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EFFECT OF SOME SOURCES OF PHOSPHORUS FERTILIZER ON THE GROWTH AND YIELD OF COWPEA PLANT

Ali, Aisha H.

Department of Horticulture , National Research Centre, Dokki, Cairo , Egypt .

ABSTRACT

Two field experiments were carried out during two successive seasons of 1998 and 1999 at the experimental station of National Research Centre in Shalakan , to study the response of cowpea plant to chemical and bio phosphorus fertilizers . Each experiment included 3 rates of chemical phosphorus fertilizer , i.e. 0 , 150 and 300 kg/fed.as super phosphate , and 3 rates of phosphorine (bio-phosphorus) , i.e. 0, , 14 and 21 g/kg of seeds .

The important obtained results are shown as follows :

The addition rate of phosphorus up to 300 kg/fed. as super-phosphate per feddan had a gradual increase in values of length of plant , average number of leaves and shoots as well as fresh and dry weight of whole plant and its different organs. Treating seeds of cowpea before sowing by phosphorine at rate of 14 g/kg and/or 21 g/kg of seeds gave a considerable effect on the growth characters of cowpea plant during the two seasons. The best growth of cowpea plant , as expressed by fresh and dry weight of whole plant and its different parts recorded its highest values when chemical phosphorus at rate of 300 kg/fed. was added and Bio-phosporus (phosphorine) was applied at rate of 21 g/kg of seeds . The highest concentration N, P and K in leaf and/or shoot tissues were recorded when phosphorine at rate of 21 g/kg of seeds as well as chemical phosphorus fertilizer at rate of 300 kg/feddan were added. Addition of chemical phosphorus as super phosphate at rate upto 300 kg/fed. had a significant increase in total yield of dry seeds .Also the interaction treatments of chemical X bio-phosphorus fertilizers caused an increase in total yield of dry seeds .

INTRODUCTION

Cowpea is one of the most important vegetable shown great success in the new reclaimed land. The new Bio- phosphorus (phosphorine) is widely used now in Egypt particularly in new reclaimed land . This system was found to save amounts of chemical super- phosphate fertilizer . There are insufficient information on scientific basis of the relation of Bio-fertilizer and chemical fertilizer application in such soil and their relation to plant growth . Many investigators studied the effect of phosphorus on growth of cowpea and/or other crops such as Sanchez *et al.*, 1986 ; Hundal *et al*., 1990 ; Bationo *et al*., 1992; Kang *et al.*, 1993 ; Jayapaul and Purushothaman 1995 ; Pande *et al*., 1995 on Sugarcane; John *et al.*, 1996 on sorghum, rice and soyabean; and Lal , 1997 on maize and cowpea . On other side, Bhagwan *et al.*, 1997 ; Okeleye and Okelana 1997 and Mayz and Cartwright 1998 reported that phosphorus addition affected total yield and its quality . On other side , Mishra and Patjoshi , 1995 on Okra ; Mba , 1996 ;Sattar *et al*. , 1996 on grain legumes and Selvi *et al.*, 1997 studied that the

response of plant to the bio-phosphorus fertilization and reported that plants which received bio-phosphorus fertilizer resulted in the better plant growth and the higher yield .

The aim of this study was to find out the effect of different rates of chemical phosphorus fertilizer and/or bio-phosphorus fertilizer on cowpea growth and yield .

MATERIAL AND METHODS

Two field experiments were carried out during the seasons of 1998 and 1999 at the Experimental Station of National Research Centre at Shalakan to investigate the response of cowpea plant to chemical and bio phosphorus fertilizer on growth and yield of cowpea.

Seeds of cowpea (Karim 7) were sown on 28th , 21st April of 1998 and 1999 respectively . The soils of the experimental field were clay loam in mixture in both two seasons and EC. 0. 23 mmhos/cm, PH 7.80 and available nitrogen of 141 meg/100g.soil , phosphorus of 4.9 meg/100g.soil and exchange-able K 0.32 meg/100g.soil in 1st season .These values are : EC of 1.05 mmohs/cm , pH of 7.88 , available N 183 meg/100g soil , phosphorus 5.01 meg/100g. Soil exchangeable K of 0.51 meg/100g.soil in 2nd season .

Each experiment included 3 rates of chemical phosphorus fertilizer, i.e. 0, 150 and 300 kg/fed. as super phosphate , and 3 rates of phosphorine (Bio-phosphorus) , i.e. 0 , 14 and 21g/kg of seeds . The chemical phosphorus was added before sowing and during preparing the soil for planting , but the phosphorine was mixed with cowpea seeds before sowing . The design of the experiment was split-plot one time with 4 replicates , where the chemical phosphorus distributed in the main plots and phosphorine treatments arranged in sub-plots . The area of sub-plot was11.2 m^2 including 4 ridges , 70 cm width and 4.0 meter long . The normal cultural treatments of growing cowpea were practised as usually followed in the commercial production of cowpea. During the vegetative growth period , sample of 10 plants were taken at 75 day after sowing and the following parameters were recorded : length of plant , number of leaves/plant shoots , fresh and dry weight of whole plant and its different organs . Also chlorophylls content was estimated according to the method described by Wettestein (1957). Nitrogen , phosphorus and potassium content etermined in tissues of leaves and shoots using the methods of Troug and Mayer (1939) , Brown and Lilleland (1946) respectively .

