

**UTILIZATION OF REDUCED RATES  
OF ORGANOPHOSPHATE INSECTICIDE  
FOR SAFENING COTTON TO COMMAND 3 ME**

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**Abstract**

Several trials were initiated to evaluate the potential for liquid disulfoton at rates lower than 0.75 lb ai/ac applied in-furrow as a safener for Command 3 ME in cotton. Liquid disulfoton rates evaluated were 0, 0.3, 0.4, 0.5, and 0.75 lb ai/ac, all applied in-furrow at planting. Command 3 ME plus fluometuron at 0.5 + 0.5, 0.75 + 0.75, and 1.0 + 1.0 lb ai/ac, respectively, were applied preemergence after planting. Treatments receiving Command + fluometuron at 0.5 + 0.5 lb ai/ac, resulted in cotton chlorosis of only 4 % at 2 to 3 WAE when disulfoton was applied in-furrow, regardless of disulfoton rate. When command at 0.75 lb ai/ac + fluometuron at 0.75 lb ai/ac was applied PRE, disulfoton at 0.4 lb ai/ac or higher provided effective safening. Foliar chlorosis was negligible by 4 to 5 weeds after emergence at disulfoton rates of 0.4 to 0.75 lb ai/ac and with the highest herbicide rates tested in these trials. At higher Command + fluometuron rates, disulfoton at 0.5 lb ai/ac was most consistent in maintaining stunting and stand reductions at negligible levels (<5%) at 2 to 3 weeks after emergence.

**Introduction**

Numerous researchers have demonstrated the infurrow use of organophosphate insecticides such as disulfoton or phorate to effectively safen cotton to Command herbicide (Applewhite and Mitchell, 1990; Harrison and Hayes, 1992; Jordan, et. al., 1993; Jordan, et. al., 1991; Smith et. al., 1996; York and Jordan, 1992; York et. al., 1991). The recent commercialization of the Command 3 ME formulation provided opportunity to re-examine the relationship between the organophosphate insecticides and Command. Recent field work indicated that cotton was more tolerant to Command 3 ME than to Command 4 EC (unpublished). Field research work was initiated to examine cotton tolerance differences between Command 4 EC and

Command 3 ME and to evaluate the potential for the use of liquid disulfoton at rates lower than the commercially recommended rate of 0.75 lb ai/ac applied in-furrow as a safener for Command 3 ME in cotton.

**Materials and Methods**

In 1997, eight field trials were conducted to evaluate the potential of liquid disulfoton at rates of 0.3 to 0.75 lb ai/ac as a safener for Command 3 ME herbicide in cotton. Trials were conducted in Alabama, Louisiana, Mississippi, North Carolina, and Tennessee.

Command 3 ME was applied according to premerge label recommendations. Command 3 ME was tank-mixed with fluometuron at a 1:1 ratio of each herbicide. Herbicide rates were as follows: Command 3 ME plus fluometuron at 0.5 + 0.5, 0.75 + 0.75, and 1.0 + 1.0 lb ai/ac, respectively. Liquid disulfoton rates evaluated were 0, 0.3, 0.4, 0.5, and 0.75 lb ai/ac, all applied in-furrow. All trials were conducted in a small plot format, either two or four treated rows and two untreated rows per plot. Each plot was about 30 to 50 feet long. Herbicides were applied with small plot, air-compressed sprayers. Liquid disulfoton was applied in-furrow at planting. Herbicides were applied preemergence to cotton immediately following planting.

Crop tolerance data collected included percent chlorosis (foliar bleaching), percent stunting, and percent stand reduction as compared to untreated controls. Environmental conditions during the first 4 to 6 weeks of the cotton planting season in the mid-south was described as below normal air temperatures and above average rainfall.

**Results and Discussion**

All data were summarized by location, then compiled over locations as similar trends occurred at each location. Only the data summarized over the eight locations will be discussed in this manuscript.

When disulfoton was not applied in-furrow, Command + fluometuron applied at 0.5 + 0.5, 0.75 + 0.75, and 1.0 + 1.0 lb/ac, resulted in 10, 18, and 24% chlorosis of cotton plants, respectively, 2 to 3 weeks after emergence (WAE). At 4 to 5 WAE, percent chlorosis was only 1, 1, and 5% when disulfoton was not applied in-furrow and Command + fluometuron was applied at 0.5 + 0.5, 0.75 + 0.75, and 1.0 + 1.0 lb/ac, respectively. Early season foliar injury decreased over time to negligible levels, which is in agreement with findings of other researchers (Jordan et. al., 1991 and York and Jordan, 1992). As the herbicide rate increased, chlorosis of cotton leaves increased in the treatments that did not receive disulfoton. Treatments receiving Command + fluometuron at 0.5 + 0.5 lb/ac, resulted in cotton chlorosis of only 4% at 2 to 3 WAE when disulfoton was applied in-furrow, regardless of disulfoton rate.

When command at 0.75 lb/ac + fluometuron at 0.75 lb/ac was applied PRE, disulfoton at 0.4 lb/ac or higher was needed for safening. There was no differences in cotton chlorosis when Command + fluometuron at 0.75 + 0.75 lb/ac was applied PRE over disulfoton in-furrow at 0.4, 0.5, or 0.75 lb/ac. Cotton chlorosis in these treatments was less than 10% at 2 to 3 WAE. By 4 to 5 WAE, chlorosis was negligible in treatments with Command + fluometuron (0.75 + 0.75 lb/ac) applied PRE with disulfoton applied at rates of 0.4 to 0.75 lb/ac in-furrow at planting.

