Onion Stunting Caused by *Rhizoctonia*: Management and Economic Importance in the Columbia Basin of Oregon and Washington

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Abstract:

Rhizoctonia spp. can cause patches of stunted plants in onion bulb crops planted in sandy soils of the semi-arid Columbia Basin of central Oregon and Washington following cereal cover crops. Cover crops are killed with herbicides when onion seed is planted in spring, to protect onion seedlings from wind- and sand-blasting. However, *Rhizoctonia* spp. colonize dead cereal roots and crowns, and then infect onion seedlings, leading to stunted patches (0.5 to >10 m in diameter). Fungicide trials were completed in center-pivot irrigated onion fields in 2011 and 2012. Each plot was 12 beds wide x the field diameter. In 2011, a pre-plant, broadcast, incorporated application of Quadris (azoxystrobin) at 0.69 and 1.39 l/ha (9.5 and 19 fl oz/acre, respectively) resulted in 51 and 56% reduction in number of patches, 60 and 68% reduction in cumulative area of stunting, and 19 and 23% reduction in severity of stunting, respectively, compared to control plots. In 2012, when Quadris (1.39 l/ha) and Fontelis (penthiopyrad at 1.75 l/ha = 24 fl oz/acre) were applied in the same manner, only Quadris significantly reduced the number of patches (by 24%), cumulative patched area (33%), and disease severity (18%). Similarly, Quadris alone or Quadris + Rhizoburst (10-34-0 + 0-0-19 + humic acid) led to comparable results in another grower-cooperator trial in 2012. In a separate growers' field in 2012, GlyStar Plus (glyphosate) was sprayed at 3.5 l/ha (48 oz/acre) on the winter wheat cover crop 3, 17, or 27 days before onion seeding. Applying herbicide 17 or 27 days prior to seeding reduced the number of patches by 46 or 54%, cumulative patched area by 43 or 50%, and severity of stunting by 13 or 19% , respectively, compared to spraying herbicide 3 days prior to onion seeding. Stunting reduced the size of onions bulbs, with a greater effect the more severe the stunting. Reduction in total marketable yield in three growers' fields (cvs. Mercury, Cometa, and Tamara) ranged from 25-49% in patches with a severity rating of 1 (most plants stunted by <33%), from 48-58% in patches with a severity of 2 (plants stunted 33 to 66%), and from 61-79% in patches with a severity of 3 (stunted >66%). Research is in progress to understand the biology of *Rhizoctonia* spp. in onion production and evaluate the use of fungicides, fumigants, and potential tolerance of onion cultivars to the pathogen for management of stunting caused by *Rhizoctonia*.

Introduction:

Cereals such as winter wheat are used as cover crops to protect onion seedlings from wind- and sand-blasting on the very sandy soils typical of the semi-arid Columbia Basin of central Washington and Oregon. Herbicide is applied to kill the cover crop, usually in the spring prior to onion seeding. Herbicide application is necessary to prevent the cover crop from competing with the onion crop. The incorporated cereal stubble is readily colonized by *Rhizoctonia* spp., resulting in rapid buildup of soilborne levels of the fungi, which then infect onion seedlings, resulting in stunted onion plants. Severely stunted patches of plants can develop in onion bulb crops (**Fig. 1**). Patches occur primarily when planting soon after incorporating a cover crop. Patches can range from 2 feet to >30 feet in diameter (**Fig. 2**). Stunted onion plants have sparse, short roots with a 'spear-tipping' effect (**Fig. 3A**). Roots may be lightly discolored with more branching than normal.

Fig. 1. Aerial, infra-red photo of an onion bulb crop with numerous patches of severely stunted plants.

Fig. 2. A patch of stunted plants in an onion bulb crop.

