Report No. K-TRAN: KSU-16-1 ▪ FINAL REPORT ▪ December 2018

Preliminary Evaluation of Perennial Ryegrass and Buffalograss Blends for Seeded Roadside Establishment to Comply with Storm Water Control Regulations

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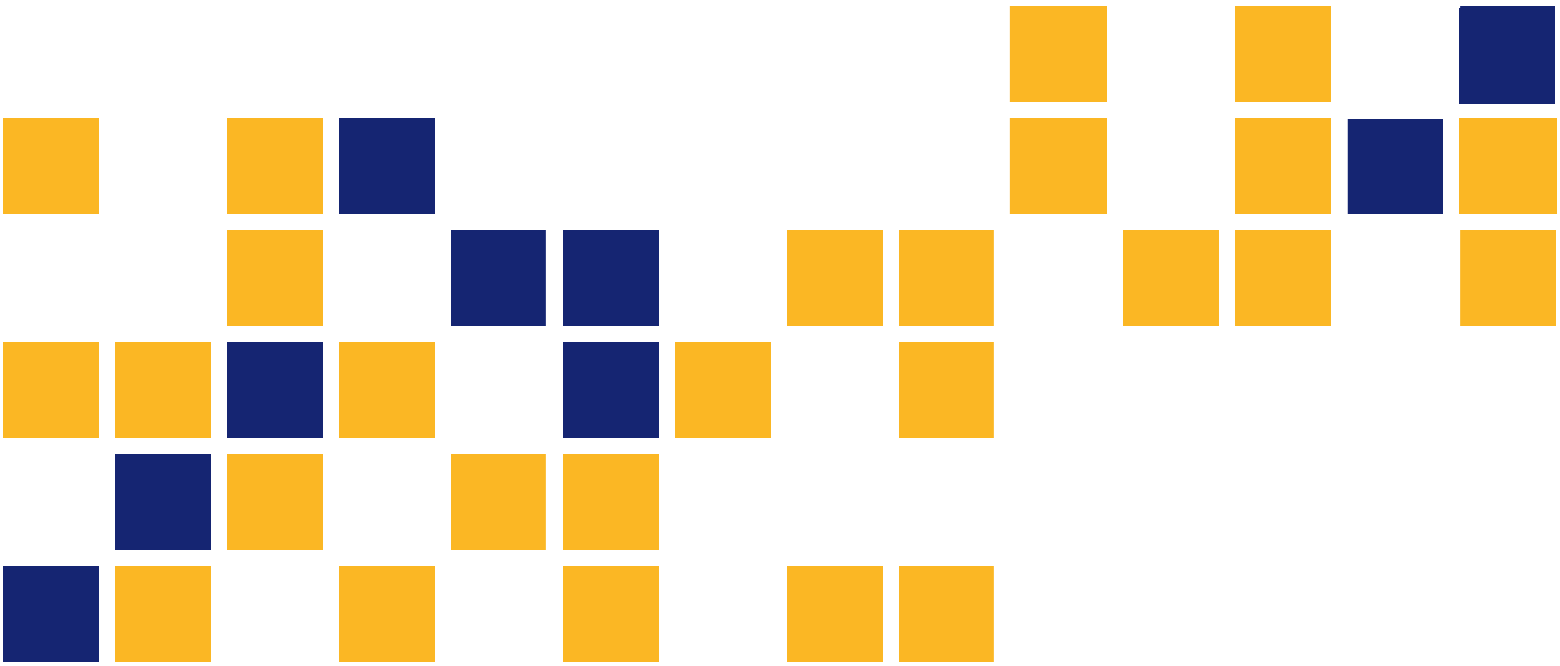

Kansas Department of Transportation

1 Report No. K-TRAN: KSU-16-1	**2 Government Accession No.**	**3 Recipient Catalog No.**
4 Title and Subtitle Preliminary Evaluation of Perennial Ryegrass and Buffalograss Blends for Seeded Roadside Establishment to Comply with Storm Water Control Regulations		**5 Report Date** December 2018 **6 Performing Organization Code**
7 Author(s) Jared Hoyle, Ph.D., Carol Baldwin, Ph.D.		**8 Performing Organization Report No.**
9 Performing Organization Name and Address Kansas State University Transportation Center Department of Horticulture and Natural Resources 1712 Claflin Rd, 2021 Throckmorton Manhattan, Kansas 66506		**10 Work Unit No. (TRAIS)** **11 Contract or Grant No.** C2072
12 Sponsoring Agency Name and Address Kansas Department of Transportation Bureau of Research 2300 SW Van Buren Topeka, Kansas 66611-1195		**13 Type of Report and Period Covered** Final Report November 2015–April 2018 **14 Sponsoring Agency Code** RE-0687-01
15 Supplementary Notes For more information write to address in block 9.		

16 Abstract

Buffalograss (*Buchloë dactyloides* [Nutt.] Engelm.) is a native low maintenance turfgrass species that is well adapted for lawns, parks, athletic fields, roadsides, and golf courses in the transition zone of the Midwestern United States. Perennial ryegrass (*Lolium perenne*) has also been used in many states as perennial roadside vegetation. Blending buffalograss with a rapidly establishing cool-season turfgrass, perennial ryegrass, could provide quick temporary vegetative cover, followed by the establishment of a sod-forming, drought-tolerant permanent cover of buffalograss.

Research was repeated on two separate roadside shoulder areas (25–100 feet from roadway) west of US-281. The parameters evaluated will include nine seed blend treatments and three seeding timings. All seed blends were established at all seeding timings at both locations. Seed blends included Kansas Department of Transportation (KDOT) standard seed mix for west of US-281, 100%/0%, 80%/20%, 60%/40%, 50%/50%, 40%/60%, 20%/80%, and 0%/100% buffalograss/perennial ryegrass on a volume-to-volume ratio. A non-treated control was also included at each seeding timing for comparison. Seed timings included dormant (January 26, 2016), Spring/Summer (May 23, 2016), and Fall (September 20, 2016).

Treatments were evaluated bi-monthly until 1 year after final treatment application (September 2017). Evaluations included visual percent aerial cover ratings of perennial ryegrass, buffalograss, and weed cover on a scale of 0 (no cover) to 100% (complete cover). Turfgrass quality was also assessed using a scale of 0 to 9, where 9 is considered to be optimal turf quality and 6 is the minimum acceptable level according to National Turfgrass Evaluation Program (NTEP) standards.

Spring/Summer and dormant season (January) treatments were both successful in establishing roadside plantings with acceptable survival and growth rates, but all Fall treatments had less than 40% desirable vegetative species coverage.

All Spring/Summer seeding treatments resulted in >80% buffalograss cover by 506 days after seeding (October 12, 2017), except the non-treated control, the standard KDOT mix, and the 0% buffalograss/100% perennial ryegrass (p.ryegrass) treatment.

Spring/Summer sown buffalograss and perennial ryegrass blends that provided the quickest continuous roadside cover were: (1) 100% buffalograss/0% p.ryegrass; (2) 80% buffalograss/20% p.ryegrass; and (3) 60% buffalograss/40% p.ryegrass treatments when established in the Spring/Summer.

While Spring/Summer seeding resulted in optimal establishment timing for buffalograss and perennial ryegrass blends, dormant (January) seeding timing was also successful.

17 Key Words Buffalograss, Perennial Ryegrass, Roadside Stabilization, Storm Water Control, Seed Blends		**18 Distribution Statement** No restrictions. This document is available to the public through the National Technical Information Service www.ntis.gov.	
19 Security Classification (of this report) Unclassified	**20 Security Classification (of this page)** Unclassified	**21 No. of pages** 76	**22 Price**

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Final Report

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A Report on Research Sponsored by

THE KANSAS DEPARTMENT OF TRANSPORTATION
TOPEKA, KANSAS

and

KANSAS STATE UNIVERSITY TRANSPORTATION CENTER
MANHATTAN, KANSAS

December 2018

PREFACE

The Kansas Department of Transportation's (KDOT) Kansas Transportation Research and New-Developments (K-TRAN) Research Program funded this research project. It is an ongoing, cooperative and comprehensive research program addressing transportation needs of the state of Kansas utilizing academic and research resources from KDOT, Kansas State University and the University of Kansas. Transportation professionals in KDOT and the universities jointly develop the projects included in the research program.

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Abstract

Buffalograss (*Buchloë dactyloides* [Nutt.] Engelm.) is a native low maintenance turfgrass species that is well adapted for lawns, parks, athletic fields, roadsides, and golf courses in the transition zone of the Midwestern United States. Perennial ryegrass (*Lolium perenne*) has also been used in many states as perennial roadside vegetation. Blending buffalograss with a rapidly establishing cool-season turfgrass, perennial ryegrass, could provide quick temporary vegetative cover, followed by the establishment of a sod-forming, drought-tolerant permanent cover of buffalograss.

Research was repeated on two separate roadside shoulder areas (25–100 feet from roadway) west of US-281. The parameters evaluated will include nine seed blend treatments and three seeding timings. All seed blends were established at all seeding timings at both locations. Seed blends included Kansas Department of Transportation (KDOT) standard seed mix for west of US-281, 100%/0%, 80%/20%, 60%/40%, 50%/50%, 40%/60%, 20%/80%, and 0%/100% buffalograss/perennial ryegrass on a volume-to-volume ratio. A non-treated control was also included at each seeding timing for comparison. Seed timings included dormant (January 26, 2016), Spring/Summer (May 23, 2016), and Fall (September 20, 2016).

Treatments were evaluated bi-monthly until 1 year after final treatment application (September 2017). Evaluations included visual percent aerial cover ratings of perennial ryegrass, buffalograss, and weed cover on a scale of 0 (no cover) to 100% (complete cover). Turfgrass quality was also assessed using a scale of 0 to 9, where 9 is considered to be optimal turf quality and 6 is the minimum acceptable level according to National Turfgrass Evaluation Program (NTEP) standards.

Spring/Summer and dormant season (January) treatments were both successful in establishing roadside plantings with acceptable survival and growth rates (Appendix A, Figures A.1–A.8; Appendix B.1 and B.2), but all Fall treatments had less than 40% desirable vegetative species coverage (Appendix A, Figures A.9–A.12; Appendix B.3).

All Spring/Summer seeding treatments resulted in >80% buffalograss cover by 506 days after seeding (October 12, 2017), except the non-treated control, the standard KDOT mix, and the 0% buffalograss/100% perennial ryegrass (p.ryegrass) treatment.

Spring/Summer sown buffalograss and perennial ryegrass blends that provided the quickest continuous roadside cover were: (1) 100% buffalograss/0% p.ryegrass; (2) 80% buffalograss/20% p.ryegrass; and (3) 60% buffalograss/40% p.ryegrass treatments when established in the Spring/Summer.

While Spring/Summer seeding resulted in optimal establishment timing for buffalograss and perennial ryegrass blends, dormant (January) seeding timing was also successful.

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction

1.1 Proposal Background

Storm water control and roadside stability are key goals for roadside plantings. Traditional seeding mixes for more mesic sites have failed to establish in semi-arid Western Kansas. Improved varieties of regional native grasses are likely better adapted, but are slow to establish and may take several years to provide adequate coverage.

New varieties of buffalograss (*Bouteloua dactyloides*) show excellent drought, cold, and salinity tolerance and may provide a solution for long-term roadside stability. However, the soil is subject to erosion during the long germination and establishment period. A blend of grasses could offer a solution: perennial ryegrass to quickly stabilize the soil, with the slower germinating buffalograss providing a long lasting, sod-forming, drought-tolerant sward.

We hypothesized that blending improved varieties of buffalograss with perennial ryegrass would provide quick, short-term roadside stability while allowing time for successful buffalograss establishment. We also hypothesized that over time, perennial ryegrass populations will die out as the native buffalograss becomes established, providing continuous roadside stability and storm water control. Minimal research exists on the feasibility and methodology of establishing buffalograss and perennial ryegrass blends on roadsides in western Kansas. The goal of this project was to test the effect of seeding date, different blend proportions, and cultural methods in the growth and establishment of buffalograss and perennial ryegrass blends for short-term and long-term roadside stabilization.

1.2 Overview

Buffalograss (*Buchloë dactyloides* [Nutt.] Engelm.) is a native, short stature, low maintenance turfgrass species that is well adapted for lawns, parks, athletic fields, roadsides, and golf courses in the transition zone of the Midwestern United States (Wenger, 1943; Beard, 1973; Fry, 1995; McCarty, 1995; Fry & Huang, 2004). Only minimal management inputs like irrigation, mowing, and pest control are needed to achieve an acceptable stand of buffalograss (Beard, 1973; Feldhake, Danielson, & Butler, 1984; McCarty & Colvin, 1992; Bowman, Devitt, Huff, & Miller, 1999; Wu, Guo, & Harivandi, 1998).

Many roadside conditions are maintained at the natural growing height of buffalograss, resulting in safety and maintenance benefits. Due to buffalograss' slow vertical shoot growth and low growth habit, mowing frequency is reduced or even eliminated (Beard, 1973; Hoyle, Keeley, & Fagerness, 2014). With less mowing activity, there are safety benefits as well. KDOT mowing crews interact less with vehicles moving at highway speeds, while motorists enjoy better roadside visibility. Resources can be diverted from roadside maintenance to other transportation needs.

Although there are many positive attributes of buffalograss, there are also several drawbacks to its adoption as a species of choice for roadside seedings. It is relatively slow to germinate and establish (Ahring & Todd, 1977; Fry, Upham, & Leuthold, 1993). Best management practices for seeding buffalograss recommend eradicating all existing vegetation in conjunction with soil tillage, resulting in a long conversion or establishment time period (Hoyle, Braun, Reeves, Keeley, & Bremer, 2018). During the first two years of establishment, 70% of fixed carbohydrates are allocated to root development, so little above-ground vegetation is produced (Harker, Evans, Evans, & Harker, 1993). Root development is essential for subsurface soil stabilization and drought tolerance but does not mitigate soil surface erosion.

Slow establishment can cause buffalograss stands to fail to meet roadside stabilization standards. Without quick and successful roadside turfgrass establishment, KDOT can also be held liable for not meeting erosion run-off standards and regulations. Quick but long-term roadside stabilization is needed to minimize soil erosion and maintain or improve water quality.

Perennial ryegrass (*Lolium perenne*) has been used in many states as perennial roadside vegetation. It establishes quickly from seed and forms a usable turfgrass stand faster than other grasses (Hoyle, 2017). In Rhode Island, perennial ryegrass had the best establishment of all tested treatments and locations (Brown & Gorres, 2011). Quick establishment with perennial ryegrass on roadsides would stabilize new roadside construction in the short term, but it is less tolerant to heat and drought and has more disease problems than the other major turfgrasses in Kansas (Hoyle, 2017). Therefore, due to a lack of tolerance to Kansas' environmental conditions, perennial ryegrass would not be a long-term sustainable turfgrass species for roadsides.

Warm- and cool-season turfgrasses have been cultivated simultaneously to increase utility of turfgrass stands throughout the year. Both seeding mixes and overseeding are used to create mixed warm- and cool-season swards. Perennial ryegrass is commonly used for overseeding existing warm-season grass stands to extend the season of use or color (Foy, 1998; Horgan & Yelverton, 2001; Trappe, Karcher, Richardson, & Patton, 2011; Hoyle, 2017). Blends and mixtures of warm- and cool-season grass seed are commonly used in many types of turfgrass establishment including roadsides. Current KDOT standards, depending on district, can require up to 14 different grass species, both warm- and cool-season species.

Due to the excellent drought, cold, and salinity tolerance along with the minimal required maintenance, long-term roadside stability can be achieved with the successful establishment of buffalograss, but the lack of rapid establishment can lead to failure to meet erosion run-off standards and regulations. Blending buffalograss with a rapidly establishing cool-season turfgrass such as perennial ryegrass could provide quick temporary vegetative cover, followed by the establishment of a sod-forming, drought-tolerant permanent cover of buffalograss. Determining the ratio of buffalograss and perennial ryegrass seed blend and correct cultural procedures is critical in ensuring successful long-term establishment.

Current recommendations for establishment of buffalograss and perennial ryegrass are May/June and September, respectively (Hoyle, 2017). Not all roadside renovation and construction are executed during these times of year, resulting in a vegetation establishment failure if the improper blend is utilized. Therefore, blend ratios can vary depending on the planting season.

1.3 Project Objectives

The objectives of this research were:

1. Identify the buffalograss and perennial ryegrass blend that will provide the quickest continuous roadside turfgrass establishment.
2. Determine the optimal planting season for buffalograss and perennial ryegrass blends.
3. Evaluate buffalograss and perennial ryegrass composition (cover) one year after establishment.

1.4 Expected Benefits/Costs for Kansas

This research provides DOT roadside managers with the ability to select the best buffalograss and perennial ryegrass seed blend for planting at specific times of the year resulting in both short- and long-term roadside stabilization and vegetation coverage. Determining the optimal buffalograss and perennial ryegrass blend for quick establishment will stabilize roadsides in a timely manner to minimize failure to comply with storm water control regulations. Use of proven seed mixtures will reduce the cost of installation and failed plantings of roadside turfgrass. Establishment of improved low maintenance native turfgrass species (buffalograss) for roadsides can reduce roadside maintenance costs (mowing). Lastly, research will provide insight on a sustainable roadside system that will increase safety for all motorists and DOT employees working or traveling on Kansas roadways. By selecting a long-term native grass species for roadside planting, inadvertent introduction of invasive, non-native plants is avoided.

1.5 Project Deliverables

This project has provided the KDOT Bureau of Construction and Materials as well as the Bureau of Right of Way Environmental Services Section with an applied evaluation of perennial ryegrass and buffalograss blends for roadside establishment. Results will be published in peer-reviewed literature, presented to practitioners in trade articles and conferences and taught to undergraduate students in horticulture science, park management and conservation as well as wildlife and outdoor enterprise management.

1.6 Urgency and Payoff

Successful establishment of roadside turfgrass during all times of the year is extremely important. Without short and long term successful roadside establishment: (1) motorists will be traveling along roads with hazardous shoulders; (2) KDOT employees will be exposed to increased hazardous conditions; and (3) roadside soils will erode and water quality will be reduced across the state of Kansas. Without quick and successful roadside turfgrass establishment, KDOT can also be held liable for not meeting erosion run-off standards and regulations.

1.7 Implementation/Technology Transfer Plan

This research has provided KDOT roadside managers with best management practices for establishing buffalograss and perennial ryegrass blends at various seasons for quick and permanent vegetation coverage.

Chapter 2: Research Approach, Work Plan, Materials & Methods

The research approach and plan of work encompassed six primary tasks. Tasks executed in the timeline and project log presented below.

- **Task 1.** Literature Review (Complete)
- **Task 2.** Research Plot Preparation (Complete)
- **Task 3.** Research Trial Initiation (Complete)
- **Task 4.** Treatment Applications (Complete)
- **Task 5.** Data Collection (Complete)
- **Task 6.** Data Analysis and Final Report (Complete)

2.1 Experimental Locations

Research was repeated on two separate roadside shoulder areas (25–100 feet from roadway) west of US-281. Research Location 1 (TRG) was located west of US-281, south of A Rd in Trego County Kansas (39.131007, -99.868844). Research Location 2 (GHM) was located west of US-281, north of A Rd in Graham County Kansas (39.1132717, -99.868243). Soils at both locations were a Harney silt loam with pH of 6.7 and 2% organic matter (OM). Prior to treatment applications each site was mown at 1.5" and glyphosate (Glyphomate 41, PBI-Gordon, Kansas City, MO) was applied to entire experimental areas at 1.6 fl oz/1,000 ft^2 on December 19, 2015. Non-selective herbicide application was used to remove existing vegetation to simulate new roadside construction/establishment.

