

Influence of Certain Herbicides on some Peanut Characteristics

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Abstract: The side effect of four herbicides, pendimethalin, oxyfluorfen fluazifop –P– butyl and clethodim on certain peanut characteristics such as chlorophyll dry weight of each of plants and pods, oil and protein contents of the seeds were estimated. The herbicides at complete recommended and at half rates with or without KZ oil were applied. The results clearly showed that the highest increase in chlorophyll (a, b and total) was obtained with the treatment of clethodim at half rate + 1500 ml oil; whereas the treatment of clethodim at half rate without oil recorded the lowest effect during 2004 and 2005 seasons. The results also revealed that the highest effect on dry weight of each of plants and pods was more pronounced for the treatment of the half rate of clethodim plus 1500 ml of mineral oil. The herbicides had no effect on each of oil and crude protein content of peanut seeds.

Keywords: Herbicides, characteristics, influence, peanut

INTRODUCTION

Peanut or groundnut (*Arachis hypoagea* L.) is an excellent source of oil and protein. The invasion of weeds resulted in great losses in both yield and quality. Chemical control of peanut weeds is considered an excellent alternative method to the manual control. The herbicides may be applied as pre – emergence (Silva *et al.*, 1983; Deer *et al.*, 1985; Colvin *et al.*, 1985) or post-emergence treatments (Rogers *et al.*, 1980; Ennis and Ashley, 1988; Fletcher and Kirwood, 1982). Pre-emergence treatment of herbicides may allow weeds to emerge after certain period of time. However, application of pre - or - post emergence herbicides delays the emergence of weeds. Mineral oil can be added to herbicides for melioration weeds control (kudsk, 1984; Glemmestad, 1985; Barrol, 1989). Chemical control treatments can affect peanut growth and yields (Grichar and Boswell, 1986).

The main subjective of this research is to shed light on the the effect of some herbicides on certain peanut characteristic such as chlorophyll, dry weight of each of plants and pods, oil and protein contents of peanut seeds.

MATERIALS AND METHODS

Chemical used:

Pendimethalin 12% EC (Stomp)

IUPAC name: N – (1- ethylpropyl) - 2, 6 – dinitro-3, 4-xylydine

Oxyfluorfen 12% EC (Goal)

IUPAC name: 2–a, a, a trifluoro –p– tolyl 3- emoxy–4– nitro phenyl ether

Fluazifop-P-butyl 12% EC (Fusilade super)

IUPAC name: 2 - [4 - (5 - trifluoro methyl)]

Clethodim 12% EC (Select super)

IUPAC name: (±) - 2 - [(E) - 3 – chloro allyloxy imino propyl] 5 - [2 – (ethyl thio) propyl] hydroxyl – cyclohex - 2- enone

Field experiment:

The experiment was carried out at Ismailia Agricultural Research Station, Agricultural Research

Centre (ARC), throughout the two successive seasons, 2004 and 2005. Peanut seeds CV. (Giza 16) were sown on 15-4 – 2004 and on 18 – 5 – 2005 at a constant rate of 40 Kg. pods/fed. The cultivated area was divided into 52 plots. Each plot was prepared as ridges (6 ridges), 60 Cm. between each other. The distance between the planted pods was 10 Cm. on one side of the ridge. Normal agricultural practices, irrigation and fertilization were followed. The experiment included 12 treatments:

