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Cultivar, Mowing Height, and Herbicide Effects on Bermudagrass, Cynodon Dactylon [L.] Pers., Suppression in Tall Fescue, Schedonorus Arundinaceus [Schreb.] Dumort., Nom. Cons.

Daniel S. Sandor
Western Kentucky University, daniel.sandor174@topper.wku.edu

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Paul Woosley, Director of Thesis

Becky Gilfillen

Todd Willian

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Directed by: Paul Woosley, Becky Gilfillen, and Todd Willian

Department of Agriculture Western Kentucky University

In the fall of 2011, a study was initiated at the Western Kentucky University Farm in Bowling Green, Kentucky on a Crider silt loam (Typic Paleudalf). The objective of this study was to determine cultivar, mowing height, and herbicide effects on bermudagrass, *Cynodon dactylon* [L.] Pers., suppression in tall fescue, *Schedonorus arundinaceus* [Schreb.] Dumort., nom. cons. The experimental design was a split plot design with whole plots consisting of varying mowing heights and split plots consisting of different herbicide treatments with three replications. Two separate experiments were conducted. The tall fescue variety 'KY 31' was utilized for one study and the turf type cultivar 'Bullseye' was utilized in the other. In the fall of 2011, glyphosate (Roundup Pro) was applied to selected plots at the rate of 0.36 kg ae/ha. 'KY 31' and 'Bullseye' tall fescues were sown into an existing mixed stand of common and hybrid bermudagrass at 342 kg pls/ha. Mowing heights were maintained at 7.62 cm, 10.16 cm, and 12.70 cm. In the spring of 2012, treatments containing fenoxaprop (Acclaim Extra), mesotrione (Tenacity), and fluazifop (Fusilade II) were applied to selected plots at the rates of 0.07 kg ai/ha, 0.48 kg ai/ha, and 0.24 kg ai/ha respectively. A non-ionic surfactant at 0.25% (v/v) was utilized in treatments containing mesotrione and fluazifop. Three weeks later these treatments were applied a second time. Data were collected visually on turf quality, tall fescue cover, broadleaf weed cover, and bermudagrass cover. The study was repeated

in 2012 – 2013. Fluazifop and glyphosate + fluazifop resulted in significantly lower turf quality than all other treatments up until ten weeks after initial treatment. Treatments containing fluazifop significantly reduced tall fescue cover but also significantly suppressed bermudagrass cover the greatest. However, these treatments also resulted in the greatest amount of broadleaf weed cover. High mowing heights may play a role in achieving high turf quality ratings and better broadleaf weed and bermudagrass suppression in forage type tall fescue than in turf type tall fescue.

Introduction

Turf quality can be defined as a function of a turf's utility and appearance due to the density, uniformity, and aesthetic color of the turf (Turgeon, 2008). Achieving and maintaining excellent or even acceptable turf quality is difficult when managing a mixed stand of turfgrass species. In a mixed stand, one or all of the aforementioned components of turf quality are susceptible to being compromised due to the growth habits of the different turfgrass species within the stand. This is especially true when the mixed grasses are different in leaf texture and growth habits such as bermudagrass and tall fescue (Johnson and Carrow, 1993). This is a common problem throughout the transition zone of the United States where bermudagrass (*Cynodon dactylon* [L.] Pers.) invades tall fescue (*Schedonorus arundinaceus* [Schreb.] Dumort., nom. cons.) turf during the summer. Throughout the transition zone, brown, dormant bermudagrass mixed with tall fescue results in poor turf quality during the late fall and continuing through early spring (Johnson and Carrow, 1993).

Bermudagrass is a desirable turfgrass species when grown as a monoculture, but when mixed within a cool season turfgrass it is considered a weed (Johnson, 2005). Bermudagrass is best adapted to temperatures from 27 - 35°C while tall fescue's temperature range for optimum growth is 18 - 24°C. Shoot growth of cool season grasses occurs rapidly during the spring, proceeds slowly during the summer because of the intolerance to summer temperatures and stresses, and increases again in the fall (Fidanza and Johnson, 2001). When bermudagrass and a cool season grass are grown in a mixed stand or in close proximity, bermudagrass, being a warm season grass, can become an aggressive competitor during the summer months when its shoot growth is maximized

(Fidanza and Johnson, 2001). Bermudagrass grows aggressively by stolons and rhizomes, and additionally spreads through seed (Powell Jr. 2005). Bermudagrass may be introduced into new fescue lawns from a variety of sources, including propagules present in the soil and from clippings from neighboring lawns that contain viable stolons (Brede, 1992).

Herbicides can be utilized for selective and non selective bermudagrass control in cool season turf. Fenoxaprop and fluazifop are aryloxyphenoxy-propinoate herbicides used for postemergence grassy weed control in tall fescue and zoysiagrass (*Zoysia spp*.). Fluazifop alone should be applied with a non-ionic surfactant at 0.25% v/v of spray solution. These herbicides inhibit lipid synthesis in susceptible grassy weeds (McCullough, 2011). Sensitive weeds exhibit injured leaf tissue with reddish discoloration while the plant nodes become necrotic and die (McCullough, 2011).

Glyphosate is a foliar absorbed, nonselective herbicide that is systemically translocated, inhibiting 5 enolpyruvylshikimate-3-phosphate synthase (EPSPS) in the shikimic acid pathway, blocking the production of aromatic amino acids (McCullough, 2011). Depletion of these amino acids reduces plant protein production necessary for growth and development (McCullough, 2011). Glyphosate should be applied to bermudagrass that is actively growing, and repeat treatments are required for complete control. Perennial grasses generally have greater translocation of photosynthate from leaves to stems in fall than spring, which increases glyphosate movement to rhizomes; thus fall glyphosate applications generally control bermudagrass more effectively than summer treatments (McCullough, 2011).

Johnson (2000) utilized the herbicides fenoxaprop and fluazifop, as well as Horizon 2000, a combination product of fenoxaprop plus fluazifop, in a study focused on reducing bermudagrass contamination in tall fescue stands. Horizon 2000 applied at the rate of 0.40 kg ai/ha, in three sequential applications proved effective in controlling bermudagrass rhizomes and stolons. Applications of fenoxaprop alone at the rates of 0.40, 0.80, 1.18 kg ai/ha, and fluazifop alone at the rate of 0.20 kg ai/ha showed only temporary control of bermudagrass shoots (Johnson, 2000).

In regards to tall fescue herbicide tolerance, fenoxaprop was safe on tall fescue, but the rates that were evaluated did not significantly suppress bermudagrass for an extended period of time (Johnson, 2000). Fluazifop alone at 0.20 kg ai/ha produced moderate injury levels with no visible injury four weeks after the second application (Johnson, 2000). Horizon 2000 at the rate of 0.40 kg ai/ha showed severe turfgrass injury with noticeable fescue discoloration (Johnson, 2000).

McElroy and Breeden (2011) investigated if adding triclopyr or fluroxypyr to fenoxaprop and fluazifop would safen their use on tall fescue. Fluazifop at 0.1 kg ai/ha injured tall fescue greater than fluazifop (0.1 kg ai/ha) + triclopyr (1.12 kg ae/ha) or fluazifop + fluroxypyr (0.26 kg ae/ha). Fluazifop alone controlled bermudagrass by 74%, fluazifop + fluroxypyr controlled bermudagrass by 76%, and fluazifop + triclopyr controlled bermudagrass by 69% (McElroy and Breeden, 2011).

Fenoxaprop at 0.13 kg ai/ha, and fenoxaprop (0.05 kg ai/ha) + fluroxypyr (0.26 kg ae/ha) resulted in minimum tall fescue injury. Fenoxaprop + triclopyr (1.12 kg ae/ha) showed greater tall fescue injury than fenoxaprop + fluroxypyr but less than fenoxaprop alone. Fenoxaprop + triclopyr controlled bermudagrass by 67%, whereas fenoxaprop

alone and fenoxaprop + fluroxypyr controlled bermudagrass at 39% and 35% respectively (McElroy and Breeden, 2011).

In conclusion, McElroy and Breeden recommend to utilize fluazifop at 0.10 kg ai/ha or fenoxaprop at 0.13 kg ai/ha plus triclopyr at 1.12 kg ae/ha beginning Mid-May and applying sequential applications every 4 weeks throughout the growing season and ending in mid-August. They also note to increase the mowing height of the fescue to greater than or equal to 7.62 cm and to fertilize twice in the fall and once in the spring with 49 kg N/ha and to not fertilize between April 1 and September 1 (McElroy and Breeden, 2011).

Teuton *et al*. (2005), investigated the control and renovation of hybrid bermudagrass (*Cynodon dactylon* [L.] Pers. var. *dactylon* x *C*. *transvaalensis* Burtt-Davy) using glyphosate and fluazifop, when trying to establish a pure, contaminant-free stand of a new bermudagrass cultivar. At twelve weeks after the initial treatment (WAIT) (4 weeks after the final herbicide application), treatments containing glyphosate (4.5 kg ai/ha) + fluazifop (0.4 kg ai/ha), and glyphosate + fluazifop + ammonium sulfate (1 kg N per ha) provided 99% bermudagrass control after three applications. There was a 12% increase in control for three versus two applications at 12 WAIT. The research also indicated a 7% increase in bermudagrass control 12 WAIT with fluazifop + glyphosate relative to glyphosate alone. Also, the addition of ammonium sulfate increased control at 4 WAIT by 4%, but no differences in control were observed at 8 and 12 WAIT (Teuton *et al*., 2005).

Johnson and Carrow (1993) researched the control of common bermudagrass in tall fescue with fenoxaprop. Fenoxaprop applied at 0.20 kg/ha in May and repeated at 3

to 4 week intervals for a total of six applications during spring and summer in each of two consecutive years controlled 97% of bermudagrass without injuring tall fescue. When the herbicide rate was increased to 0.56 kg/ha and repeated at 3 to 4 week intervals for a total of six applications, common bermudagrass control was greater than or equal to 97%. Fenoxaprop treatments resulted in moderate to severe injury to tall fescue. However, the turf recovered within 3 to 4 weeks following application without stand loss (Johnson and Carrow, 1993).

