared using a least significant difference test according to Dawdy and Wearden(1983).

Results and Discussion

In the absence of added phosphate, symptoms of P deficiency-stunted plants with small dark-green leaves-developed early in the growth period in the P_0-treatment, was more pronounced at the highest Zn levels. Symptoms of Zn deficiency-retarded stem and leaf growth and crinkled chlorotic leaves-appeared in P-treated plants without Zn fertilizer in the Zn_0 series, but only at the highest phosphate levels.

Plant height and number of branches per plant

Data presented in Table 1 reveled that, phosphorous and zinc treatments produced taller plants and more branches per plantthan controls (P_0 and Zn_0). The tallest plants with maximum number of branches were obtained by applications of phosphorous at 280ppm and zinc at 24ppm. These results are in agreement with those found by Omer (1992) on *Tagetespatula* and El-Sallami (2001) on *Seneciaocruentus*, L.

Table 1. Effect of P and Zn fertilization on plant height and number of branches per plant of Night-Blooming Jessamine during 2012 and 2013 seasons.

P level (ppm).	Plant height (cm)											
	2012 Season						2013 Season					
	Zn level (ppm)						Zn level (ppm)					
	0	6	12	24	48	Mean	0	6	12	24	48	Mean
0	66.30	74.20	77.60	82.50	71.70	**74.50**	63.90	76.40	79.20	87.30	73.80	**76.10**
70	71.80	81.00	85.70	93.80	76.20	**81.70**	70.10	83.70	88.60	99.70	75.40	**83.50**
140	76.00	83.60	84.50	94.90	86.50	**85.10**	78.30	86.70	89.00	98.10	84.50	**87.30**
280	80.60	87.30	98.70	107.0	88.10	**92.30**	82.60	90.10	97.80	118.2	90.30	**95.80**
560	76.60	75.40	78.60	83.70	81.20	**77.30**	74.30	86.50	81.30	89.30	72.60	**80.80**
Mean	**74.26**	**80.30**	**85.02**	**92.38**	**80.74**		**73.84**	**84.68**	**87.18**	**98.52**	**79.32**	
L.S.D. 0.05	**P:5.16 Zn: 4.67Px Zn: 10.44**						**P: 4.40 Zn: 4.45Px Zn: 9.96**					
	Branch No./plant											
0	5.25	6.50	7.25	8.75	6.00	**6.75**	5.65	6.25	6.75	8.25	6.00	**6.58**
70	6.50	8.50	9.75	10.75	7.00	**8.50**	6.25	8.00	8.50	9.50	7.25	**7.90**
140	8.00	9.75	10.25	13.75	9.50	**10.25**	7.50	9.25	9.75	11.50	8.25	**9.25**
280	10.50	11.00	12.50	16.50	10.75	**12.25**	9.25	10.25	12.00	16.75	10.75	**11.80**
560	7.25	8.00	9.50	12.50	7.75	**9.00**	6.75	7.25	9.50	11.50	7.00	**8.40**
Mean	**7.50**	**8.75**	**9.85**	**12.85**	**8.20**		**7.08**	**8.20**	**9.30**	**11.50**	**7.85**	
L.S.D. 0.05	**P: 0.94 Zn: 0.73Px Zn: 1.64**						**P: 0.89 Zn: 0.81 Px Zn: 1.80**					

Earliness and flowering period

Phosphorous and zinc treatments did not delay anthesis compared to control (Tables 2 and 3). Time required for plants to reach anthesis significantly decreased with increasing levels of applied P above 70 ppm and 12 ppm or more of Zn fertilization. Greatest earliness occurred by the combined treatment of P_{280} Zn_{24} (Table 4) plants averaged 114 and 105 days from planting to anthesis in the first and second seasons, respectively. Numerous workers (Mohamed, 1992; El-Sallami, 2001 and Mohamed *et al.*, 2011) have also reported that P and Zn nutrition at certain rates occurred earliness of visible bud, complete bud formation, complete flowering and increased flower duration of gerbera, florists cineraria and strawberry. Leopold and Kriedemann (1980) stated that greater earliness would refer to an earlier morphological differentiation of flowers and hence to the formation of the first flower primordial at a lower node.

Table 2. Flowering of night-blooming jessamine in relation to P treatments in 2012 and 2013 seasons.

P applied, ppm in soil	Time from planting to anthesis, days		Period of flowering, days	
	2012	2013	2012	2013
0	160	164	37	35
70	153	151	50	46
140	146	142	58	54
280	131	125	76	81
560	145	140	56	58
LSD at 0.05	12	14	9	8

Table 3. Flowering of night-blooming jessamine in relation to Zn treatments in 2012 and 2013 seasons.

