

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

Project #: 3019-3379

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 were summarized in the WSU Weed Control Report, which was 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 and Russian-thistle.

Impact: The WSU Weed Science Program impacts wheat and barley 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. In terms of value, herbicide inputs are typically among costliest a grower faces, and using the most economical and effective treatment will improve the net income and long term sustainability of any operation

- The project continues to generate data and local insights for Dow, Syngenta and BASF to assist these companies in labeling their new herbicide products for weed control in wheat. Our work is also critical in getting BASF to label higher use rates of in the PNW, contrary to what is labeled for the rest of the country. We have been working with bicylopyrone, a new broadleaf herbicide from Syngenta, as well as new broadleaf herbicides from Dow.
- A number of grower driven projects were started in the new cycle, including management of rush skeletonweed in wheat, troublesome weed management in fallow systems, management of rushes in wheat, and spring wheat preemergence herbicides for Italian ryegrass control.
- Combined, Drs. Burke and Lyon have presented the results of this research program at ~40 events over the first year of this project. We host the WSU Weed Science Field Day, and typically participate in the Lind Field Day, the Wheat Academy, and Far West Agricultural Associates meeting, as well as numerous county meetings.

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WGC project title: Weed Management in Wheat
Project PI(s): Ian C. Burke and Drew J. Lyon
Project initiation date: July 1, 2016
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 2015 WSU Weed Control Report was published in January of 2016 and distributed to the Washington Grain Commission, County Extension Educators in eastern Washington, and sponsoring chemical companies. The published studies will also be posted on the WSU Extension smallgrains website and discussed at winter Extension meetings. The 2016 report will be released before the WGC Research Review.	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 host an outlet for our efficacy results see https://herbicideefficacy.cahnr.wsu.edu/
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		The second year of a field study looking at smooth scouringrush control was completed near Rearden. Only one treatment, Glean + MCPA-ester, provided significantly improved control compared to the nontreated check, but only when applied in consecutive years. Greenhouse efficacy work has been initiated to determine the affects of MCPA and Glean on root and shoot growth and recovery.	The data from the first year of the scouringrush study will be combined with data from a simliar study initiated in 2015 in Oregon. The data from the two sites will be used in a student M.S. thesis in preparation for submission in 2018. The second year of the scouringrush study was completed in 2016.	Annual weed control report, extension publications, extension meetings and field days, and refereed journal articles

		A laboratory study was conducted to understand surfactant effects on absorption and translocation of metsulfuron in smooth scouringrush. Metsulfuron applied with NIS had greater absorption than metsulfuron applied with a basal bark oil, which disagreed with greenhouse efficacy work suggesting the opposite. Very little applied metsulfuron was absorbed, and surfactant appears to be critical for management of smooth scouringrush.	The experiment is complete and a publicaion is in preparation.	Annual weed control report, extension publications, extension meetings and field days, and refereed journal articles
		Two years of a field study were completed in 2017 near Lacrosse addressing control of rush skeletonweed in wheat following CRP. Clopyralid and aminopyralid provided very good control of rush skeletonweed, particularly when applied in the fall.	The 2016 and 2017 field work is complete, a publication has been submitted to Weed Technology.	Annual weed control report, extension publications, extension meetings and field days, and refereed journal articles
		A study addressing buckwheat control in irrigated wheat was completed in 2017 at a field site near Pasco.	The 2016 and 2017 field work is complete, a publication is in preparation.	Annual weed control report, extension publications, extension meetings and field days, and refereed journal articles
		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.	Field studies were completed in the summer of 2016 and new winter wheat studies initiated in the fall of 2016.	Annual weed control report, extension publications, extension meetings and field days, and refereed journal articles
		Multiple field studies were initiated in 2016 and 2017 to identify alternatives to Roundup for fallow weed management in grain-fallow systems. Trials were targeted to identify 1) herbicides for troublesome weeds, 2) application through a weed-sensing sprayer, or 3) for rotation to pea or canola. Metribuzin was suprisingly effective for prickly lettuce control, and other products also had activity on Russian thistle.	New studies based on the results from 2016 and 2017 will be developed and put out in 2018.	
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.	A Russian-thistle common garden was grown in Pullman and Central Ferry in 2015. Accessions were sprayed with glyphosate and paraquat. No differential responses were observed to paraquat, but some variation in response to glyphosate was observed. A genetic analysis was completed in the fall of 2016. There appears to be just a single species of Salsola present in the PNW, and no real strong population structure.	Field studies are complete. A Ph.D. thesis was completed in 2017, and publications and extension bulletins are in preparation.	Annual weed control report, extension publications, extension meetings and field days, and refereed journal articles

		<p>Common garden and greenhouse experiments using the downy brome PNW core collection were performed from 2015-2017 to identify differences in downy brome seed dormancy. Four distinct dormancy scenarios, or phenotypes, were identified for the PNW region. Differences in dormancy phenotypes were then used to explore the possibility that downy brome seed dormancy is regulated, at least in part, by the genes that control the synthesis and degradation of the dormancy promoting hormone abscisic acid (ABA). Quantitative PCR was used to measure relative gene expression of two ABA biosynthesis genes (NCED1 and NCED2) and two ABA catabolic genes (ABA8'OH-1 and ABA8'OH-2) in all identified dormancy phenotypes. Expression patterns were partially conserved with wheat, barley, and brachypodium gene orthologues suggesting some genetic overlap with related species. Expression patterns were also distinct for specific seed dormancy phenotypes. Competitive ELISA tests were also used to quantify changes in endogenous ABA levels associated with dormancy phenotypes from the PNW core collection. ABA levels were higher in more dormant downy brome embryos and lower with decreased dormancy. The differences being the length of time required for dormancy release. i.e. after-ripening. A subset of the PNW core collection is being sequenced to identify novel SNPs that might be associated with seed dormancy.</p>	<p>Work on seed dormancy continues and will be completed in 2018. We anticipate development of molecular markers to detect dormancy type by 2018.</p>	<p>Annual weed control report, extension publications, extension meetings and field days, and refereed journal articles.</p>
		<p>Mayweed chamomile is a difficult to manage spring annual weed primarily found in the high rainfall zone. We have observed that mayweed has a very consistent developmental pattern, so we have collected sufficient data to create a growing degree day model. The degree day model will be incorporated into a decision support system and used to more accurately time herbicide applications.</p>	<p>Project completed in 2017.</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.	<p>Results from a two-year field study on windrow burning to control Italian ryegrass were published in Weed Technology in 2016.</p>	<p>Project completed in 2016.</p>	<p>Journal article and extension presentations. Data will be used to support future grant proposals on harvest weed seed control.</p>