RESULTS AND DISCUSSION

FIRST STUDY

I- Growth Characters

1- The effect of nitrogen fertilizer levels :-

The parameters studied for growth of soybean plants were: plant height, number of branches/plant, number of leaves/plant, number of flowers/plant , number of pods/plant , dry weight of stems/plant , dry weight of leaves/plant , and dry weight of pods/plant at 55,76 and 97 days after sowing .

The results of the combined analysis of 1983 and 1984 seasons are shown in Table (5) . The results indicated that, number of leaves/plant , and dry weight of leaves/plant , at 55 days after sowing , number of flowers/plant , number of pods/plant , and dry weight of pods/plantat 76 days after sowing, number of pods/plant , and dry weight of pods/plant , at 97 days after sowing reached the significant level at 5% . On the other hand the effect of nitrogen levels on the other parameters studied for growth of soybean plants under different stages were not great enough to reach the significant level at 5% .

Table (5) The average values of some growth measurements of soybean plants as affected by nitrogen and phosphorus fertilizers at 55,76 and 97 days from sowing time .

" Combined analysis of 1983 and 1984 seasons "

Treatments	Plant height " cm "	Number of branches/ plant	Number of leaves/ plant	Number of flowers/ plant	Number of pods/ plant	Dry weight of stems/ plant "g."	Dry weight of leaves/ plant "g."	Dry weight of pods/ plant "g."
KgN/fed.		55 days from sowing time						
00	61.6	4.8	27.0	55.3	30.2	5.8	7.2	-
20	65.2	5.2	31.5	67.7	37.8	6.9	10.0	-
40	63.5	5.1	35.8	77.6	47.4	9.7	12.9	-
60	63.1	5.1	32.9	59.8	41.2	8.2	11.2	-
80	61.0	5.0	33.1	65.1	36.4	8.1	11.9	-
100	64.7	6.1	38.3	86.8	53.5	9.5	13.3	-
120	65.6	5.7	34.9	71.1	40.4	10.2	13.7	-
New L.S.D 5%	N.S	N.S	7.207	N.S	N.S	N.S	3.310	-
Kg P_2O_5/fed.								
00	62.1	5.2	33.4	67.4	38.3	8.0	11.8	-
30	64.8	5.3	32.3	73.1	43.2	8.3	11.2	-
60	63.7	5.3	34.4	71.0	41.4	8.8	11.4	-
New L.S.D 5%	N.S	N.S	N.S	N.S	N.S	N.S	N.S	-
KgN/fed.		76 days from sowing time						
00	79.0	5.2	31.2	67.2	56.1	9.1	11.2	7.0
20	88.4	5.5	36.6	82.6	73.1	11.1	13.1	9.6
40	85.0	5.8	35.4	90.2	78.6	13.6	13.4	11.6
60	85.6	6.1	40.1	90.8	81.2	13.8	15.4	11.6
80	84.7	5.3	39.7	98.3	88.4	10.8	12.5	10.6
100	82.0	5.7	39.7	91.9	78.3	11.9	15.2	12.7
120	85.2	5.7	38.0	95.0	84.5	13.4	15.8	12.4
New L.S.D 5%	N.S	N.S	N.S	14.03	14.1	N.S	N.S	4.076
Kg P_2O_5/fed.								
00	84.1	5.6	38.1	90.0	80.0	12.3	14.6	11.4
30	85.1	5.5	37.2	86.4	75.1	12.6	14.0	11.2
60	83.7	5.6	36.5	87.6	76.4	11.1	12.8	9.7
New L.S.D 5%	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S
KgN/fed.		97 days from sowing time						
00	97.9	5.1	26.6	-	63.5	12.0	9 .9	23.1
20	86.1	5.1	27.8	-	68.3	12.6	11.9	28.5
40	87.5	5.2	29.1	-	78.6	13.2	11.6	30.5
60	84.9	5.5	26.3	-	81.1	13.7	12.0	35.3
80	85.3	5.5	27.9	-	83.3	14.8	13.4	35.2
100	84.3	5.9	28.7	-	80.3	15.5	16.7	38.2
120	86.4	5.4	29.4	-	91.0	14.2	13.9	36.2
New L.S.D 5%	N.S	N.S	N.S	-	14.8	N.S	N.S	7.1
Kg P_2O_5/fed.								
00	85.0	5.6	28.5	-	80.8	13.6	12.7	32.0
30	85.3	5.2	28.1	-	77.5	13.6	12.6	32.3
60	84.4	5.3	27.3	-	75.8	14.0	13.1	32.9
New L.S.D 5%	N.S	N.S	N.S	-	N.S	N.S	N.S	N.S

The highest values of number of leaves/plant, and dry weight of leaves/plant , were obtained at 100 Kg N/feddan and 120 Kg N/feddan, respectively, at 55 days after sowing whereas the minimum ones were obtained from the control treatment .

The increase in the different parameters of soybean plants which were studied in the scope of our study might be attributed to the favorable effect of nitrogen on reproductive organs of the plant during growth stage . In addition increasing nitrogen level caused a favour photosynthetic activity and this in turn increased the dry weight of different organs .

These results are partioly agreement with those obtained by ,Singh and Saxena (1973 a), Sharaf (1980), Ali (1981) , Aamer (1982) and Osman (1985) .

The highest values of number of flowers and pods/plant were obtained when received 80 Kg N/feddan at 76 days after sowing . The dry weight of pods/plant reached it's peak by applying 100 Kg N/feddan at 76 and 97 days after sowing . The maximum number of pods/plant at 120 Kg N/feddan, whereas the minimum one was obtained from the control .

The increase in the different parameters of soybean plants which were studied in the scope of our study might be attributed to the favorable effect of nitrogen on the reproductive organs of the plant during growth stages and or to reduction in flowering which followed by increasing in pod abortion .

Increasing nitrogen level favours photosynthetic activity and this in turn increased the dry weight of the different organs .

The same trend was also realized by, Singh and Saxena (1973 a), Shahidullah and Hossain (1980) , Ali (1981),Aamer (1982) and Osman (1985) .

2- The effect of phosphorus fertilizer levels :-

The mean values of parameters studied for growth of soybean plant of the combined analysis over two years are presented in Table (5) . The differences between the mean values of plant height , number of branches/plant , number of leaves/plant , number of flowers/plant , number of pods/plant , dry weight of stems /plant , dry weight of leaves/plant , and dry weight of pods/plant , were not significantly affected by increasing phosphorus fertilizers rates at 55, 76 and 97 days from sowing time . This result might be due to enough available

phosphorus dose in the site of the experiment in addition to adequate requirement of soybean plants to phosphorus at this growth stage .

1- The effect of nitrogen fertilizer levels :-

The growth analysis studied under the scope of our study for soybean plants were : leaf area (L.A.) , leaf area index (L.A.I.) , specific leaf weight (S.L.W.) , and specific leaf area (S.L.A.) . The results of the combined analysis of 1983 and 1984 experiments which reported in Table (6) .

The results revealed that nitrogen levels gave a significant effect on leaf area (L.A.) , leaf area index (L.A.I.), specific leaf area (S.L.A.) , at 55 and 76 days after sowing , and specific leaf weight (S.L.W.) , at 55 and 97 days after sowing . On the other hand, the nitrogen effect was not significant on specific leaf weight (S.L.W.) at 76 days after sowing and leaf area (L.A.) , leaf area index (L.A.I.) , and specific leaf area (S.L.A.) , at 97 days after sowing .

