

## Influence of Mineral Oil on the Efficacy of the Two Herbicides Fluazifop-p-butyl and Clethodim for Controlling Peanut Weeds

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**Abstract:** As an attempt to reduce the hazard effect of the two post-emergence herbicides fluazifop-p-butyl and clethodim, which result from the usage of high rate as well as the high cost of controlling the weeds in peanut field, the influence of addition the mineral oil (KZ oil) to half of the recommended rate / fed was investigated. The mineral oil (1000 or 1500 ml) was added to the tested herbicides at half of the recommended rates. The results were recorded during the critical period of growing, 15 days after application. Results clearly showed that the addition of the mineral oil induced significant increase in the herbicidal activity compared with that the recommended rate only. The addition of 1000 ml mineral oil to fluazifop-p-butyl at half rate resulted in 62.1 and 69.9% reduction in the number of grassy weeds during 2004 and 2005 seasons respectively, whereas the addition of 1500 ml mineral oil, the reductions were 65.3 and 64.6 % during the same seasons, respectively. The recommended rate alone, caused 68.5 and 66.1 % reductions during these two seasons, respectively. The mixtures of the two former rates of oil/clethodim gave 99.6 % reduction in numbers of grassy weeds, for both rates, during season 2004, whereas reductions reached 99.3 and 98.6 % for the two aforementioned treatments, respectively throughout season 2005. Clethodim alone at the recommended rate induced 98.4 and 98.0% reduction in grassy weeds during 2004 and 2005 seasons, respectively. No significant differences were recorded between the two addition rates of oil. The dry weight of grassy weeds was also affected by 99.9 and 99.0 % reduction at 15 days after application during 2004 and 2005 seasons, respectively.

**Keywords:** Mineral oil, Fluazifop-p-butyl, Clethodim, Peanut weeds

### INTRODUCTION

The peanut (*Arachis hypoagea* L., family Leguminosae), one of the most important summer oil crops in Egypt. The crop is cultivated all over the country specially at the new reclaimed areas; Ismailia is one of these areas. The importance of this crop is rising from its high nutritional value, it contains about 50% oil and 27% high quality protein. Numerous weed, annual broad and narrow leaves and perennial weed invade this crop. Weed reduce peanut yield up to 75% (Kalaiselvan *et al.* 1991).

The first 3 to 4 weeks of crop growth periods are critical for weeds control, (Gnanamurthy and Balosubramanian 1998). The high expensive cost of hoeing and hand weeding oblige framers to control weeds chemically. A wide range of chemicals have been marketed for controlling peanut weeds (Zagonel *et al.*, 2000; Richburg *et al.*, 1995 and Kumar *et al.* 2003a). The miss use of chemicals leads to many problems, pollution and chemical residues endangering human health (Dogheim *et al.*, 1996; Zidan and Abd El-Daim, 1996; Osfor *et al.*, 1996; El-Kabbany *et al.*, 2000 and Gupta *et al.*, 2002); as well as raising of production costs. Therefore, minimize the quantity of chemical is necessary lowering the recommended rate of pesticides is an option as long as keeping the same level of efficacy. This study aimed to determine the efficiency of certain herbicides / mineral oil mixtures on peanut weeds to reduce the harmful effect of some post-emergence herbicides when be used singly at the recommended rates.

### MATERIALS AND METHODS

#### Chemical used:

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 / feddan. The cultivated area was divided into 28 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. The cultivated area was divided into 28 plots. Normal agricultural practices, irrigation and fertilization were followed. The experiment included 6 treatments as follows:

1- Fluazifop-p-butyl 12.5 % EC (Fusilade super) at the rate of 187.5 g. (a.i.)/ fed.

2 -Fluazifop-p-butyl 12.5% EC (Fusilade super) at the rate of 93.75g. (a.i.)/ fed. Mixed with (KZ oil) at the rate of 1000 ml/fed.

3- 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.

4- Clethodim 12.5 % EC ( Select super ) at the rate of 125.0 g. (a.i.)/ fed.

5- 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.

5- 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 .