2.2 Experimental Design

Nine seed blend treatments and three seeding timings were evaluated. Treatments were arranged in a 9 by 3 Randomized Complete Block Two-Way Factorial Design with five replications. Therefore, all seed blends were established at all seeding timings at both locations. Seed blends included KDOT standard seed mix for west of US-281, 100%/0%, 80%/20%, 60%/40%, 50%/50%, 40%/60%, 20%/80%, and 0%/100% buffalograss/perennial ryegrass on a volume-to-volume ratio. A non-treated control was also included at each seeding timing for

comparison. Individual treatment combinations were applied to 10’ by 10’ plots. Seeding mixes and timings are listed below.

2.3 Seed Varieties, Rate and Timing

Buffalograss and perennial ryegrass varieties were ‘Sharp’s Improved II’ buffalograss (*Buchloe dactyloides* [Nutt.]) and ‘Clubhouse’ perennial ryegrass (*Lolium perenne*), respectively. KDOT seed blend consisted of 14% ‘El Reno’ sideoats grama (*Bouteloua curtipendula*), 0.5% ‘Lovington’ blue grama (*Bouteloua gracilis*), 50% ‘Sharp’s Improved II’ buffalograss (*Buchloe dactyloides* [Nutt.]), 13% ‘Barton’ western wheatgrass (*Pascopyrum smithii*), 0.5% sand dropseed (*Sporobolus cryptandrus*), and 14% ‘Regreen’ wheat x wheatgrass hybrid. Each seed blend was seeded at 4 lbs/1,000 ft^2. Seed timings included dormant (January 26, 2016), Spring/Summer (May 23, 2016), and Fall (September 20, 2016).

2.3.1 Environmental Conditions for Site Preparation and Seeding Dates

December 19, 2015

Air Temperature – 39.3°F

Soil Temperature (2”) – 24°F

Relative Humidity – 76.7%

Wind Speed – 8.3 MPH

Soil Moisture – Adequate

Cloud Cover – 100%

Dew Present – NO

January 26, 2016

Air Temperature – 42.5°F

Soil Temperature (2”) – 32°F

Relative Humidity – 65.6%

Wind Speed – 9.2 MPH

Soil Moisture – Adequate

Cloud Cover – 75%

Dew Present – NO

May 23, 2016

Air Temperature – 64.8°F

Soil Temperature (2”) – 60°F

Relative Humidity – 74%

Wind Speed – 16.6 MPH

Soil Moisture – Wet to Saturated

Cloud Cover – 100%

Dew Present – NO

September 20, 2016

Air Temperature – 85 °F

Soil Temperature (2”) – 70.3°F

Relative Humidity – 58.5%

Wind Speed – 22 MPH

Soil Moisture – Adequate

Cloud Cover – 0 %

Dew Present – NO

2.4 Seeding, Fertilization, Mulching, and Irrigation

Each area was lightly tilled (rotary tiller) and rolled (Agri-Fab 24-in. Push/Tow Poly Lawn Roller, 250 lbs., from Agri-Fab, Inc., Sullivan, IL) prior to seeding to meet the requirements of KDOT (2015a) Standard Specifications Section 904.3 b. Preparation of the Seedbed. Following seedbed preparation (tilling and rolling), each of the individual plots were drill-seeded (Ryan Turf Mataway Overseeder, from Schiller Grounds Care, Inc., Johnson Creek, WI) in two directions at a half seeding rate (2 lbs/1,000 ft2) for a total of 4 lbs/1,000 ft^2 with knives set at 0.125 inches deep and 2-inch separation to meet the requirements of KDOT (2015b) Standard Specifications Section 904.3 c. Seeding. A starter fertilizer (14-20-4; Lesco Inc., Cleveland, OH) was applied at a rate of 0.18 lbs N/1,000 ft^2 with a broadcast spreader after each seeding timing. Mulch was placed and punched immediately after fertilizing and seeding operations. Mulch was aged hay, free of weed seeds (Blueville Nursery, Manhattan, KS), and applied as a thin uniform layer at 1 small bale per 1,000 ft^2 (Fagerness, 2002). Mulch was then punched to approximately a 2-inch depth with a custom spike aerator (40-inch Spike Aerator, from Agri-Fab, Inc., Sullivan, IL) in two perpendicular directions. Six of the 12 spikes were replaced with solid disks to ensure mulch was punched into soil. Individual spike/disk spacing was 3.3 inches. Mulching and punching were in accordance to KDOT (2015c) Standard Specifications Section 905.3 a. Mulching. Research plots were irrigated following seeding, fertilization, and mulching with 0.5 inches of water by over-head rotary sprinklers. No other supplemental irrigation was applied to research plots throughout trials.

2.5 Weed Control and Maintenance

Although research plot areas were to be treated with herbicide applications as needed to prevent weed encroachment, environmental considerations (wind speeds > 15 mph) prevented any application at times researchers were on site. Plots were mown to a height of 6 inches bi-monthly, if needed, throughout the duration of the research project. Weed species present in research plots were considered any plant species that was not designated as a seeded species.

2.6 Data Collection and Analysis

Treatments were evaluated bi-monthly until 1 year after final treatment application (September 2017). Evaluations included visual percent aerial cover ratings of perennial ryegrass, buffalograss, and weed cover on a scale of 0 (no cover) to 100% (complete cover) and Digital Image Analysis (DIA).

Visual estimation techniques that are commonly used in turfgrass research adequately represent turfgrass cover and therefore were utilized in this experiment (Hoyle, Yelverton, & Gannon, 2013). Turfgrass quality was also assessed using a scale of 0 to 9, where 9 is considered to be optimal turf quality and 6 the minimum acceptable level according to National Turfgrass Evaluation Program (NTEP) standards. Evaluated area consisted of 8’ by 8’ center of research plots to minimize any surrounding plot effects.

Data was subjected to analysis of variance using SAS (2008; Version 9.2, SAS Institute Inc.) and ARM 9 (2012; Gylling Data Management, Inc.), and means separation using Fisher’s Protected LSD at the 0.05 confidence level.

Digital photography was used to document the visual appearance of the first replication for all seeding dates and trial locations at all rating dates and seeding dates for each individual plot. Plot photos are included in Appendix C. All plot photos are in order of: Non-treated, KDOT, 100% buffalograss/0% p.ryegrass, 80% buffalograss/20% p.ryegrass, 60% buffalograss/40% p.ryegrass, 50% buffalograss/50% p.ryegrass, 40% buffalograss/60% p.ryegrass, 20% buffalograss/80% p.ryegrass, and 0% buffalograss/100% p.ryegrass.

DIA was conducted according to Richardson, Karcher, and Purcell (2001). DIA utilizes digital images and software analysis to determine percent green vegetative cover. Due to vegetation within research plots falling outside of DIA thresholds and standards, DIA was not useful and was ineffective in determining vegetation cover in this situation.

2.7 Timeline

Table 2.1: Completed Project Schedule

2015 Tasks	January	February	March	April	May	June	July	August	September	October	November	December
Task 1. Literature Review												
Task 2. Plot Preparation												
Task 3. Trial Initiation												
Task 4. Treatment Application												
Task 5. Data Collection												
Task 6. Final Report												
2016 Tasks	January	February	March	April	May	June	July	August	September	October	November	December
Task 1. Literature Review												
Task 2. Plot Preparation												
Task 3. Trial Initiation												
Task 4. Treatment Application												
Task 5. Data Collection												
Task 6. Final Report												
2017 Tasks	January	February	March	April	May	June	July	August	September	October	November	December
Task 1. Literature Review												
Task 2. Plot Preparation												
Task 3. Trial Initiation												
Task 4. Treatment Application												
Task 5. Data Collection												
Task 6. Final Report												
2018 Tasks	January	February	March	April	May	June	July	August	September	October	November	December
Task 1. Literature Review												
Task 2. Plot Preparation												
Task 3. Trial Initiation												
Task 4. Treatment Application												
Task 5. Data Collection												
Task 6. Final Report												

2.8 Research Log Overview

Conducted at both trial locations. Details for each logged event are mentioned in Sections 2.1 through 2.6.

December 19, 2015

1. Mowed down research plot areas.
2. Marked out individual plot area with paint and flags.
3. Sprayed entire research areas with glyphosate to simulate new construction.

January 26, 2016

1. Remarked plots with paint and flags.
2. Tilled January (Dormant) seeding date areas according to KDOT seedbed preparation standards.
3. Rolled January (Dormant) seeding date areas according to KDOT seedbed preparation standards.
4. Seeded January (Dormant) seeding date areas according to KDOT seeding standards.
5. Broadcast fertilized (14-20-4) January (Dormant) seeding date areas.
6. Mulched January (Dormant) seeding date areas according to KDOT mulching standards.
7. Punched mulch in January (Dormant) seeding date areas according to KDOT mulching standards.
8. Irrigated January (Dormant) seeding date areas with 0.5” water with over-head rotary sprinklers.

March 23, 2016

1. Remarked plots with paint and flags.
2. Data collection on January (Dormant) seeded areas.
3. Sprayed May (Spring/Summer) research areas with glyphosate to simulate new construction.

May 23, 2016

1. Remarked plots with paint and flags.
2. Mowed January (Dormant) seeded areas to 6”.
3. Data collection on January (Dormant) seeded areas.
4. Tilled May (Spring/Summer) seeding date areas according to KDOT seedbed preparation standards.
5. Rolled May (Spring/Summer) seeding date areas according to KDOT seedbed preparation standards.
6. Seeded May (Spring/Summer) seeding date areas according to KDOT seeding standards.
7. Broadcast fertilized (14-20-4) May (Spring/Summer) seeding date areas.
8. Mulched May (Spring/Summer) seeding date areas according to KDOT mulching standards.
9. Punched mulch in May (Spring/Summer) seeding date areas according to KDOT mulching standards.
10. Irrigated May (Spring/Summer) seeding date areas with 0.5” water with over-head rotary sprinklers.

July 27, 2016

1. Remarked plots with paint and flags.
2. Mowed January (Dormant) and May (Spring/Summer) seeded areas to 6”.
3. Data collection on January (Dormant) and May (Spring/Summer) seeded areas.
4. Sprayed September (Fall) research areas with glyphosate to simulate new construction.

September 20, 2016

1. Remarked plots with paint and flags.
2. Mowed January (Dormant) and May (Spring/Summer) seeded areas to 6”.
3. Data collection on January (Dormant) and May (Spring/Summer) seeded areas.
4. Tilled September (Fall) seeding date areas according to KDOT seedbed preparation standards.
5. Rolled September (Fall) seeding date areas according to KDOT seedbed preparation standards.
6. Seeded September (Fall) seeding date areas according to KDOT seeding standards.
7. Broadcast fertilized (14-20-4) September (Fall) seeding date areas.
8. Mulched September (Fall) seeding date areas according to KDOT mulching standards.
9. Punched mulch in September (Fall) seeding date areas according to KDOT mulching standards.
10. Irrigated September (Fall) seeding date areas with 0.5” water with over-head rotary sprinklers.

November 30, 2016

1. Remarked plots with paint and flags.
2. Data collection on January (Dormant), May (Spring/Summer), and September (Fall) seeded areas.

February 3, 2017

1. Remarked plots with paint and flags.
2. Data collection on January (Dormant), May (Spring/Summer), and September (Fall) seeded areas.

March 31, 2017

1. Remarked plots with paint and flags.
2. Data collection on January (Dormant), May (Spring/Summer), and September (Fall) seeded areas.

June 1, 2017

1. Mowed January (Dormant), May (Spring/Summer), and September (Fall) seeded areas to 6".
2. Remarked plots with paint and flags.
3. Data collection on January (Dormant), May (Spring/Summer), and September (Fall) seeded areas.

July 25, 2017

1. Mowed January (Dormant), May (Spring/Summer), and September (Fall) seeded areas to 6".
2. Remarked plots with paint and flags.
3. Data collection on January (Dormant), May (Spring/Summer), and September (Fall) seeded areas.

October 12, 2017

1. Remarked plots with paint and flags.
2. Data collection on January (Dormant), May (Spring/Summer), and September (Fall) seeded areas.

Chapter 3: Results

Objective 1. Identify the buffalograss and perennial ryegrass blend that will provide the quickest continuous roadside turfgrass establishment.

Results from this current research trial, at these locations and application methods, indicate that the buffalograss and perennial ryegrass blends that will provide the quickest continuous roadside turfgrass establishment are: (1) 100% buffalograss/0% p.ryegrass, (2) 80% buffalograss/20% p.ryegrass, and (3) 60% buffalograss/40% p.ryegrass treatments with Spring/Summer sowing.

Objective 2. Determine the optimal establishment timing for buffalograss and perennial ryegrass blends.

Optimal establishment timing for buffalograss and ryegrass blends found in this study was the Spring/Summer seeding treatments (Appendix A, Figures A.5–A.8; Appendix B.2). At 64 days after seeding (DAS) treatments, 100% buffalograss/0% p.ryegrass, 80% buffalograss/20% p.ryegrass and 60% buffalograss/40% p.ryegrass resulted in >49% buffalograss cover. Minimal perennial ryegrass establishment (<3.4%) was observed 64 DAS Spring/Summer treatments. By 120 DAS, Spring/Summer treatments of 100% buffalograss/0% p.ryegrass, 80% buffalograss/20% p.ryegrass, 60% buffalograss/40% p.ryegrass, 50% buffalograss/50% p.ryegrass, and 40% buffalograss/60% p.ryegrass resulted in >72% buffalograss coverage. By October 12, 2017 (506 DAS) all Spring/Summer seeding treatments resulted in >80% buffalograss cover except the non-treated control, the standard KDOT mix, and the 0% buffalograss/100% p.ryegrass treatment (Table 3.1).

Table 3.1: Percent Cover of Spring Seeded Species at 64, 120, and 506 Days After Seeding

Seeding Mix	64 DAS		120 DAS		506 DAS	
	Buffalograss	P.Ryegrass	Buffalograss	P.Ryegrass	Buffalograss	P.Ryegrass
100% Buffalograss/ 0% P.Ryegrass	67.5%	0%	89.0%.	0.3%	95.0%	0.5%
80% Buffalograss/ 20% P.Ryegrass	49.3%	0%	81.5%	0.3%	97.0%	0.5%
60% Buffalograss/ 40% P.Ryegrass	59.0%	1.5%	86.5%	0%	94.5%	0.0%
50% Buffalograss/ 50% P.Ryegrass	36.0%	1.0%	74.8%	0%	88.5%	2.5%
40% Buffalograss/ 60% P.Ryegrass	29.0%	0.6%	72.5%	3.3%	94.0%	5.5%
20% Buffalograss/ 80% P.Ryegrass	18.8%	3.3%	66.5%	6.8%	81.0%	8.5%
0% Buffalograss/ 100% P.Ryegrass	6.5%	2.8%	47.5%	13.5%	54.0%	18.5%
KDOT Standard Mix	22.0%	0%	48.0%	0%	55.0%	3.5%
Control (No Seeding)	6.5%	2.8%	25.0%	0%	61.0%	0.5%

Although Spring/Summer seeding resulted in optimal establishment timing for buffalograss and perennial ryegrass blends, dormant (January) seeding was also successful (Table 3.2; Appendix A, Figures A.1–A.4; Appendix B.1). Compared to Spring/Summer seeding, dormant seeding was slower to germinate and establish. Environmental conditions are not optimal at dormant seeding timing; therefore, more emphasis should be placed on mulching when seeding occurs at this time. All dormant season treatments except the control, KDOT mix, 100% buffalograss/0% p.ryegrass, and 80% buffalograss/20% p.ryegrass increased in perennial ryegrass cover from initiation to 428 DAS, after which buffalograss cover increased throughout the remainder of the research trial. By 624 DAS, dormant season seedings of 100% buffalograss/0% p.ryegrass and 80% buffalograss/20% p.ryegrass treatments resulted in 85% and 78.5% buffalograss cover and 0.5% and 4.5% perennial ryegrass cover, respectively.

Table 3.2: Percent Cover of Dormant Season (January) Seeded Species at 64, 120, and 506 Days After Seeding

Seeding Mix	118 DAS		428 DAS		624 DAS	
	Buffalograss	P.Ryegrass	Buffalograss	P.Ryegrass	Buffalograss	P.Ryegrass
100% Buffalograss/ 0% P.Ryegrass	0.80	0	48.5	0	85.0	0.5
80% Buffalograss/ 20% P.Ryegrass	0.3	4.7	51.0	8.5	78.5	4.5
60% Buffalograss/ 40% P.Ryegrass	0.7	11.1	36.0	23	63.5	10.5
50% Buffalograss/ 50% P.Ryegrass	0.3	10.8	28.5	28.5	56.5	11.5
40% Buffalograss/ 60% P.Ryegrass	0.2	13.6	23.0	29.0	51.5	12.5
20% Buffalograss/ 80% P.Ryegrass	0.4	17.5	18.0	43.5	43.5	14.5
0% Buffalograss/ 100% P.Ryegrass	0.2	17.5	10.5	35.0	37.0	21.5
KDOT Standard Mix	0.1	0.4	13.5	0	70.0	2.0
Control (No Seeding)	0.1	0.1	38.5	0	42.0	3.5

All Fall-seeded pure stands and mixes of buffalograss and perennial ryegrass failed to establish (less than 30% vegetative cover of planted species), as did the KDOT mix (Table 3.3; Appendix A, Figures A.9–A.12; Appendix B.3).

Table 3.3: Percent Cover of Fall Seeded Species at 367 Days After Seeding

Seeding Mix	Buffalograss	P.Ryegrass
100% Buffalograss/ 0% P.Ryegrass	19.5%	1.5
80% Buffalograss/ 20% P.Ryegrass	15%	4
60% Buffalograss/ 40% P.Ryegrass	12.5%	10
50% Buffalograss/ 50% P.Ryegrass	8%	12
40% Buffalograss/ 60% P.Ryegrass	13%	15.5
20% Buffalograss/ 80% P.Ryegrass	11%	17.5%
0% Buffalograss/ 100% P.Ryegrass	8%	15.5%
KDOT Standard Mix	13.5%	0.5%
Control (No Seeding)	10%	2%

Objective 3. Evaluate buffalograss and perennial ryegrass composition (cover) one year after establishment.

One year after establishment (February 3, 2017; 373 DAS) for dormant seeding timing (January 26, 2016), all treatments that contained ≥40% perennial ryegrass resulted in significant increase in perennial ryegrass cover compared to the non-treated control (0%) and the standard KDOT blend (1%) (Appendix A, Figure A.1; Appendix B.1). For dormant seeding, treatments that contained 40, 50, 60, 80, and 100% perennial ryegrass in the blend resulted in 17, 18.5, 18, 32.5, and 24% perennial ryegrass cover, respectively, 373 DAS. Non-treated, KDOT, 100% buffalograss/0% p.ryegrass, 80% buffalograss/20% p.ryegrass, 60% buffalograss/40% p.ryegrass, 50% buffalograss/50% p.ryegrass, 40% buffalograss/60% p.ryegrass, 20% buffalograss/80% p.ryegrass, and 0% buffalograss/100% p.ryegrass treatments resulted in 0.5, 1, 0.5, 6.5, 17, 18.5, 18, 32.5, and 24% perennial ryegrass cover, respectively, 373 DAS (dormant seeding timing). One year after establishment (February 3, 2017; 373 DAS) for dormant seeding timing (January 26, 2016), treatments that contained 100% and 80% buffalograss in the blend resulted in 47.5% and 42.5% buffalograss cover, respectively (Appendix A, Figure A.2; Appendix B.1). For dormant seeding timing, buffalograss cover was significantly higher for blends that contained 100% and 80% buffalograss in the blend, 373 DAS, compared to the non-treated (16%) and the standard KDOT blend (32.5%). Non-treated, KDOT, 100% buffalograss/0% p.ryegrass, 80% buffalograss/20% p.ryegrass, 60% buffalograss/40% p.ryegrass, 50% buffalograss/50% p.ryegrass, 40% buffalograss/60% p.ryegrass, 20% buffalograss/80% p.ryegrass, and 0% buffalograss/100% p.ryegrass treatments resulted in 16, 32.5, 47.5, 42.5, 31.5, 28, 19, 18.5, and 16% buffalograss cover, respectively, 373 DAS for dormant seeding timing. All data is pooled over both locations (TRG and GHM).

