EVALUATION OF SOME SOYBEAN HERBICIDES II- GROWTH, YIELD AND SEED CHEMICAL CONTENTS OF SOYBEAN

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ABSTRACT

Two field experiments were conducted at the Agricultural Research and Experiment Center, Faculty of Agriculture at Moshtohor, Kalubia, Egypt, during 1985 and 1986 seasons. The aim of the investigation was to study the effect of some herbicides on soybean growth, yield and its components and chemical contents of seeds. The results indicated that most of weed control treatments improved growth of soybean plants i.e. plant height, number and weight of leaves/plant, number and weight of pods/plant, dry weight of whole plant, seed yield/fad., protein and oil yield/fad.

The best treatments favourably affecting most of the characters studied were the three levels of AC with and without surfactant, Amex (2.5 L./fad.), Lasso (2.0 L./fad.), Lasso + Linuron (1.5 L. + 0.75 kg/fad.), Scepter (1.05 L./fad.) and hoeing (twice). On the other hand, stomp (1.7 L./fad), Scepter + Stomp (0.7 L. + 1.25 L./fad.) and afalon S (1.0 kg/fad.) were inferior compared with other weed control treatments.

INTRODUCTION

Soybean (Glycine max [L.] Merr.) is one of the most important leguminous crops all over the world. In Egypt, great attention has been paid recently to increase its total production by increasing soybean area and/or by raising the yield per faddan. Improving growth of soybean can be achieved by improving cultural practices, i.e., weed control. Chemical weed control is an important method for eliminating early weed competition, improve soybean growth and increase the productivity (Duke et al., 1976; Abd El-Raouf and Fayed, 1978; Moursi et al., 1980a and b; Fayed et al., 1983; El-Deek et al., 1986; Shaban et al., 1987; El-Debaby et al., 1988 and Sary et al., 1988). Fayed et al., (1983) reported that,

hoeing, trifluralin, linureon, ancrack and butralin treatments gave the highest soybean seed yield.

The aim of this investigation was to study the effect of some weed control treatments using some new herbicides on growth, yield and its components and seed composition of soybean crop.

MATERIALS AND METHODS

Materials and methods are given in detail in the first paper concerning this research (El-Deepah et al., 1989). In this part the following data were recorded:

A- After 60 and 90 days from soybean planting, plant height, number of leaves/plant, fresh and dry weight of leaves/plant, number of branches/plant, fresh and dry weight of stem/plant, number, fresh and dry weight of pods/plant and dry weight of whole plant were recorded. Each measurement was taken as the average of 5-plant sample for each plot.

B- At harvesting; plant height, number of branches/plant, number and dry weight of pods/plant and 100-seed weight were recorded. Sample of each 10 plants from each plot was taken. Seed yield/fad. was estimated from the whole plot.

C- Dried mature seeds were ground into avery fine powder for determination of oil content by using Soxhlet apparatus on dry weight basis as described by Sorenson (1947).

Protein was determined as the total nitrogen by micro-kjeldahl method according to A.O.A.C. (1955) and the N multiplied by 6.25 (Tripathi et al., 1971) to obtained the protein content of seeds. Oil and protein yield/fad. were also calculated. Phosphorus concentration was determined in the acid digest according to the method decribed by John (1970), through colorimetric determination with ascorbic acid. Potassium concentration was determined by using flame-photometer according to Brown and Lilleland (1946). Total P and K uptake/fad. were also calculated.

RESULTS AND DISCUSSION

1- Effect of weed control treatments on soybean growth after 60 and 90 days from sowing:

a- Plant height:

Weed control treatments had a significant effect on plant height after 60 days from sowing (table 1). The minimum plant height was obtained by using scepter + stomp (0.7

Table (1): Effect of weed control treatments on soybean growth after 60 days from sowing (combined analysis 1985 and 1986 seasons).

