

EFFECT OF CHEMICAL AND BIO-NITROGEN FERTILIZER ON THE GROWTH AND YIELD OF COWPEA PLANT (*Vigna sinensis* savi.)

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ABSTRACT

Two field experiments were carried out at the Experimental Station of National Research Centre at Shalakan during the 1998 and 1999 growth seasons to study the response of cowpea plant to different levels of chemical and bio-nitrogen fertilizer. Every experiment included 9 treatments, which were the simple combination between 3 chemical nitrogen fertilizer, i.e. 0, 50 and 100 kg/fed. and 3 levels bio-nitrogen fertilizer, i.e. 0, 25 and 50 g/kg seeds. The important results could be summarized as follows: chemical nitrogen fertilization at rate of 100 kg as ammonium sulphate gave the best growth characters of plant. The suitable economic level of biogen is (a bio-fertilizer contain a large number of fixation bacteria) for cowpea plant is 50 g/kg seeds, where the best growth characters were gained. The heaviest total dry weight of whole plant and its different parts were obtained by adding nitrogen at rate of 100 kg/fed. in the form of ammonium sulphate with treating cowpea seeds by biogen at level 50 g/kg seeds.

The heaviest yield of dry seeds resulted from cowpea plants which received nitrogen at rate of 100 kg/fed. as ammonium sulphate. The heaviest total dry seeds yield as kg/fed. with best quality were resulted with adding 100 kg/fed. of chemical nitrogen fertilizer and with treating cowpea seeds before sowing by biogen at 50 g/kg of seeds.

INTRODUCTION

Cowpea (*Vigna sinensis* savi.) is one of most important vegetables grown in A.R.E. The increase in the yield of cowpea in recent times has come mainly horizontally by increasing area and/or vertically by increasing total yield per feddan. The increase in total yield per feddan can be achieved by many factors, including the plant fertilization. Nitrogen is the most elemental nutrition which affected plant growth and its yield. Leguminous crops needs nitrogen fertilizer like as other vegetable plants. But most legumines growers believe that nitrogen fertilizer is not necessary. Many investigators reported that, nitrogen fertilizer affected plant growth (Kang *et al.*, (1991); Szegi *et al.*, (1991) and Amara *et al.*, (1996) and total yield of plant (Shumba *et al.*, (1990); Franzluebber *et al.*, (1994) and John *et al.*, (1996) as well as its physical and chemical properties (Arozarena *et al.*, (1991), Mica *et al.*, (1991) and Minhas and Sood (1994).

The aim of this work are to study the effect of two different sources of nitrogen fertilizer (chemical and bio) on cowpea growth and its yield.

MATERIALS AND METHODS

Two field experiments were carried out during the two seasons of 1998 and 1999 at the Experimental Station of National Research Centre at Shalakan to investigate the effect of chemical and bio-nitrogen fertilizers on growth and yield of cowpea seeds of cowpea (Karem 7) sown on 28th April , 21th April 1998 and 1999 respectively . The soil of the experimental field was clay loam in texture , EC 1.27 mmhos/cm , PH 7.9 . Each experiment included 3 rates of chemical nitrogen fertilizer , i.e. 0 , 50 and 100 kg/fed. as ammonium sulphate (20.6% N) and 3 rates of bio-nitrogen fertilizer (a bio-fertilizer contain a large number of fixation bactaria) as biogen i.e. 0 , 25 and 50 g/kg of seeds .

Design of the experiment was split-plot system in randomized bludes with 4 replicates , where the chemical nitrogen fertilizer distributed in the main plots and bio-nitrogen treatments arranged in sub-plots . The area of sub-plot was 11.2 m² 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 75 days after sowing and the following parameters were recorded : length of plant , number of leaves , shoots , fresh and dry weight of whole plant and its different organs . Also, chlorophyll content was estimated according to the method described by Wettstein (1957) .

Nitrogen , phosphorus and potassium content determined in tissues of leaves and shoots using the methods of Kock and McMeekin (1924), Troug and Mayers (1939) , Brown and Lilleland (1946) respectively .

