J. Agric. Sci. Mansoura Univ., 27 (12):, 2002

PHYSIOLOGICAL RESPONSE OF MUNGBEAN PLANTS TO PHOSPHORUS LEVELS AND SOME WEED CONTROL TREATMENTS

Ramadan, Amany A. and Samia A. Saad El-Din
Botany Department, National Research Centre, Dokki, Giza, Egypt.

ABSTRACT

Two field experiments were conducted at the Agricultural Experimental Station of the National Research Centre at Shalakan, Kalubia Governorate, Egypt in summer seasons of 1999 and 2000. The objective of the experiments were to study the effect of phosphorus levels and some weed control treatments on pigments, physiological parameters, yield and chemical composition of mungbean seeds as well as associated weeds. The most important results obtained from this study could be summarized as follows:

- Increasing P-level from 0 to 15, 30 and 45 Kg P_2O_5/fed significantly increased fresh and dry weights of total weeds after 45 and 60 days from sowing, pigments, physiological parameters, yield and chemical composition of the yielded mungbean seeds compared with unfertilized treatment.
- All weed control treatments reduced significantly fresh and dry weights of total weeds as compared to the un-weeded treatments. The most effective treatments for weed control in mungbean field were: two hand hoeing; bentazone + one hand hoeing and butralin + one hand hoeing.
- Applications of two hand hoeing recorded the highest values of chlorophyll a, chlorophyll b, carotinoids and consequently total chlorophyll and total pigments compared to other treatments followed by the of one hand hoeing treatment and butralin + one hand hoeing. Vise-versa, bentazon and fluazifop-butyl produced the lowest values of the aforementioned characters.
- Application of two hand hoeing treatment recorded the highest values of physiological characters, yield and chemical composition of mungbean seeds. But, un-weeded treatment produced the highest values of specific leaf area (SLA) and leaf area duration (LAD).
- The interaction between phosphorus levels and weed control treatments had significant effect on net assimilation ratio (NAR) and crop growth rate (CGR). Application of 45 Kg P_2O_5/fed produced greater NAR and CGR compared with other treatments when two hand hoeing applied.

On the light of the obtained results, the present study recommended the importance of good phosphorus fertilization and weed control via two hand hoeing for mungbean cultivations in order to get better results.

INTRODUCTION

Mungbean (*Vigna radiata* “L.” Wilczek) is a summer growing annual legumes and high yielding pulse crops in the world. Widely spread in India, China, Thailand, Indonesia, Pakistan and Egypt (Ashour *et al.*, 1997). It is known as a short duration summer pulse crop with high nutritional value (25-28% protein, 1-1.5% fat, 3.5-4.5% fiber, 4.5-5.5% ash and 62-65% carbohydrates). Recently, mungbean introduced to Egypt in 1986. For increasing mungbean productivity in Egypt, it can be achieved through agricultural practices such as phosphorus fertilization and weed control treatments. Abd El-lateef *et al.* (1998) stated that increasing P-fertilizer levels from 0 to 15.5 and 31 Kg P_2O_5 significantly increased seed yield (Kg/fed) for mungbean. Also, Sarkar and Banik (1991); Tomar *et al.* (1995); Deka and Kakati (1996); Saxena *et al.* (1996) and Shukla and Dixit (1996) found that increasing phosphorus levels from 0 to 30 and 60 Kg P_2O_5/ha increased seed yield and total protein percentage.

Weeds, generally, compete with mungbean plants on nutrients, water, light and other essential requirements. Thus weed control is one of the most essential cultural practices of raising mungbean yield and improving its quality. Application of bentazon at 0.5 Kg/ha as post emergence after 20 days from sowing provided the lowest weed dry matter and the highest seed yield compared to the un-weeded plants, which gave the highest weed dry matter and lowest seed yield (Singh *et al.*, 1988 and Vaishya and Singh, 1989). Balyan *et al.* (1995) indicated that foliar application of fluazifop-butyl at 0.25 Kg/ha after 20 days from sowing caused significant reduction in dry matter of weeds and significantly increased seed yield. Bauer *et al.* (1995) found that post-emergence application of bentazon decreased the chlorophyll a content in *Phaseolus vulgaris* plants. Also, Ahmed and Rashad (1996) reported that application of fluazifop-butyl decreased chlorophylls and carotinoids contents in soybean plants. Many investigators studied the effect of herbicides in mungbeans and showed that there is an increase in mungbean growth, yield and yield components due to application of fluazifop-butyl at 0.25 Kg/ha after 20 days from sowing (Singh *et al.*, 1996 and Ramanthan and Chandrashekharan, 1998). Singh and Roa (1992); Singh *et al.* (1996) and Mahmoud (1998) stated that two hand hoeings gave the highest physiological parameters, seed yield, total carbohydrates and total protein contents compared with the un-weeded treatment.

Moreover, mechanical control (hand hoeing) of weeds compared to chemical control (herbicides) contributes in decreasing the hazardous effects (environmental pollution) resulted from the accumulation of these chemical compounds (herbicides) in the soil and drainage water. The solubility and toxicity of the herbicides used in this study is variance, so its accumulative effect in polluting the environment depends on the frequent applications in weed control. Butralin is practically insoluble in water (0.3 mg/l at 24^{o}C) and classified in class IV of toxicity; Fluazifop-butyl is classified in class II of toxic substances and soluble in most organic solvents, and Bentazon is a natural product incorporated into soil organic matter fraction (CO_2). Its half-life in soils is 13 days, on average, under field conditions and classified in class III of toxicity, and the Lysimeter studies clearly demonstrate bentazone does not leach (EPD, 1999). So far, as much the conventional methods of weed control (mechanical control) is convenience to get ride of weeds as the natural resources (environment) is safe against pollutants e.g. herbicides (chemical control).

The aim of this work is to investigate the reflection of phosphorus levels and some weed control treatments (mechanical vs. chemical practices as well as combination of them) on the growth and yield of mungbean plants.

