1

High traffic sports fields

2

Wear / Traffic machines used at Rutgers University

Rutgers Wear Simulator (RWS) - WEAR

Bonos, S.A., E. Watkins, J.A. Honig, M. Sosa, T. Molnar, J.A. Murphy, and W.A. Meyer. 2001. Breeding cool-season turfgrasses for wear tolerance using a wear simulator. Int. Turf. Soc. Res. J. 9:137-145.

Park, B.S., H. Chen, and J.A. Murphy. 2016. Comparing the Rutgers Wear Simulator, Cady Traffic Simulator, and Brinkman Traffic Simulator. Acta Hortic. 1122, 103-110.

3

Wear / Traffic machines used at Rutgers University

Cady Traffic Simulator (CTS) - TRAMPLING

Henderson, J.J., J.L. Lanovaz, J.N. Rogers III, J.C. Sorochan, and J.T. Vanini. 2005. A new apparatus to simulate athletic field traffic: The Cady Traffic Simulator. Agron. J. 97:1153-1157.

Vanini, J.T., J.J. Henderson, J.C. Sorochan, and J.N. Rogers III. 2007. Evaluating traffic stress by the Brinkman Traffic Simulator and Cady Traffic Simulator on a Kentucky bluegrass stand. Crop Sci. 47:782–786.

Park, B.S., H. Chen, and J.A. Murphy. 2016. Comparing the Rutgers Wear Simulator, Cady Traffic Simulator, and Brinkman Traffic Simulator. Acta Hortic. 1122, 103-110.

4

Wear / Traffic machines used at Rutgers University

Vibratory pavement roller (~2500 lbs) – SOIL COMPACTION

Samaranayake, H., T. J. Lawson, and J. A. Murphy. 2008. Traffic stress effects on bentgrass putting green and fairway turf. Crop Sci. 48:1193-1202.

5

Kentucky Bluegrass (*Poa pratensis* L.)

Hardy, well adapted to Northeastern United States
Newer cultivars have improved disease and traffic tolerance
Slow to establish from seed (best established from sod)
Slow spring green-up; although variety differences exist

6

2011 National Turfgrass Evaluation Program (NTEP) Kentucky Bluegrass Test

OBJECTIVE: Compare the Rutgers Wear Simulator and Cady Traffic Simulator

Rutgers Hort. Farm II, North Brunswick, NJ
Mowing height: 1.5-inch; 2015: 3.4 lbs N/1000 ft²
Autumn 2015 Machine Comparison: Six weeks (September 30 – November 4, 2015)

Statistical design
3 (MACHINE) x 92 (ENTRY) Strip Plot

MACHINE
- No Traffic
- RWS: 4 passes wk^{-1} (24 total passes)
- CTS: 4 passes wk^{-1} (24 total passes)

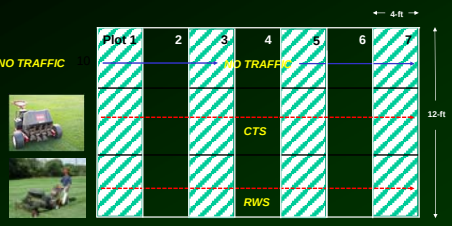
ENTRY
- Ninety-Two (92): 82 official NTEP Entries + 10 added

Data collected after machine operation
- Uniformity of Turf Cover (visual): 1-9 scale; 9=best turf cover
- Green Cover (0-100% scale); Digital image analysis (SigmaScan; Systat Software, Inc)

7

2011 National Turfgrass Evaluation Program (NTEP) Kentucky Bluegrass Test

Traffic Objectives: Compare the RWS and CTS



8

2011 NTEP Kentucky Bluegrass Test

Uniformity of turf cover and green cover (measured by digital image analysis) as affected by MACHINE and Kentucky bluegrass ENTRY during autumn 2015.

