CHEMICAL WEED CONTROL IN GLADIOLUS CORMELS

W. E. WATERS

Gulf Coast Experiment Station

Bradenton

Presently Florida gladiolus flower producers purchase an estimated 50 million new corms annually from other areas of the United States and Europe at a cost of 1 million dollars. In recent years the production of corms in Florida has increased. One of the most laborious as well as expensive operations involved is weed control.

Cormels are much less tolerant of certain herbicides than large corms and under Florida conditions may be injured by such compounds as Chloro IPC, Diuron, EPTC, and Simazine (4, 5, 6). Bing (1, 2, 3) reported that in New York State corm production from cormels was not adversely affected by Diuron, Chloro IPC, Dinitro (DNBP) or Sesone, whereas Casoron, Diphenamid, EPTC, and Tillam were injurious. Waters et al. (9) reported that Mylone and VPM are excellent herbicides for cormels; however, the cost of these materials limits their usage unless diseases and nematodes are also major problems.

In general, cormels are relatively tolerant to 2,4-D type herbicides (1, 5, 7, 8). Presently Sesone is the only herbicide recommended for cormels in Florida. The objectives of this study were (1) to determine the phytotoxicity of certain herbicides to cormels and (2) to evaluate the herbicidal activity of these materials.

METHODS AND RESULTS

Five herbicide experiments were conducted on gladiolus cormels. Experiments I through IV were arranged in randomized block designs with 4 replications on Broward fine sand (pH 5.6 to 6.5) and were watered by both open seep-ditch and overhead irrigation. Experiment V was arranged in a split-plot design on Bradenton fine sand (pH 6.5) and was watered with a garden hose. All cormels were planted approximately 2 inches deep.

Herbicides used in these experiments included: Dacthal, dimethyl ester of tetra-chloroterephthalic acid; Diphenamid, N,N-dimethyl-2,2-diphenylacetamide; Emid, 2,4-dichlorophenoxyacetamide; EPTC, ethyl N, N-di-n-propylthiolcarbamate; Lorox, 3-(3-4-dichlorophenyl)-1-methoxy-1-methylurea; Tillam, n-propyl ethyl-n-butyl thiolcarbamate; Trifluralin 2,6-dinitro-N,N-di-n-propyl-a,a,a-trifluoro-p-toluidine. All herbicide rates are reported as pounds per acre of active material on a broadcast basis.

Herbicides were applied at approximately 40 psi with a knapsack sprayer using a single 85° Tee Jet nozzle. Each plot was freed of all weeds before any pre or post-emergence[1] herbicide was applied, and no precautions were taken to prevent the herbicide from contacting the foliage. Cultivation began on all check plots immediately after weed control ratings were determined.

EXPT. I-1960-61—Herbicide treatments are shown in Table 1. Cormels were planted November 23 and preemergence herbicides applied immediately. Both EPTC treatments were soil incorporated approximately 1.5 inches. Each experimental unit was 15 x 4 feet and contained 7.5 linear feet of each of 6 varieties (GCS selection A-57-3, Friendship, Spic & Span, Spotlight, Valeria, and White Excelsior.)

Crop Tolerance—Both technical EPTC in mineral spirits and commercial EPTC preemergence treatments were very phytotoxic to all six varieties of cormels. This is reflected in the weight of corms produced (Table 1). The phytotoxic symptoms were: (1) over 50 percent of the cormels failed to emerge, (2) emergence of surviving cormels was delayed 2 to 4 weeks and (3) leaves were narrow, curved, and often severely restricted at the apex. EPTC in mineral spirits was more phytotoxic than emulsifiable EPTC.

Emid applied preemergence was not phytotoxic; however, both postemergence applications were slightly phytotoxic but not to such a degree as to affect corm yield significantly (Table 1). The toxicity occurred as (1) small burned spots where the spray material contacted the foliage and (2) a slight chlorosis, especially in the small plants.

Sesone had no adverse effects on the cormels.

Weed Control—Weed control ratings 7 weeks following preemergence treatments revealed that Emid was superior to the other compounds (Table 1). Satisfactory weed control was obtained with both EPTC treatments. Sesone gave satisfactory weed control for only about 4 weeks.

EXPT. II-1961—Herbicide treatments are given in Table 2. Medium size Spic & Span

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Florida Agricultural Experiment Stations Journal Series No. 1517.

