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FIELD DAY

JUNE 12, 2012

PULLMAN, WA

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WSU Turfgrass Field Day

June 12, 2012

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Thank you and we apologize to anyone that we have overlooked.

Contributors to WSU - Puyallup Turfgrass Research 2011-12

There are many companies, organizations, and people from outside the university who support our efforts. We would like to express our gratitude to all who help make it possible for us to accomplish the things we do, including:

Bayer-Purcell
Chemtura
Cooperative Turfgrass Breeders Tests
Dow AgroSciences
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Jefferson Park Golf Course
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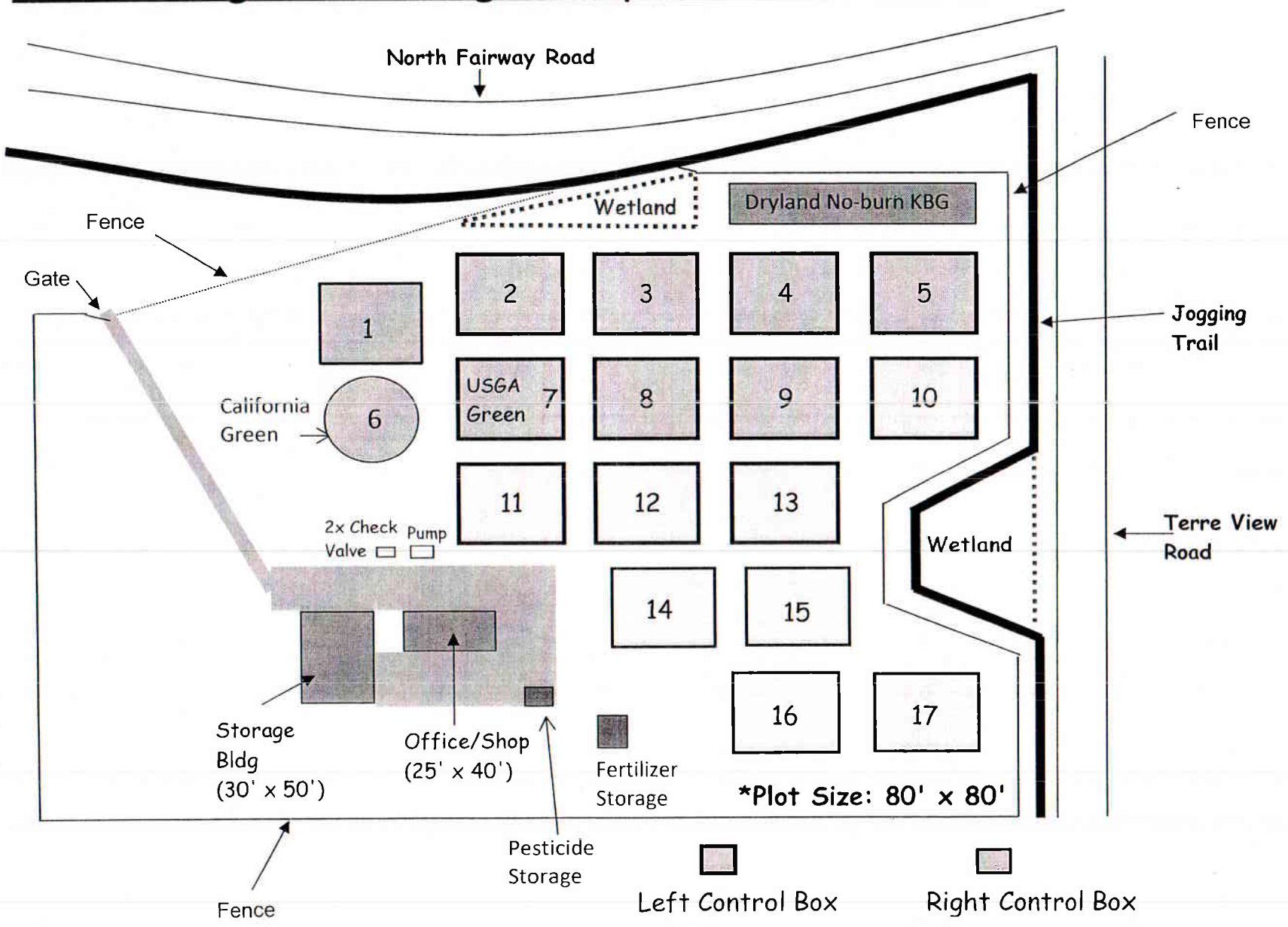
We apologize if there is anyone that we have overlooked.

WSU Turfgrass and Agronomy Research Center



WSU TURFGRASS and AGRONOMY RESEARCH CENTER (TARC)

Pullman, WA

2012

Plot #	Current Research Projects
1	Fairway blend of KBG used at the Palouse Ridge Golf Course
2	Noburn KBG turfgrass trial
3	Irrigated Noburn KBG seed production trial (Reps 1 and 2)
4	Lower ½ plot: Irrigated Noburn KBG seed production trial (Rep 3). Upper ½ plot: 'Gallery' PRG
5	Lower ¼ plot: 'Treazure' chewings fescue. Next ¼ plot:3 way mix of 'Treazure' chewings fescue, 'Gallery' PRG, and Nu Destiny KBG, Next ¼ plot: 'Gallery' PRG, and Upper ¼ plot: 'Nu Destiny' KBG.
6	California sand-based green with 'T-1' creeping bentgrass
7	USGA sand-based green with 'T-1' creeping bentgrass
8	'NuDestiny' Kentucky bluegrass
9	Seed increase noburn Kentucky bluegrass PI 368241 (heads/area selection)
10	Seed increase noburn Kentucky bluegrass PI 368241
11	Lower ½ plot: 'Gallery' perennial ryegrass. Upper ½ plot: 'Treazure' chewings Fescue
12	Seed increase noburn Kentucky bluegrass PI 371775 (seed/head selection). Spring applied methiozolin to control Poa annua in Kentucky bluegrass seed production.
13	Seed increase noburn Kentucky bluegrass Kenblue (seed/head selection)
14	Lower ½ plot: 'Gly-Rye' roundup resistant perennial ryegrass. Upper ½ plot 'Top Gun II' perennial ryegrass
15	2011 National Kentucky bluegrass test (NTEP)
16	Fallow
17	Fallow

WSU-Pullman
2012 Turfgrass Field Day Research Summaries
June 12, 2012

Reports on the following studies will be posted when they are completed, so keep checking our websites to stay current on the latest research and turfgrass program developments.