	After Autumn Traffic (Nov. 2015)	
	Uniformity of Turf Cover	Green Cover
	1 to 9 scale†	0 to 100% scale‡
Level of MACHINE		
No Traffic	8.7	93.1
Cady Traffic Simulator (CTS)	7.9	91.9
Rutgers Wear Simulator (RWS)	4.6	58.2
$LSD_{0.05}$	0.6	1.1
Source of Variation		
MACHINE	***	***
ENTRY	***	***
MACHINE X ENTRY	***	***
CV (%)	10.9	5.0

† 9 = most complete turf cover; ‡ 100% = full cover

9

Results: 2011 NTEP Kentucky Bluegrass Test

Uniformity of turf cover and green cover as affected by the interaction of MACHINE and Kentucky bluegrass ENTRY during autumn 2015.

	After Autumn Traffic (November 2015)					
	Uniformity of Turf Cover			Green Cover		
ENTRY Name	No Traffic	CTS	RWS	No Traffic	CTS	RWS
	1 to 9 scale†			0 to 100% scale‡		
Barvette HGT (BAR VV 0709)	9.0	9.0	7.7	94.2	90.3	74.9
Arrowhead	9.0	8.7	7.3	93.1	92.2	67.1
Rubix (4S2W)	9.0	8.3	7.0	94.6	94.5	74.4
Bewitched	9.0	8.3	6.7	92.4	94.8	63.4
SRX 2758	9.0	9.0	6.3	93.6	94.2	71.9
Nu Chicago	8.7	7.7	6.3	95.5	95.0	68.9
A06-46	9.0	8.3	6.3	94.7	94.2	67.9
J-1853	8.7	8.3	6.3	94.5	94.9	61.7
PST-T10-18	9.0	8.0	6.3	93.5	93.3	60.9
Aramintha (Pp 10847)	9.0	9.0	6.3	89.9	84.7	59.5
H99-1653	8.7	8.7	6.3	93.5	93.5	56.8
SRX 5221	9.0	8.7	6.3	94.4	90.2	47.0
Jackrabbit (PST-K10-106D)	9.0	8.3	6.0	92.6	93.8	62.9
Midnight	9.0	8.3	5.7	95.1	94.9	69.5
Bluebank (A03-1017)	9.0	7.7	5.7	95.1	95.0	68.8
$LSD_{0.05}$ (down) =		1.5			7.4	
$LSD_{0.05}$ (across) =		1.4			6.6	

† 9 = most complete turf cover; ‡ 100% = full cover

10

Kentucky Bluegrass Types – Blending implications

Commercially-available Kentucky bluegrass blend:
ALL Compact-Midnight Type Varieties

20% Everest Kentucky Bluegrass
20% Everglade Kentucky Bluegrass
20% Midnight Kentucky Bluegrass
20% NuGlade Kentucky Bluegrass
20% Award Kentucky Bluegrass

Honig, J.A., V. Averello, C. Kubik, J. Vaicitunas, B.S. Bushman, S.A. Bonos, and W.A. Meyer. 2018. An update on the classification of Kentucky bluegrass cultivars and accessions based on microsatellite (SSR) markers. Crop Sci. 58:1776–1787.

Honig, J.A., V. Averello, S.A. Bonos, and W.A. Meyer. 2012. Classification of Kentucky bluegrass (Poa pratensis L.) cultivars and accessions based on microsatellite (simple sequence repeat) markers. HortSci. 47(9):1356–1366.

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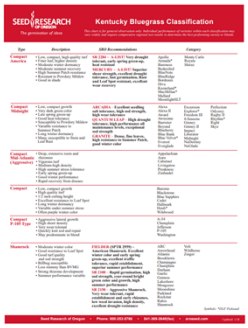
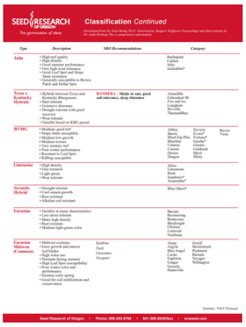
Kentucky Bluegrass Types – Blending implications

www.ntep.org/pdf/2015/KB%20DNA%20web%20report%20&%20list%20of%20entries%20classifications%208-26-15.pdf