Regarding to leaf area (L.A.), leaf area index (L.A.I.), specific leaf weight (S.L.W.) , and specific leaf area (S.L.A.) , at 55 days after sowing , the results showed that the highest values of leaf area (L.A.) , leaf area index (L.A.I.) , and

Table (6) The average values of some growth measurements of soybean plants as affected by nitrogen and phosphorus fertilizers at 55 , 76 and 97 days from sowing time .
" Combined analysis of 1983 and 1984 seasons "

Treatments	leaf area " cm^2 "	Leaf area index " cm^2/cm^2 "	S.L.W. " mg/cm^2 "	S.L.A. " cm^2/cm^3 "
Kg N/fed.	55 days from sowing time			
00	1693.3	5.9	4.43	0.104
20	2548.0	7.8	3.89	0.138
40	3056.5	8.5	4.41	0.143
60	2328·1	8.5	5.02	0.134
80	2431.4	8.4	4.79	0.131
100	2928.9	9.8	4.58	0.154
120	3359.8	11.2	4.09	0.170
New L.S.D 5%	1133.8	2.1	0.36	0.029
Kg P_2O_5/fed.				
00	2666.6	9.2	4.65	0.140
30	2584.9	7.9	4.40	0.136
60	2611.1	8.7	4.33	0.141
New L.S.D 5%	N.S	N.S	N.S	N.S
Kg N/fed.	76 days from sowing time			
00	1905.0	6.9	5.63	0.081
20	2755.9	9.4	4.78	0.100
40	2960.8	9.9	4.94	0.115
60	3373.0	11.6	4·74	0.140
80	2661.0	8.9	4.87	0.109
100	3086.0	10.3	4.91	0.128
120	3350.6	11.2	4.84	0.133
New L.S.D 5%	828.2	2.3	N.S	0.026
Kg P_2O_5/fed.				
00	3110.5	10.8	4.91	0.125
30	2854.6	9.5	5.02	0.112
60	2645.8	8.9	4.95	0.108
New L.S.D 5%	N.S	1.6	N.S	N.S
Kg N/fed.	97 days from sowing time			
00	1909.8	6.4	5.42	0.084
20	2301.4	7.7	5.29	0.090
40	2227.0	7.4	5.16	0.086
60	2105.3	7.0	5.31	0.086
80	3285.6	10.9	4.77	0.134
100	3002.9	10.0	5.54	0.122
120	2504.5	8.3	5.72	0.102
New L.S.D 5%	N.S	N.S	0.62	N.S
Kg P_2O_5/fed.				
00	2535.5	8.4	5.28	0.103
30	2500.5	8.3	5.11	0.102
60	2394.0	8.0	5.55	0.097
New L.S.D 5%	N.S	N.S	N.S	N.S

specific leaf area (S.L.A.) were obtained when received 120 Kg N/feddan, and the minimum values were obtained from the control treatment . Also the highest value of specific leaf weight (S.L.W.) was obtained at 60 Kg N/feddan , and the minimum value was obtained when received 20 Kg N/feddan at 55 days after sowing .

The increase in the leaf area of soybean plants might be due to the increase in number of leaves and leaf expantion which resulted from the increase in the number and /or size of cells during division stage . The leaf area index gave the same trend as that of leaf area where the highest value was reached at the highest nitrogen level i.e. 120 Kg N/feddan . It could be concluded that the increase in specific leaf weight of soybean plants might be attributed to the favorable effect of low rate of nitrogen which resulted in increasing the specific leaf weight owing to the highest values of leaf area (L.A.) , leaf area index (L.A.I.) , specific leaf area(S.L.A.), were obtained when received 120 Kg N/feddan , and the minimum values were obtained from the control treatment . Also the highest value of specific leaf weight (S.L.W.) was obtained at 60 Kg N/feddan , and the minimum value was obtained when received 20 Kg N/feddan at 55 days after sowing .

The increase in the leaf area of soybean plants might be due to the increase in number of leaves and leaf expantion which resulted from the increase in the number ond / or size of cells during division stage . The leaf area index gave the same trend as that of leaf area where the highest value was reached at the highest nitrogen level i.e. 120 Kg N/feddan. It could be concluded that the increase in specific leaf weight of soybean plants might be attributed to the favorable effect of low rate of nitrogen which resulted in increasing the specific leaf weight owing to the increase in leaf thickness and the decrease in leaf expanding than that obtained from the high rate of nitrogen .

Maximum and minimum values of leaf area , were 3373.0 and 1905.0 "cm^2" , while for leaf area index were 11.6 and 6.9 "$c\,m^2/cm^2$" and for specific leaf area were 0.140 and 0.081 "cm^2/cm^3" at 76 days from sowing time by 60 Kg N/feddan and control treatment,respectively . In addition the maximum and minimum values for specific leaf weight were 5.72 and 4.77 "mg/cm^2" at 97 days after sowing by 120 Kg N/feddan and 80 Kg N/feddan , respectively .

Similar results were reported by , Eisa (1980) , Hassan (1981) , Aamer (1982) , El-Kady et.al. (1982) , Abdalla (1983),

and Osman (1985) .

2- The effect of phosphorus fertilizer levels:-

The effect of phosphorus fertilizer rates on leaf area (L.A.) , leaf area index (L.A.I.) , specific leaf weight (S.L.W.), and specific leaf area (S.L.A.) of soybean plants are shown in Table (6) .

The differences between the averages of leaf area (L.A.), leaf area index (L.A.I.) , specific leaf weight (S.L.W.), and specific leaf area (S.L.A.) , were not significant at 55 and 97 days after sowing , and the leaf area (L.A.) , specific leaf weight (S.L.W.) , and specific leaf area (S.L.A.) , were not significant at 76 days after sowing . These results might be due to enough available adequate phosphorus dose in the sites of our experiments .

With regard to leaf area index (L.A.I.), the results showed that the highest value was obtained by zero fertilization. The average values of leaf area index (L.A.I.) decreased by increasing phosphorus doses up to 60 Kg P_2O_2/feddan, at 76 days after sowing .

3- The effect of interaction between N x P :-

Table (7) shows that the differences between the means number of pods/plant was significant at 55 and 97 days after sowing , whereas the other characters were not affected due to the interaction between N x P fertilizers .

The application of 100 Kg N/feddan and 60 Kg P_2O_5/feddan on soybean plants caused a significant increase in number of pods/plant at 55 days after sowing , and the number of pods/ plant at 97 days after sowing was increased significantly when received 60 Kg N/feddan with 30 Kg P_2O_5/feddan . It was clear that the higher values of number of pods/plant were 63.75 and 98.25 which observed from adding 100 Kg N with 60 Kg P_2O_5/ feddan and 60 Kg N with 30 Kg P_2O_5/feddan , respectively, at 55 and 97 days after sowing . The lower values were 22.17 and 48.83 , obtained from adding zero nitrogen with 60 Kg P_2O_5/ feddan at 55 and 97 days after sowing,respectively .

II- Yield and yield components

1- The effect of nitrogen fertilizer levels:-

Table (8) shows the combined analysis of two years for the plant height , number of branches/plant , number of pods/ plant , number of seeds/pod, weight of pod , weight of seeds/

Table (7) The average values of pods number per plant of soybean at 55 and 97 days from sowing time as affected by the interaction between nitrogen and phosphorus fertilizers.

" Combined analysis of 1983 and 1984 seasons "

Treatments	Number of pods / plant							Number of pods / plant						
	Kg N / fed.							Kg N / fed.						
	00	20	40	60	80	100	120	00	20	40	60	80	100	120
	55 days from sowing time							97 days from sowing time						
Kg P_2O_5/fed.														
00	33.72	32.28	47.75	41.06	34.67	34.61	44.17	77.61	69.00	78.83	76.44	88.19	84.75	90.50
30	34.78	34.17	56.78	39.78	28.06	62.22	46.75	64.17	67.50	71.11	98.25	71.33	82.08	87.70
60	22.17	46.94	37.64	42.67	46.42	63.75	30.39	48.83	68.33	85.84	68.61	90.28	74.20	94.75
New L.S.D 5%	17.50							21.29						

Table (8) The average values of yield components of soybean as affected by nitrogen and phosphorus fertilizers .

