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RESPONSE OF SOYBEAN AND ASSOCIATED WEEDS TO VARIOUS WEED CONTROL TREATMENTS

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ABSTRACT

Two field experiments were conducted during two successive seasons of 2007 and 2008 in Meit Nagy Village, Meit Ghamr, Dakahlia Governorate, Egypt, to study the effect of some pre-or post-emergence herbicides either alone or accompanied with hoeing on soybean yield and its components and associated weeds. The results showed that the best treatments in controlling the annual bread leaves, annual grasses and total annual weeds throughout the vegetative period of soybean plants were : The pre-emergence application of Pendimethalin at 0.425 kg a.i./fed or Metribuzin at 0.140 kg a.i./fed followed by one hoeing (21 days after sowing) or post-emergence application of Bentazon at 0.180 kg a.i./fed preceded by one hoeing (21 days after sowing), or using hand hoeing twice (21 and 35 days after sowing) compared with single herbicidal treatments. Treatment of Pendimethalin at 0.425 kg a.i./fed followed by one hoeing improved the growth of soybean plants and resulting in the tallest plants, highest number of pods/plant, number of seeds/pod, seed index, seed yield/plant and per feddan and the highest oil % in the seeds as well as seed protein percentage compared to other weed control treatments.

INTRODUCTION

Soybean [*Glycine max*, (L) Merrill] is one of the most important legumes crops worldwide. It contains about 20 % oil and 40 % high quality protein. Therefore, it is an excellent source for human and animal nutrition. The excessive occurrence of weeds limits the full expression of yield potential of this crop. Early control of weeds (first 30 days) in soybean is very critical (Chhokar and Balyan, 1999) and if not done, the reduction in yield due to weed competition reached about 58.8 % to 82 % (Rohitashav Singh *et al.*, 2003; Singh and Jolly, 2004), depending on the type of weed and soil, season and intensity of weed infestation. Two hand hoeing are more effective in suppressing weeds and increasing seed yield of soybean (Misra *et al.*, 2001; Mohamed, 2004; Kushwah and Vyas, 2005; Pandya *et al.*, 2005; Abdel-hamid and El-Metwally, 2008). Nowadays, a great shortage in hand labour and rise in wage scale that makes the use of chemical weed control very necessary to decrease the cost and to increase the productivity of soybean. Application of selective herbicides in soybean fields proved to be effective against annual weeds and gave higher seed yield of soybean such as Pendimethalin (Shah *et al.*, 2000; Manish Bhan and Kewat, 2002; Galal, 2003; El-Gayar, Sonaa, 2004); Metribuzin (Chavan *et al.*, 2000; Govindra Singh *et al.*, 2001; Jeyabal *et al.*, 2001; Ivany and Reddin, 2002) and Bentazon (Patra, 1999; Ogunyemi *et al.*, 2000; Tiwari and Mathew, 2002; Galal, 2003). Moreover, herbicides accompanied with hoeing are made to broaden the spectrum of weed control and the dosage of herbicide used can be reduced. (Chamate *et al.*, 2002; Shveta Ralli and Dhingra, 2003; Vyas *et al.*, 2003; Kalpana and Velayutham, 2004), reported that Pendimethalin

followed by one hoeing gave sufficient annual weed control at all soybean growth stages leading to higher seed yield than hand hoeing twice.

Thus, our study was planned to find out the most suitable weed control treatments that can be used to achieve the best weed control and the highest soybean yield.

MATERIAL AND METHODS

Two field experiments were conducted during two successive seasons of 2007 and 2008 in a private farm at Meit Nagy Village, Meit Ghamr, Dakahlia Governorate, Egypt, to study the effect of some weed control treatments on yield and yield components of soybean and associated weeds. Soil was clay loam in texture, having pH 8.6 and 1.89 organic matter. The experimental basic unit included 5 rows, 60 cm apart and 3.5 m length, occupying an area of 10.5 m^2 (1/400 fed). A randomized complete block design with four replications was used. Seeds of soybean [*Glycine max*, (L) Merrill] cv. Clark were sown on 14th and 17th of April in the first and second seasons, respectively. All the normal cultural practices of growing soybean plants recommended were followed especially fertilization and irrigation. The common, trade and chemical names of each herbicide used are presented in Table (1).