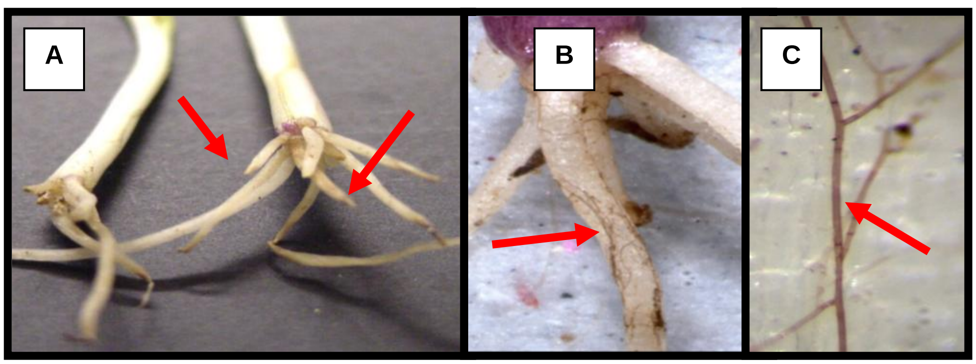

Fig. 3. Spear-tipping of onion roots (A); dark mycelium of *Rhizoctonia* on roots (B) and hypocotyl (C, magnified) of stunted onion seedlings.

Symptoms have been associated with *Rhizoctonia*, particularly *R. solani* isolates of AG 8 and AG 4. Affected roots may have dark fungal visible microscopically (**Fig. 3B** and **3C**). Symptoms can resemble injury from nematodes and *Pythium* spp. Dark *Rhizoctonia* mycelium occurs on the surface of roots so care should be taken not to wash roots prior to examination when for diagnosis. Surface-sterilizing the roots also can prevent the fungus from being detected.

Research is in progress to assess fungicide seed treatments, broadcast fungicide applications to the soil, soil fumigation, timing cover crop incorporation prior to planting onion and pea crops, tillage, seed priming, screening cultivars for potential tolerance or resistance, soil testing methods to predict the risk of patching, and other practices for reducing losses to this disease.

This presentation summarizes results of large-scale, grower-cooperator field trials in 2011 to 2012 to evaluate potential management practices for stunting in onion bulb crops in the Columbia Basin.

Materials and Methods:

Fungicide trials. Pre-plant, banded spray application of fungicides was evaluated on sandy soils in commercial onion bulb crops grown in rotation with winter cereal cover crops in the Columbia Basin in 2011 and 2012, to manage onion stunting caused by *Rhizoctonia* spp. Standard agronomic practices for the region were used, and each field was irrigated by center pivot. Each experiment was set up as a randomized complete block design with six replications/treatment, unless stated otherwise. In 2011, the efficacy of each of two rates of Quadris (azoxystrobin) application at 0.69 and 1.39 liters/ha (9.5 and 19 fl oz/acre) was compared with non-treated control plots in a field near Paterson, WA. The fungicide was applied in a 15 cm wide band over the bed, and incorporated 10 cm deep with a rototiller one day prior to planting onion seed of the cultivar Mercury. In 2012, two trials were completed. In one of the 2012 trials, Quadris was applied at 1.39 liters/ha and Fontelis (penthiopyrad) at 1.75 liters/ha (24 fl oz/acre) in the same manner as in the 2011 trial, and compared with non-treated control plots in a field near Paterson, WA. Each plot was 12 beds wide (each bed 110 cm wide and planted with two double-rows of seed of the onion cv. Mercury) and the length of the entire field (approximately 1 km long). In the second 2012 trial, a pre-plant, application of Quadris (0.88 liters/ha), Quadris (0.88 liters/ha) + Rhizoburst (92.97 liters/ha, 10-34-0 + 0-0-19 + humic acid), and ReZist (92.97 liters/ha, Cu 1.75%, Mn 1.75%, and Zn 1.75%, with polyamines and natural plant extracts) were compared with non-treated control plots in a field near Boardman, OR with four replicate plots/treatment. Each treatment was sprayed on the top of the bed and incorporated 15 cm deep with a rototiller one day prior to onion seeding. In this trial, the number of beds/plot ranged from 8 to 12, each bed was 100 cm wide with two double-rows of onion seed of the cv. Tamara, and each plot was the length of the radius of the field (approximately 0.5 km). For each experiment, the number of patches of stunted onion plants, area of stunted patches, and severity of stunting in the patches were rated. In 2011, ratings were taken at the five true-leaf stage; and in 2012, ratings were done at the five and seven true-leaf stages. Severity of onion stunting was rated on a 1-3 scale, where: 1 = a majority of the plants were stunted by <33%, 2 = most plants were 33 to 66% stunted, and 3 = most plants were >66% stunted compared to adjacent healthy plants. Plot size was standardized in the 2012 trials because of variation in plot sizes. Analyses of variance were computed for each experiment using Proc GLM in SAS (Version 9.2; SAS Institute, Cary, NC), and treatment means compared using Fisher's protected least significant difference (LSD).

