A PACIFIC NORTHWEST EXTENSION PUBLICATION

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RATTAIL FESCUE: BIOLOGY AND MANAGEMENT IN PACIFIC NORTHWEST WHEAT CROPPING SYSTEMS

Drew J. Lyon, Endowed Chair Small Grains Extension and Research, Weed Science, Washington State University; **Daniel A. Ball**, Emeritus Professor of Weed Science, Oregon State University, Pendleton; and **Andrew G. Hulting**, Extension Weed Science Specialist, Oregon State University

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Farmers are discovering that weed management practices must be adjusted to control species previously susceptible to tillage as direct-seed wheat production practices become more widely adopted to conserve soil and water resources. Rattail fescue (*Vulpia myuros*) is an example, as this grass is becoming an increasingly common weed in wheat-based cropping systems across the Pacific Northwest (PNW). Rattail fescue has been a management problem in southern Australian pastures and wheat-based cropping systems since the mid-1980s, and more recently it has become particularly widespread in PNW wheat-cropping systems as minimum-tillage and direct-seeding practices have become commonplace throughout the region (Dillon and Forcella 1984).

Description

Rattail fescue was historically assigned to the *Festuca* genus because of the appearance of its stems and leaves, before being reclassified as part of the *Vulpia* genus. Also referred to as silvergrass, six-weeks fescue, or foxtail fescue, rattail fescue is probably native to Europe and is an invasive species in natural and wildland areas, native plant restoration sites, pastures, rangeland, roadsides, and cultivated cropland throughout the PNW and California (DiTomaso and Healy 2007).

Rattail fescue is a cool-season, winter annual grass with tightly folded leaf blades less than 1/16-inch wide (Figures 1 and 2). The narrow, compact panicles usually emerge from May to June in the PNW, and are 2–6 inches long and less than half-an-inch wide, with short awns (Figure 3). Rattail fescue is self-pollinating and reproduces solely by seed (Figure 4). Mature plants range from one to two feet tall (Figure 5).

Figure 1. Vegetative growth of rattail fescue.

Figure 2. Vegetative growth of rattail fescue showing the tightly rolled and thin leaf blades. Note the light-green leaf color, which can sometimes be useful for identification.

The fibrous root system of this grass usually grows to shallow soil depths, but it may extend deeper than 12 inches if thin or rocky soils or limited moisture do not inhibit growth. It is able to grow and persist on acidic, shallow, or sandy soils. Rattail fescue is sensitive to drought and has generally been more prevalent in higher-rainfall areas around the world. Rattail fescue is considered to be a poor forage grass because its sharp awns can perforate the face and mouth of grazing animals, and it is generally avoided by livestock.

Rattail fescue can impact winter wheat yields in several ways and should be aggressively managed. Left uncontrolled for one or more growing seasons, rattail fescue can form dense mats of residue on chemical-fallow and direct-seeded wheat fields, because its tissues break down slowly (Figure 6). These residues can have an allelopathic effect on wheat seedlings, affecting radical elongation and shoot growth (An et al. 1997). Competition of rattail fescue with winter wheat during crop growth can reduce yields by 10–30 percent (Dillon and Forcella 1984). Rattail fescue is intolerant of repeated tillage, and with the continued increase in no-till and direct seeding of winter wheat, the geographic range of rattail fescue has been expanding in the PNW.

Figure 3. Rattail fescue flowering stem.

Figure 4. Magnified image of rattail fescue seeds (1 mm scale). Seeds are reddish-brown in color, narrow, and approximately 5 mm (0.2 inches) in length.

Figure 5. Mature rattail fescue growing in winter wheat.

Figure 6. A dense mat of dry rattail fescue stems and seeds on the edge of a winter wheat field in western Oregon.

Rattail Fescue Biology

Based on research conducted in Oregon, it was determined that both an after-ripening period (biochemical seed aging) and a vernalization treatment increased rattail fescue seed germination (Figure 7). This observation reinforced the classification of rattail fescue as a winter annual in growing regions across the PNW since the cool soil temperatures and adequate moisture for germination that occur in autumn will likely promote seed germination.
The optimal soil temperature for germination was approximately 68°F, with 81–100 percent germination after six days (Figure 8). Soil temperatures above 95°F resulted in low germination (0–16 percent). No differences in germination requirements were observed among seeds collected from different Oregon locations.