At harvesting, dry seed weight was collected and the following criteria were recorded : length of pod , number and weight of pods / plant , weight of 100 dry seeds as well as the total yield of dry seeds as kg/fed.

All obtained data were subjected to statistical analysis of variance according to the procedure out lined by Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

A- Plant Growth Characteristics:

1- Effect of chemical phosphorus fertilizer:

All parameters of growth characters of cowpea plant influenced significantly by the different rats of chemical phosphorus fertilizers . These findings were true in both two experimental seasons.

However, with increasing the addition rate of phosphorus up to 300 kg/fed. as super- phosphate had a gradual increase in length of plant , average number of leaves and/or shoots as well as the fresh and dry weight of whole plant and its different organs (leaves and shoots) . It means that , the highest cowpea plants which carried the highest number and heaviest weight of leaves and shoots were resulted when phosphorus was added at rate of 300 super- phosphate per fed. On the contrary the lowest values of plant growth characters were obtained with plants of control .

Table (1): Effect of chemical phosphorus fertilizer on the vegetative growth characters of cowpea plant during 1998 and 1999 seasons .

Character phosphorus addition kg/fed	Plant length (cm)	No. of leaves/ Plant	No. of shoots/plant	Fresh weight g/plant			Dry weight g/plant		
				Leaves	Shoots	Total	Leaves	Shoots	Total
1st Season (1998)									
0	22.89	13.33	2.22	34.96	18.42	53.38	10.02	6.19	16.21
150	27.89	25.00	3.33	79.84	26.12	105.96	19.45	7.47	26.91
300	33.55	29.77	4.0	107.89	44.02	151.91	37.54	11.39	48.93
L.S.D. at 5%	2.00	1.40	0.40	6.20	2.55	--	0.66	0.52	--
2nd Season (1999)									
0	25.77	11.45	2.22	25.35	17.04	42.39	7.89	5.20	13.09
150	29.11	23.89	3.0	68.52	23.65	92.17	23.90	7.10	31.0
300	35.56	30.78	3.11	101.05	38.14	139.19	38.08	10.24	48.32
L.S.D. at 5%	0.91	0.96	0.62	4.58	3.85	--	1.58	0.64	--

These results are similar in both two seasons of the study . Many investigators had the same trend such as Smith, *et al*. (1990); Kretzschmar *et al*. (1991) ; Szegi *et al.* (1991) Deb and Bora (1996) and Doube *et al*. (1997). All of them worked on leguminasea . From other side phosphorus fertilizer encouraged the plant growth of cowpea plant , due to its functions as a part of the enzyme system having a vital role in the synthesis of other foods from carbohydrates . Also , it is a constituent of nuclear proteins (Denisen , 1979) .

2- Effect of Bio-phosphorus fertilizer :

Treating seeds of cowpea before sowing by phosphorine at rates of 14 g/kg and/or 21 g/kg of seeds gave a considerable effect on the growth characters of cowpea plant during the season of 1998 and 1999 compared to the un-treated one . Whereas, values of length , number of leaves and/or shoots , fresh and dry weight of whole plant and its different parts ; all of them recorded their highest values when the cowpea seeds treated with the highest rate , i.e.21 g/kg .

Table (2) : Effect of Bio-phosphorus fertilizer on the vegetative growth of cowpea during 1998 and 1999 seasons .

Characters Phosphorine rate	Plant length	No. of leaves/ plant	No. of shoots/ plant	0Fresh weight g/plant		Dry weight g/plant			
				Leaves	Shoots	Total	Leaves	Shoots	Total
1 st Season (1998)									
0	26.11	18.44	2.66	50.66	24.27	74.93	11.91	7.06	18.97
14 g/kg of seeds	27.89	22.33	3.22	75.55	29.23	104.78	24.34	8.39	32.73
21 g/kg of seeds	30.33	27.33	3.67	96.48	35.06	131.54	30.76	9.59	40.35
L.S.D.at 5%	1.53	2.11	0.52	5.18	2.07	--	2.42	0.43	--
2 nd Season (1999)									
0	27.89	17.22	2.22	47.07	21.19	68.26	14.33	6.44	20.77
14 g/kg of seeds	29.89	21.67	2.77	64.17	24.85	89.02	26.74	7.64	34.38
21 g/kg of seeds	32.67	27.22	3.34	83.69	32.79	116.48	28.81	8.46	37.27
L.S.D at 5%	1.26	1.00	0.56	3.44	2.95	--	1.29	0.72	--

These results held good in both two experiments . Moreover, the superiority of that treatment of 21 g/kg of seeds over the un-treatment one amounted by 75.5 and 112.7% respectively for fresh and dry weight of whole plant , in 1st season , and amounted by 70.6 and 79.4% for the same respective in 2nd season . The obtained data are in good accordance with that which recorded by Mba , (1996) and Sattar *et al.*, (1996) .