Pullman: turf.wsu.edu

Puyallup: puyallup.wsu.edu/turf/

The sites are linked to permit easy access to the entire WSU Turfgrass Program.

Research in Progress

I. PoaCure (methiozolin):

Early results indicate that a new unregistered herbicide ('PoaCure' [methiozolin]) is effective at selectively controlling *Poa annua*, pre- or post-emergence, in established cool-season turfgrasses (creeping bentgrass, Kentucky bluegrass, perennial ryegrass, and fineleaf fescue). PoaCure is primarily taken up by the roots, therefore, to be most effective it must be watered in (1/8 to 1/4 in.) following application. PoaCure appears to have pre-emergent activity for 3 months or more. Studies are currently being conducted at several locations in eastern and western Washington and NE Oregon. These studies are primarily on golf course putting greens, but some are also on collars and fairways with *Poa annua* infestation varying from low (<5%) to high (60 to 70%). In addition, two studies are ongoing in irrigated Kentucky bluegrass grass seed production fields.

Fall studies on greens with low infestations of *Poa annua*:

Greens #3 and #9 at Palouse Ridge Golf Club (Fall 2010 and 2011). Results from single applications at 41 or 81 fl oz/A applied at various times from mid-September through the first week of November indicate that PoaCure at 81 fl oz/A applied between mid-October and the first week of November is most effective. Applying PoaCure as a single application at 81 fl oz/A late in the Fall for 2 consecutive years resulted in complete *Poa annua* control with no phytotoxicity to the creeping bentgrass.

Green #18 at Palouse Ridge Golf Club (Fall 2011). Results from a demonstration study showed that 2 applications of PoaCure at 54 fl oz/A applied 2 weeks apart, with the first application in early October, resulted in complete *Poa annua* control with slight phytotoxicity to the bentgrass early the following Spring.

Fall studies with high infestations of *Poa annua*:

Collar around Green #18 at Palouse Ridge Golf Club (Fall 2011). Three applications of PoaCure at 81 fl oz/A resulted in nearly complete (97%) *Poa annua* control. Applications were made beginning at the end of September through late October at 2 week intervals. *Poa annua* infestation in the Check was approximately 30%. Three applications at a 1/2 rate of PoaCure (41 fl oz/A) resulted in approximately a 50% reduction in *Poa annua*.

Chewelah Golf and Country Club nursery green (Fall 2010). The best treatments were multiple (2 or 3x) applications of PoaCure at 81 fl oz/A applied late Fall (mid-October to the first week of November). *Poa annua* infested approximately 25 to 30% of the green. *Poa annua* control in the best treatments was >90%. There was some thinning of the stand in treatments noted with the highest control of *Poa annua*; however, the bentgrass did fill in during the following Spring after several weeks.

Colfax Golf Club practice green (Fall 2011). *Poa annua* infestation on the practice green was very high, approximately 70%. PoaCure applied 3 times at 54 fl oz/A at 2 week intervals beginning late September through late October resulted in nearly complete control. However, with such a high amount of *Poa annua* removed from the stand the bentgrass was not able to completely fill in on its own and cultural practice to enhance bentgrass growth will be needed to promote a more rapid recover (e.g., fertilization, overseeding, and topdressing).

Spring PoaCure studies were initiated 2012 and currently there are no results to present. **As part of the possible Experimental Use Permit (EUP) program being set up by Moghu Research Center and EPA it is important to note that studies conducted in the northern tier of the USA will be Spring applications of PoaCure over 2 consecutive years (2014 and 2015). EPA approval and registration will possibly be at the earliest 2015(?).**

Spring 2012 *Poa annua* studies have been established at 4 locations:

Green #9 PRGC with a low infestation of *Poa annua*.
Colfax GC and Wildhorse GC greens with high infestations of *Poa* annua.
Wildhorse GC fairway with very high *Poa annua* infestation.
WSU-Pulyallup research green with high and low *Poa annua* infestation.

Greenhouse study: to determine the length of time of pre-emergent activity of PoaCure.

Creeping bentgrass was planted 0, 2, 4, 8, and 12 weeks after treatment (WAT) into pots with a mix of 90% sand:10% peat moss and treated with PoaCure at 54, 54 + 54, or 54 + 54 + 54 fl oz/A. Results indicated that 12 WAT PoaCure applied once at 54 fl oz/A still adversely affected the emergence of creeping bentgrass.

II. Fungicides for snow mold control:

Evaluation of new formulations, new compounds, and product combinations to control snow mold on putting greens in the intermountain region of the Pacific Northwest was conducted in 2011-

2012. Sites include the WSU-TARC (Pullman, WA), McCall Golf Course (McCall, ID), Chewelah Golf and Country Club (Chewelah, WA), and Meadow Lake Resort Golf Course (Columbia Falls, MT). The 2011-12 trials included products from Bayer, Petro-Canada, and Syngenta.

III. NTEP cultivar trial:

Seedling establishment followed by monthly turfgrass quality ratings, along with color, texture, density, disease susceptibility, etc. will be evaluated for the next 5 years.

