

# EVALUATION OF A SEED CONTROL UNIT FOR MANAGEMENT OF ITALIAN RYEGRASS IN WHEAT

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## **OBJECTIVES**

Italian ryegrass, also known as annual ryegrass, continues to be a problematic weed in Kentucky soft red winter wheat. The University of Kentucky has confirmed multiple populations of Italian ryegrass with resistance to pinoxaden and fenoxaprop the active ingredients in Axial Bold that is heavily used for postemergence control of ryegrass in wheat. University of Kentucky weed scientists recommend the use of pyroxasulfone as a soil residual at winter wheat planting to relieve the pressure on postemergence herbicides for ryegrass control. While the use of pyroxasulfone has proven to effectively suppress the majority of ryegrass emergence in the fall, the practice does not assure complete control of the problematic weed. In the face of increasing resistance to fenoxaprop and pinoxaden it is vital that new methods of weed control are explored.

Harvest Weed Seed Control is the method of destroying weed seed at the time of crop harvest. These methods are only effective on weeds that mature and produce seed at the same time as the crop they are competing within. There are several forms of Harvest Weed Seed Control, but one of the most successful is the use of cage mills or high impact mills to destroy any weed seed contained in the fine chaff as it exits the combine. These mills only handle the fine chaff and straw chaff is diverted into the straw chopper or spinners as it would in a normal combine operation, thus any weed seed in the straw portion of the chaff would not be destroyed. Although it has been found that the majority of weed seed in most scenarios would be contained in the fine chaff portion. The use of cage mills or high impact mills installed on combines has been effective for ridged ryegrass control in small grains in Australia over the past decade. This research was an expansion upon previous research at the University of Kentucky to understand the utility of a Seed Control Unit (SCU) for reducing Italian ryegrass seed distribution at harvest in Kentucky winter wheat. This research had two primary objectives.

1. Evaluate the ability of a Redekop Seed Control Unit (SCU) to destroy Italian ryegrass seed during wheat harvest in Kentucky.
2. Observe the distribution of Italian ryegrass seed during wheat harvest, including seed loss at the combine header, seed within the grain tank, and seed loss in straw chaff while using a SCU.

## **METHODS & MATERIALS**

Research was conducted on a grower wheat field with a known population of Italian ryegrass in 2022. A Redekop Seed Control Unit (SCU) was installed on the growers John Deere S780 combine to use for evaluation during wheat harvest. The selected field was treated with a pyroxasulfone residual herbicide at wheat planting to provide suppression of ryegrass emergence, while the farmer was instructed to not apply Axial Bold to the area of evaluation to allow for ryegrass escapes to mimic an Axial Bold resistant population.

The trial was laid out as a randomized complete block with four replications and two treatments: Seed Control Unit On and Seed Control Unit Off. Each treatment plot was approximately 1 acre in size. The following samples were collected from each plot to provide data for both Objectives:

- Four combine header shatter samples were collected by placing small trays with a cumulative area of one meter squared between wheat rows prior to harvest. The combine header was allowed to harvest over the trays but stopped prior to the front wheels reaching the trays. This allowed for the collection of ryegrass seed that shattered at the combine header.

- Four ground chaff samples were collected by placing three trays with a cumulative area of one meter squared behind the combine while harvesting to collect all chaff exiting the combine.
- Four samples of chaff were collected directly from the combine using sweep nets as the combine harvested. In plots where the SCU was off all fine chaff and straw chaff exited through the combine straw chopper, thus a single sweep net was used for collection. In contrast in the plots with the SCU engaged the fine chaff exits the SCU ejection ports while the straw chaff was ejected out the straw chopper without any interaction with the SCU. In the plots with the SCU engaged two sweep nets were used to collect chaff simultaneously from the straw chopper and the SCU. This collection allows for the evaluation Italian seed loss through the straw fraction of chaff.
- A single grain tank sample was collected at the end of each plot harvest using a chambered grain probe. The total weight and moisture of grain was also collected at the end of each plot as well to allow for calculations of seed per square meter to enable comparison to the other collection points.

