View metadata, citation and similar papers at core.ac.uk

brought to you by CORE

provided by SHAREOK repository

# Clearfield® Wheat Production Systems in Oklahoma

Joe Armstrong
Extension Weed Specialist

Jeff Edwards
Extension Wheat Specialist

Tom F. Peeper
Professor of Weed Science

Clearfield® wheat production systems have the potential to drastically change weed management in wheat across Oklahoma. Since the late 1990s several grassy weeds including downy brome, jointed goatgrass, Italian ryegrass, rescuegrass, feral rye, and wild oat (Figure 1), have become widespread in continuous wheat production fields. Maverick herbicide, commonly used to control cheat, has little or no activity on these weed species and therefore leaves these weeds to mature and produce seed after its application. Mixed populations of these weeds and cheat in the same fields are quite common in western Oklahoma. Until the availability of Clearfield® wheat systems, selective control of mixed populations of weeds, and/or populations of jointed goatgrass or feral rye in wheat was impossible. With the Clearfield® system and Beyond® herbicide, these weeds can be removed from the wheat crop and still allow grazing. The purpose of this document is to introduce the reader to the Clearfield® technology, the current limitations of the Clearfield® system in Oklahoma, the weed control strengths of the Clearfield® system, and the considerations/precautions one should take when using the system.

## Introduction to the Clearfield® Technology

The Clearfield® technology was first introduced into field corn varieties in the early 1990s with IR (imidazolinone resistant) and IT (imidazolinone tolerant) corn hybrids. In the late 1990s and early 2000s the technology was developed in canola, rice, sunflower, and wheat. The Clearfield® technology protects the crop from the effects of the imidazolinone herbicides, part of the ALS-inhibiting herbicides, that would otherwise kill the crop.

The herbicide resistant traits were developed from laboratory practices used to slightly modify the genetic code of an enzyme already found in the crop. The modification was refined using basic plant breeding techniques. This approach to developing the technology allows it to be classified as a herbicide resistant crop (HRC), but excludes it from being classified as a genetically modified organism (GMO). Therefore, the harvested seed does not need to be segregated and can be marketed/integrated with other wheat at the elevator.

Oklahoma Cooperative Extension Fact Sheets are also available on our website at:
**http://osufacts.okstate.edu**

## Current Limitations of the Clearfield® Technology

### Variety Selection/Availability

Clearfield® varieties that have been included in recent OSU variety trials include Centerfield, Okfield, and AP502CL. Centerfield and Okfield were developed by Oklahoma State breeders and are adapted to Oklahoma production. Be sure to check the results from the latest Oklahoma Small Grains Variety Performance Tests, available at www.wheat.okstate.edu, to determine which variety will have the best fit in your region and production system.

### Potential for Developing Resistant Weeds

Beyond® herbicide has the same mode of action as Amber, Finesse, Glean, Olympus, Osprey, and several other commonly used herbicides (ALS-inhibitors). Resistance to these herbicides is known to occur when these herbicides are continuously used year after year. Resistant populations of Italian ryegrass have been confirmed in all wheat-producing regions of Oklahoma. Arkansas and Texas have also confirmed the presence of ALS-resistant Italian ryegrass.

Another weed with the potential for developing herbicide resistance is jointed goatgrass (Figure 2). Jointed goatgrass is a winter annual grass commonly found in many Oklahoma wheat fields. Jointed goatgrass is genetically similar to wheat and can cross-pollinate with wheat to produce a hybrid. Almost all of these hybrids are sterile. However, if Clearfield® wheat crosses with jointed goatgrass, the herbicide resistant trait could be passed from the crop to the weed, forming a herbicide resistant weed. Since the Clearfield® production system is the only means of selectively controlling jointed goatgrass in wheat, this should be prevented.

### Saving Seed for Next Year's Crop

Due to the potential resistant weed problems discussed above, new certified Clearfield® wheat seed will need to be purchased each year. In addition, the Clearfield® system can only be used in a field for two consecutive years. Following these recommendations should help to preserve the technology for several years.