2011 Kentucky bluegrass test. 82 cultivars. (Planted 5/18/12) (TARC Plot#15)

IV. Kentucky bluegrass cultivar development for seed production:

With the loss of open-field burning of post-harvest residue in Washington, the development of Kentucky bluegrass cultivars for no-burn seed production is needed. Currently, we are testing seed production of 50 entries that have been selected for their potential for both seed production without field burning and good turf quality.

Turfgrass evaluation (TARC plot#2). Plots were established early September 2006. The 50 bluegrass entries selected for their potential to produce seed without field burning were evaluated for several turfgrass parameters in an NTEP-protocol turfgrass trial for several years. The trial ended Fall 2011.

Seed production trials: Dryland (TARC lower SE corner) and irrigated (plots #3 and #4). Established in May 2007, 50 bluegrass entries selected for their potential to produce good yields without field burning are being evaluated for long-term (>4 harvests; 2012 will be 5th harvest) seed production. Three selections out of the 50 entries were made: **PI 368241 (heads/area), PI 371775 (seeds/head), and Kenblue (seeds/head).**

Seed increase of selected Kentucky bluegrasses (2012 will be 1st harvest).

PI 368241 (heads/area) plots #9 and #10.
PI 371775 (seeds/head) plot #12.
Kenblue (seeds/head) plot #13.

Please Note:

Washington State Pest Management Resources Service required disclaimer for WSU personnel presentations and publications aimed at user groups:

"Some of the pesticides discussed in this (publication or presentation) were tested under an experimental use permit granted by WSDA. Application of a pesticide to a crop of site that is not on the label is a violation of pesticide law and may subject the applicator to civil penalties up to $7,500. In addition, such an application may also result in illegal residues that could subject the crop to seizure or embargo action by WSDA and/or the U.S. Food and Drug Administration. It is your responsibility to check the label before using the product to ensure lawful use and obtain all necessary permits in advance."

Department of Crop and Soil Sciences, Pullman Campus

Turfgrass Management

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Research

Turfgrass and Agronomy Research Center

A new turfgrass research facility in Pullman was completed in 2005. It includes a USGA experimental green, 15 turfgrass plots (80' x 80'), an office/shop, and a storage building. Charles Golob, Research Supervisor, manages the research facility.

Reseach Facility Diagram

Current Research Emphasis

Current emphasis is on comparing different fungicide treatments on snow mold disease, evaluating different grass species for the National Turfgrass Evaluation Program (NTEP), evaluating mesotrione for weed control in cool-season grasses, the use of wetting agents to control localized dry spots on putting greens, and the development of Kentucky bluegrass for non-thermal seed production. In addition to these projects, information on older projects such as controlling leaf spot on golf fairways, *Poa annua* seedheads suppression on bentgrass/annual bluegrass putting greens, quantifying post-harvest emissions from bluegrass seed production field burning, rapid and non-destructive method for seperating clippings from sand, correlation of field and controlled-environment studies of pink snow mold resistance of PNW greens-type *Poa annua*, regional climatic characterization of PNW greens-type *Poa annua*, and nitrogen leaching from a sand-based green can be found below.

PROJECTS (note these are pdf files)

- Roundup Formulations
  - Efficacy of a New Potassium Salt Formulation of Glyphosate (Roundup PROMAX) Compared to other Formulations of Glyphosate
- Fertility Projects
  - Georgia-Pacific's Nitamin® 30L (30-0-0) and Blends of Nfusion® (25-0-0) 'Steady-Delivery'® Nitrogen Soluble Fertilizer Compared to Urea (46-0-0) on a 'T-1' Creeping Bentgrass Green
  - Georgia-Pacific's Nitamin Nfusion (25-0-0) 'Steady-Delivery' Nitrogen Soluble Fertilizer Compared to Simplot's Best Polyon (43-0-0) Controlled-Release Fertilizer on a Fairway Cut Kentucky Bluegrass Turf
  - Georgia-Pacific's Nitamin® 30L (30-0-0) and Blends of Nfusion® (25-0-0) 'Steady-Delivery'® Nitrogen Soluble Fertilizer Compared to UMAXX® (47-0-0) StabilizedNitrogen™ Fertilizer on a Perennial Ryegrass Lawn
  - LESCO Fairway Fertilizer Study 2007
  - LESCO Lawn Fertilizer Study 2007
- Snow Mold Control
  - Evaluation of Syngenta and Bayer Fungicides for Snow Mold Control on Fairways 2010-11
  - Evaluation of Bayer Fungicides for Control of Pink and Gray Snow Mold 2010-11
  - Civitas for Snow Mold Control 2009-2010

- Evaluation of Bayer Fungicides for Control of Pink and Gray Snow Mold 2009-2010
- Evaluation of Bayer Fungicides for Control of Pink and Gray Snow Mold 2008-2009
- Evaluation of Syngenta Fungicides for Control of Pink and Gray Snow Mold 2008-2009
- Evaluation of Syngenta Fungicides for Control of Pink and Gray Snow Mold 2007-2008
- Evaluation of Bayer Fungicides for Control of Pink and Gray Snow Mold 2007-2008
- Evaluation of Bayer Fungicides for Control of Pink and Gray Snow Mold 2006-2007
- Evaluation of Cleary's Fungicides for Control of Pink and Gray Snow Mold 2006-2007
- Evaluation of LESCO's Fungicides for Control of Pink and Gray Snow Mold 2006-2007
- Evaluation of Syngenta Fungicides for Control of Pink and Gray Snow Mold 2006-2007
- Evaluation of LESCO's Fungicides for Control of Pink and Gray Snow Mold in Idaho, Montana and Washington 2004-2005
- Evaluation of Syngenta and Bayer Fungicides for Control of Pink and Gray Snow Mold 2004-2005
- Evaluation of Cleary's Fungicides for Control of Pink and Gray Snow Mold in Idaho, Montana and Washington 2004-2005
- Evaluation of Syngenta products to control of pink and gray snow mold 2003-2004
- Efficacy of Signature to control pink and gray snow mold 2003-2004