Zn applied, ppm in soil	Time from planting to anthesis, days		Period of flowering, days	
	2012	2013	2012	2013
0	158	157	48	48
6	154	151	51	53
12	146	143	56	55
24	133	129	65	64
48	144	141	57	54
LSD at 0.05	12	14	9	8

All P treatment significantly increased flowering period compared to control. Meanwhile, Zn at 24 ppm was more effective concentration in this respect. No considerable response in flowering period of night-blooming jessamine was obtained from applied Zn less or more than 24 ppm, in most cases. Higher response in flowering period was obviously taking place with the combination of P_{280} Zn_{24} (Table 4) as recorded longer flowering period by 57 and 67 days than control (P_0 Zn_0) in the first and second seasons, respectively.

Apparently, flowering time and period are strongly influenced by sub-higher levels of P and Zn fertilizers (optimum levels P_{280} Zn_{24}). The most recognized problem of Zn deficiency is its antagonistic effect upon P. The present result indicates that earliness and flowering period of night-blooming jessamine were best when P fertilizer level would be considered high by as much as 11.7 times to Zn added. At both ideal levels (P_{280} Zn_{24}), plant roots are able to absorb P and Zn adequately as translocation of each other enhanced from roots to the upper plant parts. The favourable effect of P fertilization was investigated by numerous researchers on flowering of some ornamentals such as chrysanthemum (Kato and Takel, 1989), gerbera (Mohamed, 1992) and violet (El-Sallami, 1996). Other scientists reported the promotive effect of Zn on flowering of marigold (Omer, 1992), narcissus (El-Sallami, 1997) and chamomile (Nasiri *et al.*, 2010).

Table 4. Flowering of night-blooming jessamine in relation to P and Zn fertilization in 2012 and 2013 seasons.

P applied, ppm in soil	Zn applied, ppm in soil	Time from planting to anthesis, days		Period of flowering, days	
		2012	2013	2012	2013
	0	167	172	34	32
	6	166	170	37	34
0	12	158	165	37	35
	24	147	152	39	38
	48	162	160	38	37
	0	165	162	40	42
	6	159	158	47	43
70	12	154	154	51	46
	24	141	138	62	57
	48	146	142	52	43
	0	158	155	52	49
	6	157	153	53	52
140	12	140	136	62	58
	24	135	130	68	59
	48	141	137	56	52
	0	136	140	68	67
	6	133	129	73	76
280	12	138	123	72	81
	24	114	105	91	99
	48	134	128	76	80
	0	162	156	48	50
	6	156	147	44	58
560	12	142	137	59	57
	24	128	121	67	69
	48	136	140	63	57
LSD at 0.05		26	31	20	18

Dry weight accumulation

Data on dry weight accumulation in different plant parts are listed in Tables (5 and 6). Apparently, weight of plant parts were increased by varying the proportions of P and Zn.

All P treatments significantly increased dry weight accumulation in leaves and roots compared to control, while P levels at 140 to 560 ppm were more effective than P_{70} in stem dry weight. The greatest increase in dry weights of different plant parts were caused by P_{280}, however, averaging 70, 48 and 58% over control plants in leaves, stems and roots, respectively. P fertilization treatments showed similar pattern in total dry weight of whole plant to that of plant parts, the heaviest weight was occurred by P_{280} achieved 56 and 50% more than control plants in 1st and 2nd seasons, respectively (Table 7). Similar results are in accordance with those reported by other investigators (Kato and Takel, 1989; El-Sallami, 2001; Mirvat *et al*., 2006; Khorgamy and Farnia, 2009; Balal *et al*., 2011 and Mohamed *et al*., 2011).

All Zn levels significantly increased leaf, stem and root dry weights, except Zn_{48} did not affect root weight. Maximum increases were obtained by Zn_{24} averaged 67, 83 and 51% over control plants in leaves, stems and roots, respectively. Either Zn_{12} or Zn_{24} significantly increased total dry weight of plants in comparison with Zn_0, Zn_{12} and Zn_{48} (Table 8). However, Zn_{24} was much greater than Zn_{12}, resulting 76 and 71% over control plants in 1st and 2nd seasons, respectively. The favorable effects of Zn on growth was concluded by numerous reports (Dell and Wilson, 1985; Webb and Loneagan, 1988; Moraghan and Grafton, 2003; Kinaci and Kinaci, 2005; Khorgamy and Farnia, 2009; Nasiri*et al*., 2010; Carolina *et al*., 2011; Mohamed *et al*., 2011; Mousavi, 2011 and Obaid and Al-Hadethi, 2013).