Pigments, physiological parameters, yield and chemical composition of mungbean seeds as well as associated weeds were also studied.

MATERIALS AND METHODS

Two field experiments were conducted during the summer seasons of 1999 and 2000 at the Agricultural Experimental Station of the National Research Centre at Shalakan, Kalubia Governorate. The experiments aimed to study the effect of phosphorus levels and some weed control treatments on pigments, physiological parameters, yield and chemical composition of mungbean seeds c.v. Kawmy1 and the associated weeds as well.

Experiments were laid-out in a split-plot design with 4 replicates. The main plots were devoted to the four phosphorus levels 0, 15 to 30 and 45 Kg P_2O_5/fed. During seed-ped preparation, the phosphatic fertilizer levels were applied as calcium super-phosphate (15.5% P_2O_5). The sub-plots included 9 weed control treatments as follows:

1. Butralin [N-(2-butyl)-4-(tert-butyl)-2,6-dinitroaniline], commercially known as Amex-820, sprayed pre-emergence at the rate of 2.5 L/fed after planting and before irrigation.
2. Fluazifop-butyl [Butyl 2-(4-(5-trifluoromosmethyl-2-pyridyloxy) phenoxy] propionate, commercially known as Fusilade, sprayed at the rate of 2.0 L/fed after 4 weeks from sowing.
3. Bentazon [3-isopropyl 1H-2, 1, 3 benzathiadiazin-4-(3H) one, 2, 2-dioxide], commercially known as Basagran 48%, sprayed at the rate of 0.75 L/fed after 2 weeks from sowing.
4. Butralin at the rate of 1.9 L/fed + one hand hoeing after 3 weeks from sowing.
5. Fluazifop-butyl at the rate of 1.5 L/fed + one hand hoeing after 2 weeks from sowing.
6. Bentazon at the rate of 0.56 L/fed + one hand hoeing after 4 weeks from sowing.
7. One hand hoeing after 2 weeks from sowing.
8. Two hand hoeing after 2 and 4 weeks from sowing.
9. Control.

Herbicides were applied in the form of foliar spraying at the rate of 200 liters water/fed.

The experimental unit of sub-plot area was 3.5 x 3.0 m (1/400 fed.). The experiments were preceded by wheat in both seasons. Experimental soil was clay-loamy with 1.80%, 2.78%, 7.80%, 0.079% and 14.2 ppm for organic matter, calcium carbonate, pH, total-nitrogen and available phosphorus. The chemical analysis of the experimental soil carried out according to the methods outlined by Piper (1950). Mungbean seeds were inoculated with the specific *Rhizobium* strain and immediately sown in hills 15 cm apart on both sides of the ridge. Sowing dates were 26^{th} and 29^{th} May in 1999 and 2000 seasons, respectively. A starter dose of 15 Kg N/fed was applied as ammonium nitrate (33.5% N) just before the first irrigation took place. Two weeks later, the plants were thinned at two plants per hill to attain the usual field number of plants.

Data recorded:

1. Weeds:

Weeds were hand pulled from one square meter of each plot at 45 and 60 days from sowing. Fresh and dry weights of total weeds were recorded. The common weeds in both growing seasons were *Amaranthus caudatus*, L.; *Convolvulus arvensis*, L.; *Xanthium spinosum*, L.; *Cyperus rotundus*, L. and *Cyndon dactylon*, L.

2. Mungbean plants:

A. Growth parameters:

Ten plants were selected at random from the inner rows of each sub-plot at 55 and 70 days after sowing to determine the following parameters:

1. Leaf area index (LAI). 2. Specific leaf area (SLA, cm^2/mg).
3. Specific leaf weight (SLW, mg/cm^2). 4. Leaf weight ratio (LWR, gm/gm).
5. Leaf area Ratio (LAR, cm^2/gm). 6. Leaf area duration (LAD, m^2/week).
7. Relative growth rate (RGR, gm/gm/week).
8. Net assimilation rate (NAR, gm/dm^2/week).

[The above growth parameters were determined according to Watson (1958)].

9. Crop growth rate (CGR, gm/m^2/day) according to Radford (1967).

B. Estimation of photosynthetic pigments:

The plant photosynthetic pigments (chlorophyll a, chlorophyll b and carotenoids) were determined by spectrophotometric method as recommended by Metzner *et al.* (1965).

C. Yield:

Seed yield/fed was estimated from the weight of seeds/plot adjusted to 15% moisture.

D. Chemical composition of mungbean seeds:

Protein percentage was determined according to A.O.A.C. (1980), while total carbohydrates percentage was determined according to Dubois *et al.* (1956). Phosphorus and potassium percentages were determined according to Cottenie *et al.* (1982).

Data were statistically analyzed by analysis of variance (ANOVA) of split-plot design as mentioned by Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

1. Weeds:

Effect of phosphorus levels:

Data in Table (1) show that the application of 30 and 45 Kg P_2O_5/fed. markedly increased in fresh and dry weights of total weeds after 45 and 60 days from sowing. On the other hand, the lowest fresh and dry weights of total weeds after 45 and 60 days from sowing were observed with unfertilized treatment. The increase in fresh and dry weights of weeds in response to P-fertilization might be due to the role of P-fertilizer in increasing the vegetative growth and development of weeds. The obtained results are in accordance with those reported by Lalithabai and Sinha (1993) and Arvadiya *et al*. (1996).

Effect of weed control treatments:

The results of weed control treatment presented in Table (1) showed significant effects on fresh and dry weights of total weeds after 45 and 60 days from sowing. The lowest values of fresh and dry weights of total weeds were obtained when two hand hoeings, bentazon+one hand hoeing, bentazon and butralin+one hand hoeing were applied. On the contrary, the highest values of fresh and dry weights of total weeds were recorded when mungbean plants were unweeded. These results may be due to the inhibition effect of weed control treatments on growth of weeds.

Table (1): Effect of phosphorus levels and weed control treatments on total fresh and dry weights of weeds after 45 and 60 days from sowing during 1999 and 2000 growing seasons.

