Physiological Maturation of Jointed Goatgrass (Aegilops cylindrica) Caryopses

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Introduction

Jointed goatgrass (Aegilops cylindrica) is an invasive annual grass weed that infests winter wheat fields to the point of reducing wheat yield and quality (Anderson 1993; Donald and Ogg 1991). Selective control of jointed goatgrass can be achieved utilizing herbicide-resistant winter wheat (Rainbolt et al. 1999). More recently, locally adapted cultivars have been developed with the herbicide resistance gene (Zota 2002). Research has demonstrated that use of a herbicide resistant cultivar will aid in the development of a herbicide resistant jointed goatgrass biotype (Rainbolt et al. 2002; Zimdahl et al. 1995). Therefore, it is critical to know how new technology not only affects germination and early growth but also how integrated weed management strategies must be altered and how this includes understanding jointed goatgrass biology (Malarkey and Rehl 1999).

A better understanding of seed biology may suggest ways to improve management techniques (Donald and Emerick 1997).

Materials and Methods

Experimental Design

Greenhouse experiments were initiated at the University of Idaho, Moscow, ID in December 2002 and May 2003. Both experiments were conducted in a randomized complete block design with three reps, and blocks were randomized in order to be effective in integrated weed management strategies. Treatments consisted of 23 harvest dates and each harvest date was determined by the number of days after anthesis (DAA) a spike was allowed to remain on the plant. Harvest dates ranged from 2 to 34 DAA in one day increments. Anthesis was defined as one third of the spikelet having anthers extended.

Comparison of blocks with the GLM procedure revealed no significant differences. Therefore, the data were pooled and fit to linear plateau (Figure 1: a,b,c) and quadratic (Figure 2:a,b,c) models. All models were modeled according to phenological development for the purpose of model construction. It was considerably larger than the Filer experiment.

The Filer experiment was a complete random design. Treatments consisted of 33 harvest dates and each harvest date was determined by the number of days after anthesis (DAA) a spike was allowed to remain on the plant. Harvest dates ranged from 2 to 34 DAA in one day increments. Anthesis was defined as one third of the spikelet having anthers extended.

Model Validation

Examination of the linearity of the data and associated standard deviations of the validation models revealed no shifts in the data or excessive values (Tables 2 & 3).

Results

Comparisons of blocks with the GLM procedure revealed no significant differences. Therefore, the data were pooled and fit to linear plateau (Figure 1: a,b,c) and quadratic (Figure 2:a,b,c) models. All models were modeled according to phenological development for the purpose of model construction. It was considerably larger than the Filer experiment.

Spikelets harvested before 7 DAA had less than 2% germination regardless of time of collection on the spike.

Spikelets harvested 7 DAA or later had more than 2% germination regardless of time of collection on the spike.

Conclusions

Although limited, jointed goatgrass spikelets are capable of germination at 2 days after anthesis.

Spikelets from the middle and bottom sections required fewer DAA to reach their maximum germination levels as well as have a greater maximum germination level. This suggests that the middle and bottom sections can potentially be used in a two-pass program.

Quadratic models constructed for time to germination in both years suggest that dormancy mechanisms exist in all sections of the spike and develop after 20 DAA.

Fluctuations in response of both germination percentage and time to germination were attributed to minor environmental differences between study locations.

Spikelet weight increased at 6 DAA in the top and bottom sections (p< 0.0001), based on analysis of variance conducted on individual data.

Literature Cited


