

Integration of biological and chemical controls for improved white mold management - snap and dry beans, 2001

Field trials were established in grower fields at four locations in Wisconsin to evaluate the efficacy of Intercept WG (previously reported as Contans WG), a commercially available preparation of the fungus *Coniothyrium minitans* which has shown activity antagonistic to the white mold fungus, *Sclerotinia sclerotiorum*. At three locations subsequently planted to snap beans, Intercept WG was applied at two rates of 1.8 and 3.6 lb/A prior to bean planting. Areas were marked in each field to make six treatment combinations: 1) untreated, 2) standard fungicide application only (grower applied), 3) Intercept WG treatment only (1.8 lb/A), 4) Intercept WG treatment only (3.6 lb/A), 5) Intercept WG (1.8 lb/A) plus grower-applied fungicide treatment and 6) Intercept WG (3.6 lb/A) plus grower-applied fungicide treatment. A fourth site subsequently planted to red kidney beans was used to evaluate Intercept WG at 1.8 and 3.6 lb/A rates in comparison with no treatment. At each site, four plots (treatment replications), each 10 rows wide by 30 feet long were marked in the central portion of each treatment area for subsequent data collection. These plots were evaluated for white mold development immediately before commercial harvest. Four five-foot-long sections of row, chosen at random from each plot, were rated for pod infection and disease severity (Centuria, Sept. 6; Hancock, Sept. 6; Plover, July 27; Menomonie, Sept. 1). The incidence of infected plants, number of infected pods and disease severity were determined for each plant in each row being evaluated.

The severity of white mold was low at all four locations during 2001, but at all four locations there appeared to be a decrease in incidence of infected plants and pods in plots treated with Intercept WG. Using the three snap bean locations as experimental replications of treatments, significant differences were observed between treatments in disease severity and the incidence of infected plants. The application of either fungicide or Intercept (high and low rates) significantly reduced disease severity and incidence when compared with the untreated check plots. However, the application of both Intercept and fungicide (separate applications on the same plots) significantly reduced disease severity and disease incidence below the levels observed with fungicide alone. Disease severity and incidence were lowest when plots were treated with the 3.6 lb/A rate of Intercept and fungicide, but these levels were not significantly lower than the levels in plots treated with the 1.8 lb/A rate of Intercept and fungicide. At each location, disease control in the snap bean plots treated with either rate of Intercept WG was equivalent to or better than control associated with the standard fungicide program. The incidence of infected plants declined somewhat as the rate of Intercept WG increased from 1.8 to 3.6 lb/A. At Plover and Hancock, application of fungicide to the foliage in areas treated with either rate of Intercept WG further reduced the incidence of infected plants, although this decrease was not statistically significant. In all four locations, Intercept WG was applied approximately 6-10 weeks prior to crop bloom, a rather short time for the sclerotial infection and decay processes to reach a nature conclusion. Ideally Intercept WG would be integrated with an existing IPM program and would be applied to processing bean or soybean fields with unacceptable levels of white mold at the time of crop incorporation in late summer or fall. This would place the *C. minitans* fungus in direct contact with the *S. sclerotiorum* sclerotia. Incorporation would then help to provide more uniform temperature and moisture, favor the sclerotial infection process by *C. minitans*, and help to initiate sclerotial decay. Depending on the length of rotation between susceptible crops, it should be possible to see substantial reductions in the amount of surviving *S. sclerotiorum* inoculum.

Appreciation is expressed to cooperating growers and field personnel for assistance in coordinating these field trials, to Encore Technologies, LLC for supplying sufficient supplies of Intercept WG for all the field trials and to the Midwest Food Processors Association membership for project funding.

