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Evaluation of Selected Seed Treatment Fungicides and Combinations for
Kenaf Stand Establishment

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INTRODUCTION

Kenaf (*Hibiscus cannabinus* L.), like cotton (*Gossypium hirsutum* L.), is a member of the family Malvaceae and is susceptible to a number of seed and seedling disease pathogens. These soilborne fungi attack kenaf in the first few days after planting, which affects emergence and stand establishment. Dempsey (1975) reported that *Rhizoctonia solani* Kühn, *Pythium* spp., and *Fusarium* spp. were primary causal agents of seedling diseases of fiber crops, including kenaf. According to White et al. (1970), soilborne diseases like damping-off and root rot could become a serious problem if kenaf production was intensified or if kenaf was planted after cotton. Thus, increased acreage of kenaf, intensive culture, or production following cotton could lead to severe kenaf seedling disease problems.

Seed treatment, generally with a combination of selective fungicides, is a standard practice for control of the seedling disease complex in cotton (Minton and Garber 1983). White et al. (1971) reported that kenaf emergence is generally greater for chemically treated versus nontreated seeds. Cook et al. (1992) found that at three of four locations in the Southwest, a seed treatment combination of metalaxyl, carboxin, and captan consistently resulted in greater stands than those achieved with nontreated seed. They suggested that these fungicides should be registered for use on kenaf to enhance emergence and stand uniformity. In 1997, data packages supporting the labeling of captan, carboxin, and metalaxyl as seed treatment materials for kenaf were submitted through the IR-4 process. However, none of these have currently been labeled for use as a seed treatment on kenaf.

The objectives of this research were to provide additional data in support of a label for use of metalaxyl as a seed treatment on kenaf and to evaluate additional seed treatment fungicides and combinations for control of seedling disease of kenaf.

MATERIALS AND METHODS

Seeds were planted at the R.R. Foil Plant Science Research Center at Mississippi State University on April 4, 1997, and May 7, 1998. The experimental design was a split plot with five replications. Main plots contained four rows, each 1 meter wide and 12 meters long. Treatments included recommended rates and half the recommended rates of metalaxyl, triadimenol, carboxin-pentachloronitrobenezene (pcnb), and thiram. Other treatments were combinations of metalaxyl + triadimenol + thiram or metalaxyl + carboxin-pcnb + thiram, each at half and full recommended rates for cotton. In an effort to create different levels of disease pressure, subplots consisted of two rows either containing indigenous populations of seedling disease pathogens or additional

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inoculum of isolates of *Rhizoctonia solani* and *Pythium ultimum* Trow from cotton. Each plot row received 15 grams of seed in 1997 and 45 grams in 1998. Seedling survival was standardized to plants per 2 meters of row determined by stand counts after postemergence damping-off had ceased.

Data were subjected to Analysis of Variance (ANOVA), and when significance was indicated, means were separated by using the Least Significant Difference procedure. All statistical analyses were performed on Statistical Analysis System 6.11 (SAS Institute, Cary, NC).

Results and Discussion

Analysis of seedling survival data indicated an interaction of year, pathogen inoculum, and seed treatment. Under conditions of indigenous populations of seedling disease pathogens in 1997, most treatments significantly increased seedling survival over that attained with the nontreated seed (Table 1). Survival was not increased in 1997 using treatments of triadimenol, the lower rate of metalaxyl, and the combination of metalaxyl, triadimenol, and thiram at the recommended rates. In 1998, however, seedling survival from seed treatments under conditions of indigenous populations of seedling disease pathogens was similar to that from nontreated seed (Table 2). Thus, under conditions of indigenous populations, control procedures were effective in 1997, but ineffective and unnecessary in 1998 since seedling disease was not prevalent. Differences in disease pressure under these conditions were influenced by environment. Soil temperatures were lower (Figure 1) and rainfall higher in 1997 than in 1998, which contributed to greater disease pressure and more seedling disease in 1997. Severity of the seedling disease complex was influenced by cool, damp soils that favored disease development.

Disease pressure was greater and seedling survival lower in plots to which additional inoculum of *R. solani* and *P. ultimum* was applied than in plots with indigenous populations of these two

Table 1. Effect of fungicide seed treatments on kenaf survival under different levels of pathogen inoculum in 1997.

Treatment	Rate (oz/cwt)	Plants per 2 meters of row	
		Indigenous population[1]	Inoculated[2]
Metalaxyl (M)	0.38	81 bcd[3]	29 ef
Metalaxyl	0.75	91 a	29 ef
Triadimenol (Tr)	0.25	77 cd	43 cde
Triadimenol	0.50	74 d	47 bcd
Carboxin-pcnb (C)	3.0	85 abc	40 de
Carboxin-pcnb	6.0	92 a	39 de
Thiram (Th)	2.25	88 ab	38 def
Thiram	4.5	87 abc	24 f
M+Tr+Th	0.38+0.25+2.25	88 ab	55 bc
M+C+Th	0.38+3.0+2.25	87 ab	42 cde
M+Tr+Th	0.75+0.50+4.5	83 a-d	60 ab
M+C+Th	0.75+6.0+4.5	91 a	71 a
Nontreated control	None	75 d	39 de
Treatment mean		84	43

[1]Natural populations of seedling disease pathogens.
[2]Inoculum of *Rhizoctonia solani* and *Pythium ultimum* added.
[3]Means within a column sharing a common letter do not differ significantly at P = 0.05 according to Fisher's Protected Least Significant Difference procedure.