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

RESULTS AND DISCUSSION

A- Growth characters :

1- Effect of chemical nitrogen fertilizer :

Data presented in Table (1) shows that , with addition nitrogen fertilizer (as ammonium sulphate , 20.6%) the elements of vegetative growth characters recorded an increase in its values compared with control treatment (without-N-addition) . Moreover , with increasing the chemical nitrogen fertilizer up to 100 kg/fed. , the gradual increase in the plant growth criteria were happened . These results were similar in both two seasons . The superiority in dry weight of whole plant with addition 100 kg/fed. over the check treatment amounted by 195.9% and 206% respectively for the first and second .

Nitrogen fertilizer increased plant growth of cowpea plant that result could be attributed to nitrogen role in increase number of leaves to the quite full

expanding and the encourage of the development of large leaves due to N application . Many investigators had a similar results such as Molnarova (1990) , Kang et al (1991) , Karim et al (1991) , Szegi et al (1991) , Amara et al (1996) and Krishan et al (1997) .

Table (1): Effect of different rates of chemical nitrogen fertilizer on the growth of cowpea during 1998 and 1999 seasons .

Characters Treatments	Plant length (cm)	Average number/plant		Fresh weight (g)		Dry weight (g)	
		Leaves	Shoots	Leaves	Shoots	Leaves	Shoots
1st Season							
Control without N.addition	27.99	10.78	1.33	16.45	14.32	7.38	3.25
50 kg/fed	36.67	19.78	2.89	33.0	17.83	14.33	4.43
100 kg/fed	42.45	25.67	4.11	57.97	30.28	25.41	6.05
L.S.D. at 5% level	1.97	2.04	0.82	5.63	2.94	2.80	0.41
2nd Season							
Control without N. addition	29.45	16.33	1.78	18.88	15.35	8.83	6.67
50 kg/fed	33.56	20.22	3.33	33.54	26.78	18.93	9.26
100 kg/fed	39.11	25.78	4.11	68.19	40.41	34.84	12.66
L.S.D. at 5% level	1.53	1.72	0.91	5.77	1.12	1.38	1.09

2- Effect of Bio-nitrogen fertilizer :

As shown in Table (2) treating cowpea seeds with biogen as bio-nitrogen fertilizer gave a significant superiority in all plant growth characters . Moreover , increasing the rate of biogen addition caused more enhancement in the criteria of plant growth .

Bio-fertilizer (biogen) significantly increased plant growth of cowpea plant i.e., numbers and weights of leaves and shoots in growing seasons .

Table (2) Effect of bio-nitrogen fertilizer on the growth characters of cowpea during 1998 and 1999 seasons .

Characters Biogen treatment	Plant length (cm)	Average number/plant		Fresh weight (g)		Dry weight (g)	
		Leaves	Shoots	leaves	Shoots	leaves	Shoots
1st Season							
Control (without)	32.56	15.22	2.22	27.49	17.09	12.87	4.10
25 g/kg	35.67	17.89	2.78	32.03	19.92	14.16	4.39
50 g/kg	38.89	23.11	3.34	47.90	25.42	20.09	5.23
L.S.D. at 5% level	1.05	1.09	0.37	2.35	1.05	2.97	0.47
2nd Season							
Control (without)	31.45	15.45	2.44	29.92	22.36	16.48	7.71
25 g/kg	34.22	18.11	3.34	38.35	27.48	21.18	8.95
50 g/kg	36.45	22.11	3.44	52.34	32.71	24.93	11.70
L.S.D. at 5% level	1.11	1.01	0.44	1.57	2.19	1.28	0.96

These results held good in 1998 and 1999 seasons , whereas , addition of 50 g/kg seeds resulted an increase amounted to 56 , 27.5 and 49.2% above control treatment respectively for dry weight of leaves , shoots and whole plant in (1998) season . This increase recorded 51.3, 51.7 and 51.4% for the same respective in 2nd season . Similar results were obtained by Senaratne and Ratnasinghe (1995) and Mba (1996) .

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

Adding Nitrogen as chemical fertilizer at rate of 100 kg/fed . and treating cowpea seed with nitrogen as bio-fertilizer (Biogen treatments) at rate of 50 g/kg seeds resulted in the highest values of plant length , number of leaves and shoots , fresh and dry weight of whole plant and its different parts . These results held good in both two seasons (Tables 3 and 4) . On the contrary , the lowest values of the above mentioned characters recorded with those plants have not received either chemical nor bio-nitrogen fertilizer .

Table (3): Effect of the interaction between chemical and bio nitrogen fertilizer on the plant growth characters of cowpea plant during 1998 season .