All samples were processed using sieves and air column cleaners to separate Italian ryegrass seed from chaff, straw, and grain. Whole ryegrass seed (partial or fragmented seed was excluded) was counted for each sample and converted to Italian ryegrass seed per square meter (for all ground tray samples and grain samples) or seed per Kg of chaff (direct chaff catches).

## **RESULTS AND DISCUSSION**

**Objective 1.** Whole ryegrass seeds deposited onto the ground during wheat harvest with the chaff was significantly reduced when the SCU was engaged. The number of ryegrass seeds was reduced from 335 seeds per m<sup>2</sup> to 60 seed per m<sup>2</sup> when the SCU was engaged (Figure 1). Similarly, Italian ryegrass seed contained in chaff collected directly from the combine was decreased when the SCU was engaged. Ryegrass seed within the chaff was reduced from 1460 seeds per kg chaff when the SCU was off as compared to 402 seeds per kg chaff when the SCU was engaged (Figure 2).

**Objective 2.** Ryegrass distribution between the header shatter, grain tank, and chaff was analyzed only in plots with the SCU off to eliminate any interaction with the seed control unit. Equal amounts of ryegrass seed per m<sup>2</sup> were found in the chaff, in the header shatter samples, and contained in the grain tank. Although, a greater amount of ryegrass seed entered the combine (combination of seed found in chaff and grain tank) as compared ryegrass seed that shattered at the combine header (Figure 3). Despite that greater portion of ryegrass seed entering the combine than shattering at the combine header, the amount of ryegrass seed shattered at the combine header was still significant. When including plots where the seed control unit was engaged and considering header shatter in combination with seed in the chaff for the total amount of ryegrass seed deposited back onto the field at harvest the benefits of the SCU were negated. The total amount of ryegrass seed being deposited back onto the field was 819 seeds per m<sup>2</sup> when the SCU was off which was similar to when the SCU was engaged at 526 seed per m<sup>2</sup> (Figure 4). Further evaluation of potential Italian ryegrass seed evasion of the SCU was evaluated by observing seed contained in the straw portion of the chaff when the seed control unit was engaged. Whole ryegrass seed contained in the fine chaff exiting the SCU was 372 seeds per kg of fine chaff as compared to 172 seed per kg of straw chaff exiting the straw chopper, indicating that there was not a significant loss or escape of ryegrass seed through the straw portion of the chaff flow (Figure 5).

## **CONCLUSION**

The use of a Seed Control unit did reduce the amount of viable Italian ryegrass seed in the chaff exiting the combine during wheat harvest in 2022. The reduction in ryegrass seed in the chaff was found in both collections on the ground behind the combine as well as collections directly from the combine chaff flow. Despite the ability of the seed control unit to effectively destroy Italian ryegrass seed, the amount of seed found shattering at the combine header negated