12

Kentucky Bluegrass Types – Blending implications


Kentucky Bluegrass Classification


Classification Continued

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Kentucky Bluegrass Types – Blending implications

Traffic Tolerance of Kentucky Bluegrass Types

Excellent to Good

- Compact – Midnight type
- Mid-Atlantic type
- Eurasian type (cultivar specific)

Good

- Compact – America type
- Compact type
- P-105 type
- Shamrock type
- Julia type
- Limousine type

Not recommended for traffic

- BVMG type

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Results/Conclusions: 2011 NTEP Kentucky Bluegrass Test

Compact-Midnight type entries with the best uniformity of turf cover and/or green cover after autumn 2015 wear

Midnight	Nu Chicago	Bluebank (A03-1017)
Award	J-1770	J-1853
Sudden Impact	Midnight II	

Eurasian type entries with the best uniformity of turf cover and/or green cover after autumn 2015 wear

Barvette HGT (BAR VV 0709)	Rubix (4S2W)	A06-46
PST-T10-18	Bolt (H99-1653)	

Mid-Atlantic type entries with the best uniformity of turf cover and/or green cover after autumn 2015 wear

SRX 2758	Cabernet	SRX 466

Compact-America type entries with the best uniformity of turf cover and/or green cover after autumn 2015 wear

SRX 4338	Blue Note	Bewitched
Pick 4340	Mazama (A04-74)	Pick TD8
Rhapsody	Burl 06-11	America

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Results/Conclusions: 2011 NTEP Kentucky Bluegrass Test

Compact type entries with the best uniformity of turf cover and/or green cover after autumn 2015 wear

A01-1106 A00-2882

P-105 type entries with the best uniformity of turf cover and/or green cover after autumn 2015 wear

Princeton P-105 Avid

Shamrock type entries with the best uniformity of turf cover and/or green cover after autumn 2015 wear

Arrowhead A04-38 Dauntless (A05-315) SR 2150 (SRX 5321)

Julia and Limousine type entries with the best uniformity of turf cover and/or green cover after autumn 2015 wear

Jackrabbit (PST-K10-106D) Aramintha (Pp 10847) Rush

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2017 NTEP Kentucky Bluegrass Test

OBJECTIVE: Evaluate the response of Kentucky bluegrass entries to traffic stresses imparted by the Rutgers Wear Simulator (wear) and Cady Traffic Simulator (trampling)

Rutgers Hort. Farm II, North Brunswick, NJ

Mowing height: 1.5-inch; 2018: 4.6 lbs N/1000 ft²; 2019: 3.6 lbs N/1000 ft²

Autumn 2018 Traffic: Four weeks (September 26 – October 17, 2018)

Summer 2019 Traffic: Four weeks (July 1-24, 2019)

Statistical design

2 (TRAFFIC) x 89 (ENTRY) Strip Plot

TRAFFIC

- RWS (4 passes wk^{-1}) + CTS (4 passes wk^{-1}); 32 total machine passes
- No Traffic

ENTRY

- Eighty-nine (89) official NTEP Kentucky bluegrass entries

Data collected after machine operation

- Uniformity of Turf Cover (visual): 1-9 scale; 9=best turf cover
- Green Cover (0-100% scale); Digital image analysis (Turf Analyzer; Green Research Services, Fayetteville, AR)

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Materials & Methods: 2017 NTEP Kentucky Bluegrass Test

Summer 2019 Traffic: Combine the RWS (Wear) and CTS (Trampling)

Rutgers Wear Simulator (RWS) Cady Traffic Simulator (CTS)


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Results: 2017 NTEP Kentucky Bluegrass Test

Table 2. Uniformity of turf cover and green cover (measured by digital image analysis) as affected by TRAFFIC and Kentucky bluegrass ENTRY during summer and autumn 2019.