Table 2. Effect of fungicide seed treatments on kenaf survival under different levels of pathogen inoculum in 1998.

Treatment	Rate (oz/cwt)	Plants per 2 meters of row	
		Indigenous population[1]	Inoculated[2]
Metalaxyl (M)	0.38	230 ab[3]	58 c
Metalaxyl	0.75	243 ab	43 c
Triadimenol (Tr)	0.25	237 ab	184 a
Triadimenol	0.50	198 bc	147 ab
Carboxin-pcnb (C)	3.0	246 ab	124 b
Carboxin-pcnb	6.0	231 ab	146 ab
Thiram (Th)	2.25	224 abc	44 c
Thiram	4.5	175 c	47 c
M+Tr+Th	0.38+0.25+2.25	261 a	175 a
M+C+Th	0.38+3.0+2.25	242 ab	139 ab
M+Tr+Th	0.75+0.50+4.5	228 abc	148 ab
M+C+Th	0.75+6.0+4.5	268 a	135 ab
Nontreated control	None	258 a	33 c
Treatment mean		234	109

[1]Natural populations of seedling disease pathogens.
[2]Inoculum of *Rhizoctonia solani* and *Pythium ultimum* added.
[3]Means within a column sharing a common letter do not differ significantly at P = 0.05 according to Fisher's Protected Least Significant Difference procedure.

fungi (Tables 1 and 2). In 1997, combination treatments containing triadimenol or the recommended rate of carboxin-pentachloronitrobenzene significantly increased stand where additional inoculum was applied (Table 1). In 1998, triadimenol and carboxin-pcnb, alone or in combination, significantly increased stand where additional inoculum was applied (Table 2). The effectiveness of these materials – and lack of efficacy of metalaxyl and thiram alone – confirms the importance of *R. solani* as a seedling disease pathogen in these tests.

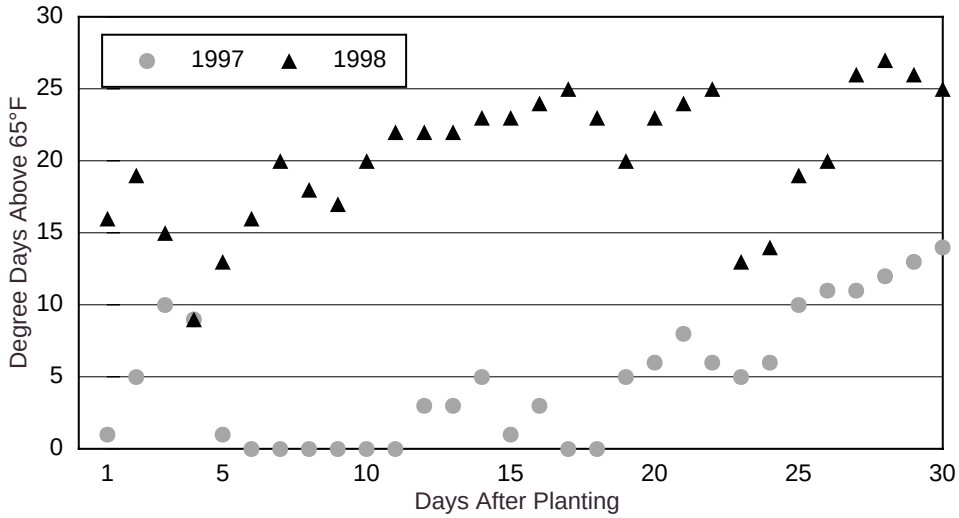

Figure 1. Daily soil degree day (SDD_{65}) accumulations after planting at 2-inch depth in 1997 and 1998 at the R.R. Foil Plant Science Research Center at Mississippi State University.

Summary and Conclusions

Kenaf was susceptible to a cotton isolate of *R. solani*. Kenaf survival was lower in plots in which inoculum of *R. solani* and *P. ultimum* had been added compared with plots containing indigenous populations of seedling disease pathogens. Therefore, when kenaf is planted after cotton or planted in other situations of enhanced disease pressure, severe seedling disease problems may result. When seedling disease pathogen populations were unaugmented, selected seed treatments and combinations significantly increased survival in 1997 when conditions were favorable for the occurrence of seedling disease, but they did not increase survival in 1998 when disease conditions were less severe. Where disease pressure was most severe (i.e. addition of inoculum in 1997 and cool, damp soil), only combination treatments significantly increased stands over the nontreated control. When conditions favor the development of disease incited by *Pythium*, seed treatments should include metalaxyl because neither triadimenol nor carboxin-pcnb has activity against this soilborne organism.

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