

**Overseeded Bermudagrass Fairway Performance and Post Dormancy Transition as
Influenced by Winter Overseeding Practices and Trinexapac-ethyl**

by

S. Matthew Wharton

Thesis submitted to the faculty of the
Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements for the degree of
Master of Science
in
Crop and Soil Environmental Sciences

APPROVED:

David R. Chalmers, Ph.D. (Chairman)

Richard E. Schmidt, Ph.D.

Paul R. Peterson, Ph.D.

December 3, 1999

Blacksburg, Virginia

Key words: Bermudagrass, Ryegrass, Overseeding, Transition, Seeding rate,
Trinexapac-ethyl

**Overseeded Bermudagrass Fairway Performance and Post Dormancy Transition as
Influenced by Winter Overseeding Practices and Trinexapac-ethyl**

by

S. Matthew Wharton

Committee Chairman: David R. Chalmers

Crop and Soil Environmental Sciences

(ABSTRACT)

Dormant bermudagrass (*Cynodon dactylon*) fairways become matted down and thinned out from winter traffic. This appears to be more of a problem on the coarser textured, winter hardy, improved varieties (e.g., ‘Midiron’ and ‘Vamont’) typically used in the colder regions of the upper transition zone. Winter overseeding with cool-season species can improve dormant bermudagrass winter and spring quality. However, bermudagrass persistence can decline in golf course fairways overseeded with ryegrasses (*Lolium* sp.) for winter quality if ryegrasses persist due to cool spring temperatures, use of persistent ryegrass varieties, and management practices that favor ryegrasses over bermudagrass. Winter overseeding practices that facilitate a reliable transition from overseeded species to bermudagrass would enable transition zone golf courses to overseed bermudagrass fairways for winter-spring quality while allowing the bermudagrass turf to persist without excessive competition from cool-season overseeded species. Studies were conducted to determine the effects of perennial ryegrass (*L. perenne*) and annual ryegrass (*L. multiflorum*) seeding rates on winter-spring quality and subsequent transition to bermudagrass in two transition zone locations. Studies were also

conducted to determine the potential influence trinexapac-ethyl (TE), a plant growth regulator used by many professional turfgrass managers to suppress foliar growth, has on encouraging overseeded species to transition to bermudagrass. These studies demonstrated that higher overseeding rates (448 and 896 kg ha⁻¹) can provide greater winter-spring quality but do not enhance transition to bermudagrass over lower overseeding rates (224 kg ha⁻¹). This was especially evident in cooler transition zone climate, where higher overseeding rates delayed transition to bermudagrass. Annual ryegrass transitioned to bermudagrass better than perennial ryegrass, but the overseeded winter-spring quality of annual ryegrass was unacceptable. Perennial ryegrass varieties differed in transition. Some perennial ryegrass varieties were too persistent to fully transition to bermudagrass even with the onset of summer temperatures. Intermediate ryegrasses (*L. multiflorum* x *L. perenne*) appeared to be promising alternatives to overseeding perennial ryegrass in areas of the transition zone where summer reliance on bermudagrass turf is strongly preferred. Trinexapac-ethyl, when applied to overseeded perennial ryegrasses, did not enhance overseeded ryegrass transition to bermudagrass. Spring TE applications to overseeded perennial ryegrasses were found to reduce or delay their transition to bermudagrass.

Acknowledgments

Dedicated in loving memory to my grandmother, Margaret R. Hankins. I miss you.

I would like to thank Dr. David Chalmers for serving as chairman of my committee. Doc, thanks for making graduate school an option and for all your support and guidance during my “second” tenure at Virginia Tech. Thanks also, for the good times on the road and the golf course, especially the trip to the Homestead. Thanks for being more than a professor, teacher, and mentor. Thanks for being a friend.

I would also like to thank Dr. Richard Schmidt and Professor Paul Peterson for serving on my committee. Thanks for allowing me to work with such “loose reigns”. I appreciate your guidance and support and I know my research would not be worthwhile without your contributions.