- Tenacity (Mesotrione) Herbicide
  - Two Consecutive Years of Multiple Fall Applications of Tenacity and Other Grass Herbicides to Control *Poa annua* in Kentucky Bluegrass Fairways 2009-2011
  - Development of Tenacity 4SC for Weed Control Recommendations with Spray Adjuvants 2011
  - Fall Program Using Tenacity, Progress, and/or Velocity for Selective Removal of *Poa annua* Post-emergence in Kentucky Bluegrass Fairways 2010
  - Fall Program Using Tenacity, Progress, and/or Velocity for Selective Removal of *Poa annua* Post-emergence in Kentucky Bluegrass Fairways 2009
  - Tenacity Impregnated Fertilizer for Broadleaf Weed Control in Home Lawns 2010
  - The Effect of Roundup/Tenacity used in a Late Fall Renovation on Subsequent *Poa annua* Re-establishment in a Golf Course Fairway 2008-2009
  - Spring Applied Tenacity 4FL Alone or with Grass Weed Herbicides to Control Annual Bluegrass 2009
  - Comparing the Safety of Tenacity 4SC Formulation to a New 2SC Formulation on Fineleaf Fescue at Seeding
  - Comparing the Safety of Tenacity 4SC Formulation to a New 2SC Formulation on Perennial Ryegrass at Seeding
  - Mesotrione: Program for Bentgrass Removal and Overseeding (Fall Timing 2007) and Early Summer 2008
  - Mesotrione: Program for Bentgrass Removal and Overseeding (Fall Timing) 2007
  - Bentgrass and fineleaf fescue cultivar and species differences in phytotoxicity to mesotrione
  - Mesotrione impregnated on fertilizer for weed control at seeding
  - Mesotrione Safety at Seeding of Turfgrass Mixtures
  - The Effect of Water Stress on the Efficacy of Mesotrione to Control Weeds in Cool-season Turfgrass Stands
  - Mesotrione: Program for Bentgrass Removal and Overseeding (Fall Timing)
  - Safety of Mesotrione 4SC when Applied to Sensitive Turf Species Grown in Mixtures
  - Safety of Mesotrione 4SC when Applied as a Spray at Planting and at First Mowing of a 3-way Mixture of Cool-Season Turfgrasses
- Methiozolin Herbicide
  - Evaluation of a New Herbicide, Methiozolin, for Selective *Poa annua* Control Post-emergence on Creeping Bentgrass Putting Greens 2010-11
- National Turfgrass Evaluation Program (NTEP)
  - 2003 National Bentgrass Fairway/Tee Test (2004-2007 Summary)
  - 2003 National Fineleaf Fescue Test (2004-2007 Summary)
  - 2004 National Perennial Ryegrass Test (2005-2008 Summary)
  - 2005 National Kentucky Bluegrass Variety Test (2006-2009 Summary)
  - 2000 National Kentucky Bluegrass Test (schedule B; medium input), 2001-2004 data
  - 2001 National Tall Fescue Test (schedule A: medium-high input), 2002-2004 data
- Spokane Reuse Water Project
  - Golf Course Reuse Water Pilot Study Phase I Report 2008
  - Golf Course Reuse Water Pilot Study Phase II Report 2009
  - Golf Course Reuse Water Pilot Study Phase III Report 2010
- Black Sand
  - The Use of Black Sand to Accelerate Creeping Bentgrass Seed Germination and Emergence on a Late Fall Planted Putting Green
- Suppression of *Poa annua* Seedheads
  - Suppression of *Poa annua* Seedheads on Bentgrass/Annual Bluegrass Putting Greens Comparing NB31150 with Embark and Primo/Proxy 2004
- Controlling Leaf spot on Golf Fairways
  - Control of Helminthosporium Leaf Spot in Cool-season Turf with Medallion 2004
- Pink Snow Mold Resistance in PNW *Poa annua*
  - Correlating Field and Controlled-environment Studies of Pink Snow Mold Resistance in PNW Greens-type Poa annua

- Characterization of PNW *Poa annua*
  - Regional Climatic Characterization of PNW Green-type Poa annua
- N Leaching from Sand-based Green
  - Nitrogen Leaching from a Sand-based Green (Coeur d'Alene Floating Green)
- Inclined Vibrating Deck
  - Rapid, Non-destructive Method for Separating Turfgrass Clippings from Topdressing Sand using an Inclined Vibrating Deck
- Kentucky Bluegrass Seed Production
  - No-burn Kentucky Bluegrass Seed Production, Puyallup Field Day 2011
  - No-burn Kentucky Bluegrss Seed Production DOE 2009-2011 Final Report
  - Development of Kentucky bluegrass for non-burn seed production-Proceedings of the International Herbage Seed Conference, Gjennestad, Norway, June 17-20, 2007
  - Development of High Yielding Kentucky Bluegrass for Non-thermal Seed Production-Final Progress Report 2006
  - Development of High Yielding Kentucky Bluegrass for Non-thermal Seed Production 2005
- Post-harvest Emissions
  - Quantifying Post-harvest Emissions from Bluegrass Seed Production Field Burning (Final Report March 2004)