The presence of phosphorous at various concentrations, along with Zn in the soil helped plant growth to attain normal or higher values as compared to control. Similar observations were reported by other workers (El-Gharably and Rushdi, 1975; Fageria, 2001; Bukvicl*et al*., 2003; Mirvat, 2006; Khorgamy and Farnia, 2009 and Mohamed *et al*., 2011).

Maximum growth occurred at $P_{280}Zn_{24}$ (Table 7) interpretation of growth and nutrient uptake is difficult because P and Zn were varying simultaneously. In the discussion that follows P deficiency was interpreted as limiting growth below $\mathbf{P_{280}Zn_{24}}$. Above this level Zn deficiency was concluded to have limited growth of night-blooming jessamine plants.

Table 5. Dry weight of leaves of night-blooming jessamine in relation to P and Zn fertilization in 2012 and 2013 seasons.

P applied, ppm in soil	Dry weight of leaves, g/plant											
	Zn applied, ppm in soil											
	0	6	12	24	48	Mean	0	6	12	24	48	Mean
	2012						2013					
0	4.52	5.88	6.05	9.04	8.51	**6.80**	4.96	6.51	6.70	9.82	8.39	**7.28**
70	5.57	8.30	9.38	12.70	8.65	**8.92**	5.98	9.67	10.25	13.73	10.30	**9.99**
140	7.97	10.18	10.24	14.42	11.14	**10.79**	9.11	10.02	10.07	15.04	11.69	**11.19**
280	8.96	10.01	11.25	14.70	11.87	**11.36**	10.49	12.46	11.51	15.04	12.93	**12.49**
560	9.94	10.12	10.41	12.63	11.45	**10.91**	10.57	10.91	10.66	12.98	11.61	**11.35**
Mean	**7.39**	**8.90**	**9.47**	**12.70**	**10.32**		**8.22**	**9.91**	**9.84**	**13.32**	**10.98**	
LSD5%	P= **1.48**		Zn= **1.48**		PxZn= **3.31**		P= **1.60**		Zn= **1.60**		PxZn= **3.57**	

Table 6. Dry weight of stems of night-blooming jessamine in relation to P and Zn fertilization in 2012 and 2013 seasons.

P applied, ppm in soil	Dry weight of stems, g/plant											
	Zn applied, ppm in soil											
	0	6	12	24	48	Mean	0	6	12	24	48	Mean
	2012						2013					
0	16.39	19.74	27.29	30.31	17.89	**22.31**	20.99	21.92	30.36	35.10	28.24	**27.32**
70	20.38	25.58	28.38	28.82	23.70	**25.37**	21.30	25.49	32.92	33.65	25.72	**27.82**
140	22.36	22.32	38.51	38.13	20.36	**28.34**	23.39	23.18	36.63	43.96	22.81	**29.99**
280	19.09	31.27	37.50	52.55	30.48	**34.18**	28.84	31.17	40.02	57.86	35.82	**38.74**
560	23.34	26.51	29.99	39.92	28.35	**29.62**	25.28	33.69	35.06	42.28	20.96	**31.45**
Mean	**20.30**	**25.08**	**32.33**	**37.95**	**24.16**		**23.96**	**27.09**	**35.00**	**42.57**	**26.71**	
LSD5%	P= **3.82**		Zn= **3.82**		PxZn= **8.53**		P= **2.65**		Zn= **2.65**		PxZn= **5.92**	

Table 7. Dry weight of roots of night-blooming jessamine in relation to P and Zn fertilization in 2012 and 2013 seasons.

P applied, ppm in soil	Dry weight of roots, g/plant											
	Zn applied, ppm in soil											
	0	6	12	24	48	Mean	0	6	12	24	48	Mean
	2012						2013					
0	5.05	5.68	6.30	6.80	5.22	**5.81**	4.93	5.42	5.86	7.47	5.03	**5.74**
70	5.26	6.55	6.63	8.18	6.08	**6.54**	5.09	6.37	7.43	8.68	6.63	**6.84**
140	7.43	7.85	8.60	9.85	7.60	**8.27**	7.58	8.55	9.03	10.90	7.78	**8.77**
280	7.70	8.68	8.83	11.75	8.20	**9.03**	7.36	9.40	9.55	11.33	8.63	**9.25**
560	6.32	7.75	9.01	9.73	6.40	**7.84**	6.43	7.92	9.35	10.21	7.69	**8.32**
Mean	**6.35**	**7.30**	**7.87**	**9.26**	**6.70**		**6.28**	**7.53**	**8.24**	**9.72**	**7.15**	
LSD5%	P=**0.71**		Zn= **0.71**		PxZn= **1.59**		P=**0.96**		Zn= **0.96**		PxZn= **2.14**	

Table 8. Dry weight of whole-plant of night-blooming jessamine in relation to P and Zn fertilization in 2012 and 2013 seasons.