- 1 - Pendimethalin 12% EC (Stomp) at the rate of 850.0 g. (a.i.)/fed.
- 2 - Pendimethalin 12% EC (Stomp) at the rate of 425.0 g. (a.i.)/fed.
- 3 - Oxyfluorfen 12% EC (Goal) at the rate of 180.0 g. (a.i.)/fed.
- 4 - Oxyfluorfen 12% EC (Goal) at the rate of 90.0 g. (a.i.)/fed.
- 5- Fluazifop – P– butyl 12.5% EC (Fusilade super) at the rate of 187.5 g. (a.i.)/fed.
- 6- Fluazifop – P – butyl 12.5% EC (Fusilade super) at the rate of 93.75 g. (a.i.)/fed
- 7- Fluazifop – p – butyl 12.5% EC (Fusilade super) at the rate of 93.75 g. (a.i.)/fed. Mixed with (KZ oil) at the rate of 1000 ml/fed.
- 8- Fluazifop –P – butyl 12.5% EC (Fusilade super) at the rate of 93.75 g. (a.i.)/ fed. Mixed with (KZ oil) at the rate of 1500 ml/fed.
- 9- Clethodim 12.5% EC (Select super) at the rate of 125.0 g. (a.i.)/fed.
- 10- Clethodim 12.5% EC (Select super) at the rate of 26.5 g. (a.i.)/fed.
- 11- Clethodim 12.5 % EC (Select super) at the rate of 26.5 g. (a.i.)/fed. mixed with (KZ oil) at the rate of 1000 ml/fed.
- 12- Clethodim 12.5% EC (Select super) at the rate of 26.5 g. (a.i.)/fed. mixed with (KZ oil) at the rate of 1500 ml/fed.

The herbicides were applied at post – emergence stage as foliar spraying, 30 days after sowing, by the aid of a knapsack sprayer, at a volume rate 200 L/fed. The experiment was designed as complete randomized blocks. Each treatment was represented by four plots as replicates. Four plots were served as control.

Determination of chlorophyll (a, b and total) in peanut plants:

To determine the photosynthetic pigments chlorophyll (a, b and total), leaves were collected, 75 days after sowing. Samples were put in 10 ml of 85% acetone in dark bottle, and left to stand for 15 hours at room temperature, then the samples were filtered in glass wool into 50 ml volumetric flask and made up to 50 ml with 85% acetone solution. The optical density of the samples were measured at wavelength of 662, 664 and 440.5 nm using Beckman DK-2 Spectrophotometer. Concentrations of chlorophyll (a and b) and carotenoides were calculated as follows:

$$\text{Chlorophyll a} = (9.784 \times E_{662}) - (0.99 \times E_{662}) = \text{mg/g (D.Wt)}$$

$$\text{Chlorophyll b} = (21.426 \times E_{644}) - (0.99 \times E_{644}) = \text{mg/g (D.Wt)}$$

E = optical density at wavelength indicated (Wettstein, 1957; Fadl and Sari El-Deen, 1978)

Determination of dry weight of each of peanut plants and pods:

From each experiment plots, five peanut plants were randomly collected at 45, 75 and 105 days after sowing. The plants – include pods -were left four days in the laboratory and then were dried for four days, under 70°C in oven. The dried plants and pods were weighted and recorded.

The increasing percentage in dry weight was calculated using the following equation: -

% increasing in dry weight =

$$\frac{\text{D.W as g/plant in treatment} - \text{D.W as g/plant in check}}{\text{D.W as g/plant weeding check}} \times 100$$

Determination of oil content of peanut seeds:

The oil content of peanut seeds was determined according to the methods of A.O.A.C. Washington (1975). The method is based on extraction of fat by using petroleum ether through soxhlet apparatus. To determine weights of seeds before and after extraction - represented oil content -two seed samples of each plot, 2 g. of each sample were grounded with blender to fine powder. The grounded sample was put into the set tube of soxhlet apparatus and filled with petroleum ether (bp < 70°C) and shaking frequently. The soxhlet was fitted on water bath for about 10 hours until upper liquid (70 - 80°C). When petroleum ether extract became particularly clear, more petroleum ether was added to set tube during extractions possesses. The sample accurately weight and the percent oil were calculated.

Determination of protein content of peanut seeds:

The protein content of peanut seeds was determined according to the methods of A.O.A.C. Washington (1975). The method is depending on digestion of protein of peanut seeds to nitrogen by using kjeldahl apparatus. Two seed samples (fine powder) of each plot, each 2 g, were putted in digestion flask of kjeldahl. After digestion and titration possesses were achieved the protein content of peanut seeds was calculated by multiplying nitrogen percentage of sample by 6.25.