	After Autumn Traffic (Oct. 2018)		After Summer Traffic (July 2019)	
	Uniformity of Turf Cover	Green Cover	Uniformity of Turf Cover	Green Cover
	1 to 9 scale†	0 to 100% scale‡	1 to 9 scale	0 to 100% scale
Level of Traffic				
NO TRAFFIC	8.7	91	8.8	92
TRAFFIC	5.3	60	5.0	63
Source of Variation				
TRAFFIC	***	***	**	**
ENTRY	***	**	***	***
TRAFFIC x ENTRY	***	***	***	***
CV (%)	10.4	7	13.0	9

† 9 = most complete turf cover; ‡ 100% = full cover

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Results: 2017 NTEP Kentucky Bluegrass Test

Uniformity of turf cover as affected by the interaction of TRAFFIC and Kentucky bluegrass ENTRY during autumn 2018.

	After Autumn Traffic (October 2018)			
	Uniformity of Turf Cover			Uniformity of Turf Cover
ENTRY Name	NO TRAFFIC	TRAFFIC	ENTRY Name	NO TRAFFIC TRAFFIC
	1 to 9 scale†			1 to 9 scale
Barvette HGT	9.0	8.3	A11-38	9.0 7.0
Prosperity	9.0	7.7		
PST-K15-172	8.7	7.7		
J-1138	9.0	7.3		
NAI-A16-3	9.0	7.3		
BAR PP 7K426	9.0	7.3	NAI-14-122	8.3 2.7
NAI-14-178	9.0	7.0	NAI-14-133	7.3 2.7
After Midnight	9.0	7.0	NAI-14-187	8.3 2.3
A-16-17	9.0	7.0	NAI-14-132	9.0 2.0
BAR PP 71213	8.7	7.0	NAI-15-80	6.7 1.3
PST-K15-167	9.0	7.0		
DLFPS-340/3549	9.0	7.0	$LSD_{0.05}$ (down) =	1.4
			$LSD_{0.05}$ (across) =	1.2

† 9 = most complete turf cover

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Results: 2017 NTEP Kentucky Bluegrass Test

Green cover as affected by the interaction of TRAFFIC and Kentucky bluegrass ENTRY during autumn 2018.

	After Autumn Traffic (October 2018)			
	Uniformity of Turf Cover			Uniformity of Turf Cover
ENTRY Name	NO TRAFFIC	TRAFFIC	ENTRY Name	NO TRAFFIC TRAFFIC
	0 to 100% scale†			0 to 100% scale
NAI-14-178	95	85	NAI-13-9	91 76
After Midnight	83	84	NAI-A16-3	94 76
A-16-17	95	84	BAR PP 7K426	93 76
PPG-KB 1131	91	83	J-3510	92 76
NAI-13-132	92	82	DLFPS-340/3548	89 75
NAI-13-14	93	81	Midnight	92 75
PST-11-7	90	81		
Barvette HGT	92	81		
BAR PP 79494	92	81		
Prosperity	88	80		
A11-26	92	80		
DLFPS-340/3500	94	79	NAI-14-176	77 38
DLFPS-340/3494	93	79	NK-1	83 38
BAR PP 71213	93	79	NAI-14-133	77 37
Blue Devil	91	79	NAI-14-132	79 35
PST-K15-172	90	78	NAI-15-80	92 29
PST-K15-167	90	77		
J-1138	92	77	$LSD_{0.05}$ (down) =	10
DLFPS-340/3556	93	77	$LSD_{0.05}$ (across) =	12

† 100% = full cover

21

Results: 2017 NTEP Kentucky Bluegrass Test

Uniformity of turf cover as affected by the interaction of TRAFFIC and Kentucky bluegrass ENTRY during summer 2019.