Treatments	Total fresh weight of weeds (gm/m^2)				Total dry weight of weeds (gm/m^2)			
	At 45 days	At 60 days	At 45 days	At 60 days	At 45 days	At 60 days	At 45 days	At 60 days
	1999	2000	1999	2000	1999	2000	1999	2000
A. P_2O_5 levels (Kg/fed.):								
0	116.42	122.92	129.72	143.17	24.17	25.67	24.58	27.47
15	133.22	142.03	145.81	168.64	27.67	29.67	27.42	32.92
30	157.69	170.36	161.25	183.79	32.97	35.56	30.22	34.94
45	166.50	176.94	167.06	189.14	34.89	36.83	31.22	36.44
F-Test	**	**	**	**	**	**	**	**
L.S.D. at 0.05	7.90	6.42	3.27	5.90	2.34	1.61	1.47	0.95
0.01	11.36	9.23	4.70	8.47	3.36	2.31	2.12	1.36
B. Weed control treatments:								
Butralin	116.38	126.00	122.07	140.88	23.31	25.32	23.69	28.88
Fluazifop-butyl	178.56	188.50	193.81	216.00	38.57	40.56	36.81	41.81
Bentazon	102.96	113.57	103.13	122.06	20.57	23.00	19.19	23.31
Butralin + one hand hoeing	109.50	119.69	111.25	129.38	21.94	24.06	20.44	24.81
Fluazifop-butyl + one hand hoeing	143.25	153.56	158.62	179.31	31.13	33.25	30.13	34.50
Bentazon + one hand hoeing	86.75	95.69	87.19	107.57	17.37	19.44	16.01	20.82
One hand hoeing	195.94	204.07	207.62	233.32	41.19	42.56	38.25	43.13
Two hand hoeing	73.44	82.07	73.94	92.75	15.50	17.12	14.00	17.94
Control	284.63	294.44	301.00	318.81	59.74	62.06	56.75	61.31
F-Test	**	**	**	**	**	**	**	**
L.S.D. at 0.05	7.27	8.82	6.42	3.79	2.52	2.06	0.63	0.34
0.01	9.65	11.70	8.52	5.03	3.35	2.73	0.84	0.45

Two hand hoeings, bentazon + one hand hoeing and bentazon treatments were the most effective for controlling mungbean weeds. This may be due to attributable efficiency of hoeing in stunting of weeds. These results were in general agreement with those obtained by Singh and Roa (1992); Borah (1994); Singh *et al.* (1996) and Yadav and Shrivastava (1998).

2. Mungbean plants:

A. Growth of mungbean:

Effect of phosphorus levels:

The means of leaf area index (LAI), specific leaf weight (SLW), leaf weight ratio (LWR) at 45 and 60 days from sowing, leaf area duration (LAD), relative growth rate (RGR), net assimilation ratio (NAR), crop growth rate (CGR) were significantly affected by P-levels in the two seasons as shown in

Tables (2 and 3). Increasing P-levels from 0 to 15, 30 and 45 Kg P_2O_5/fed. caused significant increase in LAI, SLW, LWR, LAD, RGR, NAR and CGR. Application of 30 and 45 Kg P_2O_5/fed. Lead to produce maximum values of the studied growth characters, while the lowest values of the aforementioned characters were recorded from the unfertilized plots. On the other side, the unfertilized treatment produced the highest values of SLA and LAR in both seasons. Also, the lowest values of SLA and LAR were recorded from application of 45 Kg P_2O_5/fed. These results were in harmony with those obtained by Saxena *et al*. (1996), El-Karamany (1997), Radwan (1997) and Abd El-Lateef *et al.* (1998).

Effect of weed control treatments:

Results in Tables (2 and 3) indicated that LAI, SLW. LWR at 45 and 60 days from sowing, LAD, RGR, NAR and CGR were significantly increased by using weed control treatments. This was true for both experimental seasons. Two hand hoeings treatment recorded the highest values of studied growth characters, followed by that of bentazon + one hand hoeing and butralin + one hand hoeing treatments. On the contrary, the lowest values of the aforementioned characters were recorded with the un-weeded control. Such superiority of two hand hoeings, bentazon + one hand hoeing and butralin + one hand hoeing treatments over the un-weeded treatment in these growth attributes may be attributed to the reduction in dry weight of weeds, which decreased the competition between weeds and mungbean plants on the growth factors, i.e. water, nutrients and light consequently, more dry matter was accumulated and higher growth attributes values were recorded. These results are in good accordance with those obtained by Roa *et al*. (1993) and Singh *et al*. (1994). They found that hand hoeing and herbicidal treatment had significant effects on LAI, RGR and NAR compared to the un-weeded treatments. Vise-versa the un-weeded treatment produced the highest values of specific SLA and LAR in both seasons. While, the lowest values of SLA and LAR were recorded from two hand hoeings treatment.

Effect of the interaction between P-levels and weed control treatments:

Data in Table (4) show that there were significant effect of the interaction between P-levels and weed control treatments. Application of P-fertilizer markedly increased NAR and CGR with each increase in P-levels up to 45 Kg P_2O_5/fed. under the difference of weed control methods in both seasons. Application of 45 Kg P_2O_5/fed. produced greater NAR and CGR compared with other treatments when two hand hoeing was used followed by that of bentazon + one hand hoeing and butralin + one hand hoeing in both seasons. However, the un-weeded control produced the lowest values of the tested characters compared with other treatments in the case of unfertilized treatments. Similar results were reported by Bai *et al.* (1992) and Singh and Rao (1992).

2

3

B. Photosynthetic pigments:

Effect of P-levels:

Data presented in Table (5) showed a positive effects on mungbean pigments due to the phosphatic fertilization. Such effects were significant on chlorophyll a, chlorophyll b, carotenoids and consequently total chlorophyll and total pigments. Application of 30 and 45 Kg P_2O_5/fed. gave the greatest values of photosynthetic pigments of mungbean plants. On the other hand, the unfertilized treatment produced the lowest values. These results may be attributed to the increase in cytokinins contents of the treated plants. In accordance with this conclusion Brozenkova and Makronozov (1976) who reported that cytokinins increased the number of chloroplasts in the young leaves by increasing both the intensity of cell growth hormones and the activity of cytoplasm riposomes, thus chlorophyll synthesis was stimulated.