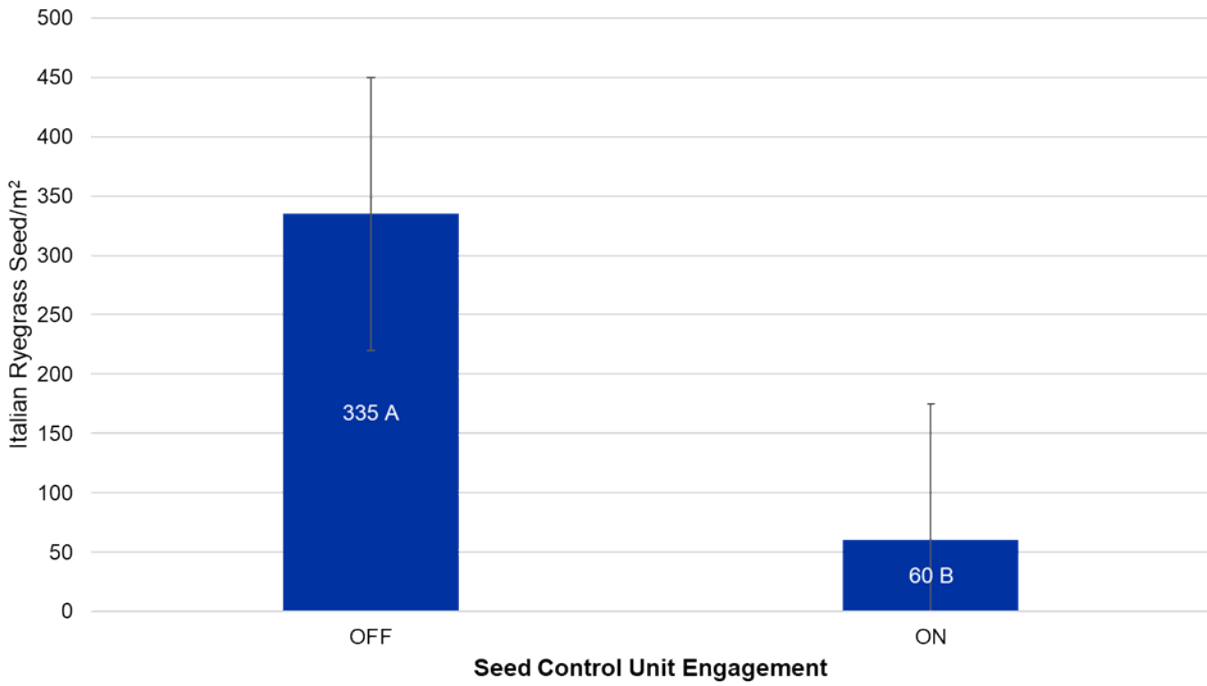
the effects of the seed control unit. Further collections were made during the 2023 wheat harvest and are being actively evaluated and analyzed. Additionally, further research into reducing Italian ryegrass seed loss due to header shatter is also warranted.

#### **ACKNOWLEDGEMENTS**

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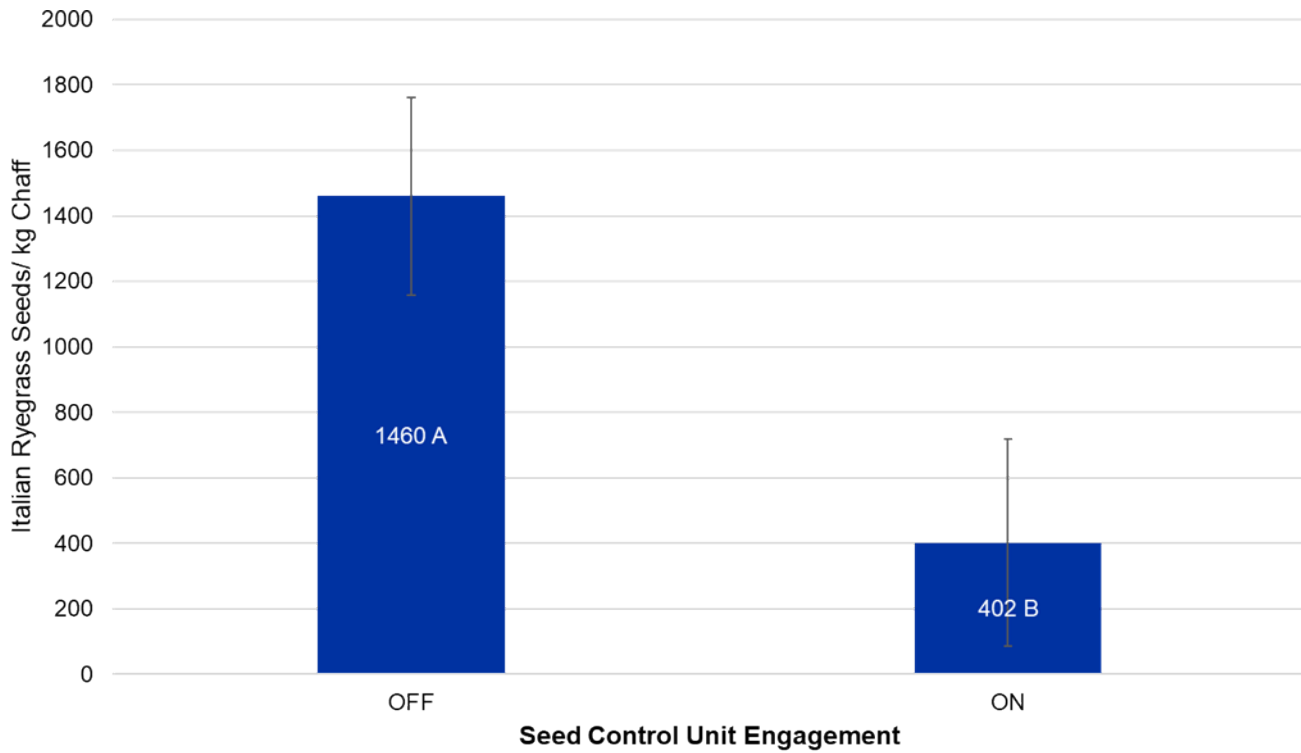
**FIGURES**