	After Summer Traffic (July 2019)			
	Uniformity of Turf Cover			Uniformity of Turf Cover
ENTRY Name	NO TRAFFIC	TRAFFIC	ENTRY Name	NO TRAFFIC TRAFFIC
	1 to 9 scale †			1 to 9 scale
A-16-17	9.0	8.0		
BAR PP 7K426	9.0	8.0		
BAR PP 7309V	9.0	7.7	NAI-14-132	8.3 2.7
BAR PP 71213	9.0	7.7	NAI-15-84	8.3 2.7
DLFPS-340/3549	9.0	7.3	J-1319	8.7 2.3
Barvette HGT	9.0	7.3	DLFPS-340/3364	8.0 2.3
PST-K15-172	9.0	7.0	Pivot	8.3 2.3
NAI-A16-3	9.0	7.0	RAD-1776	9.0 2.0
KH3492	9.0	7.0	DLFPS-340/3553	9.0 2.0
Yellowstone (A12-7)	9.0	7.0	NK-1	7.3 1.3
NAI-14-178	9.0	7.0	NAI-15-80	8.3 1.3
PPG-KB 1131	8.7	6.7		
DLFPS-340/3552	9.0	6.7	$LSD_{0.05}$ (down)	1.5
PST-K15-167	9.0	6.7	$LSD_{0.05}$ (across)	1.7

† 9 = most complete turf cover

22

Results: 2017 NTEP Kentucky Bluegrass Test

Green cover (measured by digital image analysis) as affected by the interaction of TRAFFIC and Kentucky bluegrass ENTRY during summer 2019.

	After Summer Traffic (July 2019)			
	Green Cover			Green Cover
ENTRY Name	NO TRAFFIC	TRAFFIC	ENTRY Name	NO TRAFFIC TRAFFIC
	0 to 100% scale†			0 to 100% scale
PST-11-7	94	82	DLFPS-340/3549	93 73
Prosperity	95	81	BAR PP 79494	92 73
A-16-17	95	81	DLFPS-340/3556	93 73
PPG-KB 1131	92	80	PST-K15-172	90 72
DLFPS-340/3552	94	80	NAI-A16-3	95 72
BAR PP 7K426	91	79	DLFPS-340/3500	92 72
BAR PP 7309V	92	79	After Midnight	93 71
DLFPS-340/3494	95	78	KH3492	94 71
A11-26	93	77	DLFPS-340/3455	95 70
DLFPS-340/3550	95	75	GO-22B23	92 70
NAI-13-14	93	75		
J-3510	94	75		
PST-K15-177	94	75		
PST-K15-167	91	75	NAI-15-80	90 22
BAR PP 71213	90	74		
Selway	95	74		
Midnight	91	73	$LSD_{0.05}$ (down)	12
NAI-13-132	93	73	$LSD_{0.05}$ (across)	14
Blue Devil	94	73		

† 100% = full cover

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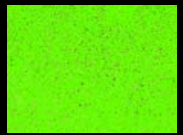
Results: 2017 NTEP Kentucky Bluegrass Test

Last traffic date: October 17, 2018; Digital images retrieved October 18, 2018

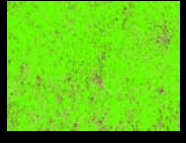
Prosperity (NO TRAFFIC); visual = 9

Prosperity (NO TRAFFIC); Turf Analyzer = 88% cover



Prosperity (TRAFFIC); visual = 8

Prosperity (TRAFFIC); Turf Analyzer = 78% cover



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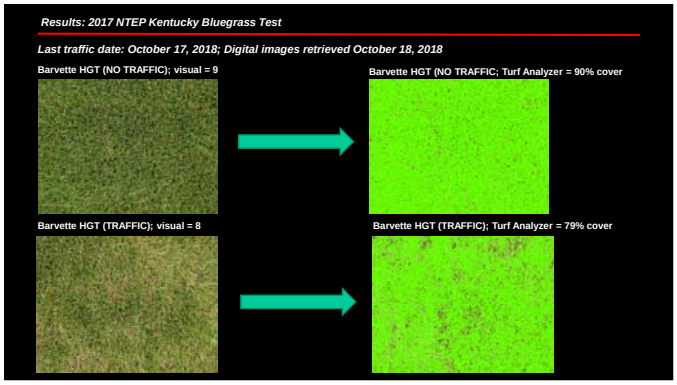