" Combined analysis of 1983 and 1984 seasons "

Treatments	Plant height "cm"	Number of branches/ plant	Number of pods/ plant	Number of seeds/ pod	weight of pod "g."	weight of seeds/ pod "g"	Number of seeds/ plant	weight of seeds/ plant "g"	seed index "g."
Kg N/fed.									
00	86.4	5.0	62.8	2.9	0.54	0.30	149.3	17.3	12.5
20	86.5	5.3	69.3	2.8	0.54	0.31	162.9	16.7	13.0
40	93.0	4.9	75.6	2.8	0.57	0.33	176.4	21.7	13.6
60	88.3	5.3	73.1	2.8	0.56	0.34	171.0	21.3	13.8
80	90.4	4.6	81.8	2.8	0.58	0.36	168.7	21.1	14.3
100	92.2	5.1	77.2	2.8	0.60	0.38	187.0	25.9	15.7
120	94.3	4.7	84.6	2.9	0.62	0.40	203.1	24.5	15.5
New L.S.D 5%	N.S	N.S	N.S	N.S	0.046	0.042	N.S	6.97	0.803
Kg P_2O_5/fed.									
00	89.9	5.0	74.4	2.8	0.56	0.35	175.9	20.6	14.0
30	89.2	4.8	74.1	2.8	0.57	0.34	171.5	21.3	13.8
60	91.3	5.2	76.2	2.9	0.58	0.35	174.8	21.7	14.3
New L.S.D 5%	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

pod , number of seeds/plant , weight of seeds/plant , and seed index .

The differences between the averages of pod weight , weight of seeds/pod , weight of seeds/plant , and seed index were significant due to nitrogen fertilizer . The results showed that , the highest means of weight of pod , and weight of seeds/pod , were 0.62 "g " and 0.40 "g " , respectively , when received 120 Kg N/feddan , whereas the minimum ones for the respective characters were 0.54 "g " and 0.30 "g " , obtained from the control treatment . On the other hand the differences between the means of plant height , number of branches/plant , number of pods/plant , number of seeds/pod , and number of seeds/plant , were not significant due to N fertilization .

The maximum values of weight of seeds/plant and seed index of soybean were 25.9 "g " , and 15.7 "g " observed when received 100 Kg N/feddan , whereas the minimum of respective characters were 17.3 "g " and 12.5 "g " , obtained from the control treatment . These increases in the mean of seed yield/plant might be due to the increases in the weight of seeds/pod and seed index .

Similar results were reported by , Eisa (1980), Sharaf (1980), Ali (1981) , Aamer (1982) , El-Kady et.al. (1982) , Hussein et. al. (1984), Sharaf (1984), and Osman (1985) .

2- The effect of phosphorus fertilizer levels :-

The mean values of yield components as affected by phosphorus fertilization in the combined analysis of the two seasons are presented in Table (8) .

The differences between the mean values of plant height, number of branches/plant , number of pods/plant , number of seeds/pod , weight of pod, weight of seeds/pod , number of seeds/plant , weight of seeds/plant , and seed index were not significantly affected by phosphorus fertilizer levels . These results might be due to the enough available phosphorus dose in the site of both experiments .

1- The effect of nitrogen fertilizer levels :-

The average values of seed yield and straw yield "ton/feddan" as affected by nitrogen fertilizer rates are presented in Table (9) .

Table (9) The average values of seed yield and straw yield " Ton/feddan " of soybean as affected by nitrogen and phosphorus fertilizers as well as the combined analysis of 1983 and 1984 seasons .

Treatments	Seed yield Ton / fed.			Straw yield Ton / fed.		
	1983	1984	Combined	1983	1984	Combined
Kg N/fed.						
00	0.825	0.702	0.764	2.433	2.550	2.492
20	0.990	0.969	0.979	3.104	2.996	3.050
40	1.304	1.199	1.252	3.733	3.145	3.439
60	1.261	1.182	1.222	3.398	2.686	3.042
80	1.446	1.274	1.360	3.573	2.607	3.090
100	1.582	1.447	1.515	3.682	3.479	3.581
120	1.817	1.611	1.714	3.805	4.710	4.257
New L.S.D 5%	0.182	0.304	0.162	0.459	N.S	1.006
Kg P_2O_5/fed.						
00	1.220	1.132	1.176	3.449	3.086	3.267
30	1.387	1.232	1.310	3.210	3.100	3.155
60	1.347	1.229	1.288	3.510	3.317	3.414
New L.S.D 5%	0.106	N.S	0.0899	N.S	N.S	N.S

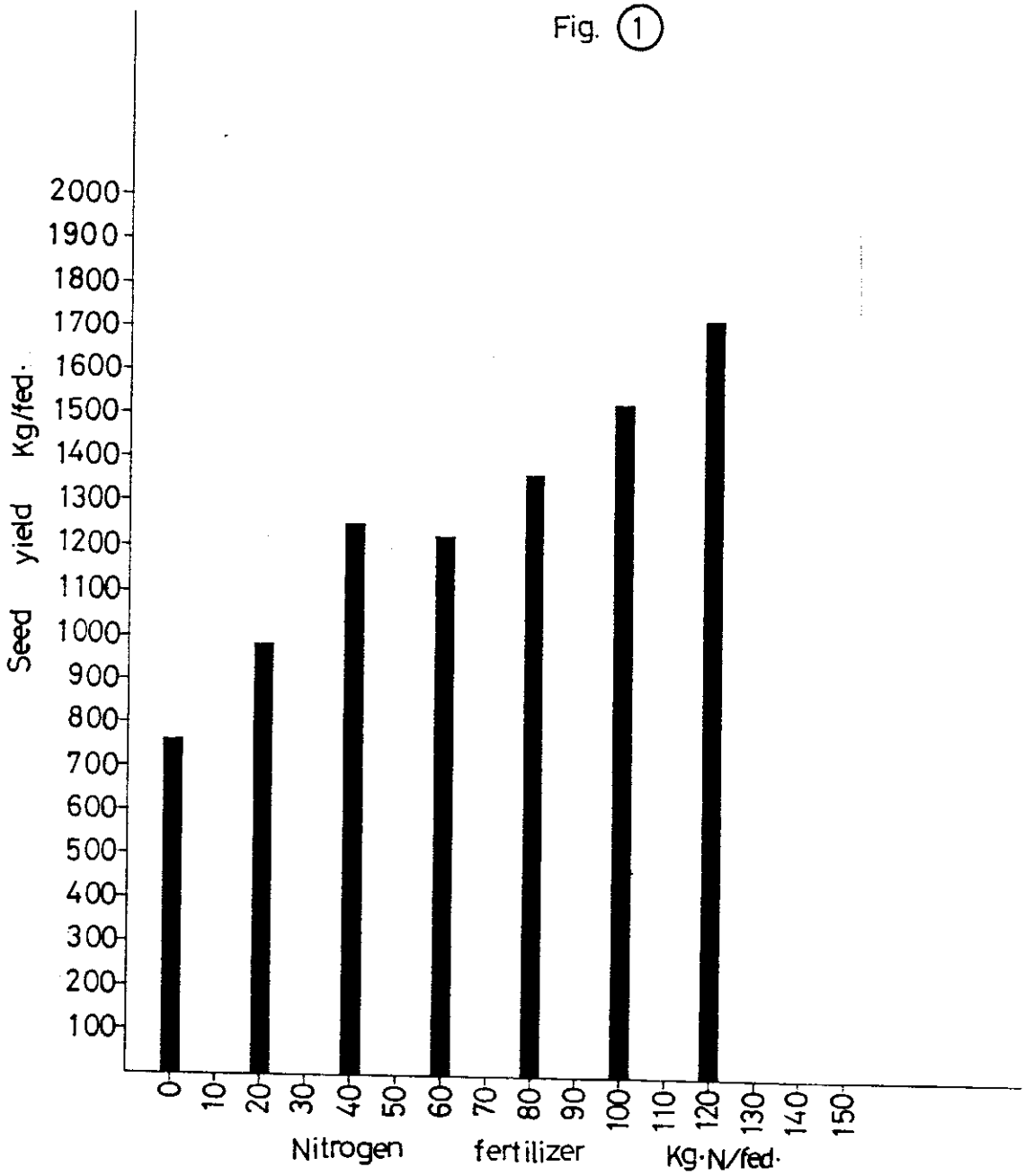
The results of 1983 , 1984 seasons and the combined analysis , indicated that the seed yield "ton/feddan" and straw yield "ton/feddan" increased by increasing nitrogen fertilizer rates up to 120 Kg N/feddan , at harvesting time . The differences between the average values of seed yield "ton/feddan" reached the significant level at 5% during the two seasons and the combined analysis .