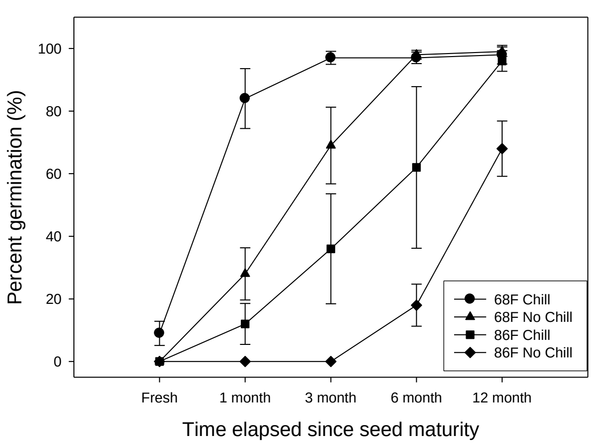

Figure 7. Effects of a 40°F prechilling treatment, seeding germination temperature, and elapsed time after seed maturity on germination of rattail fescue (Ball et al. 2008).

In another experiment, rattail fescue seeds were collected and planted on both sides of the Cascades from October to March to assess total seed production from plants germinating at these different dates. Study sites were located at Pendleton, Moro, and Corvallis, Oregon. The plants required a vernalization period to successfully produce panicles and seeds. Plants from seed sown on the earliest autumn planting dates were able to reach physiological maturity and produce viable seed, with seed production per plant decreasing for plantings later in the autumn. Plants from seed sown at the mid-winter through spring planting dates remained vegetative and did not produce viable seed. Limited soil moisture and the resulting delayed germination also affected plant growth and seed production at Moro, OR, the site with the lowest rainfall. These results indicate that those rattail fescue plants that establish early in the fall probably contribute most to the soil seed bank and should be targeted for control.

