

Jointed Goatgrass Management Strategies in Oklahoma Winter Wheat



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Introduction

After it's introduced from Europe, jointed goatgrass quickly became a weed in winter wheat. By 1946 it was found throughout Oklahoma and was recognized as a significant weed in wheat fields. It also flourishes along roadsides and in disturbed areas across much of Oklahoma and can often be found in almost pure stands along roadsides in the western half of the state. The spikelets move readily in flowing water. Thus, wheat growers often first complain of jointed goatgrass problems when they find dense stands in the channels of contour terraces.

Jointed Goatgrass was held in check for decades by the use of conventional tillage in the production of winter wheat. It does not persist in fields tilled after wheat harvest by a moldboard plow or by an offset tandem disk, because most of the seed germinates over the summer months when in contact with moist soil. When wheat growers adopt minimum tillage practices it can become a serious weed. In Oklahoma, problems in wheat with jointed goatgrass have traditionally been limited primarily to drier southwestern and northwestern counties where minimum tillage has been more common. Thus, the standard recommendation for jointed goatgrass controlled was simply to moldboard plow the field. However, moldboard plowing has decreased in popularity for conservation and economic reasons.

Over the past five years Oklahoma wheat growers have increased no-till wheat production from near zero to an estimated 33% of acreage seeded in the fall of 2008. This rapid switch was caused primarily by high fuel prices during 2008. Thus, the stage is set for jointed goatgrass to explode as a weed of concern in Oklahoma wheat.

Materials and Methods

An experiment was established in north central OK to evaluate 7 management options for their effect in controlling jointed goatgrass in continuous winter wheat. Variables included tillage system (annual moldboard plowing vs stubble mulch tillage), wheat cultivar (Clearfield or conventional), and frequency of use of imazamox herbicide. The treatments were imposed annually for five winter wheat growing seasons. Treatments varied from those with Best Management Practices for cultural control to annual application of imazamox.

The Clearfield wheat cultivar used was an experimental line being developed at OSU by Brett Carver. The conventional cultivar was Jagger, which for several years has been the most widely grown cultivar in the state.

In the fall of 2001, prior to seeding the wheat, locally obtained jointed goatgrass spikelets were evenly distributed across the plot area to establish a uniform weed density.

Plots were harvested each June with a small combine and the straw and chaff returned to each plot. After yields and grain moisture were determined jointed goatgrass spikelets were hand separated from two 200-gram samples of grain from each plot.

Conventional tillage consisted of moldboard plowing within a few days after harvest followed by tandem disking and use of a field cultivator as necessary to keep weeds under control until the plots were reseeded, typically in early October. Stubble mulch tillage consisted of using sweeps followed by a light disking if necessary to control annual grasses.

Plots were seeded with conventional disk grain drills, with 6 or 8 inch row spacing, depending on the treatment, and with or without banded starter fertilizer.

Imazamox (Beyond) was applied at 4 ounces product/acre (0.5 oz ae/acre) in water carrier with adjuvant and nitrogen solution as recommended on the label. Application in the fall was desired but due to dry conditions that often prevented jointed goatgrass emergence in the fall, herbicide was often applied in early March. No other herbicide was applied.

Each crop was fertilized according to soil test recommendations for a 50 bushel/acre yield goal. Plot size was 36 x 50 ft. Treatments were replicated 4 times. The soil was a Grant silt loam, which is a deep, gently sloping, well drained prairie soil widely used for wheat production in northern OK.

Results

The first year imazamox applied to treatments 3, 4, and 5 reduced the number of jointed goatgrass spikelets in harvested wheat by an average of 80%, compared to treatment 2, which was identical except for the imazamox treatment.

The second year spikelet production peaked in treatment 2 (check) at 193K/ bushel of wheat. With two annual applications of Beyond, spikelet density was reduced to a mean of 1160 spikelets / bushel of wheat. Cultural best management practices, i.e. moldboard plowing, a high seeding rate, narrow rows, and banded starter fertilizer (treatments 1 and 7) had reduced spikelets to a mean of 851 / bushel.

The harvest of June 2004 indicated that 3 annual applications of imazamox would eliminate jointed goatgrass. Similarly, intensive cultural practices also reduced spikelets to zero.

In June 2005 we realized that traces of jointed goatgrass were still present in almost all treatments. Within the treatments with cultural BMPS, i.e. 1 and 7, only one jointed goatgrass seed was found in sixteen 200g subsamples. Jointed goatgrass was rebounding in treatment 5 after a second year with no imazamox treatment. Traces of jointed goatgrass were still found in plots that had received four annual applications of imazamox (treatment 3).