3- Effect of the interaction between Chemical and Bio-phosphorus fertilizer:

There were no significant effects of the interaction treatments on length of plant and number of leaves in 1st season(Table 3) , and number of shoots in 2nd season (Table 3) , except that of the interaction treatments had a significant effect on the growth characters of cowpea plant . Generally , at different levels of chemical phosphorus addition , treating cowpea seeds by the bio-phosphorus resulted an increase in all plant growth parameters .

These results were similar in both two seasons . Moreover , the best growth of cowpea plant , as expressed by fresh and dry weight of whole plant and its different parts registrated its highest values when the chemical phosphorus at rate of 300 kg/fed. and bio-phosphorus (phosphorine) at rate of 21 g/kg of seeds were applied . On the contrary ,the poorest plant growth was noticed with the un-treated plants (control treatment) . These trends were realy in 1st and 2nd seasons of experiments .

Table (3):Effect of the interaction between chemical and bio-phosphorus fertilizers on the vegetative growth characters of cowpea plant during 1998 and 1999 seasons .

Characters / P.rate / phosphorine rate		Plant height	No. of leaves	No. of shoots	Fresh weight (g/plant)		Dry weight (g/plant)	
					Leaves	Shoots	Leaves	Shoots
	1st season							
	0	21.33	10.67	2.33	22.08	14.98	8.80	5.80
	14 g/kg seeds	24.00	12.00	2.00	30.64	15.02	9.83	5.81
0	21 g/kg seeds	23.33	17.33	2.33	52.15	25.27	11.45	6.96
	0	25.67	21.33	3.00	60.21	26.67	10.90	7.02
150	14 g/kg	26.67	24.33	3.33	81.44	25.54	21.42	7.32
kg/fed.	21 g/kg	31.33	29.33	3.67	97.88	26.15	26.04	8.07
	0	31.33	23.33	2.67	69.70	31.16	16.03	8.37
300	14 g/kg	33.00	30.67	4.33	114.56	47.14	41.79	12.03
kg/fed.	21 g/kg	36.33	35.33	5.00	139.42	53.77	54.79	13.78
L.S.D.at 5%		N.S.	N.S.	0.91	8.98	3.58	4.20	0.75
2nd season								
	0	25.33	8.67	1.67	19.14	14.92	6.89	5.09
	14 g/kg seeds	25.33	10.00	2.33	21.14	14.93	7.99	5.17
0	21 g/kg seeds	26.67	15.67	2.67	35.76	21.28	8.79	5.35
	0	26.67	18.67	2.33	45.44	20.67	17.95	6.73
150	14 g/kg	30.00	24.67	3.00	70.64	22.36	26.13	6.80
kg/fed.	21 g/kg	30.67	28.33	3.67	89.48	27.91	27.62	7.78
	0	31.67	24.33	2.67	76.62	27.97	18.16	7.51
300	14 g/kg	34.33	30.33	3.00	100.72	37.27	46.09	10.95
kg/fed.	21 g/kg	40.67	37.67	3.67	125.82	49.17	50.02	18.26
L.S.D. at 5%		2.18	1.73	N.S.	5.96	5.10	2.23	1.26

B- Some chemical constituents :

1- Effect of chemical phosphorus fertilizers :

Table (4) presents , the significant effect of addition chemical phosphorus as super- phosphate on the N , P and K percentage in leaves and shoots tissues of cowpea plant as well as chlorophyll a and chlorophyll b in leaves tissues of 1998 and 1999 seasons .With increasing chemical phosphorus addition up to 300 kg of. super- phosphate /fed. , the nitrogen , phosphorus and potassium uptake increased to reach its maximum peak . These findings were true in leaves and shoots tissues of cowpea plants in the two experimental seasons . However , it is known that increasing the level of phosphorus raised the availability of NPK in the soil solution which favoured increased its concentrations in both leaves and shoots (Denisen , 1979) . Similar results were obtained by Kang *et al...*, (1993) and Parmar-DK ; *et al*., (1998) .