**Figure 1.** Italian ryegrass seeds deposited onto the ground with fine and straw chaff during wheat harvest with and without the engagement of a Seed Control Unit.



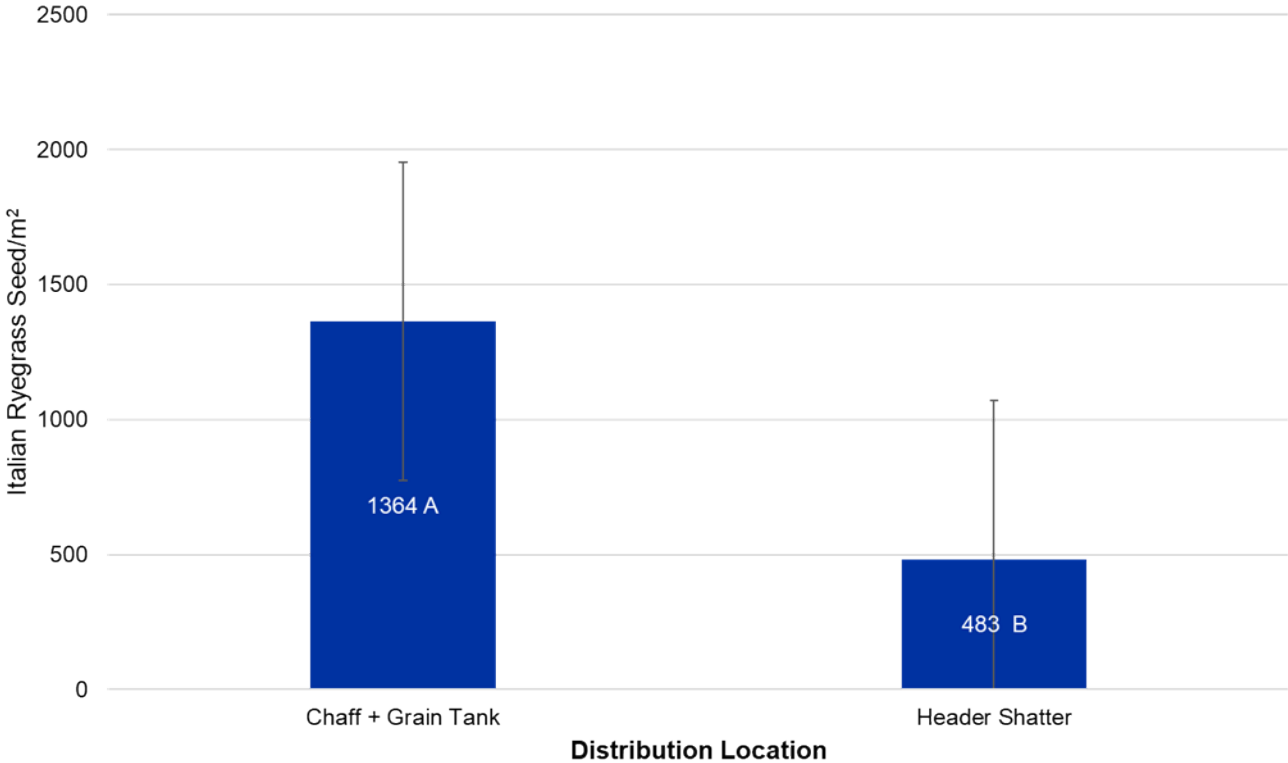
\* Means with a different letter are significantly different. Tukey HSD  $\alpha=0.05$