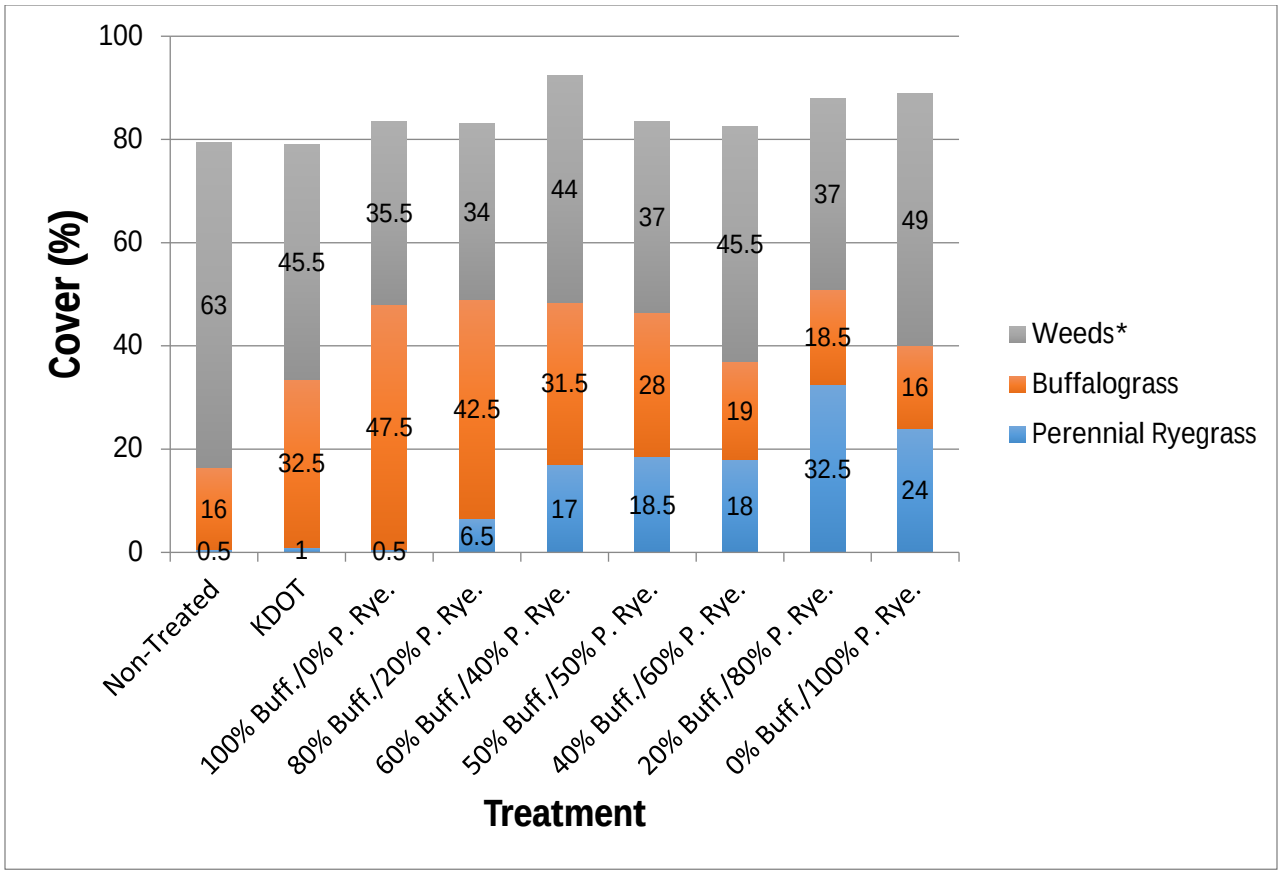

Figure 3.1: Buffalograss, Perennial Ryegrass, and Weed Composition (Cover) 1 Year (373 Days After Seeding) After Establishment for Dormant Seed Timing (January 26, 2016)

* Weed species present in research plots were considered any plant species that was not designated as a species to be seeded.

One year after establishment (June 1, 2017; 373 DAS) for Spring/Summer seeding timing (May 23, 2016), all treatments that contained ≥50% perennial ryegrass resulted in significant increase in perennial ryegrass cover compared to the non-treated control (1%) and the standard KDOT blend (1%) (Appendix A, Figure A.5; Appendix B.2). For Spring/Summer seeding, treatments that contained 50, 60, 80, and 100% perennial ryegrass in the blend resulted in 12.5, 16.5, 27, and 36.5% perennial ryegrass cover, respectively, 373 DAS. Non-treated, KDOT, 100% buffalograss/0% p.ryegrass, 80% buffalograss/20% p.ryegrass, 60% buffalograss/40% p.ryegrass, 50% buffalograss/50% p.ryegrass, 40% buffalograss/60% p.ryegrass, 20% buffalograss/80% p.ryegrass, and 0% buffalograss/100% p.ryegrass treatments resulted in 1, 1, 0, 4, 3, 12.5, 16.5, 27, and 36.5% perennial ryegrass cover, respectively, 373 DAS (Spring/Summer seeding timing). One year after establishment (June 1, 2017; 373 DAS) for Spring/Summer

seeding timing (May 23, 2016), all treatments that contained ≥40% buffalograss resulted in significant increase in buffalograss cover compared to the non-treated control (46.5%) and the standard KDOT blend (55.5%) (Appendix A, Figure A.6; Appendix B.2). For Spring/Summer seeding, treatments that contained 40, 50, 60, 80, and 100% buffalograss in the blend resulted in 74, 78.5, 91.5, 92, and 93.5% buffalograss cover, respectively, 373 DAS for Spring/Summer seeding timing. Non-treated, KDOT, 100% buffalograss/0% p.ryegrass, 80% buffalograss/20% p.ryegrass, 60% buffalograss/40% p.ryegrass, 50% buffalograss/50% p.ryegrass, 40% buffalograss/60% p.ryegrass, 20% buffalograss/80% p.ryegrass, and 0% buffalograss/100% p.ryegrass treatments resulted in 4.65, 55.5, 93.5, 92, 91.5, 78.5, 74, 56.5, and 37.5% buffalograss cover, respectively, 373 DAS, for Spring/Summer seeding timing. All data is pooled over both locations (TRG and GHM).

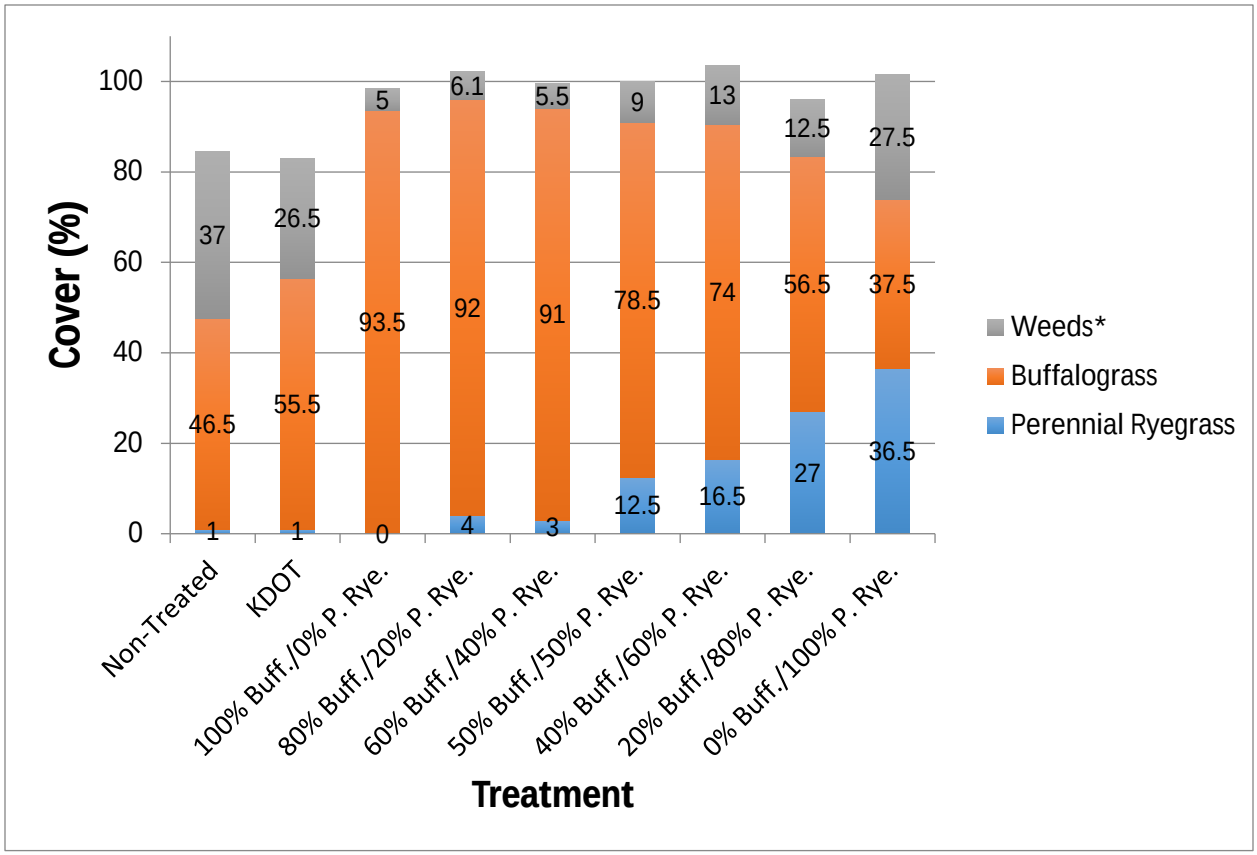

Figure 3.2: Buffalograss, Perennial Ryegrass, and Weed Composition (Cover) 1 Year (373 Days After Seeding) After Establishment for Spring/Summer Seed Timing (May 23, 2016)

* Weed species present in research plots were considered any plant species that was not designated as a species to be seeded.

One year after establishment (October 12, 2017; 387 DAS) for Fall seeding timing (September 20, 2016), all treatments that contained ≥60% perennial ryegrass resulted in significant increase in perennial ryegrass cover compared to the non-treated control (2%) and the standard KDOT blend (0.5%) (Appendix A, Figure A.9; Appendix B.3). For Fall seeding, treatments that contained 60%, 80%, and 100% perennial ryegrass in the blend resulted in 15.5%, 17.5%, and 15.5% perennial ryegrass cover, respectively, 387 DAS. Non-treated, KDOT, 100% buffalograss/0% p.ryegrass, 80% buffalograss/20% p.ryegrass, 60% buffalograss/40% p.ryegrass, 50% buffalograss/50% p.ryegrass, 40% buffalograss/60% p.ryegrass, 20% buffalograss/80% p.ryegrass, and 0% buffalograss/100% p.ryegrass treatments resulted in 2, 0.5, 1.5, 4, 10, 12, 15.5, 17.5, and 15.5% perennial ryegrass cover, respectively, 387 DAS (Fall seeding timing). One year after establishment (October 12, 2017; 387 DAS) for Fall seeding timing (September 20, 2016) all treatments resulted in buffalograss cover ranging 8–19.5%, 387 DAS. The non-treated control and the standard KDOT blend resulted in 10% and 13.5% buffalograss control, respectively, 387 DAS when seeded in the Fall (Appendix A, Figure A.10; Appendix B.3). Non-treated, KDOT, 100% buffalograss/0% p.ryegrass, 80% buffalograss/20% p.ryegrass, 60% buffalograss/40% p.ryegrass, 50% buffalograss/50% p.ryegrass, 40% buffalograss/60% p.ryegrass, 20% buffalograss/80% p.ryegrass, and 0% buffalograss/100% p.ryegrass treatments resulted in 10, 13.5, 19.5, 15, 12.5, 8, 13, 11, and 8% buffalograss cover, respectively, 387 DAS for Fall seeding timing. All data is pooled over both locations (TRG and GHM).

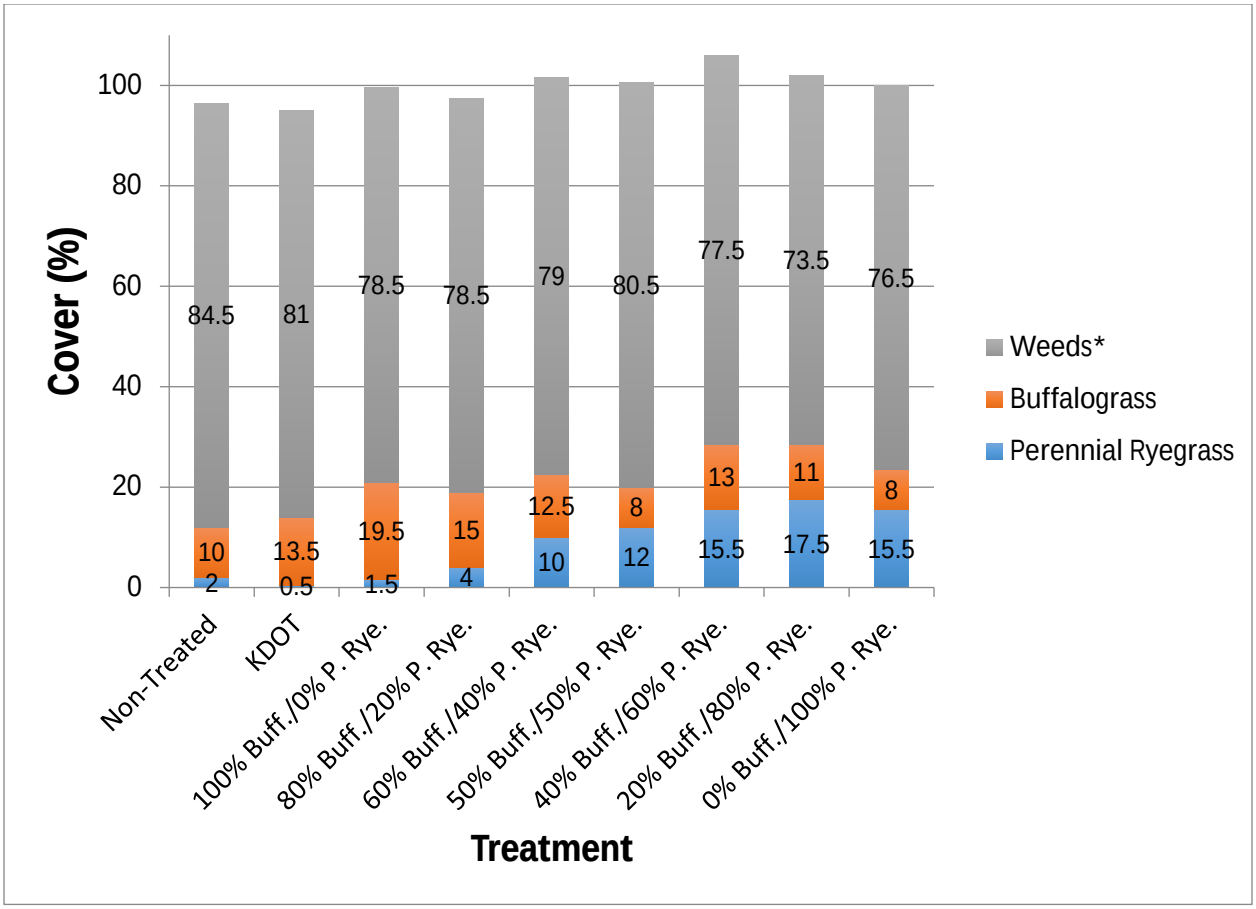

Figure 3.3: Buffalograss, Perennial Ryegrass, and Weed Composition (Cover) 1 Year (387 Days After Seeding) After Establishment for Fall Seed Timing (September 20, 2016)

* Weed species present in research plots were considered any plant species that was not designated as a species to be seeded.

Buffalograss was observed in plots that were not established with buffalograss at seeding. Researchers speculate native buffalograss could have contaminated research plot areas as well as re-introducing dormant seed to the soil surface when tilling practices were conducted.

Additional data and ratings not pertaining to the objective of this study (% weed cover and turfgrass quality) are contained in Appendix A and Appendix B.

Chapter 4: Conclusions

4.1 Conclusions

Establishment of Western Kansas buffalograss roadside plantings can be improved by adding perennial ryegrass and seeding as a blend. When buffalograss comprised 40% or more of the seeding mix, 88% or more of the final vegetative cover at 506 days after seeding was buffalograss.

Season of seeding has a strong effect on successful establishment. Spring and Summer seedings were most successful. Dormant season (January) seedings took longer to establish but had acceptable results. Fall seedings of any blend were not successful.

This project was conducted at only one location, near Hays, Kansas. Different results might occur at different locations or at times with differing conditions, such as drought. Buffalograss/perennial ryegrass seedings in Western Kansas can provide the cover and stability needed to meet regulatory standards.

Buffalograss blend seedings can help KDOT achieve several goals, including reduced roadside maintenance, greater roadside visibility for motorists, compliance with storm water control regulations on sites where other approaches have failed, and protection against the introduction of non-native invasive plant species.

4.2 Recommendations

1. Seed buffalograss and buffalograss/perennial ryegrass blends in the dormant season or preferably, in Spring or Summer. Fall buffalograss seedings waste of time and resources.
2. Inclusion of perennial ryegrass in the buffalograss seed blend will result in earlier vegetative coverage than with buffalograss alone. A blend will provide both short- and long-term roadside stabilization and water quality benefits.
3. KDOT might fund additional research into installation, site preparation, and management techniques to provide more precise planting and cultural methods that would increase success rates when seeding in various locations, soils, and conditions.

