

CONTROL OF WHITE MOLD ON DRY BEANS 2005

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BACKGROUND

White mold has become an increasing problem in dry bean production in New York State, and the primary disease that triggers the use of foliar fungicides. The causal fungus, *Sclerotinia sclerotiorum*, is known to attack 408 species of plants including dry and snap beans, cabbage, potatoes, alfalfa, tomatoes, sunflower, and soybeans, as well as many common weed hosts such as ragweed and velvetleaf. The fungus produces overwintering structures called sclerotia that are black and about the size of raisins. These sclerotia germinate when exposed to periods of moisture and produce mushroom-like structures (apothecia) that shoot spores onto susceptible plant material. If the plant is damaged or the fungus finds a blossom (a high energy food source) to infect, the fungus grows and infects the bean, which results in disease. Leaves, stems, and pods may become infected in this manner.

White mold caused by *Sclerotinia sclerotiorum* can be controlled on snap beans using one or two fungicide applications. However, the timing and number of sprays needed to control white mold on dry beans in New York has not been effectively determined. The substantially longer flowering period for dry beans and the extended harvest season as well as the lower profit margin make control in dry beans more difficult than in snap beans.

OBJECTIVES

The objectives of this study were:

1. To determine efficacious timing and cost effective methods to control white mold in dry beans.
2. Observe fields and interview producers to determine why mold pressure has increased in recent years (if it has).
3. Generate recommendations for effective disease management.

OBJECTIVE 1 To determine efficacious timing and materials

Field Crittenden Chemical Trial (Red Kanner was planted on May 23). Despite the hot dry weather, we were able to obtain useful results in our white mold inoculated and irrigated research trial at the Experiment Station in Geneva, NY. However, disease incidence was not *severe* in 2005, so the data may not necessarily reflect product performance under high disease pressure. Disease incidence increased between the two evaluation dates in all treatments. At 67 days after planting (DAP), Rovral, all Endura treatments, both Topsin M treatments, Headline, Folicur, Stratego, and Champion significantly lowered disease incidence compared to the control. At the final evaluation date, all treatments significantly reduced disease incidence compared to the

control, except for Headline and Bravo Weather Stik. Topsin M at 30 oz, Stratego, and Bravo Weather Stik had significantly higher total top dry weights than the control. Topsin M at 20 and 30 oz, Endura at 5.9 oz (2 applications), and Endura at 8 oz (2 applications) yielded significantly higher seed weights than the control. No phytotoxicity was observed.

Treatment and rate/A	White mold incidence ^z (% of plants infected)		Total dry top wt (lb/A)	Total seed yield (lb/A)
	67 DAP ^y	87 DAP		
Control	15.0 a	22.4 a	2396 cd ^x	757 c
Rovral 4F 2 pt, A, B ^w	3.2 def	6.9 cde	2913 bcd	1035 abc
Endura 70WDG 5.9 oz, A, B	0.9 f	1.8 de	2674 bcd	1093 ab
Endura 70WDG 5.9 oz, B	2.2 def	6.6 cd	2904 bcd	882 bc
Endura 70WDG 8 oz, A, B	0.9 ef	2.4 e	3124 abc	1093 a
Endura 70WDG 8 oz, B	0.9 f	1.9 de	3009 abc	1006 abc
Topsin M 4.5FL 30 fl oz, B	1.4 ef	6.7 cde	3718 a	1313 a
Topsin M 4.5FL 20 fl oz, A, B	1.0 f	1.5 de	2894 bcd	1188 ab
Headline EC 9 fl oz, A, B	7.4 bcd	16.9 ab	2731 bcd	949 bc
Folicur 3.6F 4 fl oz + Induce 0.6 pt, A, B	4.1 cde	4.5 cde	2626 bcd	1073 abc
Stratego EC 7 fl oz + Induce 0.6 pt, A, B	6.3 cd	7.4 cde	3230 ab	1083 abc
Champion 3 lb, A, B	5.9 cd	6.4 cde	2262 d	939 bc
Cuprofix Disperss3.5 lb, A, B	8.8 abc	9.7 bc	2980 bcd	1045 abc
Bravo Weather Stik 2 pt, A, B	12.9 ab	21.0 a	3134 ab	1045 abc

^zMean incidence values are shown. Incidence values were transformed using the arcsin square root transformation. Transformed data were analyzed using the general linear models procedure in SAS and treatment means were separated using Fisher's Protected LSD test ($P \leq 0.05$).

^yDays after planting (23 May).

^xMeans within a column not followed by a common letter differ significantly according to Fisher's Protected LSD test ($P \leq 0.05$).

^wChemical application dates: A=44% bloom, 6 Jul; B=100% bloom + pins, 12 Jul

Grower trials: (Planted and maintained by producers).