The highest values of seed yield "ton/feddan" were obtained at 120 Kg N/feddan , during the both seasons and the combined analysis (Fig. 1) . The maximum values of seed yield "ton/feddan" were 1.817 , 1.611 and 1.714 "ton/feddan" for 1983 , 1984 and combined analysis of the two seasons , respectively , when received 120 Kg N/feddan. The minimum ones were 0.825, 0.702, and 0.764 "ton/feddan" in 1983 , 1984 seasons and the combined analysis , respectively , obtained from the control treatment .

The increase in the average values of seed yield "ton/feddan" resulted from the increases in weight of pod, weight of seeds/pod , seed index , and weight of seeds/plant .

The same trend was also realized by,Neunylov and Slabko (1967) ,

Fig. (1)



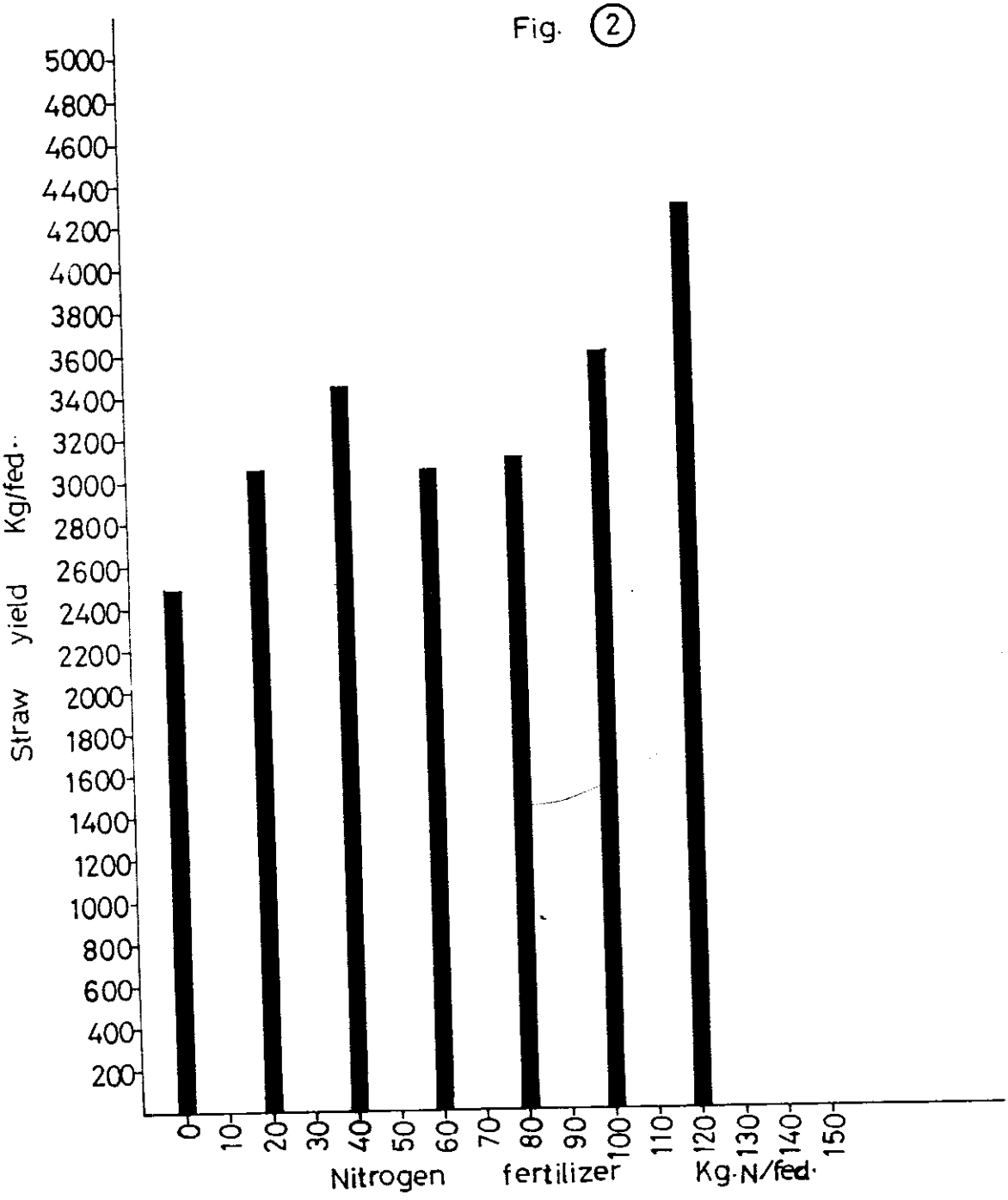
Relationship between seed yield and nitrogen fertilizer (Kg. N/feddan)

Mate (1977), Milanez et. el. (1978 b) , Eisa (1980) , Sharaf (1980) , Ali (1981) , El-Kady et. al. (1982) , Pawar et. al. (1982) , Abdalla (1983) , Bassiem (1983) , Bassiem (1983) , Hussein et. al. (1984) , Sharaf (1984) , and Osman (1985) .

The differences between the means of straw yield "ton/feddan" in the first season i.e. 1983 and the combined analysis of two seasons , were significant . On the other hand,the differences between the means of straw yield "ton/feddan" in the second season i.e. 1984 was not significant . It was clear that the highest straw yield "ton/feddan" were 3.805 and 4.257 "ton/feddan" for 1983 and the combined analysis of two years , respectively,when received 120 Kg N/feddan, whereas the lowest ones were 2.433 and 2.492 "ton/feddan" in 1983 and the combined analysis,respectively,(Fig. 2) obtained from the control treatment .

The increase in the means of straw yield of soybean might be due to the increases in plant height , number of branches/plant , number of leaves/plant.

Fig. (2)



Relationship between straw yield and nitrogen fertilizer (Kg.N/feddan)

These results are in good agreement with those obtained by Sharaf (1980) , Ali (1981) , Aamer (1982) , Katoch el. al. (1983) , Hussein et. al. (1984) and Osman (1985) .

