Soybeans

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Seed and Seedling Diseases

Inadequate stands, lack of uniform stands, and/or death of seedlings are often the result of seed or seedling diseases. The causal agents of these diseases are assorted fungi and bacteria that are either seed- or soil-borne or reside in crop residues. Seed become infected with fungi or bacteria just before harvest, particularly when harvest is delayed because of wet weather. Improper drying and storage also may lower seed quality. In general, seed with 85 percent germination by the warm germination test do not need treatment unless they are likely to be planted in cold soils (below 55 F). Seed with germination between 75 and 85 percent should be treated with a fungicide. Seed with germination rates below 75 percent generally should not be treated or used for seed. Seed treatments cannot make up for seed of poor quality and low germination. Seed that tests below 75 percent should be recleaned and retested before a final determination is made. Remember, once seed is treated it cannot be used for food, feed, or oil.

Table 3.4 - Seed Treatment Fungicides for Soybeans

Disease	Fungicide Common name	Fungicide Trade name	Remarks
Seed decay, damping-off, and seedling blights	captan thiram captan + thiabendazole	Sold under a wide variety of trade names.	Apply seed treatments as a slurry or by commercial mist method. Consult label for rates and precautions. Do not use treated seed for food, feed, or oil. Many of the thiram formulations have micronutrients and/or nitrogen-fixing bacteria included. Some formulations are sold as a pour on or planter box treatment. Do not use treated seed for food, feed or oil.
Seed and seedling diseases including those caused by *Rhizoctonia solani* and *Fusarium* spp.	carboxin + thiram carboxin + thiram carboxin + PCNB PCNB	RTU-Vitavax-Thiram Vitavax-200 Vitavax-PCNB RTU-PCNB	Do not use treated seed for food, feed, or oil. Do not graze or feed livestock forage and hay. Consult label for rates and precautions.
Pythium spp., damping-off and early season *Phytophthora* spp. root rot	metalaxyl	Apron 50W	Apply as a slurry treatment (0.5 - 1.0 fl oz/100 lbs of seed). May be combined with other registered seed treatment fungicides. Do not use treated seed for food, feed, or oil.
	mefenoxam	Apron XL LS	Can be applied as a planter box treatment either alone or in combination at the rate of 0.32 - 0.64 fl oz/100 lbs of seed. Do not use treated seed for food, feed, or oil.
	oxadixyl	Anchor Flowable Fungicide	Apply as a seed treatment at a rate of 1.5 to 2.25 fl. oz product/CWT using a mist- type commercial treater.
Pythium spp., *Rhizoctonia solani,* and *Sclerotium rolfsii* diseases of seedlings	cloroneb carboxin + PCNB	Chloroneb 65W Various other trade names Vitavax-PCNB	Apply as a planter-box treatment on seed, or with a commercial seed treater. Consult label for rates and precautions. Do not use treated seed for food, feed, or oil.

Table 3.5 - Soil-applied Fungicides for Soybeans

Disease	Fungicide Common name	Fungicide Trade name	Remarks
Pythium spp. Damping early seaon *Phytopthora* spp. root rot.	mefanoxam	Ridomil Gold EC	Apply in a 7-in band off and over row at planting or in seed furrow before seeds are covered. Seed applications will provide more consistent results if no rain is received before germination.
		Ridomil Gold WSP	Apply in a 7-in band over row at planting or in seed furrow before seeds are covered. Seed application will provide more consistent results if no rain is received before germination.
		Ridomil Gold GR	Apply in a 7-in band over row at planting or in seed furrow before seeds are covered. Seed application will provide more consistent results if no rain is received before germination.

Foliar Stem and Pod Diseases

Application of foliar-applied fungicides has not been shown to consistently and significantly increase soybean yields in the Middle Atlantic states. However, seed quality generally is improved. This practice is more likely to offer some benefit to soybeans that are grown for seed production.

Table 3.6 - Foliar-applied Fungicides for Soybeans

Disease	Fungicide Common name	Fungicide Trade name	Formulated Rate	Remarks
Pod and stem blight, anthracnose, Cercospora leaf blight, frogeye, purple seed stain, and brown spot	thiabendazole thiophanate methyl thiophanate methyl chlorothalonil azoxystrobin pyraclostrobin	Mertect 340F Topsin M 70W Topsin M 85WDG Bravo 720 Quadris 2.085C Headline	6-10 fl oz/A 8-16 oz/A 6.4-12.8 oz/A 1.5-2.5 pt/A 12.3-15.4 fl oz/A 6-12 fl oz/A	Make first applicationwhen pods begin to form and a second application 14 days later. Do not use treated vines or plants for forage. Do not use alkaline pesticides in a tank mix. Consult individual labels for other restrictions.

