IMPORTANCE OF FUNGICIDE SEED TREATMENTS FOR SOYBEANS

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Several plant pathogenic fungi affect soybean plant health at different growth stages (Table 1). Although infection may occur early, many of these pathogens do not cause apparent symptoms until later growth stages. Frequently seedling health is ignored because plant populations are acceptable and stem and leaves do not express symptoms during early vegetative growth. *Phytophthora sojae*, *Pythium* spp. and *Rhizoctonia solani* are believed most important, but other plant pathogens are actively invading plants from growth stages VE to V4. Plant health assessment is important during this phase. This information may be used to make adjustments in crop management in subsequent years, and this information may explain symptoms later in the

Table 1. Summary of diseases controlled by fungicides applied to soybean seed

Disease	Cause	Symptoms	Control
Seed rot	*Pythium* *Phytophthora* *Phomopsis*	Soft decay of seed; missing seedlings in row.	Fungicide treated seed, *Phytophthora* resistant varieties. Plant in warm soils. *Phomopsis* comes with seed and resides in soybean residue.
Seedling mortality	*Phytophthora* *Rhizoctonia*	Chlorotic and wilting leaves followed by necrosis; leaves remain attached to stem.	Fungicide treated seed, *Phytophthora* resistant varieties. Plant in warm soils.
Premature plant death of adult plants	*Rhizoctonia* *Fusarium* *Phytophthora* *Mycolepto-discus*	Reddish-brown lesions on taproot, hypocotyl and lower stem; wilt, chlorosis and eventually necrosis of leaves, stunted plants; P*hytophthora* causes brown, continuous stem above soil-line.	Fungicide treated seed, *Phytophthora* resistant varieties; Plant in warm soils. Ridge soil around stems by cultivation to simulate new roots.

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season and less than anticipated yield at harvest. Symptoms caused by pathogens are confounded by symptoms of injury caused by herbicides and other abiotic causes of plant stress. Many pathogens infect plants at VE-V4, cause chronic symptoms or remain latent, but cause symptoms of plant decline during the reproductive growth stages.

Control of seedling, root and stem diseases

Phytophthora root rot affects soybeans from planted seed to plants at early pod development (Table 1). Many soybean varieties are fully or partially resistant to *Phytophthora* and represent an important first line of defense. However, seed dressing products that contain metalaxyl or mefenoxam effectively control *Phytophthora* and the closely related pathogen, *Pythium* (Table 2). *Phytophthora* and *Pythium* are most active in soils that remain water saturated for several days, but are not carried with seed. *Rhizoctonia* is a common in all soils and is not carried with seed. Formulations of thiabendizole, carboxin, PCNB, thiram and captan are effective against *Rhizoctonia*. *Phomopsis* survives in soybean residue and is frequently infects seed. Thus, specific fungicides can be applied to seed to protect seed and seedlings from *Phomopsis* originating from crop residue, but also the destructive seed borne phase of this fungal pathogen.

Table 2. Examples of fungicides applied to seed and pathogens controlled.

Active ingredient	Common Product Names	*Pythium*	*Phytoph-thora*	*Rhizoctonia*	*Phomopsis*
mefenoxam	Apron XL	Excellent	Excellent	No activity	No activity
metalaxyl	Allegiance	Excellent	Excellent	No activity	No activity
Mefenoxam + fludioxynil	ApronMaxx	Excellent	Excellent	Excellent	Good
captan + PCNB + thiabendazole	Rival	Fair	Poor	Excellent	Excellent
captan	Many	Good	Poor	Good	Fair
carboxin + thiram	Vitavax-200	Fair	Poor	Good	Excellent
carboxin + captan	Vitavax-captan	Fair	Poor	Good	Good
PCNB + ethazole	Terraclor Super-X, Terra-Coat L-205N	Good	Poor	Good	No activity
thiram	Many	Fair	Poor	Good	Fair

Summary of fungicide seed treatment trials

Staff at the University of Wisconsin-Madison have studied the effectiveness and agronomic impact of fungicide seed treatments for several years. On-farm trials have been conducted using standard size field equipment and in small plot trials. Results of on-farm trials suggest the treatment of seed with Rival fungicide can improve yield 2.1 bushel per acre yield when compared to non-treated seed (Table 3). It is concluded that the treatment of soybean with Rival is an economic practice.