**Figure 2.** Italian ryegrass seeds contained within the composite chaff (fine and straw chaff combined) during wheat harvest with the engagement of a Seed Control Unit.



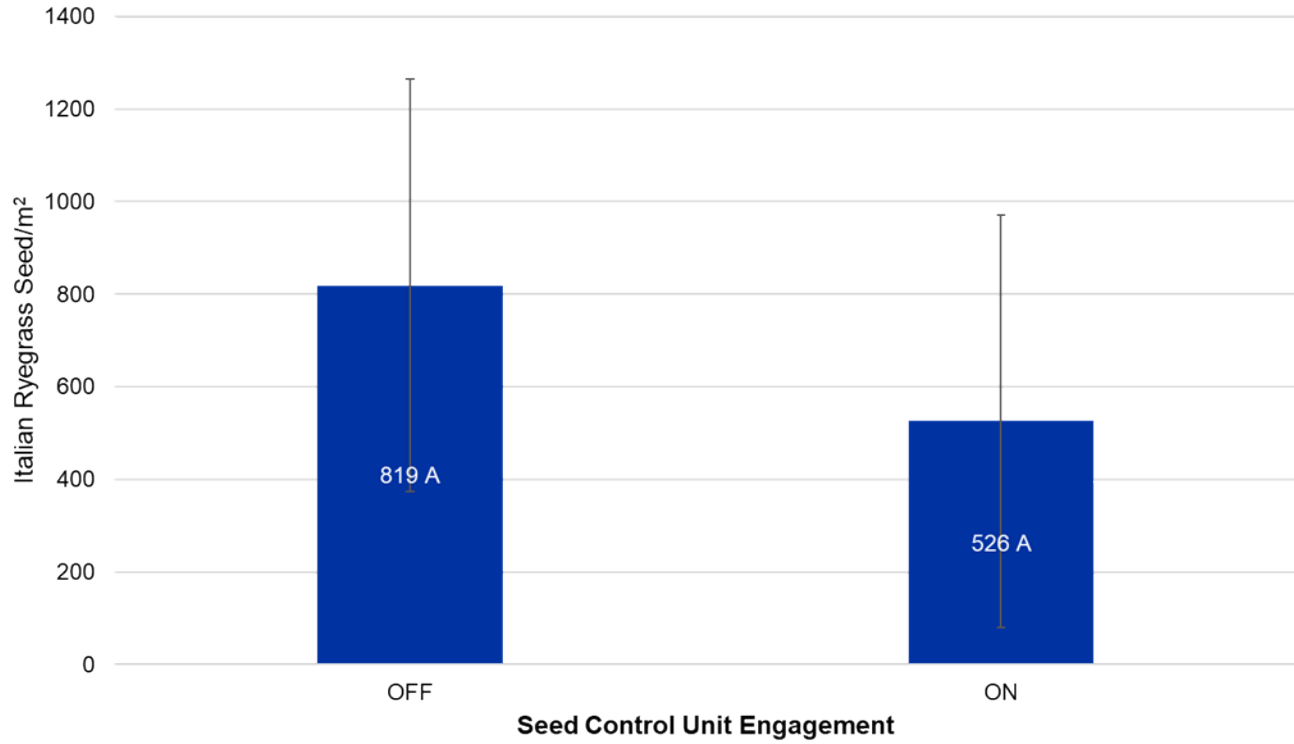
\* Means with a different letter are significantly different. Tukey HSD  $\alpha=0.05$

**Figure 3.** Italian ryegrass seed entering the combine at harvest (Chaff + Grain Tank) as compared to seed that shattered at the combine header.