I would like to express my gratitude to “Dickie” Sheppard, Charlie McCoy, and the rest of the Virginia Tech Turfgrass Research Center staff. Thanks for all your help as I conducted my research on site and a big thanks for use of the truck when I needed to get to Lynchburg. Thanks to Dr. Christine Anderson-Cook and Robert Noble for all the statistical consulting. Bob, I couldn’t have done it by myself.

I would like to thank the Virginia Tech Athletic Department for the greatest graduate assistantship ever created (GO HOKIES!). I would like to thank Assistant Athletic Director Tom Gabbard and John Ballein, Assistant Athletic Director for Football Operations, for the opportunities provided to be a part of the Virginia Tech Athletic Department Team. Thanks to Casey Underwood and Buford Meredith for a wonderful experience working with the best grounds crew in the Big East! Thanks also to Shawn Teske who previously supervised the crew before becoming a Yellow Jacket.

A very special thanks to the two men who made my on site research enjoyable. Steve Vessells and his staff at Boonsboro Country Club outside Lynchburg, Virginia and

Steve Schraw and his staff at Hermitage Country Club outside Richmond, Virginia. You guys are the greatest. Thanks for the wonderful sites, your hospitality, your assistance and willingness to be so helpful, and especially for all the GOLF!

I would like to extend a warm thank you to Mr. John Shoulders for your encouragement and guidance while Dr. Chalmers was on sabbatical. I am so thankful you took time to share with me your wealth of knowledge and I'm eternally grateful for your confidence in me. Thanks to Dr. Houston Couch and Phil Keating for your friendships, free diagnoses, and free fungicides when the baseball field needed it most. Thanks also to David McKissack for your friendship, insight, and especially your humor that made the NTEP test establishments fun and eventful.

I would like to recognize other faculty members, including a few from PPWS, who provided encouragement and friendship: Dr. Alley, Dr. Hall, Dr. Baker, Dr. Abaye, Dr. Mullins, Dr. Orcutt, and Dr. Baudoin. A special thanks to Dr. Pam Thomas for all your help with creating my ASA poster for the Baltimore meetings and your assistance with the identifications of my research site soils. A special thanks also to Sybil Phoenix, Nancy Shields, Judy Keister, Rhonda Shrader, Cheryl Adkins, and Lois Price who always had the answers to any question I asked. You ladies are special and I appreciate all your help and support.

I would also like to acknowledge graduate students (past and present) for your friendships, conversation, and even a little help. Brian Gooch, you were so instrumental in helping me my first year. I learned a lot from you and am grateful for your continued friendship. Jon Zalewski, you have been a great friend and also a big help with my research. I enjoyed all the golf we managed to "sneak" in (you too Gooch). Thanks also to John Zwonitzer, Alec Hayes, and the rest of the CSES graduate students.

Undergraduate students I would like to mention (past and present): Andrew Green (the best intramural golf partner a guy could ask for), Sean Baskette, Brian Smith, Rick Henderson, Tom Bailey, and Brian Vincell.

At this time, I would like to thank my family. My grandfather John M. Hankins, Jr. and mother Nancy H. Wharton for all your love and “support”. Sorry it took me so long to finish college. I would like to thank my stepsons, Nathan and Thad for their love and support. Most importantly, I would like to thank the one person who believes in me more than I believe in myself, my beautiful wife Darless. Your love, support, and faithfulness the last three years have meant more to me than anything in this world. I could not have accomplished this without you in my life and I may never be able to let you know just how much your support and trust have meant to me. Thanks for always being there. I love you.

Table of Contents

Abstract	ii
Acknowledgments	iv
Table of Contents	vii
List of Tables	viii
Literature Review	1
Chapter 1. Perennial Ryegrass and Annual Ryegrass Overseeded Bermudagrass Fairway Performance and Post Dormancy Transition as Influenced by Seeding Rate and Trinexapac-ethyl	36
Chapter 2. Perennial and Intermediate Ryegrass Varietal Effect on Overseeded Bermudagrass Fairway Performance and Post Dormancy Transition	127
Summary and Conclusions	155
Vita	158

