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EFFECT OF PEANUT COMPOST AND /OR COBALT APPLICATION ON COWPEA PLANTS GROWTH, YIELD PARAMETERS AND NUTRIENTS CONTENT.

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ABSTRACT

A pot experiment was conducted to study the effect of two levels of cobalt (0 & 7.5 ppm) and peanut compost rates (0, 5, 10, 15 and 20 ton/fed.) on growth, nodules formation, yield and nutrients status of cowpea plants were grown in Nobaria farm as a newly reclaimed soil.

The obtained results revealed that addition of cobalt (7.5 ppm) significantly increased plant growth, nodules number, fresh and dry weights of shoots and roots contents of (N, P, K, Co and Mn) in the different parts of cowpea plants, yield parameter, as well as protein percentage of grains as compared to the plants which untreated with cobalt. Iron content had another trend, where it decreased by cobalt addition.

Peanut compost rates significantly increased all the growth, yield parameters and nutrients content as compared to control treatment. The highest values were obtained by addition of 15 ton/fed peanut compost except iron content, followed by 20, 10 and 5 ton/fed in decreasing order.

The interaction between cobalt and peanut compost rate significantly affected all the mentioned parameters. The highest values of all the studied parameters except iron content were obtained by cobalt addition (7.5 ppm) in combination with rate of 15 ton/fed.

Keywords: peanut compost, cowpea, cobalt, nutrients status, nodules formation.

INTRODUCTION

Soils of Egypt are poor in organic matter not exceeding 2% Balba, (1976). The practical way to improve the quality of soils with a low organic matter content is the addition of organic materials to the soil either fresh or composted (Pascual *et al.*, 1999). Organic materials such as crop residues, farmyard manure, town refuses, rice straw, cotton stalks, water hyacinth compost, peanut compost, banana waste are available in abundance and reach tremendous amounts day after day. Accordingly, it seems logic to utilize by such residues through some types of profitable activities instead of their acting as environmental pollutants. Addition of composts improves soil chemical and physical properties. Increasing soil water holding capacity and improves soil structure and aggregates. Chemical properties including, decreasing soil pH, increase of cation exchange capacity and enhance of the availability of the most nutrients which are important for plant growth and agricultural production. Application rate in addition with chemical fertilization ranged between 10 to 20 tons/fed. (El- Kherbawy *et al.*, 2005 and Abo-Sedra, 2006).

Cobalt is an essential element for legumes due to its essentiality for the micro-organisms fixing atmospheric nitrogen, Young (1983); and Riley and Dilwarth, (1986). Cobalt also, is a beneficial element for other plants.

Markova (1996) added that the applied initially increased the efficiency of the symbiotic N fixation and gave similar yield increases in soybean plants. Moreover, the addition of cobalt increased the nodules formation of root and atmospheric nitrogen fixation by micro-organisms which increase the nitrogen content in cowpea plants more than the addition of organic fertilizer alone (Abdel-Moez and Nadia Gad, 2002).

The aim of this experiment was conducted to study the effect of organic compost with and without cobalt on growth, yield parameter, and nutrients status of cowpea plants.

MATERIALS AND METHODS

Soil samples were collected from National Research Centre (NRC) farm in El-Nobaria. Pot experiments were conducted in the green house of the (NRC). Some physical and chemical properties of the used soils are determined by cottenie *et al.*, (1982) and presented in Table (1).

Table (1): Some physical and chemical properties of El-Nobaria soil.

Particle size distribution				Field capacity (%)
Sand (%)	Silt (%)	Clay (%)	Soil Texture	
82.6	14.6	2.8	Sandy loam	14.4

Chemical properties						
EC dsm^{-1}	pH (1:2.5)	$CaCO_3$ (%)	O.M (%)	Cobalt (ppm)		
				Soluble	Available	Total
0.18	8.0	4.17	0.12	0.34	1.67	7.66

Soluble cations (meq L^{-1})				Soluble anions (meq L^{-1})			
Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CO_3^{-}	HCO_3^{-}	Cl^{-}	$SO_4^{=}$
2.5	1.4	0.268	1.18	-	1.60	0.6	2.04