#### Weeds assessments

One square meter , from each treatment , was selected randomly. The weeds were removed from such area (one meter) after 45 , 75 and 105 days from sowing . The weed which had been removed was classification identified according to Tackolm (1974). The account of umber of weeds per m<sup>2</sup> was taken the follow group:

- Annual narrow – leaved weeds.
- Annual broad – leaved weeds.
- Total of annual weeds.

#### Percent control of weeds

The percent in weeds inhibition (R%) was calculated using the well known equation:

Reduction % in dry weight =

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

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

## RESULTS AND DISCUSSION

Data presented in tables (1,2,3 and 4) , clearly showed that addition 1000 ml of mineral oil to fluazifop–p–butyl at half rate, 62.1 and 69.9% reduction of number of grassy weeds were existed during 2004 and 2005 seasons respectively, whereas due to adding 1500 ml mineral oil , the reductions were 65.0 and 64.6 % during 2004 and 2005 seasons, respectively. When the recommended rate only was used, the reductions were 68.5 and 66.1 % during 2004 and 2005 seasons,

respectively. The results were recorded during the critical period of growing , 15 days after application.

Such promotion effect of herbicidal activity against grassy weeds from addition mineral oil was also noted. When the oil was added (1000 ml) to clethodim at the half of recommended rate, induced a significantly increasing of its herbicidal activity compared with its effect at recommended rate only specially against grassy weeds during the critical period of growing after, 15 days from application. The treatments (half rate + 1000 ml mineral oil) and (half rate + 1500 ml mineral oil) , gave 99.6 % reduction in numbers of grassy weeds, for both rates, during season 2004 (tables 1 and 2). The percentage reductions reached 98.6 and 99.3 % for the two aforementioned treatments, respectively throughout season 2005 (tables 3 and 4) . No significance differences were recorded between the two addition rates of oil. Using clethodim at recommended rate induced 98.4 and 98.0 % reduction in grassy weeds during 2004 and 2005 seasons, respectively (tables 2 and 4).

The total numbers of total weeds were affected as results of all treatments. From the obtained results it could be conclude that the two tested herbicides became more effective when mineral oil was added . This may be due to oil which improve the adsorption of the herbicides followed by excellent translocation through was layer of grassy weeds and then translocated successfully within symplastic system of weeds to induce the potential power of its activity.

The effect of the tested herbicides, whether were treated alone or as mixtures with oil , was affected and reached to the minimum 75 days after application during 2004 and 2005 seasons respectively.

It is gained – also – 99.9 and 99.0 % reduction in dry weight of grassy weeds, 15 days after application during 2004 and 2005 seasons respectively.

This suggestion is due to the effect of oil in destroy the semi permeable nature of living membranes, by solubilization the interpolation of oil molecules into

**Table 1.** Influence of mineral oil on post – emergence herbicides in controlling on the grassy weeds and weed infested peanut plants during 2004 season.

| Treatments                   | Rate g (a.i)/fed | Time of application (days) |        |        |       |        |       |
|------------------------------|------------------|----------------------------|--------|--------|-------|--------|-------|
|                              |                  | 15                         |        | 45     |       | 75     |       |
|                              |                  | Grassy*                    | Total* | Grassy | Total | Grassy | Total |
| Fluazifop–p– butyl           | 187.5 g          | 39.0                       | 42.0   | 56.0   | 60.0  | 61.0   | 61.0  |
| Fluazifop–p–butyl+ (KZ oil)  | 93.75 g +1000 ml | 47.0                       | 80.5   | 90.0   | 100.5 | 70.5   | 70.5  |
| Fluazifop–p–butyl + (KZ oil) | 93.75 g +1500 ml | 43.0                       | 47.5   | 79.5   | 70.5  | 62.0   | 62.0  |
| Clethodim                    | 125.0 g          | 2.0                        | 10.0   | 20.0   | 28.0  | 18.5   | 18.5  |
| Clethodim+(KZ oil)           | 62.5 g +1000 ml  | 0.5                        | 25.5   | 38.5   | 40.0  | 26.0   | 26.0  |
| Clethodim+(KZ oil)           | 62.5 g +1500 ml  | 0.5                        | 20.0   | 31.0   | 35.0  | 24.5   | 24.5  |
| Control                      | -                | 124.0                      | 137.0  | 200.0  | 214.8 | 140.5  | 140.5 |
| LSD at 5%                    | -                | 34.7                       | 7.1    | 5.4    | 14.2  | 15.7   | 15.7  |

