P. M. PHIPPS, Tidewater Research Center, Suffolk, VA

Soybean and Peanut Seed Treatment: New Developments and Needs

Seed treatment test results indicate that no fungicide or method provides universal protection against seed and seedling disease. The diversity of pathogenic agents and their interaction with environmental factors compound the task of interpreting results and designing strategies for disease control. Plant stress that reduces the rate of seedling emergence often increases the vulnerability of germlings to seedborne and soilborne disease. Stress can frequently be attributed to physical factors, herbicides, insecticides, soil fertility imbalances, soil texture, seed placement, and seed injury during processing, treatment, and/or planting.

Virtually all peanut seeds are treated with fungicides to protect against seed decay and seedling disease, but soybean seeds, unless of marginal quality, are frequently not treated. Seedsmen and growers want effective seed protectants that are inexpensive, compatible with planter operation, and safe to handle. The recent development of liquid formulations of chemicals and machinery for their application in a closed system has reduced hazards often encountered with dust treatments and subsequent handling of treated seed. Solvents that afford improved seed coverage and adherence of fungicides are expected to result in a phasing out of dust treatments.

Fungicide and Nematicide Tests provides a valuable record of annual results of seed treatment evaluations, publishing reports of successes and failures to show significant differences. Over the past 5 years, results of 27 soybean and three peanut seed treatment trials have been published. In addition to chemicals with full registration for seed treatment, numerous experimental fungicides and some biocontrol agents have been tested.

Soybean seed treatment. Seed lots of high and low quality are utilized frequently to determine fungicide efficacy in controlling soilborne and seedborne pathogens. Before field evaluation, seed lots are commonly evaluated for germinability in laboratory conditions, and in some instances, accelerated aging tests have been performed to predict seed vigor after storage. Yield data from field trials have often reflected no significant benefit of seed treatment even when stands were increased significantly. The absence of yield increases may be attributed to the remarkable capacity of plants to compensate for population deficiencies and to intensive management to control weeds and insects in many field trials.

As reflected by the number of published reports mentioning specific pathogenic agents, *Phomopsis* spp. appear to be the most common cause of seedling disease in soybean (Table 1); most reports were from the southeastern United States. The broad-spectrum fungicides captan and thiram were most commonly used as reference standard treatments (Table 2). More often than not, both fungicides improved seedling emergence and with few exceptions proved equal to or significantly better than experimental materials. Blends of either captan or thiram with other fungicides have been reported to increase emergence under specific circumstances of disease pressure. Test results reported from Illinois in 1982 showed that a combination of benomyl and thiram gave 67.3% emergence, whereas benomyl alone gave 61.5% emergence and thiram alone, 57.5%; untreated seed gave 45.8% emergence. Laboratory tests indicated a germination potential of 83% and attributed a 13% loss in germination to infestation with *Phomopsis* spp. The efficacy of benomyl in preventing seed infection by *Phomopsis* spp. was reported in 1979 by researchers in Kentucky. Their work demonstrated that foliar sprays of benomyl (0.28 kg/ha) at growth stages R3 and R5 significantly reduced the incidence of *Phomopsis* spp. in seed from soybean plants grown under disease pressure.

Carboxin, metalaxyl, and pyroxyfur have also shown specific activity against certain pathogenic agents. Carboxin in combination with thiram has been effective in controlling diseases caused by basidiomycetes such as *Rhizoctonia* spp. Metalaxyl and pyroxyfur have given good control of seedling disease caused by *Phytophthora megasperma* f. sp. *glycinea*. Both materials also appear to be effective in controlling damping-off caused by *Pythium* spp. Tests over several years in Iowa showed control of Phytophthora rot of seed and seedlings

Table 1. Pathogenic fungi listed as seedborne and/or soilborne in soybean seed treatment reports published in *Fungicide and Nematicide Tests*, volumes 34–38 (1979–83)

Pathogenic fungi	Number of reports
Phomopsis spp.	13
Fusarium spp.	6
Macrophomina phaseolina	5
Phytophthora megasperma f. sp. *glycinea*	4
Colletotrichum dematium var. *truncata*	4
Cercospora kikuchii	3
Rhizoctonia solani	3
Phialophora gregata	3
Alternaria spp.	3
Pythium spp.	2

Table 2. Summary of field response of soybean to seed treatments as reported in *Fungicide and Nematicide Tests*, volumes 34–38 (1979–83)

	No. of test entries producing:				
	Improved emergence		Reduced emergence		
Seed treatment[a]	S[b]	NS	NS	S	Total
Fungicides					
Captan	9	28	11	0	48
Thiram	15	20	5	0	40
Benomyl	9	4	3	0	16
Carboxin	3	9	6	0	18
Metalaxyl	8	9	0	0	17
Carboxin/thiram	3	14	10	0	27
Metalaxyl/captan	1	3	0	0	4
Pyroxyfur	4	2	1	0	7
Biocontrol agents					
Trichoderma sp.	0	4	2	1	7
Gliocladium sp.	1	2	0	0	3
Others	0	0	1	4	5

[a] With few exceptions, rates and formulations of fungicides were within limits considered acceptable for commercial use.
[b] S = significant, NS = not significant.

with metalaxyl at 0.38 g/kg of seed. Although not a consistent finding, cultivars of soybean resistant to race 1 of the fungus tended to show a lesser response to seed treatment with metalaxyl. According to a 1982 report, pyroxyfur at 0.6 g/kg of seed increased emergence of susceptible cultivars in soil infested with the same fungus.

Interest in biocontrol agents has been limited to trials with a few selected organisms. *Gliocladium* sp. has been the only organism reported in *Fungicide and Nematicide Tests* to significantly improve seedling emergence after treatment of soybean seed (Table 2). No improvement in emergence over that achieved by reference standard treatments such as thiram or captan was demonstrated.

Peanut seed treatment. Peanut is an intensively managed crop in the southeastern United States, and seed represents one of the most expensive production inputs. Peanut plants have a remarkable capacity to compensate for reduced populations. Poor stands may reduce yield as a result of increased competition from weeds. Poor seedling vigor can likewise reduce yields as a result of abnormal primary or taproot growth and failure of this root to penetrate the B horizon of sandy soils.

Important seedborne pathogens of peanut are *Rhizoctonia* spp., *Sclerotium rolfsii*, *Aspergillus* spp., *Rhizopus* spp., and, more recently, *Sclerotinia minor.* Dicloran and captan have been used routinely by seedsmen and personnel of the state seed laboratory in Virginia to inhibit growth of *Rhizopus* spp. during routine germination tests. Although this fungus must be controlled to evaluate germination potential under laboratory conditions, it has not been a common cause of seedling disease in the field.

Combinations of dicloran and captan or thiram have been used as reference standard treatments in field trials. Seed treatments using various registered combinations of these materials with other fungicides were reported in 1980 to improve emergence up to 30% after early plantings in Virginia. Test results from Texas in 1979 showed that captan combined with carboxin or dicloran gave 93.7 and 92.5% emergence, respectively, of seed infested with *S. rolfsii* and *A. niger*; untreated seed gave 78.2% emergence. The addition of carboxin to thiram or captan appears to improve emergence greatest when seed are infested with *S. rolfsii* and/or *Rhizoctonia* spp.

Dr. Phipps is editor of the seed treatment section of Fungicide and Nematicide Tests, *D. F. Ritchie, Editor, 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.*