Characters		Plant length (cm)	Average number/plant		Fresh weight (g)		Dry weight (g)	
N.rate	biogen rate		Leaves	Shoots	Leaves	Shoots	Leaves	Shoots
Control without	Without	26.33	5.67	1.00	16.62	13.72	6.83	2.99
	25 g/kg	28.33	8.67	1.33	16.47	14.29	7.28	3.30
	50 g/kg	29.33	18.0	1.67	16.26	14.96	8.04	3.45
50 kg/fed	Without	30.67	18.67	2.00	24.20	15.57	10.31	3.43
	25 g/kg	36.67	19.33	3.00	31.18	16.48	12.23	4.38
	50 g/kg	42.67	21.33	3.67	43.62	21.43	20.45	5.47
100 kg/fed	Without	40.67	21.33	3.67	41.65	21.99	21.48	5.88
	25 g/kg	42.00	25.67	4.00	48.43	28.99	22.98	5.48
	50 g/kg	44.67	30.00	4.67	83.82	39.87	31.78	6.78
L.S.D at 5% level		1.81	1.89	N.S	4.07	1.83	1.65	N.S

Table (4): Effect of the interaction between chemical and bio nitrogen fertilizer on the plant growth characters of cowpea plant during 1999 season.

Characters			Plant length (cm)	Average number/plant		Fresh weight (g)		Dry weight (g)	
N.rate	biogen rate			leaves	Shoots	Leaves	shoots	Leaves	Shoots
Control without	without		28.67	7.67	1.67	18.75	15.00	8.21	6.25
	25 g/kg		30.00	8.33	1.67	19.23	15.84	8.80	6.75
	50 g/kg		29.67	13.00	2.00	18.65	15.24	9.48	7.00
50 kg/fed	without		30.67	17.67	2.33	24.93	22.23	14.77	7.15
	25 g/kg		34.33	19.33	3.67	36.33	36.43	18.94	9.70
	50 g/kg		35.67	23.67	4.00	39.38	31.69	23.07	10.94
100 kg/fed	without		35.00	21.00	3.33	46.08	29.85	26.46	9.74
	25 g/kg		38.33	26.67	4.67	59.49	40.16	35.81	11.10
	50 g/kg		44.00	29.65	4.33	99.01	51.20	42.24	17.15
L.S.D at 5% level			1.92	1.75	N.S	2.72	3.79	2.21	1.66

B- Chlorophyll contents:

1- Effect of chemical nitrogen fertilizer:

Significant effect of chemical nitrogen fertilizer on the content of chlorophyll in both two experiments are shown in Table (5) . Whereas , the highest concentration of chlorophyll a , b and a + b resulted from those tissues of cowpea leaves which their plants received chemical nitrogen fertilizer at the highest rate of addition , i.e. 100 kg/fed. as ammonium sulphate . The opposite was true with that plants have not received nitrogen (control) . Similar results were recorded by Lopez-Cantarero *et al.*,1994 .

Table (5): Effect of chemical nitrogen fertilizer on the pigments content of leaves tissues of cowpea during 1998 and 1999 .

Characters	1998			1999		
	Chlororo- phyll "a"	Chlororo- phyll "b"	Chlororo- phyll "a+b"	Chlororo- phyll "a"	Chlororo- phyll "b"	Chlororo- phyll "a+b"
N. rate						
Control (without)	0.118	0.075	0.193	0.127	0.087	0.214
50 kg/fed	0.124	0.160	0.284	0.142	0.167	0.309
100 kg/fed	0.136	0.208	0.344	0.164	0.225	0.389
L.S.D at 5% level	0.009	0.014	0.03	0.003	0.022	0.01

2- Effect of bio-nitrogen fertilizer :

Slight response of chlorophyll a , b and a + b in tissues of leaves to the bio-nitrogen fertilizer was noticed . Whereas , statistical analysis of the obtained data revealed , no significant effect of different bio-nitrogen treatment on chlorophyll . These results were true in both two seasons , except that of chlorophyll b in 1st season which significantly responded .

Table (6): Effect of bio-nitrogen fertilizer on the content of chlorophyll in tissues of leaves of cowpea during 1998 and 1999 .

