

**PERFORMANCE OF SAVEY® 50-WP
OVICIDE/MITICIDE FOR MITE
CONTROL IN WESTERN COTTON**

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Abstract

Savey 50-WP (hexythiazox) is a highly selective miticide that demonstrates excellent ovicidal and immature mite activity against Tetranychidae mites. Field efficacy studies were conducted in 1984-88 and 1996 to determine the ovicidal/miticidal activity of Savey (hexythiazox) against major mite pest species of western cotton. Savey applied at 3 - 5 oz/A provided commercially acceptable control of *Tetranychus turkestanii*, *T. urticae* and *T. pacificus*. Results collected to date suggest that Savey fits best in early-season cotton production where more complete coverage can be obtained with ground equipment and mite populations are low, but building. Savey does not adversely effect beneficial insects or mites.

Introduction

Savey 50-WP ovicide/miticide represents a unique class of chemistry that selectively controls tetranychid mites in a number of crops. Hexythiazox was discovered in Japan by Nippon Soda Co., Ltd. in the 1970's. It was first developed in the U.S. by Dupont in the 1980's. U.S. development and sales were transferred to Gowan in 1994. The first U.S. tolerance was established on pears in 1989 and ornamentals were added to the label in 1995. Savey was registered on apples in 1996.

The active ingredient in Savey 50WP is hexythiazox. The IUPAC name is *trans*-5-(4-chlorophenyl)-N-cyclohexyl-4-methyl-2-oxothiazolidine-3-carboxamide. Due to its favorable oral and dermal LD50's of >5000 mg/kg, Savey falls into Toxicity Category IV and carries a signal word of Caution - thus, it is not a restricted use pesticide.

The actual mode of action of Savey is unknown, but research indicates that it disrupts chitin metabolism during mite development. Savey will not control adult mites. However, it is an extremely effective product against immature stages of mites. Hexythiazox is generally considered to be a highly effective ovicide that is most

active against newly deposited tetranychid mite eggs (Anon., 1984; Hoy and Ouyang 1986; Welty et al. 1988). When the material is applied to female spider mites or if contacted by them through exposure to treated tissue, it causes temporary sterilization resulting in the laying of eggs that will not hatch. This effect diminishes in a short time after females move from treated surfaces (Chapman and Marris 1986). Finally, hexythiazox interrupts the development of immature spider mites by preventing emergence from quiescent stages. This effect occurs when immature motile stages are exposed to residues or direct sprays (Chapman and Penman, 1988). Thus, the activity of Savey against field populations of mites is a result of the combined ovicidal and immature (larva, protonymph and deutonymph) activity of the product.

Savey has no systemic or translaminar activity. Residual control with Savey is excellent. Thus, for Savey to provide best efficacy, it should be applied as a full-coverage spray to a mite population during the early stages of build up.

Savey has been evaluated for mite control in California cotton in 14 studies from 1984 -1988 and in 6 studies in 1996 against of *Tetranychus turkestanii*, strawberry spider mite, *T. urticae*, twospotted spider mite, and *T. pacificus*, Pacific spider mite. Reported herein is an overview of the results collected from these studies with emphasis being placed on individual studies.

Materials and Methods

Results presented in this paper were obtained from 16 small plot and 4 commercial-size research trials. Small plot studies employed randomized complete block experimental designs with 3 to 4 replications.

Foliar applications of Savey were applied at 2 to 5 oz product/A. Backpack CO2 spray equipment was used in four of the studies. Commercial application equipment or semi-commercial plot sprayers were used to make applications in the remaining studies. Savey was applied to early staged cotton, prior to fruit set, and against low to moderate spider mite infestation levels in 17 of the 20 studies.

Efficacy evaluations were made by counting the number of mites per leaf or by determining the percent leaves infested. Typically 20 - 25 leaves per replicate were sampled. Crop injury was evaluated by visual observations with 0=no injury and 10=plant death. Safety to mite predators was evaluated by collecting samples from replicate plots. Arthropods were identified and counted. Finally, yields were collected by machine harvesting individual plots and plot yields were converted to pounds seed cotton per acre.