The obtained data were computed and statistically analyzed as complete randomized blocks designed by the aid Mstat program to determine the significance of the differences among the percentages reduction of the treatments.

RESULTS AND DISCUSSION

Chlorophyll (a, b and total) in peanut plants:

Data presented in Tables (1 and 2) showed the effect of chemical control of weeds using the herbicides, pendimethalin, and oxyfluorfen, (as pre) and fluzafop – P – butyl and clethodim (as post – emergence herbicides) on chlorophyll (a, b and total) in peanut plants, during 2004 and 2005 seasons. The results of the 12 experiments clearly showed that all chemical treatments induced an increase in the formations of chlorophyll (a and b), either the herbicides were applied as pre or post emergence. The highest increase in chlorophyll content was achieved with the treatment of clethodim at half rate + 1500 ml oil throughout the two experimental seasons. The total chlorophyll resulted from the former treatments were 8.05 and 7.48 mg/g (D.Wt) during 2004 and 2005 seasons respectively. The increasing percentages were 174.7 % during 2004, and 187.7% during 2005 seasons.

The lowest increase in total content of chlorophyll was caused by the treatment of clethodim at half rate without oil during 2004 and 2005 seasons. The total chlorophyll values were 4.5 and 4.01 mg/g (D.Wt) during 2004, and 2005 seasons respectively. The increasing percentages were 53.6% and 55.0% during 2004 and 2005 seasons, respectively.

Such effect may give an advantage for peanut plant to grow without any competition from weeds, which leads to formation of the highest content of chlorophyll comparing with untreated plants.

Dry weight of peanut plants:

Data presented in Tables (3 and 4) showed the effect of the tested herbicides on dry weight of peanut plants during 2004 and 2005 seasons. The results showed that all the treatments resulted in increase of the dry weight of peanut plants. The highest effect was more pronounced from the post - emergence treatment especially for the half rate of clethodim plus 1500 ml of mineral oil.

The dry weights of peanut plants (g / plant), were 12.5 , 35.25 and 57.72 in 2004 season and 12.5 , 45.81 and 60.79 in 2005 season after 45, 75 and 105 days intervals after sowing, respectively.

Table (1): Effect of certain herbicides on chlorophyll (a and b) in peanut plants during 2004 and 2005 seasons

Treatments	Rate g (a.i)/fed	2004 season		2005 season	
		chlorophyll a*	chlorophyll b*	chlorophyll a*	chlorophyll b*
Pre-emergence herbicides					
Pendimethalin 12% EC	850.0 g.	3.06	4.0	3.26	3.60
Pendimethalin 12% EC	425.0 g	2.40	3.56	2.18	2.56
Oxyfluorfen 12% EC	180.0 g	2.96	3.64	3.59	2.99
Oxyfluorfen 12% EC	90.0 g	2.67	2.56	2.53	2.98
post – emergence herbicides					
Fluazifop–p– butyl	187.5 g	3.02	4.41	3.20	3.07
Fluazifop–p–butyl	93.75 g	2.84	2.23	1.86	2.18
Fluazifop–p–butyl+ (KZ oil)	93.75 g +1000 ml	3.06	3.37	2.35	2.91
Fluazifop–p–butyl + (KZ oil)	93.75 g +1500 ml	3.05	4.02	2.67	3.22
Clethodim	125.0 g	2.75	3.75	2.83	3.33
Clethodim	62.5 g	2.23	2.2	2.08	2.19
Clethodim+(KZ oil)	62.5 g +1000 ml	2.62	3.57	2.48	3.36
Clethodim+(KZ oil)	62.5 g +1500 ml	3.16	4.89	3.43	4.05
Weedy check		1.53	1.40	1.45	1.11

* Mg/g (D.Wt)

Table (2): Percentage increase in total content of chlorophyll in peanut plants during 2004 and 2005 seasons

