The Influence of Boron Foliar Spraying with Compost and Mineral Fertilizers on Growth, Green pods and Seed Yield of Pea

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Abstract: The objective of this study was to study the influence of a foliar application with boron and five levels of combinations between compost manure and mineral nitrogen fertilizer as well as their interaction on growth, yield and chemical composition of pea cv. Master B. Two field experiments were conducted at a private farm in Dakahlia Governorate during two growing seasons of 2009 - 2010 and 2010 - 2011. The experimental design was split plot design with three replicates. The vegetative growth traits of green pea, i.e., plant length, number of leaves, number of branches, fresh weight per plant, relative growth rate, yields and its components had high significant values by foliar spraying with boron. This increment reached at 5.2 and 6.2 % in 1st season, 6.2 and 6.3 % in 2nd season for total green pod and dry seed yield, respectively. The highest values of all vegetative growth traits, total yield, and yield components of pea, NPK content, protein % and total sugar as well as carbohydrate % in fresh seeds were obtained from a mixture of nitrogen fertilizer at levels 60 kg N fed^{-1} and compost at 2.5 ton fed^{-1} in both seasons. This treatment increased both total green and dry yield as (13.8%, 13.9%) and (11.1%, 11.2%) in both two seasons, respectively compared with the control. The effect of interaction between inorganic nitrogen fertilizer at a rate of 60 kg N fed^{-1} and compost manure at 2.5 ton fed^{-1} and foliar spraying of boron, (50 ppm) had a positive significant effect on growth traits and the chemical composition of green seeds in both seasons. The green pod yield and dry seed yield increased by (20.7%, 20.6%) and (20.5%, 22.5%) for the two seasons, respectively. It could be concluded that foliar spray with boron (boric acid 17 % B) at 50 ppm with application of nitrogen fertilizer in compost form at 2.5 ton fed^{-1} and inorganic N- fertilizer at 60 kg fed^{-1} in pea field were the most effective treatment for improving quality and increasing yield.

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1.Introduction

Pea (*Pisum sativum* L.) is one of the world's oldest domesticated crops cultivated before 10th and 9th millennia BC (Zohary *et al*., 2000). The crop is grown in many countries and currently ranks fourth among the pulses in the world with a cultivated area of 6.33 million hectares (FAOSTAT, 2012). In Egypt, pea is one of the most important legumes vegetable crops, being widely consumed in the country. However, the productivity of this crop is not satisfactory as most of the farmers are not applying recommended dose of fertilizers, besides the fertilizer level is imbalanced. The addition of organic matter improves the physical, chemical and biological properties of soil and the natural organic material one broken down slowly by soil microorganisms (Shafeek *et al.,* 2001; Rizk *et al.,* 2003).

As it's known, nitrogen plays a major role in plant growth and development, its shortage within plant tissue resulted in reduction in foliage and roots expansion, loss in photosynthetic efficiency and disturbance of all metabolic functions (Marschner, 1995). Hakim *et al* (2010) point the treatment by vermin compost at 10 t / ha + NPK exhibited the maximum nodule formation and yield of pea plant cv. Arkel. Abdul Kabir (2006) found that the maximum fresh pod yield plant, fresh yield pod yield / ha, a number of fresh pod / plant, fresh pod length, 100 dry seed weight, and protein content were recorded with fertilizer at a dose of 100 + 60 + 40 kg NPK / ha.

Up till on biological nitrogen fixation (Bhupinder and Kalidindi, 2003; Ngwn, 2005) nitrogen application to cowpea plants increased plants growth, dry matter content, yield and its quality as well as nutritional value of seeds (Amujoyegbe and Alofe, 2003; Singh *et al.* 2007). Brkics *et al.* (2004) investigated the highest average number of pods/ plant and the highest values a result of fertilization with 40 N kg/ha and seed yield was 4.02/ha. Ayub *et al.* (2011) indicated that the nitrogen application significantly improved all the yield and quality traits and the maximum values for all traits were recorded when nitrogen was applied at 45 kg / ha.