\* Number of weeds / m<sup>2</sup>

**Table 2.** Percentage reduction on the grassy and total weeds infested peanut plants after application with mixture of (herbicide/ mineral oil) as post – emergence treatment during 2004 season.

| Treatments                   | Rate g (a.i)/fed | Time of application (days) |        |        |       |        |       |
|------------------------------|------------------|----------------------------|--------|--------|-------|--------|-------|
|                              |                  | 15                         |        | 45     |       | 75     |       |
|                              |                  | Grassy*                    | Total* | Grassy | Total | Grassy | Total |
| Fluazifop-p-butyl            | 187.5 g          | 68.5                       | 69.3   | 72.1   | 73.1  | 56.6   | 56.6  |
| Fluazifop-p-butyl+ (KZ oil)  | 93.75 g +1000 ml | 62.1                       | 41.2   | 55.1   | 53.2  | 50.0   | 50.0  |
| Fluazifop-p-butyl + (KZ oil) | 93.75 g +1500 ml | 65.3                       | 65.3   | 60.3   | 67.2  | 55.9   | 55.9  |
| Clethodim                    | 125.0 g          | 98.4                       | 92.7   | 90.0   | 87.0  | 86.8   | 86.6  |
| Clethodim+(KZ oil)           | 62.5 g +1000 ml  | 99.6                       | 81.4   | 80.8   | 81.4  | 81.5   | 81.5  |
| Clethodim+(KZ oil)           | 62.5 g +1500 ml  | 99.6                       | 85.0   | 84.5   | 83.7  | 82.6   | 82.6  |

\* Percentage reduction on weeds / m<sup>2</sup>**Table 3.** Influence of mineral oil on post – emergence herbicides in controlling on the grassy weeds and weed infested peanut plants during 2005 season.

| Treatments                   | Rate g (a.i)/fed | Time of application (days) |        |        |       |        |       |
|------------------------------|------------------|----------------------------|--------|--------|-------|--------|-------|
|                              |                  | 15                         |        | 45     |       | 75     |       |
|                              |                  | Grassy*                    | Total* | Grassy | Total | Grassy | Total |
| Fluazifop-p-butyl            | 187.5 g          | 49.5                       | 49.5   | 54.0   | 64.0  | 48.0   | 72.0  |
| Fluazifop-p-butyl + (KZ oil) | 93.75 g +1000 ml | 44.0                       | 90.5   | 95.0   | 106.0 | 61.5   | 70.0  |
| Fluazifop-p-butyl + (KZ oil) | 93.75 g +1500 ml | 51.5                       | 70.5   | 78.8   | 78.8  | 50.0   | 59.5  |
| Clethodim                    | 125.0 g          | 3.0                        | 14.0   | 18.0   | 28.0  | 18.5   | 18.5  |
| Clethodim+(KZ oil)           | 62.5 g +1000 ml  | 2.0                        | 30.0   | 40.0   | 43.8  | 28.0   | 31.0  |
| Clethodim+(KZ oil)           | 62.5 g +1500 ml  | 1.0                        | 25.0   | 33.0   | 36.8  | 26.0   | 29.0  |
| Control                      | -                | 146.0                      | 162.5  | 205.0  | 227.0 | 142.0  | 156.7 |
| LSD at 5%                    | -                | 11.2                       | 11.4   | 14.1   | 14.6  | 11.5   | 11.7  |

\* Number of grassy – total weeds /m<sup>2</sup>**Table 4.** Percentage reduction on the grassy and total weeds infested peanut plants after application with mixture of (herbicide/ mineral oil) as post – emergence treatment during 2005 season.