Total N (mg/100g)	Available (mg/100g)		Available micronutrients (ppm)			
	P	K	Fe	Mn	Zn	Cu
15.1	1.30	12.3	4.47	2.61	1.44	4.0

Peanut compost was added at four rates (5, 10, 15 and 20 tons/fed.) with and without the soil addition of (7.5 ppm cobalt) as cobalt sulfate. The basic amounts of added mineral fertilizers were 100 kg/fed ammonium sulfate, 150 kg/fed. superphosphate and 50kg/fed. potassium sulfate. Peanut compost was prepared by the method of Abdel-Moze and Wanas, (2001). Some properties of the prepared compost are presented in Table (2).

Table (2): Some chemical properties of peanut compost.

O.M. %	Total N %	C/N ratio	pH (1:2.5)	EC dSm^{-1}	Available nutrients %		DTPA- extractable (ppm)			
					P	K	Fe	Mn	Zn	Cd
36.18	1.40	25.84	6.5	0.62	1.60	980	30.0	9.0	11.60	1.10

The experimental design was factorial experimental in complete randomized with three replicates in plastic pots, 10 kg capacity of air dried soil. Seeds of cowpea *(Vigna Sinensis*) which were previously inoculated with the specific strain of cowpea *Rhizobia* (Okadin) were sown in each pot by pressing them into soil to depth of 1 cm. The pots were watered daily to 70% of water holding capacity by weighing pots then thinned out to 4 seedlings per pot after 15 days and allowed for a period of 90 days.

All the plant analyses were determined using the standard method described by Jackson, 1973 and Lindsay and Norvell, 1978. Total protein of cowpea seed was calculated as total N % × 6.25.

All data were subjected to statistical analysis according to procedure outlined by Snedecor and Cchran (1980). Treatment means were compared by L.S.D test.

RESULTS AND DISCUSSION

Length of plant, no. of nodules/plant, no. and length of pods, fresh and dry weights of roots and shoots of cowpea plants grown on El-Nobaria soil treated with peanut compost with and without cobalt are presented in Table (3). Data show that all yield parameters are significantly increased by using the peanut compost with or without cobalt addition comparing with the control. These increases may be due to the increased rhizosphere aggregates stability which might have favored the beneficial microbes which in turn could have contributed to improve biomass. Such increases also could be due to the positive effect of compost on improving nutritional status and nutrients release and hence their availability to the growing plants as well as improving soil physical properties (Caravaca *et al.*, 2002). Peanut compost treatments with cobalt reveal that significantly increased all the yield parameters compared to peanut compost treatment without cobalt. The highest value of weight of pods/pot of cowpea plants were obtained when 7.5 ppm cobalt+ 15 ton/fed peanut compost was used. These results are in harmony with those of Sowicki (2002) who found that cobalt increased fodder hay yield compared to NPK fertilizers alone. Favorable growth responses associated with low cobalt level are attributed to low Catalase and Peroxidase enzymes activities more than the high levels of cobalt. These enzymes are known to induce plant respiration possibly resulting in successive consumption for products of photosynthesis and subsequently reduction in plant growth, Flanagam and Owens (1985). These results agree with those obtained by Abdel-Moez and Nadia Gad, (2002) and Hala kandil, (2007) who found that the addition of cobalt increased the nodules formation of root and atmospheric nitrogen fixation by microorganisms which increase the nitrogen content in cowpea and faba bea plants more than the addition of organic fertilizer alone. Cobalt increased the effect of 15 ton/fed. peanut compost on dry weight (shoots and roots) by 26.3 and 31.6 %, respectively compared with peanut compost alone on cowpea plants. In fact these results agree with those obtained by Bibak (1994) who found that cobalt increased the organic fertilizers by 33% compared to organic fertilizer alone.

Table (3): Effect of peanut compost with and without cobalt on fresh, dry weight and yield parameters in cowpea plant.