Table (4): Average of net assimilation ratio (NAR) and crop growth rate (CGR) of mungbean plants as affected by the interaction between phosphorus levels and weed control treatments during 1999 and 2000 growing seasons.

Treatments	1999				2000			
P-levels	0	15	30	45	0	15	30	45
	NAR (gm/dm^2/week)							
Butralin	0.125	0.167	0.186	0.211	0.107	0.155	0.168	0.192
Fluazifop-butyl	0.120	0.156	0.176	0.203	0.105	0.146	0.160	0.185
Bentazon	0.133	0.169	0.198	0.206	0.111	0.164	0.175	0.201
Butralin + one hand hoeing	0.157	0.188	0.213	0.221	0.152	0.175	0.196	0.207
Fluazifop-butyl + one hand hoeing	0.150	0.180	0.204	0.214	0.135	0.159	0.194	0.195
Bentazon + one hand hoeing	0.160	0.191	0.229	0.240	0.157	0.181	0.220	0.223
One hand hoeing	0.112	0.143	0.181	0.205	0.097	0.140	0.159	0.179
Two hand hoeing	0.165	0.203	0.241	0.253	0.153	0.190	0.224	0.232
Control	0.086	0.116	0.150	0.178	0.083	0.123	0.142	0.167
L.S.D. at 0.05	0.0065				0.0067			
0.01	0.0086				0.0089			
	CGR (gm/m^2/day)							
Butralin	4.67	6.53	8.63	10.03	5.41	6.30	7.23	9.10
Fluazifop-butyl	4.43	6.30	7.47	8.87	4.20	5.60	7.12	7.93
Bentazon	5.60	7.47	9.10	9.80	4.43	6.53	7.93	9.33
Butralin + one hand hoeing	7.23	9.33	12.13	13.30	7.00	8.87	10.50	11.67
Fluazifop-butyl + one hand hoeing	6.76	8.17	10.50	11.20	5.83	7.70	9.80	10.27
Bentazon + one hand hoeing	8.63	11.43	13.07	14.91	8.17	10.50	12.13	14.00
One hand hoeing	4.67	7.46	7.93	9.57	4.20	5.83	7.00	8.63
Two hand hoeing	7.93	11.66	14.23	14.95	7.70	10.50	13.07	14.23
Control	2.80	3.73	5.13	5.80	2.33	3.27	4.43	5.13
L.S.D. at 0.05	1.25				1.24			
0.01	1.66				1.64			

Effect of weed control treatments:

Chlorophyll a, chlorophyll b, carotenoids, total chlorophyll and total pigments of mungbean leaves under different weed control methods are presented in Table (5). It is obvious from the data that weed control methods revealed significant influences on aforementioned characters in mungbean during 1999 and 2000 seasons. Two hand hoeings, butralin + one hand hoeing and one hand hoeing gave the highest values of photosynthetic pigments of mungbean as compared with other treatments. Whereas, bentazon and fluazifop-butyl gave the lowest values of mungbean pigments. These findings are supported with Bauer *et al.* (1995), Ahmed and Rashad (1996) and El-Quesni *et al.* (2000).

Table (5): Effect of phosphorus levels and weed control treatments on chlorophyll (a), chlorophyll (b), carotenoids, total chlorophyll (a+b) and total pigments of mungbean plants during 1999 and 2000 growing seasons (values expressed as mg pigment.g^{-1} fresh weight).

Treatments	Chlorophyll (a)		Chlorophyll (b)		Carotenoids		Total chlorophyll (a+b)		Total pigments	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
A. P_2O_5 levels (Kg/fed.):										
0	1.514	1.539	0.807	0.859	0.711	0.736	2.321	2.398	3.032	3.134
15	2.392	2.373	1.196	1.244	0.807	0.863	3.588	3.617	4.395	4.480
30	3.190	3.198	1.487	1.396	0.835	0.906	4.677	4.594	5.512	5.500
45	3.303	3.314	1.558	0.988	0.897	0.935	4.861	4.302	5.758	5.237
F-Test	**	**	**	**	**	**	**	**	**	**
L.S.D. at 0.05	0.011	0.006	0.008	0.005	0.009	0.008	0.005	0.003	0.008	0.007
0.01	0.016	0.009	0.012	0.008	0.014	0.012	0.007	0.005	0.012	0.011
B. Weed control treatments:										
Butralin	2.849	2.808	1.305	1.169	0.857	0.925	4.154	3.977	5.011	4.902
Fluazifop-butyl	2.156	2.181	1.079	0.966	0.679	0.778	3.235	3.147	3.932	3.925
Bentazon	2.094	2.067	1.023	0.923	0.672	0.675	3.117	2.990	3.789	3.665
Butralin + one hand hoeing	2.921	2.841	1.353	1.267	0.891	0.965	4.274	4.108	5.165	5.073
Fluazifop-butyl + one hand hoeing	2.358	2.537	1.226	1.105	0.819	0.784	3.584	3.642	4.403	4.426
Bentazon + one hand hoeing	2.481	2.397	1.307	1.005	0.778	0.799	3.788	3.402	4.566	4.201
One hand hoeing	2.899	2.870	1.325	1.195	0.864	0.935	4.259	4.065	5.088	5.000
Two hand hoeing	2.934	3.060	1.429	1.301	0.902	1.086	4.363	4.361	5.465	5.447
Control	2.708	2.692	1.310	1.620	0.850	0.892	4.018	4.312	4.860	5.204
F-Test	**	**	**	**	**	**	**	**	**	**
L.S.D. at 0.05	0.010	0.012	0.013	0.013	0.012	0.013	0.013	0.014	0.013	0.013
0.01	0.013	0.017	0.017	0.017	0.016	0.017	0.018	0.018	0.017	0.018
C. Interaction:	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

C. Yield:

Effect of P-levels:

Results in Table (6) showed significant and consistent increase in seed yield with each increase in phosphorus fertilization levels up to 45 Kg P_2O_5/fed. The highest seed yield obtained from application of 45 Kg P_2O_5/fed. in both seasons. On the other hand, the lowest values of the seed yield were recorded from unfertilized plots in both seasons. Increasing P-levels increased seed yield (Kg/fed.) than unfertilized treatment by about 32.85, 25.80 and 10.44% in the first season and 31.82, 26.22 and 10.13% in the second season.

