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APRIL 1982

Insecticides Applied at Planting Time or as Foliar Sprays to Control Chinch Bugs on Grain Sorghum

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In recent years large areas of the sorghum crop in central and eastern Kansas have been damaged repeatedly by chinch bugs. The outbreak was more severe than at any time since the 1930's and overwintering numbers (as counted in the spring of 1981) were higher than at any time in recorded history. Research has been underway since the mid-1970's to identify ways of preventing or reducing damage. One approach has been to apply systemic insecticides to sorghum or corn at planting time to provide protection to the emerging seedling. The most promising method in that approach has been to apply granular carbofuran (Furadan) in furrow. With adequate soil moisture, it has protected the seedling plants about 3 weeks. Another approach has been to use rescue treatments by applying insecticides as foliar sprays directed toward the base of the plants where the bugs are congregated. In previous studies we have obtained an excellent degree of knockdown with carbaryl (Sevin) or carbofuran (Furadan) applied in this manner. Observations and data do indicate, however, that most foliar applied insecticides have a relatively short period of residual performance and must be applied frequently under conditions of reinfestation.

In 1981 we continued our studies on both planting-time and foliar treatments using both labeled and experimental nonlabeled compounds. Results for 1981 are presented here.

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AGRICULTURAL EXPERIMENT STATION
Kansas State University, Manhattan
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Results with the use of planting time insecticides

In the first test on sorghum planted next to wheat on June 5, granular applications were applied at planting and evaluated at 11 and 18 days afterwards (Table 1). The infurrow treatment of carbofuran and Tattoo significantly reduced chinch bug numbers and increased plant survival. In the second test on sorghum planted June 17, granular and liquid formulations were evaluated at 10, 20 and 29 days after planting (Table 2). At day 10 all treatments had significantly reduced chinch bug numbers. At day 20, only plants treated with liquid carbofuran (Furadan 4F) combined with liquid fertilizer or with RH 9358, an experimental insecticide, were infested with significantly fewer bugs than were the untreated check plants. At 29 days, only plots treated with liquid carbofuran (Furadan 4F plus fertilizer), Advantage 4EC plus fertilizer or Furadan 4F alone at 1 lb. Al/acre had significantly fewer stunted plants than did the untreated or those with liquid fertilizer alone.

Table 1. Insecticides applied to sorghum at planting time to control chinch bugs. Test 1. Manhattan, Kansas 1981.

Insecticide	Status ³	Form.	lb. Al/acre 40" rows	Place- ment	Mean no. % plant ² bugs ^{1,2} survival	
					6/16	6/23
Counter	NR	15G	1.0	Furrow	26.4 a	4.3 c
Counter	NR	15G	1.0	Band	22.9 ab	0.3 c
Untreated	—	—	—	—	21.6 ab	1.7 c
Furadan	R	15G	1.0	Furrow	11.3 c	79.6 b
Furadan	R	10G	1.0	Furrow	8.2 c	91.0 a
Furadan	NR	10G	1.0 + 1.0	Furrow + 4" below furrow	7.2 c	88.3 a
Tattoo	NR	10G	1.0	Furrow	6.4 c	84.3 ab

¹ Bugs counted on 5 plants per replication.

² Means followed by the same letter in the same column are not significantly different at the .05 level. Waller-Duncan K Ratio T. Test. LSD—7.04.

³ R = Registered for use; NR = Experimental, not registered.

Table 2. Insecticides applied to sorghum at planting time to control chinch bugs. Test 2. Manhattan, Kansas 1981.

Chemical	Status ³	Form.	Al/acre 40" rows	Placement	Mean no. bugs plant ^{1,2}		% plants stunted ²
					10 days	20 days	29 days
Untreated					10.5 a	17.5 a	72.0 a
Liquid fertilizer					10.4 a	17.9 a	79.6 a
Advantage + fertilizer	NR	4EC	1.0	Furrow	4.9 b	15.6 ab	29.0 cd
Counter	NR	15G	1.0	Furrow	4.7 bc	15.1 ab	72.3 a
Advantage	NR	4EC	2.0	Furrow	4.5 bcd	17.6 a	56.0 abc
Counter	NR	15G	1.0	Band	4.4 bcd	15.0 ab	49.0 abc
Advantage	NR	4EC	1.0	Furrow	3.6 bcd	18.5 a	66.0 ab
Furadan	R	15G	1.0	Furrow	3.4 bcde	16.7 a	62.0 abc
Tattoo	NR	10G	1.0	Furrow	3.3 bcde	17.9 a	73.0 a
RH 9358	NR	5G	1.0	Band	2.9 bcde	17.6 a	68.3 ab
Furadan	R	10G	1.0	Furrow	2.7 bcde	15.0 ab	56.6 abc
Furadan + fertilizer	R	4F	1.0	Furrow	2.3 bcde	12.4 b	9.3 d
Furadan	R	4F	1.0	Furrow	2.0 cde	15.5 ab	34.0 bcd
Furadan	NR	4F	2.0	Furrow	1.7 de	15.7 ab	59.6 abc
RH 9358	NR	5G	2.0	Band	0.8 e	12.9 b	68.3 ab

¹ Twenty bug cages per plant on 4 plants per replicate. Surviving bug count made after bugs were allowed to feed for 2 days.

