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Current Fungicide Testing in Tobacco

A few years ago there would have been insufficient fungicide testing on tobacco to warrant this article. Actually, there was little need for fungicide testing, except in seedbeds. Historically, tobacco has been well protected from diseases by excellent resistant varieties, crop rotation, and other cultural systems. Economic forces, however, are causing changes in the tobacco industry that are affecting the disease situation and increasing the need for fungicides. For example, many farmers are growing 30 or more acres, instead of the small 0.5–3-acre patches common just a few decades ago. Rotational frequencies are reduced on these larger acreages, and spread of soilborne pathogens is increased by the use of common equipment on the same land. Tobacco companies have recently significantly increased their production in Central America and the Caribbean, resulting in a more continuous link between wild and cultivated tobaccos in the western hemisphere.

Black shank, caused by *Phytophthora parasitica* var. *nicotianae*, has been the most economically important disease of tobacco in most flue-cured regions and is rapidly expanding in burley and dark tobacco areas. Several new fungicides—Ciba-Geigy's metalaxyl (Ridomil); Rhone-Poulenc's LS 74-783; Chevron's RE 26940, RE 31072, and RE 26745; Nor-Am's propamocarb (Previcur N); and Montedison's benalaxyl (Galben)—have opened avenues for testing. Comparisons of all these compounds in a single laboratory have not been reported. In early tests, Ridomil 2E applied at 1–2 lb/A broadcast and preplant incorporated usually proved to be superior. Control tended to diminish late in the season, and in later tests a split application (preplant plus an application at midseason) proved to be even more effective. In a Georgia flue-cured tobacco test, black shank incidence declined from 39% in the control to 4% in the Ridomil-treated plots, with a corresponding yield increase from 1,820 to 4,200 lb/A. With the best available resistant variety of burley, Kentucky reported a decline in mortality from black shank from 15% in the control to 0% in the Ridomil-treated plots. Yield increases of 450 lb/A and a corresponding $500/A return on the investment after expenses were noted. Of the Chevron compounds used under heavy disease pressure in Georgia and Kentucky, only RE 26745 at 2 lb/A promised to compete with Ridomil in efficacy; Chevron has stopped field development work with the material, however. Previcur N and Galben have given erratic results and appear to be much less effective than Ridomil. LS 74-783 at 2 lb/A applied in six to eight foliar sprays generally reduced disease incidence and increased yield but was less effective than Ridomil.

Several tests evaluated methods of reducing late season black shank activity, using Ridomil in smaller amounts or with a highly susceptible variety. In South Carolina with flue-cured tobacco, a split application of Ridomil (1 lb preplant plus 1 lb at last cultivation) was equal or superior to 2 lb preplant. Results were similar on burley and dark types in Kentucky, but higher rates were used. Split application also provided acceptable black shank control in highly susceptible burley varieties in Kentucky. The cultivation applications may be useful in an integrated pest management program where the farmer could "wait and see" before applying a "rescue treatment." In Kentucky, a moderately strong black shank epidemic was slowed markedly with 1 lb/A of Ridomil 2E applied after 5% of the plants were dead. Ridomil was sprayed onto the soil and incorporated by cultivation.

Blue mold, caused by *Peronospora tabacina*, has recently become a major field disease of tobacco in the western hemisphere. In 1979, a loss of over $250 million to U.S. and Canadian farmers was attributed to this disease, and few preventive fungicides were being used except in the plant bed. Since 1979, much of the crop in the western hemisphere has been treated with a protective fungicide program. The narrow-spectrum systemic compound Ridomil captured 90% or more of the market because a single preplant application (0.5–2 lb/A) or a few foliar sprays provided excellent control under heavy disease pressure. Labeled alternatives included weekly foliar sprays of protectant-type materials such as the dithiocarbamates (EBDC). This alternative was not received well by farmers,

who were not accustomed to spraying the foliage with anything except systemic growth regulators and insecticide once or twice a season. In addition, massive use of EBDC compounds was not acceptable to European markets because of possible residue problems. Ciba-Geigy obtained national labeling for Ridomil 2E as a soil-directed, preplant application in 1980 using efficacy and residue data obtained in 1979 from plots designed for black shank studies in which blue mold also happened to occur. Foliar use data to support labeling were not available in the United States at that time. An immediate concern of the labeled program was that development of metalaxyl-tolerant strains (both on target and on nontarget species) would be encouraged. These factors have prompted a search for alternatives.