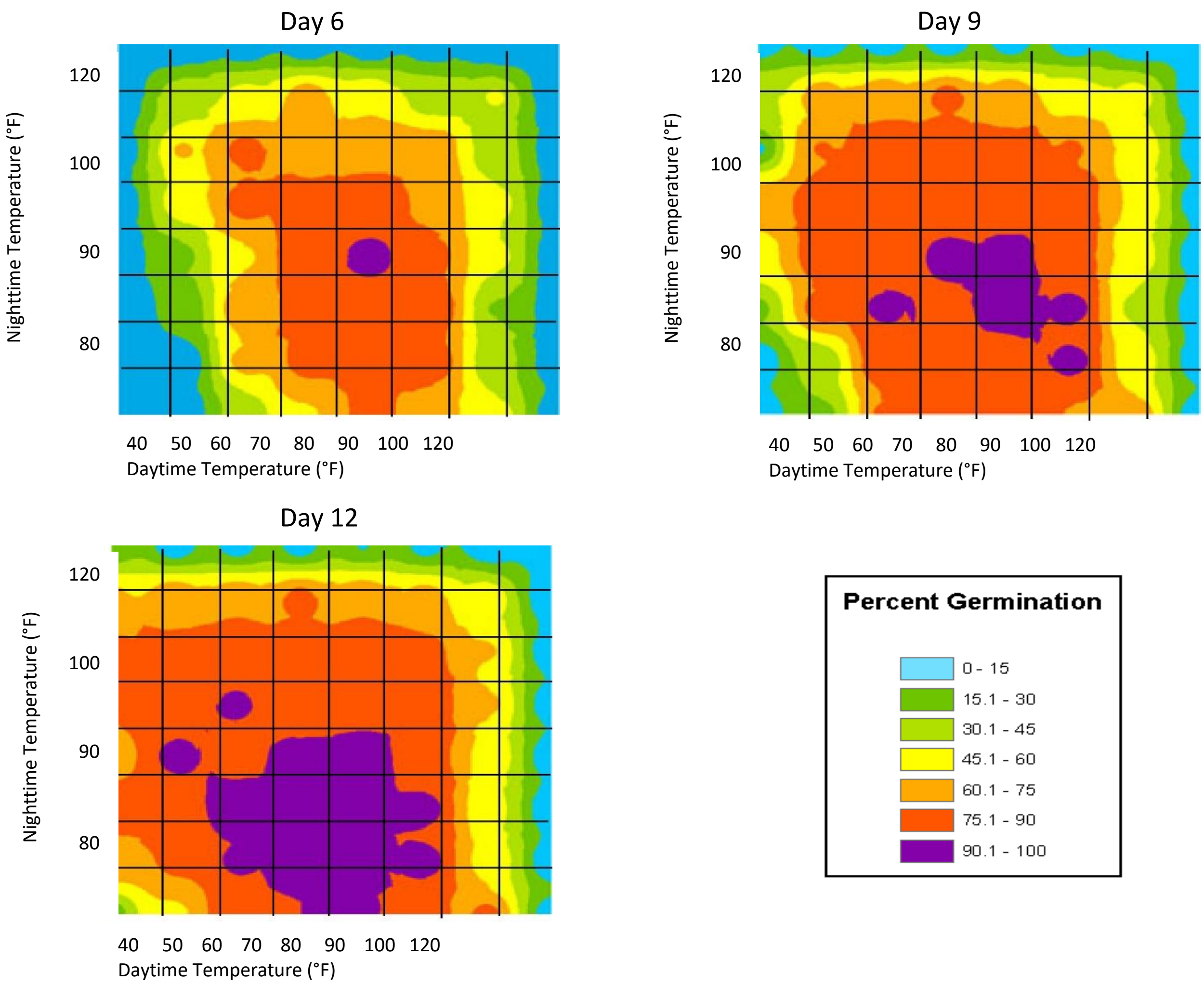

Figure 8. Percentage germination of rattail fescue seed on a two-way thermogradient plane after 6, 9, and 12 days (Ball et al. 2008).

A third study in eastern Oregon assessed the longevity of rattail fescue seed buried in various soil types over a three-year period. Seeds were collected from a common location and buried at different locations. Soil characteristics represented in this study included a range of soil pH from 6.4 at a site near Summerville, OR, 6.9 at a site near Pendleton, to 8.6 at a site near Imbler, OR. Seed viability decreased as burial time increased over a period of years. Less than 3 percent of seeds germinated after the third year of burial. Seed decay was most rapid in the higher pH soil. In addition, there was a tendency for seed longevity to increase as seed was buried more deeply in the soil, although this trend was not strongly evident. These findings indicate that rattail fescue seed is fairly short-lived in soil (Figure 9), which is consistent with the seed viability characteristics of many other annual grass species.

The temperatures needed for optimum germination explain why rattail fescue tends to germinate in late fall and throughout the winter, when cool temperatures and moist soil conditions exist across the PNW. This germination timing allows rattail fescue to establish early and to compete with a recently seeded winter wheat crop for resources throughout the winter and spring, during early stages of crop growth. Nonetheless, management of rattail fescue to prevent seed production for several growing seasons can significantly reduce an infestation over time.

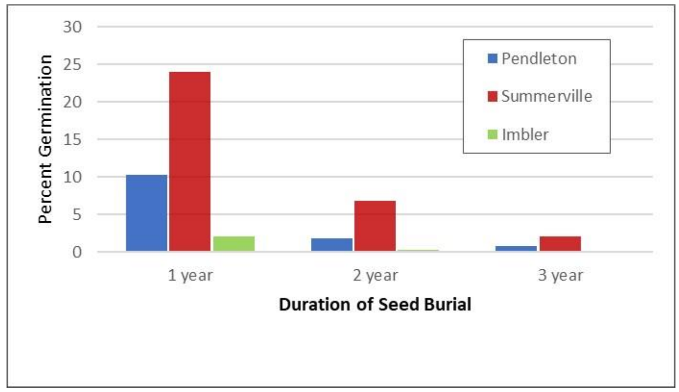

Figure 9. Effect of duration of burial on rattail fescue seed viability at three locations in eastern Oregon (Ball et al. 2008).

Rattail Fescue Management

Crop Rotation

Development of a crop rotation strategy that includes a spring cereal crop or a spring-seeded pulse or oilseed crop can be used as a tool to disrupt the winter-annual life cycle of rattail fescue and can provide effective long-term management. Although the rattail fescue sown in mid-winter in the previously discussed study completed its life cycle, these plants produced half as many seeds as those planted in October and November. A spring-seeded crop sown after the typical autumn emergence of rattail fescue seedlings would allow for a reduction in infestation by opportunistic control of rattail fescue emergence with a preplant glyphosate application or tillage, or both.

Because rattail fescue seed longevity is relatively short in the PNW, adopting a rotation without winter wheat for two years, if economically feasible for wheat growers, would significantly diminish the rattail fescue soil seed bank. Control through the preplant tillage or glyphosate strategy is crucial, because postemergence herbicides available for grass weed control in pulse and oilseed crops are ineffective at controlling rattail fescue (including herbicides containing sethoxydim, quizalofop, or clethodim). These methods, however, will only be effective if rattail fescue has germinated and emerged prior to the tillage operations or glyphosate application.

