

Integrated Pest Management of WHITE MOLD on Common Bean in Colorado & Idaho

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ABSTRACT:

This 3-year project will investigate the importance of cultural practices (plant spacing), and timely application of multi-action pesticides in reducing damage from *Sclerotinia sclerotiorum* to *Phaseolus vulgaris* cultivars with varying levels of resistance (plant architectural-disease avoidance, within common bean and interspecific physiological resistance). Replicated field trials in white mold-infested and inoculated nurseries will investigate the importance and value of cultural practice modification (spacing of breeding lines with upright plant architecture or recently transferred interspecific sources of resistance) within an Integrated Pest Management context that compares cultivar, plant density and fungicide effects. The study will be conducted during 2006 to 2008 at one site each in Colorado (furrow irrigated) and Idaho (sprinkler irrigated). This poster reviews results from Year 1 (2006).

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GOAL and OBJECTIVES:

Our goal is to reduce bean (*Phaseolus vulgaris*) losses caused by *Sclerotinia sclerotiorum*.

Our objectives were to investigate components of Integrated Pest Management such as:

- varietal growth habit,
- plant spacing, and
- timely applications of fungicides.

MATERIALS AND METHODS:

Year 1 (2006) Experiment: seed of promising entries will be increased in disease-free environments during 2006 in Colorado (Single Stem selections) and Idaho (Interspecific Resistant selections) for use in the 2007 and 2008 experiments. The complete experiment with 7 entries and 2 plant spacings and 2 fungicide treatments will then be conducted at both sites during 2007 and 2008; if funding is granted each of those years.

- **Entries:** - architectural or resistance effects: (1) 'Montrose' – type III vine, (2) 'Vision' type II upright, (3) 'Matterhorn' – type II upright; all susceptible to white mold
- **Plant Spacing:** 75 cm wide row with a 25 cm wide bed, 1- to 2-row plots by 8 m long, with a 1 meter alley and 1 row border row of Montrose, seeded as: (a) 1 line (90,000 plants/A or 222,387 plants/ha) in the center of the bed, (b) 2 lines (135,000 plants/A or 333,580 plants/ha) spaced 15 cm apart on the bed for a 150% increase in stand
- **Fungicide Protection:** (i) Control, no fungicide, (ii) Endura @ 0.77 kg/ha at 100% bloom and 7 days later applied in 234 l water/ha with a CO₂ backpack sprayer

RCB Design (for 3 entries in 2006 and 7 entries in 2007 and 2008 – see following description) with a split-split block (for 2 plant spacings each 4 m long with each split again 2 m for the 2 fungicides as the split-split treatment), replicated 3 times each at ARDEC (Agricultural Research, Education & Development Center, furrow irrigation) in Colorado and Idaho (sprinkler irrigation) in 2006 to 2008. The entire experiment will be inoculated post-fungicide application (100% bloom and 7 days later) with a mycelial suspension (approximately 10¹³ fragments/ml) of white mold grown on PDA in the lab at 22°C for 10 – 14 days applied in 234 liters water/hectare with a backpack sprayer and flat fan nozzle directed onto the upper 1/3 of the flowering plants prior to sunset and dew formation. The ARDEC nursery has a history of light white mold disease; the field space in Idaho has an unknown history of white mold. Grower practices of high fertility (150 kg N broadcast preplant), post-plant inter-row ripping to 20 cm, and irrigation (1 – 2 applications of 2.5 cm of water per week as needed) will be followed. Preplant soil tests will determine the amount of nitrogen fertilizer to amend the plot to 150 kg/ha.