Asian Soybean Rust

Eleven fungicides have a federal label for the control of Asian soybean rust. An additional six fungicides or combination formulations have an Emergency Section 18 registration for Asian soybean rust control. This emergency registration expires on November 10, 2007, for several of these and for others it will be March 31, 2009. Consult the Department of Plant Pathology, Physiology, and Weed Science Asian Soybean Rust website at *http://www.ppws.vt.edu/ipm/soybeanrust/index.htm* for the latest information on fungicides available for control and recommendations for use.

Timing of fungicide applications: It is imperative that growers and applicators follow spray guidelines and adhere to the labeled rates for each fungicide.

Vegetative Growth Stages

Current data indicate that fungicide applications are not needed in the early vegetative growth stages. Spraying just prior to crop flowering (R1) may be prudent if the disease is increasing. This is especially true for late-planted crops and/or very late-maturing varieties that may develop a large canopy before flowering.

R1-R5 Reproductive Stages

Soybean rust symptoms are most prevalent, and increase most rapidly, during crop reproductive-growth stages. **The first fungicide application should be made before rust has appeared on more than 5 percent of the leaves in the crop canopy.** One, two, or three applications may be needed, depending upon at which growth stage the disease is first detected and subsequent environmental conditions. Consecutive applications of either strobilurins or triazoles alone should never be made due to resistance concerns. Refer to fungicide labels for specific directions and restrictions.

R6 and later

Spraying at late-growth stages is not recommended due to lack of yield response. In addition, many fungicides have days-to-harvest (preharvest) intervals or growth-stage restrictions. Refer to fungicide labels for specific directions and restrictions.

Soybean Reproductive Stages (R1 to R8)--Note: vegetative stages occur prior to bloom.

R1-R2 beginning bloom to full bloom

R3 beginning pod development

R4 full pod developed

R5 beginning seed development

R6 full-seed development

R7 beginning-maturity (i.e. one pod at mature-pod color; 50 percent or more leaves yellow)

R8 full-maturity (i.e. 95 percent pods at mature-pod color)

Table 3.7 - Foliarly Applied Fungicides for the Control of Asian Soybean Rust

Fungicide Common Name	Fungicide Trade Name	Formulated	Remarks Rate	Postharvest Interval or Growth Stage
azoxystrobin	Quadris	6.2-15.4 fl oz/A	protectant and systemic	14 days
chlorothalonil	Bravo WeatherStik Echo 720 Equus 720 SST	16.0-36.0 fl oz/A 16.0-40.0 fl oz/A 25.0-40.0 fl oz/A	protectant protectant protectant	42 days 42 days 42 days
cyproconazole	Alto 100SL	2.75-5.5 fl oz/A	curative/protectant systemic	—
flusilazole	Punch 3.3EC	3.0-4.0 fl oz/A	curative/protectant systemic	30 days
flutriafol	Topguard 1.04EC	7.0 fl oz/A	curative/protectant systemic	21 days
metconazole	Caramba	6.0-8.2 fl oz/A	curative/protectant, systemic	—
myclobutanil	Laredo 25EC Laredo 25EW	4-8 fl oz/A 4.8-9.6 fl oz/A	curative/protectant, systemic	28 days
propiconazole	Tilt 3.6EC Bumper 41.8EC	4.0-8.0 fl oz/A 4.0-8.0 fl oz/A	curative/protectant, systemic	28 days
propiconazole + azoxystrobin	Quilt 1.66EC	14.0-20.5 fl oz/A	curative/protectant, systemic	28 days
propiconazole + trifloxystrobin	Stratego 2.08EC	5.5-10.0 fl oz/A	curative/protectant, systemic	21 days
pyroclostrobin	Headline	6.0-12.0 fl oz/A	protectant and locally systemic	21 days
tebuconazole	Folicur 3.6F Uppercut 3.6F	3.0-4.0 fl oz/A 3.0-4.0 fl oz/A	curative/protectant, systemic	30 days
tetraconazole	Domark 230ME	5.0-6.0 fl oz/A	curative/protectant, systemic	R5

Nematode Diseases

The need for a nematicide should be based on the previous site history and on the results of a soil test for the presence and level of plant pathogenic nematodes. The best time to collect samples for nematode testing is in the fall. Consult your local Extension office for information on proper sampling procedures for nematode testing and for information on threshold levels before deciding to use a nematicide. In Virginia, the Nematode Advisory Program provides this service at a charge of $11.00 (vermiform) or $19.00 for vermiform and cysts per sample. Virginia growers interested in this program should note that soil samples must be collected in the fall no later than November 20.