The response of chlorophylls in leaves tissues to the addition rates of chemical phosphorus in both two seasons , compeletly followed the same pattern of change like N , P or K . It means that , the highest values of chlorophylls were obtained with addition phosphorus at highest rate , i.e. 300 kg super- phosphate per feddan , but the opposite was happened , when no-phosphorus addition . Similar trend was registrated by Subramani *et al.* (1998).

Table (4): Effect of chemical phosphorus fertilizer on some chemical consistuents of cowpea plant at sampling time (60 days after sowing) in two experimental seasons of 1998 and 1999 .

Characters / P. rate	N%		P%		K%		Chlorophyll contents as mg/100 gm fresh wt. in Leaves tissues		
	Leaves	shoots	Leaves	Shoots	Leaves	shoots	Chloro-phyll (a)	Chloro-phyll (b)	Total chloro-phyll
1 st Season (1998)									
0	2.31	2.40	0.24	0.12	2.25	2.43	0.129	0.111	0.240
150 kg.	3.52	3.08	0.34	0.25	3.83	3.74	0.150	0.130	0.280
300 kg.	4.22	3.09	0.43	0.29	4.15	3.86	0.150	0.161	0.311
L.S.D.at 5%	0.34	0.17	0.03	0.017	0.12	0.24	0.004	0.017	0.04
2 nd Season (1999)									
0	2.80	2.46	0.26	0.23	3.05	2.28	0.131	0.085	0.216
150 kg.	3.72	3.01	0.35	0.29	3.79	3.03	0.149	0.088	0.237
300 kg.	4.0	3.33	0.45	0.30	4.48	3.73	0.163	0.129	0.292
L.S.D.at 5%	0.41	0.12	0.03	0.01	0.14	0.28	0.004	N.S.	0.03

2- Effect of biophosphorus fertilizer :

The effect of bio-phosphorus (phosphorine) addition at different rates on the percentage of N , P and K in leaves and shoots tissues as well as the chlorophyll contents in leaves tissues of 1998 and 1999 seasons are shown in Table (5) .

Seed treating with phosphorine before sowing caused an increase in the percentages of N , P and K , and with increasing the rate of phosphorine up to 21 g/kg of seeds the gradual increase in the elemental absorption increased to reach its highest peaks . These held good for leaves and shoots tissues in both two experiments . (Mishra and Patjoshi , (1995) ; Selvi *et al.*, (1997) had same trend of the results .

Regarding to the chlorophylls content in leaves tissues of cowpea plant , the obtained data (Table 5) revealed that the highest values were associated with addition 21 g phosphorine/kg of seeds . These findings held good in 1998 and 1999 season . Similar results were recorded by Subramani *et al*., (1998) on cowpea plants .

Table (5) Effect of bio-phosphorus (phosphorine) on some chemical consistuents of cowpea plant at sampling time (60 days after sowing) in two experimental seasons of 1998 and 1999.

Characters / Phospho-rine rate	N%		P%		K%		Chlorophyll contents as mg/100 gm fresh wt. in Leaves tissues		
	Leaves	Shoots	Leaves	Shoots	Leaves	Shoots	Chloro-phyll(a)	Chloro-phyll (b)	Total chloro-phyll
1 st Season (1998)									
0	2.60	2.3	0.28	0.18	2.86	2.87	0.131	0.093	0.224
14 gr./kg	3.62	2.94	0.35	0.23	3.52	3.56	0.148	0.143	0.291
21 gr./kg	3.83	3.1-	0.39	0.25	3.85	3.61	0.153	0.167	0.320
L.S.D.at 5%	0.37	0.20	0.02	0.014	0.10	0.14	0.004	0.017	0.03
2 nd Season (1998)									
0	3.19	2.63	0.33	0.21	3.34	2.70	0.132	0.068	0.200
14 gr./kg	3.48	2.91	0.35	0.29	3.88	2.95	0.151	0.105	0.256
21 gr./kg	3.85	3.26	0.41	0.32	4.10	3.39	0.162	0.130	0.292
L.S.D.at 5%	0.15	0.08	0.02	0.01	0.16	0.17	0.005	N.S.	0.02

3- Effect of the interaction between chemical and bio-phosphorus fertilizer :

Table (6) clearly showed that , the interaction treatments had a significant effect on N , P and K content , with exception of nitrogen percent of shoots in 1998 season and phosphorus percent of leaves in 1999 season

Table (6): Effect of interaction between super-phosphate and phosphorine addition of different rates on the some elemental and chlorophyll content in different plant organs , of cowpea during 1998 and 1999 .

