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# Weed Control in Peanuts with Ethalfluralin[1]

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## ABSTRACT

Ethalfluralin [N-ethyl-*n*-(2-methyl-2-propenyl)-2,6-dinitro-4-(trifluoromethyl)benzenamine], a recently introduced dinitroaniline herbicide, was tested at two locations in Florida for weed control in peanuts (*Arachis hypogaea* L.). When applied alone as a preplant incorporated (PPI) treatment at 0.8 and 1.7 kg/ha, and as a preemergence or ground cracking (GC) treatment at 1.1 and 2.2 kg/ha, ethalfluralin provided 85 to 100% control of goosegrass (*Eleucine indica* (L.) Guerin.), crabgrass (*Digitaria ciliaris* (Retz.) Koel), and Florida pusley (*Richardia scabra* L.) without peanut injury. Excellent control of Florida beggarweed (*Desmodium tortuosum* (SW.) DC.) and smallflower morningglory (*Jacquemontia tamnifolia* (L.) Griseb.) (100 and 97% respectively) was observed at one location when ehalfluralin was applied at 1.7 kg/ha PPI. Consistent control of both grass and broadleaf weeds required a combination of ethalfluralin with naptalam (*N*-1-naphthylphthalamic acid) plus dinoseb (2-*sec*-butyl-4,6-dinitrophenol) applied at GC. This herbicide program provided weed control comparable to that obtained with the standard GC treatment of alachlor (2-chloro-2',6'-diethyl-*N*-(methoxymethyl) acetanilide) plus naptalam + dinoseb.


Key Words: Weed control, peanuts, *Arachis hypogaea* L., Ethalfluralin.

Ethalfluralin [*N*-ethyl-*N*-(2-methyl-2-propenyl)-2, 6-dinitro-4- (tri-flluromethyl) benzenamine] is a recently introduced dinitroaniline herbicide with potential for use in both agronomic and vegetable crops (2, 3, 4, 5). It provides good control of annual grass weeds in cucurbit vegetables without crop injury (2, 3). Ethalfluralin also shows promise for control of annual grasses and certain broadleaf weeds in peanuts (*Arachis hypogaea* L.), cotton (*Gossypium hirsutum* L.), and soybeans (*Glycine max* (L.) Merr.) when applied either as a preplant incorporated or premergence treatment (5).

This study was conducted to determine the effectiveness of ethalfluralin for weed control in peauts and to determine how it can best be utilized in a peanut weed control program.

## Materials and Methods

Field studies were conducted at the University of Florida Agricultural Research Center, Jay, Florida in 1976, 1977, and 1978 and at the Agricultural Research Center, Marianna, Florida in 1976 and 1977 to determine the effectiveness of ethalfluralin for weed control in peanuts. The soil at Jay was a Tifton fine sandy loam (Plinthic Paleudult) with 2% organic matter and pH of 5.8 while at Marianna, the soil was a Red Bay loamy fine sand (Rhodic Paleudult) with 1.5% organic matter and pH of 6.0.

Peanuts were planted between April 27 and May 27 in rows spaced 91 cm apart at a seeding rate of 95 kg/ha. Herbicides were applied with a tractor mounted air propellent sprayer at Jay and with a $CO_2$ back-pack sprayer at Marianna. Both sprayers were calibrated to deliver 187 L/ha. Peanut plots were 3.7 m wide (4 rows) X 6.0 to 7.6 m long with the center two rows of each plot harvested for yields. A randomized complete block experimental design with either 3 or 4 replications was used in all experiments.

The peanuts were irrigated as needed at Marianna while at Jay they were rainfed. During 1976 rainfall was near normal at Jay while May and June of 1977 had below normal precipitation and July and August above normal. Extremely wet conditions prevailed during the 1978 growing season.