Characters	1998			1999		
	Chlororo- phyll "a"	Chlororo- phyll "b"	Chlororo- phyll "a+b"	Chlororo- phyll "a"	Chlororo- phyll "b"	Chlororo- phyll "a+b"
Bio-N. fertilizer						
Control (without)	0.123	0.113	0.236	0.127	0.118	0.245
25 g/kg of seeds	0.123	0.160	0.283	0.147	0.164	0.311
50 g/kg of seeds	0.135	0.169	0.304	0.159	0.197	0.356
L.S.D at 5% level	N.S.	0.012	N.S.	N.S.	N.S.	N.S.

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

The treatments of the interactions had no significant effect on chlorophyll a as well as chlorophyll a + b , but the response of chlorophyll b to the interactions followed an opposite trend (Table 7) . Whereas , the highest concentration of chlorophyll b obtained with that cowpea plants which was fertilized by chemical nitrogen as ammonium sulphate at highest rate , i.e. 100 kg/fed. with treating its seeds with bio-nitrogen as biogen at rate of 25 g/kg seeds . These findings held good in both experimental seasons .

Table (7): Effect of interaction between chemical and bio-nitrogen fertilizer on the chlorophyll content of cowpea plant during 1998 and 1999 .

Characters		1998			1999		
Chem. N rate	Bio-N-rate kg/kg of seeds	Chlororo- phyll "a"	Chlororo- phyll "b"	Chlororo- phyll "a+b"	Chlororo- phyll "a"	Chlororo- phyll "b"	Chlororo- phyll "a+b"
without	Without	0.115	0.067	0.182	0.113	0.086	0.199
	25 g	0.118	0.073	0.191	0.134	0.087	0.221
	50 g	0.121	0.086	0.207	0.134	0.089	0.223
50 kg/fed	Without	0.121	0.090	0.211	0.129	0.091	0.220
	25 g	0.123	0.197	0.320	0.145	0.207	0.352
	50 g	0.127	0.193	0.320	0.153	0.203	0.356
100 kg/fed	Without	0.123	0.183	0.306	0.140	0.177	0.317
	25 g	0.129	0.210	0.339	0.162	0.199	0.361
	50 g	0.157	0.230	0.387	0.190	0.30	0.490
L.S.D. at 5% level		N.S.	0.021	N.S.	N.S.	0.019	N.S.

C- Nitrogen , phosphorus and potassium contents :

1-Effect of chemical nitrogen fertilizer :

Table (8) presents the response of N , P and K in leaves and shoots tissues of cowpea plant as affected by the chemical nitrogen fertilizer in both seasons . Generally , addition of N as ammonium sulphate caused an increase in the percent of N , P and K in plant tissues . Whereas the highest contents were obtained with addition the highest rate of nitrogen fertilizer. These results were accordance in both seasons . Similar results were found by Arozarena *et al* (1990) , Mica *et al* (1991) and Minhas and sood (1994) .

2- Effect of bio-nitrogen fertilizer :

The content of phosphorus and potassium in leaves and shoots tissues of cowpea plant had no significant response to the treatments of bio-nitrogen (biogen) fertilizer. Concerning to nitrogen percent in leaves tissues of 1998 and 1999 seasons and in shoots of 1998 season (Table 9) , the obtained data reveals that , bio-nitrogen fertilizer resulted in a significant increase in N percent .

In spite of insignificant responses , mixing cowpea seeds with biogen before sowing , gave an increase in percentages of N , P and K. These results held good for leaves and shoots tissues in both seasons . Similar results were reported by Senaratne and Ratnasinghe (1995) and Selvi *et al* (1997).

2-Effect of the interaction between chemical and bio-nitrogen fertilizer :

Table (10) shows clearly that , there was no significant effect of interaction treatments on the percent of phosphorus in leaves and shoots tissues of 1998 and 1999 seasons , and percent of nitrogen in leaves (two seasons) and shoots (2nd season) as well as percent of potassium in shoots tissues (two seasons) .

On the contrary , the percent of nitrogen in shoots (1st season) and potassium in leaves tissues (both seasons) was significantly responded by the interaction treatment . Generally , the results could be summarized as follows , the highest percent of nitrogen , phosphorus and potassium in leaves and shoots tissues resulted from cowpea plant received nitrogen as chemical application at rate of 100 kg/fed. as ammonium sulphate and treating the seeds before sowing with bio-nitrogen fertilizer as biogen at rate of 50 gm/kg seeds . These results were true in both experimental seasons .