Compost products have gained impetus in organic farming to boost agricultural production to its important multi various features such as being rich in nutrients, vitamins, growth regulators, free from pathogens and containing immobilized micro flora. These composts provide all nutrients in readily available forms and also enhance uptake of nutrients by plants and play a major role in improving growth and yield of different field crops. Hassan *et al*. (2007) found that compost manure application at a rate of 15 t/fed., With a half rate of recommended NPK (25 + 60 + 50 kg / ha) significantly affected on the quality and mineral content of NPK in seeds of pea plants. Khosro *et al*. (2010) found that content of phosphorus, zinc and other mineral in the chick pea plant increased under application of compost, farmyard manure and bio-fertilizers.

Boron is one of the essential micronutrients required for plant growth and productivity. It plays an important role in cell wall synthesis, RNA metabolism, and root elongation as well as phenol metabolism. Also, boron involved in pollen and tube growth as mentioned by (Marschner, 1995; Srivastava and Gupta, 1996). Fageria *et al*. (2007) found that boron application significantly increased common bean yield. Mary *et al.* (1990) observed that foliar application of boron resulted increase in the number of pods / branches, increased the number of seeds/ plant and seed yield / plant. In similar study on pea (*Pisum sativum* L), Kumar *et al*., (2006) reported increased plant high, fruiting and pod yield when seeds were primed in 0.5 % boron solution with a concomitant reduction in days to 50 % flowering. In pigeon pea, boron application through seed treatment (4 g / kg seed) was more effective and economical in increasing seed yield by 10.53 % compared with the control. In another study soil application (10 kg / ha) increased yield by 5.26 % (Malla *et al.*, 2007). Kalyani *et al*. (1993) observed that boron applied as boric acid increased the plant height, relative growth rate, net assimilation rate and leaf area index in pigeon pea. The response of chick pea to boron application varied from 167 to 182 kg / ha with 2 kg B / ha (Sakal *et al*., 1995).

The objective of this study was to assay the influence of compost manure and mineral nitrogen fertilizer with foliar spraying by boron on growth, yield and chemical composition of pea.

2.Materials and Methods

Two field experiments were carried out at a private farm in Sherbein city, Dakahlia Governorate, Egypt during growing seasons of 2009 / 2010 and 2010 / 2011 on pea. The seeds of cv. Master B were sown in the four sides of ridges. One ridge was 3 m length and 1 m width and 25 cm spacing between plants in rows and 10 cm between plants in row. The experimental plot area was 12.0 m^2. Physical and chemical properties of the experimental soil at a depth of 0-30 cm are shown in Table (1). The experimental design was split plot design with three replicates. Boron foliar spray at 50 ppm as boric acid 17 % B besides control were randomly destructed in main plots. which were sub divided to four subplots, each plot contained one of compost manure and mineral nitrogen fertilizer sole or combined application were conducted as follows compost manure (1% N); at the rate of 10 ton fed^{-1}, cmpost manure at a rate of 7.5 ton fed^{-1} + mineral fertilizer 20 kg fed^{-1} of recommended rate / fed, compost manure at a rate of 5 ton fed^{-1} mineral N fertilizer 40 kg fed^{-1} recommended rate / fed, compost manure at a rate of 2.5 ton fed^{-1} + mineral nitrogen fertilizer 60 kg fed^{-1} of recommended rate / fed, mineral nitrogen (100% recommended N rate) 80 kg fed^{-1} as control. The quantity of compost manure were calculated based on total nitrogen N content of compost. Chemical analysis of compost manure are shown in Table (2).

During two seasons of study, seeds were sown in the open field at 15 and 17 of October respectively in four ridges at spacing 10 cm. Pea plants were sprayed three times with boron solutions at 20, 30 and 40 days after sowing. The untreated plants (control) were sprayed with tap water. As a source of organic nitrogen, compost was incorporated into the soil before planting. Sulphate ammonium (20.6 % N) was used as a source of nitrogen added as the two equal sub rate after completing germination, before irrigation and at the beginning the flowering. Superphosphate (15 % P_2O_5) was added as only one addition during soil preparation with rate of 60 Kg P_2O_5 fed^{-1}. Potassium sulphate (48 % K_2O) was added after 5 and 7 weeks from sowing date with rate at 50 Kg K_2O fed^{-1}. Other normal cultural practices for pea were followed according to the instruction laid down by Egyption Ministry of Agriculture.