Planting date	Variety/color	Topsin M rate/A, /# of applications/date of applications
6/8/05	T 39/black	30 oz, one, 7/29/05
6/20/05	Chinook/lt. red	30 oz, one, 8/8/05
6/20/05	Beluga/white	20 oz, two, 8/2/05 and 8/8/05
6/27/05	Beluga/white	20 oz, two, 8/8/05 and 8/18/05
6/28/05	Beluga/white	30 oz, one, 8/8/05
6/29/05	ECLRK/lt. red	20 oz, two, 8/2/05 and 8/8/05

8/12/05 Helene Dillard and Ann Cobb extensively scouted all fields in the trials (50 to 70 foot sections in each trial) including unsprayed check areas, and found no white mold on any of the plants. The growth stage of the plants in the early planted fields were in blossom to the 4-inch pod stage. No apothecia (the mushroom like structures) of *Sclerotinia* were found on the ground. The beans looked healthy and vigorous, but the ground was quite dry. There was no evidence of white mold disease or apothecia found in additional scouted fields, some of

which had been heavily damaged by white mold in 2004. There was evidence of drought stress and viruses.

8/16/05 Bob Farner found the first white mold in dry beans (T39 and ECLRK) in fields that were not in the trials. These fields had not been planted to dry beans or soybeans for 15 years, but had been in pasture and hay.

9/2/05 About 3 weeks after the first scouting of the trial fields, Jeff Huether discovered only 4 plants infected with mold: 1 pod, 1 blossom, and 2 leaves in the trial fields. He intensely searched where mold usually lurks: near hedgerows and locations where bean foliage was dense.

OBJECTIVE 2 Why is white mold occurrence increasing in dry beans?

We interviewed several people as to why they thought the white mold problem was increasing in recent years. Here is a summary of possible reasons mentioned:

1. Short rotations: generally 3 years (sometimes 4): corn, wheat, dry beans.
2. Lack of profitable crops to grow in the rotation.
3. Mechanical damage to the plants: currently producers drive through the fields (often using dedicated spray rows) 2 to 4 times to spray for leafhoppers.
4. Wet weather: *S. sclerotiorum* (the fungus that causes white mold) prefers wet conditions and not hot weather.

OBJECTIVE 3 Summary and recommendations

TO SPRAY OR NOT TO SPRAY? RISK ASSESSMENT+SPRAY DECISION GUIDELINES

In order for disease to occur there must be inoculum (ascospores) available, a susceptible crop (dry beans at flowering stage, or damaged plant tissue), and conducive weather (cool and wet weather is preferred by *Sclerotinia*). About 2 weeks prior to bloom apothecia (mushroom like structures) can be looked for under the canopy. The difficulty is that effectively scouting for a low level of apothecia is time intensive and there is always the chance that ascospores may blow in from nearby fields. If the beans are in bloom or nearly in bloom and the ground is wet, there is moderate to high risk of white mold development, and it is probably safe to assume that inoculum is present. We studied the risk assessment prototype under the National Sclerotinia Initiative proposed by bean researchers and commodity personnel (collated by Dr. Howard F. Schwartz) and found this risk index to be so conservative that a spray would nearly always be called for in a climate such as ours.

The following information from other states was obtained from the Proceedings of the Sclerotinia Workshop (1/21/98) A fungicide spray is likely to provide an economic return if:

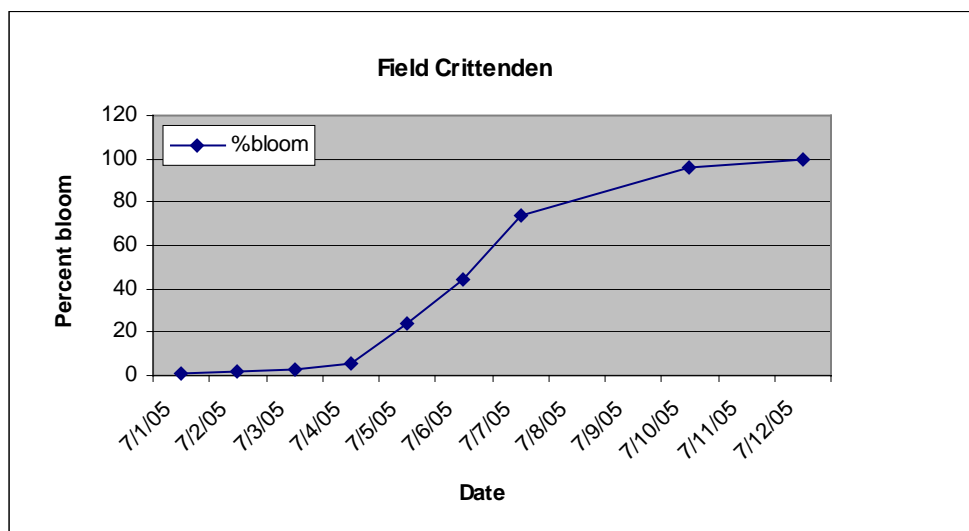
- there was wet weather about 2 weeks prior to flowering
- it is wet and humid at flowering
- white mold has been a problem in the planted field or nearby fields within the past 2 to 4 years
- there is good yield potential from dense vigorous plant growth.