The response of mungbean yield to the phosphatic fertilizer applied could be attributed to the regulatory effect of phosphorus as well as the nutritional balance of the elements which reflected on the final yield. The obtained results are in accordance with those reported by several investigators among them (Saxena *et al.*, 1996; Shukla and Dixit, 1996 and Abd El-lateef *et al*., 1998).

Effect of weed control treatments:

Seed yield (Kg/fed.) was significantly increased by different weed control treatments in 1999 and 2000 seasons (Table 6). Data cleared that the greatest seed yield (Kg/fed.) were achieved by using bentazon + one hand hoeing followed by that of two hand hoeings and butralin + one hand hoeing treatments. While, the lowest seed yield was recorded with the un-weeded (control). The results obtained herein indicated that the use of bentazon + one hand hoeing produced a promising effect against weed prevailing in mungbean fields and in turn exhibited better increase in mungbean yield in comparison with other treatments.

The previous treatments increased seed yield of mungbean by 31.18, 28.59 and 24.27% in the first season and by 36.45, 33.39 and 27.35% in the second season, respectively as compared o the un-weeded treatment. These results are in general agreement with those obtained by Viashya (1994); Singh *et al.* (1996); Shaban and El-Metwally (1997) and Yadav and Shrivastava (1998).

D. Chemical composition of mungbean seeds:

Effect of phosphorus levels:

Data presented in Table (6) show significant increase in all studied traits (total carbohydrate, total protein, potassium and phosphorus%) with increasing P-levels from 0 to 15, 30 and 45 Kg P_2O_5/fed. in both seasons.

Table (6): Effect of phosphorus levels and weed control treatments on mungbean seed yield (Kg/fed.) and its contents of total carbohydrates, total protein, potassium and phosphorus percentages during 1999 and 2000 growing seasons.

Treatments	Seed yield (Kg/fed.)		Total carbohydrate %		Total protein %		Potassium %		Phosphorus %	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
A. P_2O_5 levels (Kg/fed.):										
0	628.23	637.70	61.32	62.33	23.06	23.56	2.89	2.97	0.531	0.541
15	693.80	702.29	62.29	63.22	23.48	24.18	3.00	3.10	0.570	0.590
30	790.29	804.92	63.07	63.87	24.51	25.22	3.20	3.29	0.591	0.620
45	834.60	840.63	63.37	64.37	24.73	25.43	3.26	3.37	0.601	0.631
F-Test	**	**	**	**	**	**	**	**	**	**
L.S.D. at 0.05	24.25	33.66	0.93	1.06	0.37	0.34	0.050	0.025	0.012	0.008
0.01	34.84	48.36	1.34	1.53	0.53	0.48	0.072	0.036	0.018	0.012
B. Weed control treatments:										
Butralin	730.36	739.90	62.45	63.38	24.03	24.68	3.06	3.18	0.568	0.590
Fluazifop-butyl	701.84	699.04	61.72	62.91	23.93	24.60	2.99	3.10	0.553	0.578
Bentazon	750.67	745.44	62.70	63.63	24.19	24.84	3.09	3.20	0.574	0.595
Butralin + one hand hoeing	764.16	777.35	62.85	63.78	24.39	25.04	3.23	3.28	0.588	0.613
Fluazifop-butyl + one hand hoeing	757.25	771.75	62.68	63.63	24.31	24.96	3.20	3.23	0.575	0.605
Bentazon + one hand hoeing	806.65	832.91	63.33	64.26	24.75	25.40	3.26	3.32	0.595	0.615
One hand hoeing	714.03	726.51	62.55	63.23	22.80	23.46	2.99	3.14	0.561	0.585
Two hand hoeing	790.79	814.19	63.75	64.68	25.02	25.67	3.30	3.34	0.620	0.635
Control	614.90	610.40	60.60	61.58	22.09	22.74	2.69	2.88	0.526	0.543
F-Test	**	**	**	**	**	**	**	**	**	**
L.S.D. at 0.05	23.83	24.95	1.19	1.27	0.57	0.52	0.053	0.053	0.011	0.011
0.01	31.62	33.09	1.58	1.69	0.76	0.69	0.070	0.071	0.014	0.014
C. Interaction:	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

On the other side, unfertilized treatments produced the lowest values of total carbohydrate, total protein, potassium and phosphorus%.

Effect of weed control treatments:

Data presented in Table (6) show significant differences among weed control treatments in total carbohydrate, total protein, potassium and phosphorus%. Two hand hoeings produced the highest values of the aforementioned characters followed by that of bentazon + one hand hoeing and butralin + one hand hoeing, respectively compared with the un-weeded treatment which gave the lowest percentages. The lowest percentages of total carbohydrate, total protein, potassium and phosphorus% in the un-weeded treatment may be due to a strong competition between plants and weeds for nutrients, moisture and light transmission, consequently less assimilates are available to store in the seeds. These results were in harmony with those obtained by Bai *et al.* (1992) and Mahmoud (1998).

REFERENCES

Abd El-lateef, E.M.; T.G. Behairy and N.I. Ashour (1998). Effect of phosphatic and potassic fertilization on yield and its components of mungbean (*Vigna radiata* “L.”, Wilczek) varieties. Arab. Univ. J. Agric. Sci., Ain Shams Univ., Cairo, 6 (1): 167-181.