Table 3. Soybean yield, early plant population and percent plant survival for all varieties and locations for Rival fungicide seed treatment and nontreated seed for On-Farm locations from 1997-98.

Treatment	Yield bu/a	Early plant population x 1000	% survival of early plant population
Untreated	51.9	135.0	89
Rival	54.0	154.0	89
LSD (p=0.10)	2.1	9.1	-

Data from experiments conducted at six on-farm locations. DSR-222 was used in 1997 and DSR-222, S19-90 and Sturdy were soybean varieties used in 1998.

The benefit of a fungicide seed treatment will not always be achieved. Soil conditions and pathogen pressure are factors that have a major influence on whether fungicide treated seed will result in a yield increase. Variation in results of seed treatments is illustrated in Table 4. Rival treated seed enhanced yield at five on six locations. A yield increase was not observed at the Dodge County. The greatest yield response to Rival seed treatment was 5.7 bu/a at the Juneau location (Table 4). An explanation for this result is not conclusive, but it is interesting to note that *Rhizoctonia* was extremely active at the Juneau field location. Rival has excellent activity against *Rhizoctonia*.

Table 4. Mean of soybean yield, early plant population and percent plant survival for all varieties treated or not treated with Rival fungicide at each on-farm trial location from 1997-98.

Treatment	Rock	Columbia	Trempealeau	Juneau	Dodge	Jefferson
Not treated	59.8	50.1	49.6	42.8	47.2	60.8
Rival	61.7	53.5	51.7	48.4	47.5	63.5
Yield difference	1.9	3.4	2.1	5.6	0.3	2.7

Results from the on-farm study were similar to results from small plot experiments conducted at the Arlington Agricultural Research Station (Table 5). Increased yield associated with Rival could be partially explained by improved stands in both the on-farm and small plot experiments.

Table 5. Results on Rival fungicide seed treatment in small plots from 1996-98

Treatment	Yield bu/a	Early plant population x1000	% survival of early plant population
Untreated	53.9	124.2	84
Rival	57.9	141.8	77

Data from six experiments conducted by E.S. Oplinger at the Arlington Agricultural Research station.

Planting date and fungicide seed treatments

The yield potential soybeans is increased if soybean are planted in late April or early May. However, cool and wet soils are frequently encountered at these planting dates. No tillage further increases the likelihood of cool and wet soil conditions which favor seed rot and seedling death caused by plant pathogenic fungi (Table 1). Several years of field trials in Illinois suggest that fungicide treated seed will result in greater plant populations and higher yields for early planted soybeans (Table 6). The benefits of fungicide treated seed were not observed in later plantings.

Table 6. Effect of fungicide seed treatment and planting date on plant population and soybean yield in DeKalb, Illinois 1997-1999[a].

Planting Date	Treatment	Population plants /acre	Yield bu/a
April 15-18	Control	97,200	55.2
(4 trials)	ApronMaxx	155,280	64.3
May 1-4	Control	133,520	58.3
(3 trials)	ApronMaxx	163,970	65.2
May 15-17	Control	144,370	57.2
(11 trials)	ApronMaxx	148,640	57.9
LSD (p=5%)		14,270	4.1

[a]Data courtesy of Wayne Pedersen and Walker Kirby, University of Illinois. All trials were conducted in no-till fields.

Summary

Fungicides applied to seed may result in greater plant population density and soybean yield.

The probability of a positive response to fungicide treated seed is increased if soybeans are planted early and no-till or reduced till systems are implemented.

The probability of a positive response to fungicide treated seed is increased if seeding rates are lowered because of seed costs or an attempt to avoid white mold.

Fungicide seed treatment products should be matched to expected disease pressure to achieve best results.

References

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