Crop Protection 89 (2016) 72–77

Contents lists available at ScienceDirect

Crop Protection

journal homepage: www.elsevier.com/locate/cropro

Efficacy of pre and postemergence herbicides on weed suppression in established turfgrass with a conventional and an ultra-low volume sprayer

J. Connor Ferguson [a, *], Roch E. Gaussoin [a], John A. Eastin [b], Matthew D. Sousek [a], Greg R. Kruger [c]

[a] University of Nebraska-Lincoln, Lincoln, NE, USA
[b] Kamterter LLC, Waverly, NE, USA
[c] University of Nebraska-Lincoln, North Platte, NE, USA

ARTICLE INFO

Article history:
Received 26 April 2016
Received in revised form
27 June 2016
Accepted 7 July 2016

Keywords:
ULV sprayer
Turfgrass weed control
Dandelion
Ground ivy
Large crabgrass
Mesotrione
2,4-D
Dicamba

ABSTRACT

Previous research has shown the effectiveness of an ULV (Ultra-Low Volume) sprayer compared to a conventional sprayer for weed control in row crop applications. This sprayer produced comparable disease control and foliar nutrient applications to a conventional sprayer in turfgrass, but has not previously been evaluated for weed control in established turf. Four weed control field studies were conducted in the spring and summer of 2012 and 2013 at the University of Nebraska-Lincoln: John Seaton Anderson Turfgrass Research Facility near Mead, NE, USA to compare the weed control efficacy between a novel ULV sprayer and a conventional sprayer. The studies compared the two sprayers for the control of: ground ivy and dandelion in established turf in a summer application; preemergence control of large crabgrass in established turf in a late spring application and ground ivy control in established turf in a late spring application. No differences were observed in weed control between sprayer types in the four studies over both years of the study despite a thirty fold decrease in application volume rate across different herbicide modes-of-action in all of the studies. The Kamterter ULV sprayer system may be a useful and effective management option for control of the weeds in turfgrass.

1. Introduction

Herbicide spray applications are most effective when they result in maximum coverage and droplet distribution on plant material. Weeds cause economic and aesthetic losses by competing against plant systems for limited resources (Beckett et al., 1988; Crook and Renner, 1990; Kudsk and Streibig, 2003). In turfgrass management, dandelion (*Taraxacum officiniale* G.H. Weber ex Wiggers), large crabgrass (*Digitaria sanguinalis* (L.) Scop.), and ground ivy (*Glechoma hederaceae* L.), compete with turfgrass species for resources and can dominate landscapes. In managed systems without tillage, dandelion is considered a troublesome weed (Franssen and Kells, 2007). Dandelion is a perennial broadleaf weed and without proper control is problematic for turfgrass managers each year. Previous research has demonstrated that 2,4-D and mesotrione are effective at reducing dandelion stands in no-tillage systems (Franssen and Kells, 2007).

Ground ivy is a common, stoloniferous perennial weed that can disrupt a turfgrass system (Kohler et al., 2004a). Ground ivy has the ability to spread into a dense canopy and outcompete established turfgrass creating thin stands and reduced turf vigor (Kohler et al., 2004b). Hatterman-Valenti et al. (1996) reported that ground ivy control could be inconsistent, where control from identical treatments can range from 66% to 91% making successful management strategies difficult to establish. Patton and Weisenberger (2012) observed effective ground ivy control in established turf using 2,4-D, dicamba, mecoprop, sulfentrazone, triclopyr or mesotrione.

Large crabgrass is a competitive, annual warm season grass that is often observed in established turfgrass systems throughout the US. Pendimethalin is a commonly used preemergence (PRE) herbicide to control large crabgrass in turfgrass (Bhowmik and Bingham, 1990; Johnson, 1993a, 1993b, 1997), but prior studies have not researched variations in application volume rates and

* Corresponding author. Northwest Missouri State University, Maryville, MO, 64468, USA.
E-mail address: cferguson@nwmissouri.edu (J.C. Ferguson).

http://dx.doi.org/10.1016/j.cropro.2016.07.006

their effects on large crabgrass control with pendimethalin. Application volume rates in these studies ranged from 375 L ha^{-1} to 470 L ha^{-1}. It should be noted that an irrigation event is made after application of a preemergence herbicide like pendimethalin, as it is most effective at the crown of the plant and/or in the top 1 cm of the soil and thus would be less affected by application volume (M. Sousek, Personal communication).