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Appendix A: Figures

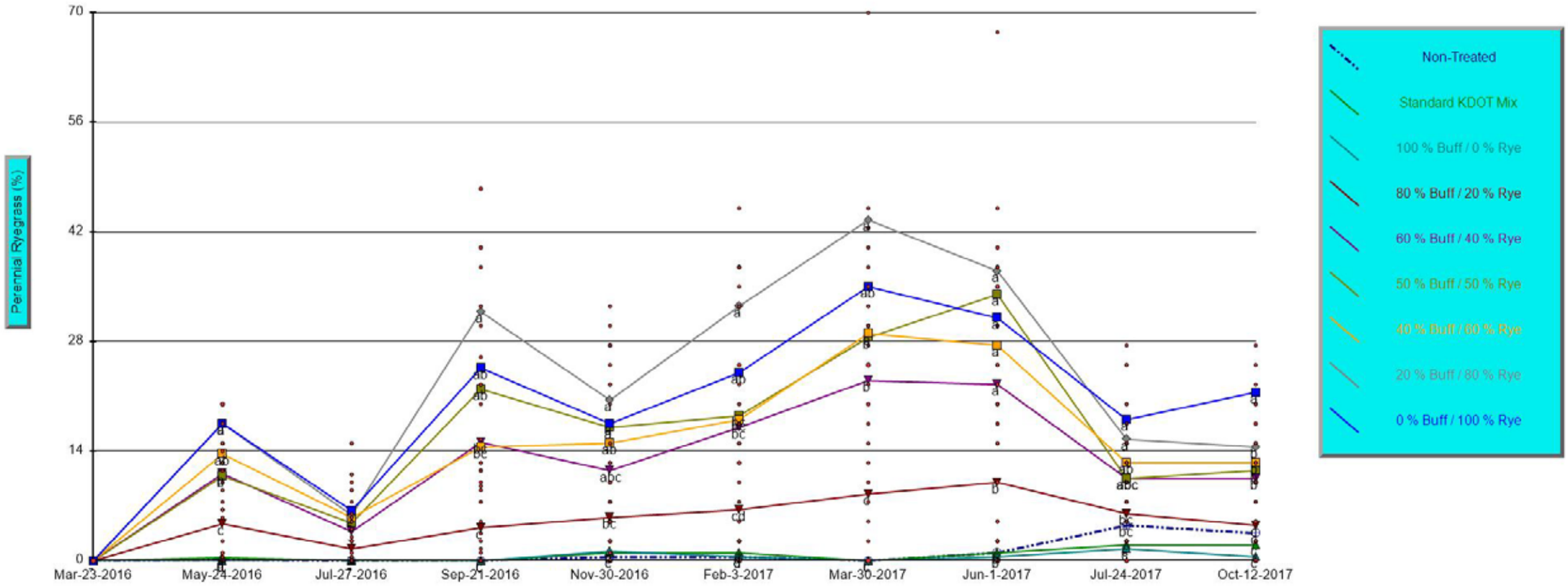

Figure A.1: Percent Visual 'Clubhouse' Perennial Ryegrass (*Lolium perenne*) Cover for Dormant Seeding Timing (January 26, 2016), Pooled Over Both Trial Locations (TRG & GHM)[A]

[A] Plots were seeded on January 26, 2016.

[B] Within each rating date, means with different letters are significantly different according to Student-Newman-Keuls LSD ($P \leq 0.05$)

[C] Means and corresponding letter separations can be found in appendix.

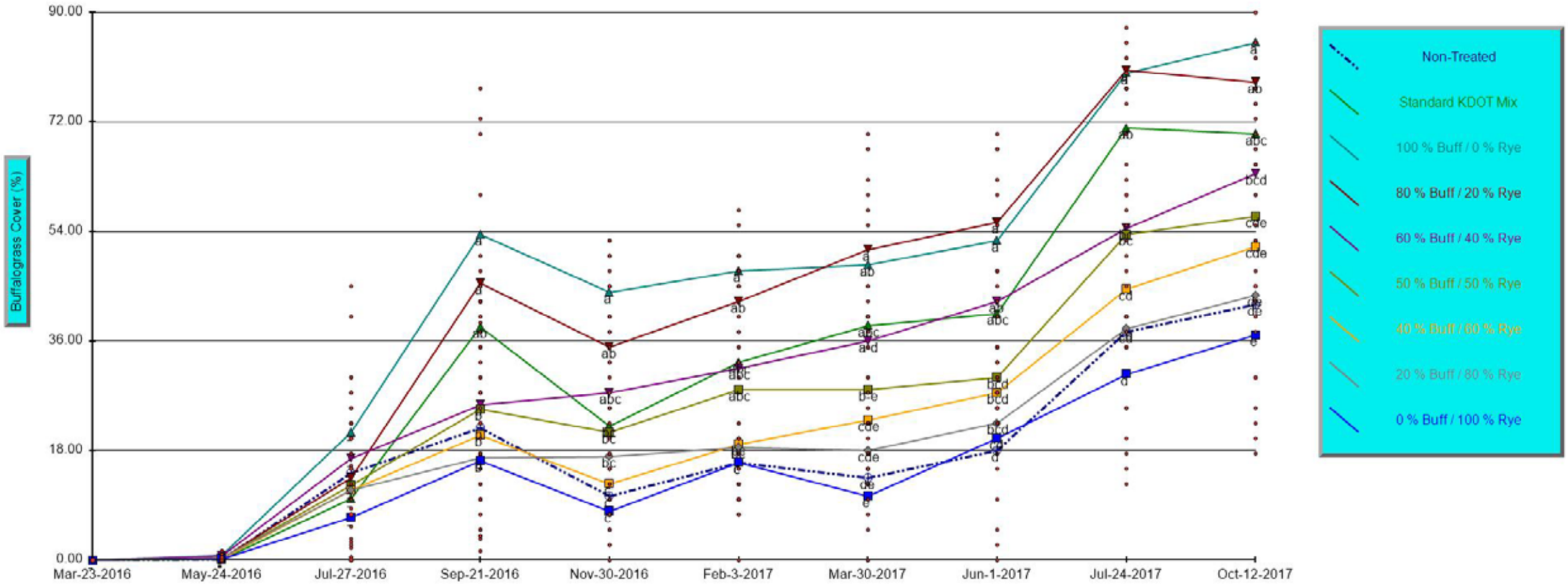

Figure A.2: Percent Visual 'Sharps Improved II' Buffalograss Cover (*Buchloe dactyloides* [Nutt.]) for Dormant Seeding Timing (January 26, 2016), Pooled Over Both Trial Locations (TRG & GHM)[A]

[A] Plots were seeded on January 26, 2016.

[B] Within each rating date, means with different letters are significantly different according to Student-Newman-Keuls LSD ($P \leq 0.05$)

[C] Means and corresponding letter separations can be found in appendix.

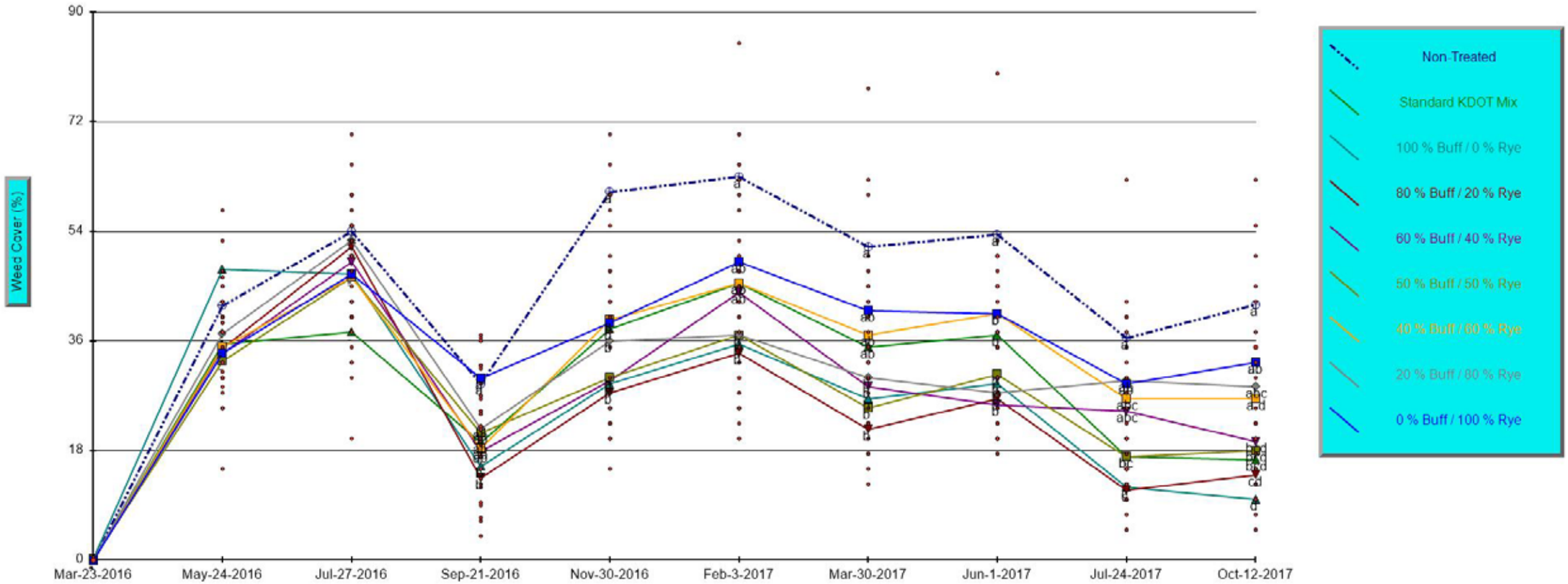

Figure A.3: Percent Visual Weed Cover[D] for Dormant Seeding Timing (January 26, 2016), Pooled Over Both Trial Locations (TRG & GHM)[A]

[A] Plots were seeded on January 26, 2016.

[B] Within each rating date, means with different letters are significantly different according to Student-Newman-Keuls LSD ($P \leq 0.05$)

[C] Means and corresponding letter separations can be found in appendix.

[D] Weed species present in research plots were considered any plant species that was not designated as a species to be seeded.

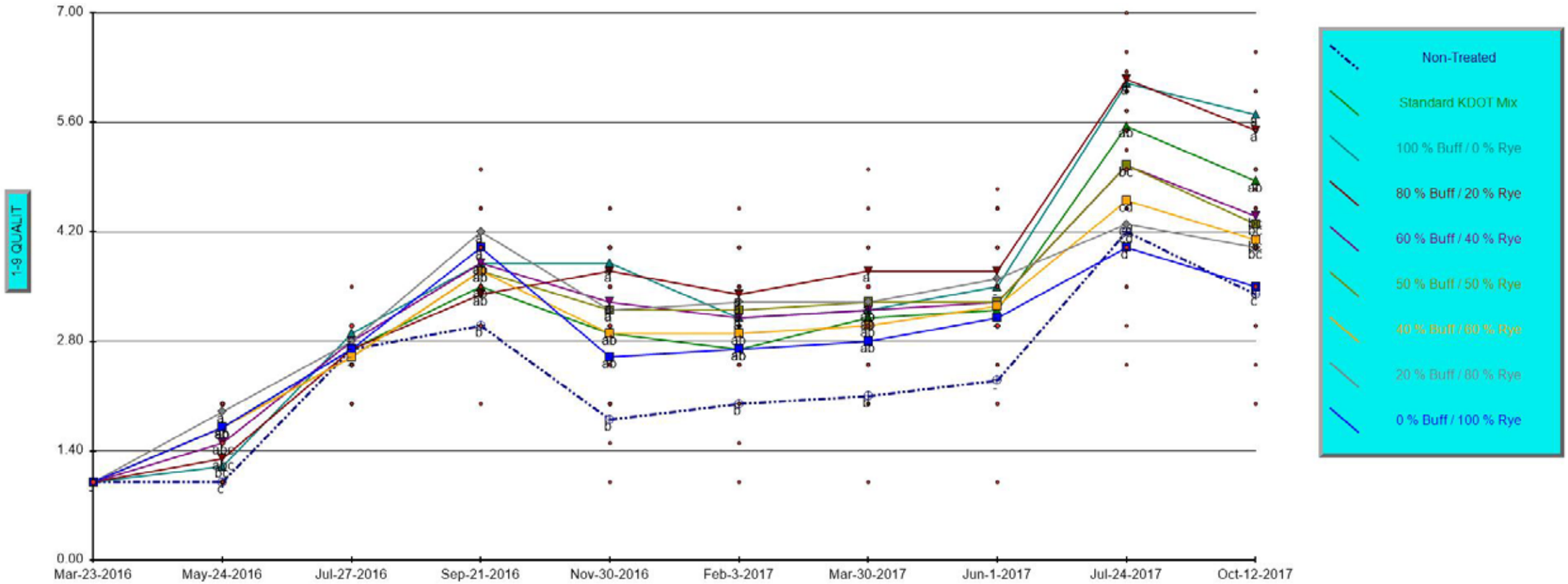

Figure A.4: Visual Turfgrass Quality[D] for Dormant Seeding Timing (January 26, 2016), Pooled Over Both Trial Locations (TRG & GHM)[A]

[A] Plots were seeded on January 26, 2016.

[B] Within each rating date, means with different letters are significantly different according to Student-Newman-Keuls LSD ($P \leq 0.05$)

[C] Means and corresponding letter separations can be found in appendix.

[D] Visual turfgrass quality is rated on a 1 to 9 scale where 9 being outstanding or ideal turf and 1 being poorest or dead. A rating of 6 or above is generally considered acceptable, according to Nation Turfgrass Evaluation Program (NTEP) standards.

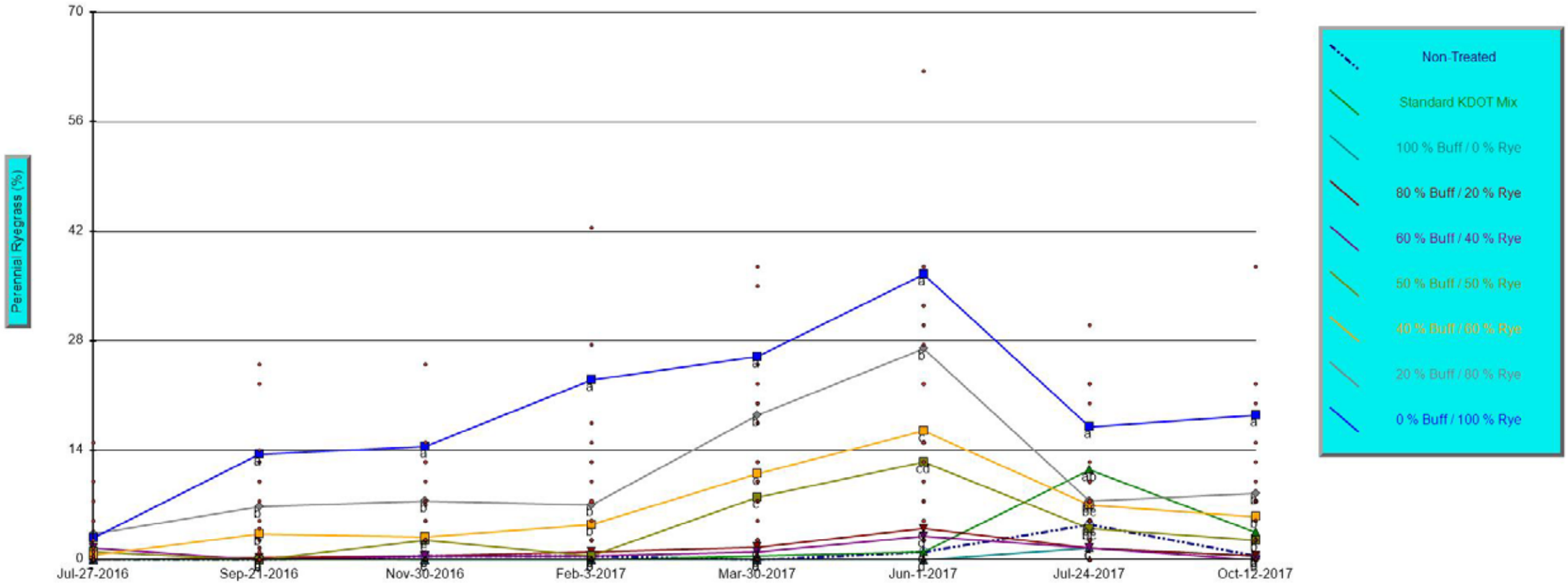

Figure A.5: Percent Visual 'Clubhouse' Perennial Ryegrass (*Lolium perenne*) Cover for Spring/Summer Seeding Timing (May 23, 2016), Pooled Over Both Trial Locations (TRG & GHM)[A]

[A] Plots were seeded on May 23, 2016.

[B] Within each rating date, means with different letters are significantly different according to Student-Newman-Keuls LSD ($P \leq 0.05$)

[C] Means and corresponding letter separations can be found in appendix.

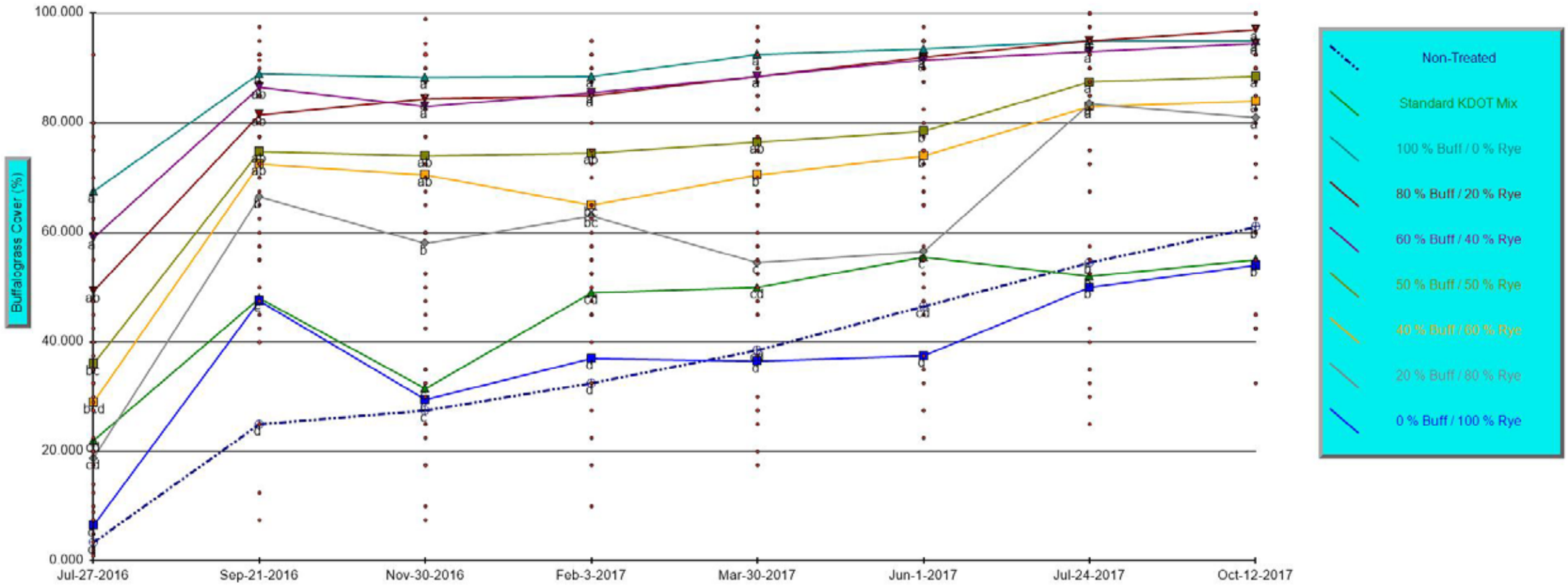

Figure A.6: Percent Visual 'Sharps Improved II' Buffalograss Cover (*Buchloe dactyloides* [Nutt.]) for Spring/Summer Seeding Timing (May 23, 2016), Pooled Over Both Trial Locations (TRG & GHM)[A]

[A] Plots were seeded on May 23, 2016.

[B] Within each rating date, means with different letters are significantly different according to Student-Newman-Keuls LSD ($P \leq 0.05$)

[C] Means and corresponding letter separations can be found in appendix.