Results and Discussions

Results summarized herein are presented as means and were generated from numerous ratings of Savey against spider mites across a number of studies in California. Also, mean data will be presented from selected individual studies.

When data generated from 1984 - 1988 is summarized and analyzed (Table 1), clearly Savey can be used to control spider mites in California cotton. Performance was equal to that achieved with the standards - Comite or Kelthane.

A number of studies were conducted in the 1980's in which Savey was applied at 2, 3, 4 and 5 oz/A as well as tank-mixes of Savey plus Kelthane. Data from these studies are presented in Tables 2 - 5. In these studies, Savey applied at 3 - 5 oz/A provided control similar to that achieved with Kelthane or Comite or a tank-mix of Kelthane plus Comite. Tank-mixes of Savey plus Kelthane were very effective treatment although the tank-mix was not significantly better than Kelthane or Savey alone at the higher rates.

Six studies were conducted in 1996 in which Savey was evaluated against spider mites in cotton. Five of these studies were replicated small plot studies where Savey was applied at 2, 3 and 4 oz/A. In a portion of these studies Savey tank-mixes were evaluated. The sixth study was a semi-commercial large plot study.

In small plot studies (Tables 6 - 9), Savey provided commercially acceptable control of low to moderate populations of spider mites similar to that achieved by Zephyr. Tank-mixes with Zephyr did not improve spider mite control significantly.

In one study (Table 10), Savey was applied to a high mite population on moderately-sized actively growing cotton. Because Savey has no effect on mite adults, is not systemic, and lacks translaminar activity, significant control was never achieved in the Savey treatments in this study. This trial clearly demonstrates the need to apply Savey early, to building populations, where it can most effectively control eggs and immature mites.

In the large plot semi-commercial study (Table 11), Savey was applied to a moderate-heavy spider mite population. At 3 oz/A, Savey provided spider mite control similar to that achieved with Zephyr. A tank-mix of Savey and Zephyr did not significantly improve control compared to Savey alone.

Historic data (Table 12) indicate that Savey does not cause adverse effects on beneficial/ predatory species in cotton. This is the same trend that has been observed in other crops where Savey is used commercially.

Phytotoxicity was not observed in any of the studies. Yield data (Table 5) indicates that mite control with Savey can result in significant yield increases.

Summary

Historic and current data demonstrate that Savey can offer commercially acceptable control of spider mites in California cotton. Use rates in the 3 - 5 oz/A range appear to provide the best control. Tank-mixes of Savey with commercially available miticide standards provided good efficacy however the level of control was not significantly better than that achieved with the higher rates of Savey alone. Savey does not adversely effect beneficial species in cotton. Also, the use of Savey for mite control can result in cotton yield increases. Thus it can be concluded that Savey can be a very useful tool: 1) to control low - moderate mite populations that are building in cotton early season; 2) by providing growers with an IPM tool since Savey has less affect on beneficial insects and predatory mites; and 3) by providing growers with an alternative early-season mite control product for use in a resistance management program.

Literature Cited

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Table 1: Mean Percent Spider Mite Control from Savey 50WP applied in 14 California Cotton Trials from 1984 to 1988.

Mean Percent Spider Mite Control					
Savey 50-WP Product Rate (oz/A)	21-30 DAT	31-40 DAT	41-50 DAT	51-60 DAT	61+ DAT
2	75.3(9)	65.0(3)	90.8(9)	89.4 (4)	71.8 (1)
3	92.4(10)	83.3(3)	83.0(9)	72.7 (4)	67.2 (1)
4	86.1(10)	90.3(3)	94.7(9)	91.8 (4)	69.0 (1)
5	98.4(4)	92.2(3)	90.6(8)	94.6 (4)	83.0 (4)
TM	96.8(4)	99.9(1)	98.2(4)	92.0 (2)	85.3 (1)
Standard	85.7(14)	83.4(7)	94.4(9)	96.8 (3)	74.1 (4)

TM = Savey 50-WP at 3 to 4 oz/A tank-mixed with Comite or Kelthane
 Standard = Comite or Kelthane
 DAT = Days after treatment
 (x) = Total number of observations

Table 2: Efficacy of Savey 50-WP against Twospotted Spider Mites on Cotton in Kerman, CA in 1986 (Nord Farm).

