Enhancing Alfalfa Yields and Stand Life by Improving Management of Seed Rot and Seedling Damping Off

Deborah Samac, Melinda Dornbusch, Samadangla Ao, USDA-ARS

RATIONALE & OBJECTIVES

- Seed rot and seedling damping off disease causes thinning of alfalfa stands after planting and the same pathogens damage older plants decreasing forage yields and winter survival.
- Experiments were conducted to identify potential alternative fungicide and biological seed treatments for combating seed rot and damping off of alfalfa seedlings.
- Three germplasm sources were selected for resistance to seed rot and damping off as a first step in developing resistant varieties.

STUDY DESCRIPTION

- Nine commercial fungicides labeled for use on soybean seed were evaluated in agar plate-based assays to determine the sensitivity of alfalfa seed rot and damping off pathogens to each fungicide. Pathogens were isolated from diseased alfalfa plants or soil from Minnesota alfalfa fields. The pathogens tested were: *Pythium irregulare*, *P. sylvaticum*, *P. ultimum*, *P. paroecandrum*, *Aphanomyces euteiches* race 1 and race 2 strains, three strains of *Phytophthora medicaginis*, *Fusarium verticilliodes*, *F. incarnatum-equiseti*, and *F. oxysporum*.
- Five proprietary biological seed treatments were tested against seed rot and damping off pathogens.
- Two fungicides with the widest range of pathogen growth inhibition were compared to ApronXL for protecting seeds from pathogens in infested soil.
- Three alfalfa germplasms, UMN2804 previously selected in field studies for resistance to soilborne pathogens, UMN2841 previously selected for resistance to Pythium seed rot, and UMN3988, a biomass type previously selected for resistance to Phytophthora root rot, were selected for resistance to a moderately aggressive isolate of *P. irregulare*. A second cycle of selection was done with *P. irregulare*, *P. sylvaticum*, and *P. paroecandrum*. The percentage of plants resistant to Pythium seed rot from the parental germplasms and selected germplasms was measured.

RESULTS

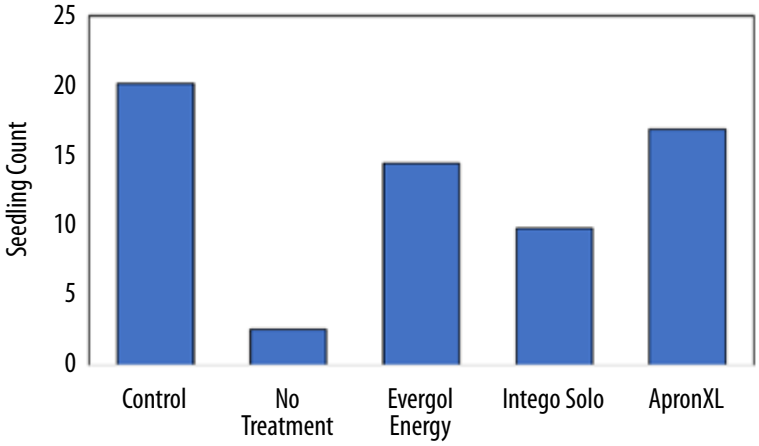
- ApronXL, the most widely used alfalfa seed fungicide, lacks activity against Fusarium seed rot pathogens and does not protect against Aphanomyces root rot (Table 1). Evergol Energy (Bayer CropScience), a mixture of three active ingredients (prothioconazole, penflufen, and metalaxyl), was active against all pathogens. Intego Solo (Valent) with the active ingredient ethanboxam had activity against all pathogens except Fusarium. Valent recommends combining Intego Solo with Rhizolex for control of fungal pathogens, but this fungicide had low activity against the alfalfa *Fusarium* pathogens.

Table 1. Growth inhibition of seed rot and damping off pathogens by commercial fungicide preparations. EC_{50} values (the concentration causing 50% reduction in growth) were calculated for each strain. Excellent (E)= <0.05-0.1 µg/ml, Very Good (VG) = 0.11-0.99 µg/ml, Good (G) = 1.0-9.9 µg/ml, Fair (F) = 10-99.9 µg/ml, Poor (P) = >100 µg/ml. ND= not determined.

Fungicide	*Pythium*	*Aphanomyces*	*Phytophthora*	*Fusarium*
ApronXL	E-VG	P	E	P
Rancona Dimension	E-VG	P	E	E-VG
Rancona Summit	E-G	P	E	VG
Rancona V RTU FS	E-VG	P	E	VG
Trilex	P	P	P	P
Dynasty	G-F	G	G-F	P
Evergol Energy	E-VG	G	E	G-F
Vibrance	P	P	P	P
Intego Solo	VG	E	E-VG	P
Rizolex	ND	ND	ND	P

- None of the proprietary biological seed treatments had activity against *Pythium*, *P. medicaginis*, or *A. euteiches*.
- Evergol Energy had statistically similar activity as ApronXL when used as a seed treatment against damping off organisms in infested soil (Figure 1).
- One cycle of selection increased resistance to multiple strains of Pythium seed rot and damping off pathogens (Figure 2).