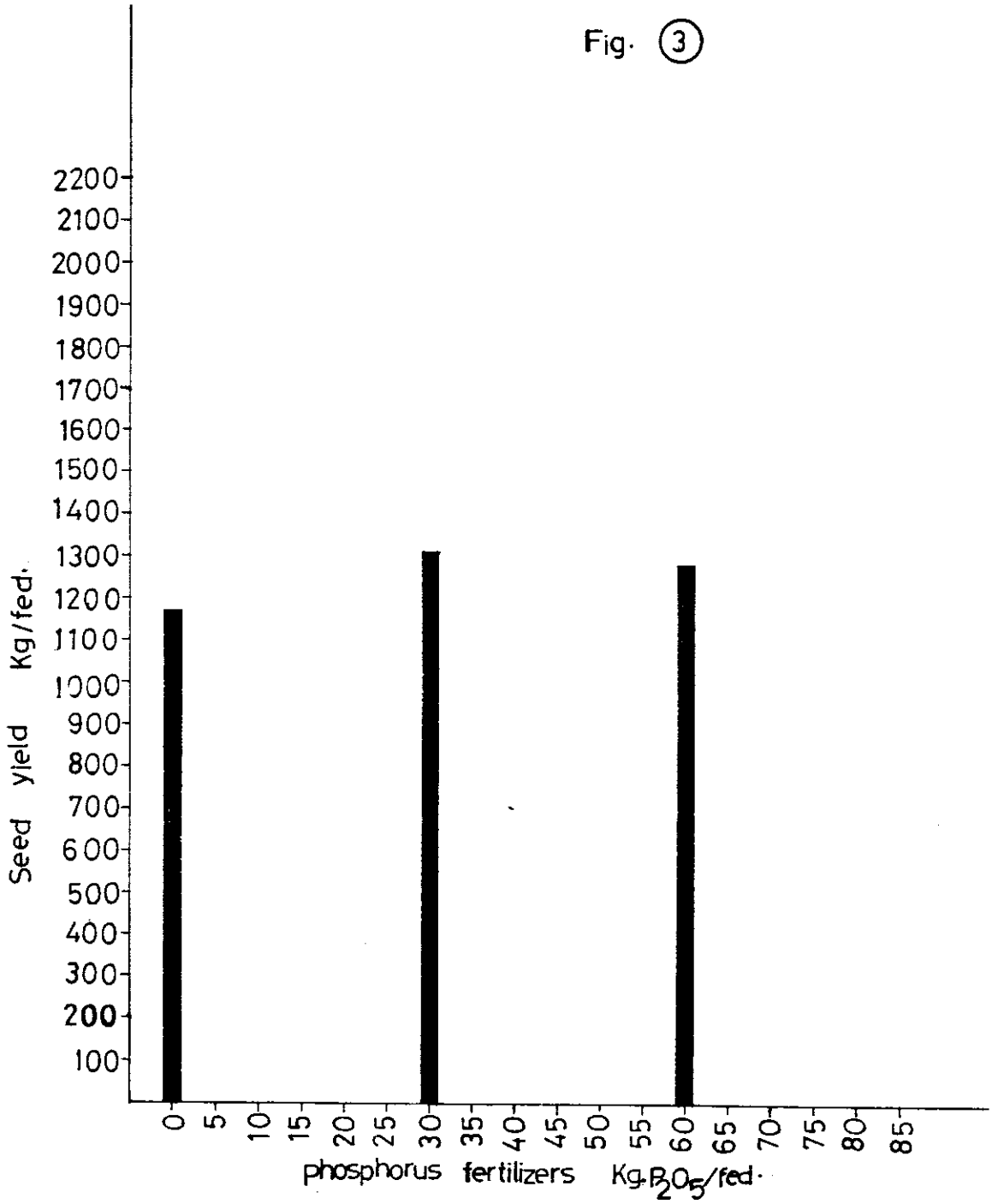
2- The effect of phosphorus fertilizer levels :-

The mean values of seed yield and straw yield "ton/feddan" as affected by phosphorus fertilization during 1983, 1984 seasons and the combined analysis between the two seasons are shown in Table (9) .

The differences between the mean values of seed yield was not significantly increased by increasing phosphorus levels up to 60 Kg P_2O_5/feddan as compared with the control treatment during 1984 season . The differences between the averages of seed yield "ton/fed." were significant in 1983 season and the combined analysis at 30 Kg P_2O_5/feddan, (Fig.3) whereas in 1984 season the seed yield was not affected due to P fertilization.

The maximum values of seed yield were 1.387 and 1.310 "ton/feddan" observed when received 30 Kg P_2O_5/feddan, whereas the minimum ones were 1.220 and 1.176 "ton/feddan" obtained from the control treatment in 1983 season and the combined analysis of 1983 and 1984 seasons , respectively .

Fig. (3)



Relationship between seed yield and phosphorus fertilizers (Kg. P_2O_5/feddan)

It should be mentioned that the increase in seed yield might be attributed to the essential effect of phosphorus for seed formation in legumes .

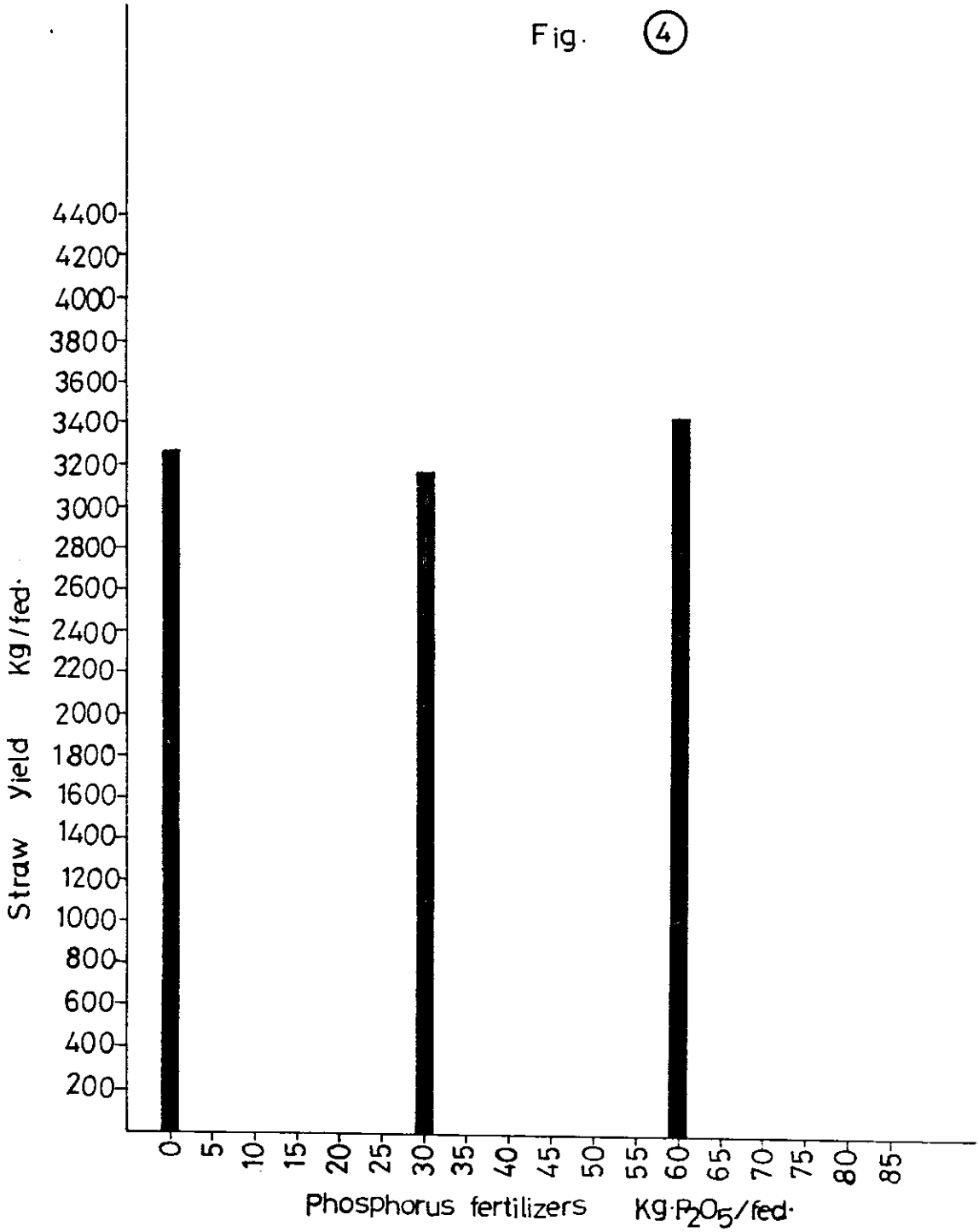
Similar trend was obtained by , Singh and Saxena (1973 b), Roy and Mishra (1975) , Milanez et. al. (1978 a) , Abd El-Rhhman et. al. (1979) , Sharaf (1980), Mahajan et. el. (1982), Gaydou and Arrivets (1983), and El-Deepah (1985) .