Cover crop 'green bridge' trial. The effect of preplant herbicide application interval on development of stunting in onion crops was evaluated in a grower-cooperator onion bulb crop near Paterson, WA. The winter wheat cv. Madsen was planted in strips as a cover crop on 10 October 2011. Spring 2012 treatments consisted of preplant applications of GlyStar Plus (glyphosate) to the cover crop at a rate of 3.5 liters/ha (48 oz/acre) at three different intervals prior to planting an onion bulb crop. GlyStar Plus was sprayed on the cover crop 3, 17, and 27 days before onion seeding on 20 April 2012. The experiment was set up as a randomized complete block design with each treatment replicated six times. Each plot was 12 beds wide (each bed 55 cm wide with two double-rows of onion plants). Plot length was the diameter of the 50 ha, center-pivot irrigated field. Recommended agronomic practices were done by the grower-cooperator. Onion stunting was rated at the 5 and 7 true-leaf growth stages (18 June and 3 July, respectively) for the eight center beds/plot to avoid effects of herbicide drift between adjacent plots. The number of patches in each plot was counted, and the length and width of each patch was measured as an estimate of patch size. Severity of onion stunting in each patch was rated on a 1-3 scale as described for the fungicide trials. Results were standardized to accommodate variation in plot size across the center-pivot field. Analyses of variance were calculated using Proc GLM in SAS, and treatment means compared using Fisher's protected LSD.

Yield loss assessment. Field surveys were carried out to assess the effects of onion stunting caused by *Rhizoctonia* spp. on the yield of three onion cultivars in grower-cooperator, center-pivot irrigated fields: the red cv. Mercury was planted in four rows per 110 cm wide bed on 13 March in a field near Paterson, WA; the yellow cv. Tamara was seeded in two double-rows per 100 cm wide bed on 16 March in a field near Boardman, OR; and the white cv. Cometa was planted in two double-rows per 85 cm wide bed on 8 April in a field near Pasco, WA. Each field was maintained by a different grower-cooperator. Patches of onion plants with different severity of stunting were selected in each field at the five to seven true-leaf growth stages. The severity of stunting was rated on a 1 to 3 scale as described above. Five patches were selected per field for each of the three severity levels. Each patch was >1.5 m long and at least two beds wide. Manual harvest of the bulbs was done on 21, 1, and 27 August for Cometa, Mercury, and Tamara, respectively, by harvesting bulbs from 1.5 m of each of two double rows per patch. Bulbs also were harvested from an equivalent area of healthy plants adjacent to each patch. Bulbs from each patch and adjacent healthy area were bagged separately and graded by size: colossal (>10.0 cm diameter), jumbo (7.5 to 10.0 cm), medium (5.5-7.5 cm), prepack (<5.5 cm), and culled (non-marketable). The total number of bulbs in each size category was counted, and the total bulb weight per size measured. All bulb sizes, except culled bulbs, were considered marketable. The number and weight of bulbs in each size category was calculated as a percentage of bulbs harvested in a plot. The reduction in number and weight of bulbs of each size was then computed as a percentage of the number and weight of bulbs of each size harvested from healthy plants. The relationship between severity of onion stunting and percentage reduction in yield for each cultivar was calculated using correlation and regression analyses in SigmaPlot Version 12.

