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EFFECT OF PENDIMETHALIN (STOMP) AND BENZYL ADENINE (BA) ON ASSOCIATED WEEDS, GROWTH, YIELD AND CHEMICAL COMPOSITION OF SOYBEAN PLANTS AT NOBARYA

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ABSTRACT

Two field experiments were conducted to study the effect of Pendimethalin [0 ,0.9 L and 1.7 L/fed.] and BA [0 , 25 and 50 ppm] on the associated weeds, growth, yield and its components, in addition to chemical composition of soybean seeds.

All Pendimethalin treatments alone or in combination with BA significantly depressed the growth of associated weeds. The highest reduction in fresh and dry weights of total weeds were obtained by Pendimethalin (1.7 L/fed. BA (25 ppm) treatment.

It was found that application of Pendimethalin as well as BA gave significant improvements in growth parameters, yield and its component of soybean. In addition recorded increases in total carbohydrate, crude protein, N, P, K, Fe, Mn, Cu and Zn content in seed of soybean, whereas oil content of the seeds was decreased.

Pendimethalin (1.7 L/fed.) + BA (25 ppm) gave the highest value of growth, yield and seed content, whereas, control treatment produced the lowest values of growth and yield.

INTRODUCTION

Soybean is considered as an important leguminous summer crop which has shown extensive success along different regions - previous in Egypt and all over the world soybean seeds contain about 20 % oil and 40 % protein. Therefore, it is an excellent source for human and animal consumption. Soybean yield is significantly decreased by weed competition for nutrient, water and light than other factors. Therefore, weed control is essential especially during early development of soybean (Munyabba *et al.* (1982). At present time there is a great shortage in hand labour and rise in wage scale this makes the uses of chemical weed control very necessary to decrease the weed growth and to increase the production of soybean. Also Pendimethalin gave good control of grasses in soybean fields (Jain and Acharya, 1985). The same authers mentioned that stomp gave effective control of grass weeds in soybean. Shams El-Din and Salwan (1994) and El-Quesni, *et al.* (2002) demonstrated that all the herbicides treatments gave a satisfactory level of weeds control and increased growth and yield of soybean plants.

Recently, Chaphale *et al.* (2003); Nargis kumari, *et al.* (2003), Panghal, *et al.* (2003); Ramakrishna *et al.* (2003), Rathore, *et al.* (2003) and Sonawane and Sabale (2003) found that Pendimethalin application recorded significantly weed control efficiency and increased growth and yields of many crops.

In recent years, several growth regulators solutions have been tried to increase crop tolerance against different stress conditions such as water deficiency, nutrient deficiency in sand soil and weed competition.

In recent years, attention has been focused upon the application of several plant growth regulators to improve qualitatively and/or quantitively the yield of many crop plant. Benzyl adenine is one of the cytokinins which regulators various growth processes [Abo-Hamed *et al.* (1987) using barley plants reported that kinetin increased the number of fruits, number of seeds, seed weight per plant, yield per fed., harvest index and crop index over those values of control.

Mansour *et al.* (1994) reported that lower concentration of benzyl adenine (50 and 100 ppm) significantly increased the plant height, number of nods, and leaves, number of flowers as well as the fresh and dry weights of soybean shoots.

The objective of the present investigation was to study the effect of Pendimethalin (stomp) and Benzyl Adenine (BA) as growth regulators on growth and yield component of soybean plant as well as on the chemical composition of seeds, and associated weeds during its growth and harvest stage.

MATERIALS AND MEHTODS

A field experiment was carried out in two successive seasons (1997 & 1998) at the Agricultural Experimental Station of (Nobarya). Where the soil is sandy in texture with pH 8.36. The soil characteristics of the experimental site is presented in Table (1). Analysis of the soil was carried out according to Jackson (1985). The experiments included three treatments with six replicates arranged in a randomized complete block design. The plot area was 14 m² (4 X 3.5 m) each plot consists of 5 rows 70 cm a part and 4 meters length.

Table (1) : Mechanical and chemical analysis of Nobarya soil.