The differences between the mean values of straw yield "ton/fed." were not significant due to phosphorus fertilizers under study in 1983 , 1984 seasons and the combined analysis , (Fig. 4) . These results indicate that there was no relationship between different phosphorus fertilizer rates and vegetative growth of soybean plants and this in turn gave no response to straw yield .

3- The effect of interaction between N x P :-

The effect of interaction between nitrogen and phosphorus fertilizers on yield components and straw yield in the combined analysis were not significant and consequently the data were excluded . On the other hand the effect of interaction on seed yield "ton/feddan" was significant (Table 10) . The results

Fig. (4)



Relationship between straw yield and phosphorus fertilizers (Kg. P_2O_5/feddan)

Table (10) The average values of seed yield " Ton/feddan" of soybean as affected by the interaction between nitrogen and phosphorus fertilizers .
" Combined analysis of 1983 and 1984 seasons "

Treatments	Kg N /fed.						
	00	20	40	60	80	100	120
Kg P_2O_5/fed.							
00	0.711	0.924	1.098	1.098	1.433	1.391	1.647
30	0.814	0.991	1.333	1.355	1.506	1.506	1.663
60	0.766	1.023	1.324	1.213	1.142	1.647	1.900
New L.S.D 5%		0.3396					

illustrated in Table (10) show that the seed yield significantly increased by increasing nitrogen and phosphorus fertilizers rates . The maximum value of seed yield was 1.900 "ton/feddan" , obtained from adding 120 Kg N with 60 Kg P_2O_5/feddan, whereas the minimum one was 0.711 "ton/feddan" , obtained from unfertilized treatment .

The increases in the seed yield of soybean might be attributed to the increase in phosphorus fertilizer levels which encouraged the absorption of nitrogen fertilizer and this in turn increased in the photosynthetic and transporting effeciency of the plants . It was clear that these elements resulted in increasing the yield components of soybean plant .

The same trend was also realized by Kocur (1974) .

III- Chemical contents

1- The effect of nitrogen fertilizer levels :-

Photosynthetic pigments i.e. chlorophyll "a" , chlorophyll "b" and carotenoides "mg/dec^2" of soybean plants as affected by nitrogen fertilizer rates at different stages of plant growth i.e. 55, 76 and 97 days after sowing .

The results of the combined analysis of 1983 and 1984 seasons which is reported in Table (11) indicated clearly that

Table (11) The average values of photosynthetic pigments in soybean leaves as affected by nitrogen and phosphorus fertilizers at 55,76 and 97 days from sowing time.

" Combined analysis of 1983 and 1984 seasons "

Treatments	Chlorophyll 'a' " mg / dec^2 "	Chlorophyll 'b' " mg / dec^2 "	Carotenoides " mg / dec^2"
Kg N/fed.	55 days from sowing time		
00	2.00	0.79	1.22
20	2.46	0.80	1.46
40	2.61	0.82	1.48
60	2.78	0.85	1.54
80	2.64	0.94	1.49
100	2.63	0.87	1.54
120	2.85	1.01	1.60
New L.S.D 5%	0.30	N.S	0.18
Kg P_2O_5 / fed.			
00	2.61	0.84	1.50
30	2.53	0.91	1.47
60	2.57	0.86	1.46
New L.S.D 5%	N.S	N.S	N.S
Kg N / fed.	76 days from sowing time		
00	1.58	0.49	0.94
20	1.76	0.68	0.93
40	2.05	0.75	1.10
60	2.12	0.67	1.04
80	2.37	0.83	1.25
100	2.34	0.80	1.32
120	2.38	0.79	1.29
New L.S.D 5%	0.47	0.25	0.23
Kg P_2O_5 / fed.			
00	2.02	0.71	1.12
30	2.12	0.77	1.06
60	2.13	0.67	1.19
New L.S.D 5%	N.S	N.S	N.S
Kg N/fed.	97 days from sowing time		
00	1.24	0.41	0.71
20	1.18	0.38	0.68
40	1.27	0.40	0.68
60	1.24	0.45	0.74
80	1.50	0.49	0.84
100	1.50	0.45	0.82
120	1.27	0.45	0.72
New L.S.D 5%	N.S	N.S	0.09
Kg P_2O_5 / fed.			
00	1.28	0.41	0.73
30	1.36	0.45	0.74
60	1.28	0.44	0.76
New L.S.D 5%	N.S	N.S	N.S

photosynthetic pigments of soybean plants i.e. chlorophyll "a" chlorophyll "b" and carotenoides, at 55 , 76 and 97 days after sowing increased by increasing nitrogen levels.

The differences between the averages of chlorophyll "a", carotenoides , at 55 days after sowing as well as chlorophyll "a" , chlorophyll "b" , carotenoides , were significant at 76 days after sowing and carotenoides at 97 days after sowing due to N fertilizer level . On the other hand,the differences between the means of chlorophyll "b" at 55 days after sowing and chlorophyll "a", chlorophyll "b" , in soybean plants at 97 days after sowing were not significant .

Adding nitrogen fertilizer at the rate of 120 Kg N/feddan, gave the highest values of chlorophyll "a" , carotenoides, at 55 days after sowing . The highest values of chlorophyll "a" and chlorophyll "b" were obtained at 120 Kg N, and 80 Kg N/ feddan , respectively , whereas carotenoides reached it's peak at 100 Kg N/feddan at 76 days after sowing . The highest value of carotenoides , was obtained at 80 Kg N/feddan , at 97 days after sowing .

It could be concluded that the high rate of N resulted in increasing the content of photosynthetic pigments of soybean .

This result might be attributed to the great increase in both number and /or size of cells of green leaves with nitrogen application . Nitrogen is necessary for building more chlorophyll units which in turn encourages plant to convert light energy to metabolites .

The same trend was also realized by , Ali (1981), Yakout et.al. (1981) , and Osman (1985) .

2- The effect of phosphorus fertilizer levels :-

The mean values of photosynthetic pigments i.e. chlorophyll "a" , chlorophyll "b" , and carotenoides "mg/dec^2" of soybean plants as affected by phosphorus fertilizer rates at 55, 76 and 97 days after sowing and the combined analysis of 1983 and 1984 seasons , are illustrated in Table (11).

The results indicate that applying all levels of P fertilizer , did not gave a significant effect on photosynthetic pigments i.e. chlorophyll "a" , chlorophyll "b" , and carotenoides "mg/dec^2" , at 55 , 76 and 97 days after sowing .

It could be concluded that the available phosphorus in experimental farm was great enough for soybean plants under study .