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PRESENTATIONS

- Snow Mold Control
  - Evaluating Fungicides for Snow Mold Control on Putting Greens and Fairways in the Intermountain West 2010-2011 Results
  - Snow Mold Control on Putting Greens in the Intermountain West with Prolonged Snow Cove 2010
  - Snow Mold Control on Putting Greens in the Intermountain West 2007
- Mesotrione (Tenacity)
  - Multi-year (2 consecutive) Fall Tenacity Plus Prograss Program for Selective Post-emergence *Poa annua* Suppression in Kentucky Bluegrass Fairways
  - Selective Bentgrass Removal from Perennial Ryegrass with Mesotrione (Tenacity)
  - Tenacity: A New Herbicide for Turfgrass Establishment
  - Tenacity for Bentgrass Removal
  - Tenacity for Bentgrass and *Poa annua* Control
- Methiozolin Herbicide
  - Selective *Poa annua* Removal from Creeping Bentgrass Putting Greens with a New Herbicie Methiozolin 2010-2011
- Spokane Reuse Water Project
  - Pilot Reuse Water Project 2009
- High Yielding Kentucky Bluegrass Germplasm
  - Ag Burning Taskforce Presentation 2009
- Overviews
  - 2007 WSU-Pullman Turfgrass Research Overview

FIELD DAY REPORTS

- 2008 Field Day Research Reports

Poa annua Control with Methiozolin in *Agrostis stolonifera* Golf Greens

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Keywords: methiozolin, MRC-01, 'PoaCure'

Introduction

Creeping bentgrass (*Agrostis stolonifera* L.) golf greens infested with annual bluegrass (*Poa annua* L.) is universal. Greens in the intermountain Pacific Northwest, USA can range from a few percentage to nearly 100% *P. annua*. *P. annua* in greens can have an undesirable effect on aesthetics and playability. Selective control of *P. annua* with herbicides in golf greens is not currently available and the turf industry is focused on suppression of *P. annua* with plant growth regulators (Christians, 2008). Methiozolin [aka, MRC-01, 'PoaCure', or (5-(2,6-difluorobenzyl) oxymethyl-5-methyl-3-(3-methylthiophen-2-yl)-1,2-isoxazoline)] is a new herbicide currently being tested in the USA for selective *P. annua* control in golf greens. The mode of action of methiozolin is an inhibition of cell wall biosynthesis (Lee, 2007). Hwang and Koo (2009) reported excellent efficacy for *P. annua* control and no phytotoxicity to creeping bentgrass greens. Methiozolin controls both biotypes of *P. annua* (personal communication with Harold Walker, Auburn University, 2011). Mohgu Research Center Ltd., South Korea, is presently trying to register the product in Japan and the USA. The objective of the study was to evaluate the efficacy of methiozolin to selectively remove *P. annua* from creeping bentgrass golf greens.

Material and Methods

In Autumn 2010, studies were initiated at Palouse Ridge Golf Club (PRGC), Pullman, WA and at Chewelah Golf and Country Club (CGCC), Chewelah, WA. The PRGC site was a 4-year-old USGA green with 'T-1' bentgrass. The CGCC site was an older sand-based green with 'Penncross' bentgrass. Treatments were applied in water at 749 L ha^{-1} with a bicycle-wheeled CO_2 pressurized sprayer using 11004 flat fan spray nozzles at 276 kPa. At PRGC, single applications were applied at 0.75 or 1.50 kg a.i. ha^{-1} on 16 Sept., 7 Oct., or 28 Oct. 2010. At CGCC, single and multiple applications were applied at 0.75 or 1.50 kg a.i. ha^{-1} on 17 Sept., 8 Oct., and/or 29 Oct. 2010. *P. annua* plants m^{-2} were counted on 25 May, 8 July, and 19 Aug. 2011 at PRGC. At CGCC, visual percentage of *P. annua* in the plots was initially rated on 17 Sept. 2010 and again on 23 May, 1 July, and 2 Sept. 2011 and expressed as percentage change in *P. annua* population. Plots (experimental units) were 4 m^2 with three replications in a randomized complete-block experimental design. Analysis of variance was performed with Statistix 9.0 (Analytical Software, Tallahassee, FL) and mean separation with Fisher's protected Least Significant Difference (LSD) ($P = 0.05$).

Results and Discussion

At PRGC, where only single applications were made, the most effective treatment was methiozolin applied 28 Oct. 2010 at 1.50 kg a.i. ha^{-1} (Table 1). By Spring 2011, *P. annua* plants m^{-2} were reduced to zero, while the check had 36.3 *P. annua* plants m^{-2}. Methiozolin applied 7 Oct. 2011 at 1.50 kg a.i. ha^{-1} also reduced *P. annua* to 1.3 plants m^{-2} by Spring. No phytotoxicity was noted on the bentgrass during the study.

At CGCC there was >90% reduction in *P. annua* with multiple methiozolin applications at 1.50 kg a.i. ha^{-1} (Table 2). A slight thinning of the turf was noted in early Spring with three Autumn applications of methiozolin at 1.50 kg a.i. ha^{-1}; however, within a few weeks no thinning was observed as the bentgrass initiated growth. Hwang and Koo (2009) observed no phytotoxicity on bentgrass greens with a high level of *P. annua* with a lower rate of methiozolin applied at 0.5 kg a.i. ha^{-1}.

Table 1. Number of *Poa annua* plants on a bentgrass green at Pullman, WA.

Methiozolin	Application[1]	25 May 2011	8 July 2011	19 Aug. 2011
(kg a.i. ha^{-1})		---------- (Number m^{-2}) ----------		
0.75	1	45.7	47.1	44.4
1.50	1	14.8	20.2	20.2
0.75	2	14.8	12.1	14.8
1.50	2	1.3	2.7	2.7
0.75	3	6.7	10.8	10.8
1.50	3	0.0	0.0	1.3
CHECK		36.3	47.1	47.1
	LSD (0.05)	8.2	8.7	8.9

[1]Application: 1 = 16 Sept.; 2 = 7 Oct.; and 3 = 28 Oct. 2010.

Table 2. Percentage change in *Poa annua* on a bentgrass green at Chewelah, WA.

