

**Washington Grain Commission
Wheat and Barley Research Annual Progress Reports and Final Reports**

Project #: AWD0001471

Progress Report Year: 2 of 3

Title: Weed Management in Wheat

Researcher(s): Ian C. Burke and Drew J. Lyon

Executive summary: Weed control is one of the major challenges facing wheat growers in the PNW. To address this problem, the Weed Science Program conducts a multi-disciplinary field, greenhouse, and laboratory research project to address the critical issues that Washington wheat growers face. One aspect of this work is the evaluation of herbicides, both registered and nonregistered, for crop tolerance and weed control in wheat production systems. This work is often, but not always, conducted in partnership with agricultural chemical companies. These field studies allow us to make better recommendations to growers, and they provides us the opportunity to work with the various companies to better refine their labels for the benefit of Washington wheat growers. The results from these studies are summarized in the WSU Weed Control Report, which is shared with the Washington Grain Commission and posted on the WSU Extension Small Grains website annually. The Weed Science Program continues to look at the biology and ecology of troublesome weeds including downy brome, Russian-thistle, and mayweed chamomile.

Introduction: Weed Management in Wheat facilitates non-biased research on new weed management products or approaches. The research will focus on control of difficult to manage weeds, rotational restrictions, variety tolerance and other aspects deemed necessary based on our expertise and through grower interaction. Trials and protocols will be determined cooperatively with public and private sector scientists and most importantly, with farmers. Improved management will be realized through new and expanded herbicide labels, more effective application timings, improved herbicide application technology, increased knowledge of the biology and ecology of the weeds, or other management practices.

Approach: Studies will be conducted on WSU Research Stations and in cooperating grower fields. Studies will be conducted in the low, intermediate, and high rainfall areas. Control of Italian ryegrass, downy brome, Russian-thistle, prickly lettuce, rush skeletonweed, smooth scouringrush, and mayweed chamomile will be the primary research focus, but work will also be conducted on other weed species in wheat, chemical fallow, or under land use that represents a source for infestation to wheat fields. The research will focus on weed control, herbicide resistance management, rotational restrictions, variety tolerance and other aspects deemed necessary. The exact number of trials and specific protocols will be determined cooperatively with public and private sector scientists and growers. Research into the biology of weeds and their interaction with crops will continue in an effort to identify more effective herbicide application timings and perhaps identify cultural methods for weed control, particularly for downy brome, rattail fescue, Italian ryegrass, and mayweed chamomile. Emphasis will be placed on minimizing crop-weed competition and developing a database for a decision support system

based on economic loss and cost of control. Information from herbicide trials will be used to design integrated crop management research and Extension activities.

Results:

- The project continues to generate data and local guidance and new uses for various agrichemical companies to assist them in labeling their new herbicide products for weed control in wheat. Drs. Burke and Lyon are working with new herbicides from Corteva, Bayer, FMC, Valent, and Helm and well known herbicides from Syngenta, Albaugh and Gowan.
- A number of farmer driven projects were continued in the new cycle, including management of rush skeletonweed and Russian thistle in fallow and post harvest, management of scouringrushes in wheat, use of weed sensing sprayers in fallow, evaluation of preemergence herbicide systems for downy brome and Italian ryegrass control.
- Dr. Lyon continued to publish extension output in the form of webcasts and extension bulletins based on our research. Both Dr. Lyon and Dr. Burke regularly present at extension functions throughout the year.
- The yearly Weed Management report includes an array of research focused on small grains and critical rotational crops in Washington.

Impact: The WSU Weed Science Program impacts small grain production in Washington and the Pacific Northwest by producing timely, accurate, non-biased weed control and weed biology information. That information is most commonly extended to stakeholders in the form of presentations, extension publications, news releases, and the Internet (wsu.smallgrains.edu). In terms of value, herbicide inputs are typically among costliest a farmer faces, and using the most economical and effective treatment will improve the net income and long term sustainability of any operation. Weed losses due to weeds without weed management would likely exceed \$200M per year.