² Means with the same letter are not significantly different at 5% level.

³ R—Registered; NR—Experimental, not registered.

Results with foliar applied insecticides

In two tests involving grain sorghum at Manhattan in 1981, we evaluated various labeled and experimental nonlabeled compounds in foliar applications for chinch bug control. In these studies, the initial knockdown of chinch bugs was indicated in the counts that were made one day after treatment, and residual performance noted 4, 8, and 14 days after the treatment counts. All insecticides significantly reduced chinch bug numbers, as counted one day after treatment. The degree of reduction, however, ranged from 99.7% with fenvalerate (Pydrin) to 19.3% with phorate (Thimet 15G) in Test 1 (Table 3); and from 100% with FCR 1272 to 26% with Aspon at the 1½ lb. per acre rate in Test 2 (Table 4). Of the insecticides labeled for chinch bugs on sorghum in the first test, Lorsban at the .75 lb. rate gave the best residual performance as judged at 4, 8, and 14 days after treatment. FCR 1272, an experimental compound that also provided

good initial and residual control, deserves further study. In Test 2, a few treatments showed residual activity on the 4th day but by the 14th day, only Endrin, Lorsban at 0.75 lb. AI/acre, and FCR 1272 at 1.0 lb. AI/acre were continuing to provide some control.

Discussion

Our studies indicated that infurrow applications of liquid carbofuran are as effective as granular formulations. The liquid might have a slight advantage under dry soil conditions; that difference, however, might not be enough to warrant the additional hazard encountered in handling the liquid solutions during the busy process of planting. The use of carbofuran as a liquid combined in a tank mix with a starter fertilizer, applied infurrow at planting time, appeared to offer some advantage in terms

Table 3. Efficacy of foliar insecticides on chinch bugs on grain sorghum. Test 1. Manhattan, Kansas 1981.

Treatment	Status ^f	Form.	Rate (lbs. A.I./A)	Mean No. Chinch Bugs ^{abe}			
				1 DAT ^c 7/17	4 DAT 7/21	8 DAT 7/24	14 DAT 7/30 ^d
Untreated	—	—	—	21.8 a	28.9 ab	19.8 ab	24.2 a
Untreated	—	—	—	16.6 b	22.9 c	19.5 ab	—
Thimet	NR	15G	1.0	13.4 c	24.9 bc	18.2 abcd	—
Trithion	NR	8E	0.5	6.3 c	24.8 bc	21.0 a	—
Aspon	NR	6E	3.0	4.4 d	30.7 a	19.0 abc	—
Trithion	NR	8E	1.0	3.0 de	22.5 cd	17.9 abcd	—
Oncol	NR	40% EC	0.5	2.9 de	25.6 bc	21.1 a	—
Aspon	NR	6E	1.5	2.1 ef	22.8 c	17.8 abcd	—
Endrin	NR	1.6EC	0.25	1.5 efg	15.0 gh	13.0 def	9.7 bc
Lorsban	R	4E + oil	0.5	1.5 efg	11.6 gh	16.6 bcde	—
Lorsban	R	4E	0.75	0.9 fg	11.3 gh	11.2 f	10.0 bc
Dyfonate	NR	4E	1.0	0.9 fg	18.5 def	17.0 abcde	—
Lorsban	R	4E	0.5	0.8 fg	14.5 fg	14.0 def	—
Sevin	R	4SLR	1.5	0.7 fg	24.5 bc	18.5 abc	—
Sumithion	NR	8E	0.5	0.7 fg	18.2 ef	17.1 abcde	—
Endrin	NR	1.6	0.5	0.6 fg	8.5 h	6.0 g	5.4 d
Advantage	NR	4EC	0.5	0.5 fg	22.5 cd	18.0 abc	—
Lorsban	R	4E + oil	0.75	0.5 fg	9.9 h	6.7 g	8.1 cd
Amaze	NR	6E	0.5	0.4 fg	17.9 ef	16.9 bcde	—
Furadan	R	4F	0.5	0.3 g	21.6 cde	13.3 ef	—
FCR 1272	NR	200EC	0.05	0.3 g	3.4 i	15.1 cdef	—
FCR 1272	NR	200EC	0.10	0.1 g	1.4 i	4.5 g	6.5 cd
FCR 1272	NR	200EC	0.025	0.1 g	4.0 i	19.8 ab	—
Pydrin	NR	2.4EC	0.15	0.05	1.0 i	12.0 f	12.7 b

^a Average of 3 replications, 8 plants per replicate.

