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Effects of Seed Treatment with Fungicides and Systemic Insecticides on Stand of Cotton[1]

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ABSTRACT

In 1967 the insecticide, 0,0,diethyl-S-2- [(ethylthio) ethyl] phosphorodithioate (disulfoton), did not affect cotton (*Gossypium hirsutum* L.) seedling stands when used with the fungicide combinations of tetrachloroisophthalonitrile (chlorothalonil) + p-dimethylaminobenzenediazo sodium sulfonate (Dexon[3]) + 1,4-dichloro-2,5-dimethoxybenzene (chloroneb). However, it caused a slight reduction of the stand when used with chlorothalonil + N-(trichloromethylthio)-4-cyclohexene-1,2-dicarboximide (captan), as compared to seed treated only with fungicides. In another test, stands from acid-delinted seeds were not affected differentially by combination seed treatments of pentachloronitrobenzene + 3-trichloromethyl-5-ethoxy-1,2,4-thiadiazole (formulated as Terracoat L21[3]) and any of the systemic insecticides tested. However, stands from machine-delinted seeds were lower consistently with the combined fungicide-insecticide treatments, as compared to the fungicide treatment alone. In 1968 stands were increased by seed treatment with Terracoat L21 + disulfoton, or by the multiple-fungicide treatment of Terracoat L21 + methyl mercury-2,3-dihydroxy propyl mercaptide and methyl mercury acetate (Ceresan L[3]), as compared to seeds treated with only Terracoat L21. When an emulsifiable formulation of Terracoat L21, as compared to the oil-base seed treatment formulation, was used for seed treatment purposes, stands from the combination treatments were reduced.

Additional index words: ***Gossypium hirsutum*** **L., Chemical interactions.**

THE objective of the tests reported here was to compare the effects of seed treatments with fungicides and systemic insecticides on seedling stands of cotton (*Gossypium hirsutum* L.).

Cottonseed used for planting may be treated with fungicides and a systemic insecticide to control seedling diseases and insects that may damage seedlings. Observations made by the author during 1967 showed that some cottonseed, treated with two fungicides and a systemic insecticide, gave poor stands on the High Plains of Texas. Other cottonseed treated with the same chemicals gave good to excellent stands. Where stands were poor, most seeds germinated, but many seedlings did not emerge. The hypocotyl and radical tissues of emerged seedlings were short and enlarged, with very little elongation. Although soil temperature 20 cm deep was favorable for germination of cottonseed and emergence of seedlings, cold fronts moved through the area at approximately weekly intervals and thus kept the soil temperature at seed depth at a lower-than-normal level for several weeks. The low temperature contributed to delayed seedling emergence and seedling stunting.

LITERATURE REVIEW

Ranney (4) found that some combinations of pesticides were deleterious under most environmental conditions and that others were deleterious under specific conditions. Adverse interactions between fungicide and systemic insecticide treatments can occur if the materials are not compatible, even though both materials may be beneficial when used alone (5). Motsinger (2) pointed out that adverse weather and low-quality seed appeared to be the two factors most responsible for poor stands. Application of a seed-protectant fungicide, a systemic fungicide, and a systemic insecticide to low-quality seed resulted in poor stands in the field under adverse conditions, but resulted in good stands in the greenhouse under favorable conditions. The same materials applied to high-quality cottonseed resulted in good stands across a wide range of environmental conditions.

According to Primmer (3), stands were not affected by systemic insecticides applied to cottonseed planted May 11, 1967, but stands were reduced when seeds were planted 1 day later. Stands were reduced by certain granule insecticides and herbicides used alone and in combination. Some fungicides used with systemic insecticides reduced the phytotoxicity obtained with the latter pesticide (6).

Soil fungicides reduced the harmful effects obtained from herbicides and systemic insecticides (1). Weather conditions greatly influenced the amount of injury obtained when these materials were used alone and in combination.

MATERIALS AND METHODS

During March, Amarillo loam soil at the Texas A&M University Agricultural Research and Extension Center at Lubbock was prepared for planting. Prior to listing the soil into beds for planting, we applied α,α,α-trifluoro-2,6-dinitro-*N*,*N*-dipropyl-*p*-toluidine (trifluralin) at 0.67 kg/ha and disc-incorporated the herbicide 10 cm deep. Preplant irrigation was required only in 1967.