WGC project number: AWD0001471
WGC project title: Weed Management in Wheat
Project PI(s): Ian C. Burke and Drew J. Lyon
Project initiation date: July 1, 2022
Project year: 2 of 3

Objective	Deliverable	Progress	Timeline	Communication
Evaluate herbicides	Efficacy and crop injury data to support use recommendations, new labels, and label changes to benefit WA small grain growers.	The WSU Weed Control Report was published annually and distributed to the Washington Grain Commission, County Extension Educators in eastern Washington, and sponsoring chemical companies. The published studies are posted on the WSU Extension smallgrains website and discussed at winter Extension meetings.	Annually, in time for winter meetings.	Annual weed control report; articles in Wheat Life, trade magazines and/or posted to WSU smallgrains website; field days; winter Extension meetings; decision support system tools. The Small Grains website now hosts an outlet for our efficacy results see https://herbicideefficacy.cahnrs.wsu.edu/
		Finesse herbicide is effective for smooth scouringrush control when applied late spring in fallow; however, applications at other times may fit better in certain management strategies. Finesse is labeled for application anytime in fallow including just before fall seeding, and after one leaf but before the boot stage in wheat and barley. Smooth scouringrush stems usually begin emerging in May and persist until freezing temperatures in the fall. Therefore, it is possible that late fall or early spring applications of Finesse would be applied when smooth scouringrush is not present or not actively growing and the efficacy of these timings is unclear. It appears that preplant foliar Finesse applications in the fall can reduce smooth scouringrush density the following year, and it is important to apply to green standing stems. It is too early to determine the efficacy of the spring applications in the crop, but all treatments will be reevaluated in 2024.	This project will be completed in 2024.	Annual weed control report, extension publications, extension meetings and field days, and refereed journal articles
		Indaziflam was tested for preemergence control of downy brome in wheat cropping systems in 2021 and 2022. Seedbank samples are still being assessed. Indaziflam controls downy brome up to 2 years after application at rates up to 3 oz/A. We plan on assessing the downy brome seedbank in response to indaziflam compared to a typical wheat fallow system.	This project will be completed in 2024.	Annual weed control report, extension publications, extension meetings and field days, and refereed journal articles

		<p>Chemical fallow is used in reduced-tillage or no-till cropping systems to protect soil from erosion; however, control of ongoing flushes of Russian thistle through the summer requires repeat herbicide applications. Glyphosate is a common herbicide for weed control in fallow, but it has no soil residual, and repeat applications are often required. Herbicides with some soil residual could reduce the number of repeat applications, providing the herbicide is effective on Russian thistle. Timing of application and soil activity of the herbicide are important factors in Russian thistle control in chemical fallow. Early applications with herbicides with little or no soil activity will not control subsequent flushes. Later applications may have the potential to be effective if they include tank-mix partners that are effective on larger plants, but larger plants also have had time to deplete soil moisture.</p>	<p>This project will be completed in 2024.</p>	<p>Annual weed control report, extension publications, extension meetings and field days, and refereed journal articles</p>
		<p>Multiple field studies were conducted in association with agrichemical companies to investigate efficacy and crop tolerance to a range of grass and broadleaf weed control products. These studies allow us to evaluate new chemistries or new uses of old chemistries and also help us modify company labels to better suit our region.</p>	<p>Field studies will be conducted every year during this project.</p>	<p>Annual weed control report, extension publications, extension meetings and field days, and refereed journal articles</p>
Evaluate weed biology & ecology	Weed biology and ecology to aid in the design of effective and economic control strategies for troublesome weeds in WA small grain crops; decision support system database development.	<p>A reference genome was assembled for Downy Brome to map genes for reproductive phenology and Sulfosulfuron resistance. Stochastic simulation techniques were used to identify mechanisms maintaining genetic variation in <i>B. tectorum</i> and how self-fertilization impacts the ability of Downy Brome to invade new environments. We are now working on developing CRISPR in downy brome to directly study individual genes involved in dormancy, germination, and flowering time.</p>	<p>A large downy brome panel was phenotyped for flowering time. Initial analyses indicate that flowering time is highly heritable, unlike growth or tillering. Highly heritable traits may facilitate ecological approaches to management of downy brome by field, and indicates that movement between fields should be minimized.</p>	<p>Annual weed control report, extension publications, extension meetings and field days, and refereed journal articles.</p>

Evaluate cultural & mechanical management	Data to support recommendations for integrated weed management systems to control troublesome weeds in WA small grains.	We conducted field studies to ascertain seed shattering in Italian ryegrass by harvest time in winter and spring wheat. In 2022, we initiated a field study to evaluate chaff lining for the management of Italian ryegrass in winter wheat. In 2023, the Italian ryegrass infestation was such that the Cook Farm had to be rotated to winter pea to use Kerb. The herbicide was effective, and no Italian ryegrass germinated. We collected seedbank samples this year and will do so again in 2024 to assess the effect of this novel rotation on Italian ryegrass seedbank longevity.	The chaff lining experiments will monitored through 2024 for changes in Italian ryegrass density.	Annual weed control report, extension publications, extension meetings and field days, and refereed journal articles.
---	---	---	---	---