Table 1. Treatment Summary

Location	Cultivar	Planted	Intercept WG applied:		Fungicide applied:	
			Date	Rate	Date	Product, Rate
Snap Bean						
Centuria	HyStyle	10 Jul	21 Jun	1.8, 3.6 lb/A	22 Aug	Benlate 2 lb/A + Kocide 2000 1.6 lb/A
Hancock	HyStyle	14 Jul	26 Apr	1.8, 3.6 lb/A	17 Aug	Topsin M 70WP 2.0 lb/A
Plover	Romano	4 Jun	4 Jun	1.8, 3.6 lb/A	11 Jul 14 Jul	Benlate 1.5 lb/A
Dry Bean						
Menomonie	WI 126	1 Jun	25 May	1.8, 3.6 lb/A	---	None applied

Table 2. Data from the three snap bean trials analyzed using locations as replications.

Treatment	Disease severity (%) ¹	Incidence of infected Plants ²	Avg. no. infected pods/plant ³	% of plants with			
				0	1	2	3
				infected pods/plant			
Intercept WG, 3.6 lb/A + Fungicide	0.8	6.2	0.02	98.0	1.7	0.3	0.0
Intercept WG, 3.6 lb/A	1.8	9.2	0.02	98.4	1.5	0.1	0.1
Intercept WG, 1.8 lb/A + Fungicide	1.0	7.8	0.01	98.9	0.9	0.2	0.0
Intercept WG, 1.8 lb/A	1.5	11.3	0.02	98.1	1.7	0.1	0.1
Fungicide only	1.7	13.5	0.03	97.1	2.4	0.4	0.1
No treatment	2.1	17.0	0.02	98.0	2.0	0.0	0.0
Pr > F ⁴	0.03	< 0.01	0.18	0.23	0.35	0.37	0.69
LSD ⁴	0.6	3.5	NS	NS	NS	NS	NS
Effect of Intercept biocontrol							
No Intercept	1.9	15.3	0.03	98.5	2.2	0.2	0.04
Intercept – Low rate	1.3	9.6	0.02	97.5	1.3	0.1	0.03
Intercept – High rate	1.3	7.7	0.02	98.2	1.6	0.2	0.05
Pr > F ⁴	0.08	< 0.01	0.20	0.15	0.15	0.85	0.97
LSD ⁴	0.6*	3.5	NS	NS	NS	NS	NS
Effect of fungicide treatment							
None	1.8	12.5	0.02	98.1	1.7	0.1	0.05
Fungicide treated	1.2	9.2	0.02	98.0	1.7	0.3	0.02
Pr > F ⁴	0.01	0.03	0.52	0.74	0.87	0.07	0.55
LSD ⁴	0.5	2.9	NS	NS	NS	0.2*	NS
Interaction biocontrol x fungicide Pr > F⁴							
	0.41	0.99	0.13	0.22	0.41	0.43	0.28
Effect of location (replications)							
Centuria	0.1	1.1	0.01	99.1	0.8	0.1	0.00
Hancock	3.1	20.9	0.03	97.5	2.3	0.1	0.04
Plover	1.2	10.5	0.03	97.5	2.1	0.3	0.07
Pr > F ⁴	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.26	0.45
LSD ⁴	0.6	3.5	0.01	1.0	0.9	NS	NS

1 Four 5-ft-long sections of row were rated in each plot. Severity of disease on the entire plant was estimated for each plant on a 0-10 scale (0 = no infection, 1 = 10% infected, 2 = 20% infected . . . 10 = 100% infected). Numbers are the means of all plants rated (expressed as percentages).

2 The percentage of plants (out of the 20 ft of row rated) with any level of infection.

3 The total number of infected pods from the 20 ft of row rated divided by the number of plants rated.

4 Analysis of variance was performed on data, and Fisher's protected least significant difference (LSD) was calculated. NS = not significant at $P = 0.10$ (* indicates differences between treatments were significant at $P = 0.10$, but not at $P = 0.05$).

Table 3. Data from individual locations

Site #1 – Snap Beans, Centuria, WI. Plot coordinated by Tom Rabaey, Pillsbury Inc.