Command at 1.0 lb/ac + fluometuron at 1.0 lb/ac applied PRE, caused slightly higher chlorosis when disulfoton was applied at 0.3 lb/ac in-furrow compared to the same herbicide rate plus disulfoton at higher rates. At 2 to 3 WAE, chlorosis ranged from 9 to 11% when Command + fluometuron at 1.0 + 1.0 lb/ac was applied PRE with disulfoton rates of 0.4, 0.5, and 0.75 lb/ac. Foliar chlorosis was again negligible by 4 to 5 WAE at disulfoton rates of 0.4 to 0.75 lb/ac along with the highest herbicide rate tested in these trials.

Minimal stunting was observed when Command + fluometuron was applied at any rate tested with no disulfoton in-furrow. Stunting ranged from 8 to 9% at 2 to 3 WAE and was negligible by 4 to 5 WAE. At the lower rates of Command + fluometuron (0.5 + 0.5 lb/ac), percent stunting was decreased to negligible levels at all rates of disulfoton. However, at higher Command + fluometuron rates, at least 0.4 to 0.5 lb/ac disulfoton was needed to reduce stunting to negligible levels (<5%) at 2 to 3 WAE. At 4 to 5 WAE, there were no differences in stunting (<1%) between any disulfoton treatments when combined with the highest Command + fluometuron rate.

Percent stand reduction was recorded in each trial from 4 to 8 WAE. Stand reduction ranged from 3 to 11% when Command + fluometuron was applied PRE without disulfoton in furrow. With no disulfoton in the treatment, there was a trend towards increased stand reduction as the Command + fluometuron rate increased. Stand reduction was less than 4 % for all herbicide treatments when disulfoton was applied at 0.5 to 0.75 lb/ac. Disulfoton at rates of at least 0.5 lb/ac more consistently prevented cotton stand reduction than disulfoton at lower rates.

### Summary

Liquid disulfoton at rates of 0.4 to 0.75 lb/ac generally safened cotton from Command at rates of 0.5 to 0.75 lb/ac. These results agree with earlier research with Disulfoton rates lower than 0.75 lb ai/ac along with Command (York and Jordan, 1992). However, trends were towards less cotton tolerance when disulfoton was applied at rates lower than 0.5 lb/ac, especially with percent stand reduction when Command 3 ME + fluometuron was applied at the higher rates. Only the liquid disulfoton formulation was tested due to difficulties with accurately calibrating granular

applicators at disulfoton rates below 0.75 lb/ac. For the 1998 season, FMC plans to recommend liquid disulfoton at 0.5 lb/ac and 0.75 lb/ac as a safener for Command 3 ME in cotton. Disulfoton rates lower than 0.5 lb/A will not be recommended.

### References

- Applewhite, C. D. and H. R. Mitchell. 1990. Safening effects of organophosphate insecticides on clomazone applications to cotton. Proc. South. Weed Sci. Soc. 43:83.
- Harrison, M. A. and R. M. Hayes. 1992. Utilization of Command with selected in-furrow insecticides in no-till and conventional cotton. Proc. South. Weed Sci. Soc. 45:44.
- Jordan, D. L., A. C. York, M. R. McClelland, and R. E. Frans. 1993. Clomazone as a component in Cotton (*Gossypium hirsutum*) herbicide programs. Weed Technol. 7:202-211.
- Jordan, D. L., M. R. McClelland, and R. E. Frans. 1991. Evaluation of clomazone (Command) in cotton. Abstr. Ark. Pest. Assoc. 30:9.
- Smith, M. C., P. C. Carter, and M. R. McClelland. 1996. Effect of application method and rate on efficacy of clomazone herbicide. Proc. South. Weed Sci. Soc. 49: 5 - 6.
- York, A. L. and D. L. Jordan. 1992. Cotton (*Gossypium hirsutum*) response to clomazone and insecticide combinations. Weed Technol. 6: 796 - 800.
- York, A. C., D. L. Jordan, and R. E. Frans. 1991. Insecticides modify cotton (*Gossypium hirsutum*) response to clomazone. Weed Technol. 5: 729 - 735.

Table 1. Cotton tolerance to Command 3 ME + disulfoton in-furrow - 1997.

Disulfoton lb ai/ac	% Chlorosis					
	Command 3 ME + fluometuron (lb ai/ac)					
	0.5 + 0.5		0.75 + 0.75		1.0 + 1.0	
	Weeks After Emergence					
	2-3	4-5	2-3	4-5	2-3	4-5
0	10	1	18	1	24	5
0.3	4	0	12	0	16	1
0.4	4	0.2	6	0	11	0.2
0.5	4	0.2	7	0.2	11	0.4
0.75	4	0	9	0.2	9	1

Mean of eight trials in AL, LA, MS, NC, and TN.

Table 2. Cotton tolerance to Command 3 ME + disulfoton in-furrow - 1997.

Disulfoton lb ai/ac	% Stunting					
	Command 3 ME + fluometuron (lb ai/ac)					
	0.5 + 0.5		0.75 + 0.75		1.0 + 1.0	
Weeks After Emergence						
	2-3	4-5	2-3	4-5	2-3	4-5
0	9	4	8	3	8	3
0.3	3	0.6	6	2	9	0.3
0.4	4	2	2	2	5	0.8
0.5	3	1	4	2	2	0.3
0.75	3	0.4	2	1	4	0.3

Mean of eight trials in AL, LA, MS, NC, and TN.

Table 3. Cotton tolerance to Command 3 ME + disulfoton in-furrow - 1997.

Disulfoton lb ai/ac	% Stand Reduction		
	Command 3 ME + fluometuron (lb ai/ac)		
	0.5 + 0.5	0.75 + 0.75	1.0 + 1.0
0.0	3	9	11
0.3	3	1	0.2
0.4	3	5	4
0.5	2	3	2
0.75	2	0.7	3

Mean of eight trials in AL, LA, MS, NC, and TN at 4 - 8 weeks after emergence.