Depth in cm.	Particile size distribution			Texture class	$CaCO_3$ %	pH	EC mmhos/cm
	Sand	Silt	Clay				
0-30	92.181	3.81	3.01	Sandy	2.25	8.36	0.11

The treatments were as follows :

1. Unweeded control.
2. Treatment with BA [Benzyl Adenine] as foliar spray (25 ppm).
3. Treatment with BA 50 ppm.
4. Treatment with Pendimethalin,N-(1-ethyl-propyl)-3,4-dimehtyl-2,6 dinitrobenzamine (50 % EC), the soil surface pre-emergence 0.9 L/fed.
5. BA 25 ppm + Pendimethalin 0.9 L/fed.
6. BA 50 ppm + " "
7. Pendimehtalin at a rate of 1.7 L/fed.
8. BA 25 ppm + Pendimethalin (1.7 L/fed.).
9. BA 50 ppm + Pendimethalin (1.7 L/fed.).

The plants for each treatment with BA were sprayed two time after fourty and fifty days from sowing.

Seeds of soybean treated with *Rhizobium japonicum* before sowing. Seeds were sown on 10 and 18 May, in the first and second seasons, respectively.

The field was fertilized with super-phosphate (15.5 % P_2O_5) at rate of 100 kg/fed. and potassium sulphate (48.5 % K) at rate of 100 kg/fed., during the preparation of the soil. Ammonium nitrate (33.5 %) at rate of 80 kg/fed., also was added.

Data recorded :

On the weeds : After 60 days from sowing, weeds were hand pulled from the middle ridge of each plot and classified in two groups.

i) Broad leaves weeds.
ii) Grasses weeds.

Fresh, dry and total weight of each group, as well as total weeds were estimated.

During the growth season samples of soybean plants from each treatment in the six replicates were taken 75 days after sowing. In each sample the height of the plants number of leaves, number of branches, no. of pods and plant and dry weight of the plant were determined. The total weight of seeds number of pods/plant and seed index were recorded as well as pods yield ton/fed. at harvest time.

For chemical analysis of seeds, plant samples were taken from all replicates, dried, grounded and total nitrogen was determined by conventional micro kieldahil methods according to (Piper, 1950). Phosphorus content was determined according to Chapman and Prat (1978) Zn, Mn, Fe and Cu were determined using a Zeis PMC Atomic Absorption Spectrometry according to the method adopted by Chapman and Pratt (1978). Potassium and calcium were determined photometrically by using flamephotometer (B700-E).

Carbohydrate content was determined according to Snell and Snell (1954). All data obtained were statistically analyzed according to Snedecor and Cochran (1967), L.S.D. at 5 % level of significance was used to compare between means.

RESULTS AND DISCUSSION

1. Effect of weed control (Pendimethalin) and growth regulator (BA) on associated weeds of soybean plants :

The infestation of soybean plants with different species of weeds has created a hard competition between them. This, inturn reflects unfavourable effect on the obtained yield. The dominant weeds species encountered in the experimental plots of soybean fields at Nobarya were :

1- Annual broad leaved weeds, i.e. *Portulaca oleraceae*, *Chenopodium sppl* and *Gynandropsis gynandra* L.
2- Annual grass weeds i.e. *Dactyloctenium aegyptium* L. and *Echinochlca colonum* L.
3- Perenial weeds, i.e. *Cynodon dactylon* L., Cyprus rotondus L. and *Convolvulus arvensis* L.

Data in Table (2) indicated that efficiency of herbicides [Pendimethalin] was extended to exert a depressing effect on fresh weight and dry weight of soybean weeds at 60 days after sowing. Pendimethalin 1.7 L/fed. treatments the BA 25 ppm gave highest depression in Fresh and dry weight. On the other hand, BA treatments alone were least effective. It could be concluded that all Pendimethalin treatments alone or combined with BA significantly decreased the total weeds grown in soybean when compared with untreated plants. The fresh and dry weights of above mentioned weeds grown in soybean fields decreased by Pendimethalin when compared with BA. This might be due to increasing the vegetative growth of soybean plants treated with BA subsequently inhibited weeds growth.

The results coincide with those of Patil *et al.* (1999), El-Quesni, *et al.* (2002), Chaphale *et al.* (2003) and Sonawane and Sabale (2003).

Growth responses :

Plant growth characters measured at 60 days after sowing were affected significantly by all Pendimethalin treatments alone or in combination with BA when compared with untreated plants as shown in Table (3). Pendimethalin plus BA gave the tallest soybean plants exceeded those plants of the other treatment followed by those obtained by BA treatments.

The No. of leaves, leaf area, diameter of stem, dry weight of plant No. of branches were increased by Pendimethalin as well as BA foliar application. The aforementioned results indicated that Pendimethalin treatment favours the growth of soybean plants Superiority of Pendimethalin treatments is correlated with their marked efficiency on soybean associated weeds. This finding could be due to the limiting weeds infestation and minimizing weed competition. This in turn favoured growth of soybean plants and consequently the length and weight, No. of flower and No. of pods/plant.