Peanut compost (ton/fed)	Length of plant (cm)	No. of nodules/ plant	Length of pod (cm)	No. of pods/ plant	Fresh weight (g)		Dry weight (g)		Weight of pods/ pot (g)
					Shoots	Roots	Shoots	Roots	
Without cobalt addition									
Control	22.70	2.0	6.5	8.0	12.48	3.89	1.82	0.75	44.20
5	24.50	3.0	8.1	9.0	29.11	12.00	4.26	2.16	49.70
10	27.10	5.0	9.6	13.0	35.29	15.70	5.16	2.84	61.80
15	30.00	8.0	11.0	22.0	44.96	17.80	6.42	3.22	73.00
20	28.20	7.0	10.1	19.0	41.88	16.33	5.65	3.04	68.50
Mean	26.48	5.0	9.1	14.2	32.74	13.14	4.66	2.40	59.44
With 7.5 ppm cobalt									
Control	41.20	6.0	8.7	11.0	13.85	5.16	2.00	0.91	60.51
5	43.00	7.0	10.1	16.0	35.86	13.15	5.24	2.42	93.00
10	46.10	10.0	11.4	23.0	42.95	16.46	6.32	3.50	125.20
15	48.20	13.0	13.7	26.0	56.00	18.96	8.11	4.24	141.60
20	47.50	11.0	12.1	24.0	46.48	17.16	7.75	3.92	132.90
Mean	45.20	9.4	11.2	20.0	39.03	14.18	5.88	3.00	110.64
Mean of control	31.95	4.0	7.6	9.5	13.17	4.53	1.91	0.83	52.36
Mean of 5 ton	33.75	5.0	9.1	12.5	32.29	12.58	4.75	2.29	71.35
Mean of 10 ton	36.60	7.5	10.5	18.0	39.12	16.08	5.74	3.17	93.50
Mean of 15 ton	39.10	10.5	12.4	24.0	50.48	18.38	7.27	3.73	107.30
Mean of 20 ton	37.85	9.0	11.1	21.5	44.18	16.75	6.70	3.48	100.70
L.S.D 5% of peanut	0.82	1.41	1.62	0.88	1.63	0.86	0.29	0.32	1.25
L.S.D 5% of cobalt	0.87	1.15	1.60	0.71	1.69	0.30	0.28	0.33	1.08
L.S.D 5% of Pea*Co	1.02	1.51	1.61	0.91	1.71	0.96	0.33	0.36	1.38

Concerning N, P and K content in the different parts of cowpea plants and protein%, data in Table (4) showed that the application of peanut compost increased the content of N, P and K. The addition of 7.5 ppm cobalt with peanut compost gave a significant beneficial effect on macronutrients (N, P and K) in shoots, roots and grains of the cowpea plants compared to control. These results agree with those obtained by Castro *et al.*, (1996); Abdel-Moez and Nadia Gad, (2002); Basu *et al.*, (2006) and Hala Kandil (2007) who stated that cobalt addition had a primitive effect for better status of N, P and K in tomato, cowpea, groundnut and faba bean plants.

The highest values of micronutrients in shoots, roots and grains were found at 15 ton/fed peanut compost with cobalt. Generally, data show that the content of grain from N, P and K values were higher than those of shoots and roots of cowpea plants. Data also reveal that applying the cobalt with peanut compost highly increased (%) protein in grains at 15 ton/fed peanut compost with 7.5 ppm cobalt treatment compared to control.

Table (4): Effect of peanut compost with and without cobalt on protein and macronutrients content in parts of cowpea plant.

