

**Report to the Pennsylvania Vegetable Marketing and Research
Program for work undertaken in 2009**

Breeding for White Mold Resistance in Snap Beans

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Abstract:

White mold (*Sclerotinia sclerotiorum*) is an important disease of snap beans in the northeast particularly during cool, damp seasons. Incorporation of high levels of resistance to this pathogen in commercial type snap bean lines is a major focus of the breeding program. 'Cornell 501' was released in 2002 and tested nationally in W-1150 white mold nurseries in 2002-2005, 'Cornell 504' was released in 2008. These breeding line have ranked among the best performing lines with Cornell dry bean releases in multiple field and greenhouse tests throughout the US. Yield studies of Cornell 501 were undertaken in 2004 and it was estimated to yield over 4 tons/acre of sieve 4 snap beans, 'Cornell 504' will be yield tested in collaborative trials in 2009. Additional crosses have been made between commercial snap bean and breeding lines have been advanced through white mold greenhouse inoculation trials. Five lines exhibiting the highest level of resistance were selected from several hundred between 2003 and 2006 from which Cornell 504 was selected (lines WM 18, WM2 8, WM 48, WM 60 and WM 70). The plant structure of these lines likely requires some improvement, as they grow into a more open bush than is preferable. Additional crosses have been made to correct this, and improve type by crossing with 2 bush type varieties, the commercial variety 'Hystyle' and a new source (A-195) from Idaho to further enhance resistance. Crosses have also been made to two small sieve lines for the development of white mold resistant whole beans. In 2009, snap beans populations will be selected with acceptable yield/quality with a high level of resistance to white mold.

Objectives:

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[1] To greenhouse and field test advanced breeding lines for resistance to white mold, yield and quality.

[2] To screen and cross white mold resistant field selections and advanced breeding populations in the greenhouse, and advance the generations with further screens to determine resistant types with good horticulture.

Results:

[1] Snap bean breeding lines were evaluated for white mold resistance in 2009 in both the large sieve and small sieve plant types for selection of breeding lines with high levels of resistance. These evaluations were based on populations developed from crosses with the resistant breeding lines and previously released lines (Cornell 501 and Cornell 504). Common bean lines were also included in W-1150 national white mold nurseries, where they continue to perform as the best entries in multi-state trials. These national entries were tested in a greenhouse trial against Cornell breeding lines being developed (Table 1). Breeding lines derived in the light red and dark red kidney backgrounds following crosses to Red Kanner were also used in development of new populations for transfer of enhanced resistance to snap beans focusing on the development of four new populations for enhancement of resistance. A total of 38 F₄ lines were selected and progeny planted for confirmation of resistance. Twelve lines were selected with high levels of resistance and crossed to snap beans ASR 1644 and ASR 1544. Of the 24 possible cross combinations, 23 segregating F₂ populations were derived and planted in fall 2009 for selection of plant type and seed quality, prior to selection of white mold resistance at the F₃ generation. The twelve lines from the 2007-2008 round of crossing are also advanced for potential entry in 2010 W-1150 national trials. Additional evaluation of resistance in greenhouse trials will help to determine the best snap bean materials for development of tolerant varieties.

[2] Snap bean breeding lines have been developed by accumulating minor genes for white mold resistance using sources that include PI 204717 and PI 169787. The accumulation of genes in these breeding lines requires extensive greenhouse screening through multiple generations in order to recover lines with high levels of physiological resistance to white mold. Crosses have been made to improve horticultural type focusing on crosses to 'Hystyle' and small sieve cultivars. Lines advanced in the greenhouse trials were used for field evaluation in 2007, but exhibited lower than expected yields, thought to be caused by a more open plant structure and heat stress. These lines were re-tested in 2008, and have been used as parental material for increasing the bush-type canopy of the lines.

Snap bean lines were evaluated for white mold resistance in two greenhouse screens in 2009 focusing on 12 new breeding lines developed following crosses in January 2008. Lines exhibiting any significant level of disease symptoms were

eliminated during the trials. Additional populations to improve horticultural type were included in populations developed following crosses and backcrosses to 'Hystyle', A-195 and two small-sieve bush types. The materials developed have been released to seed companies for improvement of commercial varieties including line Cornell 504 in 2008. Additional crosses were made to further improve the horticultural type.

Table 1: Mean rankings of Cornell WM lines when compared to W-1150 entries in greenhouse straw test trials Fall 2009

Line	# of plants rated	Mean disease rating (1-9)	Rank
Cornell 611	20	3.90	1
Cornell 608	20	4.40	2
Cornell 607	20	4.65	3
Cornell 610	19	5.10	4
Cornell 612	20	5.25	5
Cornell 609	19	5.47	6
Cornell 605	20	5.65	7
A 195	20	6.35	8
Cornell 504	20	6.40	9
G122	19	6.79	10
VCW54	20	6.85	11
PO7751	20	7.10	12
B07104	20	7.80	13
ExRico(Bunsi)	18	7.89	14
WM31	19	7.95	15
P07863	17	8.18	16
Beryl	19	8.21	17
OSU904	18	8.33	18
ND04094-4	18	8.56	19
NDZ06238	20	8.60	20
B05055	19	8.63	21
ND060067	19	8.68	22
NDZ06219	20	8.95	23
NDZ06218	19	9.00	24