^b Means in the same column followed by the same letter are not significantly different at the .05 level. Waller-Duncan K-Ratio T Test.

^c DAT = Days after treatment.

^d Counts made only on treatments showing consistent residual activity.

^e LSD for counts on 7/17, 7/21, 7/24, and 7/30: 1.71, 4.22, 4.0, and 3.16, respectively.

^f R = Registered, NR = Experimental, not registered.

of reduced injury to sorghum plants. The current Kansas 24(c) label, written so as to not prohibit it from being combined with starter fertilizer, allows Furadan 4F to be applied as a liquid infurrow treatment. But the user does that at his own risk, and a few growers have reported severe stand losses where Furadan 4F combined with certain starter fertilizer mixtures had been used. Growers are advised to investigate that possibility closely with chemical representatives and fertilizer dealers before electing to use this approach.

The results of our foliar studies showed that carbaryl (Sevin), carbofuran (Furadan 4F), chlorpyrifos (Lorsban 4E), all of which are registered for controlling chinch bugs on sorghum, gave good initial control of chinch bugs under the conditions of these two studies, and showed that chlorpyrifos (Lorsban 4E) might have some advantage in residual performance in controlling infestations if a continuing migration into the field is expected.

Table 4. Efficacy of foliar insecticides on chinch bugs on grain sorghum. Test 2. Manhattan, Kansas 1981.

Treatment	Status ^f	Form.	Rate (lbs AI/a)	Mean no. chinch bugs ^{abe}			
				1 DAT ³ 7/17	4 DAT 7/21	8 DAT 7/24	14 DAT ^d 7/30
Untreated				16.2 a	26.7 ab	27.8 bcde	21.2 a
Untreated				14.0 b	23.3 bcd	25.8 cdefg	—
Aspon	NR	6E	1.5	12.0 c	27.3 ab	32.4 b	—
Thimet	NR	15G	1.0	9.7 d	24.0 abc	24.9 cdef	—
Trithion	NR	8E	0.5	6.7 c	27.1 ab	29.8 bc	—
Oncol	NR	40% EC	0.5	5.8 ef	23.9 bc	28.5 bcd	—
Aspon	NR	6E	3.0	5.2 ef	23.7 bc	26.5 cdef	—
Trithion	NR	8E	1.0	4.0 f	23.8 bc	39.8 a	—
Sumthion	NR	8E	0.5	2.0 g	21.3 cde	26.8 bcdef	—
Lorsban	R	4E	0.5	1.4 g	26.4 abc	23.0 defg	—
Dyfonate	NR	4E	1.0	1.3 g	18.1 def	22.4 efg	—
Advantage	NR	4EC	0.5	1.3 g	14.8 fg	15.5 ij	—
Endrin	NR	1.6EC	0.25	1.2 g	20.3 cdef	15.7 ghi	7.0 c
Sevin	R	4SLR	1.5	1.1 g	25.0 abc	30.7 bc	—
Endrin	NR	1.6E	0.5	1.0 g	13.5 ghij	14.4 hi	6.2 c
Lorsban	R	4E	0.75	0.9 g	7.7 hij	14.7 ij	9.3 bc
Amaze	NR	6E	0.5	0.8 g	17.3 ef	22.4 efg	—
Lorsban	R	4E + oil	0.5	0.4 g	14.8 fg	21.5 fgh	—
Lorsban	R	4E + oil	0.75	0.3 g	11.3 gh	11.7 j	13.0 b
Furadan	R	4F	0.5	0.3 g	29.8 a	24.3 cdefg	—
FCR 1272	NR	200EC	0.10	0.1 g	2.7 j	10.3 j	12.8 b
FCR 1271	NR	200EC	0.025	0.08 g	10.4 ghi	28.5 bcd	—
Pydrin	NR	2.4 EC	0.15	0.04 g	5.1 ij	16.0 hij	19.8 a
FCR 1272	NR	200EC	0.05	0.0 g	7.6 hij	20.3 ghi	—

^a Average of 3 replications, 8 plants per replicate.

^b Means in the same column followed by the same letters are not significantly different at the .05 level. Duncan's new multiple range test 7/17; Waller-Duncan K Ratio T Test 7/21, 7/24, and 7/30.

^c DAT = Days after treatment.

^d Counts made only on treatments showing consistent residual activity.

^e LSD for 7/21, 7/24, and 7/30: 5.29, 5.81, and 4.78, respectively.

^f R = Registered; NR = Experimental, not registered.