

## EFFICACY OF THE SELECTED HERBICIDES IN CONTROLLING WEEDS AND THEIR SIDE EFFECTS ON PEANUT

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**Abstract:** The field experiments were carried out at Ismailia Agricultural Research Station, Agriculture Research Center (ARC) during 2004 and 2005 seasons, to study the effect of the selected herbicides (pendimethalin, oxyflurofen, fluazifop-p-butyl and clethodim) on weeds control as well as their effect on certain crop characters of peanut *Arachis hypogaea* L. family leguminous, compared with unchemical control means. The results showed that pendimethalin, as pre-emergence treatment, at recommended rate, gave the highest reduction in number and dry weight of weeds per sq. meter. Whereas clethodim as post-emergence treatment at half recommended rate recorded the least effect. Mechanical mean weed free had the superior effect after 75 and 105 days from sowing, followed pendimethalin and clethodim at (recommend rate) in 2004 and pendimethalin in 2005. The results also showed that clethodim as post-emergence treatment at recommend rate was the most effective's treatment reduction on dry weight of weeds. Weed free caused percentage reduction of dry weight ranged from 91.5 to 99.8%. The results also showed that the tested herbicides increased the dry weight, pod yield and yield components, whereas there were no significant effect on the crude protein and oil content in seeds between all treatments and unweeded treatment.

**Key words:** peanut, *Arachis hypogaea*, weeds control, herbicides, pendimethalin

### INTRODUCTION

All over the world amongst oil seed crops, peanut or groundnut (*A. hypogaea* L.) occupies a pre-dominant position in terms of acreage and total production. In Egypt peanut is considered one of the most important summer oil crops. The cultivated area, all over Egypt, during 2004 season, was computed to sum 63615 hectare, in both old and new lands, with average yield of 6259.65 kg per hectare. Numerous weeds

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were found side by side peanut plants. Uncontrolled weeds reduce groundnut yield up to 75% (Gnanamurthy and Balasubramaniyan 1998). The first 3 to 4 week of crop-growth period is critical for weed control in peanut (Kalaiselvan *et al.* 1991).

Weed control cost a lot and cause problems to farmers. Hoeing and hand weeding are often the most expensive control means. Chemical control is an excellent alternative method to manual weeding. However, pre and post-emergence application of herbicides may allow the emergence of weeds after some time.

This experiment aimed to evaluate the efficacy of certain herbicides on weed control, compared with unchemical methods also studies the effect of the tested herbicides on certain crop characters of peanut.

## MATERIALS AND METHODS

### I. Chemicals used

- 1- Pendimethalin
- 2- Oxyfluorfen
- 3- Fluazifop-p-butyl
- 4- Clethodim

### II. Field experiment

The experiment was carried out at the farm of Ismailia Agricultural Research Station, Agricultural Research Center (ARC), during 2004 and 2005 successive seasons. The soil in the experimental area was sandy textured. The area was prepared and divided to plots, each measured 21m<sup>2</sup>. Peanut seeds Ismailia 1 cultivar (83.3kg/ha) were inoculated with the specific strain of *Bradyrhizobium* sp, then sowed on the first week of May in rows (60cm apart and 10cm between hills). Traditional agriculture practices were employed.

Each of the tested herbicides was applied into two doses as follows:

#### 1. Pre-emergence treatments

- Pendimethalin at the rate of 2023g active substance/ha. (recommended rate) and 1011.5g a.s./ha.
- Oxyfluorfen at the rate of 428.4g (recommended rate) and 214.2g a.s./ha.

The soil surface was sprayed with the two rates herbicide after sowing but before irrigation.

#### 2. Post-emergence treatment: 30 days after sowing

- Fluazifop-p-butyl at the rate of 446.25g (recommended rate) and 223.13g a.s./ha.
  - Clethodim at the rate of 297.5g (recommended rate) and 148.75g a.s./ha.
- The two former rates were applied as foliar application.

#### 3. Mechanical means

- Hand-hoeing twice was carried out (20 and 35 days after sowing).
- Weed free: weeds were hand pulled weekly until harvest.

Four replicates for each treatment were used. Four plots were left as a check. The treatments were arranged in complete randomized blocks. The crop was harvested in the first week of October in both seasons.

The percent reduction in weed inhibition (R %) was calculated using the well known equation.

### **III. Crop characters**

The following determinations were carried out in the laboratory of Plant Protection Department, Faculty of Agriculture, Suez Canal University. Samples were collected in paper pages and transferred to the lab.

#### **1. Determination of dry weight of weeds (g/m<sup>2</sup>)**

Weeds one square meter – were collected from each experimental plot. Samples were left for 3 days in the laboratory for primary drying for four days and then in an oven at 70°C. Dry weights of weeds were recorded after 45, 75 and 105 days from cultivation for each treatment.