A representative samples of five plants were taken randomly each plot at 50 days after sowing to obtain the following traits; vegetative traits (plant length, number of leaves/plant, number of branches/plant, fresh weight/plant (g), relative growth rate (R.G.R.) was estimated using the following equation (Richards, 1969):

$$R.G.R = (L_n W_2 - L_n W_1) / (T_2 - T_1)$$

Where, W_1 and W_2 and the plant dry weight at the timing of sampling T_1 and T_2 respectively. Yield and yield components where the green pods of two ridges of each plot were harvested three times at the proper maturity stage. The following traits were recorded, average number of green pod/plant (mean number of pods per 10 plants), fresh pods yield/plant (g/plant), average pod weight (g) (mean weight of 20 pods), total green pods yield (ton/fed); chemical constitutions of seed by taking a representative samples of 100 g of green seeds from each experimental plot and oven dried to determine the following characteristics total nitrogen as described by A.O.A.C. (1975). Phosphorous was determined colorimetrical according to the standard methods of Jackson (1967) using 560 nm. Potassium was determined using flame photometer as described by Jackson (1967). Total protein % was calculated by multiplying nitrogen content by 6.25. Total sugar was determined according to methods of Forsee (1938). Total carbohydrates content was determined calorimetrically according to methods described by Michel *et al.* (1956). Dry pods of two ridges of each plot were harvested at the end of experiment to calculate the total dry seed yield (ton/fed) and seed index (the dry weight of 100 seeds).

Table 1: Physical and chemical properties of the experimental soil during 2009 / 2010 and 2010 / 2011 seasons.

Chemical analysis	2009	2010
Physical analysis (%)		
Sand	23.65	22.90
Silt	24.15	24.85
Clay	50.80	51.90
Soluble cations in saturation extract 1.5 (meq / 100g soil):		
Ca^{++}	0.870	0.861
Mg^{++}	0.470	0.450
Na^{+}	2.120	2.120
K^{+}	0.170	0.221
HCO_3	0.521	0.493
CL^-	1.242	1.251
$SO4^=$	2.305	2.202
pH	7.820	7.931
EC 125^0C (mmohs / cm)	0.532	0.541
Organic matter (%)	1.321	1.460
Nitrogen: (mg / 100 g soil)		
Total	182.46	197.6
Available	4.18	5.105
Phosphorus: (mg / 100 g soil)		
Total	14.415	15.701
Available	7.260	8.624
Soluble	3.086	4.161
Potassium: (mg / 100 g soil)		
Total	52.00	54.561
Available	0.210	0.321
Soluble	0.170	0.212

Table 2: Chemical analysis of the compost manure during 2009 and 2010 seasons.

Compost manure	Weight of m^3 (kg)	pH	EC dS/m	Organic matter %	C : N ratio %	Humus value	Total N%	Total P%	Total K%	Fe (ppm)	Zn (ppm)	Mn (ppm)
2009	615	7.1	4.8	31.5	18:1	23.10	1.0	0.55	1.12	750	40	162
2010	635	7.3	5.1	30.0	18.5:1	22.0	1.0	0.60	1.23	780	50	175

3. Results and Discussion

Data were subjected to the statistical analysis and means were compared using new L.S.D according to (Gomez and Gomez 1984).

The effect of boron

Vegetative growth traits

The vegetative growth traits of green pea i.e., plant length, number of leaves, number of branches, fresh weight/plant, and the relative growth rate were increased significantly by foliar spraying with boron compared with untreated plants, in the two seasons (Table 3). These results could be attributed to the enhanced photosynthetic activity and metabolic activity with application of boron (Garcia *et al.,* 1991, Lalit Bhott *et al.,* 2004, Sathya *et al.,* 2009).

Yield and its components

The foliar application with boron at 50 ppm had a significant increase in the number of pods, weight of pod/ plant, weight of pod, total green pod yield per feddan and total dry seed yield compared to untreated plants, in the both seasons (Table 4). This increment reached to be (5.5, 6.2 % in 1st season and 6.2, 6.3 % in the 2nd season) for total green and dry seed yield, respectively, while insignificant differences were detected as weight of 100 dry seeds in the two seasons.