Preplant incorporated (PPI) treatments of ethalfluralin (0.8 and 1.7 kg/ha) and benefin (*N*-butyl-N-ethyl-∝,∝,∝-trifluro-2,6-dinitro-*p*-toluidine) (1.7 kg/ha) were applied 2 days before planting. Preemergence (PRE) applications of ethalfluralin (1.1 and 2.2 kg/ha) and alachlor (2-chloro-2'-6'diethyl-*N*-(methoxymethyl)acetanilide) (2.2 kg/ha) were made within 2 days after planting. Ground cracking (GC) treatments included: (1) ethalfluralin (1.1 and 2.2. kg/ha), (2) ethalfluralin (1.1. and 2.2 kg/ha) plus dinoseb (2-*sec*-butyl-4,6-dinitrophenol) (1.7 kg/ha), (3) ethalfluralin (1.12 and 2.2 kg/ha) plus dinoseb (1.7 kg/ha) + naptalam (*N*-1-naphthylphthalamic acid) (3.4 kg/ha), (4) alachlor (2.2 kg/ha) plus dinoseb (1.7 kg/ha), and (5) alachlor (2.2 kg/ha) plus dinoseb (1.7 kg/ha) plus naptalam (3.4 kg/ha). Ground cracking treatments were applied when peanuts were beginning to emerge (7 to 10 days after planting). Control of individual weed species was visually rated within 6 weeks after peanut planting. Common names and botanical names of the weed species rated are listed in Table 1.

**Table 1. Common name and botanical name of weed species present in peanuts.**

| Common Name | Botanical Name |
|---|---|
| Crabgrass | Digitaria ciliaris (Retz.) Koel |
| Cocklebur | Xanthium strumarium L. |
| Florida beggarweed | Desmodium tortuosum (SW.) DC. |
| Florida pusley | Richardia scabra L. |
| Goosegrass | Eleusine indica (L.) Guerin. |
| Sicklepod | Cassia obtusifolia L. |
| Smallflower morningglory | Jacquemontia tamnifolia (L.) Griseb. |
| Tall morningglory | Ipomoea purpurea (L.) Roth. |

## Results and Discussion

Estimated percent week control and peanut yields for 1976 at Jay and Marianna are presented in Table 2. Ethalfluralin, when applied alone, PPI, PRE, or GC, provided 88 to 100% control of the grass species at both locations and 85 to 100% control of Florida pusley (treatments 1, 2, 4, 5, 7, and 8). Control of the other broadleaf species was less than Florida pusley. Tall morningglory control (58 to 80%) at Jay was best when ethalfluralin was applied PPI (treatments 1 and 2). Cocklebur was not adequately controlled with any of the ethalfluralin-alone treatments. Ethalfluralin (1.7 kg/ha) ap-

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Table 2. Influence of ethalfluralin on weed control and peanut yield at Jay and Marianna, 1976.

