EFFECT OF STROBILURIN FUNGICIDES APPLIED AT TWO TIMINGS ON SEED YIELD IN TALL FESCUE

N.P. Anderson and T.G. Chastain

Introduction

Stem rust is frequently a serious problem in tall fescue grown for seed in the Willamette Valley. Depending on the age of the stand, the variety, and seasonal weather patterns, fields receive 1 to 4 fungicide applications per year. Under severe rust pressure, seed yields can be reduced over 70% when rust is not controlled. Although a significant production expense, excellent stem rust control can be obtained with available fungicides.

The newer class of strobilurin fungicides (Quilt Xcel®, Absolute®, Stratego®, Headline®) has been reported to provide a yield boost beyond that from disease control in winter wheat crops (Zhang et al., 2010). Positive effects on yield in other crops have been attributed to physiological effects on plants resulting in better nitrogen metabolism (Glaab and Kaiser, 1999). Thus, many grass seed producers in the Willamette Valley have begun integrating an early application of a strobilurin fungicide at 2-3 nodes (BBCH stage 32-33) into their crop production plans, mostly through tank mixing with a plant growth regulator (PGR).

Oregon grass seed growers spend approximately $15 to $20 million annually for rust control, making stem rust the most costly disease in Pacific Northwest grass seed production. The cost of treating tall fescue with a strobilurin fungicide is approximately $20 to $30 per acre. Results from a 7-year study on early fungicide treatments (with PGR) in perennial ryegrass indicated an increase in seed yield in only 4 of 13 site years (Gingrich and Mellbye, 2006). These results suggest a benefit to early strobilurin fungicide applications only under severe and early rust pressure in perennial ryegrass.

This study was conducted to determine if and under what circumstances an early strobilurin treatment at 2-3 nodes (with PGR) increases tall fescue seed yield compared to a standard fungicide treatment applied later in the season when stem rust begins to develop.

Methods

Results in this report were obtained from large scale, on-farm yield trials conducted on five turf-type tall fescue fields in three years, 2010 – 2012. Study sites were located at: (2010) a 2nd-year field located near Banks (`Padre`), (2011) a 2nd-year field in the Carlton area (`Sidewinder`) and a 3rd-year field near North Plains (`Padre`), and (2012) two 1st-year fields near Independence (`Van Gogh`) and Rickreall (`Inferno`).

The experimental design for the on-farm trials was a split-plot with treatments arranged in three randomized complete blocks. Main-plots were farm research sites and sub-plots were strobilurin fungicide timing and rate. Treatments were compared to an untreated control. Individual plot size was approximately 24 feet wide and 300-400 feet in length. Treatments included:

1. **Control:** no fungicide
2. **Early:** 10 oz/acre Quilt Xcel (azoxystrobin + propiconazole) applied at 2- 3 nodes (BBCH stage 32-33)
3. **Late:** 12 oz/acre Quilt Xcel applied at early flowering (BBCH stage 59)
4. **Early + Late:** 10 oz/acre Quilt Xcel applied at 2-3 and 12 oz/acre Quilt Xcel applied at early flowering.

All plots were treated with 1 pt/a of Palisade EC plant growth regulator at 2-3 nodes. Plots were harvested and a weigh wagon was used to measure yields from each plot. Sub-samples from the harvested seed were collected and cleaned to determine percent cleanout and thousand seed weight. Nitrogen concentration in flag leaf tissue was determined on samples taken from each of the farm site locations. Total above-ground biomass and tissue N concentration were measured in 2012.

Results and Discussion

Large variation in seed yield, seed weight, and flag leaf N was noted among the on-farm sites (Table 1). This was expected since the five on-farm sites represented not only the inherent soil and

management conditions present at these locations but also five different cultivars of tall fescue, three stand ages, and three crop years. Seed yield and seed weight were affected by the fungicide treatments but not flag leaf N. There were no interactions of farm sites and fungicides for any of the characteristics measured.