Treatments	Plant height (cm)	No. of leaves per plant	Leaves weight (gm)/plant		No. of branches/ plant	Stem weight (gm)/plant		Dry weight of whole plant
			Fresh	Dry		Fresh	Dry	
1- AC 0.210 L.	52.3	16.4	42.8	9.80	1.07	25.7	5.46	15.26
2- AC 0.315 L.	57.3	18.3	46.6	10.15	1.27	30.5	6.38	16.53
3- AC 0.420 L.	58.1	16.2	39.6	9.51	1.17	26.4	5.39	14.90
4- AC 0.315 L. + Surfactant	50.2	14.0	33.5	7.32	0.87	20.8	4.05	11.37
5- Scepter 1.05 L.	50.7	16.2	43.8	9.97	1.07	25.8	5.23	15.20
6- Stomp 1.7 L.	43.1	13.9	35.3	8.34	0.67	22.2	4.08	12.42
7- Scepter + Stomp (0.7 L. + 1.25 L.)	39.6	10.6	27.1	6.18	0.49	15.4	3.23	9.41
8- Afalon S 1.0 kg	54.0	13.5	33.8	7.79	0.52	21.6	4.54	12.33
9- Lasso 2.0 L.	57.0	16.3	41.8	9.03	1.17	28.5	5.43	14.46
10- Lasso + Linuron (1.5 L. + 0.75 kg)	58.5	13.2	38.5	8.57	0.72	24.3	5.01	13.58
11- Ronstar 1.5 L.	56.7	13.5	40.2	8.89	0.95	26.0	5.26	14.15
12- Ronstar 2.0 L.	57.6	11.6	31.6	7.12	0.97	21.6	4.40	11.52
13- Amex 2.5 L.	56.4	15.5	41.2	9.13	1.02	26.5	5.12	14.25
14- Lemamex 3.5 L.	55.0	14.4	40.2	8.62	0.70	23.4	4.85	13.47
15- Hoeing (twice)	54.6	12.2	38.5	8.34	0.75	23.3	4.77	13.11
16- Control	53.6	10.7	28.9	6.53	0.47	18.9	3.98	10.51
L.S.D. at 5%	7.2	3.2	9.3	2.23	0.50	5.6	1.17	

L. + 1.25 L./fad.) and stomp (1.7 L./fad.). These treatments reduced significantly plant height compared with un-weeded treatment. This finding confirmed the data obtained by Duke et al. (1976), on soybean. After three months from sowing all weed control treatments increased plant height compared with un-weeded check except stomp, scepter + stomp and lasso (2.0 L./fad.). Results in table (2) indicate that, the highest value was found by hoeing (twice) and AC (0.420 L./fad.). Sary et al. (1988), found that mixtures of linuron + mitribuzin or linuron + oxadiazon gave the tallest soybean plants. On the other hand Moursi et al. (1980a), showed that all herbicidal treatments as well as hoeing had no significant effect on plant height of soybean after 60 days from sowing.

b- Number and weight of leaves/plant:

Concerning the effect of weed control treatments on the number and weight of leaves/plant after 60 days from sowing, results in table (1) indicate that, the best treatments were the three levels of AC without surfactant, scepter (1.05 L.), Lasso (2.0 L.) and amex (2.5 L./fad.). These herbicidal treatments increased number, wet and dry weight of leaves/plant over the un-weeded treatment. Data in table (2) demonstrate that, all weed control treatments significantly increased number of leaves/plant compared with un-weeded treatment except scepter and afalon S (1.0 kg/fad.). On the other hand, amex (2.5 L./fad.), AC (0.21 and 0.42 L./fad.), hoeing, lenamex (3.5 L./fad.), lasso (2.0 L./fad.) and ronstar (1.5 L./fad.) increased significantly fresh and dry weight of leaves/plant after 90 days from sowing. These results confirmed the data obtained by Sary et al. (1988), who found that most of weed control treatments especially linuron + tridex increased number of leaves/plant and increased dry weight of soybean leaves with the exception of metribuzin (0.5 kg/fad.) and diphenamide (1.5 kg/fad.), whereas Moursi et al. (1980a), found that all weed control treatments had no significant effect on number of leaves/plant.

c- Number of branches and stem weight/plant:

Data in table (1) indicate that un-weeded check, scepter + stomp (0.7 L. + 1.25 L./fad.) afalon S (1.0 kg/fad.) and stomp (1.7 L./fad.) gave the lowest number of branches/plant. Several herbicidal treatments especially AC without surfactant, lasso (2.0 L./fad.) and scepter (1.05 L./fad.) significantly increased number of branches/plant compared with un-weeded treatment. On the other hand, differences among all treatments were not significant after three months from sowing (table 2).

Table (2): Effect of weed control treatments on soybean growth after 90 days from sowing (combined analysis 1985 and 1986 seasons).