Field evaluations will include 4-week post-planting emerged plant stand, flowering date (100% bloom), canopy density at 100% bloom (average canopy height x between row coverage), white mold disease intensity = incidence x severity (of 50 plants at 14 and 28 days post-bloom), and yield (as kg/ha, seed size as 200 seed weight). An economical analysis will also be made for the cost/benefit effects. Microclimate variables (air temperature, rainfall at 1 m above bare soil) will be monitored with a Spectrum WatchDog weather station (Spectrum Inc., Plainfield, IL) placed near the experiment at each site (note: equipment will be provided by Schwartz). Experiment with 7 entries will be repeated in 2007 and 2008, if Year 2 and Year 3 funding is granted.

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Field Results: Cultivar Response to Varying Plant Spacing & Fungicide Protection, 2006

TREATMENT	Colorado - Yield		Idaho - % White Mold	
	Whole Plot (g)	100-Seed Wt (g)	+ Fungicide	No Control
Montrose – 1 Line/Bed	346.5	34.47	44.75	93.75
Montrose – 2 Lines/Bed	602.4	34.85	45.25	98.75
C.V. %:	31.3	1.60	-	16.38
Probability:	<u>0.0926</u>	0.4068	-	<u>0.0005</u>
Vision – 1 Line/Bed	429.4	35.7	4.00	12.00
Vision – 2 Lines/Bed	666.2	33.9	1.25	18.00
C.V. %:	18.13	6.31	-	50.54
Probability:	<u>0.0434</u>	0.3217	-	<u>0.0002</u>
Matterhorn – 1 Line/Bed	375.5	33.1	3.75	9.50
Matterhorn – 2 Lines/Bed	474.0	31.3	1.50	8.25
C.V. %:	28.9	8.28	-	123.84
Probability:	0.3388	0.4003	-	0.3735

Combined Factorial Analysis was significant for market class, so separate analyses were run

Colorado Results compare 1 vs 2 lines for plot yield **OR** 100-seed weight

Idaho Results compare 1 vs 2 lines for fungicide **AND** no control

RESULTS and DISCUSSION:

Colorado Results - During 2006, the Colorado experiment was adversely affected by drought conditions during flowering to pod fill stages of growth, and only a trace amount of white mold could be induced. Agronomic responses of treatments revealed that there was a noticeable increase in plot yield when plant population was increased 50% from 1 row to 2 rows. The % increase in yield when comparing 1 to 2 rows was 74%, 55% and 26% for Montrose, Vision and Matterhorn, respectively. With an average yield of 20 cwt/A (2240 kg/ha) and average grower price of \$0.20/pound (\$0.44/kg), the increased plant population (2 rows) could provide an addition return of 11 cwt valued at \$220/A (1232 kg valued at \$542/ha) for a upright Type II cultivar like Vision in the absence of white mold or if the cultivar was resistant to the white mold.

Idaho Results - The Idaho experiment was planted later and avoided the effects of high temperatures during critical phases of flowering and pod set. Three inoculations with white mold were successful and fungicide treatments reduced infection by 50% or more for each cultivar and each plant population. White mold incidence in non-fungicide treated plots was comparable for all three cultivars and either population; Montrose, Vision and Matterhorn % disease intensity ratings with 1 and 2 rows were 94 and 99, 12 and 18, and 10 and 8, respectively. The Type II Vision - 2 lines had 18% white mold with no fungicide protection, but only 1.25% with fungicide. Assuming this modest disease control and associated yield gain with an upright, susceptible cultivar like Vision, 1 fungicide application, and 2 rows per bed, a grower could net an additional \$190/A or \$512/ha at a cost of \$30/A or \$74/ha for the fungicide application in the presence of white mold.

Outreach Plan: We will distribute results at annual meetings and progress reports (Annual Report of the Bean Improvement Cooperative) of our professional societies and in the new on-line refereed publication, *Crop Management*, that will be published jointly by the American Society of Agronomy and American Phytopathological Society. This information will also be released to bean producers and others in CSU publications such as *From the Ground Up* (Soil & Crop Science). Results will also be distributed at annual field days and extension meetings during 2007 to 2009 in coordination with the Extension Bulletins on white mold and the Risk Index).

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