Ahmed, A.H.H. and M.H. Rashad (1996). Comparative studies on the effect of fusilade in corn (*Zea mays*) and soybean (*Glycine max*) plants. Bulletin of Faculty of Agriculture University of Cairo, 47 (4): 577-610.

A.O.A.C. (1980). Association of Official Analytical Chemists. Official Methods of Analysis. 13th ed., Washington, D.C.

Arvadiya, L.K.; C.L. Patel and M.K. Arvadiya (1996). Effect of irrigation, weed management and phosphorus on yield of summer greengram (*Vigna radiata*,L.).Gujarat Agricultural University Research Journal,21(2):104-106.

Ashour, N.I.; S.H. Abou-Khadra; M.E. Mosalem; G.M. Yakout; M.E. Zedan; E.M. Abd El-lateef; T.G. Behairy; Sh.A. Shaban; A.N. Sharaan; M.M. Selim; S.A. Mahmoud; M.W. Hassan; G.G. Darwish and M.Z. El-Hifny (1997). Introduction mungbean (*Vigna radiata* “L.”, Wilczek) in mungbean yield. J. Agron. (Accepted), Vol. 20.

Bai, E.; M.N. Sinha and R.K. Rai (1992). N P utilization by greengram (*Vigna radiata* “L.”, Wilczek) as influenced by phosphorus and weed management. J. of Nuclear Agric. And Biology, 21 (2)?: 105-111.

Balyan, R.S.; S. Singh; R.K. Malik and S. Singh (1995). Efficacy of soil and foliage applied herbicides for weed control in mungbean (*Vigna radiata* “L.”, Wilczek). Haryana Agricultural University Journal of Research, 25 (1-2): 35-40.

Bauer, T.A.; K.A. Renner and D. Penner (1995). “Olathe” Pinto bean (*Phaseolus vulgaris*) response to post emergence imazethapyr and bentazon. Weed Science, 43 (2): 276-282.

Borah, U.K. (1994). Effect of weed control and fertilizer application on productivity of mungbean under rainfed condition. Ann. of Agric. Res., 15 (4): 499-501.

Brozenkova, R.H. and R. Makronozov (1976). The role of phytohormones in biogenesis of chloroplasts. Field Crop Abst., 32 (4): 2436-2443.

Cottenie, A.; M. Verloo; L. Kiekens; G. Velge and R. Camerlyneck (1982). Chemical Analysis of Plant and Soil. Pp. 15-17.

Deka, N.C. and N.N. Kakati (1996). Effect of Rhizobium strains, methods of inoculation and levels of phosphorus on mungbean (*Vigna radiata* “L.”, Wilczek). Legume Research, 19 (1): 33-39.

Dubois, M.; K.A. Gilles; J.K. Hamilton; P.A. Rebers and F. Smith (1956). Colorimetric and determination of sugars and related substances. Anal. Chem., 27: 350.

El-Karamany, M.F. (1997). Effect of some agronomic treatments on growth, yield and chemical components of mungbean (*Vigna radiata* “L.”, Wilczek). Ph.D. Thesis, Fac. of Agric., Al-Azhar Univ., Cairo, Egypt.

El-Quesni Fatma, E.M.; M.R. Abo El-Suoud and S.M. Salwa Gaweesh (2000). Effect of Glyphosate and Fluazifop-Butyl herbicides with addition of urea on Bermuda grass (Cynodon dactylon) control at Nubariya. Bull. N.R.C. Egypt, 25 (2): 189-206.

EPD (1999). Electronic Pesticide Dictionary. Libera, Inc. and Meister Publishing Company, 37733 Euclid Ave., Willoughby, Ohio USA 44094.

Gomez, K.A. and E.A. Gomez (1984). Statistical Procedures for Agricultural Research. John Wiley and Son. Inc., New York.

Lalithabai, E.K. and M.N. Sinha (1993). Effect of phosphorus and weed management on greengram (*Phaseolus radiatus*) and its residual effect on mustard (*Brassica juncea*). Indian J. Agron., 38 (1): 37-41.

Mahmoud, M.H. (1998). Effect of plant population density and weed control treatments on growth and yield of mungbean. M.Sc. Thesis, Fac. of Agric., Cairo Univ., Egypt.

Metzner, H.; Rau, H. and Senger, H. (1965). Unter-Suchunger Zur Synchronisier barkit einzelner Pigmentmangel. Mutanten Von chlorella. Planta, 65: 186.

Piper, C.S. (1950). Soils and Plant Analysis. Interscience Publisher Inc., New York.

Radford, P.J. (1967). Growth analysis formula. Their use and ad-use. Crop Sci., 7: 171-175.

Radwan, F.L. (1997). Yield response of mungbean (*Vigna radiata* “L.”, Wilczek) to VA-micorrhizal inoculation and phosphorus fertilization. Menofiya J. Agric. Res., 22 (6): 1511-1533.

Ramanthan, S.P. and B. Chandrashekharan (1998). Weed management in blackgram (*Phaseolus mungo*). Indian J. of Agron., 43 (2): 318-320.

Rao, M.V.B.; K. Veeraiah; D. Subrahmanyam and B. Krishnamurthy (1993). Herbicide induced variation in greengram (*Vigna radiata* “L.”, Wilczek). International J. of Tropical Agric., 11 (3): 218-221.

Sarkar, R.K. and P. Banik (1991). Response of greengram to nitrogen, phosphorus and molybdenum. Indian J. of Agron., 36 (1): 91-94.

Saxena, K.K.; H.R. Verma and H.K. Saxena (1996). Effect of phosphorus and potassium on greengram (*Phaseolus radiatus*). Indian J. of Agron., 41 (1): 84-87.

Shaban, A.S. and E.A. El-Metwally (1997). Weed control in mungbean fields symposium on around mungbean crop and its future in Egypt. National Research Centre, Cairo 13th May, pp. 16 (Arabic text).