In June 2006 jointed goatgrass spikelet density was considerable lower in the check (treatment 2), indicating that jointed goatgrass may be less competitive in crop years that favor high wheat grain yields. The following season wheat was not planted and imazamox was applied to determine if any jointed goatgrass had become resistant to the herbicide. No plants were found that survived that herbicide treatment.

| Treatment | JGG PLANTS/YARD ² PRIOR TO PLANTING | | | | | WHEAT YIELD – BU/AC | | | | | NUMBER OF JGG SPIKELETS PER BU OF GRAIN | | | | |
|-----------|---------------------------------------------------|-----------|-----------|-----------|-----------|---------------------|------------|------------|------------|----------------|--------------------------------------------|------------|------------|------------|------------|
| | OCT 01 | OCT 02 | SEP 03 | OCT 04 | OCT 05 | JUNE 02 | JUNE 03 | JUNE 04 | JUNE 05 | JUN E 06 | JUNE 02 | JUNE 03 | JUNE 04 | JUNE 05 | JUNE 06 |
| 1 | 3 | 6 | 43 | 3 | 2 | 34 | 45 | 46 | 68 | 74 | 2111 | 136 | 0 | 17 | 0 |
| 2 | 12 | 100 | 269 | 53 | 92 | 21 | 27 | 38 | 46 | 77 | 3718 | 193268 | 20267 | 23784 | 1123 |
| 3 | 18 | 63 | 40 | 3 | 3 | 16 | 51 | 42 | 51 | 69 | 994 | 272 | 0 | 51 | 68 |
| 4 | 29 | 48 | 65 | 3 | 6 | 21 | 51 | 41 | 65 | 85 | 654 | 613 | 0 | 136 | 0 |
| 5 | 49 | 61 | 95 | 10 | 6 | 18 | 51 | 46 | 67 | 84 | 586 | 2588 | 327 | 1243 | 34 |
| 6 | 18 | 157 | 128 | 17 | 8 | 26 | 39 | 46 | 50 | 87 | 6170 | 42631 | 1199 | 426 | 102 |
| 7 | 6 | 14 | 0 | 10 | 2 | 25 | 51 | 46 | 56 | 81 | 4263 | 1566 | 0 | 0 | 34 |

Blue shading indicates data collected following an application of Beyond herbicide to that year's wheat crop. Red = Clearfield wheat, Black=Jagger

NOTE : Our limit of detection in 2006 was 34 spikelets/bushel, which equals 1 spikelet in an 800 gram sample. We checked 200 g per plot by hand.

Treatment 1: Conventional tillage (moldboard plow), Jagger wheat at 120 lb/a, 6-inch row spacing, 18-46-0 banded at 50 lb/ac and no herbicide any year. NOTE: All treatments receive broadcast nitrogen required to meet a 50 lb/a yield goal.

Treatment 2: Stubble-mulch tillage, Clearfield wheat at 60 lb/a, 8-inch row spacing and no herbicide any year

Treatment 3: Stubble mulch tillage, Clearfield wheat at 60 lb/a, 8-inch row spacing and Beyond applied at 4 fl oz/a each year.

Treatment 4: Stubble mulch tillage, Clearfield wheat at 60 lb/a, 8-inch row spacing and Beyond applied at 4 fl oz/a for the first 3 years, then switch to Jagger wheat same cultural practices and with no herbicides in 2004-05 and 2005-06.

Treatment 5: Stubble mulch tillage, Clearfield wheat at 60 lb/a, 8-inch row spacing, and Beyond applied at 4 fl oz/a for the first two years, then switch to Jagger wheat with same cultural practices and no herbicides in 2003-04, 2004-05, and 2005-06.

Treatment 6: Stubble-mulch tillage, Jagger wheat at 60 lb/a, 8-inch row spacing and no herbicides the first year and alternate years thereafter. Clearfield wheat with same cultural practices and 4 fl oz/a of Beyond the other years (2002-03, 2004-05).

Treatment 7: Conventional tillage (moldboard plow), Jagger wheat at 120 lb/a, 6-inch row spacing and no herbicides the first year and alternate years thereafter. Same cultural practices and Clearfield wheat with no herbicides in 2002-03 and 2004-05.

Discussion

Clearfield wheat has not yet become popular in Oklahoma for several reasons. First, well adapted Clearfield varieties have only been available for two years, and certified seed growers have been very slow to produce Clearfield seed. Thus, seed supplies are very limited.

Secondly, many growers first tried imazamox for the control of feral rye and were disappointed with the results. We have since learned that feral rye in OK varies greatly in its tolerance to imazamox.

A third reason is that there was a shortage of experienced company personnel during the first years of introduction and some growers were unhappy with the service they received when they complained about performance.

Additionally, the price of the seed has been relatively high and the total cost of the Clearfield system has exceeded the price that most wheat growers have been willing to plan ahead to invest in weed control. There is also strong traditional resistance to purchasing any seed that they are not allowed to save and replant.

Thus, it remains to be seen whether wheat growers will adopt Clearfield technology for jointed goatgrass control, revert to conventional tillage, or adopt a crop rotation. Wheat acreage has continued to decline in OK and acreage of winter canola and summer crops have increased. Growers will continue to seek the most profitable farming system that has a risk level that they are comfortable with.

Future Efforts

On-farm demonstrations of the use of the Clearfield technology for jointed goatgrass management are underway at five sites in north central OK. Growers have been provided with 20 bushels of seed and enough herbicide to treat it. We hope that tours this spring will enable additional growers to evaluate control on these fields and make informed decisions as to the potential for the Clearfield system on their farms.