Table (1) : The common, trade and chemical names of herbicides used during two successive seasons of 2007 and 2008.

Common name	Trade name	Chemical name
Pendimethalin (E.C.)**	Stomp 50 % a.i.*	N-(1-ethylpropyl)-3-4-dimethyl-2,6-dinitrobenzine amine
Metribuzin (W.P.)***	Sencor 70 % a.i.	4-amino-6-tert-butyl-3-(methyl thio)1,2,4-triazin-5(4H)one.
Bentazon (E.C.)	Basagran 48 % a.i.	3-isopropyl-1H-2,1,3-benzothiodiazin-3(H)-one-2,2-dioxide.

*** a.i. = active ingredient**
**** E.C. = Emulsified**
***** W.P = Water able powder**

The experiment included 11 treatments as shown in Table (2).

Table (2) : Various weed control treatments, rates of herbicides, time and method of application during 2007 and 2008 seasons.

Treatments	Rates (kg a.i./fed)	Time and method of application
1. Pendimethalin	0.425	Pre-emergence
2. Pendimethalin	0.850	Pre-emergence
3. Metribuzin	0.140	Pre-emergence
4. Metribuzin	0.280	Pre-emergence
5. Bentazon	0.180	Post-emergence (21 DAS*)
6. Bentazon	0.360	Post-emergence (21 DAS)
7. Pendimethalin + one hoeing	0.425 -	Pre-emergence + (21 DAS)
8. Metribuzin + one hoeing	0.140 -	Pre-emergence + (21 DAS)
9. One hoeing + Bentazon	- 0.180	21 DAS + Pot-emergence (35 DAS)
10. Hand hoeing twice	-	21 and 35 DAS
11. Unweeded check	-	Left without weed removal

***DAS = days after sowing.**

The herbicidal treatments applied pre-emergence or post-emergence either alone or accompanied with hoeing were compared with hand hoeing twice and the unweeded check (control). The formulated herbicides were sprayed by knapsack sprayer using 200 liters water/fed Two weed samples were randomly taken from an area of one square meter from each plot at 50 and 75 days after sowing. Weeds were identified and classified into annual broad leaves and annual grasses. The dry weight of weed species was recorded. At harvest, samples of 5 soybean plants were randomly collected from each plot to study the following characters; plant height (cm), number of pods/plant, number of seeds/pod; seed index (g); seed yield/plant (g). Seed yield was estimated from the seed yield per plot (kg) and then converted to ton/fed. Total nitrogen content of seeds was determined according to A.O.A.C. (1980) N values were multiplied by 6.25 to calculate total crude protein (TCP). Oil percentage in soybean seeds was measured by extraction using soxhlet apparatus with Hexane as an organic solvent as outlined by A.O.A.C. (1980). All data were statistically analyzed and the combined analysis of the two seasons was calculated according to Little and Hills (1978).

RESULTS AND DISCUSSION

A. Effect on weeds :

A.1. Annual broad-leaved weeds :

The most common weeds were : *Portulaca oleraceae*, L.; *Xanthium strumarium*, L.; *Hibiscus trionum* L., and *Amaranthus lividus*, L., data presented in Table (3) show that all weed control treatments significantly decreased the dry weight of annual broad-leaved weeds at 50 and 75 days from sowing in both seasons, compared to the unweeded check.

At 50 days from sowing, Bentazon preceded by one hoeing, Metribuzin or Pendimethalin followed by one hoeing showed the best control of annual broad-leaved weeds (92.16, 90.14 and 89.11 %, respectively), as compared with unweeded check. While, hand hoeing treatment achieved 85.62 % control. Also, Bentazone or Metribuzin each alone at the higher dose ranked second (over 82 %). On the other hand, the rest treatments were significantly less efficient than hand hoeing treatment and giving the least control of annual broad-leaved weeds (61.12 – 73.59 %), compared to the other weed control treatments (Table 4).