Characters / p. rate / phosphorine rate		N%		P%		K%		Chlorophyll contents as mg/100 gm fresh wt. in Leaves tissues		
		Leaves	shoots	Leaves	Shoots	Leaves	Shoots	Chloro-phyll (a)	Chloro-phyll (b)	Total chloro-phyll
1 st season (1998)										
0	0	2.06	2.11	0.22	0.11	2.11	2.15	0.125	0.093	0.218
	14 g./kg	2.17	2.37	0.25	0.12	2.21	2.45	0.129	0.113	0.242
	21 g./kg	2.71	2.73	0.26	0.13	2.44	2.70	0.133	0.127	0.260
150 kg/fed.	0	2.97	2.85	0.29	0.19	3.19	3.28	0.134	0.093	0.227
	14 g./kg	3.59	3.11	0.35	0.27	4.10	4.09	0.158	0.140	0.298
	21 g./kg	4.0	3.29	0.39	0.30	4.19	3.85	0.158	0.160	0.318
300 kg/fed.	0	2.77	2.63	0.33	0.23	3.29	3.18	0.135	0.093	0.228
	14 g./kg	5.09	3.35	0.44	0.31	4.25	4.13	0.159	0.177	0.336
	21 g./kg	4.79	3.28	0.51	0.32	4.92	4.28	0.168	0.213	0.381
L.S.D. at 5%		0.65	N.S.	0.04	0.025	0.12	0.25	0.006	0.030	0.046
2 nd season (1999)										
0	0	2.63	2.17	0.24	0.20	2.89	2.23	0.131	0.037	0.168
	14 g./kg	2.66	2.50	0.26	0.22	3.05	2.30	0.124	0.093	0.217
	21 g./kg	3.10	2.71	0.29	0.27	3.20	2.30	0.134	0.127	0.261
150 kg/fed.	0	3.49	2.91	0.35	0.21	3.28	2.58	0.134	0.079	0.213
	14 g./kg	3.82	3.08	0.37	0.31	3.99	2.71	0.146	0.094	0.240
	21 g./kg	3.87	3.05	0.42	0.34	4.11	3.81	0.168	0.091	0.259
300 kg/fed.	0	3.45	2.82	0.40	0.23	3.84	3.30	0.132	0.088	0.220
	14 g./kg	3.97	3.15	0.43	0.33	4.61	3.83	0.175	0.127	0.302
	21 g./kg	4.58	4.03	0.51	0.35	4.99	4.07	0.184	0.173	0.357
L.S.D. at 5%		0.25	0.13	N.S.	0.02	0.28	0.02	0.009	N.S.	0.033

Generally, the highest N , P and K concentration in leaves and/or shoots were recorded when super- phosphate at rate of 300 kg/fed. and phosphorine at rate of 21 g/kg of seeds were added in both two seasons . On the contrary with no-phosphate and phosphorine addition the lowest concentration of N P and K were recorded .

Chlorophylls a, b and a + b as responded to the interaction treatments (Table 6) . Wherease , the chlorophylls significantly influenced by the interaction treatments with exception of chlorophyll b in 2nd season . Generally, the response of chlorophylls to the treatments of interaction followed the same pattern of N , P and K content in both two seasons .

C- Total seed yield and its quality :

1- Effect of chemical phosphorus fertilizer :

Addition chemical phosphorus as super-phosphate at rate upto 300 kg/fed. had a significant increase in length , weight of cowpea pod as well as average number of seeds/pod , pods/plant , and weight of 100 seeds . However , with increasing the rate of phosphorus addition , values of the previous crictria increased to reach its highest with addition the highest rate, i.e. 300 kg super-phosphate / feddan . These findings were true in both two experiments . Regarding the total yield of dry seeds , the data represented in table (7) , shows clearly , that addition chemical phosphorus at 300 kg super-phosphate / fed. increased the dry seed yield over than the un-treated plants by 250.4 and 275.4 kg/fed. respectively in 1st and 2nd season .Whereas the variation within different rates of chemical phosphorus addition concerning to the different parameters of total yield and its quality (Table 7) were enough to reach the level of 5% significant in both two experiments .

Table (7) : Effect of chemical phosphorus fertilizer on the total yield of cowpea and its quality during 1998 and 1999 seasons .

Characters Phosphorous Rate kg/fed.	Av. pod Length (cm)	Pod weight (gm)	Av. no. of Seed/pod	No. of Pod	Weight of 100 seeds	Total yield of dry seed/kg
1 st Season						
0	8.28	1.81	6.89	38.89	9.52	211.78
150 kg	16.44	5.21	15.55	63.22	15.02	376.0
300 kg	17.39	5.72	15.89	75.33	16.78	462.22
L.S.D at 5%	0.98	0.80	1.02	4.22	0.40	39.10
2 nd Season						
0	6.89	1.97	4.78	32.99	7.82	199.44
150 kg	14.94	5.22	11.33	53.44	15.13	400.0
300 kg	16.61	6.72	14.89	72.11	16.83	474.44
L.S.D at 5%	0.50	0.12	0.87	2.22	0.36	38.94

The higher total yield obtained from using the different phosphorus levels may be due to the increase in one or more of the estimated attributes either in leaves or shoots. However, the picture reflected significant increase in leaves number, dry weight , N , P and K contents and shoots number and dry weight , as well as total chlorophyll .