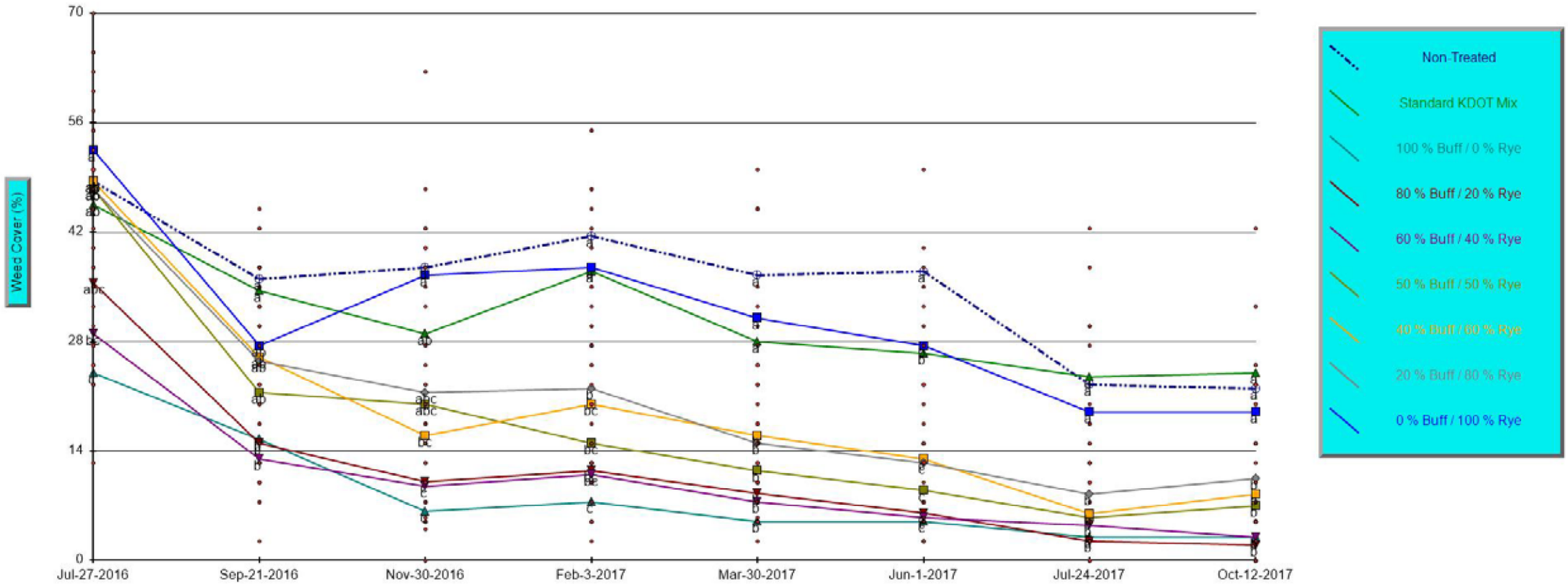

Figure A.7: Percent Visual Weed Cover[D] for Spring/Summer Seeding Timing (May 23, 2016), Pooled Over Both Trial Locations (TRG & GHM)[A]

[A] Plots were seeded on May 23, 2016.

[B] Within each rating date, means with different letters are significantly different according to Student-Newman-Keuls LSD ($P \leq 0.05$)

[C] Means and corresponding letter separations can be found in appendix.

[D] Weed species present in research plots were considered any plant species that was not designated as a species to be seeded.

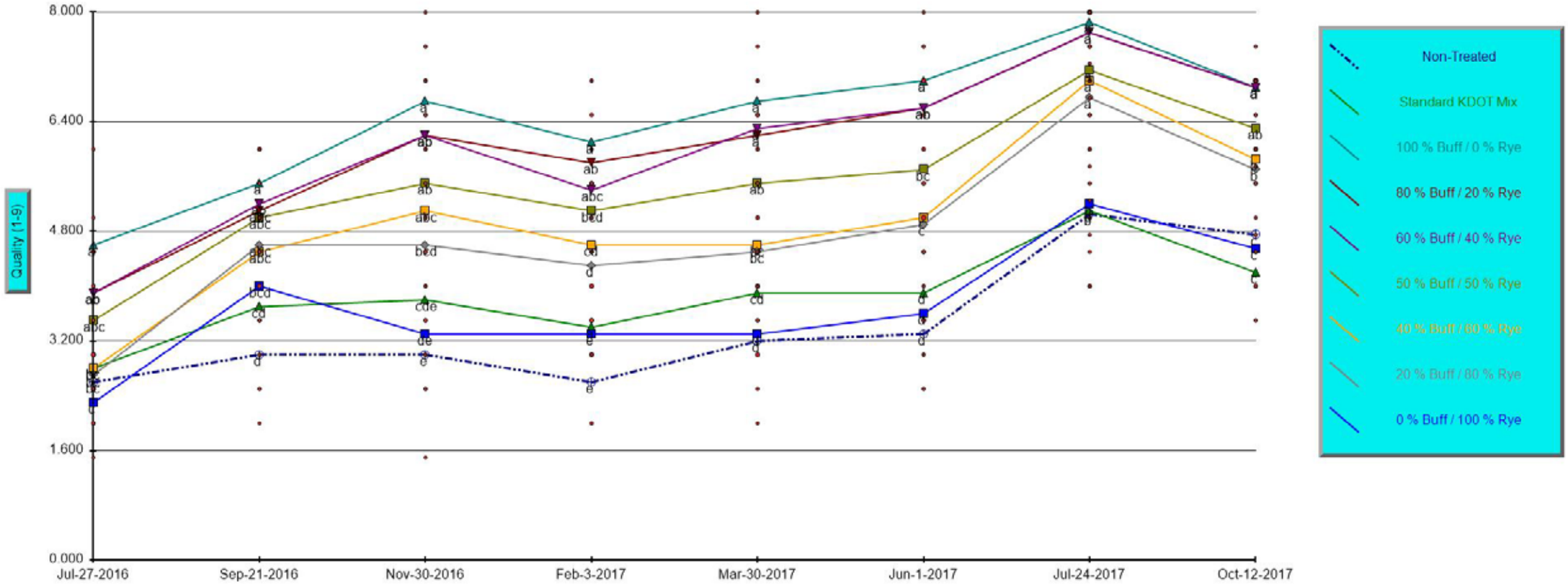

Figure A.8: Visual Turfgrass Quality[D] for Spring/Summer Seeding Timing (May 23, 2016), Pooled Over Both Trial Locations (TRG & GHM)[A]

[A] Plots were seeded on May 23, 2016.

[B] Within each rating date, means with different letters are significantly different according to Student-Newman-Keuls LSD ($P \leq 0.05$)

[C] Means and corresponding letter separations can be found in appendix.

[D] Visual turfgrass quality is rated on a 1 to 9 scale where 9 being outstanding or ideal turf and 1 being poorest or dead. A rating of 6 or above is generally considered acceptable, according to Nation Turfgrass Evaluation Program (NTEP) standards.

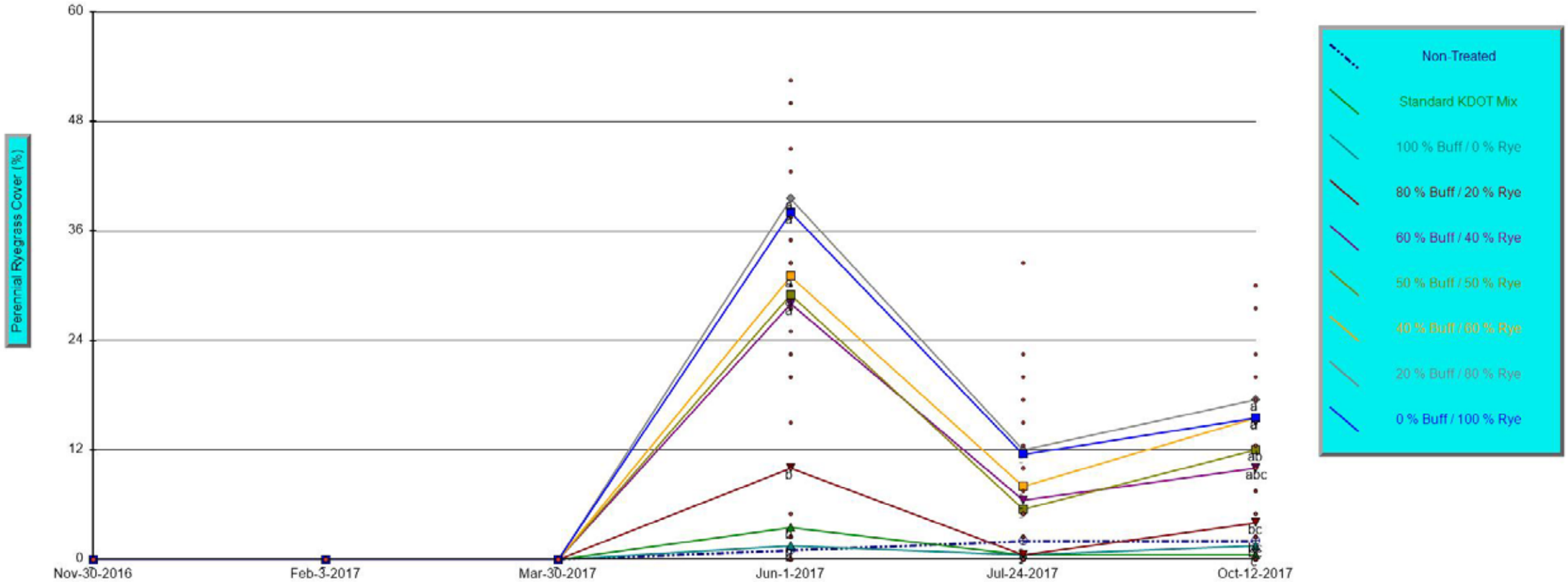

Figure A.9: Percent Visual 'Clubhouse' Perennial Ryegrass (*Lolium perenne*) Cover for Fall Seeding Timing (September 20, 2016), Pooled Over Both Trial Locations (TRG & GHM)[A]

[A] Plots were seeded on September 20, 2016.

[B] Within each rating date, means with different letters are significantly different according to Student-Newman-Keuls LSD ($P \leq 0.05$)

[C] Means and corresponding letter separations can be found in appendix.

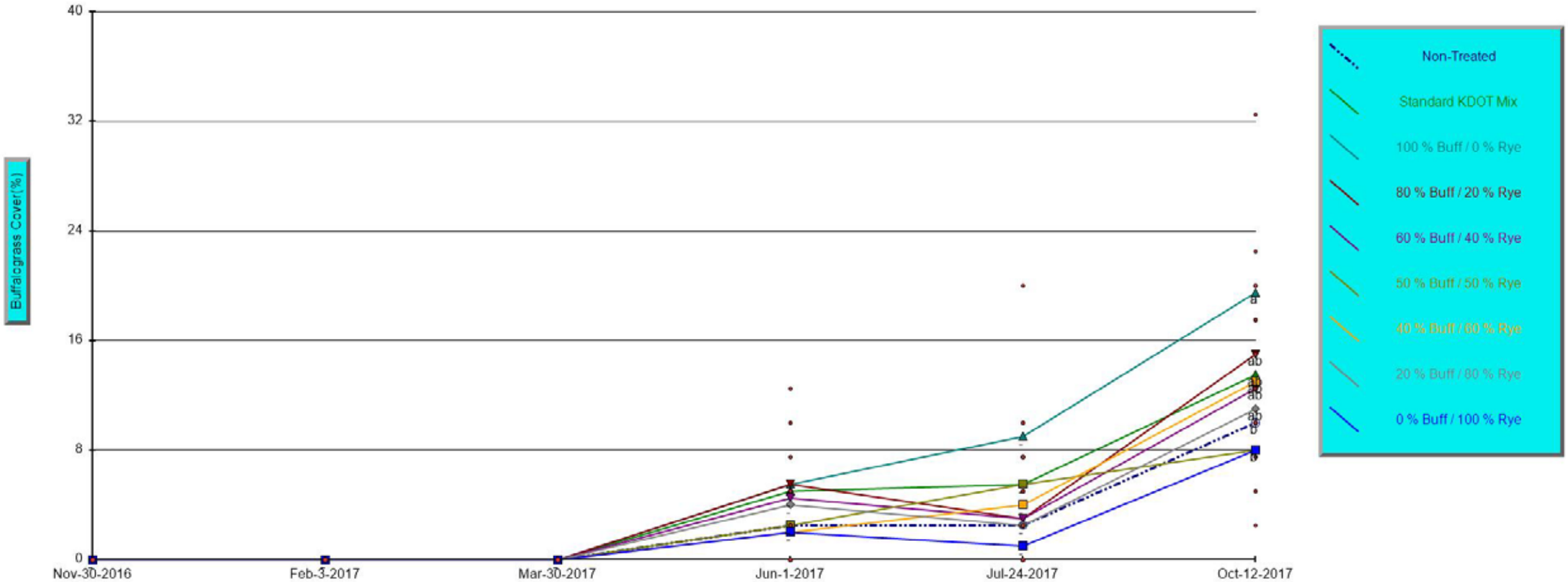

Figure A.10: Percent Visual 'Sharps Improved II' Buffalograss Cover (*Buchloe dactyloides* [Nutt.]) for Fall Seeding Timing (September 20, 2016), Pooled Over Both Trial Locations (TRG & GHM)[A]

[A] Plots were seeded on September 20, 2016.

[B] Within each rating date, means with different letters are significantly different according to Student-Newman-Keuls ($P \leq 0.05$)

[C] Means and corresponding letter separations can be found in appendix.

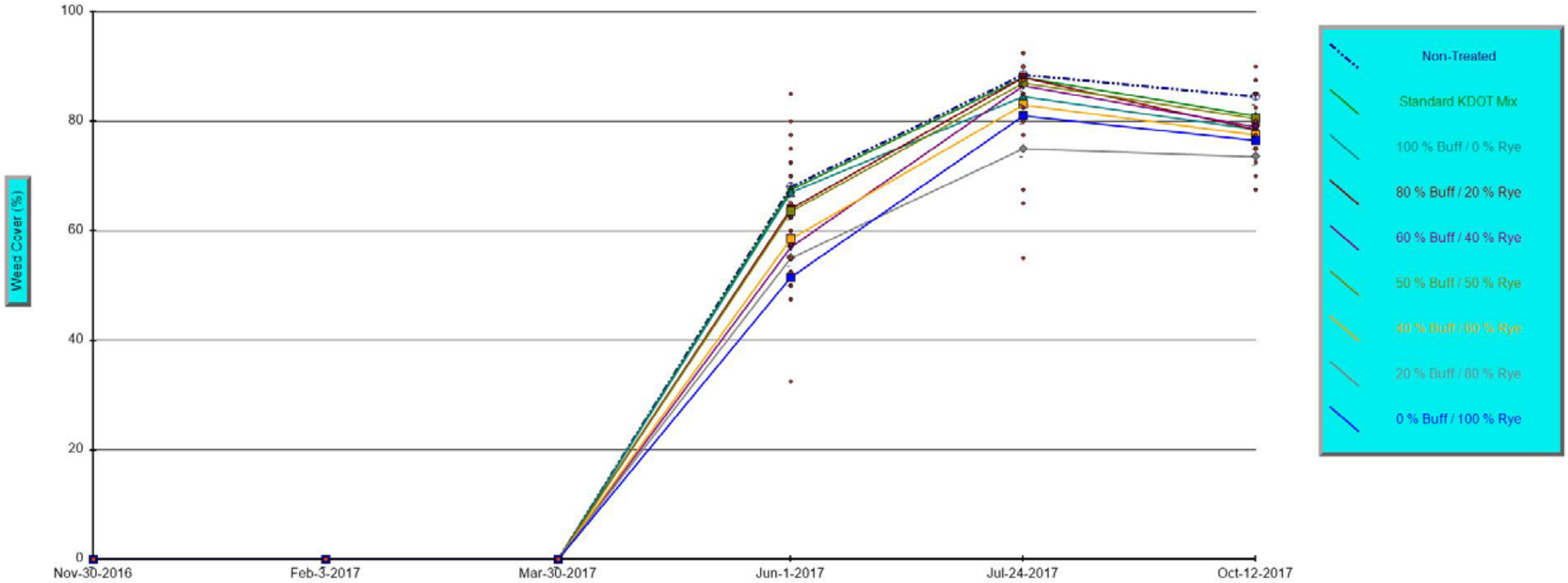

Figure A.11: Percent Visual Weed Cover[D] for Fall Seeding Timing (September 20, 2016), Pooled Over Both Trial Locations (TRG & GHM)[A]

[A] Plots were seeded on September 20, 2016.

[B] Within each rating date, means with different letters are significantly different according to Student-Newman-Keuls LSD ($P \leq 0.05$)

[C] Means and corresponding letter separations can be found in appendix.

[D] Weed species present in research plots were considered any plant species that was not designated as a species to be seeded.

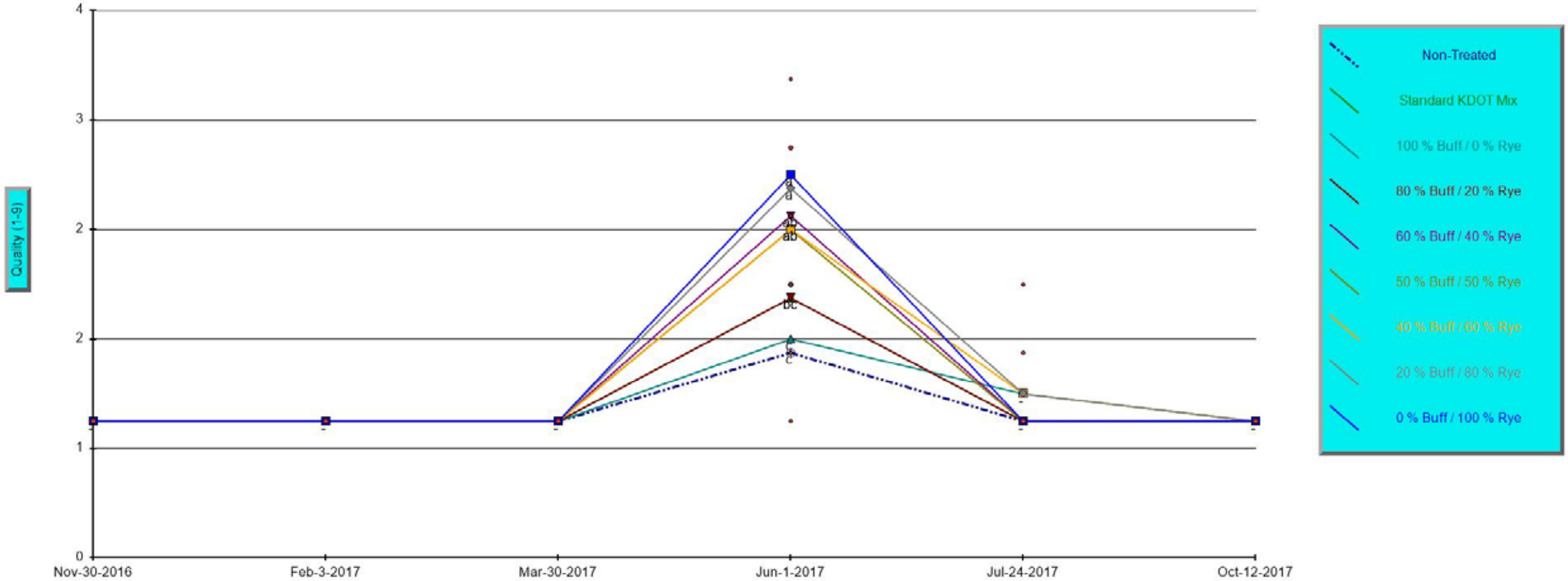

Figure A.12: Visual Turfgrass Quality[D] for Fall Seeding Timing (September 20, 2016), Pooled Over Both Trial Locations (TRG & GHM)[A]

[A] Plots were seeded on September 20, 2016.

[B] Within each rating date, means with different letters are significantly different according to Student-Newman-Keuls LSD ($P \leq 0.05$)

[C] Means and corresponding letter separations can be found in appendix.

[D] Visual turfgrass quality is rated on a 1 to 9 scale where 9 being outstanding or ideal turf and 1 being poorest or dead. A rating of 6 or above is generally considered acceptable, according to Nation Turfgrass Evaluation Program (NTEP) standards.