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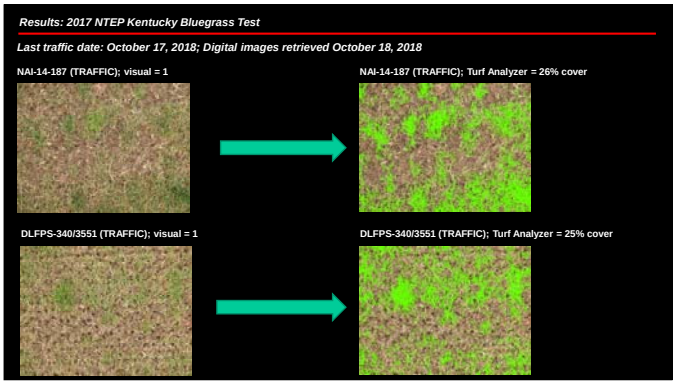

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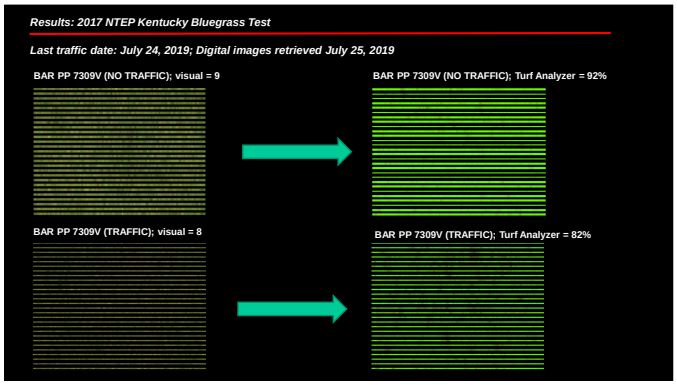

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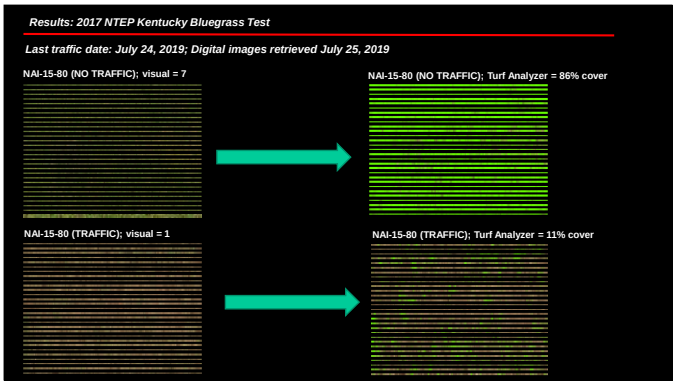

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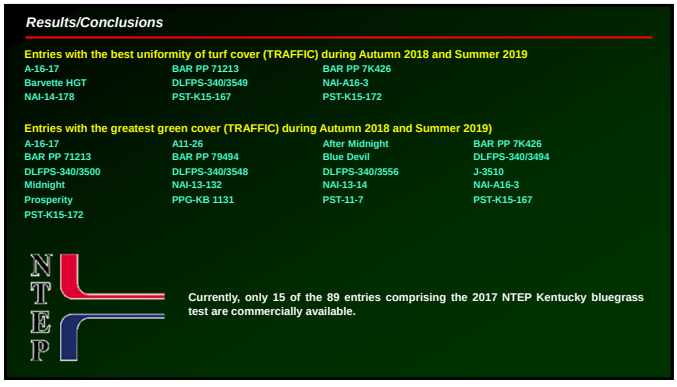

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2006 NTEP Tall Fescue Test

OBJECTIVE: Evaluate the response of tall fescue entries to traffic stresses imparted by Rutgers Wear Simulator (wear) and vibratory roller (soil compaction)

Rutgers Hort. Farm II, North Brunswick, NJ

Mowing height: 2.75-inch;

2007: 4.0 lbs N/1000 ft²; 2008: 3.3 lbs N/1000 ft²; 2009: 2.4 lbs N/1000 ft²; 2010: 1.1 lbs N/1000 ft²; 2011: 0.9 lbs N/1000 ft²