Yield and its quality :

1- Effect of chemical nitrogen fertilizer :

Table (11) shows clearly that , addition chemical nitrogen fertilizer as ammonium sulphate caused a significant increase in the values of length and weight of pod , number of seeds/pod , weight of 100 dry seeds as well as total yield of dry seeds as kg/fed. Moreover with increasing the amount of chemical nitrogen addition up to 100 kg/fed. a consistant increase in dry seed yield was obtained .

Table (11): Effect of different rates of ammonium sulphate on the total yield of cowpea and its quality during 1998 and 1999 .

Characters Chem-N-rate	Average / pod		Number of Seeds/pod	Weight of 100 dry seeds	Total yield of dry seeds Kg/fed.
	Length (cm)	Weight (g)			
1st Season					
Control (without)	5.76	2.35	3.88	6.68	211.99
50 kg/fed.	6.90	3.07	4.45	7.54	352.28
100 kg/fed.	7.86	3.73	5.77	7.85	412.71
L.S.D. at 5% level	1.13	1.02	0.83	1.24	34.57
2nd Season					
Control (without)	5.13	2.40	4.43	6.24	187.28
50 kg/fed.	6.21	3.24	5.17	7.54	255.28
100 kg/fed.	6.73	4.17	5.97	8.42	262.35
L.S.D. at 5% level	0.62	0.48	N.S.	1.16	23.18

It means that the heaviest yield of dry seeds was recorded with addition the highest ammonium sulphate. These results held good in both experimental seasons . The superiority which resulted with addition 100 kg of ammonium sulphate per fed. over that of checked treatment (without N addition) in t otal dry seed yield amounted by 95.1% and 40.1% respectively in 1st and 2nd season .

This increament may be attributed to the role of nitrogen to encourag plant growth through the stimulative effect on the meristematic activity of tissues , consequently this favourable effect is reflected to increase total yield and its quality. The obtained results are in accordance with those obtained by Kang *et al.*, (1985) , Shumba *et al.*, (1990) , Karim *et al.*, (1991) , Szegi *et al.*, (1991) , Thimmegowda (1993) , Bharadwaj *et al.*, (1994) , Franzluebbers *et al.*, (1994) , Das and Deb (1995) , Amara *et al.*, (1996) , John *et al.*, (1996) , Joseph *et al.*, (1996) , Kalyan *et al.*, (1996) , Shahien (1996) , Baskar and Saravanan (1997) , Annan *et al.*, (1997) and Parmar *et al.*, (1998) .

2- Effect of bio-nitrogen fertilizer :

The statistical significant effect of addition different raets of bio-nitrogen fertilizer as biogen on total yield of cowpea and its quality are shown in Table (12) . The obtained results clearly indicate that mixing biogen with cowpea seeds before sowing caused higher values of pod length , weight of pod , number of seeds/pod , weight of 100 dry seeds as well as total dry seed yield as kg/fed. above the un-treated treatments .

Table (12) Effect of bio-nitrogen fertilizer on the total yield and quality of cowpea during 1998 and 1999 .

Characters Bio-N-rate	Average / pod		Number of Seeds/pod	Weight of 100 dry seeds	Total yield of Dry seeds Kg/fed.
	Length (cm)	Weight (g)			
1 st Season					
Control (without)	6.40	2.41	4.12	6.95	288.93
25 g/kg	6.78	3.05	4.46	7.33	326.11
50 g/kg	7.35	3.29	5.54	7.79	351.60
L.S.D. at 5% level	0.80	N.S.	0.63	1.24	36.68
2 nd Season					
Control (without)	5.62	3.01	4.92	7.03	206.91
25 g/kg	6.13	3.24	5.16	7.21	235.52
50 g/kg	6.33	3.58	5.49	8.04	262.47
L.S.D. at 5% level	1.42	N.S.	0.82	0.90	19.62

Moreover, with rising the rate of addition , the previous parameters recorded higher values . These findings are true in (1998) and (1999) season . With other meaning mixing cowpea seeds before seeding with 50 g/kg of biogen caused an incause in total dry seed yield above control treatment by 21.7 and 26.8% respectively in the first and second . (Sattar et al.,(1996)) .

3- Effect the interaction of chemical with bio-nitrogen fertilizer :

Data presented in Tables (13 and 14) reveal a significant effect of the interaction treatments on the total dry seed yield and its quality in both experimental seasons of (1998) and (1999) with exception of pod length value .

