

## Pacific Northwest Vegetable Association: 2010 Pre-Proposal

1. **Title: Management of *Rhizoctonia* in onion bulb crops in the Columbia Basin**
2. **Investigators:** Lindsey J. du Toit, Washington State University Mount Vernon NWREC, 16650 State Route 536, Mount Vernon, WA; (360) 848-6140, [dutoit@wsu.edu](mailto:dutoit@wsu.edu); Tim Paulitz, USDA ARS, Rm. 363 Johnson Hall, Pullman, WA 99164-6430. [paulitz@wsu.edu](mailto:paulitz@wsu.edu) ; Phil Hamm, Oregon State University Hermiston AREC, P.O. Box 105, Hermiston OR 97838. [Philip.B.Hamm@oregonstate.edu](mailto:Philip.B.Hamm@oregonstate.edu); Lyndon Porter, USDA ARS, WSU Prosser IAREC, 24106 N. Bunn Rd, Prosser, WA 99350. [lyndon.porter@ars.usda.gov](mailto:lyndon.porter@ars.usda.gov); Bill Dean, Research Director, River Point Farms, 77460 Paterson Rd, Irrigon, OR 97844, (541) 481-6055, [bdean@riverpointfarms.com](mailto:bdean@riverpointfarms.com)
3. **Institutions:** Washington State University, USDA ARS, and Oregon State University.
4. **Summary:** Approximately 27,000 acres of onion bulb crops and 40,000 acres of green pea crops are grown under irrigation in the Columbia Basin (WA/OR) annually. Significant losses have occurred as a result of seedling blight/stunt caused by *Rhizoctonia* spp. when onion or pea crops are planted soon after incorporating cereal cover crops. This has led to grower-cooperator field trials in 2008-09 that demonstrated the potential value of several management practices for this disease. Symptomatic pea plants mature earlier than healthy plants, affecting tenderometer readings; symptomatic onion plants remain stunted, producing smaller bulbs at harvest. These effects reduce prices growers are paid. This proposal requests funding to continue research initiated in 2008-09 in large-scale grower-cooperator fields. The project entails evaluations of fungicide seed treatments, fungicide sprays, fumigation with Telone II, and cultural practices that enable growers to optimize the duration between herbicide kill and incorporation of cereal cover crops prior to planting onion or pea crops by minimizing losses to *Rhizoctonia*. Field trials will be combined with lab research to increase our understanding of *Rhizoctonia* spp. that infect onion and pea crops. This will enhance growers' abilities to reduce losses to this pathogen, and remain competitive in national and international onion and pea markets.
5. **Statement of the problem to be addressed:** Approximately 27,000 acres of onion bulb crops and 40,000 acres of green pea crops are grown under irrigation in the Columbia Basin (WA/OR) annually. Onion bulb crops have farm gate values of \$4,000-\$7,000/acre and pea crops of \$500-\$700/acre. The Basin region ranks 3<sup>rd</sup> in the US for production of storage onions and 3<sup>rd</sup> for green pea. Empirical evidence suggests increasing prevalence of seedling blight in onion bulb crops planted soon after incorporation of a winter cover crop such as wheat or barley. Strips of the cover crop are left standing in the spring to protect emerging seedlings from wind/sandblasting. Stunted seedlings occur in patches ranging from <1 m to >10 m in diameter. Symptomatic onion plants remain stunted through the season, resulting in smaller bulbs at harvest. Grower profits for storage onions are dependent on jumbo and colossal-sized bulbs. Symptomatic pea plants mature earlier than healthy plants, affecting tenderometer readings. These effects reduce prices onion and pea growers are paid.

We have demonstrated that the primary pathogens causing this problem are *Rhizoctonia* species. Symptoms can resemble injury from nematodes and *Pythium* spp., so accurate diagnoses are important. The primary factor promoting the disease is the presence of significant decomposing residues in the soil into which onion or pea seeds are planted. However, cover crops are essential on sandy soils in the Basin to prevent soil erosion during the winter/spring, and sandblasting of emerging seedlings. *Rhizoctonia* spp. colonize decomposing crowns and roots of the incorporated cover crop, from which the fungi then colonize roots of onion and pea seedlings growing through the residues. The problem does not occur in the absence of significant residues. Patches typically appear in the same areas of individual fields in subsequent years.