Brown patch controlled preventatively

Traffic

Autumn 2007: 24 RWS passes during Oct. 2-4; 10 roller passes on Oct. 10

Summer 2008: 16 RWS passes during July 22-23; 10 roller passes on Aug. 4

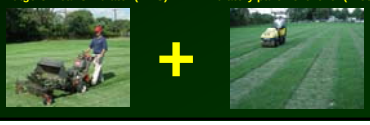
Spring 2009: 24 RWS passes during April 29-30; 10 roller passes on May 6

Fall 2009: 24 RWS passes during Oct. 13-15; 10 roller passes on Oct. 20

Summer 2010: 24 RWS passes during July 20-21; 10 roller passes on August 4

Spring 2011: 24 RWS passes during May 11-12; 10 roller passes on May 17

Rutgers Wear Simulator (RWS) **Vibratory pavement roller (~2500 lbs)**



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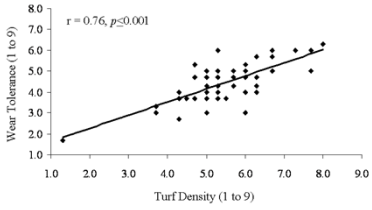
2006 NTEP Tall Fescue Test

Relationship between turf density and wear tolerance in tall fescue



Park, B.S., J.M. Bokmeyer, J.A. Murphy, S.A. Bonos, and W.A. Meyer. 2009. Evaluation of tall fescue under simulated wear. Int. Turfgrass Soc. Res. J. 11:563-572.

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2006 NTEP Tall Fescue Test

Tall fescue variety selection

Turfgrass Quality **Brown patch susceptibility** **Traffic tolerance**

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2006 NTEP Tall Fescue Test

35

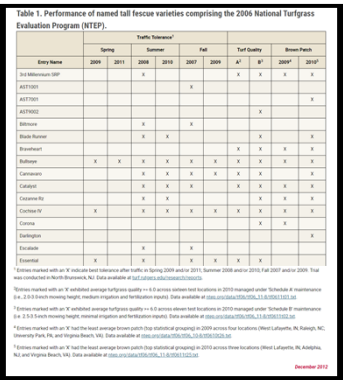

Table 1. Performance of named tall fescue varieties comprising the 2006 National Turfgrass Evaluation Program (NTEP).

	Traffic Tolerance[1]						Turf Quality		Brown Patch	
	Spring		Summer		Fall					
Entry Name	2009	2011	2008	2010	2007	2009	A[2]	B[3]	2009[4]	2010[5]
3rd Millennium SRP			x				x	x	x	x
AST1001					x					
AST7001										x
AST9002								x		
Biltmore			x		x					
Blade Runner			x	x				x		x
Braveheart							x	x	x	x
Bullseye	x	x	x	x	x	x	x	x	x	x
Carnavaro			x	x	x	x	x	x		x
Catalyst			x	x			x	x	x	x
Cezanne Rz			x	x				x	x	x
Cochise IV	x		x	x	x	x	x	x	x	x
Corona								x	x	
Darlington										x
Escalade			x		x					
Essential	x		x		x	x	x	x		

[1] Entries marked with an 'X' indicate best tolerance after traffic in Spring 2009 and/or 2011, Summer 2008 and/or 2010, Fall 2007 and/or 2009. Trial was conducted in North Brunswick, NJ. Data available at turf.rutgers.edu/research/reports.

[2] Entries marked with an 'X' exhibited average turfgrass quality >= 6.0 across sixteen test locations in 2010 managed under 'Schedule A' maintenance (i.e., 2.0-3.0-inch mowing height, medium irrigation and fertilization inputs). Data available at ntep.org/data/tf06/tf06_11-b/tf061101.txt.

[3] Entries marked with an 'X' exhibited average turfgrass quality >= 6.0 across eleven test locations in 2010 managed under 'Schedule B' maintenance (i.e. 2.5-3.5-inch mowing height, minimal irrigation and fertilization inputs). Data available at ntep.org/data/tf06/tf06_11-b/tf061102.txt.