As general , the addition of chemical nitrogen fertilizer at rate of 100 kg as ammonium sulphate per feddan and treating cowpea seeds before sowing with bio-nitrogen fertilizer as biogen at rate of 50 g/kg of seed, resulted in the highest values of average pod weight (g) , number of seeds/pod , weight of 100 dry seeds as well as total yield of dry seeds as kg/feddan . On the contrary , the lowest values of the previous creteria were obtained with cowpea plants no-received neither chemical nor bio-nitrogen fertilizers . These findings are in accordance for both experiments .

Table (13): Effect of interaction between chemicaland bio-nitrogen fertilizer on the total yield of cowpea and its quality during 1998 .

Characters Chem.N. rate bio-N- Rate		Pod length (cm)	Average pod Weight (g)	Number of seeds/pod	Weight of 100 dry seeds	Total yield of dry seeds Kg/fed.
Control Without	Control	5.17	1.93	3.32	6.20	156.33
	25 g/kg	5.98	2.30	3.67	6.76	204.61
	50 g/kg	6.13	2.83	4.67	7.09	275.03
50 kg/fed	Control	6.63	3.00	4.00	7.25	304.22
	25 g/kg	6.93	3.07	4.52	7.42	363.50
	50 g/kg	7.16	3.13	4.84	7.96	389.14
100 kg/fed	Control	7.41	3.50	5.03	7.41	406.26
	25 g/kg	7.43	3.78	5.18	7.83	410.22
	50 g/kg	8.76	3.92	7.11	8.33	421.65
L.S.D. at 5% level		N.S.	0.84	1.03	1.10	43.54

Table (14): Effect of interaction between chemical and bio-nitrogen fertilizer on the total yield of cowpea and its quality during 1999 .

Characters		Pod length (cm.)	Average pod Weight (g.)	Number of Seeds/ pod	Weight of 100 dry seeds	Total yield of dry seeds Kg/fed.
Chem-N-rate	Bio.N.rate					
Control	Control	4.38	2.03	4.18	5.73	141.03
Without	25 g/kg	5.40	2.41	4.52	5.89	195.82
	50 g/kg	5.62	2.76	4.60	7.32	225.01
50 kg/fed	Control	5.91	2.97	4.98	7.48	239.14
	25 g/kg	6.22	3.08	5.12	7.53	252.56
	50 g/kg	6.51	3.69	5.43	7.82	274.15
100 kg/fed	Control	6.58	4.02	5.62	8.07	240.57
	25 g/kg	6.77	4.22	5.86	8.22	258.18
	50 g/kg	6.86	4.28	6.43	8.98	288.26
L.S.D. at 5% level		N.S.	0.55	1.19	1.73	24.19

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تأثير الاسمدة النيتروجينية الكيماوية والحيوية على نمو ومحصول اللوبيا

منى محمود عبد المعطى

قسم البساتين - المركز القومى للبحوث - الدقى - القاهرة

أجريت تجربتان فى مزرعة المركز القومى للبحوث بشلقان لدراسة تأثير ٣ معدلات مختلفة من سماد سلفات النشادر (صفر ، ٥٠ ، ١٠٠ كجم/فدان) ، ٣ معدلات من سماد البيوجين (صفر ، ٢٥ ، ٥٠ جم/كجم جرام من بذور اللوبيا) على صفات النمو الخضرى والمحصول وجودة لنبات اللوبيا وتضمنت أهم النتائج ما يلى :

- أحسن صفات النمو الخضرى معبرا عنها بطول النبات وعدد الاوراق/نبات ، الوزن الغض والجاف للنبات ولأجزائه المختلفة بالإضافة الى أعلى قيم لعدد القرون/نبات ووزن القرن الواحد ووزن ١٠٠ بذرة جاف بالإضافة الى محصول البذرة الجاف للفدان ثم الحصول عليها بالإضافة سماد سلفات النشادر بمعدل ١٠٠ كجم/فدان .
- أدى خلط تقاوى اللوبيا قبل زراعتها بالسماد الحيوى البيوجين بمعدل ٥٠ جم/كجم جرام من التقاوى الى الحصول على أعلى رقم لصفات النمو الخضرى بالإضافة الى صفات محصول القرون والبذور الجاف مقارنة باستعمال المعدلات الأقل من ذلك .
- أدى التسميد الارض بسماد سلفات النشادر بمعدل ١٠٠ كجم/الفدان وخلط ٥٠ جم من السماد الحيوى البيوجين بتقاوى اللوبيا الى الحصول على أعلى قيم لطول النبات وعدد الاوراق والوزن الغض والجاف ولأجزاء النبات المختلفة لنبات اللوبيا وكذلك اعلى رقم لطول ووزن القرن الواحد وعدد القرون/نبات ووزن ١٠٠ بذرة جافة بالإضافة الى محصول بذور اللوبيا الجاف بالكيلو جرام للفدان .