So these increments led to the favoured increase in the yield of cowpea. The obtained results are in good accordance with those which recorded by Bhagwan *et al.*, (1997) , Okeleye and Okelana (1997) and Mayz and Cartwright (1998) who worked on some other legume crops .

2- Effect of bio-phosphorus fertilizer :

Table (8) shows the effect of treating cowpea seeds with phosphorine at different rates in both two experiments . Addition bio-phosphorus at rates of 14 g/kg seeds and/or 21 g/kg seeds before sowing gave a superiority over control treatment (without phosphorine addition) concerning to length and weight of pod ; and weight of seeds/pod ; number of pods/plant in both two experimental seasons . Moreover , the highest values of the above mentioned characters were obtained with addition highest rate of phosphorine . On the contrary, the lowest values were associated with the non-treatment. These were true in both two experiments.

Total yield of dry seeds responsed by the same pattern of change like the previous parameters in both two seasons. By other means, the superiority in dry seed yield of that treatment of addition 21 g phosphorine / kg seeds over the control treatment amounted by , 48.7% and 60.0% respectively for 1st and 2nd season . The obtained results are in good accordance with those which were reported by Mba , (1996) ; Mishra and Patjoshi , (1995) ; Sattar *et al*., (1996) and Selvi *et al.*, (1997) .

Table (8) : Effect of bio-phosphorus fertilizer on the total yield of cowpea and its quality during 1998 and 1999 seasons .

Characters Phosphorine rate	Pod length (cm)	Pod weight (gm)	Av. No. of Seed/pod	No. of Pod/plant	Weight of 100 seeds	Total yield of Dry seeds kg/fed
1 st Season						
0	11.22	3.19	10.0	47.78	11.26	281.55
14.0 gr/kg	15.16	4.67	13.66	62.33	14.67	349.67
21.0 gr/kg	15.72	4.86	14.67	67.33	15.39	418.78
L.S.D at 5%	0.59	0.42	0.80	2.54	1.04	26.87
2 nd Season						
0	10.72	3.48	7.44	45.0	11.51	281.67
14.0 gr/kg	13.45	4.97	10.78	50.89	12.99	341.66
21.0 gr/kg	14.28	5.45	12.78	62.67	15.28	450.55
L.S.D at 5%	0.50	0.51	0.78	2.45	0.49	28.91

Table (9): Effect of the interaction between chemical and bio-phosphorus fertilizer addition the total yield of cowpea and its quality during 1998 and 1999 seasons .

Characters p. rate phosphorine rate		Pod length (cm)	Pod weight (g)	Number of Seeds /Pod	Weight of 100 seeds	Number of Pod/	Dry weight Of pod/	Total yield Of dry seeds/kg
1st season								
0	0	6.67	1.54	5.33	8.39	31.0	166.33	172.33
	14 g	8.83	1.82	6.67	9.58	41.33	190.0	222.0
	21 g	9.33	2.07	8.67	10.60	44.33	227.67	241.0
150 kg	0	13.83	4.38	13.00	12.96	51.67	251.67	303.0
	14 g.	17.33	5.96	16.33	15.27	66.33	344.0	379.0
	21 g.	18.17	5.29	17.33	16.82	71.67	371.67	446.0
300 kg	0	13.17	3.67	11.67	12.43	60.67	259.67	369.33
	14 g.	19.33	6.24	18.00	19.16	79.33	448.0	448.0
	21 g.	19.67	7.24	18.00	18.75	86.0	529.33	569.33
L.S.D.at 5%		1.03	0.73	1.39	1.79	4.41	35.51	46.53
2nd season								
0	0	5.33	1.85	4.0	6.86	29.33	156.33	175.0
	14 g	7.17	1.96	4.67	7.71	32.33	167.33	176.33
	21 g	8.17	2.09	5.67	8.89	37.33	190.0	247.0
150 kg Super	0	12.83	3.56	7.33	13.08	43.67	217.33	332.67
	14 g.	15.67	5.67	11.33	14.43	48.67	288.0	419.0
	21 g.	16.33	6.43	15.33	17.87	68.0	338.33	448.33
300 kg Super	0	14.00	5.04	11.00	14.59	62.0	273.67	337.33
	14 g.	17.50	7.29	16.33	16.82	71.67	393.67	429.67
	21 g.	18.33	7.83	17.33	19.08	82.67	471.67	656.33
L.S.D at 5%		N.S.	0.89	1.35	0.86	4.24	23.53	50.07

3- Effect of the interaction between chemical and bio-phosphorus fertilizers :

The interaction treatments of chemical X bio-phosphorus fertilizers significantly affected total yield of dry seeds as well as its different parameters of quality .These were true in both two seasons , except of pod length in 2nd season which responsed no-significantly at 5% level .