Johnson and Carrow (1995) conducted experiments to determine the influence of fenoxaprop and ethofumesate treatments on suppression of common bermudagrass in tall fescue turf. In one experiment, fenoxaprop plus ethofumesate applied at 0.2 + 1.7 kg/ha in late April and repeated at 3 to 4 week intervals for a total of five applications resulted in 97% or greater common bermudagrass suppression. The suppression was higher from the combination of fenoxaprop and ethofumesate compared to when fenoxaprop was applied alone at 0.2 kg/ha in five applications (≤67% suppression). In most instances, fenoxaprop plus ethofumesate applied at 0.2 + 1.7 kg/ha caused only slight to moderate (<30%) injury to tall fescue for one to two weeks after treatment. Turf fully recovered within two to three weeks after treatment.

Cudney *et al*., (1997) also investigated controlling common bermudagrass in cool season turfgrass using triclopyr and fenoxaprop. Common bermudagrass averaged 55% of the turf stand at the time their study was initiated. In both 1994 and 1995, herbicide treatments were applied a total of four times at 4 to 8 week intervals beginning May 18 in 1994, and June 14 in 1995. In the first year of their study, herbicide treatments were applied at 4 to 8 week intervals the combination of triclopyr and fenoxaprop at the rate of

1.12 + 0.42 kg/ha reduced common bermudagrass cover more than triclopyr alone at 0.56 and at 1.12 kg/ha. The combination treatments of triclopyr + fenoxaprop at 0.56 + 0.21 kg/ha, 0.56 + 0.42 kg/ha, 1.12 + 0.21 kg/ha, and 1.12 + 0.42 kg/ha as well as the high rate of triclopyr alone at 1.12 kg/ha reduced bermudagrass cover.

In the second year of the study, all treatments reduced common bermudagrass cover except the low rate of triclopyr alone at 0.56 kg/ha. Triclopyr was not as effective as fenoxaprop when comparing the low and high rates of each when applied alone (54% and 28% compared to 15% and 8% respectively, for common bermudagrass cover) (Cudney *et al*., 1997).

McCalla *et al*. (2010) evaluated mesotrione on two seeded bermudagrass cultivars, 'Princess-77' and 'Riviera', for winter injury and spring green-up. Mesotrione acts as a pigment inhibitor, causing the plant tissue to turn white by inhibiting the production of carotenoids, thus impeding the production of plastoquinone. This results in extreme phytotoxicity, which would be unacceptable in most turfgrass situations. However, the phytotoxicity is short-lived and the turfgrass can recover from injury (McCalla *et* al., 2010). The treatments in their research included 4 sequential applications of 0.14 kg ai/ha, 2 sequential applications of 0.28 kg ai/ha, and 2 sequential applications of 0.56 kg ai/ha. Significant reductions in turfgrass cover were observed on both cultivars in the fall for all herbicide treatments. Spring green up was slightly delayed due to the herbicide treatment of mesotrione at the highest rate, especially in 'Princess-77' (McCalla *et al*., 2010).

Cultural controls for suppressing bermudagrass in tall fescue turf include seeding rates, mowing heights, and proper fertilization and irrigation practices. Most turf

specialists recommend a seeding tall fescue at a rate of 244 – 391 kg/ha (5-8#/1000ft^2); with excessive seeding rates, seedlings may become spindly, weak and susceptible to *Pythium* and other diseases, leading to gaps in the turf canopy which can lead to an invasion of grassy weeds such as bermudagrass (McCarty, 2002 and Willis and McCarty, 2006). New turf-type tall fescue cultivars grow better when mowed at 2.0 to 2.5 inches but may require higher mowing heights during dry periods in the summer or under heavy shade, whereas 'KY 31' should be mowed at the minimum of 3.0 inches (McCarty, 2002 and Willis and McCarty, 2006). Keeping tall fescue in this height range encourages maximum root growth and provides enough canopy to help shade, and thus discourage bermudagrass growth (McCarty, 2002 and Willis and McCarty, 2006).

Tall fescue tolerates low fertility, but at least 98 – 196 kg N/ha (2-4#/1000ft^2) per year is the recommended range by most turf managers. Avoiding fertilization during the late spring and summer months is ideal because this only adds heat, disease, and drought stress to the fescue (McCarty, 2002).

McCarty and Willis (2006) suggest irrigating to prevent drought stress on an as-needed basis, irrigating when 30 to 50% of the turf begins to wilt, or when recovery from traffic is slow (2002, 2006). The goal is to apply enough water to rewet the soil root zone and then wait until the turf shows signs of drought again before the next irrigation; for most soils, no more than 1.65 cm (0.75 in) of water is necessary for each irrigation to rewet the top 8.80-17.60 cm (4-8 in) of the root zone (McCarty, 2002 and Willis and McCarty, 2006). Light, and frequent (i.e. daily,) irrigation can eventually weaken the tall fescue and encourage brown patch disease, bermudagrass, crabgrass, and other weeds (McCarty, 2002 and Willis and McCarty, 2006).

Breeden *et al*. (2010) reported the following cultural control practices to prevent bermudagrass infestations in tall fescue turfgrass. Soil, compost, plant material and seed should be inspected to ensure no vegetative structures such as rhizomes or stolons are present in those materials. Increasing mowing improved turf rooting and thus resulted in a healthier stand that was less susceptible to bermudagrass encroachment. They recommended fertilizing twice annually, once in the spring and once in the fall; and to avoid fertilizing during the summer. Proper irrigation practices also are noted in which they stated to water deep and infrequently, irrigating to a depth of about 6 inches, approximately twice a week (Breeden et. al., 2010).

A study by Brede (1992) in the 1980's looked at cultural factors for minimizing bermudagrass invasion into tall fescue turf. The purpose of the study was to examine multiple cultural factors to prevent bermudagrass invasion into tall fescue turf. Tall fescue cultivars 'KY 31' and 'Mustang' were seeded at the rates of 2,100, 12,900, and 34,400 pls/m^2. Included in the study were mowing heights of 19 mm and 57 mm and fertilization rates of 49 and 244 kg N/ha/yr. No bermudagrass was observed in fescue plots that were seeded at the two higher seeding rates and mowed at the higher cutting height. The greatest bermudagrass coverage occurred in plots of 'Mustang' seeded at the lowest seeding rate, mowed at the lower cutting height, and fertilized at the heavier rate with seed as the source of bermudagrass introduction. Brede concluded that tall fescue at closer mowing heights with high fertility rates may eventually give way to invading bermudagrass (1992).

Powell Jr. (2005) reports that making two to three nitrogen applications (at approximately 49 kg N/ha) to cool season grasses during the fall and early winter is

advantageous since it increases the density of the cool season turf and increases the surface shading necessary to slow down spring growth and bermudagrass encroachment. Overseeding bermudagrass in the fall and/or early spring with a turf-type tall fescue may control little bermuda, but will tend to mask the ugly brown color of dormant bermudagrass. Another option is removing the bermudagrass with a sod cutter by cutting and/or removing the bermudagrass sod at a minimum depth of 2.2 cm (1 in), and additionally hand raking or removing obvious rhizomes, then re-sodding with a dense tall fescue sod. Bermuda will recover, but it may take a few years (Powell Jr., 2005).

Herbicide treatments of fluazifop, fenoxaprop, and mesotrione have demonstrated some level of bermudagrass suppression in tall fescue (McCalla *et al*., 2010, Johnson and Carrow, 1993, Cudney *et al*., 1997, Johnson, 2000, and McElroy and Breeden, 2011). Also, management practices may play an important role in the ability of tall fescue to resist bermudagrass invasion (Brede, 1992, McCarty and Willis, 2006, and Breeden *et al*. 2010). Combinations of best management practices along with a chemical control strategy may be the solution for bermudagrass control. Further investigation into these combinations is needed.

For this reason, a research study was initiated in 2011 at the Western Kentucky University farm to investigate the effects of herbicide application and mowing heights on bermudagrass control in 'KY 31' and 'Bullseye' tall fescue.

Materials and Methods

This study was initiated on September 7, 2011 and repeated on September 13, 2012 at the Western Kentucky University farm located in Bowling Green, KY (Lat: 36.93°; Lon: -86.47° Elev: 170m). The soil type was a Crider silt loam (Typic Paleudalf).

On September 1, 2011, the plots were established in an existing stand of bermudagrass containing a mixture of common and hybrid bermudagrass. The experimental design was a split plot design with whole plots consisting of varying mowing heights and split plots consisting of different herbicide treatments with three replications (Table 1 and Table 2). Two separate experiments were conducted. The tall fescue variety 'KY 31' was utilized for one experiment and the turf type cultivar 'Bullseye' was selected for the other.

Treatments were assigned to each plot at random. On September 7, 2011 treatments containing glyphosate (Roundup Pro) were applied to selected plots at the rate of 0.36 kg ae/ha or 11.69 L/ha (5 qts/ac) using a CO_2-pressurized sprayer calibrated to apply 379 L/ha (40 gal/ac) at 2.78 bar (40 psi) using 8003E flat fan nozzles. On September 8, 2011, 'KY 31' tall fescue and 'Bullseye' tall fescue each were sown in two directions into the bermudagrass stand using a 50.80 cm (20 in) 8 horsepower Lesco commercial plus power seeder at the rate of 342 kg pls/ha (7 # pls/1000ft^2). Irrigation was available at the site and the plots were irrigated on an "as needed" basis. Germination of both 'KY 31' and 'Bullseye' tall fescue was visible on September 15, 2011. The mowing heights were maintained at 7.62 cm (3 in), 10.16 cm (4 in), and 12.70 cm (5 in) using a John Deere ZTrakProZ950A rotary mower. On October 3, 2011 the plots were fertilized in two directions with nitrogen at the rate of 24.4 kg N/ha (0.5 #N/1000ft^2). On March 26, 2012 the same rate of nitrogen was repeated.

On April 7, 2012, treatments containing fenoxaprop (Acclaim Extra), mesotrione (Tenacity), and fluazifop (Fusilade II) were applied at the rates of 0.07 kg ai/ha or 1.46 L/ha (20 fl oz/ac), 0.48 kg ai/ha or 0.584 L/ha (8 fl oz/ac), and 0.24 kg ai/ha or 0.44 L/ha (6 fl oz/ac) respectively (Table 1). A non-ionic surfactant at 0.25% (v/v) was utilized in

treatments containing mesotrione and fluazifop. These same treatments were applied again to the plots on April 30, 2012. Throughout the study, data were collected visually on turf quality, tall fescue cover, broadleaf weed cover, and bermudagrass cover. Turf quality was visually rated on a scale of 1 to 9 with 1 being brown, dormant turf, 6 being acceptable turf quality, and 9 being excellent turf quality. Tall fescue cover, broadleaf weed cover, and bermudagrass cover was rated on a scale of 0 to 100 percent coverage. Data were analyzed using the GLM procedure of SAS version 9.2 and version 9.3 and means were separated using LSD.