There are cultural practices (rotation, fallow, and use of resistant or tolerant cultivars) that will reduce nematode populations. Rotation with nonhost crops and resistant cultivars are particularly effective in controlling soybean cyst nematodes. Only when these measures are not feasible should chemical control measures be considered.

Cultivar selection is the most economic and powerful line of defense against diseases of soybeans. Before purchasing seed, growers should review local reports of cultivar performance and characteristics for their region. Several excellent yielding cultivars are available with resistance to soybean cyst nematode, lesion nematode, soybean mosaic, and peanut stunt viruses.

Table 3.8 – Soybean Cultivar Reactions to Herbicides, Nematodes, Frog Eye Leafspot

Brand	Cultivar	MG	Herbicide Resistance	Nematode Resistance		Frog Eye Leafspot Resistance
				Cyst	Root Knot	
Asgrow	AG3602	3.6	RR	MR3		MR
Asgrow	AG4403	4.4	RR	MR3		MR
Asgrow	AG4404	4.4	RR/STS	MR3,14		R
Asgrow	AG4604	4.6	RR	R3,MR14		R
Asgrow	AG4703	4.7	RR	MR3		
Asgrow	AG4801	4.8	RR	R3		R
Asgrow	AG4902	4.9	RR	R3,MR14		MR
Asgrow	AG4903	4.9	RR/STS			MR
Asgrow	AG5301	5.3	RR	MR3,5,14		MR
Asgrow	AG5605	5.6	RR/STS	MR3,14		MR
Asgrow	AG5702	5.7	RR	MR3		R
Asgrow	AG5905	5.9	RR	R3		MR
Clark	CL49RR	4.9	RR			
D&PL	DP3861RR	3.8	RR	R3		MR
D&PL	DP4112RR/S	4.1	RR/STS			
D&PL	DP4331RR	4.3	RR	MR3		MR
D&PL	DP4546RR	4.5	RR			MR
D&PL	DP4690RR	4.6	RR			
D&PL	DP4724RR	4.7	RR	R3		R
D&PL	DP4748S	4.7	STS			
D&PL	DP4919RR/S	4.9	RR/STS			
D&PL	DP5110S	5.1	STS			MR
D&PL	DP5115RR/S	5.1	RR/STS			
D&PL	DP5414RR	5.4	RR	R3		R
D&PL	DP5634RR	5.6	RR	R1,3	MRi	MR
D&PL	DP5806RR	5.8	RR	R3,MR14		
D&PL	DP5808RR	5.8	RR	R3		MR
D&PL	DP5915RR	5.9	RR	R3		MR
DeltaKing	DK4866RR	4.8	RR/STS	MR3		
DeltaKing	DK4967RR	4.9	RR	R3, MR6,14		MR
DeltaKing	DK5066RR	5	RR	R3,MR14		MR
DeltaKing	DK5366RR	5.3	RR	MR3,14		MR
DynaGro	3437NRR	4.3	RR/STS	R3,MR14		

Cyst nematode: R=resistant, MR=moderate resistance, no. specifies race

Root knot nematode: R=resistant, MR=moderate resistance, i=southern root knot, a=peanut root knot.

No soybean varieties are resistant to northern root knot nematode.

Frog eye leafspot: R=resistant, MR=moderate resistance

Note: above listing provided by David Holshouser, Virginia Soybean Specialist.

Listing shows cultivars adapted to Virginia according to performance in field trials.

Disease resistance information is from vendor's listing of traits and field observations.

Table 3.8 – Soybean Cultivar Reactions to Herbicides, Nematodes, Frog Eye Leafspot (cont.)

