

## DODDER (*CUSCUTA EPILINUM*) CONTROL IN FLAX (*LINUM USITATISSIMUM*, L.)

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### Abstract

Three field experiments were conducted during 1998-99, 1999-2000 and 2000-2001 seasons at Sakha Agricultural Research Station, Kafr El-Sheikh, Egypt to investigate the effect of some weed control treatments on dodder control and flax productivity and estimate yield losses of flax due to dodder parasitism. The experimental site was artificially infested with dodder seeds.

Data revealed the effectiveness of some weed control treatments against dodder in flax fields. These treatments were butralin (48%) at 2.5 L/fed. (either soil incorporated or surface applied); imadazolinone (18%) at 0.40 L/fed. (applied twice); butralin at 2 L/fed. (soil incorporated); and imadazolinone at 0.40 L/fed. (applied once). These treatments did not show any adverse effect on flax, but on the contrary they increased plant height, biological and seed yield of flax. Hand weeding (twice) was not effective against dodder during the three seasons of study, where, it reduced dodder population by 45, 46 and 23%, respectively.

Data revealed that dodder parasitism decreased plant height significantly. Also, it reduced the biological yield by 1.86 and 1.57 t/ fed. and reduced seed yield by 0.57 and 0.62 t/fed., respectively during 1998/99 and 2000/2001 seasons as compared with the non-infested plots.

### INTRODUCTION

Dodder (*Cuscuta spp.*) is an obligate stem and leaf parasite on legumes and other broadleaf species (Dawson and Saghir, 1983). Dodder species parasitism is a wide problem which infest many crops as clover and flax in Egypt and some other countries all over the world. In Egypt, dodder is a serious problem in some forage and vegetable crops, fruit trees and ornamental plants as reported by Al-Menoufi and Hassan, 1976 and 1977; and Al-Menoufi *et al.*, 1983.

Dodder affects the growth and yield of infested plants and causes losses which range from slight to complete destruction of the crop (Agrotis, 1978). Infection leads

to large losses by reducing seed yield, lowering seed quality, interfering with machine harvesting in addition to the cost of cleaning seeds (Dawson, 1978; Lee and Timmons, 1958). As a result of parasitism of dodder (*Cuscuta epilinum*) in flax (*Linum usitatissimum*), Al-Shair (1986) reported that dodder decreased fiber length, straw yield, seed yield and extracted oil iodine value of flax. Moreover, it increased seed moisture content, refractive index and acid value of extracted oil.

In the fields, where infestation were moderate to heavily levels by dodder species (*Cuscuta spp.*), the most effective control are herbicides. Garcia-Torres (1993) reported that glyphosate at 75-150 g/ha and its analog sulfosate control dodder directly and through their systematic mevements within the host phloem system.

Dawson and Saghir (1983) stated that most of the soil applied herbicides for dodder control didn't persist long enough in the soil to control dodder for the entire season. Graph, *et al.* (19682) found that dodder (*Cuscuta spp.*) was selectively controlled by propyzamide or chlorthal dimethyl pre-emergence or by propyzamide post-emergence. Abd El-Wahed (1996) found that glyphosate at 130 g a.i./fed. (theric) gave 94-97% control of *Cuscuta spp.* in Egyptian clover, lupine and chick pea. The half rate (65 g a.i./fed., theric) gave about the same results (90-92%). Also, pendimethalin at 800, 600, 400 or 200 g a.i./fed. achieved 100, (94-98), (90-92) and (82-88) dodder control, respectively.

Concenering hand weeding Sher and Shad (1989) reported that the manual control (hand plucking) of *Cuscuta spp.* does not give effective control.

The present work aimed to investigate the efficacy of some weed control treatments against dodder and flax productivity and to determine yield losses in flax due to dodder infestation.

## MATERIALS AND METHODS

During 1998-1999, 1999-2000 and 2000-2001 seasons, three field experiments were carried out at Sakha Agricultural Research Station to investigate the efficacy of some herbicidal treatments on dodder (*Cuscuta spp.*) and flax yield and estimate yield losses due to dodder infection.