Shukla, S.K. and R.S. Dixit (1996). Effect of *Rhizobium* inoculation, plant population and phosphorus on growth and yield of summer greengram (*Phaseolus radiatus*). Indian J. of Agron., 41 (4): 611-615.

Singh, A.N.; S. Singh and V.M. Bhan (1996). Crop-weed competition in summer greengram (*Phaseolus radiatus*). Indian J. of Agron., 41 (4): 616-619.

Singh, B.G. and G.R. Roa (1992). Physiological effect of pre-emergence herbicides in mungbean. Ann. of Agric. Res., 13 (4): 401-403.

Singh, B.G.; M. Kirshana and K. Mohan (1994). Physiological effects of pre-emergence herbicides in mungbean (*Vigna radiata* “L.”, Wilczek). Annals of Plant Physiology, 8 (1): 79-82.

Singh, R.P.; P.P. Singh; M.D. Vyas; A.K. Sharma; H.B. Gwal and O.P. Girothia (1988). Effect of weed management on grain yield of mungbean. Indian J. of Pulses Research, 1 (2): 124-127.

Tomar, S.S.; U.K. Shrivastava; R.K. Sharma; S.S. Bhadouria and A.S. Tomar (1995). Physiological parameters of summer mungbean (*Vigna radiata*) as affected by seed rate, moisture regimes and phosphorus levels. Legume Research, 18 (2): 125-128.

Vaishya, R.D. and S.P. Singh (1989). Integrated weeds management in summer mungbean. Indian J. of Pulses Research, 2 (2): 129-132.

Vaishya, R.D. (1994). Efficacy of haloxyfop-methyl formulation in controlling weeds of summer mungbean. Indian J. of Pulses Research, 7 (2): 193-195.

Watson, D.J. (1958). The dependence of net assimilation rate of leaf area index. Ann. Bot. Lond. N.S., 22: 37-54.

Yadav, R.R. and U.K. Shrivastava (1998). Integrated weed management in black gram (*Phaseolus mungo*). Indian J. of Agron., 43 (1): 106-109.

الاستجابة الفسيولوجية لنباتات فول المانج لمستويات التسميد الفوسفاتي وبعض معاملات مكافحة الحشائش

أماني عبد المحسن رمضان ، ساميه أمين سعد الدين

قسم النبات – المركز القومي للبحوث – الدقي – الجيزة – مصر

أجريت تجربتان حقليتان خلال موسمي ١٩٩٩ ، ٢٠٠٠ بمزرعة المركز القومي للبحوث بشلقان– محافظة القليوبية ، بهدف دراسة تأثير مستويات التسميد الفوسفاتي وهي صفر ، ١٥ ، ٣٠ ، ٤٥ كجم فو٢أ٥ وبعض معاملات مكافحة الحشائش وهي بيوترالين ، فلوزيفوب-بيوتيل ، بنتازون ، بيوترالين + عزقة واحدة، فلوزيفوب-بيوتيل + عزقة واحدة ، بنتازون + عزقة واحدة ، العزيق مرة واحدة بدون مبيدات ، والعزيق مرتين بدون مبيدات على صبغات البناء الضوئي وبعض الصفات الفسيولوجية والمحصول والتركيب الكيماوي لبذور نباتات فول المانج والحشائش المصاحبة له. وقد أظهرت النتائج ما يلي:

أدت زيادة مستويات التسميد الفوسفاتي من صفر إلى ١٥ ، ٣٠ ، ٤٥ كجم فو٢أ٥ إلى زيادة معنوية في الوزن الغض والجاف للحشائش الكلية بعد ٤٥ ، ٦٠ يومًا من الزراعة. وكذلك أدت زيادة مستويات التسميد الفوسفاتي إلى زيادة معنوية للصبغات ، والصفات الفسيولوجية المدروسة ومحصول البذور والمحتوى الكيماوي للبذور من الكربوهيدرات ، البروتين ، الفوسفور ، والبوتاسيوم.

أظهرت معاملات مكافحة الحشائش نقصاً معنوياً في الوزن الغض والجاف للحشائش الكلية بعد ٤٥ ، ٦٠ يوماً من الزراعة ، حيث أعطت معاملة العزيق مرتين يليها معاملة البنتازون + عزقة واحدة أقل القيم لوزن الحشائش الكلية ، بينما أعطت نفس المعاملتين زيادة معنوية لمعظم الصفات المدروسة لنبات فول المانج.

أظهرت الدراسة وجود تأثير معنوي للتفاعل بين مستويات التسميد الفوسفاتي ومعاملات مكافحة الحشائش على صافي معدل التمثيل الضوئي ومعدل نمو المحصول ، حيث أدى استخدام التسميد الفوسفاتي بمعدل ٤٥ كجم فو٢أ٥ والعزيق مرتين إلى الحصول على أعلى القيم لهاتين الصفتين.

وعلى ضوء النتائج المتحصل عليها توصي الدراسة بالاهتمام بعملية التسميد الفوسفاتي ومقاومة الحشائش بالعزيق عند زراعة فول المانج.

Table (2): Effect of phosphorus levels and weed control treatments on leaf area index (LAI), specific leaf area (SLA) and specific leaf weight (SLW) of mungbean plants at 45 and 60 days from sowing during 1999 and 2000 growing seasons.