At 75 days from sowing the same trend for controlling annual broad-leaved weeds was observed. It could be concluded that Bentazon at 0.180 kg a.i./fed preceded by one hoeing, Metribuzin at 0.140 kg a.i./fed or Pendimethalin at 0.425 kg a.i./fed followed by one hoeing as well as hand hoeing treatment showed superiority in controlling annual broad-leaved weeds up to 75 days after soybean sowing. Moreover, Bentazon at 0.360 kg a.i./fed or Metribuzin at 0.280 kg a.i./fed each applied alone gave good control of annual broad leaved weeds. These results are in agreement with previously recorded by Kankal *et al.* (1999), Bilandzic *et al.* (2003); Dheeraj Pandey *et al.* (2003); Reddy *et al.* (2003).

A.2. Annual grass weeds :

The most common grassy weeds during the two seasons were *Echinochloa colonum* (L.) Link; *Dinebra retroflexa* (Vahl) Panz and *Dactyloctenium aegyptium* (L.) P. Beauv. Data in Tables (3 and 4) revealed that all various weed control treatments significantly reduced the dry weight of annual grass weeds after 50 and 75 days from sowing than the unweeded check.

At 50 days from sowing, the highest efficiency against grass weeds was obtained by Pendimethalin followed by one hoeing (98.26 %). While, the efficiency of hand hoeing treatment provided 84.25 % control. On the other side, single herbicides of Metribuzin and Bentazon at the two doses gave poor control of annual grasses (49.25 – 67.25 %), as compared to the weedy check. Moreover, the other weed control treatments were statistically equal to hand hoeing treatment (75.21 – 88.23 %) (Table 4).

At 75 days from sowing, all treatments gave the same trend but the efficiency for these treatments decreased at 75 days from soybean sowing, compared to the first simple. It is evident that Pendimethalin at 0.425 kg a.i./fed followed by one hoeing or Bentazon at 0.180 kg a.i./fed preceded by one hoeing or Metribuzin at 0.140 kg a.i./fed followed by one hoeing were the most effective against the annual grass weeds. Also, hand hoeing treatment or Pendimethalin alone at 0.850 kg a.i./fed showed good results in controlling annual grass weeds in soybean fields. These results are similar to those obtained by Chauhan *et al.* (2002); Taylor-Lovell *et al.* (2002); Shveta Ralli and Dhingra (2003); Kalpana and Velayutham (2004).

A.3. Total annual weeds :

Data recorded in Table (3) show significant differences among the various weed control treatments for the two tested stages (50 and 75 days after sowing), in both seasons. All weed control treatments significantly reduced the dry weight of annual weeds compared with unweeded check. The reduction in weed dry weight might be due to the inhibition effect of herbicide treatments on growth and development of weeds. In general, all tested herbicides either followed or preceded by one hoeing increased the spectrum and effectiveness of weed control over single herbicides. As shown in Table (4) Pendimethalin at 0.425 kg a.i./fed followed by one hoeing or Bentazon at 0.180 kg a.i./fed preceded by one hoeing were the best annual weed control treatments (over 90 % control), at all growth stages. Moreover, Metribuzin at 0.140 kg a.i./fed followed by one hoeing as well as hand hoeing treatment were significantly more effective for controlling annual weeds than the other treatments. These results are mostly in concordance with those obtained by Gaikwad and Pawar (2002); Trunkov and Koleva (2002); Sonawane and Sabale (2003); Vyas *et al.*, (2003); Pandya *et al.*, (2005); Abdel-hamid and El-Metwally (2008).

Table (3) : Effect of various weed control treatments on dry weight of annual weeds (g/m²) at 50 and 75 days after sowing (Combined analysis for two seasons).