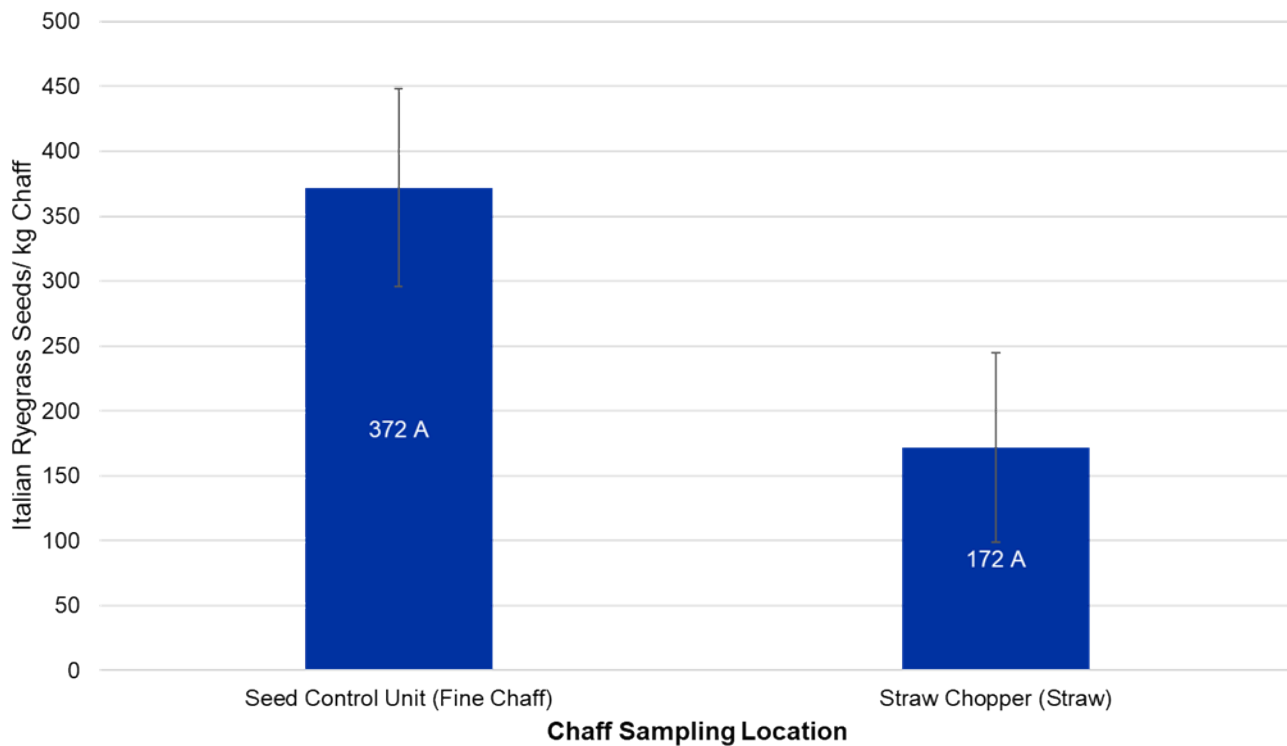
\* Means with a different letter are significantly different. Tukey HSD  $\alpha=0.05$

**Figure 4.** Italian ryegrass seed deposited back onto field when considering both seed within chaff and seed shattered at the combine header as influences by Seed Control Unit engagement.



\* Means with a different letter are significantly different. Tukey HSD  $\alpha=0.05$

**Figure 5.** Italian ryegrass contained in fine chaff and straw chaff portions of the chaff flow when the Seed Control Unit was engaged. During SCU engagement only the fine chaff passes through the SCU to destroy weed seed, while all straw chaff bypasses the SCU. Thus, any seed found in the chaff would remain viable and be placed back on the field.



\* Means with a different letter are significantly different. Tukey HSD  $\alpha=0.05$