The increase occurred in the total yield and its components might be attributed to the increase in vegetative growth traits in Tables (3 &4). Boron is also functionally associated with one or more of the processes of calcium utilization, cell division, flowering and fruiting, carbohydrate and nitrogen metabolism. These results are in agreement with those obtained by (Salinas *et al*. 1986; Fageria *et al.,* 2007).

The yield increase in these treatments may be the results of inhibition in flower and pod abscission, improvement in morpho – physiological characters (stem length, early vigor, growth and crop establishment) and enhance dry matter production and its partitioning in addition to higher pods per plant (Reddy *et al*., 2007). Similar results have been observed by Velayutham *et al*. (2003) in black gram (*Vigna mungo*). Boron's involvement in hormone synthesis and translocation, carbohydrate metabolisms and DNA synthesis probably contributed to additional growth and yield (Ratna Kalyani *et al*.,1993)

Chemical composition

The foliar spraying of boron significantly affected on NPK contents, protein %, total sugar and carbohydrates in fresh seeds in both seasons (Table 5). Boron fertilization improves photosynthetic activity, enhances activity of enzymes and plays significant roles in protein and nucleic acids metabolism, also, has been functional in the transport of carbohydrate and translocation of sugar, is enhanced by the formation of borate-sugar complexes (Tariq *et al*., 1993). Born is a micronutrient essential for normal growth of pollen grains, sugar translocation and movement of growth regulators within the plant (Hamasa and Putaiah, 2012).

Effect of compost manure and nitrogen fertilizer levels

Vegetative growth traits

Plant length, number of leaves; number of branches, fresh weight / plant and relative growth rate were significantly increased by addition of compost manure nitrogen fertilizer and in combination with mineral N fertilizer in both seasons. The highest values of all vegetative growth traits were obtained from a mixture of nitrogen fertilizer at levels 60 kg fed^{-1} + compost at level 2.5 ton fed^{-1} compared with other treatments in the two seasons study (Table 3). The simulative effect of nitrogen on growth traits may be due to that nitrogen is an essential element for building up protoplasm, amino acids and protein, which induce cell division and imitate meristematic activity, in addition to its vital contribution in several biochemical processes that related to plant growth (Marschner 1995). Moreover, the positive effect on growth traits by using compost manure might be related to the improvement of physical conditions of the soil and supplying plant with mineral nutrients, i.e., N.P.K and micronutrients (Fe, Zn and Mn), organic matter as well as humic acid content (Rechcigl, 1995). Many researchers have reported that application of compost and vermicompost became of supplying optimum nourishment condition cause to improve quality, yield and its components (Federico *et al.* 2007), Vijaya *et al*. 2008; Hernandez *et al*. 2010)

Yield and its components

The yield and its components of pea, i.e., number of pod/ plant, green pod yield / plants, weight of pod, total green pod yield/F, total dry seed yield and weight of 100 dry seeds were significantly increased by adding compost or nitrogen fertilizer in sole form or in combination in both seasons. This increment reached to be (13.9, 13.8%) in the 1st season and (11.2, 11.1 %) in the 2nd season for total green yield and dry seed yield, respectively (Table 4).

The maximum values of total yield and its components of pea were obtained when plants received nitrogen fertilizer at 60 kg N with 2.5 ton fed^{-1} compost manure in the two seasons compared with other treatments. These results might be due to the function of increase in total yield and its components of the plant pea and also, the addition of compost manure had more nutrients which may increase its availability for plant and improved the physical and chemical proprieties and supply nutrients of the soil. AbdAlla (1998) and Abd El-Hamid *et a*l (2004) obtained results in agreement with our findings. Supplementation of the soil and inoculants with organic matter has been shown to enhance the survival and numbers of rhizobis in soils and increase both early nodulation and N_2 fixation (Mohammed *et al.,* 2010).