Treatments	Rates (kg a.i./fed)	Days after sowing					
		50 days			75 days		
		Broad leaved	Grasses	Total ann. weeds	Broad leaved	Grasses	Total ann. weeds
Pendimethalin	0.425	35.70 b	14.95 cde	50.65 bc	38.26 b	18.82 def	57.08 bc
Pendimethalin	0.850	26.10 bc	10.70 def	36.80 d	31.47 bc	13.12 ef	44.59 cd
Metribuzin	0.140	27.05 bc	30.60 b	57.65 b	32.81 bc	36.75 b	69.56 b
Metribuzin	0.280	16.50 cde	27.0 b	43.50 cd	21.40 cde	31.91 bc	53.31 cd
Bentazon	0.180	24.25 cd	22.20 bc	46.45 bcd	29.28 bcd	28.52 bcd	57.80 bc
Bentazon	0.360	14.55 de	19.75 bcd	34.30 de	16.82 def	23.44 cde	40.26 de
Pendimethalin + One hoeing	0.425	10.00 e	1.05 f	11.05 f	11.10 ef	3.69 g	14.79 f
Metribuzin + One hoeing	0.140	9.05 e	8.30 ef	17.35 f	10.02 ef	9.99 fg	20.0 f
One hoeing + Bentazon	0.180	7.20 e	7.10 ef	14.30 f	6.64 f	9.28 fg	15.92 f
Hand hoeing twice	-	13.20 e	9.50 ef	22.7 ef	14.17 ef	11.30 fg	25.47 ef
Unweeded check	-	91.82 a	60.30 a	152.12 a	113.55 a	69.30 a	182.85 a

Table (4) : Efficiency (%) of various weed control treatments for annual weeds at 50 and 75 days after sowing (Combined analysis for two seasons).

Treatments	Rates (kg a.i./fed)	Days after sowing					
		50 days			75 days		
		Broad- leaved	Grasses	Total ann. weeds	Broad- leaved	Grasses	Total ann. weeds
Pendimethalin	0.425	61.12	75.21	66.70	66.31	72.84	68.78
Pendimethalin	0.850	71.57	82.26	75.81	72.29	81.07	75.62
Metribuzin	0.140	70.54	49.25	62.10	71.11	46.70	61.96
Metribuzin	0.280	82.03	55.22	71.40	81.15	53.96	70.85
Bentazon	0.180	73.59	63.18	69.46	74.21	58.85	68.39
Bentazon	0.360	84.15	67.25	77.45	85.19	66.18	77.98
Pendimethalin + One hoeing	0.425	89.11	98.26	92.74	90.22	94.68	91.91
Metribuzin + One hoeing	0.140	90.14	86.24	88.59	91.02	84.15	89.06
One hoeing + Bentazon	0.180	92.16	88.23	90.60	94.15	86.61	91.30
Hand hoeing twice	-	85.62	84.25	85.08	87.52	83.69	86.07
Unweeded check	-	00.00	00.00	00.00	00.00	00.00	00.00

B. Effect on soybean yield and its components :

B.1. Plant height (cm) :

Data in Table (5) show significant differences in plant height in both seasons. Generally, all weed control treatments surpassed unweeded check. Plant height ranged from 59.48 to 76.33 cm. The tallest soybean plants were obtained from Pendimethalin at 0.425 kg a.i./fed followed by one hoeing compared to both hand hoeing treatment and unweeded check. Moreover, Bentazon at 0.180 kg a.i./fed preceded by one hoeing or Metribuzin at 0.140 kg a.i./fed followed by one hoeing as well as hand hoeing treatment were in the second rank. This, might be due to the better weed control efficiency for these treatments (Tables 3 and 4). On the other hand, the shortest plants were obtained from the unweeded check. Plants of all the rest treatments were significantly shorter than that of hand hoeing treatment. Similar results were reported by Kushwah and Kushwaha (2001); Chamate *et al.*, (2002); and Galal (2003).

B.2. Number of pods/plant :

Data in Table (5) show that all weed control treatments significantly gave higher number of pods/plant than unweeded check. The greatest number of pods/plant was obtained with Pendimethalin at 0.425 kg a.i./fed followed by one hoeing compared with hand hoeing treatment and unweeded check. In contrast, Metribuzin alone at 0.140 kg a.i./fed significantly gave lesser number of pods/plant than the hand hoeing treatment, but was higher than unweeded check. The other treatments were statistically equal with the hand hoeing treatment. It could be state that the use of selective herbicides either alone or followed by one hoeing in soybean fields was effective in controlling weed types and improved soybean growth and hence number of pods/plant. These results are in agreement with those reported by Kushwah and Kushwaha (2001); Chamate *et al.* (2002); Sankaranarayanan *et al.* (2002).