P applied, ppm in soil	Dry weight of whole-plant, g/plant											
	Zn applied, ppm in soil											
	0	6	12	24	48	Mean	0	6	12	24	48	Mean
	2012						2013					
0	25.91	31.30	39.64	46.15	31.63	**34.93**	30.88	35.85	42.92	52.39	41.66	**40.34**
70	31.21	40.43	44.39	49.70	38.44	**40.83**	32.38	41.53	50.60	56.06	42.65	**44.64**
140	37.76	40.35	57.35	62.40	39.10	**47.39**	40.08	41.75	55.74	69.90	42.28	**49.95**
280	35.75	49.97	57.58	79.00	50.55	**54.57**	46.69	53.03	61.08	84.24	57.38	**60.48**
560	39.60	44.38	49.41	62.28	46.20	**48.37**	42.28	52.52	55.07	65.47	40.26	**51.12**
Mean	**34.05**	**41.27**	**49.67**	**59.91**	**41.18**		**38.46**	**44.54**	**53.08**	**65.61**	**44.85**	
LSD5%	P=**8.48**		Zn= **8.48**		PxZn= **18.94**		P=**8.22**		Zn= **8.22**		PxZn= **18.36**	

Shoot/root ratio

In the absence of added P shoot/root ratio was increased with increasing Zn level from 0 to 48 ppm; Fig. 1. The increase in this ratio might be considered evidence of the beneficial effect of Zn on stimulating the vegetative growth at the expense of root growth. El-Sallami (2001) also reported similar observations with the florists cineraria. Phosphorus at 140 and 280 ppm with high Zn levels, the ratio averaging 5.3, while with lower or no added Zn, the ratio was a lesser degree (4.3). The combinations of P_{70} and P_{560} with Zn levels showed a nearly constant ratio within the shoot and root weight. The implications of this parallel effect of these combinations on growth of shoot and root are not clear.