Treatment	Disease severity (%) ¹	Incidence of infected Plants ²	Avg. no. infected pods/plant ³	% of plants with infected pods/plant				
				0	1	2	3	4
No treatment	0.30	2.2	0.01	98.9	1.1	0.0	0.0	0.0
Fungicide only	0.20	1.3	0.02	98.3	1.4	0.2	0.0	0.0
Intercept WG, 1.8 lb/A	0.05	0.5	0.00	100.0	0.0	0.0	0.0	0.0
Intercept WG, 1.8 lb/A + Fungicide	0.09	0.9	0.00	99.8	0.2	0.0	0.0	0.0
Intercept WG, 3.6 lb/A	0.07	0.7	0.00	99.8	0.2	0.0	0.0	0.0
Intercept WG, 3.6 lb/A + Fungicide	0.11	1.0	0.03	97.8	1.8	0.3	0.0	0.0
Pr>F ⁴	0.21	0.37	0.03	0.04	0.07	0.43	---	---
Lsd ⁴	NS	NS	0.02	1.5	1.4*	NS	---	---
Analysis of the effect of Intercept rate and fungicide treatment								
Effect of Intercept rate (data pooled for fungicide treatment levels)								
No Intercept	0.25	1.7	0.01	98.6	1.3	0.1	0.0	0.0
Low rate	0.07	0.7	0.01	99.9	0.1	0.0	0.0	0.0
High rate	0.09	0.9	0.00	98.8	1.0	0.2	0.0	0.0
Pr>F ⁴	0.06	0.16	0.05	0.05	0.06	0.52	---	---
Lsd ⁴	0.16*	NS	0.01	1.1	1.0*	NS	---	---
Effect of fungicide treatment (data pooled for Intercept treatment levels)								
No fungicide	0.14	1.1	0.004	99.6	0.4	0.0	0.0	0.0
Fungicide treated	0.14	1.1	0.015	98.6	1.2	0.2	0.0	0.0
Pr>F ⁴	0.93	0.96	0.03	0.04	0.07	0.14	---	---
Lsd ⁴	NS	NS	0.01	0.9	0.8*	NS	---	---
Interaction - Pr>F ⁴	0.55	0.45	0.21	0.22	0.29	0.52	---	---

Site #2 – Snap Beans, Hancock, WI. Cooperation with Seneca Foods Inc.

Treatment	Disease severity (%) ¹	Incidence of infected Plants ²	Avg. no. infected pods/plant ³	% of plants with infected pods/plant				
				0	1	2	3	4
No treatment	4.3	33.9	0.02	97.9	2.1	0.0	0.0	0.0
Fungicide only	2.9	24.6	0.03	97.0	3.0	0.0	0.0	0.0
Intercept WG, 1.8 lb/A	3.2	22.3	0.02	97.9	2.1	0.0	0.0	0.0
Intercept WG, 1.8 lb/A + Fungicide	2.3	15.2	0.03	97.5	2.2	0.3	0.0	0.0
Intercept WG, 3.6 lb/A	4.5	17.4	0.04	96.9	2.6	0.3	0.3	0.0
Intercept WG, 3.6 lb/A + Fungicide	1.5	11.9	0.02	98.1	1.6	0.3	0.0	0.0
Pr>F ⁴	0.17	0.03	0.85	0.94	0.95	0.75	0.45	---
Lsd ⁴	NS	13.0	NS	NS	NS	NS	NS	---
Analysis of the effect of Intercept rate and fungicide treatment								
Effect of Intercept rate (data pooled for fungicide treatment levels)								
No Intercept	3.6	29.2	0.03	97.4	2.3	0.0	0.0	0.0
Low rate	2.7	18.8	0.02	97.7	2.2	0.1	0.0	0.0
High rate	3.0	14.7	0.03	97.5	2.1	0.3	0.1	0.0
Pr>F ⁴	0.60	0.01	0.84	0.96	0.88	0.41	0.39	---
Lsd ⁴	NS	9.2	NS	NS	NS	NS	NS	---
Effect of fungicide treatment (data pooled for Intercept treatment levels)								
No fungicide	4.0	24.6	0.03	97.6	2.3	0.1	0.1	0.0
Fungicide treated	2.2	17.2	0.03	97.5	2.3	0.2	0.0	0.0
Pr>F ⁴	0.02	0.06	0.94	0.98	0.97	0.62	0.33	0.0
Lsd ⁴	1.5	7.5*	NS	NS	NS	NS	NS	---
Interaction - Pr>F ⁴	0.49	0.91	0.47	0.60	0.68	0.78	0.35	---

