Benomyl Controls Rice White Tip Disease

G. E. Templeton, T. H. Johnston, and J. T. Daniel

Professor of Plant Pathology, University of Arkansas, Fayetteville 72701; Research Agronomist, PSR, ARS, USDA, Stuttgart, Arkansas 72160; and Graduate Assistant, Department of Plant Pathology, University of Arkansas, respectively.

Published with approval of the Director, Arkansas Agricultural Experiment Station. Cooperative investigation of the Arkansas Station and Plant Science Research Division, ARS, USDA.

ABSTRACT

White tip disease of rice was effectively controlled by treatment of seeds with benomyl at either 2 or 4 oz/bu. Phytopathology 61: 1522-1523.

White tip disease of rice incited by the seed-borne nematode, *Aphelenchoides besseyi* Christie 1942 (Syn. *A. oryzae* Yokoo 1948), one of the bud and leaf nematodes morphologically indistinct from the incitant of summer crimp of strawberries, has been effectively controlled in commercial rice fields in the United States by seed certification programs. The pathogen, however, remains a nuisance in the rice-breeding program because it has defied attempts to eradicate it from the thousands of lines and experimental varieties in the extensive breeding programs in the United States (1). Other control methods, such as hot water seed treatment, fumigation, and chemical seed treatments, which have been summarized by Cralley (2) and Todd & Atkins (7), are cumbersome, may reduce germination, or are hazardous to humans.

Miller (4, 5) reported that the systemic fungicide benomyl, when applied to the soil or used as a root drench, suppressed larval penetration of tobacco, eggplant, and tomato roots by the tobacco cyst nematode *Heterodera tabacum*. McGuire & Goode (3) found that benomyl, when applied as a seed treatment, was lethal to *Xiphinema americanum,* the nematode vector of tobacco ringspot virus, but had no apparent effect on the root knot nematode, *Meloidogyne incognita,* on the same host. These studies indicate that benomyl repels or is nematicidal to certain soil-borne nematodes at relatively low concentrations.

The current study was undertaken to determine whether benomyl might effectively control rice white tip disease when applied as a seed treatment.

Seeds of the experimental rice variety, Lacrosse X Zenith (C.I. 9355), heavily infested with white tip nematodes, were treated with benomyl at the rate of 2 and 4 oz/bu as Benlate 50% WP. (Benomyl is marketed as a 50% wettable powder under the tradename Benlate 50% WP by E. I. du Pont de Nemours and Company Inc., Wilmington, Del.) These rates were applied as a slurry in 3 or 6 ml water/1 lb. seed and dried at room temperature. Controls were treated similarly with 3 or 6 ml water.

Seeds were drilled-seeded 14 May 1970 at the Rice Branch Experiment Station, Stuttgart, Ark., a few hours after treatment. A second planting was made on 8 June from the remaining seed, which had been stored in paper bags in the laboratory at room temperature. Plots were 15 X 15 ft, with rows 1 ft apart. Treated and corresponding check plots were separated by a 4-ft unseeded alley. Standard cultural practices were used.

Approximately 1 month before harvest, diseased plants were counted in 6-ft portions of rows in each quadrant of the early-seeded plot. Five 12-ft portions were harvested from alternate interior rows of each plot and threshed separately for yield determinations. Moisture determinations were made and yield adjusted to 13% moisture.

Nematode infestation in the harvested grain was determined for each of the early-seeded plots. A 25-grain sample was taken from a composite of the grain harvested from the plot, then hulled. Hulls were soaked in water for 3-6 hr, then active and inactive nematodes were hand-picked and counted.

Nematodes were cultured according to the procedure of Todd & Atkins (6), and soaked in solutions of benomyl at concentrations of 0.01 ppm to 1,000 ppm for 12 hr at room temperature. Observations on nematode activity were made hourly.

White tip was effectively controlled by benomyl seed treatment at both rates. The degree of nematode and symptom reduction plus correlated yield increases are shown in Table 1. The average number of plants per 6 ft of row which showed white tip symptoms was reduced from 44 to 4 by the 4-oz rate, whereas yield increased from 291 to 456 g/row. Nematode infestation was reduced from 153/25 seeds to 67/25 seeds. The grain yield of the late-seeded rice was slightly greater, but response to treatment was similar to that of the early-seeded rice, and yield was inversely related to symptom expression.

Nematode activity in solutions containing up to 1,000 ppm benomyl was not different from that of nematodes in water for periods of up to 12 hr.

These data on symptom expression and yield and nematode infestation indicate that benomyl, applied as a seed treatment, can effectively control white tip of rice. The few infected plants and relatively low level of infestation in the treated plots might be accounted for either by migration of nemas from the check plots through the flood water or to incomplete coverage of seeds with the chemical. The slightly lower yields in the early-seeded plots are attributed to different environmental conditions during development of the rice rather than to phytotoxicity. The lack of any apparent effect of benomyl solution on activity of cultured nematodes suggest that its

TABLE 1. The effect of benomyl seed treatment on white tip symptoms, yield, and nematode infestation of rice

Treatment	Rate oz/bu	Diseased plants/ 6 ft/row[a]	Nemas/ 25 seed	Yield g/12-ft row	
				Early-seeded	Late-seeded
Water		44	182	291	303
Benomyl	2	10	90	341	397
Benomyl	4	4	67	456	484

[a] Number of plants showing typical white tip symptoms.

action is more complex than that of previously used chemicals for white tip control.

LITERATURE CITED

1. ATKINS, J. G., & E. H. TODD. 1959. White tip disease of rice. III. Yield tests and varietal resistance. Phytopathology 49:189-191.
2. CRALLEY, E. M. 1952. Control of white tip of rice. Ark. Farm Res. 1(1):6.
3. MCGUIRE, J. M., & M. J. GOODE. 1970. Effect of benomyl on Xiphinema americanum and tobacco ringspot virus infection. Phytopathology 60:1150-1151.
4. MILLER, P. M. 1969. Benomyl and thiabendazole suppress root invasion by larvae of Heterodera tabacum. Phytopathology 59:1040-1041 (Abstr.).
5. MILLER, P. M. 1969. Suppression by benomyl and thiabendazole of root invasion by Heterodera tabacum. Plant Dis. Reptr. 53:963-966.
6. TODD, E. H., & J. G. ATKINS. 1958. White tip disease of rice. I. Symptoms, laboratory culture of nematodes, and pathogenicity tests. Phytopathology 48:632-637.
7. TODD, E. H., & J. G. ATKINS. 1959. White tip disease of rice. II. Seed treatment studies. Phytopathology 49:184-188.