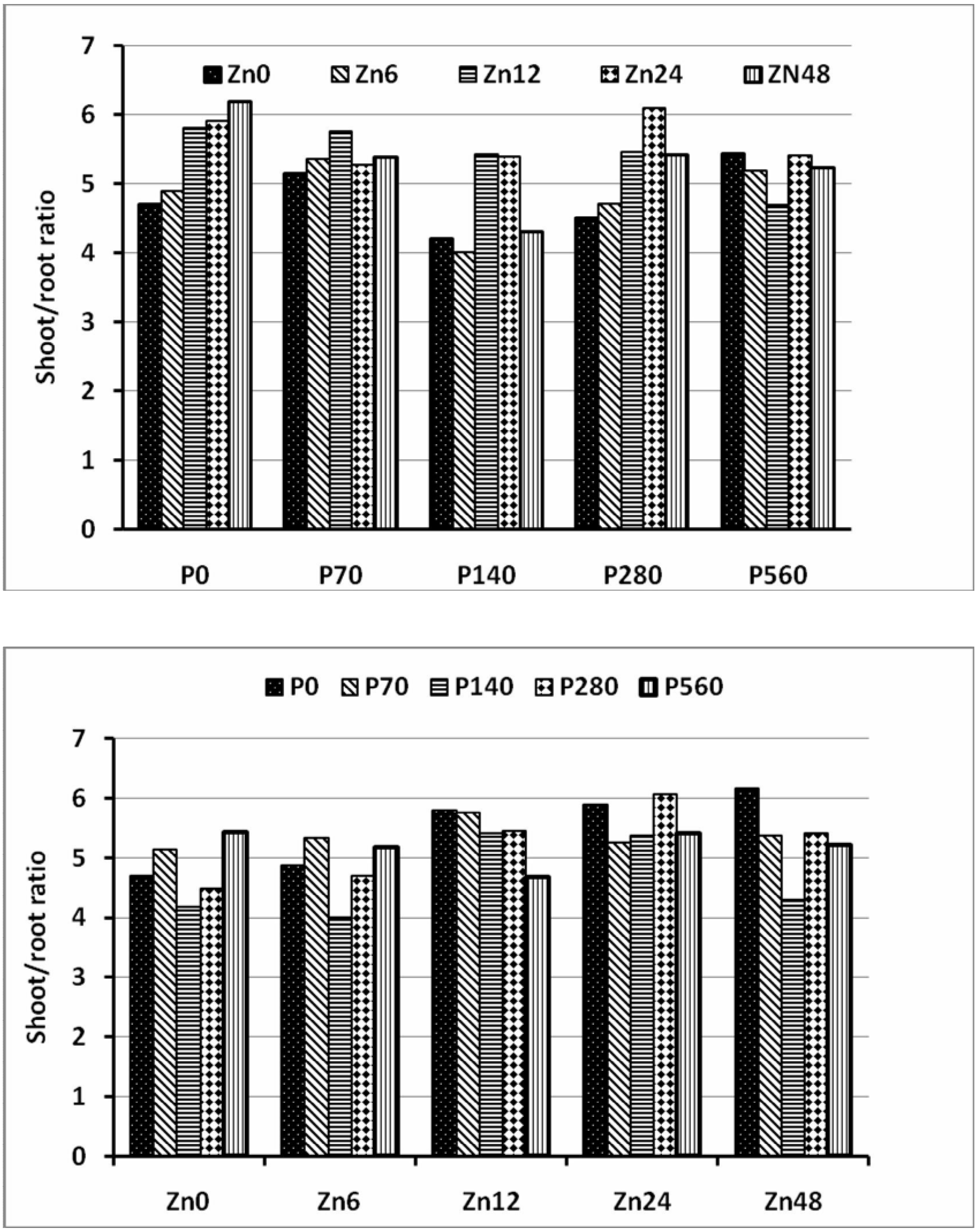

Fig.1. Shoot/root ratio as influenced by P and Zn fertilization (average of both seasons).

Uptake of P by plant parts

Adding P treatments consistently and markedly increased P uptake. As expected, high P level resulted in greater proportions of P remaining in all plant parts (Fig. 2). High P uptake may involve a high rate of P transport from root to shoot via the xylem, and this may hinder Zn uptake and translocation, as the proportion of Zn uptake by plant parts were consistently lower. Zinc application without added P show that P uptake was considerably increased as Zn supply raised up to 24ppm in all parts. This indicate that low Zn supplies caused an increase in the proportion of total P uptake. Excess Zn addition (Zn_{48}) has a reduction on P uptake by plant. With no Zn applied, total P uptake by plant parts was 96% greater in the presence of 560ppm P than in the presence of 48ppm Zn without P added. This clearly suggests that Zn application has decreased the uptake of P from soil. In general, total uptake of P by stems was much greater than by leaves or roots.

Uptake of Zn by plant parts

Zinc uptake without P supply showed greater responses to Zn fertilizer in all plant parts as increased with increasing Zn level (Fig. 3). The degree of response to Zn uptake under the utilization of P fertilizer was varied with the levels of P. With no P applied, total Zn uptake by plant parts at Zn $_{48}$ level was about twice that of P_{560} without Zn added. Large application of fertilizer P to soil that are low in available Zn can depress Zn uptake.Increase in Zn uptake with low soil P availability over high P availability, and the inverse relationship between each of P and Zn uptake. The uptake of Zn under P_{560} treatment is lower than under P_0 in all plant parts. Such reduction in Zn uptake by roots, stems and leaves were 32, 51 and 36%, respectively. The present results cleared that an increase in available soil P was associated with lower Zn uptake by plant which is in general agreed with the finding of Gianquinto *et al* (2000). They explained that the P-induced decrease in Zn concentration is caused by a dilution effect of increased shoot growth rather than by reduced Zn uptake by roots.

