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Title: Impact of Cereal Cover Crop Residues Weed Emergence and White Mold Severity and Incidence in Snap Beans

Project Leaders: Ray William and Ed Peachey, Horticulture Department
Project Status: Concluding one year
Amount Requested: $6,000

Summary

Two trials were established with a late season planting to evaluate the potential of manipulating tillage and vegetation to suppress white mold severity in snap beans. Small grain cereals were spring planted and killed in June to provide a dead mulch into which snap beans were planted with a cross-slot planter. In the first trial, white mold severity was greatest in the *Wheeler* rye residue, and least in the conventional tillage plot with Ronlian. Eliminating tillage was the most effective practice in reducing white mold severity but the difference was statistically unimportant. Plant nutrient analysis at harvest indicated no difference in nitrogen content between plants collected from these treatments. However, levels of calcium, magnesium and manganese were highest in the fallow treatment with no cereal residue, the same treatment with the lowest level of white mold. Snap bean yield was highest in the Ronilan treated plot and lowest in the residue plots, partially due to delayed maturity.

In the second trial, white mold severity was lowest in the conventional tillage treatment with Ronilan and highest in the conventional tillage treatment without Ronilan. Within residue plots, snap beans planted into unflailed residue had lower white mold ratings. However, plant density also was highest in plots that were flailed. Trends also indicate that *Wheeler* rye treatments again had the highest level of white mold while *Micah* barley may have reduced white mold to some extent. Bean plant biomass yield was primarily a factor of white mold severity and did not reflect the direct impact of cereal residues on plant growth..

Objective

Evaluate the interaction of cereal residue management with weed emergence and growth, white mold incidence and snap bean yield.

Project Progress

Methods. This study is a continuation of trials evaluated in 1993 and 1994 trials. *Steptoe* and *Micah* barley and *Wheeler* rye were drilled into prepared 15 by 60 foot plots on May 23, 1995 that were fertilized with 600 lbs/acre of 12-29-10. Cereals and weedy vegetation growing in fallow plots were killed on July 3 with glyphosate. Just before planting, one of the two fallow plots was chisel plowed and rototilled for the conventional tillage seedbed. In Trial 1, the cereal residues were rolled and snap beans planted with the cross-slot planter. Liquid fertilizer was banded at planting (50 gal/acre of 10-34-0; ie 70 lbs N). After planting, the residue was flailed in one-half of each plot. Metolachor was applied immediately after planting to all but 15 foot of the plot to allow for evaluation of residue on weed emergence. Glyphosate (1 lb./A) was again applied to the entire plot at this time to kill surviving weeds such as common purslane, particularly in the fallow and *Wheeler* rye plot. Basagran was applied to the entire plot on August 8, timed to kill emerging weeds in the conventional tillage plot. Any remaining weeds were removed by hand, except from the area that was used for weed evaluation. Ronilan was applied to one half of the conventional tillage plot with a backpack sprayer and nozzle angled at 45 from both sides of the row.

In trial # 2, snap beans were planted on July 19 into unflailed residue and the conventional tillage seedbeds with the cross-slot planter. Metolachlor and glyphosate were applied (tank mixed) immediately afterward, then half of each plot flailed. One plot was covered with a landscaping fabric to simulate a soil barrier to white mold spores.

Weed emergence was determined from 4 ft^2 on August 7, 4 WAP in the first trial only. Snap beans were harvested from 15 foot of row and total bean biomass and pod weights determined. White mold severity was evaluated on a 0-4 scale (1=single point infection on the plant stems, 2=multiple stems infected, 3=multiple point infection with wilting stems or damaged pods, 4=dead plant). White mold incidence was determined by the number of plants with any sign of infection.

Beginning at first bloom, the canopy was wetted with 15 minutes of irrigation late in the evening to encourage white mold development.

Results. Experiment 1. Growth was vigorous in this trial because of the high fertility conditions. White mold developed on a high percentage of the plants. Bean yield was highest for the treatment with Ronilan probably because of reduced mold pressure. White mold severity was least for the Ronilan treatment and greatest for the *Wheeler* rye plot. Though treatment differences were significant, the primary difference was between the Ronilan treated plot and the same tillage treatment without Ronilan. *Wheeler* rye also tended to increase white mold severity and whole-plot visual observations (aside from single plant evaluations) in the field confirmed this. *Steptoe* and *Micah* barley (very similar residue types) had similar levels of white mold, and disease severity in these plots was slightly less than the conventional tillage treatment. The lowest level of mold was in the fallow plots with no cover crop. However, variability in the data prohibit any consensus as to whether this is an actual fact or simply an artifact of plot location and other unknown effects. Flailing the residue seemed to have little consistent effect on white mold incidence.