Treatments	Rate g (a.i)/fed	Total chlorophyll *		% increasing	
		2004	2005	2004	2005
Pre-emergence herbicides					
Pendimethalin 12% EC	850.0 g.	7.15	5.86	144.0	125.4
Pendimethalin 12% EC	425.0 g	5.96	4.64	103.4	78.5
Oxyfluorfen 12% EC	180.0 g	6.60	6.58	125.3	153.1
Oxyfluorfen 12% EC	90.0 g	4.73	5.51	61.4	111.9
Post – emergence herbicides					
Fluazifop–p– butyl	187.5 g	8.03	6.27	174.1	141.2
Fluazifop–p–butyl	93.75 g	5.07	4.04	73.0	55.4
Fluazifop–p–butyl+ (KZ oil)	93.75 g +1000 ml	6.43	5.26	119.5	102.3
Fluazifop–p–butyl + (KZ oil)	93.75 g +1500 ml	7.53	5.89	157.0	126.5
Clethodim	125.0 g	6.50	6.16	121.8	136.9
Clethodim	62.5 g	4.50	4.01	53.6	55.0
Clethodim+(KZ oil)	62.5 g +1000 ml	6.19	5.84	111.3	124.6
Clethodim+(KZ oil)	62.5 g +1500 ml	8.05	7.48	174.7	187.7
Weedy check	-----	2.93	2.66	0.00	0.00

* Mg/g (D.Wt)

Table (3): Effect of certain herbicides on dry weight of peanut plants during 2004 season

Treatments	Rate g (i.e.) / Fed	Dry weight as g / plant		
		45 days	75 days	105 days
Pre-emergence herbicides				
Pendimethalin 12% EC	850.0 g.	14.6	32.4	50.72
Pendimethalin 12% EC	425.0 g	10.08	21.58	40.26
Oxyfluorfen 12% EC	180.0 g	12.50	24.58	46.22
Oxyfluorfen 12% EC	90.0 g	8.94	20.89	41.99
Post – emergence herbicides				
Fluazifop–p– butyl	187.5 g	10.63	28.88	46.6
Fluazifop–p–butyl	93.75 g	8.51	23.40	44.54
Fluazifop–p–butyl+ (KZ oil)	93.75 g +1000 ml	10.18	32.40	46.4
Fluazifop–p–butyl + (KZ oil)	93.75 g +1500 ml	11.62	35.08	51.12
Clethodim	125.0 g	11.16	32.84	51.05
Clethodim	62.5 g	8.85	25.31	50.90
Clethodim+(KZ oil)	62.5 g +1000 ml	10.14	33.37	55.63
Clethodim+(KZ oil)	62.5 g +1500 ml	12.5	35.25	57.72
Weedy check	----	6.80	12.712	23.73

Table (4): Effect of certain herbicides on dry weight of peanut plants during 2005 season

Treatments	Rate g (i.e.) / Fed	Dry weight as g / plant		
		45 days	75 days	105 days
Pre-emergence herbicides				
Pendimethalin 12% EC	850.0 g.	12.02	39.63	56.30
Pendimethalin 12% EC	425.0 g	8.62	26.45	46.36
Oxyfluorfen 12% EC	180.0 g	11.87	30.71	52.61
Oxyfluorfen 12% EC	90.0 g	8.96	27.12	45.61
Post – emergence herbicides				
Fluazifop–p– butyl	187.5 g	9.45	35.17	50.12
Fluazifop–p–butyl	93.75 g	7.94	28.88	45.53
Fluazifop–p–butyl+ (KZ oil)	93.75 g +1000 ml	8.47	36.27	49.01
Fluazifop–p–butyl + (KZ oil)	93.75 g +1500 ml	9.93	38.2	52.91
Clethodim	125.0 g	9.0	37.2	63.0
Clethodim	62.5 g	7.52	31.17	50.06
Clethodim+(KZ oil)	62.5 g +1000 ml	8.66	41.77	57.06
Clethodim+(KZ oil)	62.5 g +1500 ml	12.50	45.81	60.79
Weedy check	---	5.94	15.51	26.44