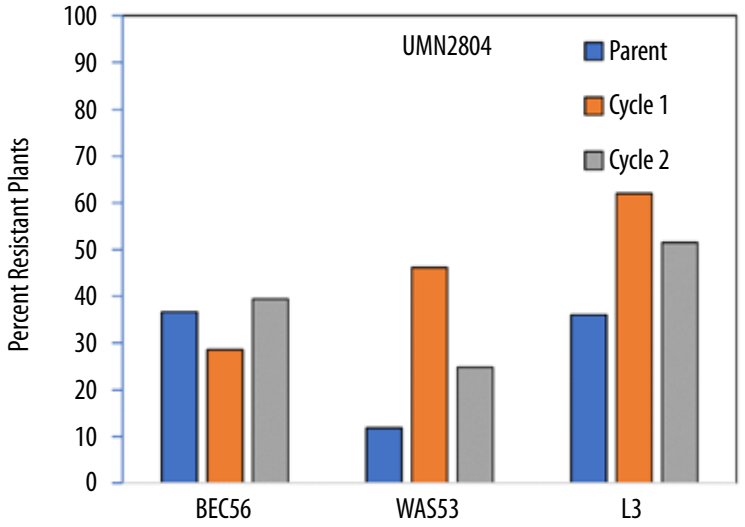
Figure 1. Protection of alfalfa seeds from seed rot and damping off pathogens in infested soil by fungicide seed treatments. Seedling counts were made at 7 days after planting in soil infested with cultures of *Pythium*, *A. euteiches*, and *Phytophthora medicaginis*. Plants were grown at 18°C with a 16 h photoperiod.

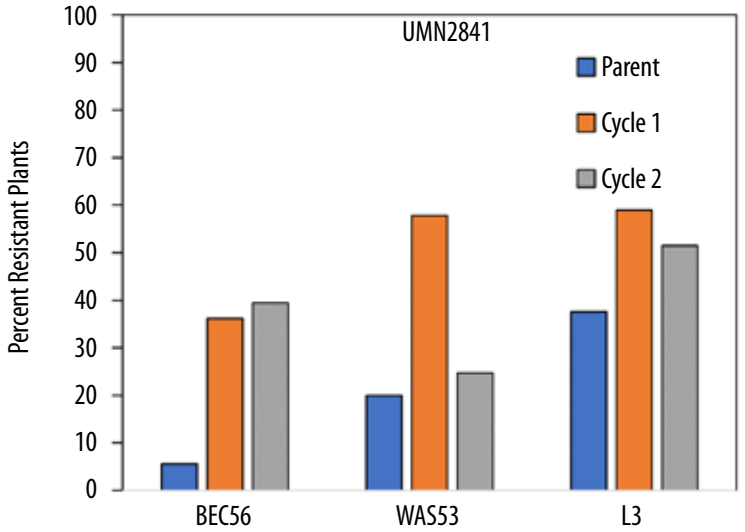


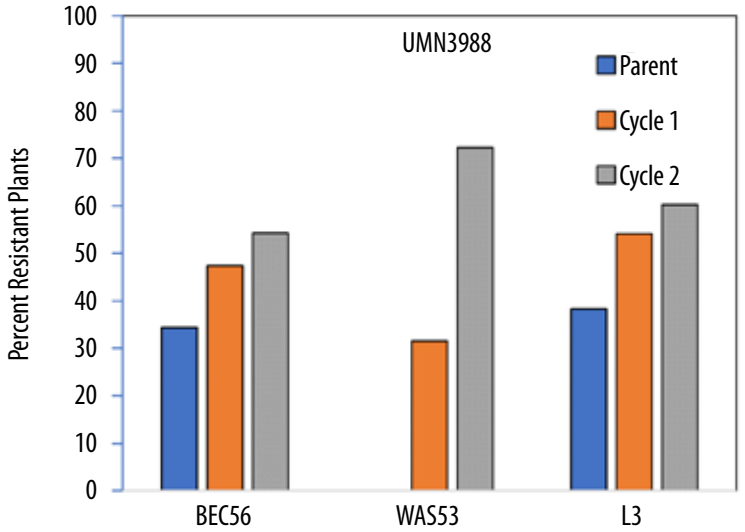
CONCLUSIONS

- Evergol Energy is a potential alternative seed treatment fungicide for alfalfa seed. Evergol Energy is currently labeled for use on alfalfa seed. Intego Solo is effective against oomycete diseases including Aphanomyces root rot.
- A significant increase in resistance to Pythium seed rot and damping off can be accomplished in one cycle of selective breeding.
- Combining seed treatments and resistance will provide protection for seedlings and mature plants to enhance forage yields and winter survival.

Figure 2. Response of parental and selected populations to three *Pythium* strains. Seeds were tested for resistance to seed rot and damping off in the agar plate-based assay. Percent resistant plants were scored 6 days after inoculation.







Alfalfa
U.S. Alfalfa Farmer Research Initiative

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