Managing Invasive Weeds in Wheat

WERA-77 (2009-2014)

Invasive Weeds Threaten Winter Wheat Yield & Quality

Invasive weeds infest more than 20 million acres of winter wheat in the western US, costing growers over $500 million in yield losses each year. Dense infestations of weeds can result in complete crop failure. Smaller weed populations decrease wheat yields and increase the amount of weed seeds and stems that must be cleaned from harvested wheat grain. Weeds can also interact with viruses and other pests and have complex, synergistic impacts on grain yields and quality. Furthermore, many weeds are developing resistance to herbicides, requiring higher and/or more frequent applications, which can raise production costs, injure wheat plants, and pose threats to environmental and human health. Many weeds are difficult to manage. Thorough, up-to-date information about weed biology, ecology, and genetics is required to develop best management practices that offer integrated control.

With rolling hills and deep soils, the Palouse region in the northwestern US is a major agricultural area and a leading producer of wheat. USDA-ARS photo.

Multistate Research Project Improves Weed Control & Wheat Production

Multistate Research and Extension Project WERA-77 formed to find sustainable, economical ways to manage invasive weeds in wheat. Coordinating research and extension efforts across the region has facilitated rapid transmission of new knowledge and promising technologies to wheat growers. In particular, the project has provided the tools and information for quicker, more accurate identification of weed species. Faster identification has led to timely, targeted herbicide applications that prevent serious, costly outbreaks. Data from research trials have also been used to support labeling of herbicides for use in diverse wheat production systems. Continued education has encouraged more wheat growers to carefully manage herbicide use so that the onset of herbicide resistance in weed species is delayed as long as possible. New herbicides and application guidelines have helped growers control invasive weeds efficiently and avoid wheat injury and yield reductions. Additionally, because of WERA-77 trials and demonstrations, farmers are aware of effective ecological approaches to managing weeds. For example, WERA-77 studies showed that the combination of taller wheat varieties and increased seeding rates can be a viable and simple way to reduce weed seed production. WERA-77 studies also improved and expanded the use of winter canola as a crop rotation that improves weed control in wheat. For the 2011-2012 growing season, a record level of around 200,000 acres of winter canola were planted. All in all, WERA-77's efforts have helped maintain the competitiveness of wheat production in western states.

Mayweed chamomile, a common weed in the western US, often grows in winter wheat fields. Photo by Andreas Krappweis. RGBStock.com License.

Research Activities

Researchers conducted long-term field experiments and analyzed genes to identify wheat varieties with higher tolerance to both weeds and the herbicides used to control weeds. Based on their findings, a Colorado State University wheat breeder developed a two-gene hard red winter Clearfield wheat, which is much more tolerant to Beyond herbicide. A more tolerant wheat variety has allowed for more aggressive and effective control of stubborn weeds such as feral rye. Studies also examined wheat injury rates due to certain rates, timings, and combinations of herbicide applications. In two trials in eastern Oregon, all of the tested winter wheat varieties exhibited injury if Osprey was applied in cold conditions. Although Aim and Vida applications caused irregular necrotic flecks on the leaves of Goetze, Skiles, and cultivar 726 wheat varieties shortly after application, the wheat recovered, and no further injury was documented from the additional 16 herbicide treatments. Researchers also evaluated Tubbs 06 and 301 (an experimental variety near release) under western Oregon growing conditions and detected no major herbicide sensitivity problems.