A four-row belt planter was used. It was equipped with seed press wheels and fish-tail covering drags to distribute uniformly and to cover seeds of 'Stoneville 213' with 5 cm of soil. In 1967 and 1968, 275 and 100 seeds, respectively, were planted per plot. Chemicals used for the seed treatments are listed in Table 1.

Experimental design was a randomized complete block, replicated six times. Each plot consisted of one row, 10 m long. Stand counts were made about 30 days after planting and reported as percent seed planted.

RESULTS AND DISCUSSION

1967 Tests: Percent seedling survival did not differ significantly among chemical treatments (Table 2). However, plant populations were higher for all chemical treatments than for the untreated check.

Significant differences in seedling survival occurred among the treatments for machine-delinted but not

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[3] Mention of a trademark or proprietary product does not constitute a guarantee or a warranty of the product by the US Department of Agriculture and does not imply its approval to the exclusion over other products that may also be suitable.

Table 1. Commercial chemicals used in interaction studies.

Common name	Trade name	Chemical name and concentration
		Fungicides
Captan	---	32% N-(trichloromethylthio)-4-cyclohexene-1,2-dicarboximide
---	Ceresan L	2.89% methyl mercury-2,3-dihydroxy propyl mercaptide and .62% methyl mercury acetate
Chloroneb	---	65% 1,4-dichloro-2,5-dimethyoxybenzene
---	Dexon	40% p-dimethyaminobenzene-diazo sodium sulfonate
---	Difolatan	32% N-(1,1,2,2,-tetra-chloroethylsulfenyl)-Cis--4-cyclohexene-1,2-dicarboximide
---	Terracoat L21	23% pentachloronitrobenzene and 12.5% 3-trichloromethyl-5-ethoxy-1,2,4-thiadiazole
Chlorothalonil	---	40% tetrachloroisophthalonitrile
		Insecticides
Disulfoton	---	95% O,O-diethyl-S-2-[(ethylthio)-ethyll phosphorodithioate
Monocrotophos	---	56% 3-hydroxy-N-methyl-cis-cortonamide dimethyl phosphate
Phorate	---	67.1% O,O-diethyl-S-[(ethylthio) methyll phosphorodithioate

Table 2. Survival of cotton seedlings grown from acid-delinted seeds treated with fungicides and a systemic insecticide, planted April 20, 1967.

Treatment	Rate, g-ml/kg	% Survival*
Ceresan L + chloroneb	1.30 + 6.25	53a
Chlorothalonil-Dexon (40+32) + chloroneb+disulfoton	1.25 + 6.25 + 4.50	53a
Chlorothalonil-Dexon (40+32) + chloroneb	1.25 + 6.25	50a
Chlorothalonil + Ceresan L	5.00 + 1.30	49a
Ceresan L	1.30	48a
Chlorothalonil - Difolatan (4C+32)	1.25	46a
Chlorothalonil - Difolatan (4C+32) + chloroneb	1.25 + 6.25	45a
Chlorothalonil-Captan (40+32) + chloroneb + disulfoton	1.25 + 6.25 + 4.50	40a
Check	---	27b

* Numbers followed by the same letter are not significantly different at the .05 level of probability according to Duncan's Multiple Range Test.

for acid-delinted seed (Table 3). Stands were reduced slightly when the rate of Terracoat L21 was increased from 10.4 to 15.6 ml/kg for machine-delinted seed. Disulfoton, monocrotophos, and phorate used with Terracoat L21 reduced stand either slightly or significantly as compared to only fungicide treatment. Disulfoton had the least adverse effect, and monocrotophos, the most adverse effect on stand.

The fact that the stand of machine-delinted seeds was lower than that of acid-delinted seeds was probably related to both lower seed quality and the higher rate of fungicide used to treat machine-delinted seeds. Also, chemicals are probably held longer by the fuzz of machine-delinted than by the seed coat of acid-delinted seeds. The slower germination of machine-delinted as compared to acid-delinted seeds may expose them longer to toxic levels of the chemicals.