*Similar conclusions were obtained by Sangkara et al. (1995), El-*Quesni *et al.* (2002), Chaphal, *et al.* (2003), Nargis kumari, *et al.*, (2003), Panghal, *et al.* (2003), Ramakrishna . (2003) and Rathore, *et al.* (2003) who found that the adverse effect of weeds was greatest on vegetative growth, soybean treated with Pendimethalin shaw significant response to plant vegetative growth, No. of branches, No. of leaves and increase fresh and dry weight of green pods. The significant increase in plant height, stem diameter and leaf area in response to 25 and 50 ppm of benzyl adenine may be due to the effect of this synthetic cytokinin on the cell division and enlargement via the increase in cell wall extensibility. In this connection, Zack and Loy (1984) using hypocotyls of watermelon seedlings reported that benzyl adenine treatment markedly increased osmotic potentials and decreased the estimated turgor pressures which promoted elongation of the hypocotyls, like

benzyl adenine induced cotyledon expansion which was accompanied by a sharp increase in osmotic potential and decrease in estimated turgor.

The data reported in Table (3) show that the most pronounced increment in the plant length, stem diameter and area of leaves in 25 and 50 ppm benzyl adenine treated plants were associated with increases in dry weight of soybean plants through out the experimental stages in both seasons of the study. This results are in agreement with those obtained by Mansour, *et al.* (1994) who reported that treatment with BA caused a significant increase in dry matter of *Daucus arota* and in dry matter of Hibiscus sabdariff throughout the period of the growth compared with untreated plants.

In this work, the different concentrations of benzyl adenine significantly increased the number of flower per plant in comparison with the control. The magnitude of increase was more pronounced with 25 ppm of BA (Table 3). In this respect wareing and Phillips (1981) reported that the exogenous application of cytokinins induced the stimulation of flower formation, fruit development and the inhibition of senescense.

The close parallism between the change in No. of flowers (Table 3) and in the number of pods per plant (Table 4) let us to suggest that benzyl adenine treatments (25 and 50 ppm), stimulated the flowering and pod setting.

Rylott and Smith (1990) stated that the application of cytokinins in flowers caused active cell division of the embryo and hence the attraction of assimilates to the new developing pods form other plant parts. This view was supported by the results obtained by Mansour *et al.* (1994).

Yield and its components :

All Pendimethalin treatments as well as BA treatments in Table (4) under investigation showed significant improvements in yield and its components (number and weight of pods/plant, number and weight of seeds/plant, weight of 100 seeds, plant height.

From the same table the highest value of yield and its components was recorded by Pendimethalin 1.7 L/fed. + BA (25 ppm).

The results are also in good agreement with those obtained by Mansour (1994), Patil *et al.* (1999) and El-Quesni *et al.* (2002).

4. Effect on chemical composition of soybean seeds :

The results in Table (5) indicated that all Pendimethalin treatments increased total content of carbohydrate and protein content of soybean seeds. The increase in carbohydrate and protein content was accompanied with the decrease in oil content.

Table (2) : Effect of Pendimethalin and BA on fresh weight and dry weights of associated weeds after 60 days from sowing (g/m²) (Combined analysis of Two season of 1997 and 1998).

Treatments	Pennernial weeds		Annual grass		Annual broad leaved		Total weeds	
	Fresh wt.	Dry wt.	Fresh wt.	Dry wt.	Fresh wt.	Dry wt.	Fresh wt.	Dry wt.
Untreated	393.90	99.00	339.31	105.00	774.22	190.70	1500.43	397.53
BA 25 ppm	383.33	93.00	329.23	99.41	766.50	181.50	1479.06	373.75
BA 50 ppm	389.60	96.00	333.50	103.49	760.33	185.00	1470.75	386.83
Pendimethalin 0.9 L/fed.	195.50	50.00	127.55	39.91	282.31	73.43	604.56	162.81
Pendimethalin 0.9 L/fed. + BA 25 ppm	166.98	44.00	119.46	33.29	274.52	68.00	559.96	145.52
Pendimethalin 0.9 L/fed. + BA 50 ppm	178.11	47.00	125.50	38.33	279.25	69.26	582.84	154.51
Pendimethalin 1.7 L/fed.	138.18	35.00	105.71	25.50	156.50	41.66	400.33	101.83
Pendimethalin 1.7 L/fed. + BA 25 ppm	121.50	28.00	94.86	20.38	144.13	33.99	356.50	83.12
Pendimethalin 1.7 L/fed. + BA 50 ppm	127.38	31.00	97.30	22.99	149.61	37.22	374.20	91.21
L.S.D. at 5 %	13.23	7.35	12.20	5.21	29.62	10.2	45.20	27.33

Table (3) : Effect of Pendimethalin and BA on growth parameters of soybean plants after 60 days from sowing. (Combined analysis of the two growing seasons of 1997 and 1998).