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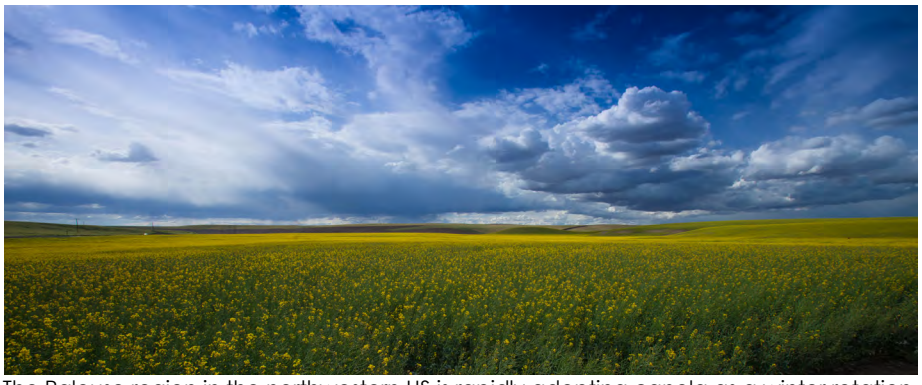
Long-term field experiments and genetic analysis were also used to identify problematic herbicide-resistant weed varieties. For example, researchers surveyed wheat fields for herbicide-resistant hybrid weeds produced by crossing of jointed goatgrass and Clearfield wheat. A Montana project assessed the synergistic effects of stressors like soil moisture, pests, and viruses on both wheat yields and weed yields. Findings will help scientists evaluate whether the joint usage of pathogens, insects, and herbicides provides efficient, durable management of weeds like Canada thistle.

In several studies, researchers treated different weed samples with a wide range of existing and newly developed herbicides to determine weed sensitivity and proper herbicide application rate. Montana State University researchers screened herbicides under a range of environmental and crop conditions. Under cold conditions, herbicide uptake by weeds was limited, allowing weeds to survive a field application. In another study, fall applications of three different herbicides provided greater than 90% control of downy brome, while spring applications provided only about 60% control.

WERA-77 also identified non-chemical methods for controlling invasive weeds in wheat. Researchers found that increasing wheat seeding rate and crop height reduced weed seed production by approximately 30% and 20%, respectively. Field and greenhouse studies showed that burning narrow windrows can reduce Italian ryegrass seed survival and can be an effective tactic for integrated control of Italian ryegrass in the Palouse region of eastern Washington and northern Idaho. Italian ryegrass emergence was 63% in the non-burned control, 48% in the burned standing stubble, and 1% with burned windrow treatments. Researchers also found that higher elevation and steeper slope reduced mayweed chamomile and common lambsquarter weed presence. Looking at how conservation tillage and crop rotation practices affect weeds, researchers found that Italian ryegrass and mayweed chamomile weeds increased when crops rotated from winter wheat to spring wheat to spring alternative crop with a no-tillage system. Other studies showed that using canola as a winter rotation crop effectively controls winter grass weeds. Researchers also showed that grazing sheep on grain stubble could impact weed communities and population dynamics. To reduce movement and dispersal of invasive weed seed sources, researchers evaluated weed seed dormancy and longevity and developed methods to help manage weed seed banks.

Extension

To encourage adoption of new weed control strategies, WERA-77 developed outreach programs to provide up-to-date information on weed management to wheat growers, crop consultants, grain merchandisers, grain processors, Extension personnel, and other scientists. Researchers at Oregon State University and Washington State University hosted tours of research trials for interested industry partners. These tours have allowed about 150 individuals representing multiple companies to see demonstrations and have open discussions. Oregon State University Extension, researchers, and faculty developed and taught a Wheat Production Short Course. The course was well-received and attended by western Oregon wheat growers, agricultural chemical industry personnel, faculty, and students. Project members also delivered presentations at several industry-grower meetings and Extension meetings and produced hard copy and online Extension bulletins. Colorado State University and Montana State University developed an electronic key to identify weed species, and in Idaho, project members created the Herbicide Resistance and Persistence computer program, which is available for free download. WERA-77 members from Idaho, Washington, and Oregon also published—and continuously updates—chapters in the Pacific Northwest Weed Management Handbook.



The Palouse region in the northwestern US is rapidly adopting canola as a winter rotation crop to control weeds in wheat fields. Photo by SeattleForge, Flickr.

Want to know more?

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