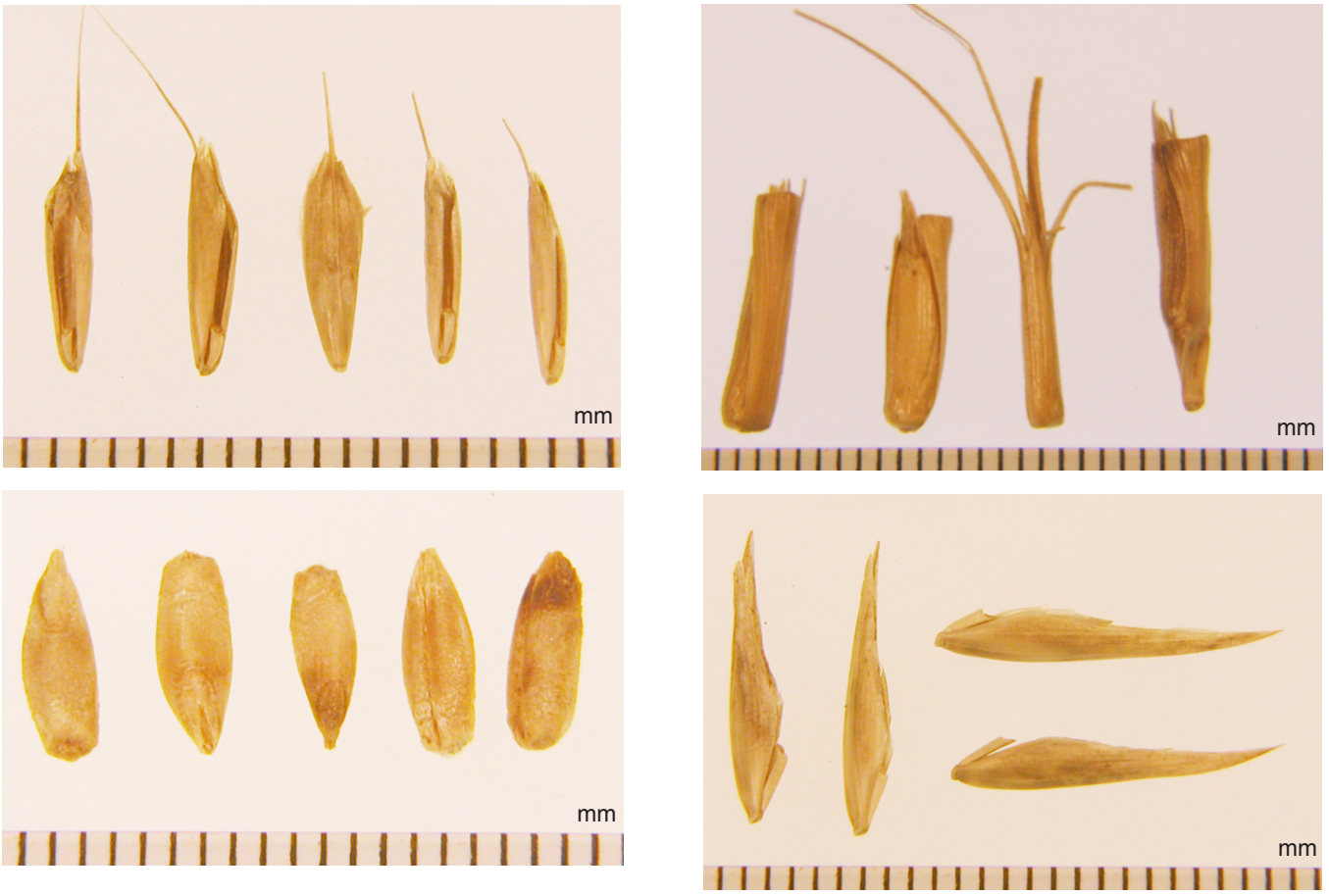


**Figure 1. Cheat (top left), jointed goatgrass (top right), feral rye (bottom left), rescuegrass (bottom right), and other common grass weed seeds infest grain harvested from wheat fields in Oklahoma. The Clearfield® technology can help to control most of these problem weeds.**

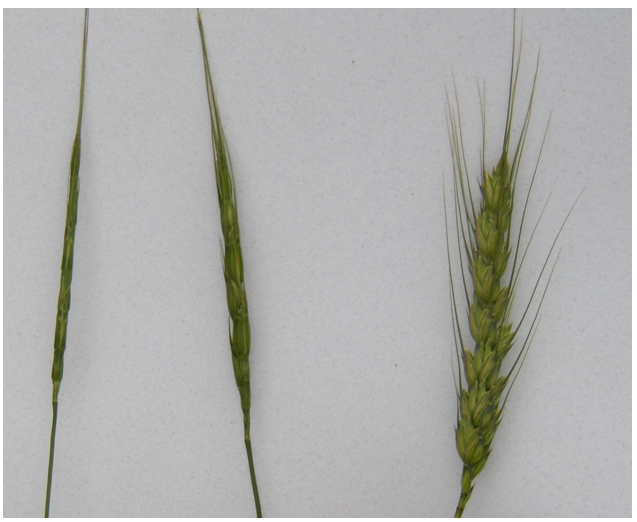

**Figure 2. Jointed goatgrass (left) can cross-pollinate with wheat (right) to form a hybrid seed (center). If this occurs with a Clearfield® wheat variety, the herbicide resistant trait could possibly be transferred to the weed. In OSU research, less than 1 of 100 hybrid seeds was viable and few of these hybrid plants produced seed that was viable.**

### No Grazing Restriction

There is no grazing restriction following an application of Beyond® herbicide. Since Beyond® is most effective when applied in the fall to small, actively growing weeds, the most logical production system will consist of planting in the fall, allowing the weeds to emerge, and applying the Beyond® herbicide before the grassy weeds reach the two tiller stage, and are actively growing.