Treatments	LAI				SLA (m^2/mg)				SLW (mg/cm^2)			
	At 45 days		At 60 days		At 45 days		At 60 days		At 45 days		At 60 days	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
A. P_2O_5 levels (Kg/fed.):												
0	3.74	3.65	4.61	4.41	0.220	0.231	0.157	0.171	5.80	4.28	7.40	5.72
15	3.99	3.93	5.04	4.90	0.192	0.193	0.148	0.164	6.86	5.12	7.61	5.87
30	4.12	4.10	5.29	5.16	0.168	0.172	0.128	0.149	7.57	5.74	8.32	7.09
45	4.24	4.25	5.46	5.41	0.140	0.157	0.121	0.139	7.74	6.09	8.37	7.46
F-Test	**	**	**	**	**	**	**	**	**	**	**	**
L.S.D. at 0.05	0.054	0.058	0.027	0.036	0.007	0.007	0.005	0.006	0.08	0.10	0.10	0.08
0.01	0.079	0.083	0.039	0.051	0.010	0.010	0.007	0.008	0.12	0.15	0.14	0.11
B. Weed control treatments:												
Butralin	3.94	3.89	5.11	4.99	0.185	0.195	0.140	0.158	7.01	5.07	7.88	6.28
Fluazifop-butyl	3.65	3.58	4.63	4.50	0.189	0.208	0.143	0.162	6.74	4.92	7.83	6.32
Bentazon	3.98	3.88	5.05	4.88	0.181	0.186	0.136	0.156	7.10	5.47	8.04	6.46
Butralin + one hand hoeing	4.43	4.56	5.68	5.71	0.171	0.175	0.135	0.152	7.41	5.54	8.07	6.67
Fluazifop-butyl + one hand hoeing	4.36	4.36	5.58	5.39	0.182	0.181	0.140	0.155	7.18	5.39	7.91	6.45
Bentazon + one hand hoeing	5.14	5.06	6.47	6.30	0.165	0.171	0.131	0.145	7.48	5.92	8.51	7.04
One hand hoeing	2.85	2.78	3.60	3.48	0.184	0.191	0.141	0.160	6.86	5.02	7.93	6.48
Two hand hoeing	5.42	5.32	6.76	6.56	0.161	0.169	0.130	0.147	7.49	5.94	8.60	7.16
Control	2.45	2.40	3.02	2.94	0.200	0.221	0.154	0.169	5.67	4.50	6.57	5.99
F-Test	**	**	**	**	**	**	**	**	**	**	**	**
L.S.D. at 0.05	0.069	0.066	0.064	0.066	0.009	0.010	0.006	0.006	0.12	0.13	0.12	0.13
0.01	0.092	0.088	0.085	0.088	0.012	0.014	0.009	0.008	0.16	0.17	0.17	0.18
C. Interaction:	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

Table (3): Effect of phosphorus levels and weed control treatments on leaf weight ratio (LWR), leaf area ratio (LAR), leaf area duration (LAD), relative growth rate (RGR), net assimilation ratio (NAR) and crop growth rate (CGR) of mungbean plants at 45 and 60 days from sowing during 1999 and 2000 growing seasons.

Treatments	LWR (gm/gm)				LAR (cm^2/gm)				LAD (m^2/week)		RGR (gm/gm/week)		NAR (gm/dm^2/week)		CGR (gm/m^2/day)	
	At 45 days		At 60 days		At 45 days		At 60 days									
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
A. P_2O_5 levels (Kg/fed.):																
0	0.537	0.465	0.491	0.500	80.42	83.41	76.15	80.79	0.131	0.115	0.111	0.106	0.134	0.122	5.86	5.47
15	0.525	0.480	0.504	0.516	75.06	75.50	71.14	73.28	0.158	0.146	0.126	0.122	0.168	0.159	8.01	7.23
30	0.544	0.489	0.515	0.527	70.79	74.39	66.56	69.92	0.176	0.160	0.139	0.134	0.198	0.182	9.80	8.80
45	0.549	0.508	0.508	0.534	66.79	70.30	62.90	67.36	0.183	0.174	0.142	0.136	0.215	0.198	10.94	10.03
F-Test	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
L.S.D. at 0.05	0.003	0.007	0.005	0.007	1.35	1.09	2.61	2.75	0.003	0.005	0.004	0.005	0.0016	0.0036	0.30	0.23
0.01	0.005	0.009	0.007	0.010	1.94	1.57	3.75	3.95	0.004	0.007	0.005	0.007	0.0023	0.0025	0.43	0.33
B. Weed control treatments:																
Butralin	0.529	0.478	0.508	0.510	75.37	76.05	70.20	72.63	0.176	0.165	0.128	0.123	0.172	0.156	7.47	7.01
Fluazifop-butyl	0.524	0.468	0.488	0.503	75.91	77.04	71.53	73.78	0.148	0.139	0.123	0.117	0.164	0.149	6.77	6.21
Bentazon	0.538	0.488	0.508	0.523	74.43	75.53	69.49	72.13	0.161	0.150	0.131	0.127	0.177	0.163	7.99	7.06
Butralin + one hand hoeing	0.555	0.504	0.513	0.533	69.77	71.76	67.12	69.93	0.188	0.172	0.137	0.132	0.195	0.183	10.50	9.51
Fluazifop-butyl + one hand hoeing	0.545	0.491	0.512	0.526	70.59	72.21	67.90	71.53	0.184	0.155	0.127	0.122	0.187	0.171	9.16	8.40
Bentazon + one hand hoeing	0.571	0.514	0.528	0.545	68.63	70.86	64.37	67.86	0.201	0.186	0.142	0.137	0.205	0.195	12.02	11.26
One hand hoeing	0.520	0.468	0.498	0.509	75.83	77.14	71.48	74.26	0.113	0.105	0.122	0.119	0.160	0.144	7.41	6.42
Two hand hoeing	0.573	0.519	0.533	0.553	68.67	70.42	64.37	68.45	0.203	0.187	0.144	0.141	0.216	0.200	12.19	11.32
Control	0.494	0.443	0.456	0.474	80.19	92.09	76.23	84.99	0.087	0.081	0.112	0.103	0.133	0.129	4.37	3.79
F-Test	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
L.S.D. at 0.05	0.006	0.013	0.013	0.014	2.69	2.58	2.41	2.44	0.006	0.006	0.006	0.006	0.0032	0.0045	0.30	0.30
0.01	0.008	0.017	0.018	0.018	3.57	3.43	3.20	3.23	0.008	0.007	0.008	0.008	0.0043	0.0034	0.40	0.39
C. Interaction:	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	*	*	N.S.	N.S.	**	**	**	**