Identifying New Seed Treatments for Alfalfa

National Alfalfa & Forage Alliance - US Alfalfa Farmer Research Initiative project.

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Rapid and uniform seedling emergence is critical for a productive and persistent alfalfa stand. In many locations, alfalfa is planted into cold, wet soil ideal for seed rot and damping off. A complex of soil-borne microorganisms cause seed rot and damping-off of alfalfa seedlings. If the seedling is not killed, injury to the root may cause root "forking," forming shallow adventitious roots above the damaged primary root (Figure 1). These organisms are not only a problem during stand establishment, but infection of mature plants during wet spring weather causes destruction of fine feeder roots, interfering with nitrogen fixation, soil nutrient uptake, and water absorption. Together, these diseases reduce yields, decrease winter survival, and shorten stand life.

Figure 1. Symptoms of damping off and seed and root rot caused by Pythium species.

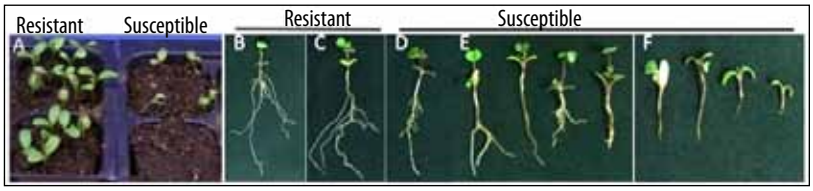


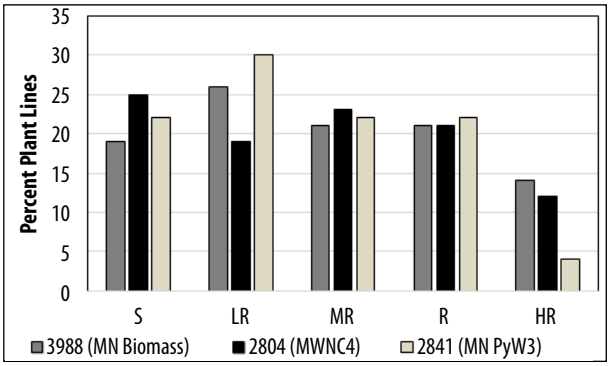
Table 1. Activity of soybean seed fungicides on alfalfa damping off pathogens.

Fungicide	Active Ingredient(s)	Manufacturer	*Pythium*	*Aphanomyces*	*Phytophthora*	*Fusarium*
Rancona Dimension	Metalaxyl, Ipconazole	Arysta	E-VG	P	E	E-VG
Rancona V RTU FS	Metalaxyl, Ipconazole, Carboxin	Arysta	E-VG	P	E	VG
Trilex	Trifloxystrobin	Bayer	P	P	P	P
EverGol Energy	Metalaxyl, Penflufen, Prothioconazole	Bayer	E-VG	G	E	G-F
Dynasty	Azoxystrobin	Syngenta	G-F	G	G-F	P
Vibrance	Sedaxane	Syngenta	P	P	P	P
Intego Solo	Ethaboxam	Valent	VG	E	E-VG	P
Rizolex	Tolclofos-methyl	Valent				P

E=excellent; VG=very good, G=good, F=fair, P=poor.

Since the 1980s, alfalfa has been treated with Apron (metylaxyl) or more recently with Apron XL (mefanoxam) to protect seeds and seedlings from *Pythium* spp., causing seed rot and damping off, as well as from *Phytophthora medicaginis*, which causes damping off and root rot. But these treatments are not effective against other organisms causing seed rot and damping off or the seedling disease *Aphanomyces* root rot. In addition, many strains of *Pythium* are not controlled by Apron XL or Stamina seed treatments (see *Forage Focus*, August 2016). Newer, more effective seed treatments have been labeled for use on soybean seed to protect them from seed and seedling diseases but none of them had been tested previously on alfalfa.

Figure 2. Pythium Resistance in Cycle 1 Selected Lines.



S=susceptible, LR=low resistance, MR=moderate resistance, R=resistant, HR=highly resistant.

Commercially available fungicides used for seed treatments in other legume crops were used in an agar plate assay. Of the eight fungicides tested, three showed good activity against *Pythium*, *Phytophthora,* and *Aphanomyces* (Table 1). Of these, one also had activity against tested *Fusarium* strains that are aggressive seed rot pathogens. Interestingly, Rhizolex, which is labeled for use on alfalfa to control fungal pathogens causing seed decay and seedling damping-off, did not have strong activity against these *Fusarium* strains. Future experiments will test the efficacy of these three fungicides as a seed treatment in infested soil in controlled conditions and then in field plots.

Most alfalfa diseases are managed using resistant varieties. Previously, it was shown seedlings with resistance to seed rot and damping off can be identified in a culture plate assay. A disease resistance variety would have greater potential seedling establishment. Importantly, since seed treatments are short-lived, a resistant variety would have improved adult plant root health, increasing productivity. Resistant plants were selected from three diverse germplasm sources in an agar plate assay, planted into soil, and intercrossed within each germplasm. Seeds collected from each female parent were tested for resistance to *Pythium* in the culture plate assay. Approximately half of the female parents produced seeds with little pathogen resistance (Figure 2). Susceptible (S) lines had 0-5% resistant seeds and low resistance (LR) lines had 6-14%, similar to starting populations. Half of the lines had higher resistance levels with some producing highly resistant (HR) progeny (>50%). A second round was done to determine if resistance levels could be increased. Final resistant germplasm will be made available to alfalfa breeding programs. A standard test for *Pythium* seed rot and seedling damping off has been approved by the North American Alfalfa Improvement Conference, facilitating registration of cultivars with this trait.