Treatments	Plant height (cm)	No. of leaves per plant	Leaves weight (gm)/plant		No. of branches per plant	Stem weight (gm)/plant		No. of pods per plant	Pods weight (gm)/plant		Dry weight of whole plant (gm)
			Fresh	Dry		Fresh	Dry		Fresh	Dry	
1- AC 0.210 L.	97.8	27.3	58.8	15.39	1.25	49.3	15.60	40.0	36.9	10.09	41.08
2- AC 0.315 L.	91.8	24.5	50.0	13.42	1.24	43.5	13.82	33.0	32.9	9.20	36.44
3- AC 0.420 L.	100.9	26.2	57.7	15.84	1.59	52.6	16.39	39.2	39.1	10.49	42.72
4- AC 0.315 L. + Surfactant	95.5	24.4	48.9	13.14	1.27	49.8	15.15	29.9	32.6	8.35	36.64
5- Scepter 1.05 L.	97.0	23.0	48.7	13.06	1.15	43.5	13.81	33.6	33.8	8.98	35.64
6- Stomp 1.7 L.	77.6	24.3	41.2	10.49	1.04	34.9	11.39	22.3	21.2	4.92	26.80
7- Scepter + Stomp (0.7 L. + 1.25 L.)	85.0	25.6	48.9	13.01	1.02	40.7	12.99	25.9	22.5	5.72	31.72
8- Afalon S 1.0 kg	96.5	23.3	45.1	12.62	1.01	41.7	13.01	26.8	27.8	7.61	33.24
9- Lasso 2.0 L.	93.2	24.5	51.9	14.08	1.12	44.9	14.08	33.8	34.6	9.33	37.52
10- Lasso + Linuron (1.5 L. + 0.75 kg)	91.3	24.1	50.2	12.78	1.15	45.8	14.36	30.6	31.6	8.96	36.10
11- Ronstar 1.5 L.	95.4	26.4	55.0	13.96	1.05	47.9	15.59	36.1	35.6	9.15	38.70
12- Ronstar 2.0 L.	97.0	24.1	53.1	13.59	1.04	49.7	15.81	34.6	35.1	8.67	38.07
13- Amex 2.5 L.	96.4	26.0	58.3	16.02	1.17	52.7	16.34	41.8	42.5	11.34	43.70
14- Lemamex 3.5 L.	102.3	25.3	54.3	14.23	1.20	49.9	15.64	38.0	38.5	9.55	39.82
15- Hoeing (twice)	105.2	24.9	55.3	14.51	1.27	50.4	15.72	39.9	39.3	10.13	40.36
16- Control	87.5	21.1	43.2	11.62	1.10	35.9	11.09	23.6	24.3	5.59	28.30
L.S.D. at 5%	8.4	2.8	7.5	2.22	N.S.	7.4	2.21	7.5	7.4	2.25	5.50

Concerning to fresh and dry weight of stem/plant, the three levels of AC herbicide without surfactant, scepter, lasso and ronstar (1.5 L./fad.) increased significantly fresh and dry weight of stem/plant over the control treatment after 60 days from sowing (table 1). At 90 days (table 2), all weed control treatments with few exceptions (stomp, scepter + stomp and afalon S) significantly increased fresh and dry weight of stem/plant compared with un-weeded check.

Data in tables (1 and 2) indicate clearly that, the effect of all herbicidal treatments was more evident on stem weight after three months than after two months from sowing. Similar results were obtained by Sary et al., (1988), who found that, all chemical weed control treatments as well as hoeing increased significantly dry weight of whole soybean plant after 40, 60 and 80 days from sowing.

d- Number, wet and dry weight of pods/plant:

Results in table (2) reveal clearly that, all herbicidal treatments as well as hoeing significantly increased number of pods/plant, wet and dry weight of pods/plant with few exceptions like stomp (1.7 L./fad.), Scepter + Stomp (0.7 L./fad. + surfactant) and lasso (2.0 L./fad.) on number of pods/plant and only the first three herbicidal treatment on wet and dry weight of pods/plant. Fayed et al., (1983) and El-Debaby et al. (1988), indicated that, weed control treatments increased significantly number and dry weight of pods/plant, while others like Shaban et al. (1987), found that metribuzin (0.14 kg/fad.) did not increase number of pods/plant.

e- Dry weight of whole plant:

Data in tables (1 and 2) indicate that, weed control treatments positively affected dry weight of plant after three months than after two months from sowing. At the later period all weed control treatments significantly increased plant dry weight than un-weeded control except stomp (1.7 L./fad.), scepter +stomp (0.7 L. + 1.25 L./fad.) and afalon S (1.0 kg/fad.). The stimulation effect on total dry weight of soybean plants was more evident with AC (0.42 and 0.21 L./fad.), hoeing and lenamex (3.5 L./fad.). Similar results were reported by Sary et al., (1988).

In conclusion, stomp, scepter + stomp and afalon S were inferior with regard to their effect on most of the studied characters and also concerning their effect on eradicating weeds compared with other herbicidal treatments (El-Deepah and Salwau, 1989), whereas the three levels of AC, amex, ronstar, haeing and lenamex were superior

in affecting soybean growth and controlling weeds as shown in the first part of this series (El-Deepah and Salwau, 1989).