B.3. Number of seeds/pod :

The combined analysis of data in Table (5) show that all various weed control treatments significantly increased number of seeds/pod compared to the weedy check. The highest number of seeds/pod was achieved from Pendimethalin at 0.425 kg a.i./fed followed by one hoeing, Bentazon at 0.180 kg a.i./fed preceded by one hoeing or Metribuzin at 0.140 kg a.i./fed followed by one hoeing, respectively as compared with hand hoeing treatment and single herbicidal treatments. These results, might be due to excellent weed control for the previous treatments (Tables 3 and 4). On the other side, the least number of seeds/pod was obtained from unweeded check. Similar results were recorded by Kankal *et al.* (1999); Kushwah and Kushwaha (2001); Chamate *et al.* (2002); Mohamed (2004).

B.4. Seed index :

Concerning seed index (100-seed weight) data in Table (5) show significant differences between various treatments in this trait in both seasons. All treatments were significantly higher in seed index than unweeded control. The highest seed index was significantly produced from Pendimethalin at 0.425 kg a.i./fed followed by one hoeing, Bentazon at 0.180

kg a.i./fed preceded by one hoeing or Metribuzin at 0.140 kg a.i./fed followed by one hoeing respectively, as compared with hand hoeing treatment and unweeded control. Moreover, Pendimethalin or Bentazon alone at the high dose were statistically similar with hand hoeing treatment. These treatments showed satisfactory control of annual weeds, particularly broad-leaved weeds, and minimizing the competition effects on the crop. On the other hand, the lowest seed index was produced from the weedy control. The rest other treatments were significantly less than hand hoeing treatment. The above findings were in agreement with those of Galal (2003); El-Gayar, Sonaa (2004); Mohamed (2004).

B.5. Seed yield/plant :

As shown in Table (5) the seed yield/plant of all tested treatments were significantly greater than unweeded check. The highest seed yield/plant was obtained from the combinations of either Pendimethalin at 0.425 kg a.i. or Metribuzin at 0.140 kg a.i./fed followed by one hoeing as compared with unweeded check. Superiority of these treatments for higher seed yield/plant, might mainly be due to higher suppression in the total annual weeds (Table 4), thus leading to higher number of seeds/pod. On the contrary, all single herbicidal treatments at low dose were significantly lesser effective than hand hoeing treatment. While, the rest treatments were statistically equal with hand hoeing treatment. These results are in accordance with those obtained by Kushwah and Kushwaha (2001); Chamate *et al.* (2002); Tiwari and Mathew (2002); Galal (2003); El-Gayar, Sonaa (2004).

B.6. Seed yield/feddan :

Data in Table (6) show significant differences among the various weed control treatments in seed yield/feddan. In general, all weed control treatments increased to great extent soybean seed yield relative to the weedy check. The combinations of both Pendimethalin and Metribuzin followed by one hoeing as well as Bentazon preceded by one hoeing gave significantly better seed yield/fed over the weedy check by about 221.14, 210.57 and 192.56 % respectively, compared to the weedy check. Moreover, these treatments excelled that achieved through hand hoeing treatment by 41.96, 37.28 and 29.33 %, in the respective order. The aformentioned increases in seed yield/fed of soybean as a result of the previous treatments may be attributed to higher suppression effect on the annual weeds (Tables 3 and 4), which helped in minimizing competition between soybean plants and associated weeds at the critical period of soybean growth, leading to higher seed yield per unit area and its related components. On the contrary, single herbicides Metribuzin, Bentazon and Pendimethalin at the low dose significantly gave lower seed yield/fed than hand hoeing treatment. This, may be due to their less weed control efficiency against the natural populations of soybean fields (Tables 3 and 4). Whereas, the rest herbicidal treatments as well as hand hoeing treatment ranked in the second place. They produced increase in seed yield/fed ranged from 99.80 to 126.22 %, compared with unweeded check.