Methiozolin	Application[1]	17 Sept. 2010	23 May 2011	1 July 2011	2 Sept. 2011
(kg a.i. ha^{-1})		(Initial, %)	---------- (Change, %)[2] ----------		
0.75	1	25.0	2.1	25.0	18.3
1.50	1	25.0	-36.7	-28.3	-20.0
0.75	2	20.0	-25.6	-24.0	-25.7
1.50	2	23.3	-65.7	-63.3	-59.0
0.75	3	23.3	-18.9	-16.2	-5.1
1.50	3	15.0	-55.0	-50.0	-32.2
0.75	1,2	23.3	-53.3	-56.7	-35.6
1.50	1,2	26.7	-94.9	-92.2	-87.1
0.75	2,3	26.7	-56.2	-55.6	-38.4
1.50	2,3	23.3	-92.2	-92.8	-95.6
0.75	1,2,3	23.3	-77.7	-72.3	-65.7
1.50	1,2,3	28.3	-97.2	-98.3	-96.7
CHECK		21.7	53.3	60.0	66.7
	LSD (0.05)		23.4	18.9	19.1

[1]Application: 1 = 17 Sept.; 2 = 8 Oct.; and 3 = 29 Oct. 2010.

[2]Percentage change in *Poa annua* population from initial visual rating taken 17 Sept. 2010.

Conclusions

Autumn-applied methiozolin shows excellent promise to selectively control, or reduce, *P. annua* in bentgrass greens in the intermountain Pacific Northwest, USA. Current research is focused on Spring applications, which should be a good option in this cool-season grass region.

Literature Cited

Christians, N. 2008. Annual bluegrass update: 12 years later. Golf Course Management. June, p. 96-101.

Hwang, K., and Koo, S. 2009. Herbicide activity of MRC-01 on *Poa annua*. Weed Sci. Soc. Am. Abst. 49:213.

Lee, J.N., Koo, S.J., Hwang, K.H., Hwang, I.T., Jeon, J.D., and Kim, H.R. 2007. Mode of action of a new isoxazoline compound. Proc. 21st APWSS Conf. p. 597-601. Colombo, Sri Lanka.

Multiple Fall Applications of Mesotrione plus Ethofumesate for Selective Post-emergence Annual Bluegrass (*Poa annua* L.) Suppression in Kentucky Bluegrass (*Poa pratensis* L.) Fairways

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Keywords: phytotoxicity, 'Prograss', 'Tenacity'

Introduction

Poa annua L. invasion especially in fairways that are planted to newer, dark green, Kentucky bluegrass cultivars are often aesthetically unpleasing. The lighter green of the *P. annua* contrasts to the darker green color of Kentucky bluegrass and gives fairways a mottled look. This can also have an undesirable impact on stripe mowing on fairways. In addition, there are greater challenges in maintaining these stands to desirable playing conditions throughout the season. Beginning in 2009, a 2-year study was conducted at the WSU Palouse Ridge Golf Club (PRGC) at Pullman, WA to determine the efficacy of mesotrione ('Tenacity') applied alone or combined with a grass weed herbicide, ethofumesate ('Prograss'), in the Fall, for post-emergence control of *P. annua* in a Kentucky bluegrass/*P. annua* fairway.

Materials and Methods

This study was conducted on a fairway at the PRGC that was approximately 45% *P. annua* and 55% Kentucky bluegrass at the beginning of the study, Fall of 2009. Treatments were applied at a rate of 234 L ha^{-1} three times each Fall on 22 Sept., 7 Oct., and 19 Oct. 2009 and 16 Sept., 4 Oct., and 18 Oct. 2010 with a bicycle–wheeled CO_2 pressurized sprayer using 11002 flat fan spray nozzles at 276 kPa. In the Fall of 2010, prior to applying treatments, a pre-emergent herbicide, 'Barricade' (prodiamine), was applied on 8 Sept. at 1.1 kg ai ha^{-1} to the study area. Individual plots were 1.8 m x 3 m. The experimental design was a randomized complete-block with 3 replications. Kentucky bluegrass and *P. annua* phytotoxicity was rated once every week, or two, up to 2 Dec. 2009 and 2 Nov. 2010. Phytotoxicity was rated from 0 to 10; with 0 = no phytotoxicity and 10 = dead turf. The percentage of *P. annua* within each plot was determined at the beginning of the study in 2009 and at various times throughout the following two growing seasons. Turfgrass quality (2010 data only) was rated from 1 to 9; with 9 = excellent.

Results and Discussion

There was very little to no phytotoxicity noted on the Kentucky bluegrass in either year following fall treatments; however, there was considerable phytotoxicity to the *P. annua*. Tenacity at 0.36 L ha^{-1} resulted in the highest level of phytotoxicity in the Fall only of both years, but when tank mixed with Prograss at 2.3 L ha^{-1} the level of *P. annua* phytotoxicity was reduced by 25% or more (data not presented).

Tenacity 0.36 L ha^{-1} + Prograss 2.3 L ha^{-1} resulted in the greatest reduction of *P. annua* in the turfgrass stand over the 2 years of the study (Fig. 1) with reductions in *P. annua* during the first year (Summer 2010) as great as 83% and the second year (Summer 2011) 94%. However, by the end of the study in September 2011, the Tenacity + Prograss treatment had reduced *P. annua* in the stand by 60% compared to the beginning of the study. The Tenacity 0.36 L ha^{-1} treatment resulted in approximately a 20% reduction of *P. annua* in the stand by the end of the study. On the otherhand, the check and Prograss 2.3 L ha^{-1} each resulted in a >75% increase in *P. annua* over this same 2-year period. By the end of each Summer,

the percentage of *P. annua* increased regardless of treatment. It did not appear that the application of 'Barricade' in the Fall of 2010 reduced *P. annua* in the stand the following spring.

Fig. 1. Percentage change in *P. annua* in a Kentucky bluegrass/*P. annua* fairway over 2 years.