[1]Postemergence refers to the application of herbicides to weed-free soil after cormels emerged.

Table 1 - 1960-61. The effects of pre and postemergence herbicides on weed control and corm production[1]

No.	Treatment	Weed control rating[2] Jan. 15	Corm yield (lbs.)[3] per 45 ft. of row
1	Check	34[d]	10.4[b]
2	Technical EPTC in mineral spirits 4 lb./A. PreE.	82[b]	5.2[c]
3	Emulsifiable EPTC 4 lbs./A. PreE.	83[b]	5.5[c]
4	Emid 4 lbs./A. PreE. + 4 lbs. Jan. 18 + 4 lbs. March 16	96[a]	12.6[ab]
5	Sesone 4 lbs./A. PreE. 4 lbs. Jan. 18 + 4 lbs. March 16	58[c]	13.4[a]

[1]Treatment means within a column followed by same letter(s) are not significantly different at 5% level.
[2]Control rating scale 1-100: 1 = no control - treated area completely covered with weeds. 100 = complete control.
[3]Average per plot for all varieties.

Table 2 - 1961. The effects of pre and postemergence herbicides on weed control and corm production[1]

No.	Treatment	Weed Control Ratings[3] March 2	Weed Control Ratings[3] May 16	Corm yield (lbs.) per 10 ft. of row
1	Check	18[d]	10[c]	6.3
2	Emid 4 lb./A. PreE + 4 lb. Apr. 5	83[a]	80[a]	5.2
3	Dacthal 5 lb./A. PreE + 5 lbs. Apr. 5	41[c]	48[c]	5.3
4	Dacthal 10 lbs./A. PreE + 10 lbs./A. Apr. 5	61[b]	78[a]	5.3
5	Dacthal 15 lbs./A. PreE + 15 lbs. Apr.5	80[a]	88[a]	6.3 NS

[1]Treatment means within a column followed by same letter(s) are not significantly different at 5% level.
[2]Control ratings scale - 1-100; 1 = no control - treated areas completely covered with weeds. 100 = complete control.

cormels were planted January 30, and preemergence herbicides were applied immediately. Each experimental unit contained 10 linear feet of row.

Crop Tolerance—Fifteen lbs./A. of Dacthal both pre and postemergence had no adverse effects on plant growth or corm yields (Table 2). The postemergence application of Emid produced similar effects as described in Expt. I.

Weed Control—Pre and postemergence weed control ratings (Table 2) revealed that 15 lbs./A. of Dacthal were necessary in order to obtain satisfactory weed control. There was little difference between the Emid treatment and the high rate of Dacthal as far as weed control was concerned. Neither Emid nor Dacthal was effective against nutsedge.

EXPT. III-1961-62—Herbicide treatments are listed in Table 3. Ten linear feet of both large size Friendship and small Traveler cormels were planted November 15 and preemergence herbisides applied immediately.

Crop Tolerance—Diphenamid was the only preemergence treatment that was phytotoxic to the cormels. The phytotoxicity occurred as a

Table 3 - 1961-62. The effects of pre and postemergence herbicides on weed control and corm production[1]

No.	Treatment	Weed control ratings[2] Dec. 20	Weed control ratings[2] Mar. 3	Corm yield (lbs.) per 10 ft. of row Traveler	Corm yield (lbs.) per 10 ft. of row Friendship
1	Check	20^{d}	31^{e}	4.9^{ab}	2.7
2	Sesone 4 lbs./A. PreE + 4 lbs. Feb. 16	66^{c}	73^{d}	5.4^{ab}	3.5
3	Emid 2 lbs./A. PreE + 2 lbs. Feb. 16 + 2 lbs. Apr. 9	85^{ab}	87^{ab}	4.8^{ab}	3.3
4	Emid 4 lbs./A. PreE + 4 lbs. Feb. 16 + 4 lbs. Apr. 9	79^{b}	81^{cd}	3.8^{bc}	3.4
5	Emid 2 lbs./A. PreE + 2 lbs. Feb. 16	82^{ab}	94^{ab}	5.5^{ab}	4.1
6	Emid 4 lbs./A. PreE + 4 lbs. Feb. 16	84^{ab}	96^{a}	3.8^{bc}	3.6
7	Dacthal 15 lbs./A. PreE + 15 lbs. Feb. 16	73^{bc}	82^{cd}	6.2^{a}	3.7
8	Diphenamid 5 lbs./A. PreE + 5 lbs. Feb. 16	92^{a}	94^{ab}	3.0^{c}	3.4
9	Lorox 0.75 lb./A. PreE + Sesone 4 lbs./A. Feb. 16	84^{ab}	83^{bcd}	6.6^{a}	3.4
10	Trifluralin 4 lbs./A. PreE + 4 lbs. Feb. 16	95^{a}	97^{a}	6.0^{a}	3.6
					NS

[1]Treatment means within a column followed by same letter(s) are not significantly different at 5% level.