Results:

Fungicide trials. In the 2011 trial, plots treated with either rate of Quadris had a significant reduction in the number of patches of stunted plants, patched area, average severity of stunting, and severity index compared to the non-treated control plots (**Table 1**). Plots treated with Quadris at 0.69 and 1.39 liters/ha had 51 and 56% fewer patches, 60 and 68% smaller cumulative patched area, 19 and 23% less severe stunting, and 76 and 81% reduced disease severity index, respectively. There was no significant difference in disease ratings between the two rates of Quadris application (**Table 1**).

Table 1. 2011 Onion field trial evaluating Quadris for management of stunting caused by *Rhizoctonia*.

Treatment	Number of patches	Cumulative patch area/plot (ft^2)	Severity of stunting (0 - 3 scale)	Patch index (area x severity)
Non-treated ………………..	35 a*	949 a	1.9 a	1,990 a
Quadris 0.69 liters/ha ….	17 b	382 b	1.5 b	487 b
Quadris 1.39 liters/ha ….	15 b	303 b	1.5 b	379 b
LSD ……………………………	6	199	0.3	651

* Within each column, numbers followed by the same letter are not significantly different based on Fisher's protected LSD at $P = 0.05$.

In the 2012 trial near Paterson, WA, plots treated with Quadris had significantly fewer stunted patches (24% less), less stunted area (33%), less severe stunting (18%), and a reduced stunting index (44%) compared to non-treated control plots at the five true-leaf stage of growth on 5 June (**Table 2**). In contrast, plots treated with Fontelis did not exhibit a significant reduction in incidence or severity ratings compared to control plots. Similarly, at the second rating (19 June), similar reductions in the number of patches and patch area were observed in plots treated with Quadris, whereas Fontelis was ineffective at reducing onion stunting (**Table 2**).

Table 2. 2012 Onion field trial evaluating Quadris and Fontelis for management of stunting caused by *Rhizoctonia*.

Treatment	No. of patches/acre	Cumulative patch area (ft^2/acre)	Stunted patch area (% of plot)	Severity of stunting (0 - 3 scale)	Patch index (area x severity)
		5 June 2012			
Non-treated control …..	73 a*	1,023 a	2.3 a	1.7 a	1,864 a
Fontelis 1.75 liters/ha ..	62 a	904 ab	2.1 ab	1.6 ab	1,542 a
Quadris 1.39 liters/ha ..	55 b$^{(P = 0.078)}$	688 b	1.6 b	1.4 b	1,039 b
LSD ………………………….	20	266	0.6	0.2	458
		19 June 2012			
Non-treated control …..	41 ab	538 a	1.2 a	1.7 a	988 a
Fontelis 1.75 liters/ha ..	48 a	525 a	1.2 a	1.6 a	887 a
Quadris 1.39 liters/ha ..	30 b	370 b	0.9 b	1.6 a	630 a
LSD ………………………….	13	154	0.4	0.4	413

* Within each column and for each rating date, numbers followed by the same letter are not significantly different based on Fisher's protected LSD at $P = 0.05$ or at the probability level shown.

In the 2012 trial near Boardman, OR, Quadris applied alone or in combination with Rhizoburst was effective at reducing the number of stunted patches, cumulative patch area, severity of stunted patches, and stunting index on 23 May and 6 June (**Table 3**). There was no significant difference in onion stunting parameters measured in plots treated with Quadris alone or Quadris + Rhizoburst. On 23 May, plots treated with Quadris had 52% fewer patches, 82% less patched area, 40% less severe stunting, and 84% reduced disease severity index compared to the control plots. Plots treated with ReZist did not differ significantly from the non-treated control plots in the first and second disease ratings (**Table 3**).

Table 3. 2012 Onion field trial evaluating Quadris, Rhizoburst, and Rezist for management of stunting caused by *Rhizoctonia* spp.

