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Aminopyralid Constrains Seed Production of the Invasive Annual Grasses Medusahead and Ventenata

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Abstract

Invasive annual grasses, such as medusahead (*Taeniatherum caput-medusae* [L.] Nevski), ventenata (Ventenata dubia [Leers] Coss.), downy brome (*Bromus tectorum* L.), and Japanese brome (*Bromus japonicus* Thunb. ex Murr.), are negatively impacting millions of hectares of US rangelands. Amino acid synthesis inhibitor and photosynthesis inhibitor herbicides are sometimes used to control invasive annual grasses. Conversely, growth regulator herbicides are generally considered ineffective against invasive annual grasses. However, in a recent study of pre-emergence herbicide applications, the growth regulator aminopyralid appreciably reduced medusahead cover, primarily by killing emerging medusahead plants. Additionally, in recent studies of postemergence herbicide applications, we found the growth regulators aminopyralid, dicamba, and picloram drastically reduced downy brome and Japanese brome seed production. In these postemergence studies, growth regulators sterilized the plants without otherwise greatly affecting them. The purpose of this greenhouse study was to extend our growth regulator/plant sterility research from downy brome and Japanese brome to medusahead and ventenata. Each tested aminopyralid rate and application growth stage (late seedling, internode elongation, heading) reduced medusahead seed production to nearly zero. Picloram also reduced medusahead seed production, but not quite as consistently as aminopyralid. With ventenata, aminopyralid applied at the seedling stage reduced seed production ~95–99%. Beyond the seedling stage, however, ventenata responses to aminopyralid were highly variable. Picloram had low activity against ventenata seed production. These results contribute to a growing body of evidence suggesting it may be possible to use growth regulators to control invasive annual grasses by depleting their short-lived seedbanks.

Key Words: downy brome, growth regulator herbicide, herbicide, invasive plant, seedbank, weed

INTRODUCTION

Exotic annual grasses, such as downy brome, Japanese brome, medusahead, and ventenata negatively impact millions of hectares of US grasslands (Sheley and Petroff 1999; DiTomaso 2000; Sperry et al. 2006; Davies and Svejcar 2008). These grasses can reduce native species richness and abundances (Haferkamp et al. 2001b; Davies and Svejcar 2008), reduce livestock carrying capacities (Knapp 1996; Haferkamp et al. 2001a), alter nutrient cycling (Rimer and Evans 2006) and microbial communities (Belnap et al. 2005), and shorten wildfire return intervals (D'Antonio and Vitousek 1992). Herbicides are sometimes used alone (Shinn and Thill 2002; Ward and Mervosh 2012) and other times combined with seeding (Morris et al. 2009; Owen et al. 2011), prescribed fire, and/or grazing (Whitson and Koch 1998; Calo et al. 2012) in efforts to replace the invaders with more desirable vegetation.

The photosynthesis inhibitor herbicide tebuthiuron and the amino acid synthesis inhibitor herbicides rimsulfuron, glyphosate, and imazapic are sometimes used to control invasive annual grasses. Although these herbicides can provide partial, short-term control (~1–2 yr) of invasive annual grasses, they can damage or kill desirable perennial grass plants growing with the weeds (Lym and Kirby 1991; Monaco et al. 2005), including desirable grasses seeded around the time of herbicide application (Shinn and Thill 2004; Sheley et al. 2007; Hirsch et al. 2012).

Compared to amino acid synthesis inhibitors and photosynthesis inhibitors, growth regulator herbicides, such as aminopyralid, clopyralid, 2,4-D, dicamba, and picloram, are generally less damaging to desirable perennial grasses (Lym and Messersmith 1985; Lym and Kirby 1991; Sheley et al. 2000; Shinn and Thill 2004). Growth regulator herbicides are commonly used for controlling broadleaf weeds (Lym and Messersmith 1990; e.g., Enloe et al. 2007; Seefeldt and Conn 2011), and these herbicides have historically been considered ineffective against invasive annual grasses. However, recent anecdotal reports indicate the growth regulator herbicide aminopyralid applied pre-emergence has activity against some invasive annual grasses, including downy brome and soft brome (*Bromus hordeaceus* L.) (Kyser et al. 2012b). Moreover, a recent study found aminopyralid applied pre-emergence was as least as effective as rimsulfuron or imazapic at reducing medusahead cover (Kyser et al. 2012b).

In other recent research, we found that postemergence applications of the growth regulators dicamba, picloram, and aminopyralid, but not 2,4-D, drastically reduced seed production of downy brome (Rinella et al. 2013) and Japanese brome (Rinella et al. 2010a, 2010b). This suggests growth regulators

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