Subtropical Plant Science, 48: 25-28.1996

Effect of Insecticides on Okra, Squash and Southern Pea Seeds

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Additional index words. Insecticides, okra seed, squash seed, southern pea seed, germination.

ABSTRACT

A lab bioassay was conducted to determine the effect of the insecticides carbofuran (2,3-dihydro- 2,2-dimethyl-7-benzofuranyl N-methyl carbamate) and thiodicarb (etanimidotioic acid,N,N-tiobis- (metilimino) carboniloxy bisester dimethylic) on okra, squash and southern pea germination. These insecticides are labeled in Mexico for seed treatment in crops such as corn, sorghum, rice and wheat for grubworm control. Carbofuran was used at rates of 0.0, 0.3, 0.45, 0.6, 0.75, 0.9, 1.05 and 1.2 kg (AI) per 100 kg of seed. Thiodicarb rates were 0.0, 0.35, 0.53, 0.70, 0.88, 1.05, 1.28 and 1.4 kg (AI) per 100 kg of seed. Okra seeds showed significant reduction in the percentage of germination at rates of 0.75 or greater of carbofuran but was affected much less by thiodicarb. Squash seeds percentage of germination was more affected at the highest three rates of carbofuran while less percentage reduction on seeds germination was observed with thiodicarb. Southern pea seeds percentage of germination was severely affected with carbofuran at every different rate, being less affected by thiodicarb.

RESUMEN

Un ensayo de laboratorio fue conducido para determinar el efecto de los insecticidas carbofuran (2,3-dihidro-2,2-dimetil-7-benzofuranol N-metil carbamato) y thiodicarb (ácido etanimidotioico,N,N-tiobis-(metilimino) carboniloxi bisester dimetílico) en la germinación de semillas de okra, calabacita y chícharo. Estos insecticidas se recomiendan en México para tratamiento a semillas de maíz, sorgo, arroz y trigo para control de gallina ciega. Carbofuran se aplicó a dosis de 0.0, 0.3, 0.45, 0.6, 0.75, 0.9, 1.05 y 1.2 kg de IA por 100 kg de semilla. Las dosis de thiodicarb fueron 0.0, 0.35, 0.53, 0.70, 0.88, 1.05, 1.28 y 1.4 kg de IA por 100 kg de semilla. Las semillas de okra mostraron una reducción significante en los porcentajes de germinación a dosis de 0.75 o mayores, de carbofuran, pero fueron afectadas mucho menos por thiodicarb. El porcentaje de germinación de semillas de calabacita fue más afectado a las tres mayores dosis de carbofuran mientras que reducciones menos drásticas de la germinación de semillas fue observada con thiodicarb. El porcentaje de germinación de semillas de chícharo fue severamente afectado por carbofuran en todas las dosis y fue menos afectado por thiodicarb.

Horticultural crops are grown in Northern Tamaulipas in approximately ten thousand hectares. Most important vegetables are: okra, southern pea, squash, tomato, pepper, melon, watermelon and pea (Díaz and Leal, 1992).

Among other problems, vegetables are affected by soil insects which, fortunately, can be controlled by granular insecticides applied as sidedress at planting time. However, growers are not used to apply these formulations due to lack of the proper equipment.

Carbofuran and thiodicarb insecticides have been formulated as Furadan 300 and Semevin 350, respectively, for seed treatment. They are sprayed directly onto seeds immediately before planting. These insecticides are carbamates with systemic and contact action. Furadan is also a nematicide. Both formulations are labeled in Mexico for use in crops as: corn, sorghum, rice and wheat to control grubworms and other insects such as cutworms, armyworms, lesser corn stalk borer (Pacheco, 1987) and sucking insects attacking at early plant stages.

Application rates may vary from 1.5 to 5.0 liters (actual formulation) 100 kg^{-1} of seed, depending on the type of seed. Seed germination must be considered when these insecticides are going to be used in non-labeled crops. Therefore, studies were initiated to determine the effect on seed germination when carbofuran and thiodicarb are used on okra, squash and southern pea seeds.

MATERIALS AND METHODS

The assay was conducted in the Rio Bravo Experiment Station Laboratory. Carbofuran was utilized at rates (treatments) of 0.0 (check), 0.3, 0.45, 0.6, 0.75, 0.9, 1.05 and 1.2 kg (AI) per 100 kg of seed. Thiodicarb rates were 0.0 (check), 0.35, 0.53, 0.70, 0.88, 1.05. 1.28 and 1.4 kg (Al) per 100 kg of seed. The test included okra, squash and southern pea seeds.