| Treatments                   | Rate g (a.i) / fed | Time of application (days) |        |        |       |        |       |
|------------------------------|--------------------|----------------------------|--------|--------|-------|--------|-------|
|                              |                    | 15                         |        | 45     |       | 75     |       |
|                              |                    | Grassy*                    | Total* | Grassy | Total | Grassy | Total |
| Fluazifop-p-butyl            | 187.5 g            | 66.1                       | 69.5   | 78.0   | 71.8  | 66.2   | 53.8  |
| Fluazifop-p-butyl+ (KZ oil)  | 93.75 g +1000 ml   | 69.9                       | 44.3   | 53.7   | 53.3  | 57.0   | 55.1  |
| Fluazifop-p-butyl + (KZ oil) | 93.75 g +1500 ml   | 64.6                       | 65.6   | 61.6   | 65.2  | 64.8   | 61.9  |
| Clethodim                    | 125.0 g            | 98.0                       | 91.4   | 91.2   | 87.8  | 84.5   | 84.0  |
| Clethodim+(KZ oil)           | 62.5 g +1000 ml    | 98.6                       | 81.5   | 80.5   | 80.7  | 80.3   | 80.1  |
| Clethodim+(KZ oil)           | 62.5 g +1500 ml    | 99.3                       | 84.8   | 84.0   | 83.8  | 81.7   | 81.4  |

\* Percentage reduction on weeds / m<sup>2</sup>

the protein layer of the membrane with loss bonding, disconfiguration and leakage as stated by Van Overbeek and Blondeau (1954) and Crafts and Robin (1962).

All the above results agree with the results of Kudsk (1984), Derexler and Hinderstmann (1990 and Konradt and Wulff (1990); who found that the addition

of one – two liters of mineral oil to fluazifop-p-butyl is an effective and economical alternative for grasses at growth stage.

Ferrero (1999), also found that when mineral oil was added to clethodim improved the control of grasses up to 95%.

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### تأثير إضافة زيت معدني إلى المبيدين فليزوفوف – بيوتيل وكالثديوم لمكافحة حشائش الفول السوداني

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أضيف الزيت المعدني (زيت كفر الزيات) - بمعدل ١٠٠٠ أو ١٥٠٠ مل - إلى نصف الجرعة الموصى بها لمبيد الحشائش فليزوفوف- بيوتيل و كالثديوم بهدف تقليل التأثير الحاد لهما والناتج عن استخدام جرعات كبيرة من المبيد وفي نفس الوقت لخفض تكاليف مكافحة الحشائش في محصول الفول السوداني. أدى إضافة الزيت المعدني إلى زيادة فاعلية المبيدين المختبرين مقارنة بفاعلية كل منهما عند استخدام الجرعة الموصى بها فقط. أحدث إضافة الزيت بمعدل ١٠٠٠ مل إلى مبيد فليزوفوف- بيوتيل (نصف الجرعة الموصى بها) خفضاً في تعداد الحشائش الضيقة الأوراق بلغ ٦٢,١ ، ٦٩,٩% خلال موسمى ٢٠٠٤ ، ٢٠٠٥ على التوالي ، في حين أدى إضافة الزيت بمعدل ١٥٠٠ مل إلى حدوث نقص في التعداد بلغ ٦٥,٣ ، ٦٤,٦% خلال موسمى ٢٠٠٤ ، ٢٠٠٥ على التوالي . سبب استخدام الجرعة الموصى بها لمبيد فليزوفوف- بيوتيل نقصاً في تعداد الحشائش الضيقة الأوراق بلغ ٦٨,٥ ، ٦٦,١% خلال موسمى التجربة على التوالي. خفض إضافة الزيت بالمعدلين المختبرين إلى مبيد كالثديوم (نصف الجرعة الموصى بها) في الحشائش الضيقة الأوراق إلى ٩٩,٦% خلال موسم ٢٠٠٤ ، في حين بلغ الخفض ٩٩,٣% عند إضافة الزيت بمعدل ١٠٠٠ مل ، ٩٨,٦% عند إضافة الزيت بمعدل ١٥٠٠ مل خلال موسم ٢٠٠٥. سبب استخدام الجرعة الموصى بها لمبيد كالثديوم نقصاً في تعداد الحشائش الضيقة الأوراق بلغ ٩٨,٤ ، ٩٨,٠% خلال موسمى التجربة على التوالي. لم يلاحظ وجود فروق معنوية بين استخدام جرعتي الزيت على كفاءة المبيد. حدث - أيضاً - خفضاً في الوزن الجاف للحشائش الضيقة الأوراق بلغ ٩٩,٩ ، ٩٠,٠% خلال موسمى ٢٠٠٤ ، ٢٠٠٥ على التوالي.