Treatments	Plant height (cm)	No. of leaves	Leaves area cm² plant	Diameter of stem (cm)	No. of branches /plant	Dry wt. (gm)/plant	No. of flowers/ plant
Untreated	59.20	14.73	45.41	1.87	5.33	20.33	46.33
BA 25 ppm	64.20	15.93	50.89	1.92	5.98	21.83	53.07
BA 50 ppm	63.27	15.73	47.00	2.17	5.81	21.25	59.06
Pendimethalin 0.9 L/fed.	65.44	16.57	49.09	1.95	5.75	21.63	62.07
Pendimethalin 0.9 L/fed. + BA 25 ppm	69.80	17.60	53.71	2.00	6.61	24.11	66.20
Pendimethalin 0.9 L/fed. + BA 50 ppm	68.20	16.40	50.51	2.14	6.55	23.89	62.80
Pendimethalin 1.7 L/fed.	68.73	17.27	50.33	2.30	6.43	23.50	63.03
Pendimethalin 1.7 L/fed. + BA 25 ppm	72.80	18.90	54.21	2.46	7.11	25.21	73.00
Pendimethalin 1.7 L/fed. + BA 50 ppm	71.60	17.60	53.11	2.68	6.95	24.88	67.80
L.S.D. at 5 %	3.80	0.91	3.10	0.24	N.S	1.30	2.36

Table (4) : Effect of Pendimethalin and BA yield and its components of soybean plants at harvest. (Combined analysis of two growing seasons of 1997 and 1998).

Treatments	Shoots height (cm)	No. of leaves/ plant	No. of pods/ plant	No. of seeds/ plant	Wt. of 100 seeds (mg)	Wt.of seed/ plant (gm)	Wt.of seeds/ 100 pods	Wt.of 100 pods (mg)	Wt. green pods/ plant (mg)	Seed yield kg/fed.
Untreated	73.49	18.80	32.53	87.00	12.30	10.75	32.96	44.75	17.85	1923
BA 25 ppm	80.27	20.07	36.73	100.80	12.92	13.83	36.09	59.57	21.31	2112
BA 50 ppm	75.93	19.20	35.75	97.50	12.85	12.70	35.79	57.59	21.00	2088
Pendimethalin 0.9 L/fed.	83.13	19.40	38.20	110.02	13.65	14.12	39.06	62.68	23.20	2209
Pendimethalin 0.9 L/fed.+BA 25 ppm	88.30	20.90	39.62	118.00	13.82	14.92	41.64	64.40	25.32	2420
Pendimethalin 0.9 L/fed.+BA 50 ppm	84.00	19.50	39.20	112.20	13.66	13.83	40.29	62.90	24.66	2338
Pendimethalin 1.7 L/fed.	85.80	19.80	39.80	119.22	13.93	15.33	39.81	65.59	23.45	2282
Pendimethalin 1.7 L/fed.+BA 25 ppm	89.50	20.91	40.80	129.20	14.54	16.37	42.14	59.40	26.33	2566
Pendimethalin 1.7 L/fed.+BA 50 ppm	86.50	19.90	39.60	113.00	13.92	15.35	41.11	65.44	24.77	2450
L.S.D. at 5 %	3.27	1.55	2.94	118.11	0.12	2.30	3.53	4.30	2.50	43.52

Table (5) : Effect of Pendimethalin and BA on chemical composition of soybean seeds at harvest stage. (Combined analysis of two growing seasons 1997 and 1998).

Treatments	Protein %	Carbohydrate %	Oil %
Untreated	37.99	22.20	18.0
BA 25 ppm	38.38	23.53	17.40
BA 50 ppm	38.06	23.00	17.63
Pendimethalin 0.9 L/fed.	39.60	23.92	17.11
Pendimethalin 0.9 L/fed. + BA 25 ppm	41.56	24.50	17.00
Pendimethalin 0.9 L/fed. + BA 50 ppm	38.26	24.11	17.20
Pendimethalin 1.7 L/fed.	40.11	24.20	16.81
Pendimethalin 1.7 L/fed. + BA 25 ppm	41.90	24.93	16.33
Pendimethalin 1.7 L/fed. + BA 50 ppm	39.98	24.45	16.85

Table (6) : Effect of Pendimethalin and BA on macro and micro-elements of soybean seeds at harvest.