Five hundred grams samples of each seed type were treated with each insecticide rate (treatments). Seed treatments were made by diluting the corresponding amount of insecticide in 5 cc of water and mixing it with the seed by hand in a small glass container. A good coverage was easily observed due to the coloration of each insecticide. Seed samples were let to dry on a small screen for 30 minutes.

Four groups (replications), each of one hundred seeds randomly selected, were obtained from every five hundred grams insecticide treated sample and arranged in petri dishes.

Table 1. Germination percentages of okra, squash and southpea seeds after treated with divers rates of carbofuran and thiodicarb (1992).

Insecticide	rate	seed germination		
		okra	squash	southern pea
	kg AI·100 kg seed^{-1}	---------- % ----------		
carbofuran	0	99 ab[a]	100 a	60 a
	0.3	100 a	98 abc	19 d
	0.45	99 ab	99 ab	19 d
	0.6	100 a	97 bcd	18 d
	0.75	96 c	87 e	16 d
	0.9	94 d	62 f	18 d
	1.05	94 d	[b]	16 d
	1.2	85 c	[b]	16 d
thiodicarb	0	99 ab	100 a	60 a
	0.35	99 ab	96 cd	60 a
	0.53	98 b	95 d	58 a
	0.7	99 ab	98 abc	58 a
	0.88	98 b	97 bcd	52 b
	1.05	99 ab	95 d	50 bc
	1.28	99 ab	[b]	52 b
	1.4	98 b	[b]	47 c

[a]means within columns followed by the same letter are not significantly different (P≤0.05)
[b]no tested

Seeds were located between two humid paper towel layers in petri dishes and maintained in an incubator held at 30°C. Seed germination counts were made after four days. No later seed germination was observed. A germinated seed was counted when its radicle had emerged, then, percentage of seed germination was determined for each treatment.

Numbers of germinated seeds were analyzed under a randomized design and means were separated by Duncan's test. Significant treatments (P≤0.05) were then fitted with a response equation to define the functional relationship between seeds germination and insecticides dosages.

RESULTS

Effect of carbofuran and thiodicarb on germination of okra seeds. ANOVA results of these data indicated that carbofuran did adversely influence (P≤0.05) okra seeds germination while no detectable effects were observed with thiodicarb (Table 1). A quadratic response curve (r^2=0.89) for okra seeds treated with carbofuran showed that percentage of germination diminished when rates of 0.75, 0.9, 1.05 and 1.2 were used (Fig. 1). Response to thiodicarb is shown in Fig. 2.

Effect of carbofuran and thiodicarbon on germination of squash

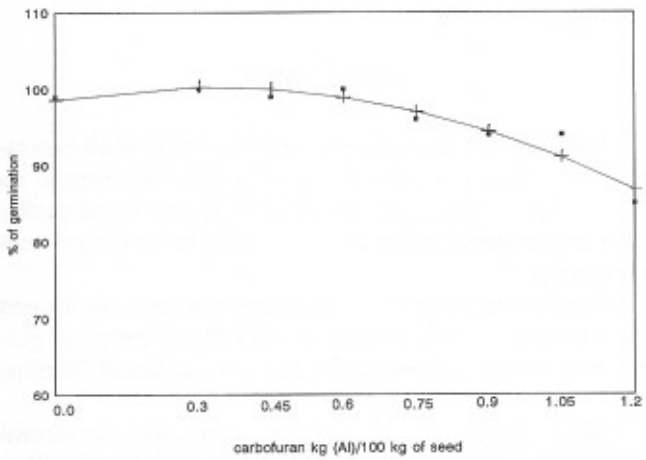

Fig. 1. Percentage of germination of okra seeds treated with different rates of carbofuran (Y = 98.5980 + 3.2514x - 1,5504 x^2), r^2 = 0.89