| Treatment | Rate (kg/ha) | When[1] app. | Weed control[2] Jay GC (%) | Jay CG (%) | Jay FP (%) | Jay TM (%) | Jay CB (%) | Marianna CG (%) | Marianna FP (%) | Marianna SW (%) | Marianna SFM (%) | Yield[3] Jay (kg/ha) | Yield[3] Marianna (kg/ha) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Ethalfluralin | 0.8 | PPI | 100 | 100 | 98 | 80 | 33 | 100 | 100 | 71 | 74 | 1220b,c,d | 3834c,d,e |
| 2. Ethalfluralin | 1.7 | PPI | 100 | 100 | 100 | 85 | 33 | 100 | 100 | 97 | 100 | 1113c,d | 4651a,b,c |
| 3. Benefin | 1.7 | PPI | 100 | 100 | 95 | 80 | 25 | 100 | 100 | 73 | 98 | 764d | 4675a,b,c |
| 4. Ethalfluralin | 1.1 | PRE | 90 | 93 | 85 | 63 | 53 | 99 | 98 | 35 | 75 | 975d | 4055b,c,d |
| 5. Ethalfluralin | 2.2 | PRE | 98 | 98 | 93 | 58 | 40 | 98 | 100 | 66 | 81 | 757d | 4818a,b |
| 6. Alachlor | 2.2 | PRE | 95 | 100 | 85 | 60 | 38 | 93 | 96 | 16 | 30 | 1025d | 4203b,c,d |
| 7. Ethalfluralin | 1.1 | GC | 88 | 90 | 90 | 68 | 45 | 92 | 91 | 20 | 20 | 1277b,c,d | 3725d,e |
| 8. Ethalfluralin | 2.2 | GC | 95 | 93 | 93 | 78 | 40 | 88 | 93 | 10 | 0 | 1044c,d | 2984e |
| 9. Ethalfluralin + | 1.1 | GC | 95 | 98 | 95 | 85 | 83 | 100 | 100 | 98 | 99 | 1569a,b,c | 5468a |
| naptalam + | 3.4 | GC | | | | | | | | | | | |
| dinoseb | 1.7 | GC | | | | | | | | | | | |
| 10. Alachlor + | 2.2 | GC | 98 | 95 | 100 | 93 | 85 | 100 | 100 | 100 | 100 | 1911a | 5208a |
| naptalam + | 3.4 | GC | | | | | | | | | | | |
| dinoseb | 1.7 | GC | | | | | | | | | | | |
| 11. Benefin + | 1.7 | PPI | 100 | 100 | 100 | 95 | 75 | 100 | 100 | 100 | 100 | 1886a | 5208a |
| ethalfluralin + | 1.1 | GC | | | | | | | | | | | |
| naptalam + | 3.4 | GC | | | | | | | | | | | |
| dinoseb | 1.7 | GC | | | | | | | | | | | |
| 12. Benefin + | 1.7 | PPI | 100 | 100 | 100 | 100 | 80 | 100 | 100 | 100 | 100 | 1634a,b | 4327b,c,d |
| alachlor + | 2.2 | GC | | | | | | | | | | | |
| naptalam + | 3.4 | GC | | | | | | | | | | | |
| dinoseb | 1.7 | GC | | | | | | | | | | | |
| 13. CHECK | --- | --- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 886d | 913f |
| LSD (.05) | | | 7 | 7 | 10 | 23 | 22 | 5 | 7 | 23 | 28 | | |

[1] PPI = preplant incorporated, PRE = preemergence, GC = ground cracking.

[2] Visually rated 5-31-76 and 6-17-76 at Jay and Marianna, respectively. GG = goosegrass, CG = crabgrass, FP = Florida pusley, TM = tall morningglory, BW = Florida beggarweed, SFM = smallflower morningglory, CB = cocklebur.

[3] Values within a column followed by the same letter are not significantly different at the 5% level as determined by the Duncan's Multiple Range Test.

plied PPI at Marianna provided 97 and 100% control of Florida beggarweed and smallflower morningglory, respectively. Florida beggarweed control was significantly better than that obtained with the standard PPI treatment of benefin. Ethalfluralin (2.2 kg/ha) applied PRE controlled both Florida beggarweed and smallflower morningglory significantly better than did the standard PRE treatment of alachlor.

The GC tank mixture of ethalfluralin plus naptalam plus dinoseb (treatment 9) controlled 83 to 100% of all weed species present and compared favorably with the standard GC treatment of alachlor plus naptalam plus dinoseb (treatment 10). The addition of benefin PPI to either of these herbicide programs had no significant effect on weed control and at Marianna actually resulted in a significantly lower yield than alachlor plus naptalam plus dinoseb alone.

Ethalfluralin did not cause injury to the peanut crop at any rate or time of application tested. In 1976 better broadleaf weed control and, in some cases, significantly better peanut yields resulted from herbicide treatments which included naptalam + dinoseb (Table 2). Among the treatments at Jay where ethalfluralin was applied alone, there were no significant yield differences. At Marianna, however, the 1.7 kg/ha PPI and 2.2 kg/ha PRE treatments resulted in higher peanut yields than either of the GC ethalfluralin applications (treatments 2 and 5 vs. treatments 7 and 8). Apparently the seedling weeds which emerged prior to the GC treatments were not controlled by the ethalfluralin.