This study was repeated using the same location, tall fescue cultivars, mowing heights, herbicide treatments, and fertility practices beginning with glyphosate treatments applied on September 13, 2012. On September 14, 2012 the second trial was seeded with the two tall fescue cultivars. However, the seeder malfunctioned and thus revealed the seed was not being sown at the correct rate of 342 kg pls/ha (7 #pls/1000ft^2). On September 20, 2012 the remaining amount of seed in both the 'KY 31' and 'Bullseye' studies were sown into the plot area using a hand-held spreader. The second trial was fertilized with nitrogen on November 8, 2013 in two directions at the same rate as the first trial. The same fertilizer treatment was applied again to the second trial on April 1, 2013. On May 8, 2013, treatments containing fenoxaprop, mesotrione, and fluazifop were applied to selected plots in the second trial, at the same rates as the previous year. A repeat application of these herbicides to the second trial was made on May, 31, 2013 (Table 2).

Table 1. List of herbicide treatments for 2011-2013 for Trial 1

Treatment	Product	Active Ingredient / Acid Equivalent Rate	Product Rate	Applications
1	Untreated Control			
2	Roundup Pro*	Glyphosate 0.36 kg ae/ha	11.69 L/ha	09/07/2011
3	Acclaim Extra	Fenoxaprop 0.07 kg ai/ha	1.46 L/ha	04/07/2012, 04/30/2012
4	Tenacity**	Mesotrione 0.47 kg ai/ha	0.58 L/ha	04/07/2012, 04/30/2012
5	Fusilade II**	Fluazifop 0.24 kg ai/ha	0.44 L/ha	04/07/2012, 04/30/2012
6	Roundup Pro* + Acclaim Extra	Glyphosate + Fenoxaprop 0.36 kg ae/ha + 0.07 kg ai/ha	11.69 L/ha + 1.46 L/ha	09/07/2011 + 04/07/2012, 4/30/2012
7	Roundup Pro* + Tenacity**	Glyphosate + Mesotrione 0.36 kg ae/ha + 0.48 kg ai/ha	11.69 L/ha + 0.58 L/ha	09/07/2011 + 04/07/2012, 04/30/2012
8	Roundup Pro* + Fusilade II**	Glyphosate + Fluazifop 0.36 kg ae/ha + 0.24 kg ai/ha	11.69 L/ha + 0.44 L/ha	09/07/2011 + 04/07/2012, 04/30/2012

* For Trial 1 all glyphosate treatments were applied on September 07, 2011 only.
** A 0.25% v/v non-ionic surfactant was applied with these treatments.

Table 2. List of herbicide treatments for 2012-2013 for Trial 2

Treatment	Product	Active Ingredient / Acid Equivalent Rate	Product Rate	Applications
1	Untreated Control			
2	Roundup Pro*	Glyphosate 0.36 kg ae/ha	11.69 L/ha	09/13/2012
3	Acclaim Extra	Fenoxaprop 0.07 kg ai/ha	1.46 L/ha	05/08/2013, 05/31/2013
4	Tenacity**	Mesotrione 0.47 kg ai/ha	0.58 L/ha	05/08/2013, 05/31/2013
5	Fusilade II**	Fluazifop 0.24 kg ai/ha	0.44 L/ha	05/08/2013, 05/31/2013
6	Roundup Pro* + Acclaim Extra	Glyphosate + Fenoxaprop 0.36 kg ae/ha + 0.07 kg ai/ha	11.69 L/ha + 1.46 L/ha	09/13/2012 + 05/08/2013, 5/31/2013
7	Roundup Pro* + Tenacity**	Glyphosate + Mesotrione 0.36 kg ae/ha + 0.48 kg ai/ha	11.69 L/ha + 0.58 L/ha	09/13/2012 + 05/08/2013, 5/31/2013
8	Roundup Pro* + Fusilade II**	Glyphosate + Fluazifop 0.36 kg ae/ha + 0.24 kg ai/ha	11.69 L/ha + 0.44 L/ha	09/13/2012 + 05/08/2013, 5/31/2013

* For Trial 2 all glyphosate treatments were applied on September 13, 2012 only.
**A 0.25% v/v non-ionic surfactant was applied with these treatments.

Results

Turf quality data among herbicide treatments for 'KY 31' tall fescue for Trial 1 are presented in Table 3. From April 18, 2012 to June 11, 2012, fluazifop and glyphosate + fluazifop exhibited a significantly lower turf quality rating than all other treatments, however, by June 20, 2012, no significant differences were observed between fluazifop and treatments containing fenoxaprop. In November of 2012 glyphosate + fenoxaprop showed a significantly higher turf quality rating than the control, fenoxaprop, mesotrione, fluazifop, and glyphosate + fluazifop treatments.

Turf quality data among herbicide treatments for 'Bullseye' tall fescue for Trial 1 are presented in Table 4. From May 10, 2012 to June 20, 2012 fluazifop and glyphosate + fluazifop exhibited a significantly lower turf quality rating than all other treatments; however, by July 7, 2012, no significant differences were observed among treatments.

Turf quality data among herbicide treatments for 'KY31' tall fescue for Trial 2 are presented in Table 5. From May 24, 2013 to June 20, 2013, treatments consisting of fluazifop and glyphosate + fluazifop exhibited significantly lower turf quality rating than all other treatments. Turf quality data among herbicide treatments for 'Bullseye' tall fescue for Trial 2 are presented in Table 6. On June 8, 2013 and June 20, 2013, significant differences were observed with treatments consisting of fluazifop and glyphosate + fluazifop exhibiting lower turf quality rating than all other treatments.

Turf quality data among mowing heights for 'KY 31' for Trial 1 are presented in Table 7. Periodically throughout the trial, turf mowed at 12.70 cm yielded a significantly higher turf quality rating than turf mowed at 7.62cm. The turf quality data among mowing heights for 'Bullseye' for Trial 1 are present in Table 8. There were no

consistent significant differences observed with the exception of November 2, 2012 to June 7, 2013 data showing turf mowed at 7.62 cm exhibiting a significantly lower turf quality rating than turf mowed at 10.16 cm and 12.70 cm.

Turf quality data among mowing heights for 'KY 31' for Trial 2 are presented in Table 9. Throughout all observation dates of the trial, turf mowed at 12.70 cm was significantly higher in turf quality than turf mowed at 7.60 cm. Turf quality data among mowing heights for 'Bullseye' for Trial 2 are presented in Table 10. On May 15, May 24, and June 20, 2013 turf mowed at 12.70 cm was significantly higher in turf quality than turf mowed at 7.62 cm.

Table 3. Turf Quality for 'KY 31' among Herbicide Treatments (Trial 1)

Treatment	Turf Quality*					
	09/20/2011	10/04/2011	10/18/2011	11/01/2011	11/17/2011	03/19/2012
1	3.33 ab	4.78 a	6.33 a	4.22 c	4.89 ab	5.67 a
2	1.78 c	2.89 c	5.78 bc	5.11 a	5.22 ab	5.44 ab
3	3.22 ab	4.67 ab	6.33 a	4.44 bc	4.78 b	5.33 ab
4	3.11 b	4.22 b	6.00 abc	4.56 bc	4.78 b	5.33 ab
5	3.56 a	4.78 a	6.00 abc	4.56 bc	4.78 b	5.33 ab
6	2.00 c	3.33 c	6.00 abc	5.11 a	5.33 a	5.56 ab
7	1.78 c	3.33 c	6.11 ab	5.11 a	5.11 ab	5.22 b
8	1.78 c	3.00 c	5.68 c	4.78 a	5.22 ab	5.44 ab
Pr > F	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
R-Square	0.85	0.79	0.68	0.79	0.71	0.78
LSD (0.05)	0.42	0.55	0.41	0.46	0.50	0.37

* Means followed by the same letter are not significantly different (P = 0.05).

Table 3. (continued)

Treatment	Turf Quality*					
	04/02/2012	04/11/2012	04/18/2012	04/25/2012	05/10/2012	05/18/2012
1	6.56 a	6.56 a	5.67 ab	5.78 a	6.22 a	5.67 a
2	6.00 b	6.44 ab	6.00 a	5.89 a	5.67 b	5.44 ab
3	5.89 b	6.11 abc	4.89 c	5.00 b	5.22 b	4.89 c
4	6.33 ab	5.89 bc	3.44 e	3.67 c	5.67 b	5.00 c
5	6.00 b	6.22 abc	4.11 d	2.78 d	2.56 c	2.78 d
6	6.33 ab	6.56 a	5.22 bc	5.22 b	5.33 b	5.44 ab
7	6.11 ab	5.78 c	3.22 e	3.56 c	5.33 b	5.22 bc
8	6.11 ab	6.22 abc	4.11 d	2.78 d	2.11 c	2.78 d
Pr > F	0.2692	0.0007	<0.0001	<0.0001	<0.0001	<0.0001
R-Square	0.46	0.67	0.87	0.92	0.94	0.93
LSD (0.05)	0.53	0.60	0.50	0.47	0.47	0.40

* Means followed by the same letter are not significantly different (P = 0.05).

Table 3. (continued)

Treatment	Turf Quality*					
	05/24/2012	06/11/2012	06/20/2012	07/11/2012	08/31/2012	09/21/2012
1	6.33 a	4.78 a	5.11 ab	4.22 abcd	5.33 ab	4.67 a
2	6.22 ab	4.89 a	5.33 ab	4.00 cd	4.67 bc	4.56 ab
3	5.78 b	4.67 a	5.00 bc	4.33 abc	4.89 abc	4.67 a
4	6.11 ab	5.11 a	5.56 a	4.67 a	5.33 ab	4.78 a
5	4.89 c	4.00 b	4.56 cd	4.11 bcd	4.89 abc	4.11 b
6	6.00 ab	5.00 a	5.00 bc	3.89 cd	4.56 c	4.56 ab
7	6.11 ab	4.89 a	5.33 ab	4.56 ab	5.56 a	4.78 a
8	4.56 c	3.78 b	4.44 d	3.78 d	4.78 bc	4.33 ab
Pr > F	<0.0001	<0.0001	0.0002	<0.0001	0.1149	<0.0006
R-Square	0.76	0.72	0.70	0.73	0.58	0.68
LSD (0.05)	0.46	0.49	0.50	0.52	0.67	0.46

* Means followed by the same letter are not significantly different (P = 0.05).