Generally , under different rates of chemical phosphorus fertilizer , addition phosphorine (bio-phosphorus) caused an increase in length , weight and number of pods as well as weight of 100 seeds and total yield of dry seeds/per kg/feddan . These findings were similar in 1998 and 1999 seasons . On the contrary , the lowest values of the previous characters were recorded with that plants which no-received either chemical nor bio-phosphorus .

REFERENCES

Bationo , A. ; A. Manu and A.U. Mokwunye (1992) . Soil phosphorus status and use of different calibration tests to predict phosphorus requirement and response of selected crops of West Africa . Trop Soil-Bulletin, (02) : 21 – 43 .

Bhagwan , Das ; R.S. Sheoran and B. Das (1997) . Effect of phosphorus fertilization on quality and yield of cowpea . Annals , of Biology . Ludhiana, 13 (1): 1995-1996 .

Brown , J.D. and O. Lilleland (1946) . Rapid determination of potassium and sodium in plant material and soil extracts by flam photometry . Proc. Amer . Soc. Hort. Sci., 38 : 341 - 364 .

Deb , .P. and Kn. Bora (1996). Effect of chemical fertilizer on the rhizosphere mycoflora and nodulation of pea plant . Environment and Ecology . 1996 , 14 : 4 , 747 – 751 .

Denisen , E.L. (1979) . Principles of horticulture . MacMillan publishing co. INC-New York , London pp. 67 – 68 .

Doube , BM. ; PML Williams ; PJ. Willmott and CA. Edwards (1997) The influence of two species of earthworm (*Aporrectodea trapezoides* and *Aporrectoedea rosea*) on the growth of wheat , barley and faba beans in three soil types in the green house . Biology – and Biochemistry, 29(3– 4): 503 – 509 .

Hundal , HS. ; BR. , Arora ; KS. , Dhillon and SK. , Dhillon (1990) . Phosphorus utilization by maize from 32 P labelled plant material of cowpea. Journal of Nuclear Agriculture and Biology, 19 : 3 , 157 – 161 .

JayaPaul , P. and S. Purushothaman (1995) . Organic matter and nutrient addition through crop residues by different rice based cropping system. Madras-Agricultural-Journal . 1995 , 82 : (3) 176 – 178 .

John , KS ; S. Kabeerathumma and VP. Potty (1996) . Nutrient availability in relation to soil microbial biomass in a long term manurial trial of

Cassava cultivated in an acid utisol . Journal of Root-Crops, 22 : (2) 88 – 92 .

Kang , BT. ; K. Mulongoy and R. Merckx (1993) . Change in soil chemical properties and crop performance with continuous croping on an Entisol in the humid tropics . Proceedings of an international symposium , Leuven Belgium , 4 – 6 (11) 297 – 305 .

Kretzschmar , RM ; H. Hafner , A. Bationo and H. Marschner (1991) . Long and short term effects of crop residues on aluminium toxicity , phosphorus availability and growth of pearl millet in an acid sandy soil . Plant and soil 136 ; (2) 215 – 223 .

Lal , R. (1997) . Soil degradative effects of slope length and tillage method on Alfisols in Western Nigeria 11. Soil chemical properties, plant nutrient loss and water quality. Land , Degradation and Development . 8 : (3) 221 – 244 .

Mayz , J. and P. Cartwright (1998) . Response of N. fertilized and N. fixing cowpea to phosphorus fertilization. Tropical-Science. 1998 , 38 : (4) 213 – 219.

Mba , C.C. (1996) . Treated-Cassava peel vermicomposts enhance earthworm activities and cowpea growth in field plots . Resources , conserration and Recycling . 17 : (3) 219 – 226 .

Mishra , M. and A.K. Patjoshi (1995) . Effect of biofertilization in Okra (Abelmoschus esculentus L.) Environment and Ecology . 13 : (3) 732 – 733 .

Okeleye , K.A. and M.A.O. Okelana (1997) . Effect of phosphorus fertilizer on nodulation, growth and yield of cowpea (Vigna unguiculata) varities . Indian – Journal of Agricultural – Sciences 1997 , 67 : (1) 10 – 12 .

Pande , HP ; BK. Sinha ; GB. Singh and S. Solomon , (1995) . Use of distillery waste as a fertilizer . Sugarcane : agro-industrial alternatives: 401 – 413 .

Parmar , DK. ; PK. Sharma and TR. Sharma (1998) . Integrated nutrient supply system for “DPP 68” vegetable pea (*Pisum sativum* var arvense) in dry temperate zone of Himachal Pradesh . Indian – Journal of Agricultural Sciences. 68 (2): 84 - 86.