The Tenacity + Prograss treatment, which had the greatest reduction in *P. annua* in the stand also had the highest turfgrass quality ratings during the Summer of 2010 (Fig. 2). With the reduction in *P. annua* there was a greater percentage of Kentucky bluegrass in the stand which resulted in higher turfgrass quality ratings.

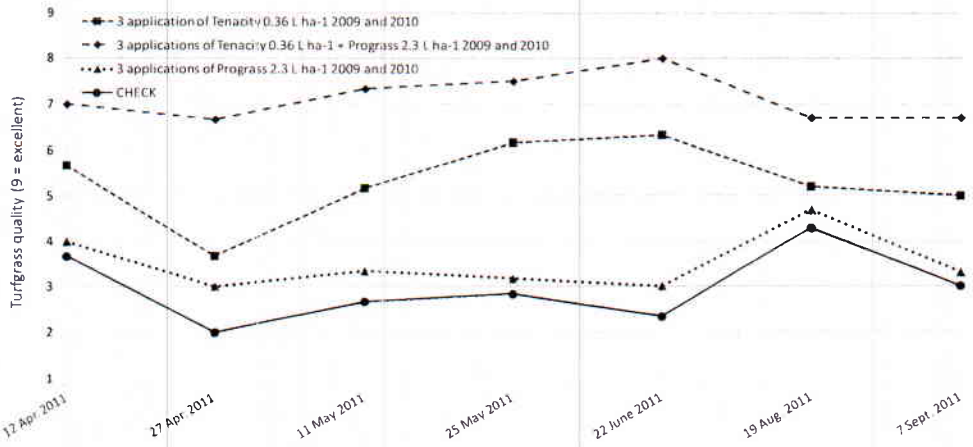


Fig. 2. Turfgrass quality of a Kentucky bluegrass/*P. annua* fairway following 2 consecutive years of multiple Fall applications at PRGC, Pullman, WA.

Conclusions

Overall, Tenacity 0.36 L ha^{-1} + Prograss 2.3 L ha^{-1}, over 2 consecutive years of multiple Fall applications resulted in low levels of phytotoxicity to Kentucky bluegrass, moderate phytotoxicity to *P. annua*, highest reduction of *P. annua* (>60%), and the highest overall turfgrass quality of all treatments. Since complete *P. annua* control was not achieved, it appears that continual Fall applications of Tenacity 0.36 L ha^{-1} + Prograss 2.3 L ha^{-1} will most likely be necessary to maintain low levels of *P. annua* in Kentucky bluegrass fairways.

Pythium Species Identification on *Poa annua* L. in the Pacific Northwest

Mr. Nathan Stacey, Drs. Marianne Elliott and Gwen Stahnke and Ms. Katie Coats, WSU-Puyallup

In October 2010, a joint project between the Northwest Turfgrass Association (NTA), the Washington State Commission o
n Pesticide Registration, and Washington State University (WSU) – Puyallup, was funded to investigate a pathogenic event occurring over the span of two years. Several golf courses, primarily west of the Cascades, sustained severe damage to numerous putting greens. Samples were sent to the WSU Plant Diagnostic Clinic in Puyallup and visual diagnostics indicated *Pythium* to be the causal agent.

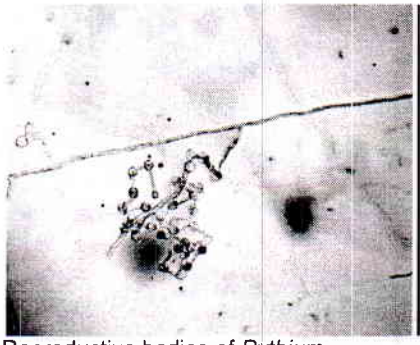
Pythium species have long been identified as pathogens of intensely managed turfgrass. Shoots, crowns and roots are susceptible to this organism, and several publications have identified species causing both a foliar blight and root dysfunction. *Pythium* species have been isolated from turfgrasses including: creeping bentgrass (*Agrostis palustris*), perennial ryegrass (*Lolium perenne* L.) and annual bluegrass (*Poa annua*).

The majority of samples collected here in the Pacific Northwest were isolated from annual bluegrass, as this is the predominant putting surface species, with few samples originating from creeping bentgrass. Samples were submitted from 27 different golf courses, of which sand is the primary growing medium. The majority of specimens were received during fall, winter and early springtime.

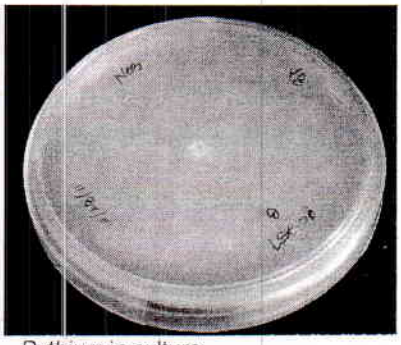
Symptomatic plant material - shoots with yellowing, chlorotic tissue, and discolored roots – was cleaned in a 10% bleach solution for 15 seconds, then rinsed in sterile de-ionized water. The material was blotted dry on a paper towel to reduce bacterial contamination, transferred to *Pythium* selective media (CARP: corn meal agar amended with 10 mg delvocid salt, 100 mg ampicillin, 5 mg rifampicin per 500 mL), and then incubated at 19°C. Five pieces of tissue, per plate, were placed into the CARP media; this was replicated in triplicate. After seven days, isolates were transferred to V8 media and stored in the dark at 19°C.

Once pure isolates were obtained, these cultures were sampled for PCR amplification. A small pipette was dragged lightly across the colony, avoiding agar contamination, and then swirled into the PCR tube. Primer sequences ITS6 and ITS4 were used to amplify ribosomal DNA (rDNA), and the resulting products were sequenced by GENEWIZ. Sequences were then compared with those in Genbank and a preliminary comparison using the Clustal alignment is underway.