Table (5) : Effect of various weed control treatments on yield components of soybean at harvest. (Combined analysis for two seasons).

Treatments	Rates (kg a.i./fed)	Plant height (cm)	No. of pods/plant	No. of seeds/pod	Seed index (g)	Seed yield/plant (g)
Pendimethalin	0.425	65.69 d	49.18 cd	2.63 bc	20.15 d	16.01 de
Pendimethalin	0.850	69.19 c	51.55 bcd	2.83 bc	21.55 bc	19.32 abc
Metribuzin	0.140	66.63 d	44.12 d	2.53 c	19.62 e	14.24 e
Metribuzin	0.280	68.83 c	50.77 bcd	2.70 bc	21.26 c	18.12 cd
Bentazon	0.180	67.09 d	47.77 cd	2.60 bc	17.84 de	14.77 e
Bentazon	0.360	69.58 c	52.32 bc	2.77 bc	21.47 bc	18.41 bcd
Pendimethalin + One hoeing	0.425	76.33 a	63.10 a	3.40 a	22.50 a	21.84 a
Metribuzin + One hoeing	0.140	73.90 b	56.70 ab	3.24 a	22.31 a	21.25 a
One hoeing + Bentazon	0.180	75.10 ab	57.90 ab	3.27 a	22.42 a	20.95 ab
Hand hoeing twice	-	73.55 b	54.22 bc	2.89 b	21.79 b	20.30 abc
Unweeded check	-	59.48 e	34.17 e	2.16 d	18.45 f	10.15 f

Table (6) : Seed yield (ton/fed) seed oil and protein content (%) of soybean as affected by various weed control treatments (Combined analysis for two seasons).

Treatments	Rates (kg a.i./fed)	Seed yield/fed (ton)	Relative yield (%)	Seed oil (%)	Seed protein (%)
Pendimethalin	0.425	0.884 cd	172.99	20.48 b	36.36 bc
Pendimethalin	0.850	1.106 b	216.44	20.65 b	36.57 abc
Metribuzin	0.140	0.794 d	155.38	20.33 b	36.13 c
Metribuzin	0.280	1.082 b	211,74	20.39 b	36.41 bc
Bentazon	0.180	0.807 d	157.93	20.42 b	36.24 c
Bentazon	0.360	1.021 bc	199.80	20.61 b	36.49 abc
Pendimethalin + One hoeing	0.425	1.641 a	321.14	21.43 a	37.05 a
Metribuzin + One hoeing	0.140	1.587 a	310.57	21.08 ab	36.89 ab
One hoeing + Bentazon	0.180	1.495 a	292.56	20.86 ab	36.79 abc
Hand hoeing twice	-	1.156 b	226.22	20.74 ab	36.66 abc
Unweeded check	-	0.511e	100.00	19.09c	35.22d

kg a.i./fed preceded by one hoeing or Metribuzin at 0.140 kg a.i./fed followed by one hoeing respectively, as compared with hand hoeing treatment and unweeded control. Moreover, Pendimethalin or Bentazon alone at the high dose were statistically similar with hand hoeing treatment. These treatments showed satisfactory control of annual weeds, particularly broad-leaved weeds, and minimizing the competition effects on the crop. On the other hand, the lowest seed index was produced from the weedy control. The rest other treatments were significantly less than hand hoeing treatment. The above findings were in agreement with those of Galal (2003); El-Gayar, Sonaa (2004); Mohamed (2004).

B.5. Seed yield/plant :

As shown in Table (5) the seed yield/plant of all tested treatments were significantly greater than unweeded check. The highest seed yield/plant was obtained from the combinations of either Pendimethalin at 0.425 kg a.i. or Metribuzin at 0.140 kg a.i./fed followed by one hoeing as compared with unweeded check. Superiority of these treatments for higher seed yield/plant, might mainly be due to higher suppression in the total annual weeds (Table 4), thus leading to higher number of seeds/pod. On the contrary, all single herbicidal treatments at low dose were significantly lesser effective than hand hoeing treatment. While, the rest treatments were statistically equal with hand hoeing treatment. These results are in accordance with those obtained by Kushwah and Kushwaha (2001); Chamate *et al.* (2002); Tiwari and Mathew (2002); Galal (2003); El-Gayar, Sonaa (2004).