List of Tables

Chapter 1

Table 1.1 1997-1998 Overseeded Perennial Ryegrass Treatments for Blacksburg and Lynchburg field trials.	40
Table 1.2 1997-1998 Overseeded Annual Ryegrass Treatments for Blacksburg and Lynchburg field trials.	41
Table 1.3 Thirty Year Mean Daily Temperature Normals ($^{\circ}$ C) and 1997-1998 Mean Daily Temperatures ($^{\circ}$ C) for Blacksburg and Lynchburg, Virginia.	45
Table 1.4 1998 Overseeded Bermudagrass Post Dormancy Transition as Influenced by Fall 1997 Perennial Ryegrass Overseeding Rates in Blacksburg, Virginia.	46
Table 1.5 1997-1998 Overseeded Bermudagrass Fairway Quality as Influenced by Fall 1997 Perennial Ryegrass Overseeding Rates in Blacksburg, Virginia.	48
Table 1.6 1998 Annual Bluegrass (<i>Poa annua</i>) Invasion in Overseeded Bermudagrass as Influenced by Fall 1997 Perennial Ryegrass Overseeding Rates in Blacksburg, Virginia.	49
Table 1.7 1998 Overseeded Bermudagrass Post Dormancy Transition as Influenced by Fall 1997 Annual Ryegrass Overseeding Rates in Blacksburg, Virginia.	51
Table 1.8 1998 Annual Bluegrass (<i>Poa annua</i>) Invasion in Overseeded Bermudagrass as Influenced by Fall 1997 Annual Ryegrass Overseeding Rates in Blacksburg, Virginia. 52	
Table 1.9 1997-1998 Overseeded Bermudagrass Fairway Quality as Influenced by Fall 1997 Annual Ryegrass Overseeding Rates in Blacksburg, Virginia.	53
Table 1.10 1998 Perennial Ryegrass Overseeded Bermudagrass Post Dormancy Transition as Influenced by Trinexapac-ethyl in Blacksburg, Virginia.	55
Table 1.11 1997-1998 Overseeded Perennial Ryegrass Quality as Influenced by Trinexapac-ethyl in Blacksburg, Virginia.	56
Table 1.12 1997-1998 Overseeded Perennial Ryegrass Density as Influenced by Trinexapac-ethyl in Blacksburg, Virginia.	58
Table 1.13 1997-1998 Overseeded Perennial Ryegrass Color as Influenced by Trinexapac-ethyl in Blacksburg, Virginia.	59

Table 1.14 1998 Annual Bluegrass (<i>Poa annua</i>) Invasion in Perennial Ryegrass Overseeded Bermudagrass as Influenced by Trinexapac-ethyl in Blacksburg, Virginia.	61
Table 1.15 1998 Annual Ryegrass Overseeded Bermudagrass Post Dormancy Transition as Influenced by Trinexapac-ethyl in Blacksburg, Virginia.	62
Table 1.16 1997-1998 Overseeded Annual Ryegrass Quality as Influenced by Trinexapac-ethyl in Blacksburg, Virginia.	63
Table 1.17 1997-1998 Overseeded Annual Ryegrass Color as Influenced by Trinexapac-ethyl in Blacksburg, Virginia.	64
Table 1.18 1998 Annual Bluegrass (<i>Poa annua</i>) Invasion in Annual Ryegrass Overseeded Bermudagrass as Influenced by Trinexapac-ethyl in Blacksburg, Virginia.	66
Table 1.19 1998 Overseeded Bermudagrass Post Dormancy Transition as Influenced by Fall 1997 Perennial Ryegrass Overseeding Rates in Lynchburg, Virginia.	67
Table 1.20 1997-1998 Overseeded Bermudagrass Fairway Quality as Influenced by Fall 1997 Perennial Ryegrass Overseeding Rates in Lynchburg, Virginia.	68
Table 1.21 1998 Annual Bluegrass (<i>Poa annua</i>) Invasion in Overseeded Bermudagrass as Influenced Fall 1997 by Perennial Ryegrass Overseeding Rates in Lynchburg, Virginia.	70
Table 1.22 1998 Overseeded Bermudagrass Post Dormancy Transition as Influenced by Fall 1997 Annual Ryegrass Overseeding Rates in Lynchburg, Virginia.	71
Table 1.23 1998 Annual Bluegrass (<i>Poa annua</i>) Invasion in Overseeded Bermudagrass as Influenced Fall 1997 Annual Ryegrass Overseeding Rates in Lynchburg, Virginia.	72
Table 1.24 1997-1998 Overseeded Bermudagrass Fairway Quality as Influenced by Fall 1997 Annual Ryegrass Overseeding Rates in Lynchburg, Virginia.	73
Table 1.25 1998 Perennial Ryegrass Overseeded Bermudagrass Post Dormancy Transition as Influenced by Trinexapac-ethyl in Lynchburg, Virginia.	75
Table 1.26 1997-1998 Overseeded Perennial Ryegrass Quality as Influenced by Trinexapac-ethyl in Lynchburg, Virginia.	76
Table 1.27 1998 Overseeded Perennial Ryegrass Density as Influenced by Trinexapac-ethyl in Lynchburg, Virginia.	77
Table 1.28 1997-1998 Overseeded Perennial Ryegrass Color as Influenced by Trinexapac-ethyl in Lynchburg, Virginia.	78
Table 1.29 1998 Annual Bluegrass (<i>Poa annua</i>) Invasion in Perennial Ryegrass Overseeded Bermudagrass as Influenced by Trinexapac-ethyl in Lynchburg, Virginia.	79