During the three seasons, 17 weed control treatments were studied as follow:

1. Glyphosate used as Sting 18% EC at 0.10 L/fed (twice) with three weeks interval, the first application with the beginning of dodder appearance.
2. Glyphosate used as Sting 18% EC at 0.15 L/fed (twice) with three weeks interval, the first application with the beginning of dodder appearance.
3. Imazamethabenz used as Assert 25% SC at 0.65 L/fed. (once) 45 days after sowing.
4. Imazamethabenz used as Assert at 0.85 L/fed. (once) 45 days after sowing.
5. Imazethapyr used as Pursuit 10% AS at 0.17 L/fed. (once) 45 days after sowing.
6. Imazethapyr used as Pursuit 10% AS at 0.17 L/fed. (twice) with three weeks interval, the 1<sup>st</sup> application at the beginning of dodder appearance.
7. Imadazolinone used as AC 299,263, 18% AS at 0.30 L/fed.(once) 45 days after sowing.
8. Imadazolinone used as AC 299,263, 18% AS at 0.30 L/fed. (twice) with three weeks interval, the 1<sup>st</sup> application at the beginning of dodder appearance.
9. Imadazolinone used as AC 299,263, 18% AS at 0.40 L/fed., applied once, 45 days after sowing.
10. Imadazolinone used as AC 299,263, 18% AS at 0.40 L/fed., applied twice with three weeks interval, the 1<sup>st</sup> application at the beginning of dodder appearance.
11. Butralin used as Amex 48% EC at 2.0 L/fed, pre-planting soil incorporated.
12. Butralin used as Amex 48% EC at 2.0 L/fed, pre-planting surface applied.
13. Butralin used as Amex 48% EC at 2.5 L/fed, pre-planting soil incorporated.
14. Butralin used as Amex 48% EC at 2.5 L/fed, pre-planting surface applied.
15. Hand weeding (twice) at 45 and 60 days after sowing.
16. Untreated (non-infested).
17. Untreated (infested).

All treatments of the field experiments were assigned in a R.C.B. design with four replicates. The plot area was 3.5 x 3 m and artificially infested with dodder seeds, where dodder seeds were mixed with soil at 10 % of flax seeds (W/W).

**Sampling and data recording:**

1. Dodder control % was observed and recorded, 90 days after sowing.
2. Plant height of flax (cm) was recorded at harvest.
3. Biological and seed yield of flax were estimated as t/fed.

All recorded data were statistically analyzed and the treatments were compared based on the least significant difference (L.S.D) according to Sendecor and Cochran (1967).

**RESULTS AND DISCUSSION****1. Effect of weed control treatments on dodder:**

During the three seasons of study, it could be noted that all studied weed control treatments significantly reduced dodder population in flax fields as compared to the untreated (infested) plots as shown in Table (1).

Table 1. Effect of some weed control treatments on dodder during 1998/1999, 1999/2000 and 2000/2001 seasons.

No.	Treatments	Rate L / fed.	Dodder control (%)		
			1998/1999 season	1999/2000 Season	2000/2001 season
1	Glyphosate 18 % EC (twice).	0.10	50	-	-
2	Glyphosate 18% EC (twice).	0.15	37	-	-
3	Imazamethabenz 25 % SC (once).	0.65	37	-	-
4	Imazamethabenz 25 % SC (once).	0.85	37	-	-
5	Imazethapyr 10 % AS (once).	0.17	50	65	55
6	Imazethapyr 10 % AS (twice).	0.17	50	76	60
7	Imadazolinone 18% AS (once).	0.30	67	76	68
8	Imadazolinone 18% AS (twice).	0.30	87	79	70
9	Imadazolinone 18% AS (once).	0.40	92	80	68
10	Imadazolinone 18% AS (twice).	0.40	95	86	78
11	Butralin 48% EC, soil incorporated	2.00	-	80	83
12	Butralin 48% EC, surface applied	2.00	-	78	83
13	Butralin 48% EC, soil incorporated	2.50	-	90	93
14	Butralin 48% EC, surface applied	2.50	-	85	95
15	Hand weeding (twice)		45	46	23
16	Untreated (non-infested)		-	96	100
17	Untreated (infested)		0	0	0
L.S.D			14.5	12.5	13.8

Data of 1998/1999 season indicated that imadazolinone 18% at 0.40 L/fed. applied once or twice recorded 92 and 95% dodder control, respectively as compared to weedy check, followed by imadazolinone 18% at the low rate (0.30 L/fed.) applied twice as it recorded 87% dodder control.

Data of 1999/2000 season indicated that the applications of butralin 48% at 2.5 L/fed. either soil incorporated or surface applied; imadazolinone 18% at 0.40 L/fed. (twice) surpassed all weed control treatments. Whereas, it reduced dodder by 90, 86 and 85%, respectively, followed by butralin 48% at 2.0 L/fed., soil incorporated (80%) and imadazolinone 18% at 0.40 L/fed., applied once (80%).