Dry weight of pods:

Data presented in Tables (5 and 6) showed the effect of the tested herbicides on dry weight of peanut mature pods, 75 and 105 days after sowing during 2004 and 2005 seasons. The obtained results clearly showed that all treatments induced increases in the dry weight of peanut mature pods. The highest percentage

of increase was recorded with the treatment of clethodim at half rate plus 1500 ml of mineral oil, which gave 501 and 541.2 %, during 2004 season and became 546.7 and 568.2% during 2005 season, such increases were obtained after, 75 and 105 days intervals after sowing during 2004 and 2005 seasons, respectively.

Table (5): Effect of certain herbicides on dry weight of peanut mature pods during 2004 and 2005 seasons

Treatments	Rate g (i.e.) / Fed	Dry weight of mature pods as g / plant			
		2004		2005	
		75 days	105 days	75 days	105 days
Pre-emergence herbicides					
Pendimethalin12% EC	850.0 g.	9.58	24.11	10.19	29.92
Pendimethalin12% EC	425.0 g	6.07	19.92	7.46	20.94
Oxyfluorfen 12% EC	180.0 g	12.69	29.66	13.39	36.96
Oxyfluorfen 12% EC	90.0 g	8.34	19.89	9.43	23.98
Post – emergence herbicides					
Fluazifop–p– butyl	187.5 g	13.15	37.46	13.59	40.65
Fluazifop–p–butyl	93.75 g	6.96	20.79	7.14	27.97
Fluazifop–p–butyl+ (KZ oil)	93.75 g +1000 ml	13.12	35.29	12.33	34.0
Fluazifop–p–butyl + (KZ oil)	93.75 g +1500 ml	14.07	37.62	14.77	36.76
Clethodim	125.0 g	14.50	36.68	14.24	39.86
Clethodim	62.5 g	9.63	25.30	9.74	26.47
Clethodim+(KZ oil)	62.5 g +1000 ml	13.74	31.91	12.17	38.65
Clethodim+(KZ oil)	62.5 g +1500 ml	15.75	37.98	17.72	40.96
Weedy check	---	2.62	5.19	2.74	6.13

Table (6): Effect of certain herbicides on increasing percentage of dry weight of peanut mature pods during 2004 and 2005 seasons

Treatments	Rate g (i.e.) / Fed	% increasing dry weight of mature pods as g / plant			
		2004		2005	
		75 days	105 days	75 days	105 days
Pre-emergence herbicides					
Pendimethalin 12% EC	850.0 g.	265.6	364.5	271.9	388.1
Pendimethalin 12% EC	425.0 g	131.7	226.0	172.3	241.6
Oxyfluorfen 12% EC	180.0 g	384.4	471.5	388.7	498.5
Oxyfluorfen 12% EC	90.0 g	218.3	283.2	244.2	291.2
Post – emergence herbicides					
Fluazifop–p– butyl	187.5 g	401.9	521.8	395.9	563.1
Fluazifop–p–butyl	93.75 g	165.6	300.6	160.6	365.3
Fluazifop–p–butyl+ (KZ oil)	93.75 g +1000 ml	400.8	510.9	350.0	454.6
Fluazifop–p–butyl + (KZ oil)	93.75 g +1500 ml	437.0	524.1	439.1	499.7
Clethodim	125.0 g	453.4	606.7	419.7	550.2
Clethodim	62.5 g	267.6	387.5	255.5	331.8
Clethodim+(KZ oil)	62.5 g +1000 ml	424.4	514.8	344.2	550.5
Clethodim+(KZ oil)	62.5 g +1500 ml	501.1	541.2	546.7	568.2
Weedy check	---	---	---	---	---

Effect of the tested herbicides is in a shadow to the effect these herbicides on dry weight of peanut plants. The highest increase in mature pods with the post – emergence treatments are in correlation to the highest increase in dry weight of plant as well as for clethodim at half rate plus 1500 ml of mineral oil, with 501.1 and 541.2 % increases in weights of dry peanut mature pods, during 2004 season and became 547.7 and 568.2 %, after 75 and 105 days after sowing during 2005 season.

