PROPOSAL TO THE OREGON PROCESSED VEGETABLE COMMISSION (2015)

1. OPVC REPORT COVER PAGE

PROJECT TITLE: Evaluation of combined fungicide and genetic resistance to control white mold in green beans

PROPOSED PROJECT DURATION: 2 years

BUDGET TOTALS
TOTAL BUDGET REQUEST (all years):
Year 1: $2,727 **Year 2**: $2,727

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2. Executive Summary

The resistance to white mold obtained so far in snap beans has been derived from NY 6020, which provides partial physiological resistance. Under light disease pressure, plants will show few if any symptoms, while under heavy pressure, the plants may show a moderate level of infection (whereas susceptible BBL types will be 100% molded). Cultivars with this form of resistance would not need any supplemental control with fungicides, whereas under heavy pressure, fungicides might be required, but at a reduced frequency or quantity. The objective of this study was to determine whether OR6771 would benefit from an integrated mold control approach that included fungicides typically used in snap production, Topsin M and Rovral tankmixed.

Two applications of Topsin and Rovral significantly reduced the percentage of pods infected with white mold in all 4 varieties but the effect was greatest in plots with very low density of snap bean plants. Even though 6771 had greater plant density, the severity rating for this variety without fungicide was similar to NY-6020. The fungicide treatments were particularly efficacious for 5630 and OR91G, probably because of the low plant density, which allowed greater penetration of the fungicide sprays. Even with the low plant densities, these two varieties had a significantly greater percentage of plants infected compared to 6771. The most interesting outcome was the 31% increase in yield of 6771 with the use of fungicides, from 8.1 t/A to 10.6 t/A, even with very high plant densities that very conducive to mold development under extremely favorable environmental conditions for mold development.

3. FULL REPORT

Justification and Literature Review

The resistance to white mold obtained so far in snap beans has been derived from NY 6020, which provides partial physiological resistance. Under light disease pressure, plants will show few if any symptoms, while under heavy pressure, the plants may show a moderate level of infection (whereas susceptible BBL types will be 100% molded). As such, cultivars with this form of resistance would not need any supplemental control with fungicides, whereas under heavy pressure, fungicides might be required, but at a reduced frequency or quantity. While we have been able to demonstrate reduced disease incidence and severity using our rating scales, how these translate into increased yield for the grower and percent moldy pods at the processing plant is not known.

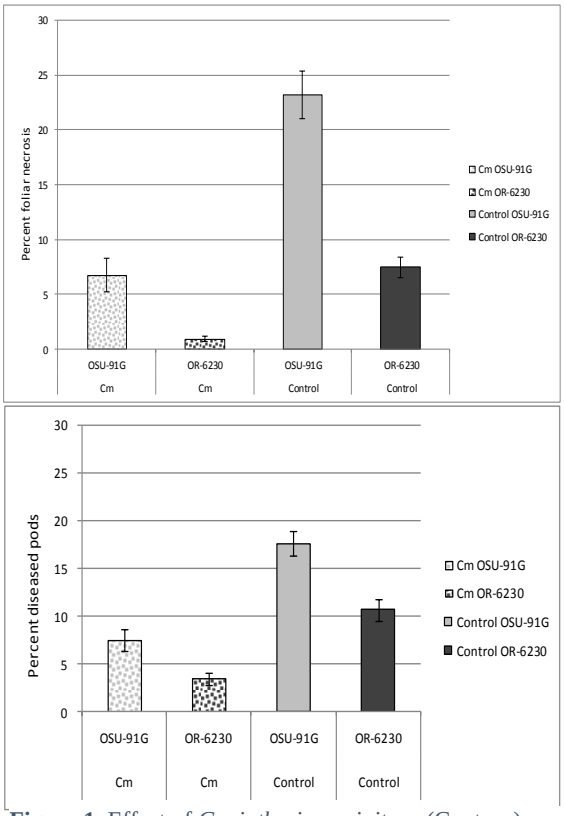

Figure 1. Effect of *Coniothyrium minitans* (Contans) application and plant resistance on foliar white mold severity and pod white mold incidence.

Previously Stone and Myers examined the effects of resistant green bean lines combined with the biological control agent Contans on white mold disease incidence (Figure 1). We observed that both resistance alone and biological control alone significantly reduced disease, and when used in combination, brought levels of disease incidence down to levels that would be acceptable to the cannery. In this particular experiment, percent moldy pods was reduced from about 24% to 4%. We would expect to see a similar additive effect using resistance in combination with fungicides.