Mean Percent Mite Control				
Savey 50-WP Product Rate (oz/A)	14 DAT	42 DAT	49 DAT	56 DAT
Untreated*	7.5	21.3	24.6	22.7
2	98.8	92.0	94.7	87.2
3	99.4	94.3	97.2	88.5
4	96.6	95.8	96.8	87.8
5	97.1	96.7	98.0	93.4
TM	99.4	97.2	98.8	96.5
Standard	100	99.1	98.0	99.6

*Numbers in the untreated row are the number of mites per leaf
 TM = Savey 50 - WP + Kelthane at 3 oz/A + 1.5 qt/A
 Standard = Kelthane at 1.5 qt/A
 DAT = Days after treatment

Table 3: Efficacy of Savey 50-WP against Twospotted Spider Mites and Strawberry Spider Mites on Cotton in Kerman, CA in 1986 (A & H Farms).

Mean Percent Mite Control			
Savey 50-WP Product Rate (oz/A)	35 DAT	49 DAT	56 DAT
Untreated*	18.3	1.3	20.1
2	96.7	100	95.0
3	69.4	0.0	86.1
4	96.7	92.3	97.5
5	82.5	53.8	95.5
Standard	94.5	100	96.5

*Numbers in the untreated row are the number of mites per leaf
 Standard = Comite + Kelthane at 1.5 pt/A + 1.0 qt/A
 DAT = Days after treatment

Table 4: Efficacy of Savey 50-WP against Twospotted Spider Mites on Cotton in Madera, CA in 1987.

Mean Percent Mite Control				
Savey 50-WP Product Rate (oz/A)	21 DAT	35 DAT	44 DAT	49 DAT
Untreated*	9.9	11.4	5.1	2.4
2	100	98.2	98.0	54.2
3	100	98.2	96.1	79.2
4	100	100	94.1	83.3
5	100	97.4	94.1	87.5
Standard	100	98.2	96.1	66.7

*Numbers in the untreated row are the number of mites per leaf
 Standard = Comite at 1.5 pt/A
 DAT = Days after treatment

Table 5: Efficacy of Savey 50-WP against Twospotted Spider Mites on Cotton in Kerman, CA in 1987.

Mean Percent Mite Control				
Savey 50-WP Product Rate (oz/A)	7 DAT	14 DAT	22 DAT	42 DAT
Untreated*	29.0	26.5	44.2	67.4
2	92.4	79.6	97.6	94.5
3	75.2	90.6	100	98.5
4	74.1	88.7	96.4	99.1
5	84.5	92.4	97.2	99.2
TM	87.9	95.5	99.3	98.2
Standard	85.5	97.0	99.0	98.5

Savey 50-WP Product Rate (oz/A)	55 DAT	64 DAT	LB Seed Cot./A
Untreated*	47.8	25.6	1767
2	84.3	71.8	4290
3	84.5	67.2	5020
4	88.5	69.9	5957
5	95.8	83.4	4937
TM	87.4	85.3	4833
Standard	94.4	74.1	5000

*Numbers in the untreated row are the number of mites per leaf
 TM = Savey 50 - WP + Kelthane at 3 oz/A + 1.5 qt/A
 Standard = Kelthane at 1.5 qt/A
 DAT = Days after treatment

Table 6: Efficacy of Savey 50-WP against Twospotted Spider Mites on Cotton in Dos Palos, CA in 1996.

Mean Percent Mite Control			
Savey 50-WP Product Rate (oz/A)	8 DAT	22 DAT	28 DAT
Untreated*	1.87	4.23	2.03
2	84.0	22.0	71.0
3	81.0	50.0	4.0
4	84.0	83.0	90.0
TM	89.0	95.0	100.0
Standard	100.0	100.0	100.0

*Numbers in the untreated row are the number of mites per leaf
 TM = Savey 50 - WP + Zephyr at 2 oz/A + 8 oz/A
 Standard = Zephyr at 8 oz/A
 DAT = Days after treatment

Table 7: Efficacy of Savey 50-WP against Twospotted Spider Mites on Cotton in Goshen, CA in 1996.