Site #3 – Snap Beans Plover, WI. Cooperation with DelMonte Inc. and Prairie Star Ranch

Site and Treatment	Disease severity (%) ¹	Incidence of infected Plants ²	Avg. no. infected pods/plant ³	% of plants with				
				0	1	2	3	4
infected pods/plant								
No treatment	1.6	14.9	0.03	97.1	2.9	0.0	0.0	0.0
Fungicide only	2.0	14.7	0.06	96.0	2.8	1.0	0.2	0.0
Intercept WG, 1.8 lb/A	1.1	11.0	0.04	96.3	3.1	0.4	0.2	0.0
Intercept WG, 1.8 lb/A + Fungicide	0.8	7.4	0.01	99.4	0.4	0.2	0.0	0.0
Intercept WG, 3.6 lb/A	1.0	9.5	0.02	98.4	1.6	0.0	0.0	0.0
Intercept WG, 3.6 lb/A + Fungicide	0.6	5.6	0.02	98.1	1.6	0.4	0.0	0.0
Pr>F ⁴	0.04	0.24	0.05	0.08	0.16	0.49	0.60	---
Lsd ⁴	0.9	NS	0.03	2.5*	NS	NS	NS	---
Analysis of the effect of Intercept rate and fungicide treatment								
Effect of Intercept rate (data pooled for fungicide treatment levels)								
No Intercept	1.8	14.8	0.04	96.5	2.9	0.5	0.1	0.0
Low rate	1.0	9.2	0.03	97.9	1.8	0.3	0.1	0.0
High rate	0.8	7.6	0.02	98.2	1.6	0.2	0.0	0.0
Pr>F ⁴	< 0.01	0.07	0.12	0.13	0.24	0.70	0.63	---
Lsd ⁴	0.6	6.5*	NS	NS	NS	NS	NS	---
Effect of fungicide treatment (data pooled for Intercept treatment levels)								
No fungicide	1.2	11.8	0.03	97.3	2.5	0.1	0.1	0.0
Fungicide treated	1.1	9.2	0.03	97.8	1.6	0.5	0.1	0.0
Pr>F ⁴	0.76	0.32	0.96	0.44	0.15	0.23	0.91	---
Lsd ⁴	NS	NS	NS	NS	NS	NS	NS	---
Interaction - Pr>F ⁴	0.35	0.80	0.03	0.05	0.18	0.34	0.28	---

Site #4 – Dry Beans, Menomonie, WI. Cooperation with Russell Doane, Chippewa Valley Beans

Site and Treatment	Disease severity (%) ¹	Incidence of infected Plants ²	Avg. no. infected pods/plant ³	% of plants with				
				0	1	2	3	4
infected pods/plant								
No treatment	13.0	40.8	0.1	95.2	2.8	0.8	1.2	0.0
Intercept WG, 1.8 lb/A	11.5	33.9	0.0	97.6	2.0	0.5	0.0	0.0
Intercept WG, 3.6 lb/A	9.9	31.6	0.0	99.0	0.0	1.0	0.0	0.0
Pr>F ⁴	0.34	0.23	0.41	0.41	0.26	0.89	0.16	---
Lsd ⁴	NS	NS	NS	NS	NS	NS	NS	---

- 1 Four 5-ft-long sections of row were rated in each plot. Severity of disease on the entire plant was estimated for each plant on a 0-10 scale (0 = no infection, 1 = 10% infected, 2 = 20 % infected . . . 10 = 100% infected). Numbers are the means of all plants rated (expressed as percentages).
- 2 The percentage of plants (out of the 20 ft of row rated) with any level of infection.
- 3 The total number of infected pods from the 20 ft of row rated divided by the number of plants rated.
- 4 Analysis of variance was performed on data, and Fisher's protected least significant difference (LSD) was calculated. NS = not significant at $P = 0.10$ (* indicates differences between treatments were significant at $P = 0.10$, but not at $P = 0.05$).