We have developed two advanced lines that have the NY 6020 resistance in a BBL background that are nearing release. In this project, we compared these two lines with susceptible checks with and without fungicidal control of white mold in our white mold nursery.

This experiment lays the groundwork for cultural recommendations for control of white mold disease using a combination of genetic resistance and fungicides. Farmers will benefit from the deployment of this technology package with reduced production costs. Processors will benefit by receiving green beans of higher quality that will require fewer resources at the plant to prepare for canning and freezing.

Objective

Determine yield, pod quality, disease incidence and severity on plants and pods of partially resistant and susceptible green bean cultivars when grown under white mold pressure.

Significant Findings

- Two applications of Topsin and Rovral significantly reduced the percentage of pods infected with white mold in all 4 varieties but the effect was greatest in plots with very low density of snap bean plants.

- Even though 6771 had greater plant density, the severity rating for this variety without fungicide was similar to NY-6020.
- The fungicide treatments were particularly efficacious for 5630 and OR91G, probably because of the low plant density, which allowed greater penetration of the fungicide sprays. Even with the low plant densities, these two varieties had a significantly greater percentage of plants infected.
- The most interesting outcome was the 31% increase in yield of 6771 with the use of fungicides, from 8.1 t/A to 10.6 t/A, even with very high plant densities that very conducive to mold development

Methods

A randomized complete block design with 20 foot single row plots and four replicates was established in our white mold nursery. Four cultivars or advanced lines were planted on July 21, consisting of OSU 5630, OR 91G (susceptible) and OSU 6771 and NY-6020 (partially resistant). Plots were planted on July 21 so that harvest occurred in the fall, when environmental conditions favored white mold disease. Plots were seeded at approx. at a density equivalent to 200,000 plants/A on 30 inch rows. Topsin M + Rovral (22 oz + 1.5 pt/A) were applied on 2-Sept and 14-Sept to the four varieties with an untreated reference for each variety. Beginning at bloom, plots received 30 minute irrigations each evening to extend the leaf wetness period. At harvest maturity (Oct 5), all of the plants in 5 ft sections of row were pulled and each plant rated for disease incidence (% plants infected) and severity (rated on a scale of 0-9 and normalized for the number of plants harvested). Pods were removed and rated for mold incidence, then graded to obtain yield and sieve size distribution.

Results

White mold pressure was extremely high in this plot and more than 70% of the plants were infected in some plots. Two applications of Topsin and Rovral significantly reduced the percentage of pods infected with white mold. Snap bean emergence differed significantly between varieties, however, and this confounded the effect of variety and fungicide on white mold incidence and pod infection. Even though 6771 had greater plant density, the severity rating for this variety without fungicide was similar to NY-6020. The fungicide treatments were particularly efficacious for 5630 and OR91G, probably because of the low plant density, which allowed greater penetration of the fungicide sprays. Even with the low plant densities, these two varieties had a significantly greater percentage of plants infected. Perhaps the most interesting result was the 31% increase in yield of 6771 with the use of fungicides, from 8.1 t/A to 10.6 t/A. No yield benefit was noted when fungicides were applied to OR5630 and 91G.

Table 1. ANOVA for effects of variety and fungicide on snap bean yield and white mold.

Source	*DF*	Plant no		Plant biomass		Pod yield		% infected plants		Mold severity rating		% moldy pods	
		F Value	*Pr > F*	*F Value*	*Pr > F*	*F Value*	*Pr > F*	*F Value*	*Pr > F*	*F Value*	*Pr > F*	*F Value*	*Pr > F*
Block	3	1.31	0.30	0.38	0.77	0.52	0.68	1.73	0.19	3.51	0.0340	1.87	0.17
Variety	3	36.09	<0.0001	5.47	0.01	10.22	0.00	0.37	0.78	0.61	0.6165	6.08	0.00
Fungicide (with/without)	1	0.59	0.45	2.93	0.10	0.94	0.34	7.15	0.01	19.80	0.0002	33.15	<0.0001
Variety x Fungicide	3	0.35	0.79	1.07	0.38	1.47	0.25	3.54	0.03	6.53	0.0029	1.89	0.16

Table 2. Effect of variety and fungicide on snap bean yield and white mold development.