Table 3. (continued)

Treatment	Turf Quality*			
	11/02/2012	03/30/2013	05/03/2013	06/07/2013
1	2.22 b	3.78 bc	4.22 abc	4.22 a
2	2.44 ab	3.89 bc	4.44 ab	4.00 a
3	2.22 b	3.78 bc	4.22 abc	4.00 a
4	2.22 b	3.67 bc	4.44 ab	4.67 a
5	2.11 b	3.44 c	3.89 c	4.00 a
6	2.89 a	4.44 a	4.44 ab	4.44 a
7	2.56 ab	4.11 ab	4.56 a	4.44 a
8	2.22 b	3.67 bc	4.00 bc	4.0 a
Pr > F	0.4471	<0.0001	<0.0001	0.0026
R-Square	0.42	0.75	0.73	0.64
LSD (0.05)	0.51	0.54	0.48	0.67

* Means followed by the same letter are not significantly different (P = 0.05).

Table 4. Turf Quality for 'Bullseye' among Herbicide Treatments (Trial 1)

Treatment	Turf Quality*					
	09/20/2011	10/04/2011	10/18/2011	11/01/2011	11/17/2011	03/19/2012
1	3.56 a	4.89 a	6.33 a	4.33 c	3.67 b	4.56 a
2	1.44 b	3.22 b	5.89 abc	4.89 ab	4.67 a	4.00 a
3	3.67 a	4.78 a	6.33 a	4.67 abc	3.78 b	4.33 a
4	3.33 a	4.78 a	6.00 abc	4.56 bc	3.67 b	4.22 a
5	3.22 a	4.67 a	6.11 ab	4.33 c	3.67 b	4.44 a
6	1.67 b	3.00 b	5.67 bc	5.11 a	4.67 a	4.78 a
7	1.56 b	3.00 b	5.89 abc	5.11 a	4.44 a	4.33 a
8	1.44 b	3.00 b	5.56 c	4.78 abc	4.33 a	4.11 a
Pr > F	<0.0001	<0.0001	0.0771	0.0004	0.0014	0.7330
R-Square	0.86	0.74	0.53	0.68	0.65	0.36
LSD (0.05)	0.51	0.71	0.55	0.53	0.53	0.80

* Means followed by the same letter are not significantly different (P = 0.05).

Table 4. (continued)

Treatment	Turf Quality*					
	04/02/2012	04/11/2012	04/18/2012	04/25/2012	05/10/2012	05/18/2012
1	4.44 a	6.33 a	6.00 a	6.11 ab	5.67 b	4.89 c
2	4.33 a	6.44 a	6.11 a	6.44 a	6.33 a	5.78 ab
3	4.78 a	6.11 a	6.00 a	5.56 bc	5.67 b	5.22 c
4	4.56 a	6.44 a	5.33 b	4.78 c	5.89 ab	5.89 a
5	4.22 a	6.33 a	5.56 ab	4.89 c	2.56 c	2.89 d
6	4.67 a	6.33 a	5.78 ab	5.78 ab	6.11 ab	5.89 a
7	4.33 a	6.67 a	5.67 ab	5.33 bc	5.67 b	5.33 bc
8	4.78 a	6.89 a	5.56 ab	5.33 bc	2.78 c	3.00 d
Pr > F	0.3604	0.7550	0.4591	0.0536	<0.0001	<0.0001
R-Square	0.44	0.83	0.42	0.54	0.90	0.89
LSD (0.05)	0.81	0.60	0.61	0.81	0.62	0.54

* Means followed by the same letter are not significantly different (P = 0.05).

Table 4. (continued)

Treatment	Turf Quality*					
	05/24/2012	06/11/2012	06/20/2012	07/11/2012	08/31/2012	09/21/2012
1	6.44 ab	5.22 ab	5.56 a	3.78 a	3.89 abc	4.67 b
2	6.78 a	5.67 a	5.78 a	3.78 a	3.44 c	5.22 a
3	6.11 b	5.33 a	5.44 a	4.11 a	3.56 bc	4.56 b
4	6.22 b	5.33 a	5.44 a	4.22 a	4.22 a	4.78 ab
5	4.44 c	4.56 bc	4.67 b	3.89 a	4.00 ab	4.89 ab
6	6.56 ab	5.44 a	5.78 a	4.00 a	3.56 bc	5.00 ab
7	6.33 ab	5.33 a	5.33 a	3.78 a	3.67 bc	5.22 a
8	3.89 c	4.22 c	4.44 b	3.56 a	4.00 ab	4.67 b
Pr > F	<0.0001	0.1022	0.0026	0.6095	0.0033	0.0189
R-Square	0.84	0.51	0.64	0.38	0.63	0.58
LSD (0.05)	0.59	0.74	0.62	0.74	0.53	0.50

* Means followed by the same letter are not significantly different (P = 0.05).

Table 4. (continued)

Treatment	Turf Quality*			
	11/02/2012	03/30/2013	05/03/2013	06/07/2013
1	3.44 b	4.00 bc	4.56 bc	4.33 ab
2	4.22 a	4.33 ab	5.11 a	4.67 a
3	3.78 ab	4.33 ab	4.78 abc	4.33 ab
4	3.44 b	4.00 bc	4.56 bc	4.44 ab
5	3.33 b	3.89 bc	4.44 c	4.00 b
6	4.11 a	4.67 a	5.00 a	4.44 ab
7	3.89 ab	4.56 a	5.11 a	4.67 a
8	3.33 b	3.78 c	4.44 c	4.44 ab
Pr > F	<0.0001	0.0082	<0.0079	0.3887
R-Square	0.77	0.61	0.61	0.43
LSD (0.05)	0.58	0.55	0.48	0.58

* Means followed by the same letter are not significantly different (P = 0.05).

Table 5. Turf Quality for 'KY 31' among Herbicide Treatments (Trial 2)

Treatment	Turf Quality*				
	03/30/2013	5/15/2013	05/24/2013	06/08/2013	06/20/2013
1	3.44 a	5.56 a	5.67 ab	5.78 a	6.33 a
2	3.44 a	5.56 a	5.78 ab	5.78 a	6.11 ab
3	3.33 a	5.22 ab	5.33 b	5.22 b	5.67 bc
4	3.78 a	5.56 a	5.89 a	5.78 a	5.78 abc
5	3.78 a	5.00 ab	4.44 c	3.78 c	3.56 d
6	3.44 a	5.44 a	5.33 b	5.22 b	5.44 c
7	3.33 a	5.56 a	5.56 ab	5.44 ab	6.11 ab
8	3.56 a	4.67 b	4.44 c	3.56 c	3.89 d
Pr > F	0.0002	0.0002	<0.0001	<0.0001	<0.0001
R-Square	0.70	0.70	0.80	0.88	0.88
LSD (0.05)	0.62	0.61	0.55	0.50	0.56

* Means followed by the same letter are not significantly different (P = 0.05).

Table 6. Turf Quality for 'Bullseye' among Herbicide Treatments (Trial 2)

Treatment	Turf Quality*				
	03/30/2013	5/15/2013	05/24/2013	06/08/2013	06/20/2013
1	2.78 a	5.56 a	6.11 a	5.78 a	5.89 a
2	2.56 a	5.33 a	5.56 ab	5.44 ab	5.67 ab
3	2.67 a	5.78 a	5.56 ab	5.44 ab	5.33 bc
4	2.89 a	5.78 a	5.56 ab	4.89 b	4.89 c
5	3.11 a	5.44 a	4.56 c	3.89 c	3.89 d
6	2.78 a	5.67 a	5.67 ab	5.33 ab	5.67 ab
7	3.00 a	5.78 a	6.00 a	5.22 ab	5.11 c
8	3.11 a	5.89 a	4.89 bc	3.78 c	4.11 d
Pr > F	0.3084	0.2501	0.0055	<0.0001	<0.0001
R-Square	0.45	0.46	0.62	0.74	0.81
LSD (0.05)	0.64	0.89	0.98	0.61	0.54

* Means followed by the same letter are not significantly different (P = 0.05).

Table 7. Turf Quality for 'KY 31' among Mowing Heights (Trial 1)

Mowing Height	Turf Quality*					
	09/20/2011	10/04/2011	10/18/2011	11/01/2011	11/17/2011	03/19/2012
7.62 cm	2.62 a	3.67 b	5.92 b	4.29 b	4.88 b	5.13 b
10.16 cm	2.67 a	3.63 b	5.75 b	4.41 b	4.54 c	5.04 b
12.70 cm	2.42 a	4.33 a	6.42 a	5.50 a	5.63 a	6.08 a
Pr > F	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
R-Square	0.85	0.79	0.68	0.79	0.71	0.78
LSD (0.05)	0.26	0.34	0.25	0.28	0.30	0.23

* Means followed by the same letter are not significantly different (P = 0.05).

Table 7. (continued)

Mowing Height	Turf Quality*					
	04/02/2012	04/11/2012	04/18/2012	04/25/2012	05/10/2012	05/18/2012
7.62 cm	6.08 a	5.79 b	4.46 b	4.17 b	4.46 b	4.63 b
10.16 cm	6.13 a	5.92 b	4.42 b	4.33 ab	4.88 a	4.46 b
12.70 cm	6.29 a	6.96 a	4.88 a	4.50 a	4.96 a	4.88 a
Pr > F	0.2692	0.0007	<0.0001	<0.0001	<0.0001	<0.0001
R-Square	0.46	0.67	0.87	0.92	0.94	0.93
LSD (0.05)	0.32	0.37	0.30	0.29	0.29	0.25

* Means followed by the same letter are not significantly different (P = 0.05).

Table 7. (continued)

Mowing Height	Turf Quality*					
	05/24/2012	06/11/2012	06/20/2012	07/11/2012	08/31/2012	09/21/2012
7.62 cm	5.67 a	4.25 b	4.54 c	3.46 b	4.75 b	4.08 b
10.16 cm	5.75 a	4.75 a	5.13 b	4.42 a	4.88 b	4.79 a
12.70 cm	5.83 a	4.92 a	5.45 a	4.71 a	5.38 a	4.79 a
Pr > F	<0.0001	<0.0001	0.0002	<0.0001	0.1149	<0.0006
R-Square	0.76	0.72	0.70	0.73	0.58	0.68
LSD (0.05)	0.28	0.30	0.31	0.33	0.41	0.28

* Means followed by the same letter are not significantly different (P = 0.05).