2- Effect of weed control treatments on soybean yield and yield components:

a- Plant height and number of branches/plant:

At harvesting, some herbicidal treatments increased plant height, but the majority showed no effect. Lenamex and hoeing treatments gave the tallest plants, but stomp alone or with scepter gave the shortest plants. The number of branches/plant at harvesting was not affected by weed control treatments (talbe 3). These results disagreed with thsoe reported by El-Debaby et al. (1988), who mentioned that all weed control treatments increased to different extents the number of branches/plant.

b- Number and weight of pods/plant:

Results in table (3) show that all weed control treatments had no significant effect on number and weight of pods/plant. Some weed control treatments such as hoeing, all AC levels with and without surfactant, the two levels of ronstar and scepter (1.05 L./fad.) increased the number of pods/plant and weight of pods/plant by about 40%, but the increase did not reach the 5% level of significance. Increases of 20% to 40% were obtained by scepter + stomp (0.7 L. + 1.25 L./fad.), lasso + linuron (1.5 L. + 0.75 kg/fad.) afalon S (1.0 kg/fad.) and stomp (1.7 L./fad.) Fayed et al., (1983) and El-Debaby et al. (1988), found that all weed control treatments increased number and weight of soybean pods/plant.

c- Weight of 100 seeds:

The herbicidal treatments as well as hoeing treatment had no significant effect on weight of 100 seeds. This result disagreed with those obtained by Fayed et al., (1983) and El-Debaby et al. (1988), who reported that fluorodifen (5.0 L./fad.) and butralin (2.0 L./fad.) gave the heavest seed index for soybean.

d- Seed yield/fad.

Results in table (3) indicate clearly that all weed control treatments increased significantly seed yield/fad. except afalon S (1.0 kg/fad.) and stomp (1.7 L./fad.). This two treatments increased seed yield by 38 and 41% over the un-weeded one but these increases were below the 5% level of significance. Best effect on soybean seed yield was achieved by AC (0.42 L./fad.), amex (2.5 L./fad.), AC (0.315 L. + surfactant), lasso (2.0 L./fad.), lasso

Table (3): Effect of weed control treatments on soybean yield and yield components (combined analysis 1985 and 1986 seasons).

Treatments	Plant height (cm)	No. of branches per plant	No. of pods per plant	Dry weight of pods/plant (gm)	100-seed weight (gm)	Seed yield	
						kg/fad.	Relative
1- AC 0.210 L.	100.1	1.95	72.8	40.05	15.31	1080.3	1.78
2- AC 0.315 L.	97.5	2.02	70.5	40.97	16.25	1169.6	1.92
3- AC 0.420 L.	104.4	2.31	71.0	39.23	15.53	1352.5	2.23
4- AC 0.315 L. + Surfactant	105.6	2.19	68.9	40.09	15.48	1281.8	2.11
5- Scepter 1.05 L.	100.6	1.57	68.1	39.09	15.09	1131.0	1.86
6- Stomp 1.7 L.	93.9	1.62	59.0	33.11	15.29	858.1	1.41
7- Scepter + Stomp (0.7 L. + 1.25 L.)	87.2	1.80	64.1	37.49	15.30	894.5	1.47
8- Afalon S 1.0 kg	96.7	1.30	58.2	32.76	15.80	841.1	1.38
9- Lasso 2.0 L.	101.0	1.65	50.9	32.92	15.83	1196.4	1.97
10- Lasso + Linuron (1.5 L. + 0.75 kg)	96.5	1.32	62.5	36.93	16.07	1191.3	1.96
11- Ronstar 1.5 L.	102.9	1.77	70.9	37.07	15.75	1184.1	1.95
12- Ronstar 2.0 L.	102.4	1.42	66.9	39.10	15.31	1009.5	1.66
13- Amex 2.5 L.	100.9	1.77	60.4	34.04	15.88	1295.2	2.13
14- Lemamex 3.5 L.	107.1	1.47	55.2	28.80	16.24	1001.2	1.65
15- Hoeing (twice)	106.8	1.62	75.1	39.76	16.00	1111.4	1.83
16- Control	91.3	1.25	49.3	26.46	15.08	607.8	1.00
L.S.D. at 5%	10.8	N.S.	N.S.	N.S.	N.S.	257.5	

+ linuron (1.5 L. + 0.75 kg/fad.), ronstar (1.5 L./fad.), AC (0.315 L./fad.), scepter (1.05 L./fad.) and hoeing. Seed yield/fad. of these promising treatments significantly exceeded that of the un-weeded check by about 123, 113, 111, 97, 96, 95, 92, 86 and 83%, respectively. No significant differences, were obtained between seed yield/fad. of these respective superior treatment. On the other hand these superior treatments gave the highest controlling effect of total weed associated with soybean (El-Deepah and Galwau, 1989). These results agree with those reported by Abd El-Raouf and Fayed (1987), Moursi et al., (1980b); Fayed et al., (1983); El-Deek et al., (1986), Shaban et al., (1987) and El-Debaby et al., (1988).