Treatments	N mg/g	P mg/g	K mg/g	Fe ppm	Zn ppm	Cu ppm	Mn ppm
Untreated	6.07	0.78	1.20	220	70.71	0.70	
BA 25 ppm	6.14	0.85	1.38	245	70.76	0.79	
BA 50 ppm	6.08	0.85	1.31	240	76.72	0.73	
Pendimethalin 0.9 L/fed.	6.33	0.78	1.24	250	93.11	0.80	
Pendimethalin 0.9 L/fed. + BA 25 ppm	6.64	0.88	1.88	262	101.20	1.03	
Pendimethalin 0.9 L/fed. + BA 50 ppm	6.12	0.83	1.73	255	99.50	0.01	
Pendimethalin 1.7 L/fed.	6.41	0.80	1.82	283	107.32	1.03	
Pendimethalin 1.7 L/fed. + BA 25 ppm	6.70	0.02	2.62	302	110.30	1.08	
Pendimethalin 1.7 L/fed. + BA 50 ppm	6.39	0.86	1.76	286	105.23	1.04	

Data presented in Table (5) evened that BA treatment alone resulted slight effects on carbohydrate and protein contents, whereas oil content in seeds of soybean decreased as a result of Benzyl Adenine treatments as compared with the control.

Results indicated that Pendimethalin (1.7 L/fed.) + 25 BA ppm recorded the highest values of carbohydrate and protein in soybean seeds. On the other hand the control treatment showed lower values in this respect.

Results presented in Table (6) indicate differences between all treatments in N, P, K and Fe, Zn, Cu and Mn content of harvested soybean seeds. All Pendimethalin treatments alone or combinated with BA treatments increased N, P, K, Fe, Mn, Cu and Zn as compared to control plants.

In Table (6) clearly indicated that BA increased seed nutrient (N, P, K, Fe, Zn, Cu and Mn) of soybean plants. This positive effect of BA may be attributed to its effect on rate of cations and anions uptake by root system of plants. These results are in harmony with those obtained by Gaweesh *et al.* (1992), El-Quesni *et al.* (2002) and Chaphale *et al.* (2003).

It can be concluded that Pendimethalin at rate of 1.7 L/fed. + BA (25 ppm) treatment can be effectively control weeds in soybean field and produce higher seed and straw yield (biological yield), as well as chemical composition of seeds.

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تأثير بنديميثالين (استومب) والبنزيل ادنين على الحشائش المصاحبة ونمو ومحصول والمحتوى الكيماوى لنبات فول الصويا فى النوبارية

صنعة حسين الجيار

قسم النبات – المركز القومى للبحوث – الدقى – الجيزة

اجريت تجربتان حقليتان بالنوبارية لدراسة تأثير مبيد بنديميثالين بتركيزات (صفر ، ٠,٩ و ١,٧ لتر/فدان) وبنزيل ادنين بتركيزات (صفر ، ٢٥ و ٥٠ جزء فى المليون) على الحشائش المصاحبة وصفات النمو والمحصول والتركيب الكيماوى لنبات فول الصويا . لوحظ ان جميع معاملات مبيد بنديميثالين سواء بمفردها او مع بنزيل ادنين قد احدثت نقصا معنويا فى نمو الحشائش وكانت المعاملة بمبيد بنديميثالين ١,٧ لتر/فدان مع الرش بنزيل ادنين (٢٥ جزء فى المليون) اكثر فعالية فى نقص الوزن الطازج والجاف للحشائش المصاحبة . بينما اعطت معاملة المقارنة اقل نمو نباتات واقل محصول . واظهرت النتائج تحسن معنوى فى صفات النمو والمحصول ومكوناته بمعاملات كل من البنديميثالين وبنزيل ادنين وكذلك اظهرت زيادة معنوية فى المحتوى الكلى للكربوهيدرات والبروتين وعناصر النتروجين – الفوسفور – البوتاسيوم – والحديد والزنك والنحاس والمنجنيز – وكانت هذه الزيادة مصاحبة لنقص نسبة الزيت فى البذور وكانت افضل المعاملات هى معاملة مبيد بنديميثالين بتركيز ١,٧ لتر/فدان مع رش بنزيل ادنين (٢٥ جزء فى المليون) .