We evaluated several factors to understand what might be influencing these results. Regression analysis indicated a very poor relationship between white mold development and plant density (R^2=0.002). Snap bean yield regressed against white mold severity indicated a moderate correlation, as would be expected if the disease pressure is high and damaging plant growth. We also hypothesized that cereal residues may limit nitrogen uptake by the beans, thus reducing susceptibility to white mold. However, nutrient analysis of the plants indicated no differences between any of the treatments for the macro elements N, P, or K. However, calcium and the micronutrients manganese and magnesium were at significantly higher levels in plants collected from the fallow plot with no cover crops. These same plots had the lowest amount of white mold. Weeds were completely controlled in the plot and did not influence white mold results.

Snap bean yield was highest in the conventionally tilled plot with Ronilan. Even though white mold severity tended to be lower in the barley plots, yields were also lowest. Maturity was slightly delayed in these plots, possibly attributing to the yield decline. Flailing the residue increased the yield of beans in the *Micah* barley plot, decreased it in the *Steptoe* barley plot and had little effect on the *Wheeler* rye treatment. *Wheeler* rye is a winter annual and had a very grass-like appearance, produced a low amount of biomass, and was easy to plant into. However, the data seem to indicate that *Wheeler* rye aggravated white mold severity.

Weed evaluations from the untreated areas indicated that the barley residues were most effective at minimizing weed emergence. *Micah* barley completely suppressed nightshade though reduced tillage was the most important component of this effect. Total weed density was reduced in all residue treatments compared to the conventional tillage plot.

Experiment #2. As in the first experiment, trends indicate a possible reduction of white mold severity due to treatment. However, the comparison between white mold severity in flailed and unflailed treatments was statistically more important ($P=0.02$). Residue treatments that were unflailed had comparatively lower white mold ratings. The conventional tillage plot without Ronilan had the highest level of white mold, but applying Ronilan effectively reduced white mold to the lowest levels. Trends also indicate that *Micah* barley treatments may have reduced white mold severity compared to the conventional tillage plot, particularly in the unflailed subplot. However, this treatment also had the lowest plant density, and the relationship between plant density and white mold severity was very low in this experiment ($R^2=0.06$). Bean biomass accumulation was not a good indicator of plant canopy or bean plant growth because white mold was very severe in this plot. It is possible that the greater residue of barley delayed bean development slightly and therefore, white mold onset, although field observations did not support this. *Wheeler* rye again had the highest white mold rating. The simulated barrier reduced white mold compared to the same treatment with no barrier, but statistically the difference is not significant.

Table 1. Cover crop residue impacts on white mold development and snap bean yield, Vegetable Research Farm, Corvallis, OR, 1995.

Cover crop	Management	Stand at 4 WAP	White mold at harvest				Plants harvested	Bean pod yield	Maturity	Bean plant biomass
		(no./2 ft)	severity (0-4)[1]		incidence (% plants)		no./15'	t/ac	% 2-4	kgs/15'.
1. Micah barley	Unflailed	12.0	0.81	*0.60*	38	*0.20*	66	6.7	61	12.0
Micah barley	Flailed	10.3	0.76	*0.50*	45	*0.30*	73	7.9	60	14.0
2. Steptoe barley	Unflailed	12.0	0.65	*0.30*	39	*0.20*	79	8.4	60	13.9
Steptoe barley	Flailed	10.3	1.15	*0.70*	58	*0.80*	73	6.8	61	12.5
3. Wheeler rye	Unflailed	11.0	1.45	*0.20*	61	*1.00*	68	6.9	66	12.2
Wheeler rye	Flailed	10.0	1.18	*0.60*	59	*0.90*	70	7.5	60	13.6
4. None	Unflailed	9.5	0.56	*0.20*	43	*0.30*	63	8.5	56	14.6
None	Flailed	9.3	0.81	*0.60*	34	*0.10*	64	8.8	53	14.8
5. Conventional tillage	No fungicide	9.6	1.00		61		73	8.1	56	13.9
6. Conventional tillage	Ronilan	-	0.21	*0.03*	19	*0.20*	68	9.3	56	14.9
Main effect means										
1 Micah barley		11.1	0.78 ab[2]		41 ab		69	7.3	61	13.0
2 Steptoe barley		11.1	0.90 ab		48 ab		76	7.6	61	13.2
3 Wheeler rye		10.5	1.31 a		60 a		69	7.2	63	12.9
4 None		9.6	0.68 ab		38 ab		67	8.1	57	14.2
5 Tilled		9.6	1.00 a		61 a		73	8.1	56	13.9
6 Tilled+ Ronilan		9.6	0.21 b		19 b		68	9.3	56	14.9
LSD (P=0.05)							19	2.0	-	1.0

[1] Probability of a difference between the mean in this cell compared to the conventional tillage treatment without Ronilan.

[2] Means in the same column followed by the same letter are statistically equal (Duncan's multiple range test, P=0.05)

Table 2. Cover crop residue and tillage impacts on weed emergence in snap beans, Vegetable Research Farm, Corvallis, OR, 1995.