In 1977 various GC herbicide programs which had ethalfluralin as a component were tested (Table 3). All programs resulted in 95 to 100% control of crabgrass, goosegrass, and Florida pusley. The addition of benefin PPI to the herbicide program of ethalfluralin plus naptalam plus dinoseb (treatment 1 vs. treatment 2) did not significantly improve control of these weed species or peanut yield. With the herbicide combinations studied, the 1.1 kg/ha rate of ethalfluralin provided control comparable to the 2.2. kg/ha application rate (treatment 1 vs. 2 and 4 vs. 5). Control of tall morningglory at Jay increased from 48 to 98% when the herbicide program included naptalam plus dinoseb instead of dinoseb alone (treatment 2 vs. treatment 4).

Though weed control appeared to be better with

Table 3. Influence of ethalfluralin on weed control and peaut yield at Jay and Marianna, 1977.

| Treatment | Rate (kg/ha) | When[1] app. | Weed control[2] Jay CG (%) | Jay GG (%) | Jay FP (%) | Jay SP (%) | Jay TM (%) | Marianna CG (%) | Marianna FP (%) | Marianna SP (%) | Marianna TV (%) | Yield[3] Jay (kg/ha) | Yield[3] Marianna (kg/ha) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Ethalfluralin + | 1.1 | GC | 98 | 95 | 90 | 42 | 98 | 100 | 99 | 89 | 100 | 2238c | 2931a,b |
| naptalam + | 3.4 | GC | | | | | | | | | | | |
| dinoseb | 1.7 | GC | | | | | | | | | | | |
| 2. Benefin + | 1.7 | PPI | 100 | 100 | 95 | 66 | 90 | 100 | 99 | 98 | 100 | 2724a,b,c | 2867a,b |
| ethalfluralin + | 1.1 | GC | | | | | | | | | | | |
| naptalam + | 3.4 | GC | | | | | | | | | | | |
| dinoseb | 1.7 | GC | | | | | | | | | | | |
| 3. Benefin + | 1.7 | PPI | 100 | 100 | 100 | 68 | 98 | 99 | 100 | 90 | 100 | 3512a | 3267a |
| ethalfluralin + | 2.2 | GC | | | | | | | | | | | |
| naptalam + | 6.8 | GC | | | | | | | | | | | |
| dinoseb | 2.4 | GC | | | | | | | | | | | |
| 4. Benefin + | 1.7 | PPI | 100 | 100 | 100 | 73 | 73 | 100 | 99 | 48 | 100 | 2667b,c | 2549b |
| ethalfluralin + | 1.1 | GC | | | | | | | | | | | |
| dinoseb | 1.7 | GC | | | | | | | | | | | |
| 5. Benefin + | 1.7 | PPI | 100 | 100 | 100 | 70 | 98 | 100 | 99 | 75 | 100 | 3123a,b | 2834a,b |
| ethalfluralin + | 2.2 | GC | | | | | | | | | | | |
| dinoseb | 3.4 | GC | | | | | | | | | | | |
| 6. Benefin + | 1.7 | PPI | 98 | 100 | 100 | 73 | 95 | 100 | 100 | 90 | 100 | 2682b,c | 2666b |
| alachlor + | 2.2 | GC | | | | | | | | | | | |
| naptalam + | 3.4 | GC | | | | | | | | | | | |
| dinoseb | 1.7 | GC | | | | | | | | | | | |
| 7. CHECK | --- | -- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1065d | 1192c |
| LSD (.05) | | | 4 | 7 | 9 | 24 | 28 | 5 | 5 | 33 | 16 | | |

[1] PPI = preplant incorporated, GC = ground cracking.

[2] Visually rated 6-4-77 and 6-16-77 at Jay and Marianna, respectively. CG = crabgrass, GG = goosegrass, FP = Florida pusley, SP = sicklepod, TM = tall morningglory.