Peanut compost (ton/fed)	Shoots (%)			Roots(%)			Grains(%)			Protein %
	N	P	K	N	P	K	N	P	K	
Without cobalt addition										
Control	0.46	0.22	1.20	0.38	0.07	0.17	0.78	0.36	1.32	4.88
5	0.84	0.30	1.32	0.42	0.11	0.32	1.16	0.49	1.47	7.25
10	1.42	0.44	1.48	0.47	0.13	0.69	1.98	0.58	1.56	12.38
15	1.57	0.62	1.69	0.66	0.22	0.80	2.31	0.74	1.75	14.44
20	1.49	0.53	1.64	0.55	0.15	0.71	2.38	0.69	1.62	14.88
Mean	1.16	0.42	1.47	0.50	0.14	0.54	1.72	0.57	1.54	10.77
With 7.5 ppm cobalt										
Control	0.68	0.26	1.32	0.53	0.10	0.19	0.93	0.41	1.46	5.81
5	1.12	0.41	1.47	0.68	0.13	0.42	1.60	0.56	1.58	10.00
10	1.56	0.53	1.76	1.50	0.19	0.71	2.15	0.68	1.74	13.44
15	1.73	0.67	1.87	1.68	0.26	0.86	3.65	0.82	1.89	22.81
20	1.68	0.61	1.78	1.65	0.21	0.78	3.64	0.75	1.78	22.00
Mean	1.35	0.50	1.64	1.21	0.18	0.59	2.39	0.64	1.69	14.81
Mean of control	0.57	0.24	1.26	0.46	0.09	0.18	0.86	0.39	1.39	5.35
Mean of 5 ton	0.98	0.36	1.40	0.55	0.12	0.37	1.38	0.53	1.53	8.63
Mean of 10 ton	1.49	0.49	1.62	0.99	0.16	0.70	2.07	0.63	1.65	12.91
Mean of 15 ton	1.65	0.65	1.78	1.17	0.24	0.83	2.98	0.78	1.82	18.63
Mean of 20 ton	1.59	0.57	1.71	1.10	0.18	0.75	3.01	0.72	1.70	18.44
L.S.D 5% of peanut	0.07	0.06	0.07	0.06	0.03	0.03	0.14	0.05	0.05	-
L.S.D 5% of cobalt	0.11	0.04	0.04	0.03	0.03	0.04	0.17	0.05	0.05	-
L.S.D 5% of Pea*Co	0.09	0.07	0.08	0.07	0.04	0.05	0.19	0.07	0.07	-

Data presented in Table (5) show that the application of cobalt with peanut compost to the soil improved the availability of micronutrients plant cntent except Fe. The highest values of Co and Mn in shoots, roots and grains were found when the peanut treatment of 15 ton/fed. with cobalt was used. These results could be referred to the slow release of nutrients through the decomposition process of organic compost. These results agree with those obtained by Ismail *et al.*, (1996) who found that the soil addition of cattle manure at rates of 1, 2, 4 and 8 % increased the availability and uptake of micronutrients by maize plants. The highest contents of Fe were found under the treatment 15 ton/fed. peanut compost without cobalt. The obtained results of iron are in accordance with those found by Bisht (1991) and Blaylock *et al.*, (1995) who showed certain antagonistic relationship between Co and Fe. Also, Atta- Aly *et al.*, (1998); Abdel-Moez and Nadia Gad, (2002) and Hala kandil (2007) found that cobalt and iron were competitive elements in the nutrition of tomato, cowpea and faba bea plants.

Data in Table (5) show that the content of all the studied micronutrients in roots of cowpea were higher than those obtained in shoots and grains in decreasing order with all treatments.

The interaction between cobalt addition and peanut compost rates significantly affected the content of all macro and micronutrients in the different parts of cowpea plants (Tables 4 & 5). The presented data show that

cobalt application in combination with peanut compost to the soil improved the availability of macro and micronutrients except Fe. The highest values of N, P, K, Co and Mn in roots, shoots and grains of cowpea plants, were found by addition of 15 ton/fed peanut compost and of 7.5 ppm cobalt, while the highest values of Fe content were found by using 20 ton/fed peanut compost without cobalt addition. Generally, data presented in Tables 4 and 5 show that the highest N, P and K values were found in grains followed by shoots and roots in decreasing order.

Table (5): Effect of peanut compost with and without cobalt on micronutrients content in parts of cowpea plant.