Brand	Cultivar	MG	Herbicide Resistance	Nematode Resistance		Frog Eye Leafspot Resistance
				Cyst	Root Knot	
DynaGro	DG3390NRR	3.9	RR	R3,MR14		
DynaGro	DG3392NRR	3.9	RR	R3,MR14		
Dyna-Gro	DG33A37	3.7	RR	R3,MR14		
Garst	4112RR/N	4.1	RR	R3,MR14		MR
Garst	5012RR/N	5.0	RR	MR3,14		R
Garst	5212RR/N	5.2	RR	R3		R
Garst	5512RR/N	5.5	RR	R3,MR14		
Garst	D437RR/N	4.3	RR	R3		
Garst	D472RRN	4.7	RR	R3,MR14		
Garst	D484RR/N	4.8	RR	R3,MR14		MR
Garst	D484RR/N	4.8	RR	R 3,MR14		MR
Montague	MFS-516	5.1				
Montague	MFS-553	5.5				
Montague	MFS-591	5.9				
NK	S40-R9	4.0	RR	R3,MR14		
NK	S42-H1	4.2		R3,14		
NK	S43-B1	4.3	RR	R3,MR14		
NK	S46-G2	4.6	RR	MR3,14		
NK	S46-W8	4.2	RR	R3, MR14		
NK	S49-Q9	4.9	RR	R3,9 MR1,14		
NK	S52-U3	5.2	RR	R3,9,14		
NK	S54-G9	5.4	RR	R3,14		
NK	S56-D7	5.6	RR	R3,14		MR
NK	S57-A4	5.7	RR	MR3,9,14		
NK	S59-V6	5.9	RR	R3,MR14	MRi	
Pioneer	93M92	3.9	RR			MR
Pioneer	94B73	4.7	RR			R
Pioneer	94M80	4.8		MR3,14		MR
Pioneer	95B96	5.9	RR	MR3,14	MR	MR
Pioneer	95M50	5.5	RR/STS	R3	Ri	MR
Pioneer	95M60	5.6	RR	R1,2,3,5,14	MR	MR
Pioneer	95M82	5.8	RR		R	R
Progeny	4949	4.9	RR			

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Frog eye leafspot: R=resistant, MR=moderate resistance

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Brand	Cultivar	MG	Herbicide Resistance	Nematode Resistance		Frog Eye Leafspot Resistance
				Cyst	Root Knot	
Public	Hutcheson	5.7				
Public	Manokin	4.9		R1,3	Rai	
Public	Teejay	5.3				
S.States	RT3851N	3.8	RR	R3,14		
S.States	RT3951N	3.9	RR	R3,14		
S.States	RT4098	4.0	RR			
S.States	RT4440N	4.4	RR	R3,14		
S.States	RT4451N	4.4	RR	R3,14		
S.States	RT4551N	4.5	RR	R3,14		
S.States	RT4808N-STS	4.8	RR	R3,14		
S.States	RT4981N	4.9		R3,14		
S.States	RT5130N	5.1	RR	R3,14		
S.States	RT5450N-STS	5.4	RR/STS	R3,14		
S.States	RT5540N	5.5	RR	R3,14		
S.States	SS381STS	3.8	STS			
S.States	SS439	4.3				
S.States	SS5200STS	5.2	STS			
Stine	4402-4	4.4	RR	R3		
Stine	4502-4	4.5	RR/STS	R3		MR
Stine	4782-4	4.7	RR/STS	R3		R
Stine	5482-4	5.4	RR/STS	R3		R
Stine	5502-4	5.5	RR	R3		R
T.A.Seed	TS4399R	4.3	RR	MR3,14		
T.A.Seed	TS4599R	4.5	RR	MR3		
T.A.Seeds	TS4389R	4.3	RR			
T.A.Seeds	TS4689RS	4.6	RR/STS	R3,MR14		R
USG	440nSTS	4.4	STS			
USG	5002T	5.0				R
USG	540nRR	5.4	RR	MR3,14		MR
USG	550nSTS	5.5	STS	MR3,14		
USG	5601T	5.6				MR
USG	7384nRS	3.8	RR/STS	R3,MR14		
USG	7393nRR	3.9	RR	R3,MR14		

Cyst nematode: R=resistant, MR=moderate resistance, no. specifies race

Root knot nematode: R=resistant, MR=moderate resistance, i=southern root knot, a=peanut root knot.

No soybean varieties are resistant to northern root knot nematode.

Frog eye leafspot: R=resistant, MR=moderate resistance

Note: above listing provided by David Holshouser, Virginia Soybean Specialist.

Listing shows cultivars adapted to Virginia according to performance in field trials.