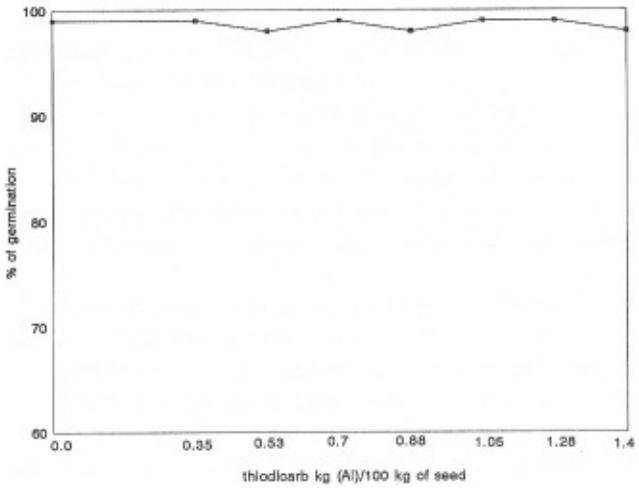

Fig. 2. Percentage of germination of okra seeds treated with different rates of thiodicarb (anova not significant)

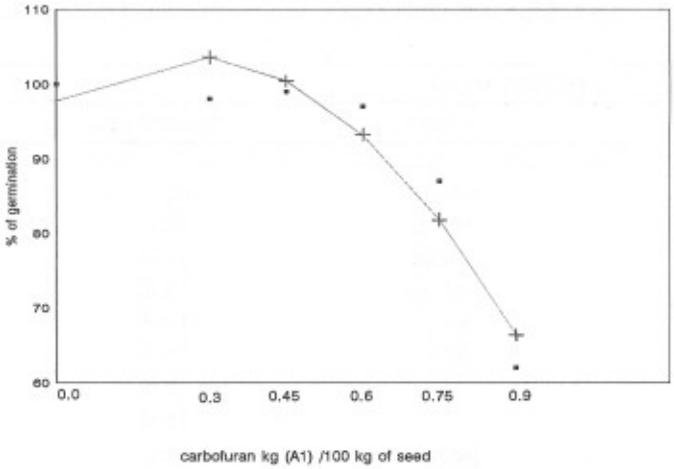

Fig. 3. Percentage of germination of squash seeds treated with different rates or carbofuran ($Y = 97.75 + 13.9714x - 8.1428x^2$), $r^2 = 0.89$

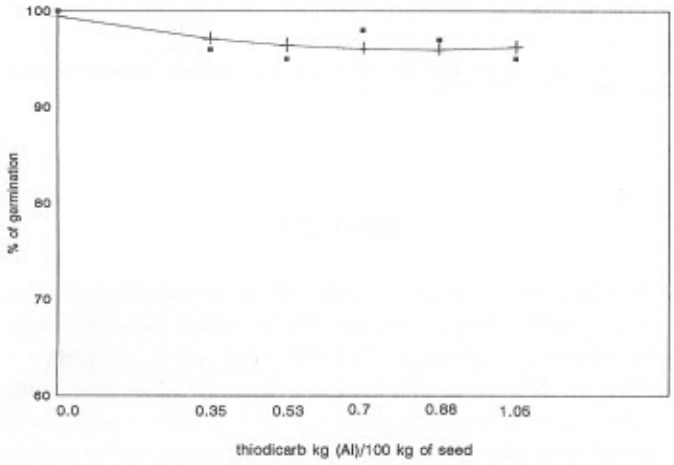

Fig. 4. Percentage of germination of squash seeds treated with different rates or thiodicarb ($Y = 99.4166 - 2.9428x + 0.6190x^2$), $r^2 = 0.36$

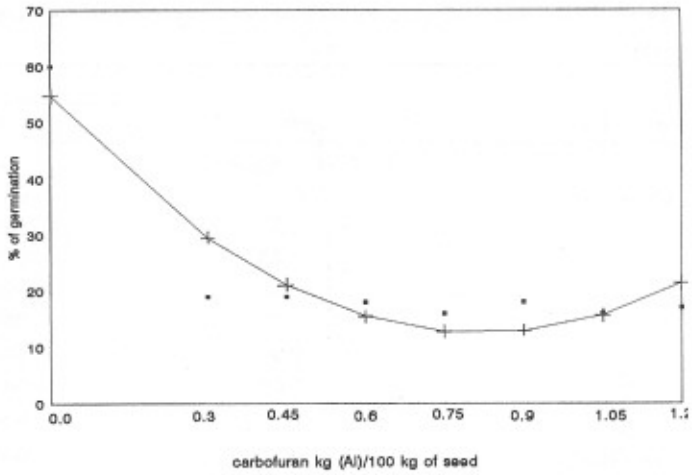

Fig. 5. Percentage of germination of southern pea seeds treated with different rates or carbofuran ($Y = 54.7450 - 30.9131x + 5.6358x^2$), $r^2 = 0.85$