Peanut compost (ton/fed)	Shoots (ppm)			Roots(ppm)			Grains(ppm)		
	Co	Fe	Mn	Co	Fe	Mn	Co	Fe	Mn
Without Cobalt addition									
Control	0.11	32.4	21.5	0.40	35.9	23.2	0.7	1.00	0.15
5	0.69	64.8	32.8	0.70	66.2	36.4	0.8	1.11	0.26
10	0.75	102.9	45.2	1.26	105.8	48.4	0.9	1.60	0.52
15	0.98	110.6	56.2	1.32	113.9	57.9	1.0	1.70	0.64
20	1.02	125.2	63.8	1.30	130.0	66.2	1.0	1.68	0.68
Mean	0.71	87.18	43.9	1.00	90.36	46.42	0.88	1.42	0.45
With 7.5 ppm cobalt									
Control	0.49	47.5	33.2	0.80	49.2	35.4	1.0	1.10	0.22
5	1.95	89.9	48.6	3.42	92.6	52.7	1.7	1.50	0.34
10	2.26	88.6	56.8	4.06	89.2	58.3	2.0	1.42	0.61
15	2.89	86.0	66.1	4.46	88.6	69.2	2.5	1.32	0.72
20	2.66	84.3	65.9	4.11	86.4	64.3	2.2	1.24	0.69
Mean	2.05	79.26	54.12	3.37	81.2	55.98	1.88	1.32	0.52
Mean of control	0.30	39.95	27.35	0.60	42.55	29.3	0.85	1.05	0.19
Mean of 5 ton	1.30	77.35	40.70	2.06	79.40	44.55	1.25	1.31	0.30
Mean of 10 ton	1.51	95.75	51.00	2.66	97.50	53.35	1.45	1.51	0.57
Mean of 15 ton	1.94	98.30	61.15	2.89	101.25	63.55	1.75	1.51	0.68
Mean of 20 ton	1.84	104.75	64.85	2.71	108.20	65.25	1.60	1.46	0.69
L.S.D 5% of peanut	0.07	0.61	0.80	0.06	0.95	0.70	0.23	0.13	0.16
L.S.D 5% of cobalt	0.11	1.38	0.81	0.06	0.97	0.74	0.14	0.06	0.09
L.S.D 5% of Pea*Co	0.13	0.90	0.95	0.07	0.99	0.81	0.28	0.17	0.16

In conclusion, the low concentration of cobalt (7.5ppm) with peanut compost had a promotives effect on plant growth, yield parameters, macro and micronutrients content of cowpea plants.

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تأثير أضافة مخلفات الفول السودانى المكمورة وعنصر الكوبلت على نمو و صفات المحصول والمحتوى المعدنى لنبات اللوبيا

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تم اجراء تجربة أصص بصوبة المركز القومى للبحوث بالدقى لدراسة تأثير أضافة مخلفات الفول السودانى المكمورة بمعدلات مختلفة (صفر، 5، 10، 15، 20 طن للفدان) و عنصرالكوبلت بمعدل (صفر-7.5 جزء فى المليون) على النمو و عدد العقد الجذرية والمحصول و المحتوى المعدنى لنبات اللوبيا فى أرض مستصلحة حديثاً (منطقة النوبارية)0

أشارت النتائج الى أن:-

- أضافة عنصر الكوبلت أعطت زيادة معنوية على نمو النبات و عدد العقد الجذرية و كذلك الوزن الطازج والوزن الجاف لكل من السيقان و الجذور و كذلك على محتوى النبات بأجزائة المختلفة من كلا من (النيتروجين- الفوسفور- البوتاسيوم- كوبالت- منجنيز) كما زادت نسبة البروتين فى الحبوب بالمقارنة بالكنترول بينما أتخذ عنصر الحديد أتجاهاً عكسياً مع المعاملة بعنصر الكوبلت لوجود علاقة تنافسية بينهما.
- أضافة مخلفات الفول السودانى المكمور كسماد عضوى للتربة أعطت زيادة فى معنوية فى النمو و المحصول و التركيب المعدنى للنبات بالمقارنة بالكنترول بأستثناء عنصر الحديد.
- المعاملة بمخلفات الفول السودانى المكمور بالمعدل 15 طن لفدان مع التركيز 7.5 جزء فى المليون كوبلت أعطت أفضل تأثير على كل قياسات النمو و المحصول مقارنة بالكنترول و المعدلات الاخرى0