1968 Test: Final stands were increased either slightly or significantly when Ceresan L, Terracoat L21 + Ceresan L, or Terracoat L21 was used with disulfoton, but final stands were reduced when Terracoat L21 EC (emulsifiable formulation) or Terracoat L21 EC + Ceresan L were used with the insecticide as compared to treatments with only fungicides (Table 4). Terracoat L21 + Ceresan L + disulfoton gave a slightly higher stand than Terracoat L21 EC + chloroneb + disulfoton. Terracoat L21 EC, used alone and in combination with Ceresan L, performed better than similar treatments with Terracoat L21. Terracoat L21 performed better than Terracoat L21 EC combined with disulfoton. Highest stands were obtained following treatment with Terracoat L21 EC + Ceresan L, and lowest stands were obtained following treatment with disulfoton. These data point out that compatibility of chemicals should be determined for different chemical formulations. Yield was not affected significantly by any of the treatments.

Table 3. Survival of cotton seedlings grown from acid and machine-delinted seeds treated with fungicides and systemic insecticides, planted April 20, 1967.

Treatment	Rate, ml/kg	% Survival*	Rate, ml/kg	% Survival*
	Acid-delinted seed		Machine-delinted seed	
Terracoat L21	7.8	35 a	10.4	34 a
Terracoat L21	10.4	35 a	15.6	32 ab
Terracoat L21 + disulfoton	7.8 + 4.5	30 a	10.4 + 4.5	32 ab
Terracoat L21 + disulfoton	10.4 + 4.5	39 a	15.6 + 4.5	29 ab
Terracoat L21 + monocrotophos	7.8 + 8.4	32 a	10.4 + 8.4	27 ab
Terracoat L21 + phorate	7.8 + 7.0	38 a	10.4 + 7.0	26 abc
Terracoat L21 + phorate	10.4 + 7.0	35 a	15.6 + 7.0	24 bcd
Terracoat L21 + monocrotophos	7.8 + 12.6	32 a	10.4 + 12.6	20 cd
Terracoat L21 + monocrotophos	10.4 + 12.6	31 a	15.6 + 12.6	18 cd
Terracoat L21 + monocrotophos	10.4 + 8.4	39 a	15.6 + 8.4	16 d

* Numbers followed by the same letter are not significantly different at the .05 level of probability according to Duncan's Multiple Range Test.

Table 4. Survival of cotton seedlings grown from acid-delinted seed treated with fungicides and a systemic insecticide, planted May 15, 1968.

Material	Rate, g-ml/kg	% survival on:* 6/15	7/5
Terracoat L21 (EC) + Ceresan L	7.8 + 1.3	10 b	22a
Ceresan L + disulfoton	1.3	9 bc	20ab
Terracoat L21 (EC)	7.8	13a	20ab
Terracoat L21 + Ceresan L + disulfoton	7.8 + 1.3 + 4.5	10 b	19ab
Terracoat L21 + Ceresan L	7.8 + 1.3	8 bc	16abc
Terracoat L21 (EC) + Ceresan L + disulfoton	7.8 + 1.3 + 4.5	9 bc	15 bc
Terracoat L21 + chloroneb + disulfoton	7.8 + 6.25 + 4.5	10 b	13 bc
Ceresan L	1.3	9 bc	12 bc
Terracoat L21 + disulfoton	7.8 + 4.5	10 b	12 bc
Terracoat L21	7.8	9 bc	11 cd
Terracoat L21 (EC) + disulfoton	7.8 + 4.5	4 d	7 de
Disulfoton	5.2	2 d	3 e

* Numbers followed by the same letter are not significantly different at the .05 level of probability according to Duncan's Multiple Range Test.

Seed treatments containing two or more fungicides did not always give significantly higher stands than treatments containing only one fungicide. Seed treatments containing fungicides + systemic insecticides usually gave lower stands than comparable fungicide treatments only. Retarded growth and increased post-emergence damping-off of seedlings were associated with treatments containing systemic insecticides. Machine-delinted seeds were more responsive to chemical seed treatments than acid-delinted seeds.

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