Treatment	No. of patches/ acre	Cumulative patch area (ft^2/acre)	Stunted patch area (% of plot)	Severity of stunting (0 - 3 scale)	Patch index (area x severity)
		23 May 2012			
Non-treated control …………	64 a*	1,244 a	2.9 a	2.0 a	2,566 a
Quadris 0.88 liters/ha ………	31 b	222 b	0.7 b	1.2 b	398 b
Quadris 0.88 liters/ha + Rhizoburst 92.97 liters/ha…	22 b	292 b	0.5 b	1.3 b	366 b
Rezist rate 92.97 liters/ha…	76 a	1,282 a	2.9 a	2.0 a	2,937 a
LSD …………………………………..	16	338	0.7	0.3	815
		6 June 2012			
Non-treated control …………	90 a	1,654 a	3.8 a	2.0 a	3,655 a
Quadris 0.88 liters/ha ………	24 b	199 b	0.5 b	1.2 b	251 b
Quadris 0.88 liters/ha + Rhizoburst 92.97 liters/ha...	17 b	155 b	0.4 b	1.3 b	217 b
Rezist rate 92.97 liters/ha…	96 a	1,858 a	4.3 a	2.0 a	3,957 a
LSD …………………………………..	18	746	1.7	0.3	1,784

* For each table and each date that disease was evaluated, numbers within a column followed by the same letter are not significantly different based on Fisher's protected least significant difference (LSD) at $P = 0.05$ or at the probability level indicated in superscript parentheses.

Cover crop 'green bridge' trial. At the five true-leaf growth stage on 18 June, the plots in which the winter wheat cover crop was sprayed with herbicide 3 days prior to onion seeding had more patches, greater cumulative patched area, more severe stunting, and a greater severity index than plots in which herbicide was applied 17 or 27 days prior to onion seeding (**Table 4**). Application of the herbicide 17 and 27 days before onion planting reduced the number of stunted patches by 32 and 55%, respectively; cumulative patched area and percentage of cumulative patched area by 46 and 54%, respectively; severity of stunting by 11 and 15%, respectively; and patch severity index by 53 and 59%, respectively, in comparison to plots in which the herbicide application occurred 3 days prior to planting. Overall, there was no significant difference in patch parameters between the 17 and 27 day herbicide treatments, except the number of patches/acre which was significantly less in plots sprayed with herbicide 27 vs. 17 days prior to onion seeding. By the 7 true-leaf stage of onion growth on 3 July, the number of stunted patches was reduced by 22 and 70% in plots sprayed 17 and 27 days before planting onion seed, respectively, compared to plots sprayed 3 days prior to planting; however, the number of patches did not differ significantly between plots treated with herbicide 3 vs. 17 days prior to planting (**Table 4**). Similarly, the cumulative area of patches in the onion crop was reduced 31 and 70% in plots sprayed with herbicide 17 and 27 days prior to planting, respectively, compared to 3 days prior to planting; and the percentage of plot area with stunted patches was reduced 31 and 70%, respectively, although only the 27 day herbicide treatment caused a significant reduction. Average severity of stunting and the stunting severity index were decreased significantly by applying herbicide to the cover crop either 17 or 27 days prior to planting onion seed: the former by 19 and 20%, respectively, and the latter by 40 and 74%, respectively, compared to applying herbicide 3 days prior to onion seeding.

Table 4. 2012 Onion field trial evaluating the effects of the interval between application of a herbicide to a winter cereal cover crop and planting of an onion bulb crop.

Herbicide application (days prior to planting onion seed)	No. of patches/acre	Cumulative patch area (ft^2/acre)	Stunted patch area (% of plot)	Average stunting severity (1 - 3)	Severity index/acre*
		18 June 2012			
3 ………………………..	56 a**	935 a	2.15 a	1.58 a	1,661 a
17 ……………………….	38 b	504 b	1.16 b	1.41 b	775 b
27 ……………………….	25 c	429 b	0.99 b	1.34 b	686 b
LSD ……………………..	10	141	0.32	0.08	316
		3 July 2012			
3 ………………………....	23 a	545 a	1.26 a	1.59 a	886 a
17 ………………………..	18 a	377 a	0.87 a	1.29 b	529 b
27 ………………………..	7 b	164 b	0.38 b	1.27 b	227 b
LSD ………………………	8	200	0.46	0.21	307

* Severity index = (severity rating) x (area of patch), summed for all patches in a plot.
** Numbers in a column with the same letter are not significantly different based on Fisher's protected least significant difference (LSD) at *P* = 0.05.