Table 1.30 1998 Annual Ryegrass Overseeded Bermudagrass Post Dormancy Transition as Influenced by Trinexapac-ethyl in Lynchburg, Virginia.	80
Table 1.31 1997-1998 Overseeded Annual Ryegrass Quality as Influenced by Trinexapac-ethyl in Lynchburg, Virginia.	81
Table 1.32 1998 Overseeded Annual Ryegrass Density as Influenced by Trinexapac-ethyl in Lynchburg, Virginia.	82
Table 1.33 1997-1998 Overseeded Annual Ryegrass Color as Influenced by Trinexapac-ethyl in Lynchburg, Virginia.	83
Table 1.34 1998 Annual Bluegrass (<i>Poa annua</i>) Invasion in Annual Ryegrass Overseeded Bermudagrass as Influenced by Trinexapac-ethyl in Lynchburg, Virginia.	84
Table 1.35 1998-1999 Overseeded Perennial Ryegrass Treatments for Blacksburg and Lynchburg field trials.	88
Table 1.36 Thirty Year Mean Daily Temperature Normals ($^{\circ}$ C) and 1998-1999 Mean Daily Temperatures ($^{\circ}$ C) for Blacksburg and Lynchburg, Virginia.	93
Table 1.37 Fall 1998 Residual Perennial Ryegrass in Overseeded Bermudagrass as Influenced by 1997 Perennial Ryegrass Overseeding Rates in Blacksburg, Virginia. ..	94
Table 1.38 Fall 1998 Residual Perennial Ryegrass in 1997 Overseeded Bermudagrass as Influenced by Trinexapac-ethyl in Blacksburg, Virginia.	95
Table 1.39 1999 Overseeded Bermudagrass Post Dormancy Transition as Influenced by Fall 1998 Perennial Ryegrass Overseeding Rates in Blacksburg, Virginia.	96
Table 1.40 1998-1999 Overseeded Bermudagrass Quality as Influenced by Fall 1998 Perennial Ryegrass Overseeding Rates in Blacksburg, Virginia.	98
Table 1.41 1999 Annual Bluegrass (<i>Poa annua</i>) Invasion in Overseeded Bermudagrass as Influenced by Fall 1998 Perennial Ryegrass Overseeding Rates in Blacksburg, Virginia.	100
Table 1.42 1999 Perennial Ryegrass Overseeded Bermudagrass Post Dormancy Transition as Influenced by Trinexapac-ethyl in Blacksburg, Virginia.	101
Table 1.43 1998-1999 Overseeded Perennial Ryegrass Quality as Influenced by Trinexapac-ethyl in Blacksburg, Virginia.	103
Table 1.44 1998-1999 Overseeded Perennial Ryegrass Density as Influenced by Trinexapac-ethyl in Blacksburg, Virginia.	104