## Weed Control Strengths of the Clearfield® Technology

Planting a Clearfield® wheat variety is the first step in using the technology. Beyond® herbicide should not be applied to non-Clearfield® wheat varieties, as it will severely injure or kill conventional varieties. **Always read and follow the pesticide label to ensure safety to the handler, applicator, and the crop.**

### Postemergence Use

The postemergence activity of Beyond® eliminates the need for rainfall to activate the product as with preemergence herbicides. This quality allows the grower to analyze his/her weed problem before applying the herbicide. However, the crop and weeds should be actively growing at the time of ap-

plication, and not under drought or adverse weather conditions.

Beyond® herbicide should be applied postemergence to the weeds and crop (i.e. after the weeds and crop have emerged from the soil and are actively growing). Apply the herbicide after the wheat crop has begun tillering, but before it begins jointing, and before grassy weeds are past the two tiller stage, and/or when broadleaf weeds are three inches in diameter/height.

### Very Effective on Many Grass and Broadleaf Weeds

Beyond® is very effective on monoculture or mixed populations of many grasses and broadleaf weeds commonly found in Oklahoma winter wheat fields. Beyond® applied at 4 fl. oz/A with 0.25 percent v/v nonionic surfactant and 1.25 percent v/v liquid nitrogen fertilizer is excellent for controlling cheat, downy brome, jointed goatgrass, and wild oats. However, if feral rye, Italian ryegrass, or rescuegrass is the targeted weed, control is better when the herbicide is applied at a higher rate and with 0.25 percent v/v nonionic surfactant and 25 percent to 50 percent liquid nitrogen as the carrier. Of the grassy weeds discussed, Beyond® is perhaps weakest on feral rye, but with proper timing (i.e. fall applications when the feral rye is in the four to five-leaf stage) at least 90 percent control can be obtained (Figure 3). If necessary, a second application of Beyond® at 4 fl oz/A can be applied to control late emerging plants. Even with proper timing, 100 percent rye control should not be expected. In OSU research to determine why rye control was not consistent, feral rye collected from producer's fields in western Oklahoma was found to vary widely in response to Beyond®. Some plants were very tolerant to it. Therefore, we anticipate that rye populations with tolerance to Beyond® will develop in some wheat fields after Beyond® is used only a few times. Therefore, if a grower has used Beyond® twice for feral rye control, he probably should not plan to use this herbicide for rye control again. Do not exceed 8 fl oz/A of Beyond® in a single growing season. Likewise, Italian ryegrass should be targeted with fall applications of Beyond® to avoid competition from the weed throughout the fall and winter. Herbicide applications that are delayed until spring allow for an extended period of competition between the wheat and weeds, leading to decreased yields and more difficult-to-control weeds. Secondary flushes of Italian ryegrass can occur after treatment, and should be controlled with an application of a herbicide with a different mode of action (e.g. Axial® XL or Hoelon®).

Beyond® acts on emerged and actively growing broadleaf weeds at the time of application. The residual soil activity of Beyond® is much shorter than other commonly used wheat herbicides, but should be sufficient to control many spring and early summer germinating weeds that can interfere with wheat harvest.

## Considerations for an Effective Weed Management System

- The best weed control and highest wheat grain yields generally occur when Beyond® is applied in the fall to small, actively growing weeds.
- Do not reduce the use rate of Beyond® in an attempt to cut costs. This is against the Oklahoma Pesticide laws (www.oda.state.ok.us/main/srvs/agform/cpl.htm), and may result in poor weed control and/or quicker development of weed resistance.

### Precautions to Take When Using the Clearfield® Technology

- Apply Beyond® herbicide only to Clearfield® wheat varieties.
- Avoid drift of Beyond® herbicide onto conventional wheat varieties as death of the non-Clearfield® wheat will occur.
- Properly clean spray equipment following a Beyond® herbicide application to avoid tank mix contamination prior to treating a conventional wheat field or other sensitive crop.
- Use the Clearfield® technology no more than two consecutive years in the same field.
- Do not apply Beyond® to weeds or crops that are under stress from drought or severe cold conditions.