Data of 2000/2001 season indicated that all weed control treatments significantly reduced dodder population if compared to weedy check. Within weed control treatments, butralin 48% at the rate of 2.5 or 2.0 L/fed. either soil incorporated or surface applied surpassed all weed control treatments. Where, it reduced dodder by 93, 95, 83 and 83%, respectively. Imadazolinone 18% at 0.40 L/fed. either applied once or twice reduced dodder population by 78 and 68%, respectively.

In this study, imazethapyr (10%) at 0.17 L/fed. applied once or twice showed little effectiveness against dodder (50-76%) if compared to butralin or imadazolinone applications. Meanwhile, Khallida *et al.* (1993) reported that imazethapyr at 75 g a.i/ha was highly effective in controlling *Cuscuta spp.* Concerning hand weeding, data of the three seasons indicated that manual weeding (twice) was not effective against dodder, where, it reduced dodder by 45, 46 and 23%, respectively as shown in Table (1). These results agreed with the results obtained by Sher and Shad (1989).

## **2. Flax plant height (cm) as affected by some weed control treatments:**

Data of Table (2) show the effect of weed control treatments on flax plant height (cm) during 1998/99, 1999/2000 and 2000/2001 seasons.

Data of 1998/1999 season revealed that imadazolinone 18% at 0.40 L/fed. applied (once) or at 0.30 L/fed. applied (twice) increased flax plant height by 17.9 and 16.8 cm, respectively as compared to weedy check. Meanwhile, during 1999/2000 season, data revealed that butralin 48% at the rate of 2.5 L/fed. either applied as soil in-

incorporated or surface applied and imadazolinone 18% at 0.40 L/fed., applied twice or once increased flax plant height by 24.2, 21.7, 23.2 and 21.0 cm, respectively as compared to weedy check. In the same respect, data of the third season (2000/2001) revealed that all applications of butralin 48% and imadazolinone 18% increased flax plant height significantly from 12.5 to 16.3 cm as compared to the untreated (infested) plots.

Table 2. Effect of some weed control treatments on flax plant height (cm) during 1998/99, 1999/2000 and 2000/2001 seasons.

No.	Treatments	Rate L / fed.	Flax plant height (cm)		
			1998/1999 season	1999/2000 season	2000/2001 season
1	Glyphosate 18 % EC (twice).	0.10	72.1	-	-
2	Glyphosate 18 % EC (twice).	0.15	75.9	-	-
3	Imazamethabenz 25 % SC (once).	0.65	65.9	-	-
4	Imazamethabenz 25 % SC (once).	0.85	64.1	-	-
5	Imazethapyr 10 % AS (once).	0.17	79.2	99.3	73.8
6	Imazethapyr 10 % AS (twice).	0.17	73.9	104.5	75
7	Imadazolinone 18% AS (once).	0.30	78.2	106.3	78.8
8	Imadazolinone 18% AS (twice).	0.30	87.6	108.0	78.8
9	Imadazolinone 18% AS (once).	0.40	88.7	108.8	78.8
10	Imadazolinone 18% AS (twice).	0.40	77.3	111.0	80
11	Butralin 48% EC, soil incorporated	2.00	-	107.5	80
12	Butralin 48% EC, surface applied	2.00	-	102.3	77.5
13	Butralin 48% EC, soil incorporated	2.50	-	112.0	82.5
14	Butralin 48% EC, surface applied	2.50	-	109.5	81.3
15	Hand weeding (twice)		82	100.0	71.3
16	Untreated (non-infested)		-	120.3	85
17	Untreated (infested)		70.8	87.8	66.3
	L.S.D		7.8	13.7	10.82

### 3. Flax biological yield as affected by some weed control treatments:

Data of Table (3) shows the effect of weed control treatments on flax biological yield (t/fed) during 1998/99, 1999/2000 and 2000/2001 seasons.

Data of the first season (1998/1999) revealed that imadazolinone 18% at 0.30 L/fed., applied once increased the biological yield by 3.08 t/fed. and surpassed other weed control treatments significantly. Meanwhile, during the second season (1999/

2000) data indicated that all treatments of butralin 48% and imadazolinone significantly surpassed other weed control treatments and increased biological yield from 1.220 to 1.1.82 t/fed. Data of the third season (2000/2001) indicated that all treatments of butralin 48% and imadazolinone 18% at the high rate (0.40 L/fed) significantly surpassed other weed control treatments and increased biological yield from 1.050 to 1.360 t/fed.