Mesotrione was released in 2008 for use in turfgrass (Anonymous, 2008), and has been reported to be effective in controlling dandelion and ground ivy (Franssen and Kells, 2007; Patton and Weisenberger, 2012). Most labels for turfgrass herbicides recommend an application volume rate of at least 187 L ha^{-1} (Anonymous, 2008, 2009a, 2009b, 2012). Previous research on the control of weeds in turfgrass has focused on alternative methods for herbicide application, but the convention is to use application volume rates of 187 L ha^{-1} or greater (Bhowmik and Bingham, 1990; Johnson, 1993a, 1993b, 1997). This results in a reduced application efficiency as applicators and golf course superintendents can only cover a limited area per tank load. The use of ULV technology has been documented in other cropping systems (Bode et al., 1985; Barrentine and McWhorter, 1988; Hanks and McWhorter, 1991, 1993) but is not widely used in turfgrass. Herbicide control with ULV sprayers have shown equal to or better control of weeds in row crop systems (Barrentine and McWhorter, 1988; Ferguson et al., 2014a, 2014b).

Previous research using a novel ULV sprayer from Kamterter LLC in Waverly, NE has shown equal to or better control of weeds in row crop applications (Ferguson et al., 2014a, 2014b) and for control of turf diseases (Ferguson et al., 2016) compared to a conventional sprayer in both systems. The sprayer has been described at length prior, and utilizes an interaction of two kinetic energy fluids – a gas and a liquid, to atomize and broadcast low volumes of spray solutions. The system was designed to handle rates as low as 9.5 L ha^{-1}. The sprayer takes a column of liquid and meters it on a spray fixture surface. The liquid is fed by a linear peristaltic positive displacement pump which then combines with an air column at the spray fixture surface that shears the liquid to form droplets (Eastin and Vu, 2012). The ULV sprayer meters liquids with high extensional viscosity and shear thinning fluid characteristics that cannot be atomized with small orifice nozzles on conventional sprayers (Fig. 1). The ULV sprayer in its turfgrass application setup is shown in Figs. 2–4.

Fig. 1. Kamterter ULV Sprayer fixture attached to the spray boom. The fixture is attached to a dry boom where the air component of the system enters the mixing chamber (labeled 105) from above and is interacted with the liquid component which enters the fixture at the back.

Fig. 2. Kamterter ULV turfgrass sprayer on a Toro Workman® 3200 applying treatments in a Kentucky bluegrass and perennial ryegrass mixture in 2012.

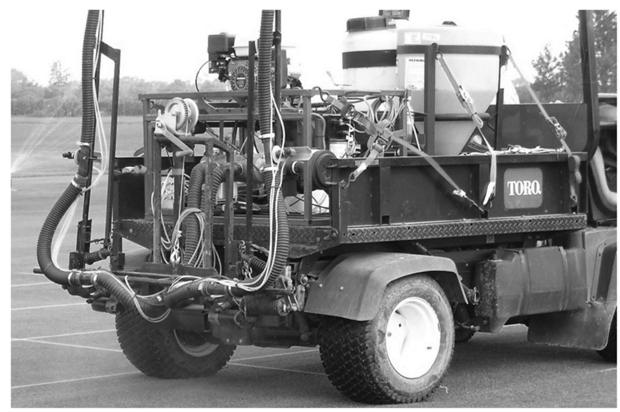

Fig. 3. Kamterter ULV turfgrass sprayer on a Toro Workman® 3200 applying treatments from an alternate angle in 2011.

The objectives of these studies were: 1. To identify if the novel ULV sprayer can effectively apply postemergence herbicides for a wide range of weed control scenarios in an established turfgrass system comparable to a conventional sprayer. 2. To identify if the novel ULV sprayer can apply preemergence herbicides comparably to a conventional sprayer in an established turfgrass system.

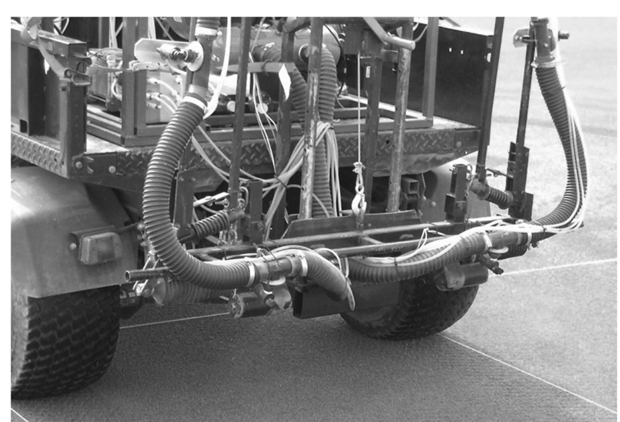

Fig. 4. Kamterter ULV turfgrass sprayer on a Toro Workman® 3200 with a focus on the fixtures applying treatments in 2011.