3- The effect of interaction between N x P :-

The effect of interaction between N x P on chlorophyll "a" and carotenoides at 76 days after sowing in combined analysis was significant Table (12) . On the other hand the interaction between nitrogen and phosphorus fertilizers on the other characters were not significant .

The highest values of chlorophyll "a" and carotenoides, were 2.906 and 1.492 "mg/dec^2" , obtained from applied 80 Kg N with 30 Kg P_2O_5/feddan and 100 Kg N with 60 Kg P_2O_5 / feddan , respectively , whereas the lowest values were 1.287 and 0.653 "mg/dec^2" , obtained from adding zero nitrogen with 60 Kg P_2O_5/feddan and 20 Kg N with 30 Kg P_2O_5/feddan , respectively , at 76 days after sowing .

1- The effect of nitrogen fertilizer levels :-

The results of the combined analysis of 1983 and 1984 seasons which reported in Table (13) indicated that , nitrogen percentage of stem , leaves and pods , as well as phosphorus percentage of stem and pods , were not significantly affected due to N fertilization under study at 76 days after sowing . On the other hand phosphorus percentage of leaves declined by increasing nitrogen doses . The results show

Table (12) The average values of chlorophyll "a" " mg/dec^2 " and carotenoides " mg/dec^2 " in soybean leaves at 76 days from sowing time as affected by the interaction between nitrogen and phosphorus fertilizers .

" Combined analysis of 1983 and 1984 seasons "

Treatments	Chlorophyll "a" " mg / dec^2 "							Carotenoides " mg / dec^2 "						
	Kg N / fed.							Kg N / fed.						
	00	20	40	60	80	100	120	00	20	40	60	80	100	120
Kg P_2O_5/fed.														
00	1.68	1.65	2.55	1.90	2.15	2.11	2.08	1.06	1.02	1.37	0.93	1.16	1.09	1.23
30	1.78	1.73	1.61	1.94	2.91	2.09	2.75	0.76	0.65	0.88	1.04	1.33	1.37	1.39
60	1.29	1.91	1.98	2.53	2.05	2.81	2.32	0.99	1.11	1.04	1.17	1.25	1.49	1.25
New L.S.D 5%				0.77							0.48			

Table (13) The average values of chemical contents of soybean plants as affected by nitrogen and phosphorus fertilizers at 76 days from sowing time. " Combined analysis of 1983 and 1984 seasons "

Treatments	Nitrogen percentage N%			Phosphorus percentage P%		
	Stems	Leaves	Pods	Stems	Leaves	Pods
Kg N/fed.						
00	0.9	3.0	2.7	0.10	0.17	0.22
20	0.9	2.4	2.7	0.12	0.08	0.21
40	1.0	3.5	3.7	0.09	0.14	0.23
60	1.3	3.3	2.6	0.07	0.10	0.20
80	1.2	3.3	3.0	0.08	0.10	0.18
100	1.4	3.3	3.0	0.08	0.12	0.17
120	1.1	4.5	3.8	0.14	0.11	0.20
New L.S.D 5%	N.S	N.S	N.S	N.S	0.06	N.S
Kg P_2O_5/fed.						
00	1.3	3.3	3.1	0.10	0.10	0.18
30	1.0	3.5	2.7	0.09	0.12	0.21
60	1.1	3.2	3.4	0.10	0.13	0.21
New L.S.D 5%	N.S	N.S	N.S	N.S	N.S	N.S

that the differences between the averages of phosphorus percentage in leaves were significant due to N levels , whereas the other characters were not affected, at 76 days after sowing.

2- The effect of phosphorus fertilizer levels :-

The effect of phosphorus fertilizers rates on nitrogen and phosphorus percentage in stems , leaves , and pods of soybean plants are shown in Table (13) .

The data show that , there were no significant differences in nitrogen and phosphorus percentages of stem , leaves , and pods owing to different phosphorus fertilizers doses , at 76 days after sowing . These results might be due to the enough available phosphorus dose in the site of the experimental farm in addition to adequate requriment of soybean plants to phosphorus at this growth stage .

1- The effect of nitrogen fertilizer levels :-

The mean values of chemical contents of soybean seeds as affected by nitrogen fertilization in combined analysis between two seasons are presented in Table (14) .

Regarding oil percentage , the results showed that there was a significant increase in oil percentage with application of nitrogen fertilizers up to 40 Kg N/feddan. Furthermore

Table (14) The average values of chemical contents as affected by nitrogen and phosphorus fertilizers on soybean seeds .

" Combined analysis of 1983 and 1984 seasons "

Treatments	Oil percentage	Protein percentage	Oil yield Kg/fed.	Protein yield Kg/fed.
Kg N/fed.				
00	25.7	33.2	196.4	252.2
20	25.2	32.0	247.9	312.2
40	27.1	35.0	337.5	438.1
60	26.8	39.9	327.3	489.8
80	25.3	43.4	343.9	591.3
100	26.0	40.2	394.9	611.1
120	26.6	41.1	452.6	696.2
New L.S.D 5%	0.848	5.5	46.6	106.0
Kg P_2O_5 / fed.				
00	26.1	36.2	307.7	431.6
30	26.1	38.4	343.1	517.9
60	26.1	38.8	335.2	503.7
New L.S.D 5%	N.S	N.S	23.8	66.8

nitrogen application caused insignificant reduction in oil percentage . Protein percentage of soybean seeds followed the same trend . Increasing nitrogen levels , caused a significant increase of protein percentage up to 80 Kg N/feddan , the protein percentage declined and this decline was not great enough to reach the significant level at 5% . It could be concluded that nitrogen at the rate of 40 Kg N/feddan , as well as 80 Kg N/feddan favorus production of oil and protein in soybean seeds . These results are in agreement with the results reported by , Weber (1966 a) , Ham et. al. (1975), Vrataric and Krizmanic (1977), Eisa (1980) , Hassan (1981) , and Pawar et. al. (1982) .

It was observed from the results of chemical contents i.e. oil yield and protein yield "Kg/feddan" increased by increasing nitrogen levels up to 120 Kg N/feddan . The results of Table (14) show that the minimum values of oil yield "Kg/feddan" and protein yield "Kg/feddan" were 196.4 and 252.2 "Kg/feddan" , respectively , obtained from the control treatment , whereas the maximum values were 452.6 and 696.2 "Kg/feddan" , respectively , when soybean plants received 120 Kg N/feddan .

The significant increases in oil yield "Kg/feddan" may be due to the increases of both oil percentage and / or seed yield "ton/feddan" . Whereas the increases in protein yield "Kg/feddan" may be attributed to the significant increase in protein percentage and /or seed yield "ton/feddan" .

These results are in good agreement with those obtained by, Ham et. al. (1975) , Chamber (1980) , Abdalla (1983), and Osman (1985) .

2- The effect of phosphorus fertilizer levels :-

The mean values of oil percentage , protein percentage , oil yield "Kg/feddan", and protein yield "Kg/feddan" as affected by phosphorus fertilization are shown in Table (14) . The results indicate that the oil percentage and protein percentage were not significantly affected by P application in the combined analysis .

The results of the combined analysis of 1983 and 1984 seasons , show that the oil yield "Kg/feddan" and protein yield "Kg/feddan" were significantly affected in the combined analysis of 1983 and 1984 seasons due to the P fertilizer . The maximum oil yield and protein yield "Kg/feddan" were 342.1 and 517.9

"Kg/feddan" , respectively , at 30 Kg P_2O_5/feddan , whereas the minimum respective values were 307.7 and 431.6 "Kg/feddan" obtained from the control treatment . The oil and protein yield "Kg/feddan" significantly increased due to the increase in seed yield "ton/feddan" because the oil and protein yield "Kg/feddan" were obtained by multiplying both oil and protein percentage by seed yield .