[2]Control rating scale 1-100: 1 = no control - treated area completely covered with weeds, 100 = complete control.

reduction in both stand and vigor and as a slight chlorosis. The phytotoxicity was much more pronounced on the small Traveler cormels than on the large Friendship cormels. This is reflected in the corm yield (Table 3). Since the preemergence application of Diphenamid was phytotoxic, it was impossible to determine the extent of the phytotoxicity resulting from the postemergence treatment. All postemergence applications of Emid produced characteristic phytotoxicity symptoms on both varieties, and corm yield was reduced slightly on the Traveler variety especially at the higher rates. Corm yield from the check plots was reduced as a result of frequent cultivation. The other herbicides produced no phytotoxic effects.

Weed Control—Diphenamid and Trifluralin gave excellent weed control for 8 to 10 weeks following the pre and postemergence treatments (Table 3). All Emid treatments gave satisfactory weed control for 5 to 6 weeks following each application. Sesone used alone was the only herbicide that did not give satisfactory weed control.

EXPT. IV-1962—Herbicide treatments are shown in Table 4. Medium Spic & Span cormels were planted January 16 and postemergence treatments applied April 12. Each experimental unit was 4 x 10 feet and contained 20 linear feet of cormels.

Table 4 - 1962. The effects of postemergence herbicides on weed control and corm production[1]

No.	Treatment	Weed control rating[2] May 2	Corm yield (lbs.)[3] per 20 ft. of row
1	Check	13[d]	4.6[bc]
2	Emid - 2 lbs./A.	66[c]	6.6[a]
3	Emid - 4 lbs./A.	82[b]	4.9[bc]
4	Dacthal - 15 lbs./A	71[c]	6.6[a]
5	Diphenamid - 5 lbs./A.	93[a]	3.6[c]
6	Trifluralin - 4 lbs./A.	81[b]	5.8[ab]

[1]Treatment means within column followed by same letter(s) are not significantly different at 5% level.
[2]Control rating scale - 1-100: 1 = no control - treated area completely covered with weeds, 100 = complete control.
[3]Average per plot for all varieties.

Crop Tolerance—Diphenamid applied postemergence was phytotoxic to cormels, and corm yield was reduced significantly (Table 4). Plant growth was retarded, and the foliage was moderately chlorotic. Both Emid treatments produced characteristic phytotoxicity symptoms, and the corm yields at the high rate was significantly lower than the low rate.

Dacthal and Trifluralin had no apparent adverse effects on the cormels.

Corm yield from the check plots was reduced drastically by weed growth and removal of the weeds by hoeing.

Weed Control—Herbicidal activity of all materials except Diphenamid was lower than in Expt. III. This was attributed to the very hot and dry weather following treatment. Excellent weed control was obtained with Diphenamid. Satisfactory control was obtained with Trifluralin or the high rate of Emid.

EXPT. V-1962—Herbicide and planting dates following herbicide applications are presented in Table 5. Both herbicides (granular formulations) were soil-incorporated 2 inches deep on January 25 and first planting made immediately. Each sub-plot (planting time) contained 4 linear feet of medium size Spic and Span cormels.

Crop Tolerance—The severe phytotoxicity of both EPTC and Tillam to cormels decreased linearly as the planting time following soil incorporation was increased (Table 5). Tillam phytotoxicity symptoms were similar to those described in Expt. I for EPTC. The severity of Tillam phytotoxicity was less at each planting date than for EPTC.

Weed Control—Both herbicides gave excellent weed control for 12 weeks. EPTC was superior in controlling nutsedge, and control with EPTC lasted 4 months.