Chemical Management in Winter Wheat

Prior to the introduction of pyroxasulfone for use in wheat, flufenacet + metribuzin (Axiom) applied preemergence (PRE) to the wheat and rattail fescue provided the most consistently effective control of rattail fescue in wheat. Pyroxasulfone provides a similar level of control (Table 1) and may be applied from 14 days before planting (PRE) up to the fourth tiller growth stage (EPOST) of winter wheat, but before rattail fescue emergence. Pyroxasulfone is the active ingredient in Zidua herbicide and it is one of the active ingredients in Anthem Flex herbicide, which also contains carfentrazone.

The addition of a sequential spring-applied postemergence herbicide (LPOST) such as pyroxsulam (PowerFlex, PowerFlex HL, or TeamMate) to a fall-applied herbicide treatment only improved rattail fescue control when pyroxasulfone was applied at a low rate. However, the use of an ALS inhibitor (Group 2) herbicide, such as flucarbazone (Everest 3.0), mesosulfuron (Osprey), or pyroxsulam postemergence in the spring (LPOST) is an effective strategy for delaying the onset of herbicide resistance in rattail fescue to flufenacet (Group 15) and pyroxasulfone (Group 15). Although the use of preemergence herbicides is not a common practice in PNW wheat production, pyroxasulfone and flufenacet + metribuzin are important tools in an integrated approach to rattail fescue control.

Table 1. Rattail fescue control with pyroxasulfone and other herbicides in 2011 and 2012 at Pullman, WA. Adapted from Lawrence and Burke, 2014.

Treatment	Rate	Timing[2]	Visual control[3]
	oz/acre		**%**
Pyroxsulam	3.5	EPOST	63d
Pyroxasulfone	1.3	PRE	74c
Pyroxasulfone	1.7	PRE	85b
Flufenacet + metribuzin	8.0	PRE	83bc
Pyroxasulfone fb[1] pyroxsulam	1.3 + 3.5	PRE fb LPOST	91ab
Pyroxasulfone fb pyroxsulam	1.7 + 3.5	PRE fb LPOST	93a
Flufenacet + metribuzin fb pyroxsulam	8.0 + 3.5	PRE fb LPOST	91ab

[1]Abbreviation fb = followed by.

[2]PRE = preemergence, i.e., after wheat planting but before emergence of wheat or rattail fescue; EPOST = early postemergence in the spring, ranging from March 16, 2010 to April 23, 2012; and LPOST = late postemergence in the spring, ranging from April 19, 2010 to May 11, 2011.

[2]Mean visual control ratings followed by the same letter are not significantly different from each other at a 95% confidence level.

Herbicide trade names change, new products come to market, some products are removed from the market, and new cases of herbicide resistance develop over time. To stay current with these changes, visit the current edition of the PNW Weed Management Handbook (Peachey 2018). As with all crop protection chemicals, read and follow label directions and understand their proper use.

Management in Chemical Fallow

Rattail fescue management strategies in chemical fallow are particularly needed for growers using direct-seeding farming methods in the PNW. Adoption of chemical fallow, which primarily relies on applications of glyphosate for grass weed control, eliminates the possibility of using tillage as a management tool for rattail fescue control during the fallow period. Studies have shown that glyphosate is only marginally effective in controlling rattail fescue and often requires the use of a higher-than-typical application rate for adequate control (Jemmett 2006). The effectiveness of glyphosate also depends on the growth stage of the rattail fescue (Figure 10), so proper application timing is needed to optimize control in chemical fallow (Leys et al. 1991; Dillon and Forcella 1984; Jemmett et al. 2008). An insufficient glyphosate application rate or incorrectly timed applications in chemical fallow can lead to an increase in rattail fescue infestations over a period of growing seasons in dryland wheat production regions where winter wheat is grown in alternate years following chemical fallow.

Figure 10. Influence of glyphosate application timing on rattail fescue control in chemical fallow. An early application timing (left) was made too soon prior to tillering of rattail fescue and resulted in poor control. A later application (right) of the same glyphosate rate applied when the rattail fescue was at the three- to five-tiller stage of development resulted in excellent control.

The effectiveness of different rates and timings of glyphosate on rattail fescue in chemical fallow has been investigated at sites in Washington, Oregon, and Idaho. Sequential applications of glyphosate resulted in the best control and, in general, higher glyphosate rates increased control in all three states (Table 2). However, for all treatments, control in Oregon was less than that in Idaho and Washington. Early postemergence (EPOST) treatments of glyphosate resulted in similar control to sequential applications in Idaho and Washington. EPOST applications were made to rattail fescue in the early tiller stage of growth (two to five tillers per plant) at the Idaho and Washington sites. Late postemergence applications (LPOST) provided somewhat less control, due to application to five- to ten-tiller plants. However, LPOST glyphosate applications provided more effective rattail fescue control than EPOST treatments in Oregon (Figure 10). This was primarily because the EPOST applications were made to young (three- to five-leaf) rattail fescue plants, prior to significant tiller development in Oregon. The LPOST treatments of glyphosate were made to rattail fescue in the early tillering stages of plant development in Oregon.