Table 7. (continued)

Mowing Height	Turf Quality*			
	11/02/2012	03/30/2013	05/03/2013	06/07/2013
7.62 cm	2.21 a	3.08 c	3.58 c	3.50 b
10.16 cm	2.38 a	4.00 b	4.42 b	4.63 a
12.70 cm	2.50 a	4.46 a	4.83 a	4.54 a
Pr > F	0.4471	<0.0001	<0.0001	0.0026
R-Square	0.42	0.75	0.73	0.64
LSD (0.05)	0.31	0.33	0.29	0.67

* Means followed by the same letter are not significantly different (P = 0.05).

Table 8. Turf Quality for 'Bullseye' among Mowing Heights (Trial 1)

Mowing Height	Turf Quality*					
	09/20/2011	10/04/2011	10/18/2011	11/01/2011	11/17/2011	03/19/2012
7.62 cm	2.54 ab	3.92 a	5.92 ab	4.13 b	3.79 b	4.42 a
10.16 cm	2.63 a	4.04 a	6.21 a	5.13 a	4.50 a	4.17 a
12.70 cm	2.29 b	3.79 a	5.79 b	4.92 a	4.04 b	4.45 a
Pr > F	<0.0001	<0.0001	0.0771	0.0004	0.0014	0.7330
R-Square	0.86	0.74	0.53	0.68	0.65	0.36
LSD (0.05)	0.31	0.43	0.34	0.32	0.32	0.49

* Means followed by the same letter are not significantly different (P = 0.05).

Table 8. (continued)

Mowing Height	Turf Quality*					
	04/02/2012	04/11/2012	04/18/2012	04/25/2012	05/10/2012	05/18/2012
7.62 cm	4.92 a	6.42 a	5.79 a	5.33 a	5.38 a	5.04 a
10.16 cm	4.50 ab	6.71 a	5.88 a	5.79 a	5.21 a	4.79 a
12.70 cm	4.12 b	6.21 a	5.58 a	5.46 a	4.67 b	4.75 a
Pr > F	0.3604	0.7550	0.4591	0.0536	<0.0001	<0.0001
R-Square	0.44	0.83	0.42	0.54	0.90	0.89
LSD (0.05)	0.50	0.51	0.37	0.49	0.38	0.33

* Means followed by the same letter are not significantly different (P = 0.05).

Table 8. (continued)

Mowing Height	Turf Quality*					
	05/24/2012	06/11/2012	06/20/2012	07/11/2012	08/31/2012	09/21/2012
7.62 cm	6.21 a	5.13 a	5.38 a	4.17 a	4.17 a	4.63 b
10.16 cm	5.58 b	5.17 a	5.25 a	3.71 b	3.50 b	4.96 a
12.70 cm	5.75 b	5.13 a	5.29 a	3.79 ab	3.71 b	5.04 a
Pr > F	<0.0001	0.1022	0.0026	0.6095	0.0033	0.0189
R-Square	0.84	0.51	0.64	0.38	0.63	0.58
LSD (0.05)	0.36	0.45	0.38	0.45	0.33	0.31

* Means followed by the same letter are not significantly different (P = 0.05).

Table 8. (continued)

Mowing Height	Turf Quality*			
	11/02/2012	03/30/2013	05/03/2013	06/07/2013
7.62 cm	2.79 b	3.79 b	4.38 b	4.04 b
10.16 cm	4.04 a	4.46 a	4.96 a	4.50 a
12.70 cm	4.25 a	4.33 a	4.92 a	4.71 a
Pr > F	<0.0001	0.0082	<0.0079	0.3887
R-Square	0.77	0.61	0.61	0.43
LSD (0.05)	0.35	0.33	0.29	0.36

* Means followed by the same letter are not significantly different (P = 0.05).

Table 9. Turf Quality for 'KY 31' among Mowing Heights (Trial 2)

Mowing Height	Turf Quality*				
	03/30/2013	5/15/2013	05/24/2013	06/08/2013	06/20/2013
7.62 cm	2.83 c	4.75 c	4.42 b	4.38 c	4.72 c
10.16 cm	3.42 b	5.25 b	5.63 a	5.04 b	5.46 b
12.70 cm	4.29 a	5.96 a	5.88 a	5.79 a	5.92 a
Pr > F	0.0002	0.0002	<0.0001	<0.0001	<0.0001
R-Square	0.70	0.70	0.80	0.88	0.88
LSD (0.05)	0.38	0.38	0.34	0.30	0.34

* Means followed by the same letter are not significantly different (P = 0.05).

Table 10. Turf Quality for 'Bullseye' among Mowing Heights (Trial 2)

Mowing Height	Turf Quality*				
	03/30/2013	5/15/2013	05/24/2013	06/08/2013	06/20/2013
7.62 cm	3.00 a	5.25 b	4.79 b	4.96 a	4.92 b
10.16 cm	2.79 a	5.75 ab	5.29 b	5.13 a	4.75 b
12.70 cm	2.79 a	5.96 a	6.38 a	4.83 a	5.54 a
Pr > F	0.3084	0.2501	0.0055	<0.0001	<0.0001
R-Square	0.45	0.46	0.62	0.74	0.81
LSD (0.05)	0.39	0.54	0.60	0.37	0.33

* Means followed by the same letter are not significantly different (P = 0.05).

Data for percent tall fescue cover among herbicide treatments for ‘KY 31’ are presented in Table 11 and for ‘Bullseye’ in Table 12. On April 25, 2012 in the ‘KY 31’ study and on May 10, 2012 in both studies, fluazifop and glyphosate + fluazifop exhibited a significantly lower percentage of tall fescue cover than all other treatments. Data shows on April 25, 2012, fluazifop had reduced tall fescue cover by 21 percent and glyphosate + fluazifop had reduced tall fescue cover by 18 percent in the ‘KY 31” study. Data for May 10, 2012, show fluazifop had reduced tall fescue cover by 44 percent in the ‘KY 31’ study and by 34 percent in the ‘Bullseye” study. Data for the same date show glyphosate + fluazifop had significiantly reduced tall fescue cover by 49 percent in the ‘KY31’ study and by 34 percent in the ‘Bullseye’ study. Data for percent tall fescue cover among mowing heights for ‘KY 31’ in Table 13 show turf mowed at 12.70 cm was significantly higher in percent tall fescue cover than turf mowed at 7.62 cm throughout the trial. In the ‘Bullseye’ study (Table 14), significant differences were not consistently observed among mowing heights for percent tall fescue cover.

Table 11. Percent Tall Fescue Cover for 'KY 31' among Herbicide Treatments (Trial 1)

Treatment	Percent Tall Fescue Cover*					
	10/18/2011	11/01/2011	11/17/2011	03/19/2012	04/02/2012	04/11/2012
1	79.78 a	65.00 a	77.22 a	76.11 a	72.78 a	76.67 a
2	73.33 bc	67.78 a	77.22 a	72.22 ab	70.00 a	75.56 a
3	78.33 ab	66.11 a	76.11 a	72.22 ab	69.44 a	72.78 a
4	72.67 c	64.44 a	75.56 a	68.33 b	71.67 a	73.89 a
5	76.44 abc	65.56 a	76.67 a	72.22 ab	68.89 a	72.78 a
6	74.11 bc	69.44 a	77.22 a	73.33 ab	71.67 a	75.56 a
7	76.56 abc	68.89 a	78.89 a	71.11 ab	68.89 a	72.78 a
8	73.56 bc	65.00 a	78.89 a	73.33 ab	70.56 a	73.89 a
Pr > F	<0.0001	<0.0001	<0.0001	<0.0001	0.0038	0.0067
R-Square	0.77	0.90	0.93	0.82	0.63	0.61
LSD (0.05)	5.49	5.67	3.47	5.10	6.00	4.81

* Means followed by the same letter are not significantly different (P = 0.05).

Table 11. (continued)

Treatment	Percent Tall Fescue Cover*		
	4/18/2012	4/25/2012	05/10/2012
1	72.22 a	74.44 a	70.56 a
2	71.11 a	75.00 a	71.11 a
3	71.67 a	72.22 ab	69.44 a
4	66.11 bc	70.56 ab	62.22 b
5	63.89 c	58.89 c	39.44 c
6	70.56 ab	70.56 ab	68.89 ab
7	66.11 bc	67.78 b	70.00 a
8	66.11 bc	61.11 c	36.11 c
Pr > F	<0.0001	<0.0001	<0.0001
R-Square	0.77	0.77	0.89
LSD (0.05)	4.96	5.43	7.12

* Means followed by the same letter are not significantly different (P = 0.05).

Table 12. Percent Tall Fescue Cover for 'Bullseye' among Herbicide Treatments (Trial 1)

Treatment	Percent Tall Fescue Cover*					
	10/18/2011	11/01/2011	11/17/2011	03/19/2012	04/02/2012	04/11/2012
1	91.22 a	65.00 b	44.44 b	57.00 a	61.67 a	75.00 a
2	86.67 abc	72.78 a	62.78 a	56.67 a	64.78 a	76.11 a
3	91.11 a	68.89 ab	49.44 b	58.56 a	67.22 a	75.56 a
4	90.89 a	68.33 ab	45.56 b	55.89 a	57.78 a	76.11 a
5	90.11 ab	68.89 ab	46.11 b	54.44 a	56.11 a	73.33 a
6	86.78 abc	72.78 a	60.56 a	54.77 a	66.11 a	76.67 a
7	85.44 bc	71.67 ab	58.89 a	50.00 a	61.11 a	76.67 a
8	84.78 c	72.22 a	59.44 a	56.67 a	68.33 a	79.44 a
Pr > F	0.0827	0.0110	0.0002	0.6409	0.0522	0.6182
R-Square	0.52	0.60	0.70	0.38	0.54	0.38
LSD (0.05)	5.29	6.69	9.19	17.67	12.25	6.12

* Means followed by the same letter are not significantly different (P = 0.05).