Disease resistance information is from vendor's listing of traits and field observations.

Table 3.8 – Soybean Cultivar Reactions to Herbicides, Nematodes, Frog Eye Leafspot (cont.)

Brand	Cultivar	MG	Herbicide Resistance	Nematode Resistance		Frog Eye Leafspot Resistance
				Cyst	Root Knot	
USG	7415nRR	4.1	RR	MR3		
USG	7423nRS	4.2	RR	R3,MR14		R
USG	7434nRR	4.3	RR	R3		R
USG	7440nRR	4.4	RR	MR3,14		MR
USG	7443nRR	4.4	RR	MR3,14		R
USG	7455nRR	4.5	RR	R3,MR14		MR
USG	7475RR	RR				
USG	7482nRR	4.8	RR	R3,MR14		R
USG	7484nRR	4.8	RR	R3,MR14	Ri	MR
USG	7489RR	4.8	RR			R
USG	7494nRR	4.9	RR	R3,MR14		
USG	7495nRS	4.9	RR/STS	R3,14		
USG	74A45	4.4	RR			R
USG	74A76	4.7	RR			MR
USG	74A91	4.9	RR			MR
USG	74F96	4.9	RR			
USG	74T35	4.3	RR	R3		R
USG	74T85	4.8	RR			R
USG	7504nRR	5.0	RR	R3,MR14		
USG	7505nRR	5.0	RR	R3		MR
USG	7505nRR	5.0	RR			
USG	7514nRR	5.2	RR	R3,MR14		MR
USG	7515nRS	5.1	RR/STS	R3,MR14		
USG	75M16	5.1	RR			
USG	ALLEN	5.6	RR			
Vigoro	V44N6RR	4.4	RR	R3,MR14		MR
Vigoro	V46N6RR	4.6	RR	R3,MR14		
Vigoro	V49N6RR	4.9	RR	R3		MR
Vigoro	V50N5RR	5.0	RR	R3,MR14		MR
Vigoro	V50N6RR	5.0	RR	R3		MR
Vigoro	V51N7RS	5.1	RR/STS	R3		MR
Vigoro	V55N5RR	5.5	RR	R3,MR14		MR

Cyst nematode: R=resistant, MR=moderate resistance, no. specifies race

Root knot nematode: R=resistant, MR=moderate resistance, i=southern root knot, a=peanut root knot.

No soybean varieties are resistant to northern root knot nematode.

Frog eye leafspot: R=resistant, MR=moderate resistance

Note: above listing provided by David Holshouser, Virginia Soybean Specialist.

Listing shows cultivars adapted to Virginia according to performance in field trials.

Disease resistance information is from vendor's listing of traits and field observations.

Table 3.9 - Nematicides Registered for Use on Soybeans[1]

Nematode	Common name	Nematicides[1] Trade name	Formulated Rate	Remarks
Root-knot, lesion, and stubby root (See Footnote)	aldicarb	Temik 15G	11-22 oz/1,000 linear row ft; 14.0-20.0 lb/A	Apply in 6 to 12-inch band over rows preplant or at planting and mix with top 3-4 inches of soil.
Cyst	—	—	—	Use of nematicides alone for the control of cyst nematodes is not recommended. A 2-year rotation scheme that alternates resistant and susceptible cultivars with nonhost crops is recommended. Application of Temik 15G at 3 to 5 oz/1000 ft of row in furrow suppresses nematode damage in full-season, conventional tillageproduction systems.
All nematodes	1, 3-D	Telone II	5.2-7.0 gal/A	Spring treatments with soil fumigants generally produce best results. Follow these six simple steps when applying soil fumigants: (1) work crop residues into soil in the fall of the year so that they are well decomposed before treatment; (2) tillage to a depth of 8 or more inches is essential with all clods broken with soil loosened thoroughly; (3) apply at least two weeks prior to planting with a single injector shank 6 to 8 inches deep and offset 3 inches from the seed furrow; (4) seal soil surface with press wheel or other equipment; (5) at time of treatment the soil should be moist and at a tempera- ture greater than 50˚F at the 5-inch level; and (6) consult product labels for additional information and safety procedures.

[1]Growers participating in the Nematode Advisory Program are provided reports on the numbers and kinds of plant parasitic nematodes in soil and recommendations on needs for nematode control. Soil samples for nematode assay must be collected in the fall and not later than November 20. Local Extension offices in Virginia have literature that describes guidelines for participating in this program.