Table 3. Effect of some weed control treatments on flax biological yield (t/fed) during 1998/99, 1999/2000 and 2000/2001 seasons.

No.	Treatments	Rate L / fed.	Flax biological yield (t/fed)		
			1998/1999 season	1999/2000 season	2000/2001 season
1	Glyphosate 18 % EC (twice).	0.10	4.760	-	-
2	Glyphosate 18 % EC (twice).	0.15	3.710	-	-
3	Imazamethabenz 25 % SC (once).	0.65	3.080	-	-
4	Imazamethabenz 25 % SC (once).	0.85	3.990	-	-
5	Imazethapyr 10 % AS (once).	0.17	3.920	6.770	2.470
6	Imazethapyr 10 % AS (twice).	0.17	4.060	7.190	2.680
7	Imadazolinone 18% AS (once).	0.30	7.000	7.120	2.520
8	Imadazolinone 18% AS (twice).	0.30	5.040	7.440	2.940
9	Imadazolinone 18% AS (once).	0.40	5.850	7.520	3.050
10	Imadazolinone 18% AS (twice).	0.40	5.040	7.670	3.050
11	Butralin 48% EC, soil incorporated	2.00	-	7.370	2.840
12	Butralin 48% EC, surface applied	2.00	-	7.340	2.780
13	Butralin 48% EC, soil incorporated	2.50	-	7.720	3.360
14	Butralin 48% EC, surface applied	2.50	-	7.560	3.100
15	Hand weeding (twice)		4.27	6.200	2.420
16	Untreated (non-infested)		-	7.760	3.570
17	Untreated (infested)		3.92	5.900	2.000
	L.S.D		2.12	0.37	0.73

#### 4. Flax seed yield as affected by some weed control treatments:

Data of Table (4) shows the effect of weed control treatments on flax seed yield (t/fed) during 1998/99, 1999/2000 and 2000/2001 seasons.

During 1998/99 season, data indicated that all applications of imadazolinone improved flax seed yield from 0.104 to 0.348 t/fed if compared to the weedy check. However, these increases in seed yield were not significant.

Meanwhile, during the second season (1999/2000) data revealed that all weed control treatments significantly improved flax seed yield. However, the application of butralin 48% at 2.5 L/fed. (soil incorporated); imadazolinone 18% at 0.40 L/fed., either applied twice or once improved flax seed yield by 0.52, 0.50 and 0.49 t/fed., respectively. Finally, data of the third season (2000/2001) confirmed that all the tested weed control treatments significantly improved flax seed yield. However, the application of butralin 48% at 2.5 L/fed., soil incorporated; imadazolinone 18% at 0.40 L/fed., applied twice or once improved flax seed yield by 0.54, 0.53 and 0.51 t/fed., respectively as compared to the weedy check.

Table 4. Effect of some weed control treatments on flax seed yield (t/fed) during 1998/1999, 1999/2000 and 2000/2001 seasons.

No.	Treatments	Rate L / fed.	Flax seed yield (t/fed)		
			1998/1999 season	1999/2000 season	2000/2001 season
1	Glyphosate 18 % EC (twice).	0.10	0.192	-	-
2	Glyphosate 18 % EC (twice).	0.15	0.287	-	-
3	Imazamethabenz 25 % SC (once).	0.65	0.103	-	-
4	Imazamethabenz 25 % SC (once).	0.85	0.134	-	-
5	Imazethapyr 10 % AS (once).	0.17	0.379	1.120	0.410
6	Imazethapyr 10 % AS (twice).	0.17	0.181	1.160	0.640
7	Imadazolinone 18% AS (once).	0.30	0.335	1.200	0.540
8	Imadazolinone 18% AS (twice).	0.30	0.539	1.250	0.580
9	Imadazolinone 18% AS (once).	0.40	0.561	1.280	0.590
10	Imadazolinone 18% AS (twice).	0.40	0.579	1.290	0.610
11	Butralin 48% EC, soil incorporated	2.00	-	1.230	0.490
12	Butralin 48% EC, surface applied	2.00	-	1.120	0.430
13	Butralin 48% EC, soil incorporated	2.50	-	1.310	0.620
14	Butralin 48% EC, surface applied	2.50	-	1.280	0.180
15	Hand weeding (twice)		0.311	1.090	0.100
16	Untreated (non-infested)		-	1.360	0.700
17	Untreated (infested)		0.231	0.790	0.080
	L.S.D		0.202	0.140	0.120

##### 5. Flax yield losses due to dodder infestation:

Data of 1999/2000 and 2000/2001 seasons declared that dodder parasitism decreased flax plant height by 32.5 and 18.7 cm, respectively as shown in Table (2).