Following the devastating blue mold epidemic of 1979, about 15 fungicide testing programs involving over 100 plots were established in tobacco production areas. Most tests yielded little valuable data because the disease has been absent in most production areas since 1979. Artificial inoculation with *P. tabacina* was not feasible because of the possibility of initiating an epidemic, so researchers awaited natural inoculation. Some laboratories established 20 or more tests around the state in hopes of having a single usable test, while others concentrated their efforts into a few tests. Some highly successful greenhouse tests were conducted during the winter using artificial inoculation. Recently, North Carolina State University established a winter field fungicide testing program in Puerto Rico, where natural epidemics occur more frequently than in the United States.

In North Carolina, 20 fungicides—16 currently registered for Phycomycete control on various crops and four unregistered materials—were compared on burley as protectants in a greenhouse test during the winter months. The fungicides were evaluated at one-half, one, and two times the standard rates, or rates suggested by the manufacturers. The plants were sprayed the day before inoculation, and evaluations were made 10 days after inoculation. Complete protection was obtained at one or more rates with benalaxyl, mancozeb, metiram, chlorothalonil, tribasic copper sulfate, metalaxyl, captafol, captan, folpet, ferbam, UC 55248, zineb, and maneb. Complete protection was not obtained at any rate with propamocarb, streptomycin sulfate, sodium hypochlorite, cymoxanil, or ethazol. A similar greenhouse test was conducted in Kentucky on burley except that 10 times the inoculum density was used and the inoculum was sprayed onto the plants instead of being placed into drops, to ensure development of systemic blue mold. Only benalaxyl and metalaxyl provided complete protection. Both laboratories evaluated many of these same materials in the field in 1982. Analyses of those tests are not complete, but generally greater differences were shown among protectant materials, with none superior to mancozeb. Preventive foliar sprays with some systemic compounds (metalaxyl, benalaxyl, cypofuram) were highly effective, providing control under moderate to heavy pressure, while others (streptomycin, cymoxanil) provided poor control.

Preplant broadcast, transplant water, and foliar applications of Ridomil for controlling blue mold in burley tobacco were compared in Kentucky in 1980. Acceptable control was provided by a broadcast preplant treatment (1–2 lb/A), preventive foliar treatments applied at 2-week intervals, or a single foliar treatment of 1 lb/A applied a month before blue mold appeared. A single foliar application of 0.5 lb/A a month before blue mold appeared, transplant water at 0.25 lb/A, or preplant broadcast at 0.5 lb/A did not provide acceptable control, although lesions usually were smaller with limited sporulation compared with no treatment.

A recent Kentucky test showed highly effective control in burley from a single application of Ridomil applied in response to a warning system. Ridomil 2E at 0.5 lb/A was sprayed on the ground and incorporated by either cultivation or irrigation. This treatment provided control equal to or better than 1 lb applied preplant only or preplant supplemented with an application at last cultivation.

The superiority of Ridomil for blue mold control in the seedbed was demonstrated in a Georgia test in 1980. Ridomil applied at seeding or as multiple foliar sprays effectively controlled blue mold, whereas nearby beds treated with carbamate fungicides and untreated beds were nearly destroyed. Multiple foliar applications at low rates were superior to a single high rate at seeding.

Dr. Nesmith is editor of Fungicide and Nematicide Tests, *published annually by the New Fungicide and Nematicide Data Committee of The American Phytopathological Society. Copies of current and past volumes may be obtained from Richard E. Stuckey, Business Manager F & N Tests, Plant Pathology Department, University of Kentucky, Lexington 40546.*