Cover crop	Management	Weed control					
		Pigweed	Sheperdspurse	Purslane	Nightshade	Misc.	Total weeds
		------------------------(no./m sq)------------------------					
1 Micah barley	Unflailed	0.5	3.5	2.3	0.0	3.3	9.5
Micah barley	Flailed	0.5	1.3	0.5	0.0	0.8	3.0
2 Steptoe barley	Unflailed	0.3	0.0	1.5	0.8	0.8	3.3
Steptoe barley	Flailed	2.0	0.8	1.5	0.5	1.0	5.8
3 Wheeler rye	Unflailed	0.8	4.3	3.0	1.5	0.8	10.3
Wheeler rye	Flailed	0.8	0.8	1.0	0.0	2.0	4.5
4 None	Unflailed	1.5	8.8	2.0	0.5	1.0	13.8
None	Flailed	1.3	2.8	4.3	0.3	1.0	9.5
5 Conventional tillage	No fungicide	2.0	15.2	8.0	3.4	5.8	34.4
LSD (P=0.05)		2.1	13.0	5.8	1.2	6.5	14.2
Main effects							
1 Micah barley		0.5	2.4	1.4	0.0	2.0	6.3
2 Steptoe barley		1.1	0.4	1.5	0.6	0.9	4.5
3 Wheeler rye		0.8	2.5	2.0	0.8	1.4	7.4
4 None		1.0	1.8	2.6	0.1	1.5	7.0
5 Tilled		2.0	15.2	8.0	3.4	5.8	34.4

Table 3. Trial #2: Cover crop residue impacts and tillage impacts on white mold incidence in snap beans, Vegetable research Farm, Corvallis, OR, 1995.

Cereal	Management	White mold at harvest		Plants harvested	Bean plant biomass
		severity (0-4)[3]	incidence (% plants)	no./15'	kgs/15'.
1 Micah barley	Unflailed	1.33 abc	65 bc	31 a	4.7 a
Micah barley	Flailed	2.21 ab	92 a	41 a	5.0 ab
3 Wheeler rye	Unflailed	2.38 a	86 ab	38 a	4.8 ab
Wheeler rye	Flailed	2.72 a	97 a	37 a	4.4 ab
4 Simulated barrier		1.93 abc	75 bc	32 a	5.6 ab
No cover crop	-	2.73 a	98 a	36 a	5.2 ab
5 Conventional tillage	Ronilan	0.98 c	46 c	34 a	6.0 a
Conventional tillage	No fungicide	2.95 a	96 ab	36 a	3.8b

[3] Means followed by the same letter are statistically equal (P=0.05). This comparison treated subplots as individual treatments.

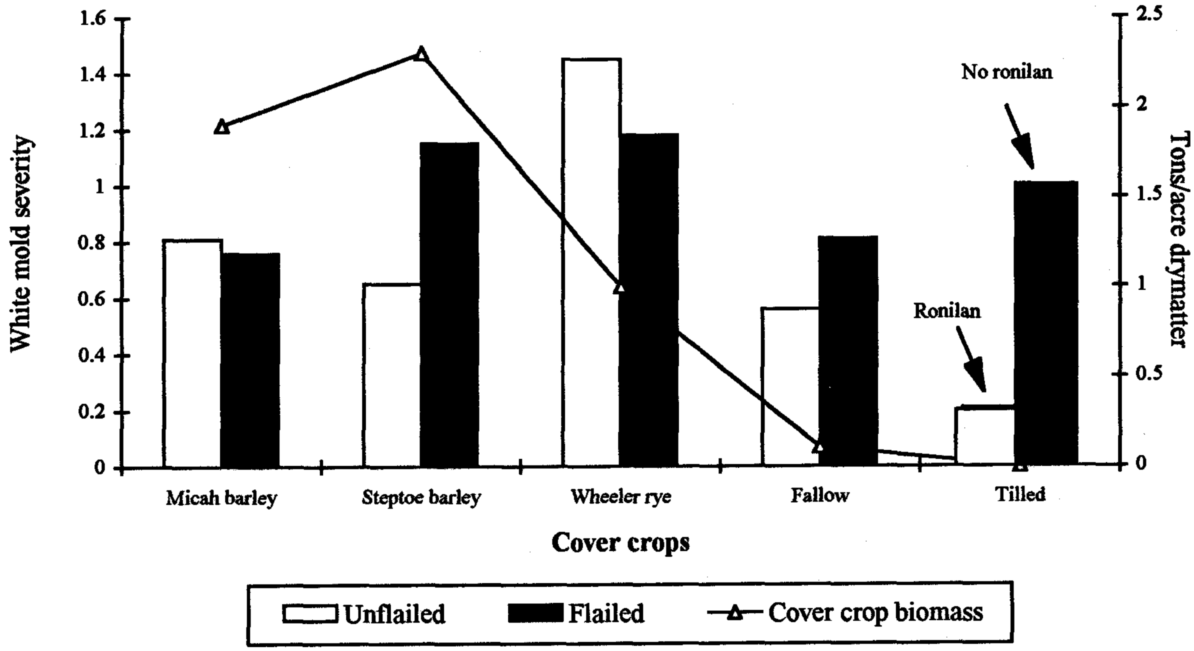

Figure 1. Impact of cereal cover crop residues and tillage on white mold severity, (Experiment #1).