Savey 50-WP Product Rate (oz/A)	Mean Percent Mite Control	
	27 DAT	34 DAT
Untreated*	13.07	27.90
2	86.0	81.0
3	95.0	73.0
4	75.0	82.0
TM	90.0	89.0
Standard	82.0	46.0

*Numbers in the untreated row are the number of mites per leaf
 TM = Savey 50 - WP + Zephyr at 2 oz/A + 4 oz/A
 Standard = Zephyr at 4 oz/A
 DAT = Days after treatment

Table 8: Efficacy of Savey 50-WP against Twospotted Spider Mites on Cotton in Kern County, CA in 1996.

Savey 50-WP Product Rate (oz/A)	Mean number of Mites/Leaf			
	0 DAT	16 DAT	30 DAT	37 DAT
2	4.2	2.93	3.93	6.08
3	4.2	2.18	0.45	1.35
4	4.2	3.33	1.75	0.90
TM	4.2	0.55	0.68	0.83
Standard	4.2	1.68	0.73	0.83

TM = Savey 50 - WP + Zephyr at 2 oz/A + 4 oz/A
 Standard = Zephyr at 8 oz/A
 DAT = Days after treatment

Table 9: Efficacy of Savey 50-WP against Twospotted Spider Mites on Cotton in Madera, CA in 1996.

Savey 50-WP Product Rate (oz/A)	Mean Percent Mite Control		
	12 DAT	16 DAT	34 DAT
Untreated*	10.0	33.0	15.0
2	80.0	27.3	6.7
3	100.0	51.5	6.7
4	60.0	63.6	6.7
TM	80.0	63.6	86.7
Standard	100.0	69.7	60.0

*Numbers in the untreated row are the number of mites per leaf
 TM = Savey 50 - WP + Zephyr at 2 oz/A + 4 oz/A
 Standard = Zephyr at 8 oz/A
 DAT = Days after treatment

Table 10: Efficacy of Savey 50-WP against Twospotted Spider Mites on Cotton in Five Points, CA in 1996.

Savey 50-WP Product Rate (oz/A)	Mean Percent Mite Control		
	14 DAT	28 DAT	35 DAT
Untreated*	86.8	77.7	153.0
2	34.6	9.8	35.0
3	0.0	36.6	51.5
4	33.6	31.7	44.8
TM	73.2	89.4	77.5
Standard	98.4	87.3	68.6

TM = Savey 50 - WP + Zephyr at 2 oz/A + 4 oz/A
 Standard = Zephyr at 8 oz/A
 DAT = Days after treatment

Table 11: Efficacy of Savey 50 - WP against Spider Mites on Cotton in a Semi-commercial Study in Bakersfield, CA in 1996.

Savey 50-WP Product Rate (oz/A)	Mean Number of Mites/Leaf				
	0 DAT	14 DAT	28 DAT	35 DAT	48 DAT
3	4.0	0.1	1.7	1.5	3.5
TM	4.0	0.1	1.7	1.2	12.9
Standard	4.0	0.0	1.1	3.2	7.5

TM = Savey 50 - WP + Zephyr at 2 oz/A + 3 oz/A
 Standard = Zephyr at 6 oz/A
 DAT = Days after treatment

Table 12: Effect of Savey 50-WP against Bigeyed Bugs and Thrips on Cotton in Kerman, CA in 1986 (A & H Farms).

Savey 50-WP Product Rate (oz/A)	Mean number of Beneficials/Sample		
	14 DAT	49 DAT	61 DAT
0	0.08	0.02	0.1
2	0.2	0.4	0.0
3	0.0	0.0	0.1
4	0.08	0.1	0.2
5	0.05	0.05	0.0
Standard	0.08	0.2	0.1

Standard = Comite + Kelthane at 1.5 pt/A + 1.0 qt/A
 DAT = Days after treatment