These results agree with those obtained by, El-Deepah (1985) who mentioned that , oil yield , protein yield "Kg / feddan" increased markedly as a result of applying P only.

SECOND STUDY

I- Growth Characters

1- The effect of soil types :-

The characters of growth measurements of soybean plants were : plant height , number of branches/plant , number of leaves/plant , number of flowers/plants , number of pods/plant number of nodules/plant , volume of nodule , dry weight of stems plant , dry weight of roots/plant , dry weight of leaves/plant and dry weight of whole plant , illustrated in Table (15) .

The results of the combined analysis of 1983 and 1984 seasons , indicated clearly that the growth parameters of soybean plants i.e. plant height , number of leaves/plant , number of flowers/plant , number of pods/plant , dry weight of stems/plant , dry weight of roots/plant , dry weight of leaves/plant , and dry weight of whole plant , at 53 days after sowing were great under clay soil , when compared with sandy and sandy clay loam soils . However the number of nodules/plant was great under sandy soil than clay and sandy clay loam soils .

The results added also that the differences between the averages of plant height , number of leaves/plant ,

Table (15) The average values of growth measurements of soybean plants as affected by three types of soil , nitrogen fertilization and inoculation at 53 days from sowing time.
" Combined analysis of 1983 and 1984 seasons "

Treatments	plant height "cm"	Number of branches/ plant	Number of leaves/ plant	Number of flowers/ plant	Number of pods/ plant	Number of nodule/ plant	Volume of nodule cm^3	Dry weight of stems/ plant "g"	Dry weight of roots/ plant "g"	Dry weight of leaves/ plant "g"	Dry weight of whole plant "g"
Type of Soil											
1- Clay Soil	38.8	1.4	10.2	16.1	6.2	5.9	0.03	0.75	0.31	1.78	2.84
2- Sandy Soil	33.6	0.7	6.7	7.9	3.3	8.2	0.03	0.34	0.30	0.74	1.38
3- Sandy Clay loam	34.9	1.1	7.7	10.2	3.5	4.6	0.02	0.42	0.17	0.99	1.59
New L.S.D 5%	2.8	N.S	0.6	1.6	1.4	2.1	N.S	0.089	0.079	0.13	0.25
Kg N/fed.											
00	36.5	1.0	7.8	11.3	3.7	6.6	0.03	0.46	0.25	1.04	1.75
40	34.5	1.1	8.5	11.4	4.5	6.4	0.03	0.52	0.26	1.24	2.02
80	36.2	1.1	8.5	11.4	4.7	5.7	0.02	0.53	0.28	1.23	2.04
New L.S.D 5%	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	0.23
Inoculation treatments											
1-Uninoculation	35.8	0.9	8.4	11.3	3.8	0.0	0.000	0.52	0.26	1.20	1.97
2-Inoculation	35.7	1.2	8.0	11.5	4.8	12.4	0.03	0.49	0.27	1.14	1.90
New L.S.D 5%	N.S	N.S	N.S	N.S	0.9	1.6	0.012	N.S	N.S	N.S	N.S

number of flowers / plant , number of pods / plant , number of nodules/plant , dry weight of stems/plant , dry weight of roots/plant , dry weight of leaves/plant , and dry weight of whole plant were significant . On the other hand, the differences between the means of branches number/plant , and volume of nodule were not significant .

The increase in different parameters of soybean plants which studied in the scope of our study in clay soil might be attributed to the increase in organic matter content which improved the chemical properties of the soil . In addition the available NP in clay soil were great enough in clay soil than those in sandy and sandy clay loam soils . On the contrary the number of nodules/plant reached the highest value "8.20 nodules" under sandy soil condition .

2- The effect of nitrogen fertilizer levels :-

Table (15) shows that the differences between the mean values of plant height , number of branches/plant , number of leaves/plant , number of flowers/plant , number of pods/plant, number of nodules/plant , volume of nodule , dry weight of

stems/plant , dry weight of roots/plant , and dry weight of leaves/plant , were not significant when received nitrogen level up to 80 Kg N/feddan when compared with the control treatment of the combined analysis of 1983 and 1984 seasons .

The data added also that the differences between the dry weight of whole plant as affected by nitrogen fertilizer was significant . Regarding to the dry weight of whole plant, the results show that the highest value was 2.04 "g " when received 80 Kg N/feddan , at 53 days after sowing . The increase in the dry weight of the whole plant at 40 and 80 Kg N/feddan was 0.27 and 0.29 "g ",respectively , over the control treatment which gave 1.75 "g " . It could be concluded that the significant increase between the averages of morphological characters of soybean plants in clay soil might be due to its suitability from the stand point of physical as well as chemical properities and this in turn encourage the meristematic activity and building more tissues and organs of the plant during , the different growth stages .

The increase in the dry weight of whole plant might be attributed to the favorable effect of nitrogen on reproductive organs of the plant during growth stage . Increasing nitrogen levels caused a favour photosynthetic activity and this in

turn resulted in increasing the dry weight of different organs.

These results are in harmony with those obtained by , Singh and Saxena (1973 a) , Rabie et.al. (1979), Barthakur (1980) , Eisa (1980) , Hassan (1981) , Abdalla (1983), and El-Essawi and Abadi (1983) for dry weight .

3- The effect of inoculation :-

The mean values of growth measurements of soybean calland cultivar as affected by inoculation with Rhizobium japonicum are illustrated in Table (15) .

The results show that the differences between the number of pods/plant , number of nodules/plant , and volume of nodule, were significant under nodulation treatments , whereas the differences between the means of plant height , number of branches/plant , number of leaves/plant , number of flowers/plant, dry weight of stems/plant , dry weight of roots/plant , dry weight of leaves/plant , and dry weight of whole plant were not significant .

Regarding to the number of pods/plant , number of nodules/plant , and volume of nodule , the results show that the highest values were obtained by nodulation soybean seeds with Rhizobium japonicum before sowing .

The increase in the different parameter of soybean plant which studied in the scope of our study might be attributed to the favorable effect of nodulation of soybean plants, which in turn resulted in higher fixed amount of nitrogen . It was clear that there was a positive relationship between the volume of nodules and the amount of nitrogen fixation .

In this connection , it showed be mentioned that similar results were obtained by , Dadson and Acquaah (1984) .

4- The effect of interaction between N x inoculation :-

Table (16) shows that the differences between the dry weight of stems/plant , and dry weight of leaves/plant "g " at 53 days after sowing were significant due to the interaction between N x inoculation . On the other hand the effect of the interaction on the other growth characters under study was not significant , and consequently the data were excluded.

The results , obtained in Table (16) indicate that the application of 80 Kg N/feddan with nonnodulation gave the highest average of dry weight of stems/plant which equal to 0.60 "g " , whereas the lowest one was 0.43 "g " , obtained from zero nitrogen with nodulation . The maximum value for dry weight

Table (16) The average values of dry weight of stems and leaves dry weight of soybean plants as affected by the interaction between nitrogen fertilization and inoculation by (Rhizobium japonicum) at 53 days from sowing time .

" Combined analysis of 1983 and 1984 seasons "

Inoculation Treatments	Dry weight of stems in g / plant			Dry weight of leaves in g / plant		
	Nitrogen levels Kg N/fed.			Nitrogen levels Kg N/fed.		
	00	40	80	00	40	80
Uninoculation	0.50	0.46	0.60	1.13	1.11	1.36
Ineculation	0.43	0.58	0.46	0.46	1.38	1.10
New L.S.D 5%		0.14			0.25	

of leaves/plant was 1.38 "g ", observed by adding 40 Kg N/ feddan with nodulation , whereas the minimum one was 0.46 "g ", obtained from unfertilized with nodulation .