Yield loss assessment. The number of bulbs harvested within stunted patches did not differ significantly from the number of bulbs harvested from adjacent, healthy plants in each of the three fields evaluated, i.e., stunting caused by *Rhizoctonia* did not affect plant stand. However, bulb size was affected significantly by onion stunting, with a greater impact on bulb size the more severe the stunting (**Table 5**). Colossal bulbs were present only in healthy areas sampled from the Mercury (1% of the bulbs and 2% of total bulb weight) and Tamara (2% of the bulbs and 6% of total bulb weight) fields, but not in healthy areas of the Cometa field, nor any of the stunted patches for any cultivar (**Table 5**). In non-stunted areas of the Mercury and Tamara fields, a majority of the bulbs were jumbo (65% of the bulbs and 77% of total bulb weight for Mercury, and 85% of the bulbs and 89% of total bulb weight for Tamara), followed by medium bulbs, with few or no prepack and culled bulbs. In healthy areas of the Cometa field, bulb size was smaller overall than the Mercury and Tamara fields (32 and 54% of the Cometa bulbs were jumbo and medium, respectively, contributing 50 and 46% of total bulb weight, respectively). For all three cultivars, the distribution of bulb number and weight among the size categories for bulbs harvested in the stunted patches shifted to a greater number and weight of smaller bulbs the more severe the stunting (**Table 5**). Total weight of Mercury bulbs was reduced by 49, 54, and 77% in patches with severity ratings of 1, 2, and 3, respectively, compared to adjacent, healthy plants. Similarly, the reduction in total marketable bulbs (colossal + jumbo + medium + prepack) was 49, 54, and 79% in patches with mean severity ratings of 1, 2, and 3, respectively.

Correlation analyses revealed significant associations between severity of stunting in the Mercury field and percent reduction in jumbo bulbs (r = 0.61, *P* = 0.012 for number of bulbs, and r = 0.60, P = 0.014 for weight of bulbs), total bulbs (r = 0.63, *P* = 0.009 for number of bulbs, and r = 0.70, *P* = 0.003 for weight of bulbs), and total marketable bulbs (r = 0.64, *P* = 0.007 for number of bulbs, and r = 0.69, *P* = 0.003 for total weight). Stunting resulted in similar reductions in bulb yield for Tamara and Cometa. The total weight of Tamara bulbs harvested from patches with a severity of 1 was 25% less than in healthy areas of the field, and patches with a stunting severity of 2 and 3 produced 58 and 61% less total bulb weight, respectively. For Cometa, stunting reduced the total number of bulbs and number of marketable bulbs, as well as total weight of bulbs and weight of marketable bulbs. Patches in the Cometa field with severity ratings of 1, 2, and 3 had a reduction in total bulb weight of 34, 47, and 66%, respectively; and a reduction in marketable bulb weight of 35, 48, and 68%, respectively. Significant regression equations calculated for total bulb weight and marketable bulb weight for Mercury, Tamara, and Cometa enabled estimation of the potential yield loss associated with each severity of stunting for each of the three cultivars evaluated (**Table 6**).

Table 5. Effect of severity of stunting caused by *Rhizoctonia* on the incidence and weight of bulbs in each size category measured as a percentage of the number and total weight of bulbs of each size harvested from healthy areas of a field for each of three onion cultivars.