Table 12. (continued)

Treatment	Percent Tall Fescue Cover*		
	4/18/2012	4/25/2012	05/10/2012
1	73.33 ab	72.22 abc	73.33 a
2	75.56 a	77.22 a	76.11 a
3	75.00 ab	73.89 abc	75.00 a
4	71.67 ab	71.67 bc	80.56 a
5	71.11 b	68.89 c	48.33 b
6	74.44 ab	75.56 ab	77.22 a
7	72.78 ab	71.67 bc	77.22 a
8	73.33 ab	70.00 c	48.33 b
Pr > F	0.6941	0.0067	<0.0001
R-Square	0.37	0.61	079
LSD (0.05)	4.36	5.36	8.71

* Means followed by the same letter are not significantly different (P = 0.05).

Table 13. Percent Tall Fescue Cover for 'KY 31' among Mowing Heights (Trial 1)

Mowing Height	Percent Tall Fescue Cover*					
	10/18/2011	11/01/2011	11/17/2011	03/19/2012	04/02/2012	04/11/2012
7.62 cm	70.71 b	53.54 c	69.17 b	66.67 b	65.83 c	71.04 b
10.16 cm	71.79 b	63.33 b	71.25 b	67.71 b	69.79 b	73.13 b
12.70 cm	84.29 a	82.71 a	91.25 a	82.71 a	75.83 a	71.04 a
Pr > F	<0.0001	<0.0001	<0.0001	<0.0001	0.0038	0.0067
R-Square	0.77	0.90	0.93	0.82	0.63	0.61
LSD (0.05)	3.36	3.47	2.12	3.12	3.67	2.94

* Means followed by the same letter are not significantly different (P = 0.05).

Table 13. (continued)

Mowing Height	Percent Tall Fescue Cover*		
	4/18/2012	4/25/2012	05/10/2012
7.62 cm	61.04 c	65.21 b	51.46 c
10.16 cm	70.21 b	69.38 a	61.88 b
12.70 cm	74.17 a	71.88 a	69.58 a
Pr > F	<0.0001	<0.0001	<0.0001
R-Square	0.77	0.77	0.89
LSD (0.05)	3.04	3.32	4.36

* Means followed by the same letter are not significantly different (P = 0.05).

Table 14. Percent Tall Fescue Cover for 'Bullseye' among Mowing Heights (Trial 1)

Mowing Height	Percent Tall Fescue Cover*					
	10/18/2011	11/01/2011	11/17/2011	03/19/2012	04/02/2012	04/11/2012
7.62 cm	85.54 b	63.54 b	44.17 b	64.08 a	69.37 a	76.04 a
10.16 cm	89.46 a	72.08 a	58.33 a	54.58 ab	65.25 a	77.50 a
12.70 cm	90.13 a	74.58 a	57.71 a	47.83 b	54.04 b	74.79 a
Pr > F	0.0827	0.0110	0.0002	0.6409	0.0522	0.6182
R-Square	0.52	0.60	0.70	0.38	0.54	0.38
LSD (0.05)	3.24	4.09	5.63	10.82	7.50	3.74

* Means followed by the same letter are not significantly different (P = 0.05).

Table 14. (continued)

Mowing Height	Percent Tall Fescue Cover*		
	4/18/2012	4/25/2012	05/10/2012
7.62 cm	75.21 a	75.83 a	68.75 a
10.16 cm	73.54 ab	73.96 a	71.25 a
12.70 cm	71.46 b	68.12 b	68.54 a
Pr > F	0.6941	0.0067	<0.0001
R-Square	0.37	0.61	079
LSD (0.05)	2.67	3.28	5.34

* Means followed by the same letter are not significantly different (P = 0.05).

Trial 1 data for percent broadleaf weed cover for ‘KY 31’ among herbicide treatments are shown in Table 15. On May 10, June 11, and July 11, 2012, treatments containing fluazifop exhibited a significantly higher percentage of broadleaf weeds than the control treatment. June 11 data showed fluazifop contained 433 percent and glyphosate + fluazifop contained 478 percent more broadleaf weed cover than the control treatment. On July 7, 2012, glyphosate + mesotrione had significantly lowered broadleaf cover by 71 percent compared to the control treatment. The Trial 1 data for percent broadleaf weed cover for ‘Bullseye’ among herbicide treatments (Table 16) show glyphosate + fluazifop exhibited significantly higher percentages of broadleaf weeds than the control treatment on May 10, June 11, and July 11, 2012. July 11 data showed fluazifop significantly contained 158 percent and glyphosate + fluazifop significantly contained 105 percent more broadleaf weed cover than the control treatment. On June 11, 2012, glyphosate + mesotrione had significantly lowered broadleaf cover by 95 percent compared to the control treatment.

Trial 2 data for percent broadleaf weed cover among herbicide treatments for ‘KY’ 31 and ‘Bullseye’ (Table 17 and Table 16) show treatments containing mesotrione exhibiting a significantly lower percentage of broadleaf weeds than the control, glyphosate, and glyphosate + fluazifop treatments. Treatments containing mesotrione controlled broadleaf weeds 100 percent compared to the control treatment. In the ‘KY 31’ study, June 20, 2013 data showed fluazifop contained 106 percent and glyphosate + fluazifop contained 111 percent significantly more broadleaf weed cover than the control treatment. In the ‘KY 31’ study, June 20, 2013 data showed glyphosate + fluazifop contained 88 percent significantly more broadleaf weed cover than the control treatment.

The data for percent broadleaf weed cover among mowing heights for ‘KY 31’ in Trial 1 (Table 19) show from March 19, 2012 to April 18, 2012, turf mowed at 7.62 cm was significantly higher in percent broadleaf weed cover than turf mowed at 12.70 cm. The same data for the ‘Bullseye” study (Table 20) for Trial 1 show no significant differences in percent broadleaf weed cover among mowing heights. Trial 2 data for percent broadleaf weed cover among mowing height for ‘KY 31’ (Table 21) is consistent with the data from the previous ‘KY 31’ trial (Table 19). Trial 2 data for percent broadleaf weed cover among mowing height for ‘Bullseye’ (Table 22) is consistent with the data from the previous ‘Bullseye’ trial (Table 20).

Table 15. Percent Broadleaf Weed Cover for 'KY 31' among Herbicide Treatments (Trial 1)

Treatment	Percent Broadleaf Weed Cover*					
	10/04/2011	03/19/2012	04/02/2012	04/11/2012	04/18/2012	04/25/2012
1	88.89 a	23.89 b	26.11 a	19.44 a	26.67 ab	22.78 bc
2	59.22 b	27.22 ab	28.89 a	20.00 a	28.89 a	21.11 cd
3	88.33 a	27.78 ab	30.00 a	24.44 a	26.11 ab	24.44 abc
4	82.67 a	31.67 a	27.22 a	23.89 a	23.89 b	16.67 e
5	91.11 a	27.22 ab	29.44 a	21.67 a	28.89 a	26.67 ab
6	67.56 b	26.67 ab	27.22 a	20.00 a	26.67 ab	24.44 abc
7	64.56 b	28.89 ab	30.00 a	27.78 a	26.11 ab	18.33 de
8	63.33 b	26.67 ab	28.89 a	24.44 a	28.89 a	27.22 a
Pr > F	<0.0001	<0.0001	<0.0001	0.0021	<0.0001	<0.0001
R-Square	0.79	0.81	0.71	0.65	0.72	0.80
LSD (0.05)	9.86	5.19	5.36	5.62	4.87	4.42

* Means followed by the same letter are not significantly different (P = 0.05).

Table 15. (continued)

Treatment	Percent Broadleaf Weed Cover*			
	05/10/2012	06/11/2012	07/11/2012	06/07/2013
1	13.33 de	5.00 c	7.78 cd	15.00 abc
2	16.11 de	12.78 b	15.56 b	16.11 ab
3	23.89 bc	11.67 b	12.22 bc	16.11 ab
4	10.56 e	0.00 c	4.44 de	7.78 bc
5	27.78 ab	26.67 a	26.11 a	10.56 abc
6	19.44 cd	13.89 b	15.00 b	19.44 a
7	9.44 e	0.56 c	2.22 e	6.11 c
8	34.44 a	28.89 a	28.89 a	20.00 a
Pr > F	<0.0001	<0.0001	<0.0001	0.0913
R-Square	0.72	0.86	0.85	0.52
LSD (0.05)	7.06	5.74	5.43	9.61

* Means followed by the same letter are not significantly different (P = 0.05).

Table 16. Percent Broadleaf Weed Cover for 'Bullseye' among Herbicide Treatments (Trial 1)

Treatment	Percent Broadleaf Weed Cover*					
	10/04/2011	03/19/2012	04/02/2012	04/11/2012	04/18/2012	04/25/2012
1	91.78 a	41.67 a	38.89 a	22.78 a	25.00 a	22.78 ab
2	70.33 b	40.89 a	34.22 a	21.67 a	21.67 a	20.56 b
3	91.89 a	37.22 a	29.44 a	22.22 a	22.78 a	21.67 ab
4	92.44 a	38.56 a	33.33 a	21.67 a	23.33 a	23.33 ab
5	80.11 ab	43.67 a	41.11 a	22.22 a	25.00 a	22.22 ab
6	69.11 b	44.44 a	32.22 a	22.22 a	21.67 a	20.00 b
7	73.11 b	48.67 a	38.89 a	22.22 a	25.00 a	22.78 ab
8	65.33 b	42.56 a	32.00 a	20.00 a	23.89 a	25.56 a
Pr > F	0.0721	0.6570	0.0546	0.6550	0.7849	0.5518
R-Square	0.53	0.37	0.54	0.37	0.34	0.40
LSD (0.05)	17.19	18.17	11.92	6.12	3.99	4.91

* Means followed by the same letter are not significantly different (P = 0.05).

Table 16. (continued)

Treatment	Percent Broadleaf Weed Cover*			
	05/10/2012	06/11/2012	07/11/2012	06/07/2013
1	18.33 b	11.67 bcd	10.56 cd	15.56 abc
2	11.67 c	4.44 de	5.56 cd	9.44 cde
3	19.44 b	14.44 abc	12.22 bc	16.67 abc
4	9.44 c	1.11 e	1.11 d	6.11 de
5	34.44 a	19.44 ab	27.22 a	21.11 a
6	14.44 bc	6.67 cde	7.78 cd	12.22 bcd
7	10.00 c	0.56 e	0.56 d	4.44 e
8	30.00 a	23.33 a	21.67 ab	19.44 ab
Pr > F	<0.0001	0.0054	0.0047	0.0056
R-Square	0.82	0.62	0.62	0.62
LSD (0.05)	5.85	9.72	10.73	7.48

* Means followed by the same letter are not significantly different (P = 0.05).