B.6. Seed yield/feddan :

Data in Table (6) show significant differences among the various weed control treatments in seed yield/feddan. In general, all weed control treatments increased to great extent soybean seed yield relative to the weedy check. The combinations of both Pendimethalin and Metribuzin followed by one hoeing as well as Bentazon preceded by one hoeing gave significantly better seed yield/fed over the weedy check by about 221.14, 210.57 and 192.56 % respectively, compared to the weedy check. Moreover, these treatments excelled that achieved through hand hoeing treatment by 41.96, 37.28 and 29.33 %, in the respective order. The aformentioned increases in seed yield/fed of soybean as a result of the previous treatments may be attributed to higher suppression effect on the annual weeds (Tables 3 and 4), which helped in minimizing competition between soybean plants and associated weeds at the critical period of soybean growth, leading to higher seed yield per unit area and its related components. On the contrary, single herbicides Metribuzin, Bentazon and Pendimethalin at the low dose significantly gave lower seed yield/fed than hand hoeing treatment. This, may be due to their less weed control efficiency against the natural populations of soybean fields (Tables 3 and 4). Whereas, the rest herbicidal treatments as well as hand hoeing treatment ranked in the second place. They produced increase in seed yield/fed ranged from 99.80 to 126.22 %, compared with unweeded check.

Table (5) : Effect of various weed control treatments on yield components of soybean at harvest. (Combined analysis for two seasons).

Treatments	Rates (kg a.i./fed)	Plant height (cm)	No. of pods/plant	No. of seeds/pod	Seed index (g)	Seed yield/plant (g)
Pendimethalin	0.425	65.69 d	49.18 cd	2.63 bc	20.15 d	16.01 de
Pendimethalin	0.850	69.19 c	51.55 bcd	2.83 bc	21.55 bc	19.32 abc
Metribuzin	0.140	66.63 d	44.12 d	2.53 c	19.62 e	14.24 e
Metribuzin	0.280	68.83 c	50.77 bcd	2.70 bc	21.26 c	18.12 cd
Bentazon	0.180	67.09 d	47.77 cd	2.60 bc	17.84 de	14.77 e
Bentazon	0.360	69.58 c	52.32 bc	2.77 bc	21.47 bc	18.41 bcd
Pendimethalin + One hoeing	0.425	76.33 a	63.10 a	3.40 a	22.50 a	21.84 a
Metribuzin + One hoeing	0.140	73.90 b	56.70 ab	3.24 a	22.31 a	21.25 a
One hoeing + Bentazon	0.180	75.10 ab	57.90 ab	3.27 a	22.42 a	20.95 ab
Hand hoeing twice	-	73.55 b	54.22 bc	2.89 b	21.79 b	20.30 abc
Unweeded check	-	59.48 e	34.17 e	2.16 d	18.45 f	10.15 f

Table (6) : Seed yield (ton/fed) seed oil and protein content (%) of soybean as affected by various weed control treatments (Combined analysis for two seasons).

Treatments	Rates (kg a.i./fed)	Seed yield/fed (ton)	Relative yield (%)	Seed oil (%)	Seed protein (%)
Pendimethalin	0.425	0.884 cd	172.99	20.48 b	36.36 bc
Pendimethalin	0.850	1.106 b	216.44	20.65 b	36.57 abc
Metribuzin	0.140	0.794 d	155.38	20.33 b	36.13 c
Metribuzin	0.280	1.082 b	211,74	20.39 b	36.41 bc
Bentazon	0.180	0.807 d	157.93	20.42 b	36.24 c
Bentazon	0.360	1.021 bc	199.80	20.61 b	36.49 abc
Pendimethalin + One hoeing	0.425	1.641 a	321.14	21.43 a	37.05 a
Metribuzin + One hoeing	0.140	1.587 a	310.57	21.08 ab	36.89 ab
One hoeing + Bentazon	0.180	1.495 a	292.56	20.86 ab	36.79 abc
Hand hoeing twice	-	1.156 b	226.22	20.74 ab	36.66 abc
Unweeded check	-	0.511e	100.00	19.09c	35.22d