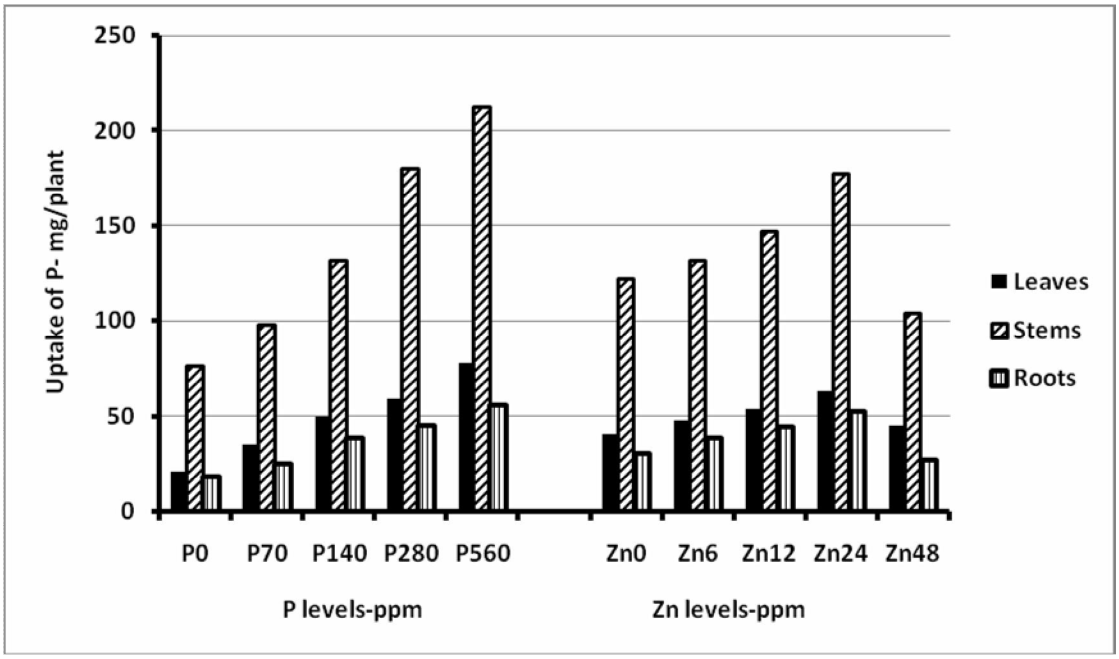

Fig.2. Effect of P and Zn fertilization on average uptake of P by roots, stems and leaves of night- blooming jessamine

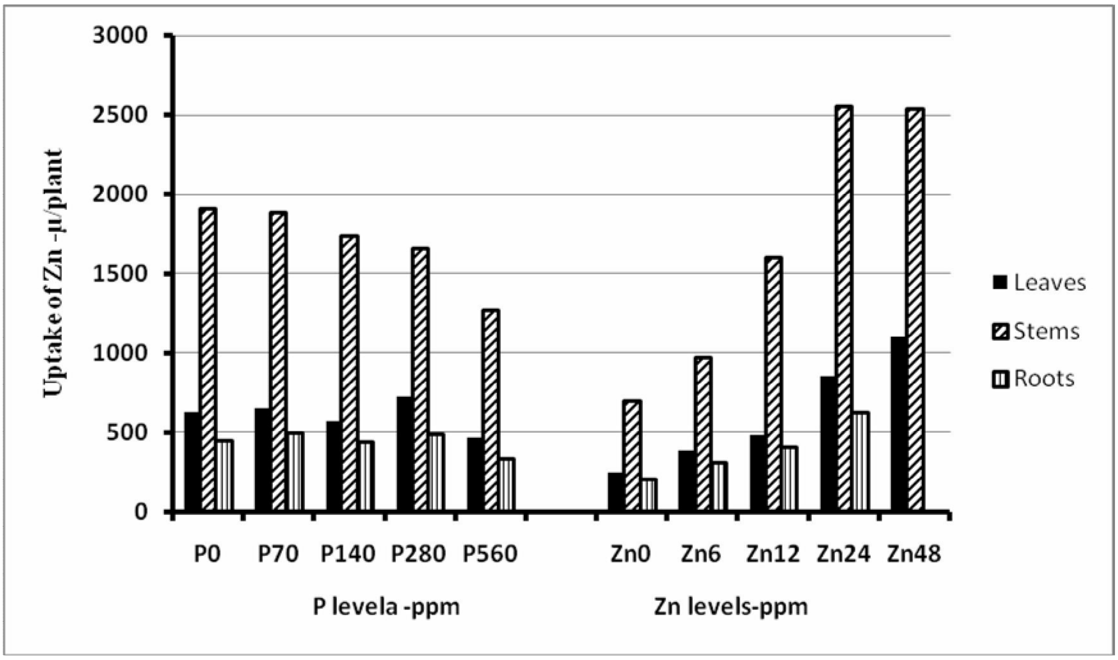

Fig.3. Effect of P and Zn fertilization on average uptake of Zn by roots, stems and leaves of night-blooming jessamine.