Appendix B: Data Sheets

Kansas State University

Preliminary Evaluation of Perennial Ryegrass and Buffalograss Blends for Seeded Roadside Establishment to Comply with Storm Water Control Regulations

Pest Type
W, Weed, G-BYRW7, G-WedStg = Weed or volunteer crop
Crop Code
LOLPE, BGRM, *Lolium perenne*, Perennial ryegrass = US
BUCDA, BGRM, *Buchloe dactyloides*, Buffalograss = US
, , , Weed = US
Part Rated
PLAGRA = plant - grasses
C = Crop is Part Rated
Rating Type
CANCRO = cover
CANWEE = cover, weed
QUALIT = quality
Rating Unit
% = percent
1-9 = 1-9 index/scale 6=acceptable, 1=poor, 9=excellent

B.1 Dormant (January) Seeding ANOVA – Pooled Over Both Locations (TRG & GHM)

(KDOT 16-1 January) ARM 2018.2 AOV Means Table

Kansas State University

Preliminary Evaluation of Perennial Ryegrass and Buffalograss Blends for Seeded Roadside Establishment to Comply with Storm Water Control Regulations (January Seeding Timing – Pooled over both locations (TRG &GHM))

Pest Type				W Weed				W Weed
Crop Code		LOLPE	BUCDA			LOLPE	BUCDA	
BBCH Scale		BGRM	BGRM			BGRM	BGRM	
Crop Scientific Name		Lolium perenne	Buchloe dactyl>			Lolium perenne	Buchloe dactyl>	
Crop Name		Perennial ryeg>	Buffalograss	Weed		Perennial ryeg>	Buffalograss	Weed
Part Rated					PLAGRA C			
Rating Date		Mar-23-2016	Mar-23-2016	Mar-23-2016	Mar-23-2016	May-24-2016	May-24-2016	May-24-2016
Rating Type		CANCRO	CANCRO	CANWEE	QUALIT	CANCRO	CANCRO	CANWEE
Rating Unit		%	%	%	1-9	%	%	%
Number of Subsamples		1	1	1	1	1	1	1
Days After First/Last Applic.		56 56	56 56	56 56	56 56	118 118	118 118	118 118
Trt-Eval Interval		56 DA-A	56 DA-A	56 DA-A	56 DA-A	118 DA-A	118 DA-A	118 DA-A
Trt No.	Treatment Name	Appl Code	1*	2*	3*	4*	5*	6*	7*
1	Non-Treated	A	0.0-	0.0-	0.00-	1.0-	0.10d	0.10-	41.80-
2	Standard KDOT Mix	A	0.0-	0.0-	0.00-	1.0-	0.40d	0.10-	35.50-
3	100 % Buff / 0 % Rye	A	0.0-	0.0-	0.30-	1.0-	0.00d	0.80-	47.80-
4	80 % Buff / 20 % Rye	A	0.0-	0.0-	0.00-	1.0-	4.70c	0.30-	34.80-
5	60 % Buff / 40 % Rye	A	0.0-	0.0-	0.10-	1.0-	11.10b	0.70-	34.00-
6	50 % Buff / 50 % Rye	A	0.0-	0.0-	0.20-	1.0-	10.80b	0.30-	32.70-
7	40 % Buff / 60 % Rye	A	0.0-	0.0-	0.00-	1.0-	13.60ab	0.20-	35.00-
8	20 % Buff / 80 % Rye	A	0.0-	0.0-	0.10-	1.0-	17.50a	0.40-	37.20-
9	0 % Buff / 100 % Rye	A	0.0-	0.0-	0.00-	1.0-	17.50a	0.20-	34.00-
LSD P=.05			.	.	0.217	.	3.428	0.509	9.768
Standard Deviation			0.00	0.00	0.169	0.00	2.661	0.395	7.582
CV			0.0	0.0	216.95	0.0	31.64	114.63	20.5
Levene's F			0.00	0.00	1.35	0.00	1.691	0.592	0.955
Levene's Prob(F)			.	.	0.251	.	0.134	0.778	0.485
Skewness			.	.	1.9669*	.	0.1214	1.1266*	-0.0099
Kurtosis			.	.	1.9536*	.	-1.4645*	0.6697	0.3808
Replicate F			0.000	0.000	0.780	0.000	0.311	0.659	0.850
Replicate Prob(F)			1.0000	1.0000	0.5462	1.0000	0.8684	0.6248	0.5043
Treatment F			0.000	0.000	2.098	0.000	37.323	2.013	2.036
Treatment Prob(F)			1.0000	1.0000	0.0656	1.0000	0.0001	0.0767	0.0735

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls)
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
* Adjusted means Could not calculate LSD (% mean diff) for columns 1,2,4 because error mean square = 0.

Kansas State University

Preliminary Evaluation of Perennial Ryegrass and Buffalograss Blends for Seeded Roadside Establishment to Comply with Storm Water Control Regulations (January Seeding Timing – Pooled over both locations (TRG &GHM))

Pest Type					W Weed			
Crop Code			LOLPE	BUCDA			LOLPE	BUCDA
BBCH Scale			BGRM	BGRM			BGRM	BGRM
Crop Scientific Name			Lolium perenne	Buchloe dactyl>			Lolium perenne	Buchloe dactyl>
Crop Name			Perennial ryeg>	Buffalograss	Weed		Perennial ryeg>	Buffalograss
Part Rated		PLAGRA C				PLAGRA C		
Rating Date		May-24-2016	Jul-27-2016	Jul-27-2016	Jul-27-2016	Jul-27-2016	Sep-21-2016	Sep-21-2016
Rating Type		QUALIT	CANCRO	CANCRO	CANWEE	QUALIT	CANCRO	CANCRO
Rating Unit		1-9	%	%	%	1-9	%	%
Number of Subsamples		1	1	1	1	1	1	1
Days After First/Last Applic.		118 118	182 182	182 182	182 182	182 182	238 238	238 238
Trt-Eval Interval		118 DA-A	182 DA-A	182 DA-A	182 DA-A	182 DA-A	238 DA-A	238 DA-A
Trt No.	Treatment Name	Appl Code	8*	9*	10*	11*	12*	13*	14*
1	Non-Treated	A	1.00c	0.00-	14.30-	54.00-	2.70-	0.00c	21.70b
2	Standard KDOT Mix	A	1.70ab	0.00-	10.10-	37.50-	2.70-	0.00c	38.30ab
3	100 % Buff / 0 % Rye	A	1.20bc	0.10-	21.00-	47.00-	2.90-	0.00c	53.50a
4	80 % Buff / 20 % Rye	A	1.30abc	1.50-	13.50-	51.50-	2.70-	4.20c	45.50a
5	60 % Buff / 40 % Rye	A	1.50abc	3.70-	16.70-	49.00-	2.80-	15.10bc	25.50b
6	50 % Buff / 50 % Rye	A	1.70ab	4.80-	12.30-	46.50-	2.60-	21.90ab	24.80b
7	40 % Buff / 60 % Rye	A	1.70ab	5.50-	11.50-	46.50-	2.60-	14.50bc	20.50b
8	20 % Buff / 80 % Rye	A	1.90a	5.80-	11.50-	52.50-	2.80-	31.80a	16.80b
9	0 % Buff / 100 % Rye	A	1.70ab	6.40-	7.00-	47.00-	2.70-	24.60ab	16.30b
LSD P=.05			0.421	4.277	8.394	12.547	0.443	11.582	15.448
Standard Deviation			0.326	3.320	6.516	9.740	0.344	8.990	11.992
CV			21.45	107.49	49.74	20.31	12.64	72.18	41.05
Levene's F			0.47	2.591	0.293	0.386	0.22	3.978	0.384
Levene's Prob(F)			0.869	0.024*	0.964	0.921	0.985	0.002*	0.922
Skewness			-0.0812	1.418*	0.6688	-0.4225	-0.4365	1.0787*	0.6075
Kurtosis			-1.4049*	1.198	-0.168	0.3756	-0.2664	-0.0339	0.0267
Replicate F			0.208	3.470	24.175	0.921	2.346	4.034	7.569
Replicate Prob(F)			0.9318	0.0183	0.0001	0.4639	0.0756	0.0093	0.0002
Treatment F			4.078	3.287	1.898	1.227	0.399	8.937	6.190
Treatment Prob(F)			0.0019	0.0075	0.0950	0.3155	0.9129	0.0001	0.0001

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls)
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
* Adjusted means
Could not calculate LSD (% mean diff) for columns 1,2,4 because error mean square = 0.

Kansas State University

Preliminary Evaluation of Perennial Ryegrass and Buffalograss Blends for Seeded Roadside Establishment to Comply with Storm Water Control Regulations (January Seeding Timing – Pooled over both locations (TRG &GHM))

Pest Type		W Weed				W Weed		
Crop Code				LOLPE	BUCDA			LOLPE
BBCH Scale				BGRM	BGRM			BGRM
Crop Scientific Name				Lolium perenne	Buchloe dactyl>			Lolium perenne
Crop Name		Weed		Perennial ryeg>	Buffalograss	Weed		Perennial ryeg>
Part Rated			PLAGRA C				PLAGRA C	
Rating Date		Sep-21-2016	Sep-21-2016	Nov-30-2016	Nov-30-2016	Nov-30-2016	Nov-30-2016	Feb-3-2017
Rating Type		CANWEE	QUALIT	CANCRO	CANCRO	CANWEE	QUALIT	CANCRO
Rating Unit		%	1-9	%	%	%	1-9	%
Number of Subsamples		1	1	1	1	1	1	1
Days After First/Last Applic.		238 238	238 238	308 308	308 308	308 308	308 308	373 373
Trt-Eval Interval		238 DA-A	238 DA-A	308 DA-A	308 DA-A	308 DA-A	308 DA-A	373 DA-A
Trt No.	Treatment Name	Appl Code	15*	16*	17*	18*	19*	20*	21*
1	Non-Treated	A	29.00a	3.00b	0.50c	10.50c	60.50a	1.80b	0.50d
2	Standard KDOT Mix	A	19.30ab	3.50ab	1.00c	22.00bc	38.00b	2.90ab	1.00d
3	100 % Buff / 0 % Rye	A	15.40b	3.80ab	1.20c	44.00a	29.00b	3.80a	0.50d
4	80 % Buff / 20 % Rye	A	13.50b	3.40ab	5.50bc	35.00ab	27.50b	3.70a	6.50cd
5	60 % Buff / 40 % Rye	A	17.90ab	3.80ab	11.50abc	27.50abc	29.50b	3.30a	17.00bc
6	50 % Buff / 50 % Rye	A	20.90ab	3.70ab	17.00a	21.00bc	30.00b	3.20a	18.50bc
7	40 % Buff / 60 % Rye	A	18.40ab	3.70ab	15.00ab	12.50c	39.50b	2.90ab	18.00bc
8	20 % Buff / 80 % Rye	A	21.60ab	4.20a	20.50a	17.00bc	36.00b	3.20a	32.50a
9	0 % Buff / 100 % Rye	A	29.90a	4.00a	17.50a	8.00c	39.00b	2.60ab	24.00ab
LSD P=.05			8.076	0.615	8.326	14.449	12.841	0.862	10.168
Standard Deviation			6.269	0.477	6.463	11.216	9.967	0.669	7.893
CV			30.35	12.98	64.85	51.11	27.27	21.97	59.95
Levene's F			0.185	0.216	2.633	0.684	0.951	0.602	1.414
Levene's Prob(F)			0.991	0.986	0.022*	0.703	0.489	0.77	0.224
Skewness			0.1591	-0.0672	0.9188*	0.5939	0.6534	-0.2676	0.8163*
Kurtosis			-0.3219	1.1797	-0.4075	-0.9976	-0.6745	-0.6265	-0.541
Replicate F			2.240	2.098	2.347	2.926	4.909	1.161	2.734
Replicate Prob(F)			0.0867	0.1042	0.0755	0.0361	0.0034	0.3465	0.0460
Treatment F			3.966	2.677	7.656	5.603	5.173	4.053	10.744
Treatment Prob(F)			0.0023	0.0225	0.0001	0.0002	0.0003	0.0020	0.0001

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls)
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
* Adjusted means
Could not calculate LSD (% mean diff) for columns 1,2,4 because error mean square = 0.

Kansas State University

Preliminary Evaluation of Perennial Ryegrass and Buffalograss Blends for Seeded Roadside Establishment to Comply with Storm Water Control Regulations (January Seeding Timing – Pooled over both locations (TRG &GHM))

Pest Type			W Weed				W Weed	
Crop Code		BUCDA			LOLPE	BUCDA		
BBCH Scale		BGRM			BGRM	BGRM		
Crop Scientific Name		Buchloe dactyl>			Lolium perenne	Buchloe dactyl>		
Crop Name		Buffalograss	Weed		Perennial ryeg>	Buffalograss	Weed	
Part Rated				PLAGRA C				PLAGRA C
Rating Date		Feb-3-2017	Feb-3-2017	Feb-3-2017	Mar-30-2017	Mar-30-2017	Mar-30-2017	Mar-30-2017
Rating Type		CANCRO	CANWEE	QUALIT	CANCRO	CANCRO	CANWEE	QUALIT
Rating Unit		%	%	1-9	%	%	%	1-9
Number of Subsamples		1	1	1	1	1	1	1
Days After First/Last Applic.		373 373	373 373	373 373	428 428	428 428	428 428	428 428
Trt-Eval Interval		373 DA-A	373 DA-A	373 DA-A	428 DA-A	428 DA-A	428 DA-A	428 DA-A
Trt No.	Treatment Name	Appl Code	22*	23*	24*	25*	26*	27*	28*
1	Non-Treated	A	16.00c	63.00a	2.00b	0.00c	13.50de	51.50a	2.10b
2	Standard KDOT Mix	A	32.50abc	45.50ab	2.70ab	0.00c	38.50abc	35.00ab	3.10ab
3	100 % Buff / 0 % Rye	A	47.50a	35.50b	3.10a	0.00c	48.50ab	26.50b	3.20ab
4	80 % Buff / 20 % Rye	A	42.50ab	34.00b	3.40a	8.50c	51.00a	21.50b	3.70a
5	60 % Buff / 40 % Rye	A	31.50abc	44.00ab	3.10a	23.00b	36.00a-d	28.50b	3.20ab
6	50 % Buff / 50 % Rye	A	28.00abc	37.00b	3.20a	28.50b	28.00b-e	25.00b	3.30a
7	40 % Buff / 60 % Rye	A	19.00bc	45.50ab	2.90ab	29.00b	23.00cde	37.00ab	3.00ab
8	20 % Buff / 80 % Rye	A	18.50bc	37.00b	3.30a	43.50a	18.00cde	30.00b	3.30a
9	0 % Buff / 100 % Rye	A	16.00c	49.00ab	2.70ab	35.00ab	10.50e	41.00ab	2.80ab
LSD P=.05			16.215	15.544	0.678	10.129	15.962	12.955	0.744
Standard Deviation			12.587	12.066	0.526	7.862	12.390	10.056	0.577
CV			45.04	27.81	17.95	42.24	41.76	30.58	18.76
Levene's F			0.82	0.412	0.279	1.914	0.439	1.005	0.616
Levene's Prob(F)			0.59	0.906	0.969	0.088	0.889	0.45	0.759
Skewness			0.189	0.5388	-0.2434	0.5784	0.598	1.1178*	0.0071
Kurtosis			-1.429*	-0.1992	0.6375	-0.178	-0.4012	1.8633*	1.3093
Replicate F			2.443	4.175	4.180	1.343	2.618	2.735	3.025
Replicate Prob(F)			0.0667	0.0078	0.0078	0.2757	0.0533	0.0459	0.0318
Treatment F			4.270	2.822	3.293	22.794	7.084	4.288	2.917
Treatment Prob(F)			0.0014	0.0173	0.0074	0.0001	0.0001	0.0014	0.0146

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls)
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
* Adjusted means
Could not calculate LSD (% mean diff) for columns 1,2,4 because error mean square = 0.

Kansas State University

Preliminary Evaluation of Perennial Ryegrass and Buffalograss Blends for Seeded Roadside Establishment to Comply with Storm Water Control Regulations (January Seeding Timing – Pooled over both locations (TRG &GHM))

Pest Type				W Weed				W Weed
Crop Code		LOLPE	BUCDA			LOLPE	BUCDA	
BBCH Scale		BGRM	BGRM			BGRM	BGRM	
Crop Scientific Name		Lolium perenne	Buchloe dactyl>			Lolium perenne	Buchloe dactyl>	
Crop Name		Perennial ryeg>	Buffalograss	Weed		Perennial ryeg>	Buffalograss	Weed
Part Rated					PLAGRA C			
Rating Date		Jun-1-2017	Jun-1-2017	Jun-1-2017	Jun-1-2017	Jul-24-2017	Jul-24-2017	Jul-24-2017
Rating Type		CANCRO	CANCRO	CANWEE	QUALIT	CANCRO	CANCRO	CANWEE
Rating Unit		%	%	%	1-9	%	%	%
Number of Subsamples		1	1	1	1	1	1	1
Days After First/Last Applic.		491 491	491 491	491 491	491 491	544 544	544 544	544 544
Trt-Eval Interval		491 DA-A	491 DA-A	491 DA-A	491 DA-A	544 DA-A	544 DA-A	544 DA-A
Trt No.	Treatment Name	Appl Code	29*	30*	31*	32*	33*	34*	35*
1	Non-Treated	A	1.00b	18.00d	53.50a	2.300-	4.50bc	37.50cd	36.50a
2	Standard KDOT Mix	A	1.00b	40.50abc	37.00b	3.200-	2.00c	71.00ab	17.00bc
3	100 % Buff / 0 % Rye	A	0.50b	52.50a	29.00b	3.500-	1.50c	80.00a	12.00c
4	80 % Buff / 20 % Rye	A	10.00b	55.50a	26.50b	3.700-	6.00bc	80.50a	11.50c
5	60 % Buff / 40 % Rye	A	22.50a	42.50ab	25.50b	3.300-	10.50abc	54.50bc	24.50abc
6	50 % Buff / 50 % Rye	A	34.00a	30.00bcd	30.50b	3.300-	10.50abc	53.50bc	17.00bc
7	40 % Buff / 60 % Rye	A	27.50a	27.50bcd	40.50b	3.250-	12.50ab	44.50cd	26.50abc
8	20 % Buff / 80 % Rye	A	37.00a	22.50bcd	27.50b	3.600-	15.50a	38.00cd	29.50ab
9	0 % Buff / 100 % Rye	A	31.00a	20.00cd	40.50b	3.100-	18.00a	30.50d	29.00ab
LSD P=.05			10.777	14.461	10.272	0.8091	6.095	15.830	10.128
Standard Deviation			8.366	11.225	7.973	0.6280	4.732	12.288	7.862
CV			45.77	32.69	23.11	19.32	52.57	22.57	34.77
Levene's F			1.914	0.448	0.514	0.404	1.165	2.416	1.848
Levene's Prob(F)			0.088	0.884	0.838	0.911	0.346	0.034*	0.10
Skewness			0.6123	0.3657	1.2528*	-0.0912	0.764*	-0.1275	0.978*
Kurtosis			-0.0921	-0.2015	3.1129*	1.0204	0.0124	-1.239	1.2298
Replicate F			2.637	3.066	3.885	3.345	2.693	4.898	5.470
Replicate Prob(F)			0.0521	0.0302	0.0111	0.0214	0.0485	0.0034	0.0018
Treatment F			16.469	7.740	6.680	2.092	7.663	11.742	6.056
Treatment Prob(F)			0.0001	0.0001	0.0001	0.0664	0.0001	0.0001	0.0001

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls)
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
* Adjusted means
Could not calculate LSD (% mean diff) for columns 1,2,4 because error mean square = 0.