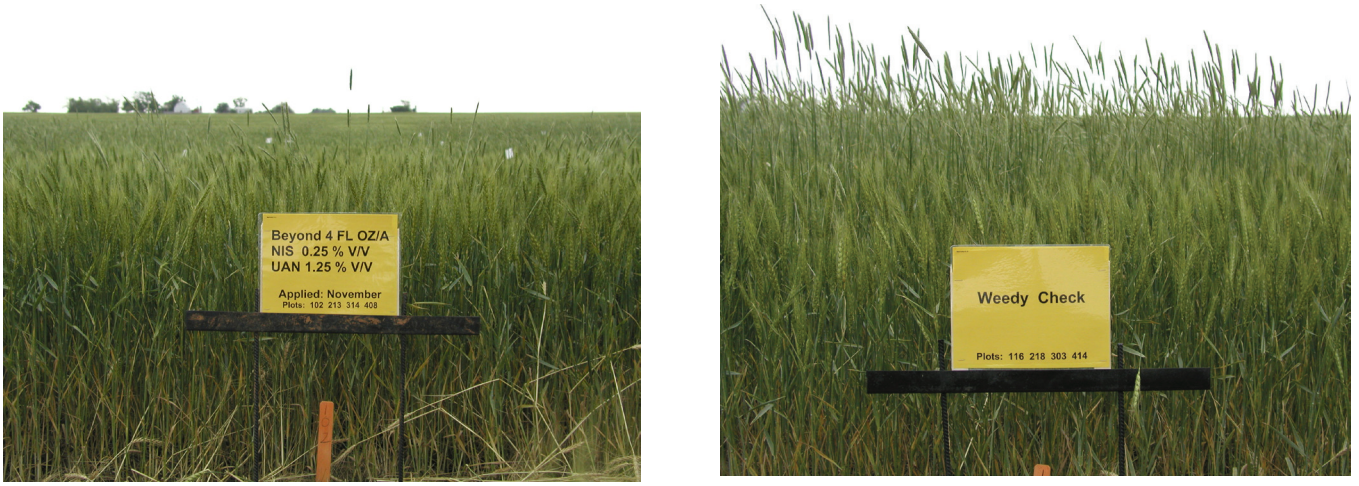


**Figure 3. When used in a Clearfield® wheat system, Beyond® herbicide can control feral rye at least 90 percent (left) compared to no control (right). Optimum feral rye control is achieved by applying Beyond® with 0.25 percent v/v nonionic surfactant and 25 to 50 percent liquid nitrogen as the carrier in the fall to small (4 to 5 leaf), actively growing feral rye plants.**

# The Oklahoma Cooperative Extension Service
## *Bringing the University to You!*

The Cooperative Extension Service is the largest, most successful informal educational organization in the world. It is a nationwide system funded and guided by a partnership of federal, state, and local governments that delivers information to help people help themselves through the land-grant university system.

Extension carries out programs in the broad categories of agriculture, natural resources and environment; family and consumer sciences; 4-H and other youth; and community resource development. Extension staff members live and work among the people they serve to help stimulate and educate Americans to plan ahead and cope with their problems.

Some characteristics of the Cooperative Extension system are:

- The federal, state, and local governments cooperatively share in its financial support and program direction.
- It is administered by the land-grant university as designated by the state legislature through an Extension director.
- Extension programs are nonpolitical, objective, and research-based information.
- It provides practical, problem-oriented education for people of all ages. It is designated to take the knowledge of the university to those persons who do not or cannot participate in the formal classroom instruction of the university.
- It utilizes research from university, government, and other sources to help people make their own decisions.
- More than a million volunteers help multiply the impact of the Extension professional staff.
- It dispenses no funds to the public.
- It is not a regulatory agency, but it does inform people of regulations and of their options in meeting them.
- Local programs are developed and carried out in full recognition of national problems and goals.
- The Extension staff educates people through personal contacts, meetings, demonstrations, and the mass media.
- Extension has the built-in flexibility to adjust its programs and subject matter to meet new needs. Activities shift from year to year as citizen groups and Extension workers close to the problems advise changes.

Oklahoma State University, in compliance with Title VI and VII of the Civil Rights Act of 1964, Executive Order 11246 as amended, Title IX of the Education Amendments of 1972, Americans with Disabilities Act of 1990, and other federal laws and regulations, does not discriminate on the basis of race, color, national origin, gender, age, religion, disability, or status as a veteran in any of its policies, practices, or procedures. This includes but is not limited to admissions, employment, financial aid, and educational services.

Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Robert E. Whitson, Director of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma. This publication is printed and issued by Oklahoma State University as authorized by the Vice President, Dean, and Director of the Division of Agricultural Sciences and Natural Resources and has been prepared and distributed at a cost of $1.35 per copy. 1009 Revised GH.