#### **2. Determination of growth characters of peanut plant**

The following characters of five peanut plants were measured after 45, 75 and 105 days from sowing.

##### **2.1. Dry weight (g/plant).**

##### **2.2. Weight of mature pods (g/plant).**

#### **3. Determination of chlorophyll in peanut plant**

The chlorophyll (a, b) content of peanut leaves was determined after 75 days from sowing according to the methods of (Fadl and Sari El-Deen, 1978).

#### **4. Yield components**

Ten plants from each plot were dried at room temp. (25°C) for four days, then the following parameters were recorded:

##### **4.1. Mean number of pods per plant.**

##### **4.2. Mean pods weight per plant (g).**

##### **4.3. Mean number of seeds per plant.**

##### **4.4. Mean seed weight per plant (g).**

#### **5. Yield**

The pod yields of two rows from each experimental plot were weighted then the value of kg per ha was calculated.

The percent increasing in pod yield kg/ha was calculated.

#### **6. Determination of oil and protein content of peanut seeds**

Oil and protein content of peanut seeds from all experimental plots were determined according to the A.O.A.C. (1975).

#### IV. Statistical analysis

The obtained data were subjected to statistical analysis according to Snedecor and Cochran (1967) and the least significant differences (LSD) at 5% level of significance were calculated.

### RESULTS AND DISCUSSION

#### 1. Effect of the tested herbicides on the number of weed

Data in table 1 showed that pendimethalin – as pre-emergence treatment- at recommended rate induced the highest effect on number of weeds, all over the tested periods. The percentage reduction values 45, 75 and 105 days after cultivation were 93.1, 94.2 and 86.9% in 2004 and 94.5, 92.4 and 88.1% in 2005 respectively. Whereas clethodim 148.75 g a.s./ha. had the least effect, the percentage reduction were 36.5, 57.4 and 27.9% in 2004 and 13.2, 34.1 and 25.9% in 2005 of 45, 75 and 105 days respectively.

Table 1. Percentage reduction in number of weed infested peanut plant after application with certain herbicides in 2004 and 2005 seasons

Treatments	Rate g (a.s.) /ha	Reduction [%]					
		2004 season			2005 season		
		days after sowing					
		45	75	105	45	75	105
Pre-emergence							
Pendimethalin	2023.0	93.1	94.2	86.9	94.5	92.4	88.1
Pendimethalin	1011.5	71.9	68.1	64.8	72.9	80.3	79.5
Oxyfluorfen	428.4	81.4	78.1	79.4	94.2	88.1	84.6
Oxyfluorfen	214.2	70.4	65.8	58.7	76.6	80.1	67.3
Post-emergence							
Fluazifop-p-butyl	446.25	76.7	60.4	56.6	69.5	71.7	53.8
Fluazifop-p-butyl	223.13	14.9	8.4	26.7	26.2	37.8	26.9
Clethodim	297.5	90.5	85.1	86.8	72.9	56.7	51.9
Clethodim	148.75	36.5	57.4	23.9	13.2	34.1	25.0
Mechanical means							
Hand hoeing	–	74.8	69.5	51.9	73.5	78.3	65.4
Weed free	–	79.9	95.6	98.9	76.6	89.4	92.3

In general the tested herbicides at half rate had less effect than at recommended rate. The percentage reductions were markedly decreased. On the other hand mechanical means weed free treatment followed pendimethalin and clethodim – at recommended rate. In 2004 and pendimethalin in 2005, 45 days after sowing; whereas it had the superior effect after 75 and 105 days. Hand hoeing was less effective than mechanical means weed free.

From the foregoing results, it is obvious that the mechanical means were less effective than the tested herbicides at recommended rate. During the most critical period for growing the peanut plant (45 days after sowing). The above results are

coincided with the results of Panwer *et al.* (1988), Hassan *et al.* (1994), Sumathi *et al.* (2000), and Kumar *et al.* (2003a) who found that pendimethalin and oxyfluorfen were the most effective herbicides – as pre-emergence application – for controlling several grassy weed.