Cultivar	Onion stunting severity (0-3)	Number of onion bulbs in each size category (% of bulbs harvested)[z]					Total onion bulb weight by size category (% of bulbs harvested)[y]				
		Colo-ssal	Jumbo	Medium	Pre-pack	Culled	Colo-ssal	Jumbo	Medium	Pre-pack	Culled
Cometa	0 ………..	0[x]	32	54	12	2	0	50	46	4	0
	1 ………..	0	10	59	25	6	0	23	66	10	1
	2 ………..	0	3	56	30	11	0	8	74	15	3
	3 ………..	0	1	35	36	28	0	5	62	27	6
Mercury	0 ………..	1	65	31	3	0	2	77	20	1	0
	1 ………..	0	26	46	18	10	0	47	45	6	2
	2 ………..	0	9	61	24	6	0	20	68	11	1
Tamara	0 ………..	2	85	11	2	0	6	89	5	0	0
	1 ………..	0	55	43	2	0	0	69	29	2	0
	2 ………..	0	20	62	17	1	0	37	55	7	1
	3 ………..	0	3	64	32	1	0	8	77	14	1

[z] Number of bulbs in each size category calculated as a percentage of all bulbs harvested (total = 100% for all size categories).
[y] Weight of onion bulbs in a particular size category calculated as a percentage of the weight of onion bulbs harvested.
[x] Each data point is the mean for five replicate patches for that severity rating.

Table 6. Regression equations for the reduction in number or total weight of onion bulbs in stunted patches calculated as a percentage of bulbs harvested from non-stunted plants for each of three onion cultivars.

Cultivar	Regression equation	*P*-value	R^2 (%)[z]
Cometa ……….	Total bulb number = -16.2 + 12.7X[y]	0.0284	32
	Total bulb weight = 16.1 + 16.4X	0.0034	50
	Marketable bulb number = -20.3 + 20.8X	0.0013	56
	Marketable bulb weight = 16.2 + 17.1X	0.0020	54
Mercury ………	Total bulb number = -16.9 + 11X	0.0089	40
	Total bulb weight = 27.7 + 15.1X	0.0027	49
	Marketable bulb number = -17.8 + 17.5X	0.0071	41
	Marketable bulb weight = 27.8 + 15.5X	0.0029	48
Tamara ………..	Total bulb number = -9.1 - 0.54X	0.9460	0
	Total bulb weight = 12.8 + 17.1X	0.0021	53
	Marketable bulb number = -11.6 + 0.44X	0.9570	0
	Marketable bulb weight = 12.4 + 17.3X	0.0020	53

[z] R^2 = Coefficient of determination for the regression equation that best fit the data.

[y] X = Mean severity of stunting of a majority of the onion plants in a patch, rated on a scale of 1 to 3, compared to adjacent, healthy plants (refer to the scale description in the main text).

Discussion:

Based on these large-scale, grower-cooperator field experiments, a pre-plant, broadcast incorporated application of Quadris can effectively reduce onion stunting caused by *Rhizoctonia* spp. The fungicide treatment significantly reduced the number of stunted patches, area of stunted patches, and severity of stunting in multiple growers' fields in the Columbia Basin over two seasons. The cover crop green bridge trial revealed an inverse relationship between the timing of herbicide application to the cereal cover crop and the incidence and severity of onion stunting. A minimum duration of 2 to 4 weeks is recommended between applying herbicide to the cereal cover crop and planting onion bulb crops in sandy fields of the Columbia Basin of central Oregon and Washington in order to minimize stunting of onion crops caused by *Rhizoctonia* spp. Yield loss assessment revealed that onion stunting caused by *Rhizoctonia* spp. reduced bulb yields significantly for all three cultivars evaluated. The greater the severity of stunting, the greater the decrease in total and marketable bulb weight as a result of smaller size bulbs. The reduction in number of total and marketable bulbs varied among the three cultivars, although cultivars were confounded with field sites and specific agronomic practices at each farm. Determining the impact of stunting severity on bulb yield and size, and translating the quantitative relationship to stunting measured in growers' field trials should enable assessment of whether management practices being evaluated as part of this project are economically feasible (e.g., fungicide applications). Additional research is in progress on these and other potential management aspects of onion stunting, as well as determining the species and anastomosis groups (AGs) of *Rhizoctonia* isolates associated with stunting in various crop rotations in the Columbia Basin, and screening for potential tolerance or resistance in onion cultivars and breeding lines.