From the previous results of this study it could be concluded that treating soybean fields with pre-emergence application of Pendimethalin at 0.425 kg a.i./fed or Metribuzin at 0.140 kg a.i./fed followed by one hoeing or post-emergence application of Bentazon at 0.180 kg a.i./fed preceded by one hoeing or hand hoeing twice produced the highest seed yield/feddan. Concerning single herbicides, the best treatments were Pendimethalin at 0.850 kg a.i./fed or Metribuzin at 0.280 kg a.i./fed applied as pre-emergence. The above results are in harmony with these obtained by Kushwah and Kushwaha (2001); Chamate *et al.* (2002); Galal (2003); Shveta Ralli and Dhingra (2003); Sonawane and Sabale (2003); Vyas *et al.* (2003); El-Gayar, Sonaa (2004); Kalpana and Velayutham (2004) and Pandya *et al.* (2005).

C. Chemical composition of seeds :

Data in Table (6) indicated that all weed control treatments exhibited significant increase in seed oil and protein content as compared with unweeded check. However, differences among all herbicidal treatments either combined with one hoeing or single and hand hoeing treatment were insignificant. The maximum percentage of oil and protein was obtained by Pendimethalin at 0.425 kg a.i./fed followed by one hoeing. While, the minimum percentages of oil and protein were obtained by unweeded check. The superiority of all weed control treatments over the weedy check in seed oil and protein content might be attributed to the better control of weeds minimizing weed competition for the environmental factors particularly nutrients. Similar results were obtained by Chamate *et al.* (2002); Galal (2003); Shveta Ralli and Dhingra (2003); Abdel-Hamid and El-Metwally (2008).

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استجابة محصول فول الصويا والحشائش المصاحبة له لمعاملات مقاومة الحشائش المختلفة

جمال الدين مصطفى متولى ، طارق عبد الغفار ابراهيم الشهاوى و فايدة احمد احمد شرارة
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أجريت تجربتان حقليتان بمحافظة الدقهلية فى عامى ٢٠٠٧ ، ٢٠٠٨ لدراسة تأثير بعض مبيدات الحشائش المضافة قبل او بعد الانبات بصورة منفردة او مصحوبة بعزقة واحدة على محصول فول الصويا ومكوناته وعلى الحشائش المصاحبة له

وقد اظهرت النتائج مايلى :

- افضل المعاملات فى مقاومة الحشائش الحولية عريضة الاوراق والحولية النجيلية والحشائش الحولية الكلية خلال فترة النمو الخضرى لنباتات فول الصويا هى (البنداميثالين بمعدل ٠,٤٢٥ كجم مادة فعالة/فدان او الميتروبوزين بمعدل ٠,١٤٠ كجم مادة فعالة/فدان مضافة قبل الانبات ومتبوعة بعزقة واحدة (٢١ يوم بعد الزراعة) او البنتازون بمعدل ٠,١٨٠ كجم مادة فعالة/فدان مضافة بعد الانبات (٣٥ يوم بعد الزراعة) ومسبوقة بعزقة واحدة (٢١ يوم بعد الزراعة) او استخدام العزيق اليدوى مرتين (٢١ ، ٣٥ يوم بعد الزراعة) وذلك مقارنة بمعاملات مبيدات الحشائش المختبرة بصورة منفردة .
- ادت معاملة البنداميثالين بمعدل ٠,٤٢٥ كجم مادة فعالة/فدان ومتبوعة بعزقة واحدة الى تحسين نمو نباتات فول الصويا حيث اعطت اطول نباتات واعلى عدد من القرون للنبات واعلى عدد من البذور للقرن واعلى معدل ووزن للبذور واعلى محصول بذور للنبات وللفدان واعلى نسبة زيت وبروتين فى البذور مقارنة بمعاملات مقاومة الحشائش الاخرى .