## 2. Effect of the tested herbicides on the dry weight of weeds

Data in table 2 indicated that clethodim as post-emergences treatment at the recommended rate was the most effective treatment on reduction of dry weight weed during all the tested periods (45, 75 and 105 days) in of 2004 and 2005 seasons. The percentage reduction in dry weight of the weeds ranged between 78.9 to 99.4% through out the two growing seasons, followed by the same former compound at rate of 148.75g a.s./ha. at 75 and 105 days after sowing. The tested herbicides can be arranged in ascending order 45 days after sowing - as follow clethodim, pendimethalin, fluazifop-p-butyl - at recommended rate, clethodim recommended at half of treatment, oxyfluorfen at recommended rate, pendimethalin, and fluazifop-p-butyl at half recommended rate. It could be noticed that mechanical weed free caused a clear reduction percentage in dry weight of weeds ranged between 91.5 to 99.8%. These results in general are in agreement with those obtained by Panwer *et al.* (1988), Hassan *et al.* (1994), Ibrahim (1995), Sumathi *et al.* (2000), Burke *et al.* (2004) and El-Sehly (2005) who found that pendimethalin and oxyfluorfen were the most effective herbicides against several grassy weeds when used as pre-emergence application.

Table 2. The percentage reduction in dry weight of weed infested peanut plant after application with certain herbicides in 2004 and 2005 seasons

Treatments	Rate g (a.s.)/ ha	Reduction [%]					
		2004 season			2005 season		
		days after treatment					
		45	75	105	45	75	105
Pre-emergence							
Pendimethalin	2023.0	96.9	87.3	78.1	94.4	83.8	79.4
Pendimethalin	1011.5	86.2	53.8	55.8	80.4	83.0	67.4
Oxyfluorfen	428.4	93.4	68.9	70.7	88.6	77.4	75.0
Oxyfluorfen	214.2	80.6	48.9	39.3	71.2	56.5	55.9
Post-emergence							
Fluazifop-p-butyl	446.25	96.9	83.7	46.7	94.8	77.3	49.4
Fluazifop-p-butyl	223.13	66.9	47.9	30.5	67.7	59.8	37.5
Clethodim	297.5	99.4	99.0	89.8	96.8	78.9	88.8
Clethodim	148.75	96.1	92.9	84.8	90.1	65.2	80.3
Mechanical means							
Hand hoeing	–	92.4	67.1	47.3	91.8	80.9	63.3
Weed free	–	94.3	98.5	99.8	94.4	91.5	99.3

Table 3. Effect of certain herbicides on dry weight of peanut plants, mature pods, chlorophyll and pods yield after 45,75 and 105 days from sowing in 2004 and 2005 seasons

Percent Increasing										Rate g a.s./ ha.	Treatments				
season 2005	season 2004	season 2005	season 2004	season 2005	season 2004	season 2005	days after sowing								
							dry weight [g/plant]								
[%] pods yield	chlorophyll		[%] mature pods												
	75	105	75	105	75	45	105	75	45						
Pre-emergence herbicides															
206.3	269.7	125.4	144.0	388.1	271.9	364.5	265.6	100	146.3	102	113.7	154.9	114.7	2023.0	Pendimethalin
146.7	160.7	74.50	103.4	241.6	172.3	226.0	131.7	75.3	70.5	45.1	69.7	69.8	48.2	1011.5	Pendimethalin
198.1	178.8	153.1	125.3	498.5	388.7	417.5	383.4	98	98.0	99.8	94.8	93.4	83.8	428.4	Oxyfluorfen
102.9	76.4	111.9	61.4	291.2	244.2	283.2	218.3	72.5	74.9	50.8	76.9	64.4	31.5	214.2	Oxyfluorfen
Post-emergence herbicides															
197.6	266.2	141.2	174.1	536.1	395.9	621.8	401.9	89.6	126.8	89.6	96.4	127.2	56.3	446.25	Fluazifop-p-butyl
109.8	123.2	55.4	73.0	356.3	160.6	300.6	165.6	72.2	86.2	72.2	87.7	84.1	25.1	223.13	Fluazifop-p-butyl
224.5	328.0	136.9	121.8	550.2	419.7	606.7	453.4	138.3	139.8	138.3	157.3	158.4	64.1	297.5	Clethodium
178.0	234.0	95.0	53.6	331.8	255.5	387.5	267.6	89.3	101.0	89.3	114.5	99.1	30.1	148.75	Clethodium

### 3. Effect of the tested herbicides on some crop characters of peanut

#### 3.1. Dry weight of peanut plant and mature pods

Results in table 3 showed that all the tested herbicides increased the dry weight of peanut plant. The highest increasing percentage was resulted from half rate of fluazifop-p-butyl as post-emergence treatment 75 days after sowing, whereas the lowest percentage was recorded with clethodim as a post-emergence at half rate.

Results were in the same trend on dry weight of mature pods. The highest increasing in mature pods with the post-emergence treatments is in apparent correlation with the highest increasing in dry weight of the plant.

The above results are similar to that of Bollich *et al.* (1988), Hassan and Metwally (2001) and Kumar *et al.* (2003a) results.