Tr no	Snap bean variety	Fungicide	Obs	Plant stand at harvest	Plant biomass	Pod yield	Plants infected	Mold severity rating	Moldy pods
				plants/A	*t/A*	*t/A*	*%*	*cumulative 0-9 for 10 plants; max rating of 90*	*%*
1	OSU 5630	None	4	54000	19.5	10.5	76.8	33	8.0
		Fungicide	4	29600	18.4	9.6	8.3	1	2.3
2	OR91G	None	4	26100	14.6	7.8	70.5	16	7.5
		Fungicide	4	25400	16.9	8.5	28.3	11	0.8
3	OSU 6771	None	4	191700	19.9	8.1	31.0	12	6.8
		Fungicide	4	173500	25.7	10.6	51.0	14	3.3
4	NY-6020	None	4	120200	19.9	5.8	42.8	21	2.0
		Fungicide	4	126500	21.8	5.9	26.3	3	0.0

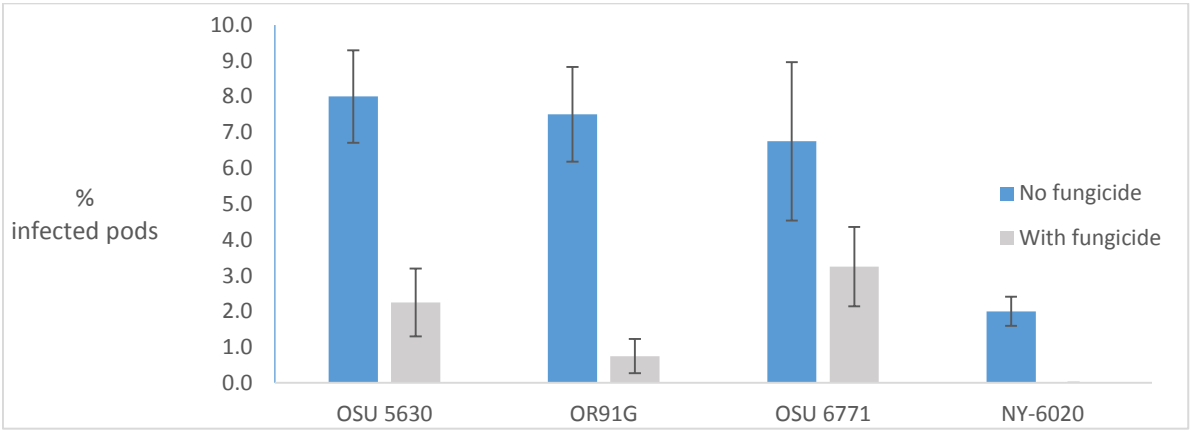

Figure 2. Effect of variety and fungicide on percent infected pods (±SE).

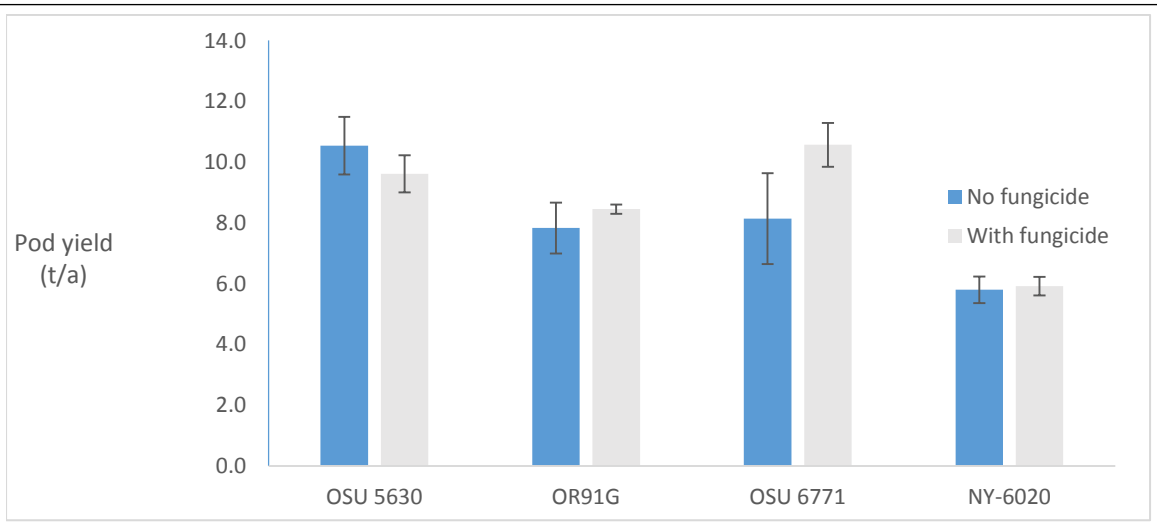

Figure 3. Effect of variety and fungicide on snap bean yield (±SE).