Table 17. Percent Broadleaf Weed Cover for 'KY 31' among Herbicide Treatments (Trial 2)

Treatment	Percent Broadleaf Weed Cover*	
	05/24/2013	06/20/2013
1	10.00 bc	10.00 b
2	11.11 b	11.11 b
3	7.78 c	10.56 b
4	0.00 d	0.00 c
5	17.78 a	20.56 a
6	11.11 b	13.89 b
7	0.00 d	0.00 c
8	16.11 a	21.11 a
Pr > F	<0.0001	<0.0001
R-Square	0.90	0.87
LSD (0.05)	3.15	4.19

* Means followed by the same letter are not significantly different (P = 0.05).

Table 18. Percent Broadleaf Weed Cover for 'Bullseye' among Herbicide Treatments (Trial 2)

Treatment	Percent Broadleaf Weed Cover*	
	05/24/2013	06/20/2013
1	4.44 ab	4.44 b
2	4.44 ab	4.44 b
3	2.22 abc	3.89 b
4	0.00 c	0.00 c
5	2.78 abc	5.00 ab
6	1.67 bc	2.78 bc
7	0.00 c	0.00 c
8	5.00 a	8.33 a
Pr > F	0.0357	0.0482
R-Square	0.56	0.55
LSD (0.05)	2.84	3.65

* Means followed by the same letter are not significantly different (P = 0.05)

Table 19. Percent Broadleaf Weed Cover for 'KY 31' among Mowing Heights (Trial 1)

Mowing Height	Percent Broadleaf Weed Cover*					
	10/04/2011	03/19/2012	04/02/2012	04/11/2012	04/18/2012	04/25/2012
7.62 cm	72.50 b	33.13 a	32.92 a	27.01 a	33.96 a	27.92 a
10.16 cm	70.46 b	32.08 a	29.58 b	21.67 b	25.42 b	22.29 b
12.70 cm	84.17 a	17.29 b	22.92 c	17.50 c	21.67 c	17.91 c
Pr > F	<0.0001	<0.0001	<0.0001	0.0021	<0.0001	<0.0001
R-Square	0.79	0.81	0.71	0.65	0.72	0.80
LSD (0.05)	6.04	3.18	3.28	3.44	2.98	2.70

* Means followed by the same letter are not significantly different (P = 0.05).

Table 19. (continued)

Mowing Height	Percent Broadleaf Weed Cover*			
	05/10/2012	06/11/2012	07/11/2012	06/07/2013
7.62 cm	20.63 a	15.63 a	17.29 a	14.38 a
10.16 cm	19.79 a	13.75 a	15.63 a	12.71 a
12.70 cm	17.71 a	7.92 b	9.17 b	14.58 a
Pr > F	<0.0001	<0.0001	<0.0001	0.0913
R-Square	0.72	0.86	0.85	0.52
LSD (0.05)	4.32	3.52	3.32	5.88

* Means followed by the same letter are not significantly different (P = 0.05).

Table 20. Percent Broadleaf Weed Cover for 'Bullseye' among Mowing Heights (Trial 1)

Mowing Height	Percent Broadleaf Weed Cover*					
	10/04/2011	03/19/2012	04/02/2012	04/11/2012	04/18/2012	04/25/2012
7.62 cm	78.21 a	32.63 b	29.79 a	22.08 a	22.29 a	22.08 a
10.16 cm	78.42 a	43.96 a	31.38 b	20.83 a	23.96 a	22.29 a
12.70 cm	81.17 a	50.04 a	43.88 b	22.71 a	24.38 a	22.71 a
Pr > F	0.0721	0.6570	0.0546	0.6550	0.7849	0.5518
R-Square	0.53	0.37	0.54	0.37	0.34	0.40
LSD (0.05)	10.52	11.12	7.30	3.74	2.44	3.00

* Means followed by the same letter are not significantly different (P = 0.05).

Table 20. (continued)

Mowing Height	Percent Broadleaf Weed Cover*			
	05/10/2012	06/11/2012	07/11/2012	06/07/2013
7.62 cm	17.29 a	7.71 a	7.92 a	13.96 a
10.16 cm	17.29 a	11.04 a	10.21 a	11.04 a
12.70 cm	20.83 a	11.88 a	14.38 a	14.38 a
Pr > F	<0.0001	0.0054	0.0047	0.0056
R-Square	0.82	0.62	0.62	0.62
LSD (0.05)	3.58	5.95	6.57	4.58

* Means followed by the same letter are not significantly different (P = 0.05).

Table 21. Percent Broadleaf Weed Cover for 'KY 31' among Mowing Heights (Trial 2)

Mowing Height	Percent Broadleaf Weed Cover*	
	05/24/2013	06/20/2013
7.62 cm	13.33 a	14.58 a
10.16 cm	9.38 b	11.25 b
12.70 cm	5.00 c	6.88 c
Pr > F	<0.0001	<0.0001
R-Square	0.90	0.87
LSD (0.05)	1.93	2.57

* Means followed by the same letter are not significantly different (P = 0.05).

Table 22. Percent Broadleaf Weed Cover for 'Bullseye' among Mowing Heights (Trial 2)

Mowing Height	Percent Broadleaf Weed Cover*	
	05/24/2013	06/20/2013
7.62 cm	2.92 ab	4.38 a
10.16 cm	3.33 a	4.17 a
12.70 cm	1.46 b	2.29 a
Pr > F	0.0357	0.0482
R-Square	0.56	0.55
LSD (0.05)	1.74	2.23

* Means followed by the same letter are not significantly different (P = 0.05).

Data for percent bermudagrass cover among herbicide treatments for ‘KY 31’ in Trial 1 (Table 23) show on June 11, June 20, and July 11, 2012 treatments containing fluazifop were significantly lower in percent bermudagrass cover than all other treatments, however, by November 11, 2012 those significant differences were not observed. Compared to the control treatment, fluazifop suppressed bermudagrass by 53, 39, and 37 percent on those dates and the glyphosate + fluazifop treatment suppressed bermudagrass 49, 41, and 38 percent. Glyphosate + fenoxaprop significantly reduced bermudagrass in comparison to the control on those dates as well, but not to the same level of suppression as treatments containing fluazifop. However, on November 11, 2012, glyphosate + fenoxaprop exhibited 33 percent significantly lower bermudagrass cover than all other treatments. By July 11, 2012, glyphosate + mesotrione had significantly lowered bermudagrass cover by 21 percent compared to the control treatment, but no significant differences were observed for that treatment in the November 11 data. Early Summer 2013 data indicate all treatments, outside of mesotrione alone, show significantly lower percent of bermudagrass cover compared to the control treatment.

In the ‘Bullseye’ study, Trial 1 (Table 24) showed a significantly lower percentage of bermudagrass cover for the fluazifop treatment on June 20, July 11, and November 12, 2012 suppressing bermudagrass by 28, 32, and 25 percent respectively. Glyphosate + fluazifop significantly lowered bermudagrass by 34 and 24 percent on June 20 and July 11, 2012 compared to the control, however, no significant difference was observed in the November 02, 2012 data. Additionally, glyphosate, fenoxaprop, and glyphosate + fenoxaprop had significantly lowered bermudagrass cover by 24, 23, and 28 percent respectively on that date.

Table 25 shows data for percent bermudagrass cover among herbicide treatments for Trial 2 in the 'KY 31' study. On June 8 and June 20, 2013, data was similar to the previous trial with fluazifop suppressing bermudagrass by 93 and 87 percent respectively, and glyphosate + fluazifop suppressing bermudagrass by 96 and 85 percent respectively compared to the control treatment. Data on May 15, 2013, show glyphosate, glyphosate + fenoxaprop, and glyphosate + mesotrione reduced bermudagrass cover by 86, 97, and 93 percent respectively, compared to the control treatment. The highest suppression of bermudagrass for fenoxaprop alone and mesotrione alone was observed on June 8, 2013 with 49 percent and 44 percent less bermudagrass cover respectively, in comparison to the control.

On June 8 and June 20, 2013, in Trial 2 of the 'Bullseye' study (Table 26), glyphosate + fluazifop shows a significantly lower percentage of bermudagrass cover than all treatments not containing fluazifop, in which bermudagrass was suppressed by 94 and 84 percent respectively. On May 24, 2013, glyphosate, glyphosate + fenoxaprop, and glyphosate + mesotrione significantly suppressed bermudagrass by 76, 74, and 75 percent respectively compared to the control treatment. June 8 data shows mesotrione and fluazifop significantly reduced bermudagrass cover by 21 and 80 percent respectively, compared to the control treatment.

Percent bermudagrass cover for 'KY 31' among mowing heights for Trial 1 (Table 27) shows significant differences in percent bermudagrass cover on observation dates during the early part of the summer with turf mowed at 12.70 cm resulting in significantly lower percentage of bermudagrass cover than turf mowed at 7.62 cm. The Trial 1 data for percent bermudagrass cover in the 'Bullseye' study (Table 28) show

similar results with turf mowed at 12.70 cm having a significantly lower percentage of bermudagrass cover than turf mowed at 7.62 cm during the early summer. In Trial 2 of study, (Table 29 and Table 30) the data reflected the similar significant differences as the previous year's trials.

Table 23. Percent Bermudagrass Cover for 'KY 31' among Herbicide Treatments (Trial 1)

Treatment	Percent Bermudagrass Cover*			
	9/20/2011	06/11/2012	06/20/2012	07/11/2012
1	38.33 a	50.56 a	60.56 a	65.00 a
2	1.89 b	43.89 a	55.00 ab	57.78 ab
3	38.89 a	42.78 a	56.67 ab	58.33 ab
4	36.67 a	48.33 a	61.11 a	62.78 a
5	47.78 a	23.89 c	36.67 c	41.11 c
6	4.78 b	31.67 bc	49.44 b	52.78 b
7	3.22 b	41.11 ab	48.89 b	51.67 b
8	5.00 b	25.56 c	35.56 c	41.11 c
Pr > F	<0.0001	<0.0001	0.0005	0.0020
R-Square	0.83	0.74	0.68	0.65
LSD (0.05)	11.12	10.17	9.72	9.53

* Means followed by the same letter are not significantly different (P = 0.05).