Kansas State University

Preliminary Evaluation of Perennial Ryegrass and Buffalograss Blends for Seeded Roadside Establishment to Comply with Storm Water Control Regulations (January Seeding Timing – Pooled over both locations (TRG &GHM))

Pest Type					W Weed	
Crop Code			LOLPE	BUCDA		
BBCH Scale			BGRM	BGRM		
Crop Scientific Name			Lolium perenne	Buchloe dactyl>		
Crop Name			Perennial ryeg>	Buffalograss	Weed	
Part Rated		PLAGRA C				PLAGRA C
Rating Date		Jul-24-2017	Oct-12-2017	Oct-12-2017	Oct-12-2017	Oct-12-2017
Rating Type		QUALIT	CANCRO	CANCRO	CANWEE	QUALIT
Rating Unit		1-9	%	%	%	1-9
Number of Subsamples		1	1	1	1	1
Days After First/Last Applic.		544 544	624 624	624 624	624 624	624 624
Trt-Eval Interval		544 DA-A	624 DA-A	624 DA-A	624 DA-A	624 DA-A
Trt Treatment No.	Name	Appl Code	36*	37*	38*	39*	40*
1	Non-Treated	A	4.200cd	3.50c	42.00de	42.00a	3.400c
2	Standard KDOT Mix	A	5.550ab	2.00c	70.00abc	16.50bcd	4.850ab
3	100 % Buff / 0 % Rye	A	6.100a	0.50c	85.00a	10.00d	5.700a
4	80 % Buff / 20 % Rye	A	6.150a	4.50c	78.50ab	14.00cd	5.500a
5	60 % Buff / 40 % Rye	A	5.050bc	10.50b	63.50bcd	19.50bcd	4.400bc
6	50 % Buff / 50 % Rye	A	5.050bc	11.50b	56.50cde	18.00bcd	4.300bc
7	40 % Buff / 60 % Rye	A	4.600cd	12.50b	51.50cde	26.50a-d	4.100bc
8	20 % Buff / 80 % Rye	A	4.300cd	14.50b	43.50de	28.50abc	4.000bc
9	0 % Buff / 100 % Rye	A	4.000d	21.50a	37.00e	32.50ab	3.500c
LSD P=.05			0.6912	4.982	15.804	11.740	0.8055
Standard Deviation			0.5365	3.867	12.267	9.113	0.6253
CV			10.73	42.97	20.93	39.53	14.16
Levene's F			0.985	0.849	1.413	1.584	1.388
Levene's Prob(F)			0.464	0.567	0.224	0.164	0.235
Skewness			-0.2068	0.6587	-0.3284	1.0543*	-0.2039
Kurtosis			-0.3966	-0.3463	-0.9315	0.6357	-0.4433
Replicate F			10.434	0.943	3.479	4.064	3.766
Replicate Prob(F)			0.0001	0.4521	0.0181	0.0089	0.0128
Treatment F			11.139	15.837	9.436	6.195	8.265
Treatment Prob(F)			0.0001	0.0001	0.0001	0.0001	0.0001

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls)
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
* Adjusted means
Could not calculate LSD (% mean diff) for columns 1,2,4 because error mean square = 0.

B.2 Spring/Summer (May) Seeding ANOVA – Pooled Over Both Locations (TRG & GHM)

(KDOT 16-1ab May) ARM 2018.2 AOV Means Table

Kansas State University

Preliminary Evaluation of Perennial Ryegrass and Buffalograss Blends for Seeded Roadside Establishment to Comply with Storm Water Control Regulations (May Seeding Timing – Pooled over both Locations (TRG& GHM))

Pest Type				W Weed				W Weed
Crop Code		LOLPE	BUCDA			LOLPE	BUCDA	
BBCH Scale		BGRM	BGRM			BGRM	BGRM	
Crop Scientific Name		Lolium perenne	Buchloe dactyl>			Lolium perenne	Buchloe dactyl>	
Crop Name		Perennial ryeg>	Buffalograss	Weed		Perennial ryeg>	Buffalograss	Weed
Part Rated					PLAGRA C			
Rating Date		Jul-27-2016	Jul-27-2016	Jul-27-2016	Jul-27-2016	Sep-21-2016	Sep-21-2016	Sep-21-2016
Rating Type		CANCRO	CANCRO	CANWEE	QUALIT	CANCRO	CANCRO	CANWEE
Rating Unit		%	%	%	1-9	%	%	%
Number of Subsamples		1	1	1	1	1	1	1
Days After First/Last Applic.		64 64	64 64	64 64	64 64	120 120	120 120	120 120
Trt-Eval Interval		64 DA-A	64 DA-A	64 DA-A	64 DA-A	120 DA-A	120 DA-A	120 DA-A
Trt Treatment No.	Name	Appl Code	1*	2*	3*	4*	5*	6*	7*
1	Untreated	A	0.00-	3.40d	48.50ab	2.60bc	0.00b	25.00d	36.00a
2	Standard KDOT Mix	A	0.00-	22.00cd	45.50ab	2.80bc	0.00b	48.00c	34.50a
3	100 % Buff / 0 % Rye	A	0.00-	67.50a	24.00c	4.60a	0.30b	89.00a	15.50b
4	80 % Buff / 20 % Rye	A	0.00-	49.30ab	35.50abc	3.90ab	0.30b	81.50ab	15.00b
5	60 % Buff / 40 % Rye	A	1.50-	59.00a	29.00bc	3.90ab	0.00b	86.50ab	13.00b
6	50 % Buff / 50 % Rye	A	1.00-	36.00bc	47.50ab	3.50abc	0.00b	74.80ab	21.50ab
7	40 % Buff / 60 % Rye	A	0.60-	29.00bcd	48.50ab	2.80bc	3.30b	72.50ab	26.00ab
8	20 % Buff / 80 % Rye	A	3.30-	18.80cd	47.50ab	2.70bc	6.80b	66.50b	25.50ab
9	0 % Buff / 100 % Rye	A	2.80-	6.50d	52.50a	2.30c	13.50a	47.50c	27.50ab
LSD P=.05			3.114	18.828	14.144	0.843	5.264	14.860	11.164
Standard Deviation			2.417	14.615	10.979	0.654	4.086	11.535	8.666
CV			236.48	45.12	26.11	20.24	151.96	17.56	36.36
Levene's F			0.903	2.276	0.923	0.794	3.668	1.107	0.668
Levene's Prob(F)			0.524	0.044*	0.509	0.612	0.003*	0.382	0.716
Skewness			3.6426*	0.6774	0.0637	0.5919	2.6436*	-0.7247*	0.0346
Kurtosis			13.8588*	-0.5202	-0.7569	0.0462	6.8664*	-0.0431	-1.0572
Replicate F			5.126	1.512	1.494	2.511	1.032	0.152	0.797
Replicate Prob(F)			0.0026	0.2221	0.2273	0.0612	0.4059	0.9609	0.5359
Treatment F			1.384	11.865	4.162	6.949	6.532	17.173	4.602
Treatment Prob(F)			0.2411	0.0001	0.0017	0.0001	0.0001	0.0001	0.0008

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls)
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
* Adjusted means

Kansas State University

Preliminary Evaluation of Perennial Ryegrass and Buffalograss Blends for Seeded Roadside Establishment to Comply with Storm Water Control Regulations (May Seeding Timing – Pooled over both Locations (TRG& GHM))

Pest Type					W Weed			
Crop Code			LOLPE	BUCDA			LOLPE	BUCDA
BBCH Scale			BGRM	BGRM			BGRM	BGRM
Crop Scientific Name			Lolium perenne	Buchloe dactyl>			Lolium perenne	Buchloe dactyl>
Crop Name			Perennial ryeg>	Buffalograss	Weed		Perennial ryeg>	Buffalograss
Part Rated		PLAGRA C				PLAGRA C		
Rating Date		Sep-21-2016	Nov-30-2016	Nov-30-2016	Nov-30-2016	Nov-30-2016	Feb-3-2017	Feb-3-2017
Rating Type		QUALIT	CANCRO	CANCRO	CANWEE	QUALIT	CANCRO	CANCRO
Rating Unit		1-9	%	%	%	1-9	%	%
Number of Subsamples		1	1	1	1	1	1	1
Days After First/Last Applic.		120 120	190 190	190 190	190 190	190 190	255 255	255 255
Trt-Eval Interval		120 DA-A	190 DA-A	190 DA-A	190 DA-A	190 DA-A	255 DA-A	255 DA-A
Trt No.	Treatment Name	Appl Code	8*	9*	10*	11*	12*	13*	14*
1	Untreated	A	3.00d	0.50c	27.50c	37.50a	3.00e	0.50b	32.50d
2	Standard KDOT Mix	A	3.70cd	0.00c	31.50c	29.00ab	3.80cde	0.00b	49.00cd
3	100 % Buff / 0 % Rye	A	5.50a	0.00c	88.30a	6.30c	6.70a	0.00b	88.50a
4	80 % Buff / 20 % Rye	A	5.10abc	0.50c	84.40a	10.10c	6.20ab	1.00b	85.00a
5	60 % Buff / 40 % Rye	A	5.20ab	0.50c	83.00a	9.50c	6.20ab	0.50b	85.50a
6	50 % Buff / 50 % Rye	A	5.00abc	2.50c	74.00ab	20.00abc	5.50ab	0.50b	74.50ab
7	40 % Buff / 60 % Rye	A	4.50abc	2.90c	70.50ab	16.00bc	5.10abc	4.50b	65.00bc
8	20 % Buff / 80 % Rye	A	4.60abc	7.50b	58.00b	21.50abc	4.60bcd	7.00b	63.00bc
9	0 % Buff / 100 % Rye	A	4.00bcd	14.50a	29.50c	36.50a	3.30de	23.00a	37.00d
LSD P=.05			0.954	3.662	16.415	12.469	1.189	5.878	14.602
Standard Deviation			0.740	2.843	12.742	9.679	0.923	4.562	11.335
CV			16.41	88.52	20.98	46.73	18.71	110.98	17.59
Levene's F			0.899	2.125	0.811	1.005	0.263	2.801	0.754
Levene's Prob(F)			0.528	0.059	0.598	0.449	0.974	0.016*	0.644
Skewness			-0.5014	2.2766*	-0.4339	0.893*	-0.0388	3.0667*	-0.5031
Kurtosis			-0.2091	5.8904*	-1.0799	0.2821	-0.5397	10.9791*	-0.6101
Replicate F			0.441	0.762	1.339	1.352	0.773	1.158	2.721
Replicate Prob(F)			0.7780	0.5577	0.2771	0.2726	0.5511	0.3478	0.0467
Treatment F			5.987	14.627	19.360	7.133	10.621	13.448	17.319
Treatment Prob(F)			0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

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Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
* Adjusted means

Kansas State University

Preliminary Evaluation of Perennial Ryegrass and Buffalograss Blends for Seeded Roadside Establishment to Comply with Storm Water Control Regulations (May Seeding Timing – Pooled over both Locations (TRG& GHM))

Pest Type		W Weed				W Weed		
Crop Code				LOLPE	BUCDA			LOLPE
BBCH Scale				BGRM	BGRM			BGRM
Crop Scientific Name				Lolium perenne	Buchloe dactyl>			Lolium perenne
Crop Name		Weed		Perennial ryeg>	Buffalograss	Weed		Perennial ryeg>
Part Rated			PLAGRA C				PLAGRA C	
Rating Date		Feb-3-2017	Feb-3-2017	Mar-30-2017	Mar-30-2017	Mar-30-2017	Mar-30-2017	Jun-1-2017
Rating Type		CANWEE	QUALIT	CANCRO	CANCRO	CANWEE	QUALIT	CANCRO
Rating Unit		%	1-9	%	%	%	1-9	%
Number of Subsamples		1	1	1	1	1	1	1
Days After First/Last Applic.		255 255	255 255	310 310	310 310	310 310	310 310	373 373
Trt-Eval Interval		255 DA-A	255 DA-A	310 DA-A	310 DA-A	310 DA-A	310 DA-A	373 DA-A
Trt No.	Treatment Name	Appl Code	15*	16*	17*	18*	19*	20*	21*
1	Untreated	A	41.50a	2.60e	0.00d	38.50cd	36.50a	3.20d	1.00d
2	Standard KDOT Mix	A	37.00a	3.40e	0.50d	50.00cd	28.00a	3.90cd	1.00d
3	100 % Buff / 0 % Rye	A	7.50c	6.10a	0.00d	92.50a	5.00b	6.70a	0.00d
4	80 % Buff / 20 % Rye	A	11.50bc	5.80ab	1.60d	88.50a	8.60b	6.20a	4.00d
5	60 % Buff / 40 % Rye	A	11.00bc	5.40abc	1.00d	88.50a	7.50b	6.30a	3.00d
6	50 % Buff / 50 % Rye	A	15.00bc	5.10bcd	8.00c	76.50ab	11.50b	5.50ab	12.50cd
7	40 % Buff / 60 % Rye	A	20.00bc	4.60cd	11.00c	70.50b	16.00b	4.60bc	16.50c
8	20 % Buff / 80 % Rye	A	22.00b	4.30d	18.50b	54.50c	15.00b	4.50bc	27.00b
9	0 % Buff / 100 % Rye	A	37.50a	3.30e	26.00a	36.50d	31.00a	3.30d	36.50a
LSD P=.05			9.026	0.727	5.054	13.365	7.940	0.913	8.477
Standard Deviation			7.006	0.564	3.923	10.374	6.163	0.709	6.580
CV			31.06	12.51	53.01	15.67	34.86	14.44	58.35
Levene's F			0.822	0.414	5.318	1.723	0.912	0.217	2.058
Levene's Prob(F)			0.589	0.905	0.001*	0.127	0.518	0.986	0.067
Skewness			0.7191*	0.0346	1.4801*	-0.5258	1.091*	0.1073	1.618*
Kurtosis			-0.3306	-0.7084	1.7423*	-0.7933	0.5458	-0.6602	2.8391*
Replicate F			2.224	1.893	1.685	2.244	1.390	1.149	1.945
Replicate Prob(F)			0.0885	0.1358	0.1777	0.0862	0.2594	0.3514	0.1269
Treatment F			17.026	23.023	29.006	22.414	17.001	17.340	19.805
Treatment Prob(F)			0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls)
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
* Adjusted means

Kansas State University

Preliminary Evaluation of Perennial Ryegrass and Buffalograss Blends for Seeded Roadside Establishment to Comply with Storm Water Control Regulations (May Seeding Timing – Pooled over both Locations (TRG& GHM))

Pest Type			W Weed				W Weed	
Crop Code		BUCDA			LOLPE	BUCDA		
BBCH Scale		BGRM			BGRM	BGRM		
Crop Scientific Name		Buchloe dactyl>			Lolium perenne	Buchloe dactyl>		
Crop Name		Buffalograss	Weed		Perennial ryeg>	Buffalograss	Weed	
Part Rated				PLAGRA C				PLAGRA C
Rating Date		Jun-1-2017	Jun-1-2017	Jun-1-2017	Jul-24-2017	Jul-24-2017	Jul-24-2017	Jul-24-2017
Rating Type		CANCRO	CANWEE	QUALIT	CANCRO	CANCRO	CANWEE	QUALIT
Rating Unit		%	%	1-9	%	%	%	1-9
Number of Subsamples		1	1	1	1	1	1	1
Days After First/Last Applic.		373 373	373 373	373 373	426 426	426 426	426 426	426 426
Trt-Eval Interval		373 DA-A	373 DA-A	373 DA-A	426 DA-A	426 DA-A	426 DA-A	426 DA-A
Trt No.	Treatment Name	Appl Code	22*	23*	24*	25*	26*	27*	28*
1	Untreated	A	46.50cd	37.00a	3.30d	4.50bc	54.50b	22.50a	5.050b
2	Standard KDOT Mix	A	55.50c	26.50b	3.90d	11.50ab	52.00b	23.50a	5.100b
3	100 % Buff / 0 % Rye	A	93.50a	5.00c	7.00a	1.50c	95.00a	3.00b	7.850a
4	80 % Buff / 20 % Rye	A	92.00a	6.10c	6.60ab	1.50c	95.00a	2.50b	7.700a
5	60 % Buff / 40 % Rye	A	91.50a	5.50c	6.60ab	1.50c	93.00a	4.50b	7.700a
6	50 % Buff / 50 % Rye	A	78.50b	9.00c	5.70bc	4.00bc	87.50a	5.50b	7.150a
7	40 % Buff / 60 % Rye	A	74.00b	13.00c	5.00c	7.00bc	83.00a	6.00b	7.000a
8	20 % Buff / 80 % Rye	A	56.50c	12.50c	4.90c	7.50bc	83.50a	8.50b	6.750a
9	0 % Buff / 100 % Rye	A	37.50d	27.50b	3.60d	17.00a	50.00b	19.00a	5.200b
LSD P=.05			10.696	7.162	0.905	6.221	15.390	8.463	0.8553
Standard Deviation			8.303	5.560	0.703	4.829	11.946	6.570	0.6639
CV			11.95	35.21	13.57	77.6	15.5	62.24	10.04
Levene's F			2.37	1.461	0.794	1.237	2.853	1.406	1.116
Levene's Prob(F)			0.037*	0.206	0.612	0.307	0.015*	0.227	0.376
Skewness			-0.5397	0.9427*	0.0045	1.7266*	-1.038*	1.4995*	-0.592
Kurtosis			-0.8241	0.0505	-0.9164	3.4296*	-0.1375	1.6338*	-0.772
Replicate F			3.896	0.486	0.405	1.409	2.515	2.470	1.174
Replicate Prob(F)			0.0109	0.7459	0.8036	0.2534	0.0609	0.0645	0.3409
Treatment F			32.509	21.890	19.488	5.926	12.931	8.554	15.709
Treatment Prob(F)			0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls)
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
* Adjusted means

Kansas State University

Preliminary Evaluation of Perennial Ryegrass and Buffalograss Blends for Seeded Roadside Establishment to Comply with Storm Water Control Regulations (May Seeding Timing – Pooled over both Locations (TRG& GHM))

Pest Type				W Weed	
Crop Code		LOLPE	BUCDA		
BBCH Scale		BGRM	BGRM		
Crop Scientific Name		Lolium perenne	Buchloe dactyl>		
Crop Name		Perennial ryeg>	Buffalograss	Weed	
Part Rated					PLAGRA C
Rating Date		Oct-12-2017	Oct-12-2017	Oct-12-2017	Oct-12-2017
Rating Type		CANCRO	CANCRO	CANWEE	QUALIT
Rating Unit		%	%	%	1-9
Number of Subsamples		1	1	1	1
Days After First/Last Applic.		506 506	506 506	506 506	506 506
Trt-Eval Interval		506 DA-A	506 DA-A	506 DA-A	506 DA-A
Trt No.	Treatment Name	Appl Code	29*	30*	31*	32*
1	Untreated	A	0.50b	61.00b	22.00a	4.750c
2	Standard KDOT Mix	A	3.50b	55.00b	24.00a	4.200c
3	100 % Buff / 0 % Rye	A	0.50b	95.00a	3.00b	6.900a
4	80 % Buff / 20 % Rye	A	0.50b	97.00a	2.00b	6.900a
5	60 % Buff / 40 % Rye	A	0.00b	94.50a	3.00b	6.900a
6	50 % Buff / 50 % Rye	A	2.50b	88.50a	7.00b	6.300ab
7	40 % Buff / 60 % Rye	A	5.50b	84.00a	8.50b	5.850b
8	20 % Buff / 80 % Rye	A	8.50b	81.00a	10.50b	5.700b
9	0 % Buff / 100 % Rye	A	18.50a	54.00b	19.00a	4.550c
LSD P=.05			6.292	11.749	8.221	0.6343
Standard Deviation			4.884	9.120	6.381	0.4924
CV			109.89	11.56	58.01	8.51
Levene's F			2.309	2.155	0.997	1.14
Levene's Prob(F)			0.041*	0.055	0.455	0.361
Skewness			2.7817*	-0.9336*	1.2011*	-0.4851
Kurtosis			9.3116*	-0.3688	0.9999	-0.823
Replicate F			1.747	4.091	1.608	1.667
Replicate Prob(F)			0.1641	0.0086	0.1962	0.1819
Treatment F			7.499	18.520	8.987	23.497
Treatment Prob(F)			0.0001	0.0001	0.0001	0.0001