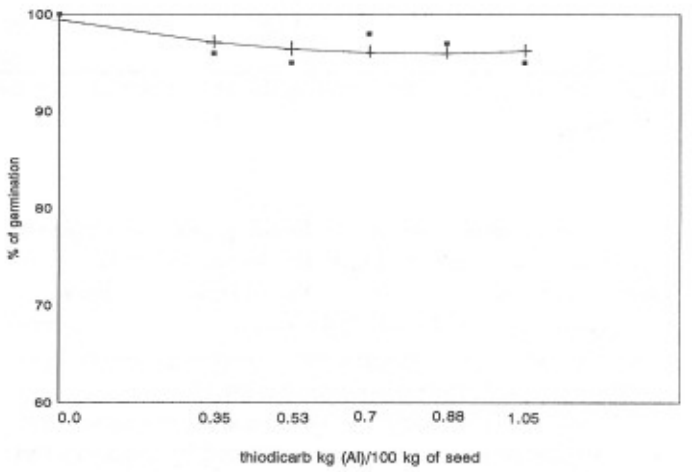

Fig. 6. Percentage of germination of southern pea seeds treated with different rates or thiodicarb ($Y = 60.7058 - 1.1470x - 0.5630x^2$), $r^2 = 0.65$

seeds. ANOVA results of these data indicated that both insecticides adversely affected ($P \leq 0.05$) squash seeds germination, however, less effects were observed with thiodicarb (Table 1). A quadratic response curve ($r^2=0.89$) for squash seeds treated with carbofuran indicated that percentage of germination was reduced when the highest dosages of 0.6, 0.75 and 0.9 were applied (Fig. 3). When treated with thiodicarb, squash seeds germination showed a slight quadratic response curve ($r^2=0.36$) (Fig. 4).

Effect of carbofuran and thiodicarb on germination of southern pea seeds. ANOVA results of these data indicated that both insecticides adversely influenced (≤ 0.05) seed germination but less adverse effects were observed with thiodicarb (Table 1). A quadratic response curve ($r^2=0.85$) was indicated for germination of southern pea seeds treated with carbofuran, however, it showed some increase when rates of 1.05 and 1.2 were used (Fig. 5). When southern pea seeds were treated with thiodicarb, a quadratic response curve ($r^2=0.65$) showed that reduction of the percentage of germination was observed as dosages increased.

DISCUSSION

Different responses on seed germination may be expected after seeds are coated with insecticides. That depend on type of seed or type of insecticides and its rate. Good quality seeds are preferred when they are going to be treated with insecticides.

Previous tests on poor quality field bean seeds treated with carbofuran have resulted in reduced percentage of germination or vigor as insecticide rates were increased (Barrios, 1983).

Good quality corn or sorghum seeds have not shown reduced percentage of germination when treated with carbofuran at rates of 0.6 or 0.9 kg (AI)·100 kg^{-1} of seed. These rates have controlled soil insects, mainly grubworms (Loera and Byerly, 1991).

In our results, okra seed gave a good response to carbo-

furan applied at rates of 0.60 and lower, giving 99-100% of seed germination. It is considered that carbofuran rates 0.60 and lower are the safest to be used and efficient for soil insects control. Okra seed showed a very nice response to thiodicarb at all rates, giving 98-100% percentages of seed germination. It may be useful and cheaper to apply the 0.70 rate as it is recommended for control of soil insects in Mexico.

Squash seed treated with carbofuran at 0.30, 0.45 and 0.60 gave 97-100% percentages of seed germination. Squash seed showed an erratic response to thiodicarb, giving 95 or higher percentages of seed germination considering all rates.

We assume that southern pea was a poor quality seed as shown by the check which produced only 60% of seed germination. Carbofuran produced less than 20% of germinated seed and that response was similar at all rates. These great differences between the check and rates made that quadratic response showed some increase when rates of 1.05 and 1.2 were used (Fig. 5). When compared with the check, thiodicarb at lower rates (0.35, 0.53 and 0.7) did not affect seed germination. A reduction of seed germination was observed when higher rates were used. Another bio-assay to clarify these results may be conducted by using good quality southern pea seed.

Generally more adverse effects on seed germination were obtained when carbofuran was used as compared with thiodicarb but in most cases the recommended rates of 0.6 kg (carbofuran) and 0.7 kg (thiodicarb) can be used for okra, squash and southern pea seeds treatment.

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