Relationship between total P uptake and total Zn uptake

Total Phosphorus uptake was increased with increasing P level in the soil while total Zn uptake remained relatively unchanged from 0 to 280 ppm P but was continued to decrease as P level increased (Fig. 5). The point of inflection for both total P and total Zn distribution occurred seldom above 280 ppm P where greatest growth occurred. This indicated that the adverse effects of high P and low Zn were already being shown within the plant. Perhaps the adverse effects of high P and low Zn may well begin to limit growth after plants obtain enough P and Zn for maximum growth. This was consistent with results obtained by El-Sallami (2001), Balal *et al*. (2011) and Mousavi (2011) showing that P and Zn reacted together to reduce the uptake by plant. Barben *et al*. (2010) reported that the main effect of P and Zn was "a physiological inhibition in the translocation of Zn from roots to tops". Bukvicl *et al*. (2003) concluded that a high level of P in the soil either reduces the solubility of Zn or interferes with the movement of Zn to its functional location in the plant.

Total phosphorus and total zinc uptake as influenced by added Zn were continued to increase as Zn level increased up to 24 ppm, however total P uptake was the maximum where the optimum growth occurred (Fig. 5). Above 24 ppm Zn, total phosphorus uptake dropped, on contrast, total Zn uptake slightly increased. The point of inflection for both P and Zn distribution occurred at 24 ppm Zn where greatest growth obtained. This explained that the adverse effects of high Zn and low P may begin to limit growth after plants obtain enough P and Zn for maximum growth. This can only be relieved by supplying Zn. At maximum growth ($P_{280}Zn_{24}$), although Zn applied at 24 ppm had little effect on total P uptake, total Zn uptake by plant increased to approximately 42% more than in the presence of added P at 280 ppm.

Data obtained showed a considerable evidence for an antagonistic interaction between P and Zn concerning their absorption, a decreased uptake of Zn as the P level is increased, and a decreased P uptake as the Zn level is increased.

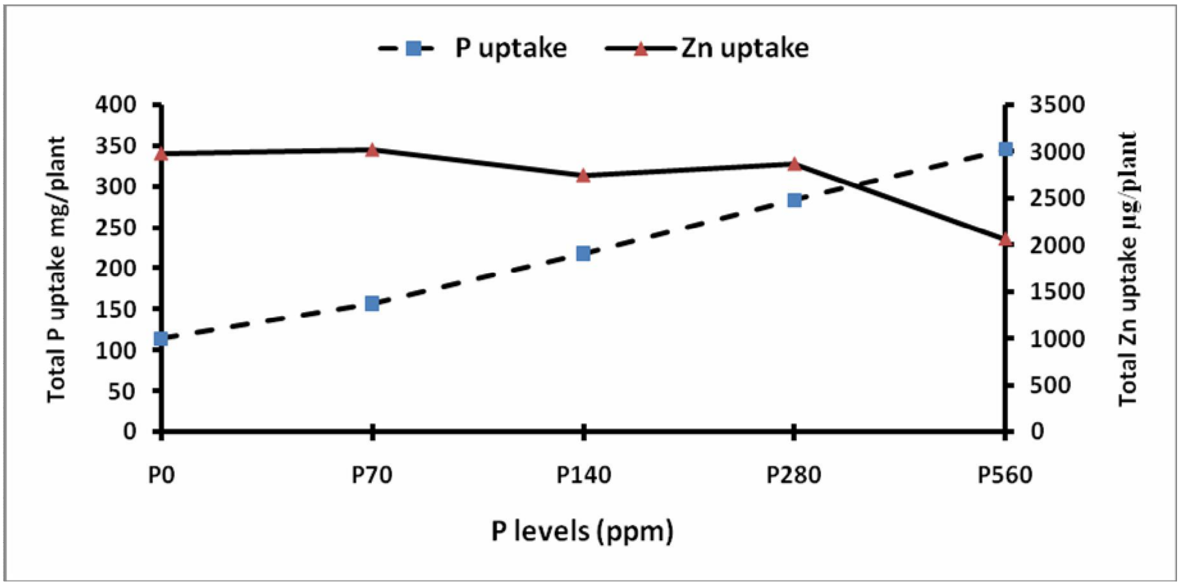

Fig.4. Relationship between total P and total Zn uptake by plant of ight- blooming jessamine as influenced by P fertilization.