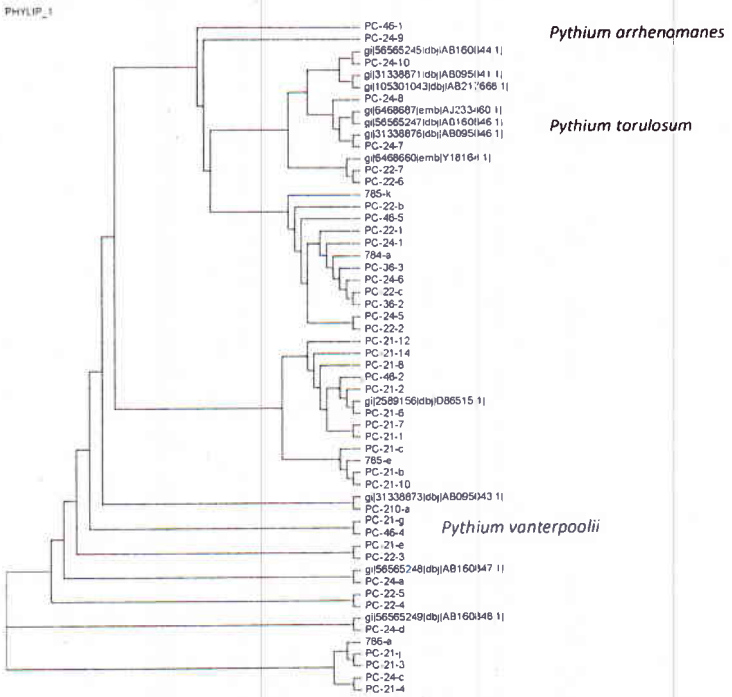
To date, *Pythium torulosum, Pythium vanterpoolii,* and *Pythium volutum* have been identified as the most common species in the samples from putting greens. This includes samples from both roots and shoots. The samples will continue to be processed until all material from 2010 is cultured and sequenced. Selected isolates of each species will be inoculated onto turfgrass and re-isolated to satisfy Koch's Postulates, and virulence of each species on the host will be evaluated. Re-infection of turfgrasses by these species of *Pythium* will be evaluated under varying conditions, such as shade, moisture and soil temperature.



Reproductive bodies of *Pythium vanterpoolii* as seen in the compound microscope.



Pythium in culture.



Phylogenetic tree showing relationships of *Pythiums* sequenced in this study with known species of *Pythium*.

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Kentucky Bluegrass for Non-burn Seed Production

W.J. Johnston[1], R.C. Johnson[2], and C.T. Golob[1]
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Open-field burning of Kentucky bluegrass (*Poa pratensis* L.) post-harvest residue, which maintains grass seed yield and stand longevity, has been eliminated in Washington. The objective of our study was to develop bluegrasses that have sustainable seed yield without post-harvest field burning and still maintain acceptable turfgrass quality. This long-term study consisted of 10 Kentucky bluegrass (*Poa pratensis* L.) entries; eight are USDA/ARS Plant Introduction (PI) accessions and two are commercial cultivars ('Kenblue' and 'Midnight'). The selected PI accessions, in previous research, had expressed high seed yield without burning of post-harvest residue and good turfgrass quality. Several agronomic yield parameters were then evaluated over a 2-yr period and individual plants were reselected within each accession, or check, with the highest seed weight, highest seeds/panicle, highest panicles/area, and highest seed yield. Remnant seed of the original USDA/ARS population were also included. Turfgrass plots were established in 2006 and seed production plots (irrigated and non-irrigated) in 2007 at Pullman, WA. The turfgrass trial was evaluated monthly according to NTEP (National Turfgrass Evaluation Program) protocol to determine turfgrass quality. Seed production plots were harvested (2008 to 2011) and seed yield was determined (2011 data presented).

Results for 2011 (4th harvest) indicated that selection for seed yield components had a variable response and Kentucky bluegrass seed yield was primarily dependent on accession. Accession PI 368241 showed the best promise of being able to provide good turfgrass quality and seed yield under non-burn management in both non-irrigated and irrigated seed production (Fig. 1 and 2). One selection within Kenblue, seed/head, had good turfgrass quality and seed yield. These studies will be followed during 2012 to determine if the seed yields are sustainable.

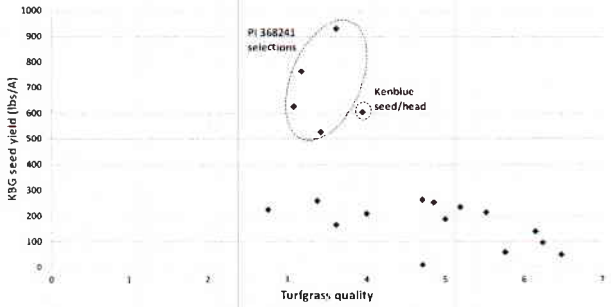

Figure 1. Kentucky bluegrass non-irrigated seed yield vs. turfgrass quality (rated 1-9; 9 = excellent quality) at Pullman, WA, 2011.

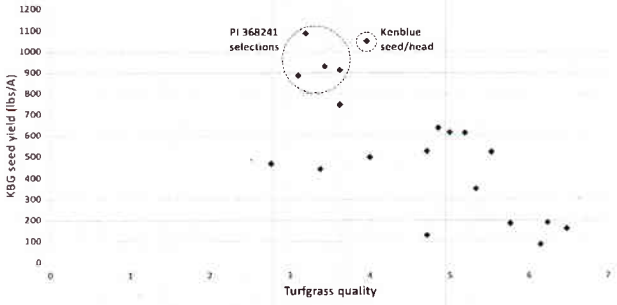

Figure 2. Kentucky bluegrass irrigated seed yield vs. turfgrass quality (rated 1-9; 9 = excellent quality) at Pullman, WA, 2011.

WSU-Pullman 2012 Turfgrass Field Day

Notes