Sanchez , PA. ; J. Benites ; D. Bandy and M. Latham (1986) . Low-input system and managed fallows for acid soils in the humid tropics soil management under humid conditions in Asia and the Pacific (Asialand) IBSRAM proceedings No. 5. 1986 , 353 – 360 .

Sattar , M.A. ; A.K. Podder ; M.C. Chanda ; M. (Ed.) Rahmah ; A.K. (Ed.) Podder ; C (ed.) Van-Hove ; ZNT (ed.) Begum ; T (ed.) Heulin and A. Hartmann 1996 . Rhizobiol biofertilizers : The most promissing BNF technology for increased grain lgume production in Banglash . Biological nitrogn fixation associated with rice production 13 , 15-20.

Selvi , D. ; Rani ; Perumal and R. Perumal (1997) . Microfood with and without organics and biofertilizers on growth and development of bhendi . Madras-Agricultural – Journal . 84 : 10 , 625 – 626 .

Smith, CB. ; KT. Demchak and PA. Ferretti (1990) . Fertilizer placement effects on growth responses and nutrient uptake of sweet corn,

snapbeans , tomatoes and cabbage . Communications-in-Soil-Science-and-Plant-Analysis, 21(1-2): 107 – 123.

Subramani, A. ; S. Saravanan ; P. Sundaramoorthy and A.S. Lakshman achary (1998) . Impact of fertilizer factory effluent on the morphometrical and biochemical changes of cowpea (*Vigna unguiculata* (L.) Walp). Advances, in Plant Sciences, 11(1): 137 - 141 .

Snedecor , G.W. and W.G. Cochran (1980) ."Statistical Methods" , 6th ed. , Lowa State Unv. Press , Ames. , Iowa , U.S.A .

Szegi , J ; F.Gulyas , ; K. Koves , Pechy and T. Soos (1991) . Experiments with rhizobia inoculants in Hungarian soils. Zentralblatt-fur-Mikrobiologie . 146 : 7 – 8 , 539 - 543 .

Troug , E. and A.H. Mayer (1939) . Improvement in the deinss colorimetric method for phosphorus and arseni Indian Engineering chemical annual Ed , 1 : 136 – 139 .

Wettestein D. , (1957) .Chlorophyll . Lthale Und der Sumbikroskopische formwechsel der plastiden . Exp. Cell. Res. 12 , 427 - 506 .

تأثير بعض مصادر السماد الفوسفاتى على نمو ومحصول نبات اللوبيا

عائشة حسنين على

قسم بحوث البساتين – المركز القومى للبحوث – الدقى – القاهرة

أجريت تجربتان حقليتان بمزرعة المركز القومى للبحوث بالقناطر الخيرية فى عامى 1998 ، 1999 لدراسة تأثير 3 معدلات من سماد السوبر فوسفات (صفر ، 150 ، 300 كجم/ف) و3 مستويات من سماد الفوسفورين (صفر ، 14 ، 21 جم/واحد كيلو بذرة) على صفات النمو الخضرى والمحصول الكلى ومكوناتة وتضمنت أهم نتائج هذه الدراسة فى الآتى :

1- إضافة سماد السوبر فوسفات بمعدل 300 كجم/ف أدى الى زيادة معنوية فى كل صفات النمو الخضرى للنبات معبرا عنها بطول النبات ، عدد الفروع ، عدد الاوراق ، الوزن الغض والجاف الكلى للنبات ولأجزائه المختلفة .

أيضا سجل محتوى الأوراق والفروع من النيتروجين والفسفور والبوتاسيوم أعلى القيم مع إضافة السوبر فوسفات بالمعدل السابق(300 كجم) . أعلى كمية محصول للبذور الجافة للوبيا (462.2 ، 474.4 كجم/ف للموسم الأول والثانى على الترتيب) سجلت بإضافة 300 كجم سوبرفوسفات/ف.

2- معاملة بذور اللوبيا بالفوسفورين (سماد حيوى) بمعدل 21 جم/كيلو جرام من البذرة أدى الى تحسن فى صفات النمو الخضرى ومحتوى أنسجة الأوراق والفروع من عناصر النيتروجين والفسفور والبوتاسيوم وكذلك زيادة فى محتوى الأوراق من الكلوروفيل . أيضا زاد المحصول الجاف من بذور اللوبيا ليصل 418.8 ، 450.6 كجم/ف فى الموسم الأول والثانى على الترتيب .

3- أدى إضافة السوبر فوسفات الى التربة بمعدل 300 كجم/ف ومعاملة بذور اللوبيا بالفوسفورين بمعدل 21 جم/كيلو بذرة قبل الزراعة الى الحصول على أعلى قيم لصفات النمو الخضرى ومحتوى عناصر النيتروجين والفسفور والبوتاسيوم والكلورفيلات بالإضافة الى المحصول الجاف لبذور اللوبيا .