Table 2. Rattail fescue control with glyphosate in chemical fallow averaged over two years (2004–2005) in Idaho and Oregon and in Washington for one year (2004).

Treatment[a]	Rate[b] fl oz/acre	Application timing[c]	Control (%) ID 2004–05[d]	OR 2004–05[d]	WA 2004	Average
Glyphosate	16	EPOST	75	37	84	65
	24	EPOST	89	41	89	73
	32	EPOST	92	44	87	74
	40	EPOST	92	51	93	79
	16	LPOST	45	58	59	54
	24	LPOST	54	66	71	64
	32	LPOST	56	72	70	66
	40	LPOST	64	76	66	69
Glyphosate/glyphosate	16/16	EPOST/LPOST	92	68	87	82
	24/16	EPOST/LPOST	96	73	94	88
	16/24	EPOST/LPOST	96	74	93	88
	24/24	EPOST/LPOST	97	78	97	91
	24/32	EPOST/LPOST	97	76	94	89
LSD (0.05)	–	–	7	5	17	–

Glyphosate applied with ammonium sulfate at 8.5 lb/100 gal. The glyphosate formulation applied was Roundup UltraMAX. Mention of an herbicidal product in this publication is not an endorsement or recommendation for commercial use. Read, understand, and follow all herbicide labels for appropriate and legal use directions.

Spray volume = 10 gallons per acre.

Early post-emergence (EPOST) and late post-emergence (LPOST) stage of growth. See text for more complete description of rattail fescue growth stage at the time of glyphosate applications in these studies.

Data combined over two years.

Conclusions from these trials, and from other field observations throughout the PNW, suggest that rattail fescue control with glyphosate in chemical fallow is more complete when glyphosate is applied to plants in the early to mid-tiller stages of growth. Control with glyphosate is less satisfactory if applied at very early (seedling) or advanced stages of tiller development. A possible explanation of these findings is that rattail fescue in the seedling stage does not have sufficient leaf surface area to allow for adequate glyphosate coverage. In addition, the erect leaf orientation of young seedlings is such that it may be difficult for applicators to obtain sufficient spray coverage on the leaf blades. In an unpublished study from Washington in 2015, different nozzle types, carrier volumes, and spray additives were used to try and improve glyphosate coverage of rattail fescue plants from the two-leaf to five-tiller stage of growth in the spring, but no consistent differences were observed.

Tillage

Although rattail fescue is considered to be intolerant of repeated tillage, there is no published research on the type and frequency of tillage required in a cropping system to provide control. Anecdotal evidence suggests that infrequent shallow tillage may be sufficient. Direct-seed operations that use high-disturbance drills (for example, drills using hoe-type openers) have fewer problems with rattail fescue than those using low-disturbance drills.

Consider using shallow non-inversion tillage after winter wheat harvest to “plant” rattail fescue seed for increased fall and winter germination. Short-residual herbicides such as glyphosate may then be used in the fall or spring to control emerged rattail fescue seedlings before seeding the next crop. Because rattail fescue infestations tend to be distributed unevenly in fields, consider using tillage only in those portions of the field where rattail fescue is located.

Integrated Weed Management Practices

Integrated weed management practices can facilitate effective long-term control of rattail fescue in PNW winter wheat production regions. For farming operations that have adopted direct seeding, inclusion of a spring-planted crop in the crop rotation, when possible, combined with appropriately executed rattail fescue control during chemical fallow periods, will provide an acceptable reduction in rattail fescue infestations. The recent labeling of pyroxasulfone in wheat has provided an effective new tool for the control of rattail fescue in wheat systems. In order to reduce the risk of selecting rattail fescue biotypes resistant to pyroxasulfone, use the highest labeled rates and avoid using pyroxasulfone more than once in a three-year period. If wheat is grown more frequently than once every three years, rotate pyroxasulfone use with flufenacet + metribuzin. Even with these effective herbicides, control will be less than acceptable on dense populations of rattail fescue. Therefore, it is essential to reduce rattail fescue soil seed banks through crop rotations and effective control of rattail fescue seedlings during fallow periods.

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Andrew G. Hulting, Daniel A. Ball, Karin Neff, and the Oregon State University Seed Laboratory.

For More Information

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