Chemical composition

The NPK contents, protein %, total sugar and carbohydrate % in fresh seeds of pea were significantly influenced by compost manure and nitrogen fertilizer levels in the two seasons of study. The highest values of NPK, protein %, total sugar and carbohydrate % in fresh seeds were obtained when compost manure 2.5 ton fed^{-1} mixed with 60 kg N fed^{-1} inorganic nitrogen fertilizer in the two seasons (Table 5). These results may be due to the high growth and pod high yield of plant fertilized by nitrogen fertilizer combined with compost manure may be due to availability of organic nitrogen, which ultimately resulted in better root growth and increased physical activity of roots to absorb the nutrients through decomposition of organic manure that lead to increase their contents these results are in harmony with those obtained by El-Mansi *et al*., (2004) on pea.

The interaction of boron, nitrogen fertilizer and compost levels

Vegetative growth traits

The effect of interaction between boron of inorganic nitrogen fertilizer and compost rates on plant vegetative growth traits of pea is presented in Table (3). The interaction had a positive significant effect on plant height, number of leaves, number of branches and fresh weight and relative growth rate in both seasons. The addition of inorganic nitrogen fertilizer at rate of 60 kg fed^{-1} + compost at 2.5 ton fed^{-1} with boron at 50 ppm resulted in the highest values of the above mentioned growth traits.

Table 3: Vegetative Growth Parameters as Affected by Foliar Spring by Boron with Compost Manure, Mineral Nitrogen Fertilizer and Their Interactions during the two seasons of 2009/ 2010 and 2010 /2011

Treatments \ Characters		Plant length (cm)		No leaves/plant		No branches/plant		Fresh weight /Plant (g)		R.G.R	
		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
A	zero	43.52	45.64	11.07	11.58	1.94	1.90	9.59	11.28	60.44	59.15
	50 ppm	46.30	47.48	11.40	11.66	1.95	2.06	10.59	12.20	61.60	61.07
L.S.D. 5%		**0.049**	**0.174**	**0.028**	**0.020**	**0.008**	**0.015**	**0.004**	**0.008**	**0.012**	**0.037**
B	10 ton	1.75	1.74	8.71	10.80	41.65	43.30	10.35	10.45	54.26	54.08
	20 kg + 7.5 ton	1.85	1.82	9.62	11.08	43.30	45.00	10.71	11.01	55.87	53.25
	40 kg + 5.0 ton	1.90	1.87	10.11	11.23	44.95	46.45	11.08	11.70	59.38	61.19
	60 kg + 2.5 ton	2.29	2.41	11.36	13.17	47.45	49.05	12.25	12.80	68.68	67.79
	80 kg	1.93	2.07	10.67	12.43	47.20	49.01	11.80	12.15	66.92	64.25
L.S.D. 5%		**0.225**	**0.268**	**0.009**	**0.026**	**0.086**	**0.130**	**0.099**	**0.075**	**0.266**	**0.132**
0 Boron	10 ton	40.10	42.20	10.20	10.30	1.71	1.70	8.20	10.48	53.24	52.83
	20 kg + 7.5 ton	42.30	44.40	10.60	10.83	1.84	1.81	9.12	10.58	55.38	53.14
	40 kg + 5.0 ton	43.80	45.90	10.86	11.60	1.86	1.83	9.60	10.73	57.36	56.95
	60 kg + 2.5 ton	45.10	47.60	12.10	13.10	2.41	2.34	10.87	12.69	69.20	68.44
	80 kg	46.30	48.10	11.60	12.10	1.91	1.85	10.17	11.93	67.00	64.41
50 ppm Boron	10 ton	43.20	44.40	10.50	10.60	1.80	1.79	9.22	11.13	55.27	55.33
	20 kg + 7.5 ton	44.30	45.60	10.83	11.20	1.87	1.84	10.12	11.58	56.36	53.36
	40 kg + 5.0 ton	46.10	47.00	11.30	11.80	1.95	1.91	10.62	11.73	61.40	65.44
	60 kg + 2.5 ton	49.80	50.50	12.40	12.50	2.17	2.49	11.86	13.65	68.16	67.14
	80 kg	48.10	49.93	12.00	12.20	1.96	2.29	11.17	12.93	66.84	64.10
L.S.D. 5%		**0.122**	**0.184**	**0.103**	**0.107**	**0.017**	**0.021**	**0.013**	**0.023**	**0.377**	**0.186**

Table 4: Total yields and its components as affected by compost manure, mineral nitrogen fertilizer with foliar spring by boron and their interactions during the two seasons 2009/2010 and 2010 /2011.