Table 23. (continued)

Treatment	Percent Bermudagrass Cover*		
	11/02/2012	05/03/2013	06/07/2013
1	61.11 a	61.67 a	73.33 a
2	52.22 ab	43.89 bcd	55.56 bcd
3	55.00 a	50.56 bc	62.22 bc
4	60.56 a	52.78 ab	64.44 ab
5	52.22 ab	47.78 bcd	59.44 bcd
6	41.11 b	40.00 d	51.67 d
7	54.44 a	43.89 bcd	55.56 bcd
8	55.56 a	42.22 cd	53.89 cd
Pr > F	0.2089	<0.0001	<0.0001
R-Square	0.47	0.81	0.78
LSD (0.05)	12.78	10.01	10.01

* Means followed by the same letter are not significantly different (P = 0.05).

Table 24. Percent Bermudagrass Cover for 'Bullseye' among Herbicide Treatments (Trial 1)

Treatment	Percent Bermudagrass Cover*			
	9/20/2011	06/11/2012	06/20/2012	07/11/2012
1	60.56 a	35.56 bc	62.78 ab	48.33 a
2	3.44 c	34.44 bcd	63.89 ab	46.11 ab
3	48.33 b	30.56 cde	55.00 c	47.22 ab
4	44.44 b	44.44 a	65.56 a	49.44 a
5	42.78 b	27.22 e	45.00 d	32.78 c
6	4.33 c	32.33 cde	58.33 bc	46.11 ab
7	3.22 c	38.89 ab	62.78 ab	53.89 a
8	5.11 c	28.89 de	41.67 d	36.67 bc
Pr > F	<0.0001	<0.0001	<0.0001	0.0679
R-Square	0.88	0.93	0.84	0.53
LSD (0.05)	11.30	5.84	5.95	11.38

* Means followed by the same letter are not significantly different (P = 0.05).

Table 24. (continued)

Treatment	Percent Bermudagrass Cover*		
	11/02/2012	05/03/2013	06/07/2013
1	41.67 ab	59.44 a	71.11 a
2	31.67 c	35.56 bc	47.22 bc
3	32.22 c	41.67 bc	53.33 bc
4	43.89 a	46.67 b	58.33 b
5	31.11 c	35.56 bc	47.22 bc
6	30.00 c	35.00 bc	46.67 bc
7	34.44 bc	39.44 bc	51.11 bc
8	36.67 abc	33.89 c	45.56 c
Pr > F	0.0002	<0.0001	<0.0001
R-Square	0.70	0.75	0.72
LSD (0.05)	8.14	11.91	11.91

* Means followed by the same letter are not significantly different (P = 0.05).

Table 25. Percent Bermudagrass Cover for 'KY 31' among Herbicide Treatments (Trial 2)

Treatment	Percent Bermudagrass Cover*			
	5/15/2013	05/24/2013	06/08/2013	06/20/2013
1	31.11 a	49.44 a	76.11 a	80.56 a
2	4.44 c	26.67 c	43.89 b	53.33 b
3	22.78 b	38.89 b	38.89 b	51.67 bc
4	22.22 b	40.00 b	42.78 b	59.44 b
5	21.11 b	25.00 c	5.00 e	10.56 e
6	1.67 c	14.44 d	17.78 d	30.56 d
7	2.22 c	22.78 c	26.67 c	41.11 cd
8	1.67 c	7.22 e	2.78 e	12.22 e
Pr > F	<0.0001	<0.0001	<0.0001	<0.0001
R-Square	0.92	0.94	0.92	0.88
LSD (0.05)	5.16	5.14	8.88	11.19

* Means followed by the same letter are not significantly different (P = 0.05).

Table 26. Percent Bermudagrass Cover for 'Bullseye' among Herbicide Treatments (Trial 2)

Treatment	Percent Bermudagrass Cover*			
	5/15/2013	05/24/2013	06/08/2013	06/20/2013
1	9.44 a	71.67 a	78.33 a	84.44 a
2	0.00 c	17.22 c	28.89 d	40.00 de
3	6.11 ab	47.22 b	45.56 c	63.33 bc
4	7.22 ab	57.22 ab	61.67 b	71.11 ab
5	4.44 bc	14.44 c	15.56 ef	27.22 ef
6	0.56 c	18.33 c	29.44 d	47.78 cd
7	0.56 c	17.78 c	26.67 de	41.67 de
8	0.00 c	9.44 c	4.44 f	13.89 f
Pr > F	0.0022	<0.0001	<0.0001	<0.0001
R-Square	0.64	0.73	0.84	0.75
LSD (0.05)	4.78	17.01	13.28	17.15

* Means followed by the same letter are not significantly different (P = 0.05).

Table 27. Percent Bermudagrass Cover for 'KY 31' among Mowing Heights (Trial 1)

Mowing Height	Percent Bermudagrass Cover*			
	9/20/2011	06/11/2012	06/20/2012	07/11/2012
7.62 cm	19.80 a	44.79 a	51.25 a	55.42 a
10.16 cm	25.75 a	38.96 a	51.88 a	54.58 a
12.70 cm	20.67 a	31.78 b	48.33 a	51.46 a
Pr > F	<0.0001	<0.0001	0.0005	0.0020
R-Square	0.83	0.74	0.68	0.65
LSD (0.05)	6.81	6.23	5.95	5.83

* Means followed by the same letter are not significantly different (P = 0.05).

Table 27. (continued)

Mowing Height	Percent Bermudagrass Cover*		
	11/02/2012	05/03/2013	06/07/2013
7.62 cm	53.13 a	64.58 a	74.58 a
10.16 cm	53.54 a	45.83 b	55.83 b
12.70 cm	55.42 a	33.13 c	48.13 c
Pr > F	0.2089	<0.0001	<0.0001
R-Square	0.47	0.81	0.78
LSD (0.05)	7.83	6.13	6.13

* Means followed by the same letter are not significantly different (P = 0.05).

Table 28. Percent Bermudagrass Cover for 'Bullseye' among Mowing Heights (Trial 1)

Mowing Height	Percent Bermudagrass Cover*			
	9/20/2011	06/11/2012	06/20/2012	07/11/2012
7.62 cm	22.38 a	55.21 a	61.46 a	45.54 a
10.16 cm	28.63 a	26.67 b	57.92 a	43.13 a
12.70 cm	28.58 a	20.21 c	51.25 b	43.54 a
Pr > F	<0.0001	<0.0001	<0.0001	0.0679
R-Square	0.88	0.93	0.84	0.53
LSD (0.05)	6.92	3.57	3.64	6.97

* Means followed by the same letter are not significantly different (P = 0.05).

Table 28. (continued)

Mowing Height	Percent Bermudagrass Cover*		
	11/02/2012	05/03/2013	06/07/2013
7.62 cm	45.42 a	54.79 a	64.79 a
10.16 cm	29.79 b	40.83 b	50.83 b
12.70 cm	30.42 b	27.08 c	42.08 c
Pr > F	0.0002	<0.0001	<0.0001
R-Square	0.70	0.75	0.72
LSD (0.05)	4.99	7.29	7.29

* Means followed by the same letter are not significantly different (P = 0.05).

Table 29. Percent Bermudagrass Cover for ‘KY 31’ among Mowing Heights (Trial 2)

Mowing Height	Percent Bermudagrass Cover*			
	5/15/2013	05/24/2013	06/08/2013	06/20/2013
7.62 cm	21.46 a	36.88 a	40.42 a	49.58 a
10.16 cm	10.63 b	25.21 b	33.33 b	42.08 b
12.70 cm	8.13 b	22.08 b	21.46 c	35.63 b
Pr > F	<0.0001	<0.0001	<0.0001	<0.0001
R-Square	0.92	0.94	0.92	0.88
LSD (0.05)	3.16	3.14	5.44	6.85

* Means followed by the same letter are not significantly different (P = 0.05).

Table 30. Percent Bermudagrass Cover for ‘Bullseye’ among Mowing Heights (Trial 2)

Mowing Height	Percent Bermudagrass Cover*			
	5/15/2013	05/24/2013	06/08/2013	06/20/2013
7.62 cm	6.04 a	34.38 a	37.71 a	55.21 a
10.16 cm	2.08 b	31.67 a	28.75 b	43.33 b
12.70 cm	2.50 b	28.96 a	42.50 a	47.50 ab
Pr > F	0.0022	<0.0001	<0.0001	<0.0001
R-Square	0.64	0.73	0.84	0.75
LSD (0.05)	2.92	10.42	8.13	10.50

* Means followed by the same letter are not significantly different (P = 0.05).

Discussion

Fluazifop and glyphosate + fluazifop temporarily discolored the fescue resulting in significantly lower turf quality and, additionally, a temporary significantly lower percentage of tall fescue cover. However, four to five weeks after the final application of those treatments, significant differences in turf quality were not observed and the fescue had recovered from injury. From the data it seems as if higher mowing heights may play a role in achieving high turf quality in 'KY 31' than in the turf type tall fescue 'Bullseye'.

Fluazifop and glyphosate + fluazifop yielded a significantly higher percentage of broadleaf weeds in Trial 1 of both studies, while glyphosate + mesotrione showed a significantly lower percentage of broadleaf weeds in both trials of the 'KY 31' study and in Trial 2 of the 'Bullseye' study. In wide textured, forage-type tall fescues, like 'KY 31', higher mowing heights may play a role in controlling broadleaf weeds during the early summer months as reflected in the data.

Bermudagrass is temporarily suppressed by two applications of fluazifop, however, more than two applications may be required for better control. Previous research has shown the addition of triclopyr to treatments containing fluazifop or fenoxaprop reduces injury to tall fescue and that triclopyr + fenoxaprop suppresses bermudagrass greater than fenoxaprop alone (McElroy and Breeden, 2011). High mowing heights seem to play a role in bermudagrass suppression, especially during the early part of the summer, therefore raising the mowing height greater than 7.62 cm may be required to provide better control.

Sufficient suppression of bermudagrass in tall fescue may require more than two applications of a fluazifop treatment, and multiple applications of glyphosate may be

required before seeding to ensure better control of bermudagrass. Additionally turf should be maintained at higher mowing heights to aid in bermudagrass suppression. Perhaps, increasing the seeding rate to 366.18 or 390.59 kg pls/ha (7.5 or 8.0 # pls/1000ft^2) and fertilizing with nitrogen at the rate of 24.4 kg N/ha (0.5 #N/1000ft^2) twice in the fall instead of once, would provide better suppression as well.

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