SPRAY TIMING

If you decide to spray, applications must be made well before disease is visible on the plants. It is very important to cover the blossoms, buds, and blossom initials. Infected blossoms will fall onto healthy pods and transmit the disease to those pods. Percent bloom is calculated by summing the number of plants with one or more open blossoms from 10 consecutive plants in 10 areas of the plot, and averaging the result. For a one-spray program, apply the material at 100% bloom when each plant has one or more open blossoms. It is acceptable to have a few pin pods present, but larger pods should not be visible or the application will be too late. When using two sprays, apply the first at 30-40% bloom and the second about 7 days later.

The field was planted May 23, 2005. Variety was Red Kanner.

Date	Percent bloom
7/1/2005	0.5
7/2/2005	2.0
7/3/2005	3.1
7/4/2005	6.0
7/5/2005	24.0
7/6/2005	44.0
7/7/2005	74.0
7/10/2005	96.0
7/12/2005	100.0



The above table and graph gives an example of how bloom progressed in one variety in 2005. Eleven days passed from the start of bloom (0.5%) until 100% of the plants had one or more open blossoms. Using the 1st spray timing at 24% bloom of a two-spray program, the second spray 7 days later would be at 100% bloom. Also, 100% bloom is the optimum timing for a single spray program. Note, that it took only 1 day to go from 24% bloom to 44% bloom.

MANAGEMENT STRATEGIES TO CONTROL WHITE AND GRAY MOLD

- Maintain good air drainage by avoiding close proximity to hedgerows.

- Avoid narrow row spacing to facilitate good airflow and drying of foliage.
- Avoid plant injury that provides nutrients for ingress of fungi.
- Avoid over fertilization and frequent irrigation that keeps the canopy wet.
- Control weeds because weeds provide additional sites for sporulation and a favorable microclimate for infection.
- Rotate fields with grains, corn, and sorghum.
- Incorporate debris immediately following harvest so microorganisms have the opportunity to feed on the survival structures called sclerotia.

Chemical control: Apply fungicides when the plants have open blossoms. Fungicide applications after disease is visible are not effective. Researchers in other states found applying fungicides using high-pressure ground application with drop nozzles or air assist worked best for white mold control.

The most economical and most effective treatment from this trial and from research data from other states is Topsin M 4.5FL at 20 oz/acre, sprayed twice. We recommend two applications because white mold spore production in a field is fairly continuous and the plant tissue needs to be protected during bloom to effectively manage the disease. However, a single spray at barely 100% bloom frequently is effective.

Biological control: Another recently available strategy for control of *Sclerotinia* is the application of a commercial biological product called Contans, containing *Coniothyrium minutans*, a mycoparasite of the sclerotia (soil survival structures) of *Sclerotinia* species. The product reduces the white mold inoculum in the field.

Recommendations for using Contans effectively.

1. In the fall, apply Contans (at 1 lb/acre) to *Sclerotinia* infected crop debris immediately following harvest, and then incorporate the debris into the soil.
2. In the spring/summer, apply Contans (at 2 lb/acre) to soil after final fitting. Excellent coverage of infested debris is critical because the material must be in contact with the white mold sclerotia. It can be tank mixed with many herbicides, but must be shallow incorporated.
3. Incorporate by mixing into soil (or irrigating) to about 1-2 inch depth.
4. Do not turn the soil profile after application of Contans. This will avoid bringing up untreated soil that contains viable sclerotia.
5. Contans needs 3 to 10 weeks depending on temperature and moisture, to effectively colonize and destroy sclerotia.
6. Growers need to reapply in subsequent years if sclerotial populations are still high (the seller recommends applying Contans for at least 3 to 4 years to reduce populations or every year a susceptible crop is grown in that field).
7. *Sclerotinia* spores can blow in from nearby fields, but in-field inoculum probably causes the most disease.

This research was supported in part by the New York State Dry Bean Industry.*Some of the tested chemicals are not registered for white mold control at this time, and only registered products can be used on dry beans. Be careful to use only materials registered on the crop and for an approved use; obey the label including days to harvest for all products used.