[3] Values within a column followed by the same letter are not significantly different at the 5% level as determined by the Duncan's Multiple Range Test.

treatment 2 compared to treatment 4, there was no significant difference in peanut yield (Table 3). The program which resulted in the highest yield at both Jay and Marianna in 1977 included ethalfluralin at 2.2 kg/ha and the 2X rate of naptalam plus dinoseb. The yield for the program of benefin plus ethalfluralin (1.1. kg/ha) plus naptalam (3.4 kg/ha) plus dinoseb (1.7 kg/ha) (treatment 2) compared favorably with that of the standard peanut weed control program of benefin plus alachlor plus naptalam plus dinoseb (treatment 6) at both locations.

Results in 1978 were similar to the previous two years with herbicide combinations including ethalfluralin providing excellent control (98 to 100%) of crabgrass and goosegrass (Table 4). Excellent Florida beggarweed control was obtained with all treatments; however, programs that included alachlor (treatments 4 and 5) provided significantly better sicklepod control. Yields form the various herbicide programs which included ethalfluralin again compared favorably with the standard program of benefin plus alachlor plus naptalam plus dinoseb.

Results from these studies indicate that ethalfluralin provides excellent control of goosegrass, crabgrass, and Florida pusley when applied either PPI, PRE, or GC and compares favorably with the standard benefin PPI and alachlor PRE or GC treatments. It has a potential advantage over benefin, which is also a dinitroaniline herbicide, in that ethalfluralin need not be mechanically soil incorporated to provide adequate weed control. This may result in an energy savings because less til-

Table 4. Influence of ethalfluralin on weed control visually rated June 15 and peanut yield at ARC, Jay, Florida 1978.

| Treatment | Rate (kg/ha) | When[1] app. | Weed control[2] GG (%) | CG (%) | SP (%) | BW (%) | Yield[3] (kg/ha) |
|---|---|---|---|---|---|---|---|
| 1. Benefin + | 1.7 | PPI | 98 | 98 | 75 | 93 | 4205a |
| ethalfluralin + | 1.1 | GC | | | | | |
| dinoseb | 1.7 | GC | | | | | |
| 2. Benefin + | 1.7 | PPI | 100 | 100 | 80 | 100 | 3034a |
| ethalfluralin + | 1.1 | GC | | | | | |
| naptalam + | 3.4 | GC | | | | | |
| dinoseb | 1.7 | GC | | | | | |
| 3. Benefin + | 1.7 | PPI | 100 | 100 | 80 | 98 | 3750a |
| ethalfluralin + | 2.2 | GC | | | | | |
| naptalam + | 6.8 | GC | | | | | |
| dinoseb | 2.4 | GC | | | | | |
| 4. Ethalfluralin + | 0.8 | PPI | 100 | 100 | 93 | 100 | 4103a |
| alachlor + | 2.2 | GC | | | | | |
| naptalam + | 3.4 | GC | | | | | |
| dinoseb | 1.7 | GC | | | | | |
| 5. Benefin + | 1.7 | PPI | 100 | 100 | 93 | 98 | 3965a |
| alachlor + | 2.2 | GC | | | | | |
| naptalam + | 3.4 | GC | | | | | |
| dinoseb | 1.7 | GC | | | | | |
| 6. CHECK | --- | -- | 0 | 0 | 0 | 0 | 655b |
| LSD (.05) | | | 4 | 4 | 10 | 10 | |

[1] PPI = preplant incorporated, GC = ground cracking.

[2] Visually rated 6-15-78. GG = goosegrass, CG = crabgrass, SP = sicklepod, BW = Florida beggarweed.

[3] Values within a column followed by the same letter are not significantly different at the 5% level as determined by the Duncan's Multiple Range Test.

lage is required. In tests conducted by others (1), ethalfluralin has exhibited control of some especially troublesome weeds such as shattercane (*Sorghum bicolor* (L.) Moench) and therefore, when applied as a PRE or GC treatment, may also have an advantage over alachlor. Ethalfluralin, like benefin or alachlor, requires a herbicide program including a GC treatment of naptalam plus dinoseb to obtain consistent control of broadleaf weed species such as sicklepod, cocklebur, and morningglory species.

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