These results are in the same trend to those reported earlier (Bollich *et al.*, 1988; Hassan and Metwally, 2001; Kumar *et al.*, 2003).

Oil and protein content of peanut seeds:

Data in Table (7) showed the effect of the tested herbicides on the crude protein and oil content in peanut seeds during 2004 and 2005 seasons. The statistical analyses revealed that no significant effect was found between the treated and untreated plants.

These results were in agreement with those obtained by Ibrahim (1995) who indicated that pendimethalin at 850 g/fed had no effect on oil and crude protein content of peanut seed compared to untreated plants.

Table (7): Effect of certain herbicides on oil and crude protein content during 2004 and 2005 seasons

Treatments	Rate g (i.e.) / Fed	2004		2005	
		Oil %	Protein %	Oil %	Protein %
Pre-emergence herbicides					
Pendimethalin 12% EC	850.0 g	53.21	15.57	52.57	16.37
Pendimethalin 12% EC	425.0 g	52.49	15.19	53.31	16.00
Oxyfluorfen 12% EC	180.0 g	52.4	13.44	52.69	16.36
Oxyfluorfen 12% EC	90.0 g	53.12	14.91	52.96	15.13
Post – emergence herbicides					
Fluazifop–p– butyl	187.5 g	54.26	16.04	51.69	17.15
Fluazifop–p–butyl	93.75 g	53.0	15.31	52.82	14.58
Fluazifop–p–butyl+ (KZ oil)	93.75 g +1000 ml	52.94	15.83	53.49	14.80
Fluazifop–p–butyl + (KZ oil)	93.75 g +1500 ml	54.45	16.20	53.05	15.58
Clethodim	125.0 g	52.94	15.83	53.49	14.8
Clethodim	62.5 g	51.71	16.72	53.33	17.97
Clethodim+(KZ oil)	62.5 g +1000 ml	53.99	15.83	54.00	116.02
Clethodim+(KZ oil)	62.5 g +1500 ml	52.97	15.73	53.08	15.70
Weedy check	---	52.29	15.51	53.27	15.92
LSD 5%		52.09	15.13	53.9	14.96

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تأثير بعض مبيدات الحشائش على بعض خصائص الفول السوداني

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تم تقدير التأثير الجانبي لمبيدات الحشائش pendimethalin, oxyfluorfen, fluazifop –P– butyl and clethodim على بعض خصائص الفول السوداني (مثل الكلوروفيل، الوزن الجاف للنباتات، وزن القرون ومحتوى كل من الزيت والبروتين في البذور). تم استخدام المبيدات بالمعدلات الموصى بها، وأيضا بمعدل نصف الجرعة الموصى بها فقط أو بخلطها بزيت معدني (كفر الزيات). أوضحت النتائج المتحصل عليها أن أقصى زيادة في محتوى الكلوروفيل حدثت عند المعاملة بمبيد الكالتديوم (عند استخدام نصف الجرعة الموصى بها مخلوطا مع ١٥٠٠ مل زيت). في حين أنت المعاملة بمبيد clethodim نصف الجرعة الموصى بها فقط) إلى أقل زيادة في محتوى الكلوروفيل خلال موسمي الزراعة ٢٠٠٤، ٢٠٠٥. تحقق أقصى تأثير على الوزن الجاف لكل من النبات ووزن القرون عند المعاملة بكل من مبيد الكالتديوم أو فليزوفوف- بيوتيل (عند استخدام نصف الجرعة الموصى بها مخلوطا مع ١٥٠٠ مل زيت). لم يحدث أي من مبيدات الحشائش المختبرة أي تأثير على محتوى أي من محتوى الزيت أو محتوى البروتين في نباتات الفول السوداني.