Also, dodder infestation resulted in reducing biological yield by 1.86 and 1.57 t/fed., respectively as shown in Table (3) and reduced seed yield by 0.57 and 0.62 t/fed, respectively as shown in Table (4) if compared with the non-infested plots. These results were in agreement with those mentioned by Lee and Timmons (1958), Agrotis (1978), Dawson (1978) and AL-Shair (1986).

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## مكافحة الحامول فى حقول الكتان

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خلال مواسم ١٩٩٨/١٩٩٩ و ١٩٩٩/٢٠٠٠ و ٢٠٠٠/٢٠٠١ تم إجراء ثلاثة تجارب حقلية بمحطة البحوث الزراعية بسخا، كفر الشيخ - جمهورية مصر العربية بغرض تقييم فاعلية بعض معاملات مكافحة حشيشة الحامول فى حقول الكتان. وكذا تقدير الخسارة فى محصول الكتان نتيجة تطفل حشيشة الحامول ونظرا لعدم وجود توصيات فنية لمكافحة الحامول فى حقول الكتان فى مصر حتى الان لذا كانت الضرورة ملحة لإيجاد معاملات جديدة لمكافحة الحامول فى هذا المحصول. شملت الدراسة اختبار عدة معاملات لمكافحة الحامول وهى معاملات الجليفوسيت ١٨٪/EC بمعدل ١٠.٠٠ أو ١٥.٠٠ لتر/ ف (مرتين) و معاملات الامازاميثابنز ٢٥٪/SC بمعدل ٦٥.٠٠ أو ٨٥.٠٠ لتر / ف (مرة واحدة) و معاملات الامازيثابير ١٠٪/AS بمعدل ١٧.٠٠ لتر / ف (مرة أو مرتين) و معاملات الامادازولينون ١٨٪/AS بمعدلات ٣٠.٠٠ أو ٤٠.٠٠ لتر / ف (مرة أو مرتين) بالإضافة الى مادة البوترالين ٤٨٪/EC بمعدلات ٢ أو ٢.٥ لتر / ف (خلطا بالتربة أو رشا سطحيا قبل الزراعة وقبل الري) الى جانب اختبار فاعلية معاملة النقاوة اليدوية فى مكافحة الحامول.

أظهرت النتائج الكفاءة العالية لمعاملات البوترالين بمعدل ٢.٥ لتر/ ف (خلطا بالتربة أو رشا سطحيا قبل الزراعة وقبل الري) ومعاملة الامادازولينون بمعدل ٤٠.٠٠ لتر / ف رشا مرتين و معاملة البوترالين بمعدل ٢ لتر/ ف (خلطا بالتربة) ومعاملة الامادازولينون بمعدل ٤٠.٠٠ لتر / ف (مرة واحدة). حيث حققت تلك المعاملات كفاءة ابداء عالية للحامول فى الكتان دون ظهور أى تأثيرات ضارة على الكتان حيث حققت زيادة معنوية فى أطوال نباتات الكتان و زيادة معنوية فى كلال من المحصول البيولوجى و محصول البذرة للكتان.

أوضحت النتائج انخفاض كفاءة معاملة النقاوة اليدوية فى مكافحة الحامول حيث أنها سجلت نسبة ٤٥ و ٤٦ و ٢٣٪ مكافحة للحامول خلال مواسم الدراسة الثلاثة.

وأوضحت الدراسة أيضا أن تطفل الحامول على نباتات الكتان أدى إلى تقليل ارتفاع النباتات وقللت المحصول البيولوجي بمقدار ١.٦٨ و ١.٥٧ طن/ ف كما خفضت محصول البذرة بمقدار ٠.٧٥ و ٠.٦٢ طن/ ف خلال موسمى ١٩٩٩/٢٠٠٠ و ٢٠٠٠/٢٠٠١ على الترتيب بالمقارنة بالقطع المعدية والغير معاملة.