Table (8): Effect of chemical nitrogen fertilizer on the N , P and K content in leaves and shoots tissue during 1998 and 1999 .

Character	1998						1999					
	N %		P %		K %		N %		P %		K %	
	leaves	Shoots	leaves	Shoots	leaves	Shoots	Leaves	Shoots	leaves	Shoots	leaves	Shoots
Chem. N-Rate												
Control (without)	2.79	2.23	0.34	0.27	3.57	3.10	2.72	2.34	0.29	0.24	3.30	3.11
50 kg/fed	4.19	3.29	0.41	0.32	4.45	3.75	3.75	3.11	0.38	0.31	4.51	3.83
100 kg/fed	4.49	3.47	0.49	0.37	5.08	4.44	4.37	3.67	0.47	0.36	5.09	4.35
L.S.D at 5% level	0.35	0.19	0.02	0.03	0.33	1.97	0.11	0.17	0.03	0.02	0.45	0.14

Table (9): Effect of bio-nitrogen fertilizer on the content of N , P and K in tissues of leaves and shoots of cowpea during 1998 and 1999 .

Characters	1998						1999					
	N %		P %		K %		N %		P %		K %	
	leaves	Shoots	leaves	Shoots	leaves	Shoots	leaves	Shoots	Leaves	Shoots	leaves	Shoots
Bio.N. rate												
Gm/kg of Seeds												
Control (without)	3.46	2.81	0.37	0.29	3.98	3.51	3.34	2.82	0.35	0.29	4.10	3.60
25 g.	3.75	3.01	0.42	0.33	4.31	3.74	3.67	3.02	0.38	0.30	4.17	2.35
50 g.	4.28	3.17	0.44	0.34	4.80	4.04	3.82	3.30	0.40	0.32	4.63	3.98
L.S.D at 5% level	0.27	0.17	N.S.	N.S.	N.S.	N.S.	0.17	N.S.	N.S.	N.S.	N.S.	N.S.

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Table (10) : Effect of the interaction between chemical and bio-nitrogen fertilizers content of N , P and K in leaves and shoots tissues of cowpea plant during 1998 and 1999 .

Characters		1998						1999					
		N %		P %		K %		N %		P %		K %	
		Leaves	Shoots	Leaves	Shoots	leaves	Shoots	Leaves	Shoots	Leaves	Shoots	Leaves	Shoots
Control Without	Control	2.61	2.14	0.32	0.26	3.46	3.06	2.43	2.19	0.28	0.24	3.23	2.95
	25 g/kg	2.73	2.11	0.33	0.26	3.55	3.09	2.82	2.36	0.28	0.23	3.28	3.13
	50 g/kg	3.06	2.45	0.36	0.29	3.69	3.15	2.90	2.48	0.30	0.25	3.38	3.26
50kg/fed	Control	3.63	3.26	0.36	0.28	4.15	3.36	3.45	2.88	0.34	0.28	4.39	3.46
	25 g/kg	4.29	3.30	0.43	0.34	4.33	3.70	3.82	2.97	0.38	0.32	4.47	3.93
	50 g/kg	4.66	3.32	0.45	0.35	4.88	4.20	3.98	3.49	0.41	0.34	4.66	4.11
100kg/fed	Control	4.13	3.04	0.44	0.34	4.34	4.11	4.15	3.38	0.44	0.34	4.67	4.40
	25 g/kg	4.22	3.63	0.51	0.38	5.06	4.44	4.37	3.72	0.48	0.35	4.75	4.09
	50 g/kg	5.11	3.73	0.51	0.39	5.83	4.78	4.58	3.92	0.50	0.38	5.86	4.56
L.S.D at 5% level		N.S.	0.27	N.S.	N.S.	0.43	N.S.	N.S.	N.S.	N.S.	N.S.	0.28	N.S.