Table 1.45 1998-1999 Overseeded Perennial Ryegrass Color as Influenced by Trinexapac-ethyl in Blacksburg, Virginia.	106
Table 1.46 1999 Annual Bluegrass (<i>Poa annua</i>) Invasion in Perennial Ryegrass Overseeded Bermudagrass as Influenced by Trinexapac-ethyl in Blacksburg, Virginia. . .	108
Table 1.47 Fall 1998 Residual Perennial Ryegrass in Overseeded Bermudagrass as Influenced by 1997 Perennial Ryegrass Overseeding Rates in Lynchburg, Virginia. . .	109
Table 1.48 Fall 1998 Residual Perennial Ryegrass in 1997 Overseeded Bermudagrass as Influenced by Trinexapac-ethyl in Lynchburg, Virginia.	110
Table 1.49 1999 Overseeded Bermudagrass Post Dormancy Transition as Influenced by Fall 1998 Perennial Ryegrass Overseeding Rates in Lynchburg, Virginia.	111
Table 1.50 1998-1999 Overseeded Bermudagrass Quality as Influenced by Fall 1998 Perennial Ryegrass Overseeding Rates in Lynchburg, Virginia.	113
Table 1.51 1999 Annual Bluegrass (<i>Poa annua</i>) Invasion in Overseeded Bermudagrass as Influenced by Fall 1998 Perennial Ryegrass Overseeding Rates in Lynchburg, Virginia.	115
Table 1.52 1999 Perennial Ryegrass Overseeded Bermudagrass Post Dormancy Transition as Influenced by Trinexapac-ethyl in Lynchburg, Virginia.	116
Table 1.53 1998-1999 Overseeded Perennial Ryegrass Quality as Influenced by Trinexapac-ethyl in Lynchburg, Virginia.	117
Table 1.54 1998-1999 Overseeded Perennial Ryegrass Density as Influenced by Trinexapac-ethyl in Lynchburg, Virginia.	119
Table 1.55 1998-1999 Overseeded Perennial Ryegrass Color as Influenced by Trinexapac-ethyl in Lynchburg, Virginia.	121
Table 1.56 1999 Annual Bluegrass (<i>Poa annua</i>) Invasion in Perennial Ryegrass Overseeded Bermudagrass as Influenced by Trinexapac-ethyl in Lynchburg, Virginia.	122

Chapter 2

Table 2.1 1998-1999 Treatments for Lynchburg and Richmond variety field trials. . .	131
Table 2.2 Thirty Year Mean Daily Temperature Normals ($^{\circ}\text{C}$) and 1998-1999 Mean Daily Temperatures ($^{\circ}\text{C}$) for Lynchburg and Richmond, Virginia.	134
Table 2.3 1999 Bermudagrass Post Dormancy Transition as Influenced by Overseeded Cultivars in Lynchburg, Virginia.	136

Table 2.4a 1998-1999 Turfgrass Quality of Overseeded Cultivars in Lynchburg, Virginia.	138
Table 2.4b 1998-1999 Turfgrass Quality of Overseeded Cultivars in Lynchburg, Virginia Continued from Table 2.4a.	139
Table 2.5 1998-1999 Turfgrass Color of Overseeded Cultivars in Lynchburg, Virginia. .	140
Table 2.6 1998-1999 Turfgrass Density of Overseeded Cultivars in Lynchburg, Virginia.	142
Table 2.7 1999 Bermudagrass Post Dormancy Transition as Influenced by Overseeded Cultivars in Richmond, Virginia.	143
Table 2.8a 1998-1999 Turfgrass Quality of Overseeded Cultivars in Richmond, Virginia.	145
Table 2.8b 1998-1999 Turfgrass Quality of Overseeded Cultivars in Richmond, Virginia Continued from Table 2.8a.	146
Table 2.9 1998-1999 Turfgrass Color of Overseeded Cultivars in Richmond, Virginia. . .	148
Table 2.10 1998-1999 Turfgrass Density of Overseeded Cultivars in Richmond, Virginia.	149