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls)
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
* Adjusted means

B.3 Fall (September) Seeding ANOVA – Pooled Over Both Locations (TRG & GHM)

(KDOT 16-1ac September) ARM 2018.2 AOV Means Table

Kansas State University

Preliminary Evaluation of Perennial Ryegrass and Buffalograss Blends for Seeded Roadside Establishment to Comply with Storm Water Control Regulations (Sept Seeding Timing – Pooled over both locations (TRG &GHM)

Pest Type				W Weed				W Weed
Crop Code		LOLPE	BUCDA			LOLPE	BUCDA	
BBCH Scale		BGRM	BGRM			BGRM	BGRM	
Crop Scientific Name		Lolium perenne	Buchloe dactyl>			Lolium perenne	Buchloe dactyl>	
Crop Name		Perennial ryeg>	Buffalograss	Weed		Perennial ryeg>	Buffalograss	Weed
Part Rated					PLAGRA C			
Rating Date		Nov-30-2016	Nov-30-2016	Nov-30-2016	Nov-30-2016	Feb-3-2017	Feb-3-2017	Feb-3-2017
Rating Type		CANCRO	CANCRO	CANWEE	QUALIT	CANCRO	CANCRO	CANWEE
Rating Unit		%	%	%	1-9	%	%	%
Number of Subsamples		1	1	1	1	1	1	1
Days After First/Last Applic.		71 71	71 71	71 71	71 71	136 136	136 136	136 136
Trt-Eval Interval		56 DA-A	56 DA-A	56 DA-A	71 DA-A	136 DA-A	136 DA-A	136 DA-A
Trt No.	Treatment Name	Appl Code	1*	2*	3*	4*	5*	6*	7*
1	Untreated	A	0.0-	0.0-	0.0-	1.0-	0.0-	0.0-	0.0-
2	Standard KDOT Mix	A	0.0-	0.0-	0.0-	1.0-	0.0-	0.0-	0.0-
3	100 % Buff / 0 % Rye	A	0.0-	0.0-	0.0-	1.0-	0.0-	0.0-	0.0-
4	80 % Buff / 20 % Rye	A	0.0-	0.0-	0.0-	1.0-	0.0-	0.0-	0.0-
5	60 % Buff / 40 % Rye	A	0.0-	0.0-	0.0-	1.0-	0.0-	0.0-	0.0-
6	50 % Buff / 50 % Rye	A	0.0-	0.0-	0.0-	1.0-	0.0-	0.0-	0.0-
7	40 % Buff / 60 % Rye	A	0.0-	0.0-	0.0-	1.0-	0.0-	0.0-	0.0-
8	20 % Buff / 80 % Rye	A	0.0-	0.0-	0.0-	1.0-	0.0-	0.0-	0.0-
9	0 % Buff / 100 % Rye	A	0.0-	0.0-	0.0-	1.0-	0.0-	0.0-	0.0-
LSD P=.05			.	.	.	.	.	.	.
Standard Deviation			0.00	0.00	0.00	0.00	0.00	0.00	0.00
CV			0.0	0.0	0.0	0.0	0.0	0.0	0.0
Levene's F			0.00	0.00	0.00	0.00	0.00	0.00	0.00
Levene's Prob(F)			.	.	.	.	.	.	.
Skewness			.	.	.	.	.	.	.
Kurtosis			.	.	.	.	.	.	.
Replicate F			0.000	0.000	0.000	0.000	0.000	0.000	0.000
Replicate Prob(F)			1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Treatment F			0.000	0.000	0.000	0.000	0.000	0.000	0.000
Treatment Prob(F)			1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls)
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
* Adjusted means
Could not calculate LSD (% mean diff) for columns 1,2,3,4,5,6,7,8,9,10,11,12,24 because error mean square = 0.

Kansas State University

Preliminary Evaluation of Perennial Ryegrass and Buffalograss Blends for Seeded Roadside Establishment to Comply with Storm Water Control Regulations (Sept Seeding Timing – Pooled over both locations (TRG &GHM)

Pest Type					W Weed			
Crop Code			LOLPE	BUCDA			LOLPE	BUCDA
BBCH Scale			BGRM	BGRM			BGRM	BGRM
Crop Scientific Name			Lolium perenne	Buchloe dactyl>			Lolium perenne	Buchloe dactyl>
Crop Name			Perennial ryeg>	Buffalograss	Weed		Perennial ryeg>	Buffalograss
Part Rated		PLAGRA C				PLAGRA C		
Rating Date		Feb-3-2017	Mar-30-2017	Mar-30-2017	Mar-30-2017	Mar-30-2017	Jun-1-2017	Jun-1-2017
Rating Type		QUALIT	CANCRO	CANCRO	CANWEE	QUALIT	CANCRO	CANCRO
Rating Unit		1-9	%	%	%	1-9	%	%
Number of Subsamples		1	1	1	1	1	1	1
Days After First/Last Applic.		136 136	191 191	191 191	191 191	191 191	254 254	254 254
Trt-Eval Interval		136 DA-A	191 DA-A	191 DA-A	191 DA-A	191 DA-A	254 DA-A	254 DA-A
Trt No.	Treatment Name	Appl Code	8*	9*	10*	11*	12*	13*	14*
1	Untreated	A	1.0-	0.0-	0.0-	0.0-	1.0-	1.00b	2.50-
2	Standard KDOT Mix	A	1.0-	0.0-	0.0-	0.0-	1.0-	3.50b	5.00-
3	100 % Buff / 0 % Rye	A	1.0-	0.0-	0.0-	0.0-	1.0-	1.50b	5.50-
4	80 % Buff / 20 % Rye	A	1.0-	0.0-	0.0-	0.0-	1.0-	10.00b	5.50-
5	60 % Buff / 40 % Rye	A	1.0-	0.0-	0.0-	0.0-	1.0-	28.00a	4.50-
6	50 % Buff / 50 % Rye	A	1.0-	0.0-	0.0-	0.0-	1.0-	29.00a	2.50-
7	40 % Buff / 60 % Rye	A	1.0-	0.0-	0.0-	0.0-	1.0-	31.00a	2.00-
8	20 % Buff / 80 % Rye	A	1.0-	0.0-	0.0-	0.0-	1.0-	39.50a	4.00-
9	0 % Buff / 100 % Rye	A	1.0-	0.0-	0.0-	0.0-	1.0-	38.00a	2.00-
LSD P=.05			.	.	.	.	.	9.035	4.139
Standard Deviation			0.00	0.00	0.00	0.00	0.00	7.013	3.213
CV			0.0	0.0	0.0	0.0	0.0	34.78	86.31
Levene's F			0.00	0.00	0.00	0.00	0.00	2.036	1.146
Levene's Prob(F)			.	.	.	.	.	0.07	0.358
Skewness			.	.	.	.	.	0.2187	0.792*
Kurtosis			.	.	.	.	.	-1.2863	0.2381
Replicate F			0.000	0.000	0.000	0.000	0.000	2.814	2.476
Replicate Prob(F)			1.0000	1.0000	1.0000	1.0000	1.0000	0.0416	0.0640
Treatment F			0.000	0.000	0.000	0.000	0.000	25.993	1.063
Treatment Prob(F)			1.0000	1.0000	1.0000	1.0000	1.0000	0.0001	0.4125

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Kansas State University

Preliminary Evaluation of Perennial Ryegrass and Buffalograss Blends for Seeded Roadside Establishment to Comply with Storm Water Control Regulations (Sept Seeding Timing – Pooled over both locations (TRG &GHM)

Pest Type		W Weed				W Weed		
Crop Code				LOLPE	BUCDA			LOLPE
BBCH Scale				BGRM	BGRM			BGRM
Crop Scientific Name				Lolium perenne	Buchloe dactyl>			Lolium perenne
Crop Name		Weed		Perennial ryeg>	Buffalograss	Weed		Perennial ryeg>
Part Rated			PLAGRA C				PLAGRA C	
Rating Date		Jun-1-2017	Jun-1-2017	Jul-24-2017	Jul-24-2017	Jul-24-2017	Jul-24-2017	Oct-12-2017
Rating Type		CANWEE	QUALIT	CANCRO	CANCRO	CANWEE	QUALIT	CANCRO
Rating Unit		%	1-9	%	%	%	1-9	%
Number of Subsamples		1	1	1	1	1	1	1
Days After First/Last Applic.		254 254	254 254	307 307	307 307	307 307	307 307	387 387
Trt-Eval Interval		254 DA-A	254 DA-A	307 DA-A	307 DA-A	307 DA-A	307 DA-A	387 DA-A
Trt No.	Treatment Name	Appl Code	15*	16*	17*	18*	19*	20*	21*
1	Untreated	A	68.00-	1.50c	2.00-	2.50-	88.50-	1.00-	2.00bc
2	Standard KDOT Mix	A	67.50-	1.90bc	0.50-	5.50-	88.00-	1.00-	0.50c
3	100 % Buff / 0 % Rye	A	67.00-	1.60c	0.50-	9.00-	84.50-	1.20-	1.50bc
4	80 % Buff / 20 % Rye	A	64.00-	1.90bc	0.50-	3.00-	88.00-	1.00-	4.00bc
5	60 % Buff / 40 % Rye	A	57.00-	2.50ab	6.50-	3.00-	86.50-	1.00-	10.00abc
6	50 % Buff / 50 % Rye	A	63.50-	2.40ab	5.50-	5.50-	87.00-	1.00-	12.00ab
7	40 % Buff / 60 % Rye	A	58.50-	2.40ab	8.00-	4.00-	83.00-	1.20-	15.50a
8	20 % Buff / 80 % Rye	A	55.00-	2.70a	12.00-	2.50-	75.00-	1.20-	17.50a
9	0 % Buff / 100 % Rye	A	51.50-	2.80a	11.50-	1.00-	81.00-	1.00-	15.50a
LSD P=.05			11.224	0.475	8.103	4.846	8.753	0.267	7.419
Standard Deviation			8.713	0.368	6.290	3.762	6.794	0.207	5.759
CV			14.21	16.83	120.45	94.04	8.03	19.45	66.03
Levene's F			0.124	0.984	1.962	0.86	1.769	0.947	2.543
Levene's Prob(F)			0.998	0.464	0.08	0.558	0.116	0.491	0.026*
Skewness			-0.0251	-0.0252	1.8547*	1.5311*	-1.8599*	3.5358*	0.9663*
Kurtosis			0.2896	-0.3175	3.5109*	4.3043*	4.0577*	11.9327*	0.3458
Replicate F			2.769	1.391	1.715	0.481	2.953	3.032	1.535
Replicate Prob(F)			0.0440	0.2591	0.1710	0.7495	0.0349	0.0316	0.2157
Treatment F			2.388	8.327	2.718	1.988	2.104	1.161	6.945
Treatment Prob(F)			0.0384	0.0001	0.0209	0.0805	0.0649	0.3519	0.0001

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* Adjusted means
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Kansas State University

Preliminary Evaluation of Perennial Ryegrass and Buffalograss Blends for Seeded Roadside Establishment to Comply with Storm Water Control Regulations (Sept Seeding Timing – Pooled over both locations (TRG &GHM)

Pest Type			W Weed	
Crop Code		BUCDA		
BBCH Scale		BGRM		
Crop Scientific Name		Buchloe dactyl>		
Crop Name		Buffalograss	Weed	
Part Rated				PLAGRA C
Rating Date		Oct-12-2017	Oct-12-2017	Oct-12-2017
Rating Type		CANCRO	CANWEE	QUALIT
Rating Unit		%	%	1-9
Number of Subsamples		1	1	1
Days After First/Last Applic.		387 387	387 387	387 387
Trt-Eval Interval		387 DA-A	387 DA-A	387 DA-A
Trt No.	Treatment Name	Appl Code	22*	23*	24*
1	Untreated	A	10.00b	84.50-	1.0-
2	Standard KDOT Mix	A	13.50ab	81.00-	1.0-
3	100 % Buff / 0 % Rye	A	19.50a	78.50-	1.0-
4	80 % Buff / 20 % Rye	A	15.00ab	78.50-	1.0-
5	60 % Buff / 40 % Rye	A	12.50ab	79.00-	1.0-
6	50 % Buff / 50 % Rye	A	8.00b	80.50-	1.0-
7	40 % Buff / 60 % Rye	A	13.00ab	77.50-	1.0-
8	20 % Buff / 80 % Rye	A	11.00ab	73.50-	1.0-
9	0 % Buff / 100 % Rye	A	8.00b	76.50-	1.0-
LSD P=.05			5.768	6.420	.
Standard Deviation			4.477	4.983	0.00
CV			36.46	6.32	0.0
Levene's F			0.804	1.329	0.00
Levene's Prob(F)			0.604	0.261	.
Skewness			1.3061*	-0.1029	.
Kurtosis			3.2351*	-0.4652	.
Replicate F			1.479	2.117	0.000
Replicate Prob(F)			0.2315	0.1016	1.0000
Treatment F			3.276	1.900	0.000
Treatment Prob(F)			0.0077	0.0946	1.0000

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls)
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
* Adjusted means
Could not calculate LSD (% mean diff) for columns 1,2,3,4,5,6,7,8,9,10,11,12,24 because error mean square = 0.

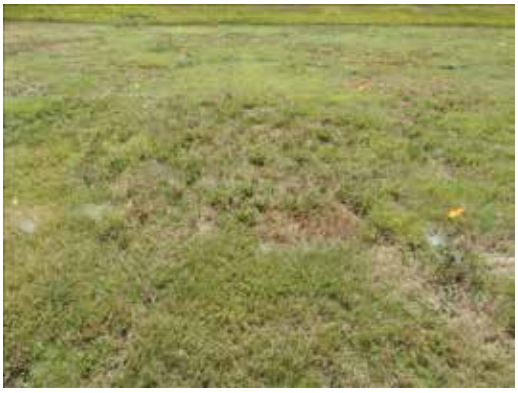
Appendix C: Plot Photographs

Digital photography was used to document the visual appearance of the first replication for all seeding dates and trial locations at all rating dates and seeding dates for each individual plot. All plot photos are in order of: non-treated, KDOT, 100% buffalograss/0% p.ryegrass, 80% buffalograss/20% p.ryegrass, 60% buffalograss/40% p.ryegrass, 50% buffalograss/50% p.ryegrass, 40% buffalograss/60% p.ryegrass, 20% buffalograss/80% p.ryegrass, and 0% buffalograss/100% p.ryegrass.







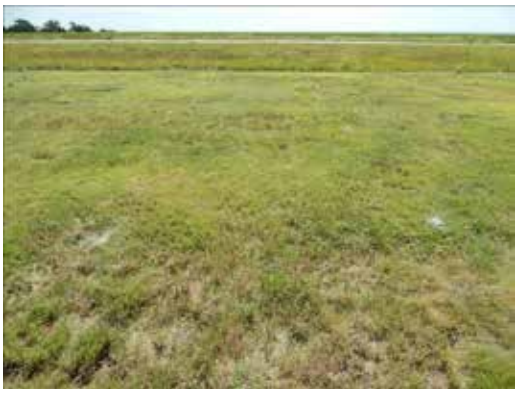




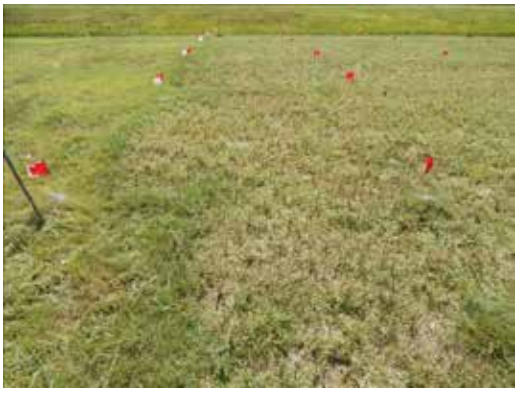
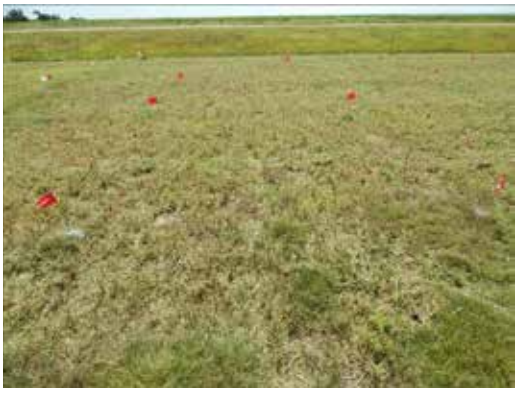
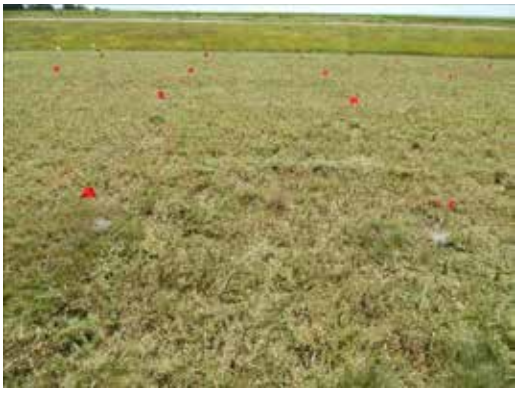




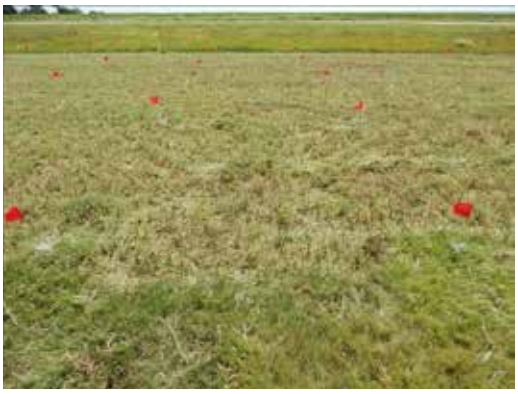
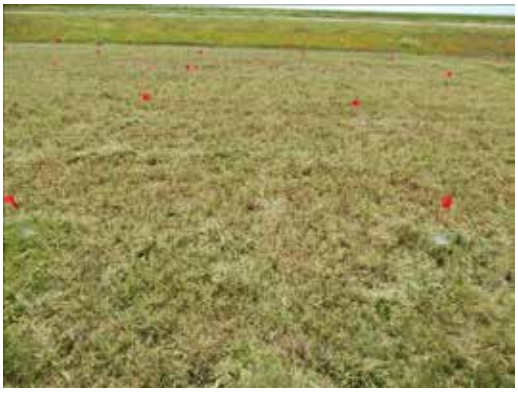




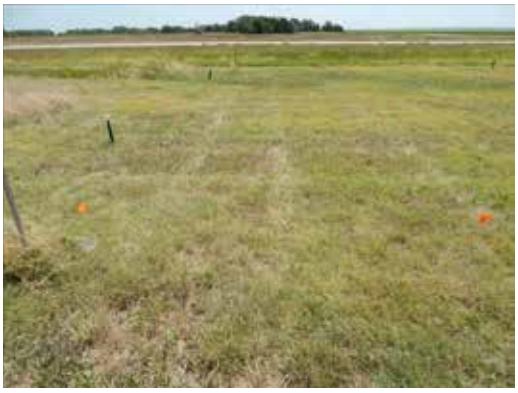
























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