3- Effect of weed control treatments on seeds chemical contents:

Data in table (4) indicate that percentage of N, P, K and protein in soybean seeds was not affected by weed control treatments, but hoeing and scepter + stomp (0.7 L. + 1.25 L./fad.) increased significantly oil percentage in seeds. Concerning protein and oil yield/fad., all herbicidal treatments as well as hoeing had no significant effect, nevertheless most of weed control treatments increased protein and oil yield by more than 40% compared with un-weeded treatment. The increasing percentage in protein and oil yield over the un-weeded treatment was 67 and 80 for hoeing; 56 and 74 for AC (0.315 L./fad.); 78 and 63 for AC (0.315 L./fad. + surfactant); 48 and 71 for lasso (2.0 L./fad.); 47 and 54 for lenamex (3.5 L./fad.) and 43 and 55 for AC (0.42 L./fad.), respectively. This finding reveals that herbicide application did not cause significant alterations in seed chemical contents compared with the un-weeded one, whereas protein and oil yields/fad. were increased as a resultant of the increases in the seed yield/fad. Fayed et al., (1983) and El-Debaby et al. (1988), reported that all weed control treatments significantly increased protein and oil yield/fad.

From the present results it could be concluded that all levels of AC, Amex, lenamex as well as hoeing (twice) favourably affected soybean growth, seed, protein and oil yield, whereas scepter, scepter + stomp and afalon S were inferior compared with other weed control treatments.

Table (4): Effect of weed control treatments on chemical contents of soybean seeds (only 1986 season).

Treatments	N %	Protein %	Protein yield		P %	P-uptake	K %	K-uptake	Oil %	Oil yield	
			kg/fad.	Relative						kg/fad.	Relative
1- AC 0.210 L.	4.15	26.0	281.4	1.14	0.74	8.02	0.96	10.5	29.0	312.4	1.32
2- AC 0.315 L.	4.46	27.9	385.1	1.56	0.70	9.67	1.01	14.1	29.7	411.2	1.74
3- AC 0.420 L.	4.53	28.3	353.8	1.43	0.77	9.14	1.02	12.3	29.8	365.7	1.55
4- AC 0.315 L. + Surfactant	5.13	32.1	438.9	1.78	0.75	10.12	0.97	13.1	28.5	385.7	1.63
5- Scepter 1.05 L.	4.67	29.2	353.0	1.43	0.83	10.05	1.07	16.5	24.5	306.1	1.30
6- Stomp 1.7 L.	4.36	27.3	244.0	0.99	0.68	6.21	0.92	8.5	29.3	264.9	1.12
7- Scepter + Stomp (0.7 L. + 1.25 L.)	4.55	28.4	302.6	1.23	0.77	7.98	0.99	10.1	30.7	326.3	1.38
8- Afalon S 1.0 kg	4.81	30.0	351.6	1.42	0.67	7.73	0.97	11.3	27.3	318.9	1.35
9- Lasso 2.0 L.	4.11	25.7	365.4	1.48	0.73	10.18	1.05	14.9	28.8	404.8	1.71
10- Lasso + Linuron (1.5 L. + 0.75 kg)	4.32	27.0	316.8	1.28	0.73	8.53	0.95	11.3	27.7	322.5	1.36
11- Ronstar 1.5 L.	4.57	28.6	330.1	1.34	0.78	8.89	1.03	12.0	28.7	334.1	1.41
12- Ronstar 2.0 L.	4.39	27.4	258.3	1.05	0.75	7.02	1.04	9.9	29.2	276.5	1.17
13- Amex 2.5 L.	4.50	28.1	341.8	1.38	0.75	8.98	1.02	12.4	28.3	338.6	1.43
14- Lemamex 3.5 L.	4.60	28.7	363.3	1.47	0.69	8.37	0.95	11.7	29.7	362.9	1.54
15- Hoeing (twice)	4.85	30.3	412.5	1.67	0.70	9.60	0.94	13.0	30.8	424.5	1.80
16- Control	4.67	29.2	246.8	1.00	0.73	6.15	1.01	8.5	28.0	236.4	1.00
L.S.D. at 5%	N.S.	N.S.	N.S.		N.S.	N.S.	N.S.	N.S.	2.6	N.S.	

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