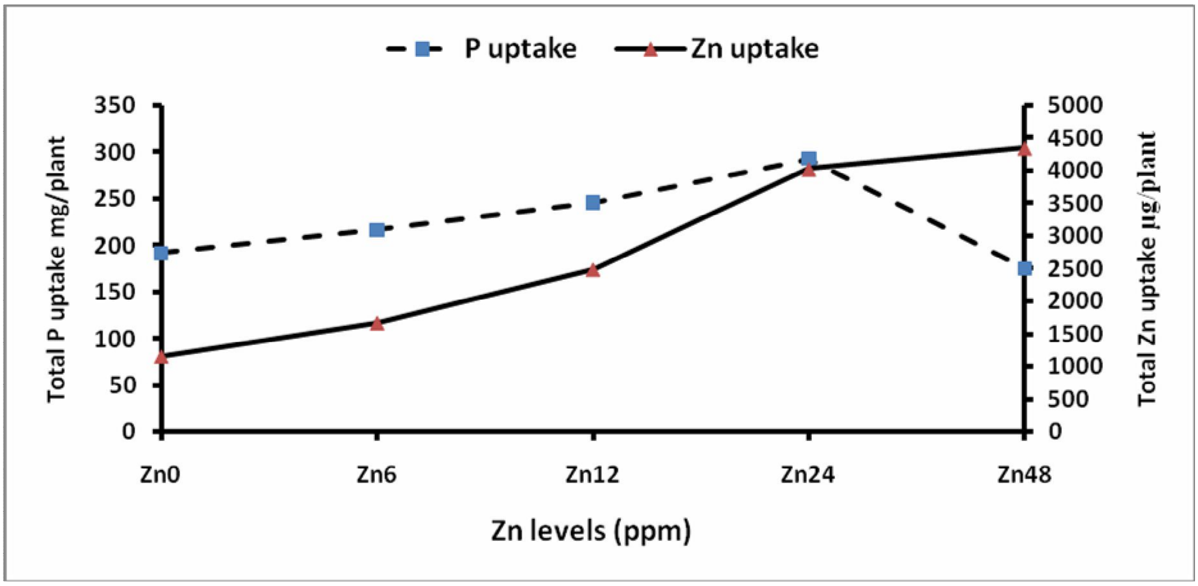

Fig.5. Relationship between total P and total Zn uptake by plant of night-blooming jessamine as influenced by Zn fertilization.

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Website: http://www.aun.edu.eg/faculty_agriculture *E-mail: ajas@aun.edu.eg*

استجابة نباتات مسك الليل للعلاقة بين الفوسفور والزنك
١-النمو والإزهار والمحتوى الممتص من الفوسفور والزنك

اسماعيل حسن السلامى و محمد مصطفى جاد

قسم الزينة -كلية الزراعة -جامعة أسيوط

الملخص

أجريت الدراسة بمزرعة نباتات الزينة – كلية الزراعة – جامعة اسيوط – لدراسة العلاقة بين اضافة الفوسفور والزنك على امتصاص النبات لكل منهما وتأثيره على النمو والإزهار.

زرعت النباتات فى اصص وأضيف الفوسفور بمعدلات من صفر حتى ٥٦٠ جزء فى المليون مع اضافة الزنك بمعدل اضافة من صفر حتى ٤٨ جزء فى المليون (خمس معاملات لكل منها).

وكانت من أهم النتائج:

– اضافة الفوسفور بتركيز ٢٨٠ جزء فى المليون والزنك بتركيز ٢٤ جزء فى المليون ادى الى زيادة فى ارتفاع النبات وعدد الأفرع والوزن الجاف لجميع اجزاء النبات كما أدى الى تبكير الإزهار وزيادة فترة بقاءها على النبات.

–عند اضافة الزنك بمفرده زادت نسبة الأفرع\الجذور مع زيادة معدل الاضافة عن ٢٤ جزء/مليون، بينما كانت النسبة تقريبا ثابته مع اضافة الفوسفور بمعدل ٧٠ و ٥٦٠ جزء/مليون مع مستويات الزنك المختلفة.

– بإضافة الفوسفور بتركيز ١٤٠ و ٢٨٠ جزء فى المليون قلت نسبة الأفرع\الجذور.

– كما دلت النتائج ان المحتوى الكلى للنبات من الفوسفور والزنك (total uptake) تبادلى فيزداد امتصاص الفوسفور مع المعدلات المرتفعة من الفوسفور والمنخفضة من الزنك، وعلى العكس مع المحتوى الكلى للزنك.

– وصل معدل النمو والازهار الى اقصاه مع اضافة الفوسفور بمعدل ٢٨٠ جزء/مليون والزنك بمعدل ٢٤ جزء/مليون.