#### 3.2. Chlorophyll content

Results in the table 3 show the effect of the all tested on chlorophyll of peanut plant. The results clearly show that all treatments induced an increasing in chlorophyll of all its formations. The highest increasing percentage was result from fluazifop-p-butyl at half rate as post-emergence treatment, whereas the lowest percentage was resulted with the half rate of clethodim as a post-emergence treatment. Such effect may give an advantage for peanut plant to grow without any competition from weeds and that lead to inform the higher content of chlorophyll comparing with the other treatments.

#### 3.3. Pods yield

In both two seasons of 2004 and 2005, the pod yield was computed as kg/ha for all the tested herbicides treatments compared with weedy check treatments as shown. Results in table 3 show that all treatments increased the yield of pod compared to unweeded treatment in both 2004 and 2005 seasons. These results are generally in agreement with those obtained by Ahemed *et al.* (1994), Ibrahim (1995), Kumar *et al.* (2003a), Kumar *et al.* (2003b) and Teuton *et al.* (2004). Also Gnanamurthy and Balasubramanian (1998) stated that the uncontrolled weed reduce peanut yield up to 75%.

#### 3.4. Oil and protein content of peanut seeds

Data presented in table 4 indicated no significant effect on crude protein and oil content in peanut seed among all treatments including unweeded treatment (weedy check). The results are concerned with Ibrahim (1995) who indicated that pendimethalin at 2023 g/ha did not effect crude protein and oil content in peanut seed compared with non-chemical control treatments.

## CONCLUSION

The results show that the treatment of pendimethalin as pre-emergence at recommended rate induced the highest effect on total weeds followed by oxyfluorfen at the recommended rate after 45, 75 and 105 days from sowing. Also pendimethalin gave a higher effect than other treatments especially after 45 days that considered the most critical period for peanut plant growth. Also the results show that all chemical control treatments increased the dry weight of peanut plant. The results show no significant effect on the crude protein and oil content in peanut seed among all treatments including unweeded treatment (weedy check).

Table 4. Effect of certain herbicides on oil and protein content at percentage in peanut seeds in 2004 and 2005 seasons

Treatments	Rate g a.s./ha.	2004 season		2005 season	
		Protein	Oil	Protein	Oil
pre-emergence herbicides					
Pendimethalin	2023.0	53.21	15.27	52.57	16.37
Pendimethalin	1011.5	52.49	15.19	53.31	16.00
Oxyfluorfen	428.4	52.40	13.44	52.69	16.36
Oxyfluorfen	214.2	53.12	14.91	52.96	15.13
post-emergence herbicides					
Fluazifop-p-butyl	446.25	54.26	16.04	51.69	17.15
Fluazifop-p-butyl .	223.13	53.00	15.31	52.82	14.58
Clethodim	297.5	51.71	16.72	53.33	17.97
Clethodim	148.75	52.97	15.37	53.08	15.70
Weedy check	–	52.09	15.13	53.9	14.96
LSD at 5 %	–	ns*	ns*	ns*	ns*

ns – not significant

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## POLISH SUMMARY

### SKUTECZNOŚĆ WYBRANYCH HERBICYDÓW W ZWALCZANIU CHWASTÓW I ICH EFEKTY UBOCZNE W UPRAWIE ORZESZKÓW ZIEMNYCH

W latach 2004 i 2005, w Agricultural Research Station, Agriculture Research Center (ARC, Egipt) przeprowadzono doświadczenia polowe w celu zbadania skuteczności wybranych herbicydów (pendimetalin, oksyflurofen, fluazifop-p-butyl i cletodim) w zwalczaniu chwastów a także stwierdzenia wpływu tychże herbicydów na niektóre parametry orzeszków ziemnych *Arachis hypogaea* L. z rodziny leguminous w porównaniu z uprawami nietraktowanymi chemikaliami. Wykazano, że pendimetalin użyty w zalecanej dawce przed wschodem orzeszków spowodował najwyższe odchwaszczenie biorąc pod uwagę liczbę i suchą masę chwastów na metr kwadratowy, natomiast cletodim użyty już po wschodzie w dawce zmniejszonej o połowę najniższe. Odchwaszczanie mechaniczne było najbardziej skuteczne po 75 i 105 dniach od wysiewu i po zastosowaniu pendimetalinu oraz cletodimu w zalecanych dawkach w 2004 r. a pendimetalinu w 2005 r. Wyniki także wykazały, że cletodim zastosowany po wschodzie orzeszków w dawce zalecanej był najskuteczniejszy pod względem zmniejszenia suchej masy chwastów. Redukcja suchej masy chwastów wahała się od 91.5% do 99.8%. Wyniki również wykazały, że badane herbicydy spowodowały wzrost suchej masy, strąków i komponentów plonu ale nie miały znaczącego wpływu na zawartość surowego białka oraz oleju w ziarnach w stosunku do uprawy kontrolnej.