Efforts to manage *Rhizoctonia* seedling blight in onion and pea crops have been limited by a previous lack of recognition of the causal agent, and limited understanding of the epidemiology of the disease. Research on a similar problem in cereal crops in the Palouse by Paulitz has demonstrated that delaying planting of a crop 3 to 6 weeks after incorporating the previous crop largely eliminated the problem. Longer durations may be needed in cold/dry soils because of slower microbial degradation of residues. Because of the patchy nature of this disease and the difficulty of generating adequate disease pressure by inoculating soils (T. Paulitz), large-scale research trials were initiated in 2008-09 by Dr. Bill Dean at River Point Farms, using 10 center-pivot circles of onion bulb crops in fields with a history of this disease as replicate plots to assess the efficacy of fungicide seed treatments and drench applications, soil fumigation with Telone II, and timing of cover crop incorporation relative to planting onion crops for reducing losses to this problem. Preliminary results demonstrated clearly that the longer the duration between cover crop incorporation and planting onion seed, the lower the impact of the disease. Decomposing cover crop residues provide a “green bridge” on which *Rhizoctonia* spp. grow and then infect the roots of onion and pea seedlings.

The promising results from the 2008-09 onion plots demonstrate the need to evaluate these practices under grower-cooperator conditions in the Columbia Basin. The research is directly applicable to green pea crops as *Rhizoctonia*. Stunting in pea crops has ranged from 5-30% of individual fields. One grower in Paterson, WA estimated the problem affects 5-20% of his pea and onion acreage. Furthermore, Steve Rathjen, onion grower and former chair of Onions Australia, and Dr. Trevor Wicks, Plant Pathologist at the South Australian Research & Development Institute, visited the Columbia Basin in spring 2009 to view research plots at River Point Farms. They showed photos depicting significant losses to this disease in onion bulb crops around the Murray-Darling River in Australia, where growers have named the disease ‘Mallee stunt’ and where the problem is exacerbated by a severe long-term drought. They have expressed interest in cooperative research on this problem. Funding for 2010 has been received from the Washington State Commission for Pesticide Registration (WSCPR) for \$20,110, pending matching support from stakeholders. To meet this requirement, River Point Farms donated \$5,000 cash, BASF Corp. \$3,000 cash, and River Point Farms is donating >\$250,000 in-kind support (see **Budget** below). *This pre-proposal requests \$9,500 to fulfill the cash match for the WSCPR funding.*

## **6. Materials and methods:**

We will assess the following for management of seedling blight caused by *Rhizoctonia* spp.:

- a. Soil fumigation with Telone II;
- b. Seed treatment with thiram, azoxystrobin (Quadris), or boscalid+pyraclostrobin (Coronet) vs. Apron (control treatment for *Pythium* spp.);
- c. Fungicide drench applications with azoxystrobin (Quadris) or thiophanate-methyl (Topsin M 70WP);
- d. Timing Roundup application and cover crop incorporation 4 weeks, 3 weeks, 2 weeks, 1 week, or 1-2 days prior to planting onion seed ('brown bridge' duration).

Treatments for each objective will be set up in a 128 acre, center-pivot irrigated onion field near Irrigon, OR with a history of significant stunting in onion and pea crops from *Rhizoctonia* spp. The field was planted to onion in 2006, pea/sweet corn in 2007, potato in 2008, and corn in 2009. A barley cover crop was planted by River Point Farms in fall 2009, and an onion crop will be planted in 2010. For each objective, a randomized complete block design with 4 replications will be used. Telone II fumigant will be applied by Dow after incorporation of the cover crop in spring 2010, in 4 replicate strips across the length of the field, each strip ~2,500' long, 4 beds wide (13'), and randomized with 4 non-fumigated strips of the same width/length. The plots will then be planted with onion seed. The three seed treatments and non-treated seed (control) will also be planted in each of 4 replicate strips, each strip 8 beds wide (26') and ~2,000-2,500' long. This will require 1 bucket of seed/treatment (\$1,000/bucket of seed plants ~3.5 acres). The fungicide drench applications will also be applied in 4 replicate plots, each 500' long and superimposed on the seed treatment plots to enable evaluation of seed treatments with/without drench applications. The cover crop herbicide treatments will include application of Roundup to the cover crop at each duration noted above (objective IV) prior to planting onion seed. Each treatment will be applied to 4 replicate plots, each plot 8 beds wide and 500' long, so that all 5 treatments fit in a replicate strip across the entire length of the field, randomized separately in each strip. The beds in which treatments are placed will be marked with a GPS unit, and plots staked to facilitate spray applications (herbicide or fungicide) and data collection. Plots will be monitored for symptoms of stunting. From ~4-6 weeks after planting, the number of stunted patches and width of each patch will be counted in each plot, to calculate average bed width of stunted patches/plot. The trial will be maintained (insecticide and herbicide sprays, cultivation, etc.) by River Point Farms. Soil samples will be collected for real-time PCR assays to identify and quantify *Rhizoctonia* species associated with the patches. Onion bulb yield and quality data will be collected from each plot in cooperation with River Point Farms. Data will be subjected to analyses of variance and means comparisons using SAS.