Strobilurin fungicide treatments increased tall fescue seed yield by an average of 17% over the untreated control across sites and years (Table 2). The incidence and severity of stem rust was much greater in 2012 than in either 2010 or 2011. Consequently, the greatest individual increases in seed yield among the farm sites were noted in 2012 with seed yield increases ranging from 36% (Early) to 52% (Early + Late). Applying the strobilurin fungicide early at the normal timing for PGR applications produced lower seed yields than either the Late or Early + Late timings under high rust pressure. Tall fescue seed yield was increased by 7% when the stem rust pressure was low only if the fungicide was applied at both Early and Late timings. Mellbye and Gingrich (2004) found that strobilurin fungicides significantly increased seed yield in perennial ryegrass in a low rust pressure year.

The increase in seed yield due to strobilurin fungicide treatments was, in part, attributable to increased seed weight (Table 2). The greatest seed weight was observed when the fungicide treatment was made at both the early and late timings. Strobilurin fungicides have been reported to delay senescence of leaves (Grossmann et al., 1999) and thus might have aided carbon partitioning to seed thereby contributing to the increased seed weight. Zhang et al. (2010) showed that strobilurin fungicides (azoxystrobin) increased seed weight in wheat and the number of seeds per spike. Tall fescue seed number per acre was also increased by the fungicide treatments, making further contributions to the observed seed yield increases (data not shown).

Total above-ground biomass and tissue N concentrations were not influenced by the fungicide treatments as measured at the farm sites in 2012 (data not shown). The reported effects of strobilurin fungicides on increased nitrate reductase activity were not sufficient to increase flag leaf or whole-plant tissue N concentrations in tall fescue.

The results of this study suggest that early strobilurin fungicide application is beneficial in tall fescue; however, the best results are obtained under severe and early rust pressure. A well timed fungicide program is a good investment for tall fescue seed producers in western Oregon.

References

Mellbye, M.E, and G.A. Gingrich. 2004. The effect of strobilurin fungicide on perennial ryegrass seed yields in a year of low rust pressure. *In* W.C. Young III (ed.) Seed Production. Crop Sci. Ext. Rep. 123:46-48.

Gingrich, G.A. and M.E. Mellbye. 2006. The effect of early fungicide applications on seed yield in perennial ryegrass. *In* W.C. Young III (ed.) Seed Production. Crop Sci. Ext. Rep. 125:24-26.

Glaab, J., and W.M. Kaiser. 1999. Increased nitrate reductase activity in leaf tissue after application of the fungicide Kresoxim-methyl. Planta 207:442-448.

Grossmann, K., J. Kwiatkowski, and G. Caspar. 1999. Regulation of phytohormone levels, leaf senescence and transpiration by the strobilurin kresoxim-methyl in wheat (Triticum aestivum). J. Plant Physiol. 154: 805-808.

Zhang, Y., X. Zhang, C. Chen, M. Zhou, and H. Wang. 2010. Effects of fungicides JS399-19, azoxystrobin, tebuconazloe, and carbendazim on the physiological and biochemical indices and grain yield of winter wheat. Pesticide Biochemistry and Physiology 98:151–157.

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Table 1. Analysis of variance for strobilurin fungicide treatments in on-farm trials with tall fescue grown for seed. On-farm trials were conducted at one farm in 2010, and two farms each in 2011 and 2012.

Source of variation	Seed yield	Seed weight	Flag leaf N
Farms (A)	*	***	***
Fungicide (B)	**	***	NS
A x B	NS†	NS	NS

* $P \leq 0.05$
** $P \leq 0.01$
*** $P \leq 0.001$
† Not significant

Table 2. Effect of strobilurin fungicide treatment timing and rate on seed production of tall fescue across all sites and years. Low rust pressure years are the average of 2010 and 2011 and moderate to severe rust pressure was encountered in 2012.

Treatment	Seed yield	Seed weight	Flag leaf N	Low rust	Moderate to severe rust
	lbs/acre	mg	%	seed yield % of control	
Control	1593 a†	2.53 a	1.72 a	100	100
Early	1807 b	2.61 b	1.87 a	101	136
Late	1848 b	2.60 b	1.74 a	102	143
Early + Late	1947 b	2.67 c	1.83 a	107	152

† Means followed by the same letter are not different $P \leq 0.05$.