Characters \ Treatments		No pods/plant		Green pod yield/plant(g)		Fresh pod weight (g)		Total green pod yield (Ton/ Fed)		Total dry seed yield (Kg / Fed)		Seed index	
		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
A	zero	8.48	8.58	36.09	37.32	4.31	4.34	5.48	5.67	875.02	907.75	32.38	34.49
	50 ppm	8.60	968.	37.42	39.66	4.46	4.61	5.78	6.02	929.48	964.52	32.40	34.53
L.S.D. 5%		**0.07**	**0.06**	**0.080**	**0.041**	**0.004**	**0.008**	**0.03**	**0.01**	**7.630**	**6.968**	**0.003**	**0.053**
B	10 ton	7.41	7.49	33.68	34.85	4.57	4.65	5.11	5.29	819.11	847.63	30.85	33.50
	20 kg + 7.5 ton	8.30	8.32	35.33	36.37	4.25	4.36	5.29	5.52	852.53	884.66	31.53	34.08
	40 kg + 5.0 ton	8.77	8.83	36.82	38.06	4.19	4.30	5.60	5.78	895.50	925.83	31.84	34.39
	60 kg + 2.5 ton	9.15	9.20	42.56	43.78	4.81	4.75	6.47	6.65	1035.28	1064.76	34.25	35.63
	80 kg	9.07	9.08	39.36	39.38	4.11	4.32	5.68	5.98	908.81	957.80	33.47	34.95
L.S.D. 5%		**0.07**	**0.05**	**0.118**	**0.039**	**0.021**	**0.020**	**0.09**	**0.01**	**6.471**	**7.001**	**0.003**	**0.044**
0 Boron	10 ton	7.33	7.49	32.70	33.84	4.45	4.51	4.97	5.14	795.36	823.00	30.84	33.49
	20 kg + 7.5 ton	8.21	8.30	34.39	35.31	4.16	4.25	5.20	5.36	822.83	858.80	31.52	34.07
	40 kg + 5.0 ton	8.74	8.85	35.75	36.96	4.08	4.17	5.43	5.61	869.43	898.90	31.83	34.38
	60 kg + 2.5 ton	9.10	9.19	41.33	42.50	4.87	4.62	6.28	6.46	1005.13	1033.76	34.24	35.59
	80 kg	9.04	9.07	36.28	38.00	4.00	4.17	5.51	5.67	882.33	894.23	33.47	34.93
50 ppm Boron	10 ton	7.50	7.49	34.66	35.87	4.68	4.78	5.26	5.45	842.86	872.26	30.86	33.51
	20 kg + 7.5 ton	8.38	8.35	36.28	37.43	4.34	4.46	5.38	5.69	882.23	910.46	31.54	34.10
	40 kg + 5.0 ton	8.81	8.81	37.89	39.17	4.30	4.44	5.76	5.95	921.56	952.76	31.85	34.41
	60 kg + 2.5 ton	9.21	9.22	43.80	45.05	4.75	4.88	6.65	6.84	1065.43	1095.76	34.27	35.68
	80 kg	9.09	9.10	34.45	40.76	4.22	4.47	5.84	6.19	935.30	991.36	33.48	34.96
L.S.D. 5%		**0.08**	**0.07**	**0.067**	**0.056**	**0.024**	**0.028**	**0.02**	**0.01**	**6.77**	**6.41**	**1.33**	**1.45**

Table 5: Chemical Parameters as Affected by Foliar Spring by Boron with Compost Manure, Mineral Nitrogen Fertilizer and Their Interactions during the two seasons 2009 / 2010 and 2010 /2011