#### 7. Anticipated timeline and results:

**Feb 2010:** Set up fumigated plots in grower-cooperator field, initiate 1<sup>st</sup> herbicide applications (4 weeks < planting) for cover crop kill and incorporation.  
**Mar** Apply rest of herbicide sprays, plant onion seed, apply fungicide drenches.  
**Apr-Jul** Tally stunted patches. Aerial photos. Assay soil samples for *Rhizoctonia* spp.  
**Aug-Oct** Harvest bulbs from each plot, rate bulb size/quality, analyze data.  
**Nov 2010:** Present results at PNVA annual meeting in Tri-Cities, WA.

Beneficiaries include onion bulb and pea growers in the Columbia Basin who rely on cover crops to reduce soil erosion and provide protection for onion or pea seedlings against sand/windblasting. This research is expected to lead to development of an integrated pest management program that includes fungicide seed/broadcast treatments, fumigation, and

optimum timing of cover crop kill and incorporation relative to planting onion or pea seed. We are also submitting a WSDA Specialty Crop Block Grant application on 5<sup>th</sup> February 2010 to request 3 years of research funding for onion and pea crops in the Basin. If we obtain that funding, in addition to the objectives described above, we will identify the primary *Rhizoctonia* species that infect onion and pea crops in the Basin, evaluate onion and pea cultivars to identify more resistant or tolerant cultivars, and evaluate cereal cultivars and other cover crops (e.g., vetch) to identify characteristics that minimize buildup of *Rhizoctonia* inoculum (cereals and other cover crops such as vetch).

## 8. Budget

Expenditure	Pacific Northwest Vegetable Assoc. (this request)	Co-funding (CASH or IN-KIND)			TOTAL COST
		Source: WSCPR	Source: BASF Corp., River Point Farms	Source: River Point Farms, seed & chemical co.'s	
		Amount (CASH)	Amount (CASH) <sup>1</sup>	Amount (IN-KIND/TIME)	
Salaries <sup>2</sup>	\$3,000	\$11,000	\$4,000		\$18,000
Employee benefits <sup>2</sup>	\$1,230	\$4,510	\$1,754		\$7,494
Temporary or hourly workers <sup>3</sup>			\$1,200		\$1,200
Travel <sup>4</sup>	\$500	\$500	\$500		\$1,500
Equipment					
Other: field, lab & greenhouse supplies <sup>5</sup>	\$4,770	\$4,100	\$546		\$9,416
Other: donations for crop maintenance <sup>6</sup>				\$250,000	\$250,000
<b>Total</b>	<b>\$9,500</b>	<b>\$20,110</b>	<b>\$8,000</b>	<b>\$250,000</b>	<b>\$287,610</b>

<sup>1</sup> Cash from BASF Corporation (\$3,000) and River Point Farms (\$5,000).

<sup>2</sup> 6 months of salary (\$18,000) + 41% benefits (\$7,380) for a Research Associate. Time donated by River Point Farms and Dow for field preparation, fumigation, planting, irrigation, crop maintenance, and harvest.

<sup>3</sup> 120 hours (3 weeks) of time-slip wages at \$10/hr (\$1,200) + 14.8% benefits (\$114) for assistance with plot set-up, treatment applications, data collection, and harvest/rating.

<sup>4</sup> Travel to Columbia Basin from WSU Mount Vernon NWREC and WSU Pullman for collecting data/samples, harvest, etc.; travel to present at 2010 PNVA annual meeting in Tri-Cities, WA.

<sup>5</sup> Supplies for soil assays, fungal isolations (petri plates, media, etc.), and lab supplies (enzymes and reagents for real-time PCR assays to monitor and quantify *Rhizoctonia* in plots).

<sup>6</sup> Donation of seed (\$1,000/bucket, ~36 buckets of seed/128 acre center-pivot circle), fertilizer, fumigant, fungicides, herbicides, insecticides, & crop maintenance/irrigation expenses. Production costs average \$4,000/acre for an onion bulb crop x 128 acres = \$500,000. At least ½ of the field will be used for this project = in-kind donation of >\$250,000.