Table 5 - 1962. The tolerance of gladiolus cormels to EPTC and Tillam as affected by time

Planting time (days following application)	Crop tolerance rating[1] EPTC 6 lbs./A.	Tillam 6 lbs./A.
0	1.1	3.3
7	2.1	4.4
14	3.1	5.4
21	3.8	6.1
28	5.9	8.6

Significant effects:	5% level
Chemicals	*
Planting time - linear	*

[1]Tolerance scale 0-10: 0 = no tolerance with complete crop kill, 10 = complete tolerance with no crop damage.

Discussion

The check plots in Experiments I through IV were heavily infested with redroot pigweed *Amaranthus retroflexus* L. and moderately infested with Bermudagrass, *Cynodon dactylon* (L.) Pers.; crabgrass, *Digitaria sanguinalis* (L.) Scop.; and lambsquarters, *Chenopodium album* L. Other weeds present in relatively large numbers were:

blue toadflax, *Linaria canadensis* (L.) Dum.; common purslane, *Portulaca oleracea* L.; cudweed, *Gnaphalium obtusifolium* L.; evening primrose, *Oenothera biennis* L.; goosegrass, *Eleusine indica* (L.) Gaertin; Mexican clover, *Richardia brasilensis* (Moq.) Gomez; nutsedge, *Cyperus rotundus* L.; ragweed, *Ambrosia artemisifolia* L.; and yerbadetajo, *Verbesina alba* L.

Untreated areas in Experiment V were heavily infested with crabgrass, nutsedge, and spurge (*Euphorbia* sp.). Other weeds present included blue toadflax, cudweed, goosegrass, and Mexican clover.

Excellent control of nutsedge as well as other weeds was obtained with EPTC; however, it was extremely phytotoxic to gladiolus cormels even when the herbicide was applied 28 days prior to plantings. These findings are in agreement with Danielson et al. (6), who reported that 1 lb/A. of EPTC incorporated into Delanco sandy loam 4 weeks prior to planting was phytotoxic to mustard, lettuce, cucumbers, and ryegrass, and 4 lbs./A of EPTC was effective against ryegrass for 13 weeks.

Tillam had less activity against nutsedge and cormels than EPTC. Two or 4 lb./A. of Emid appeared to be safe and effective when applied preemergence to cormels. All postemergence applications of Emid were slightly phytotoxic, and in some instances corm yields were decreased. This phytotoxicity could probably be decreased or eliminated by planting cormels in single rows and using spray shields to protect the plants. The primary weeds present in the Emid plots 4 to 6 weeks following treatments were crabgrass and Bermudagrass.

Fifteen lbs./A. of Dacthal per application was necessary in order to obtain satisfactory weed control. This rate gave excellent control of crabgrass and satisfactory control of red-root pigweed. In a field trial in 1962 a large area of cormels was treated with 15 lbs./A. of Dacthal with no adverse effects. Cormels appear to be extremely tolerant of Dacthal.

Five lbs./A. of Diphenamid applied pre or postemergence was phytotoxic to cormels. Diphenamid has excellent herbicidal properties.

Four lbs./A. of Trifluralin pre and postemergence or 0.75 lb./A. of Lorox preemergence looked promising; however, more extensive investigations with these compounds are necessary.

Until recently Sesone was the only herbicide recommended for cormels. As far as herbicidal properties are concerned, all herbicides tested were superior to Sesone. Generally Sesone gave fair weed control for about 4 weeks. Repeated applications of Sesone had no adverse effects on cormels.

In almost all cases the cormels were damaged in the check plots by the frequent hoeings required to keep the weeds under control. In many instances slight phytotoxic effects of a herbicide treatment did not reduce corm yields any more that frequent hoeing.

Summary

A series of 5 herbicide experiments conducted on gladiolus cormels over a 3 year period may be summarized as follows:

1. Diphenamid—5 lbs./A., EPTC—6 lbs./A., or Tillam—6 lbs./A. were extremely phytotoxic to cormels, although excellent weed control was obtained with each compound.

2. Emid—2 to 4 lbs./A. preemergence was an effective herbicide; however, postemergence applications were slightly phytotoxic.

3. Dacthal—15 lbs./A. pre and postemergence was satisfactory for use on cormels.

4. Either Lorox—3/4 lb./A. preemergence + Sesone 4 lbs./A. postemergence or Trifluralin—4 lbs./A. pre and postemergence gave excellent weed control with no apparent phytotoxic effects; however, Lorox and Trifluralin should be evaluated further.

5. Sesone—4 lbs./A. pre or postemergence, currently recommended for cormels, was less effective in controlling weeds than any other herbicide tested.

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