Treatments \ Characters		N %		P %		K %		Protein %		Total sugar%		Carbohydrates%	
		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
A	zero	3.033	3.111	0.431	0.430	1.445	1.450	18.960	19.446	16.425	17.410	50.850	52.449
	50 ppm	3.065	3.163	0.440	0.442	1.456	1.468	19.157	19.768	16.460	17.447	50.912	52.442
L.S.D. 5%		**0.001**	**0.001**	**0.002**	**0.007**	**0.002**	**0.003**	**0.007**	**0.005**	**0.003**	**0.009**	**0.009**	**0.008**
B	10 ton	2.904	2.913	0.312	0.314	1.327	1.334	18.150	18.198	15.836	16.948	49.564	50.807
	20 kg + 7.5 ton	2.926	2.928	0.390	0.395	1.406	1.418	18.289	18.307	15.915	16.980	50.038	51.762
	40 kg + 5.0 ton	2.988	3.000	0.465	0.467	1.431	1.446	18.675	18.755	16.033	16.737	51.334	51.980
	60 kg + 2.5 ton	3.300	3.506	0.510	0.508	1.592	1.594	20.625	21.914	17.924	18.826	52.061	54.049
	80 kg	3.129	3.338	0.500	0.496	1.497	1.504	19.556	20.862	16.505	17.399	51.408	53.630
L.S.D. 5%		**0.003**	**0.002**	**0.001**	**0.007**	**0.002**	**0.001**	**0.023**	**0.017**	**0.003**	**0.007**	**0.005**	**0.003**
0 Boron	10 ton	2.879	2.887	0.308	0.310	1.324	1.331	17.994	18.027	15.819	16.931	49.535	50.944
	20 kg + 7.5 ton	2.901	2.904	0.387	0.391	1.401	1.397	18.135	18.156	15.898	16.963	50.007	51.732
	40 kg + 5.0 ton	2.961	2.975	0.460	0.463	1.425	1.440	18.506	18.594	16.016	16.887	51.303	51.950
	60 kg + 2.5 ton	3.299	3.480	0.505	0.503	1.585	1.587	20.619	21.753	17.907	18.804	52.030	54.019
	80 kg	3.128	3.312	0.495	0.486	1.490	1.497	19.550	20.700	16.488	17.465	51376	53.600
50 ppm Boron	10 ton	2.929	2.939	0.317	0.319	1.330	1.337	18.306	18.369	15.854	16.966	49.594	50.671
	20 kg + 7.5 ton	2.951	2.953	0.394	0.400	1.412	1.439	18.444	18.453	15.933	16.998	50.070	51.792
	40 kg + 5.0 ton	3.015	3.026	0.471	0.472	1.438	1.453	18.844	18.917	16.051	16.588	51.366	52.010
	60 kg + 2.5 ton	3.301	3.532	0.516	0.514	1.600	1.602	20.361	22.075	17.942	18.849	52.093	54.079
	80 kg	3.130	3.364	0.506	0.507	1.504	1.511	19.562	21.025	16.523	17.333	51.440	53.660
L.S.D. 5%		**0.005**	**0.002**	**0.007**	**0.009**	**0.003**	**0.002**	**0.032**	**0.034**	**0.022**	**0.024**	**0.011**	**0.014**

Yield and its components

The interaction between boron and nitrogen fertilizers with compost had significant effects on number of pod/ plant, weight of pod/ plant, total green pod yield, dry seed yield and weight of 100 dry seeds in the two seasons. This increment reached to be (11.9, 10.5%) in 1st season and 10.4, 10.5%) in 2nd season for total green yield and dry seed yield, respectively. The addition of inorganic nitrogen fertilizer rate of 60 kg fed^{-1} + compost at rate of 2.5 ton fed^{-1} with boron at 50 ppm resulted in high values for all traits.

Chemical composition

The interaction between boron and nitrogen fertilizers with compost had no significant effect N, P, K content, protein%, total sugar and carbohydrate % in fresh seed pea in the two seasons. The addition of inorganic nitrogen fertilizer at 60 kg fed^{-1} + compost at 2.5 ton fed^{-1} with boron at 50 ppm resulted in the height values for the traits under study (Table 5).

Conclusion

The assessment of application of compost manure and mineral nitrogen fertilizer with foliar spraying by boron on pea and its effect on growth, yield and chemical composition enhanced vegetative growth, yield and its components and seed quality traits. The application of nitrogen fertilizer in compost form at 2.5 ton fed^{-1} and inorganic N- fertilizer at 60 kg fed^{-1} with foliar spray with boron (boric acid 17 % B) at 50 ppm in pea field were the most effective treatment for improving seed quality and increasing yield.

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