[4] Entries marked with an 'X' had the least average brown patch (top statistical grouping) in 2009 across four locations (West Lafayette, IN; Raleigh, NC; University Park, PA; and Virginia Beach, VA). Data available at ntep.org/data/tf06/tf06_10-b/tf061002b.txt.

[5] Entries marked with an 'X' had the least average brown patch (top statistical grouping) in 2010 across three locations (West Lafayette, IN; Adelphia, NJ; and Virginia Beach, VA). Data available at ntep.org/data/tf06/tf06_11-b/tf061102.txt.

December 2012

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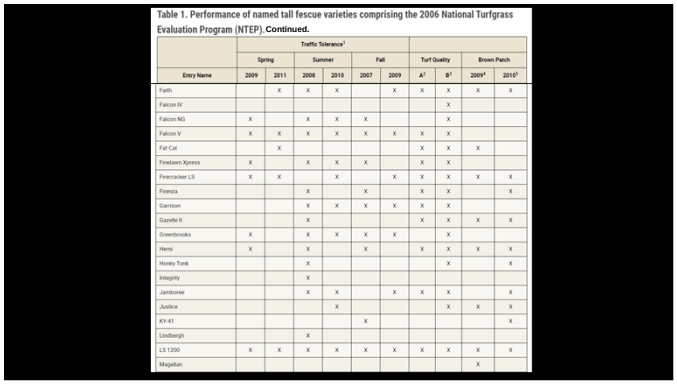

Table 1. Performance of named tall fescue varieties comprising the 2006 National Turfgrass Evaluation Program (NTEP). Continued.

	Traffic Tolerance[1]									
	Spring		Summer		Fall		Turf Quality		Brown Patch	
Entry Name	2009	2011	2008	2010	2007	2009	A[2]	B[3]	2009[4]	2010[5]
Faith		X	X	X		X	X	X	X	X
Falcon IV								X		
Falcon NG	X		X	X	X			X		
Falcon V	X	X	X	X	X	X	X	X		
Fat Cat		X					X	X	X	
Finelawn Xpress	X		X	X	X		X	X		
Firecracker LS	X	X		X		X	X	X	X	X
Firenza			X		X		X	X		X
Garrison			X	X	X	X	X	X		
Gazelle II			X				X	X	X	X
Greenbrooks	X		X	X	X	X		X		
Hemi	X		X		X		X	X	X	X
Honky Tonk			X					X		X
Integrity			X							
Jamboree			X	X		X	X	X		X
Justice				X				X	X	X
KY-41					X					X
Lindbergh			X							
LS 1200	X	X	X	X	X	X	X	X	X	X
Magellan									X	

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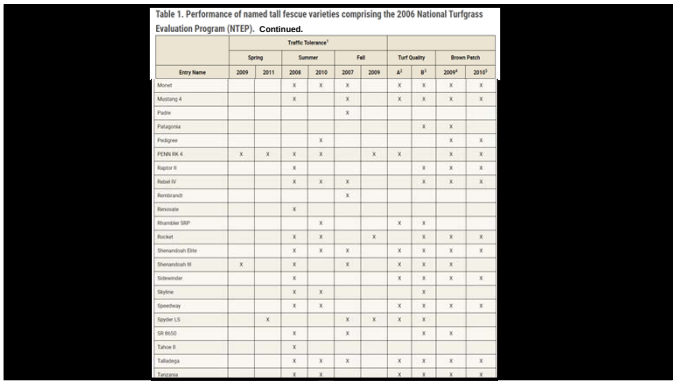

Table 1. Performance of named tall fescue varieties comprising the 2006 National Turfgrass Evaluation Program (NTEP). Continued.

	Traffic Tolerance[1]									
	Spring		Summer		Fall		Turf Quality		Brown Patch	
Entry Name	2009	2011	2008	2010	2007	2009	A[2]	B[3]	2009[4]	2010[5]
Monet			X	X	X		X	X	X	X
Mustang 4			X		X		X	X	X	X
Padre					X					
Patagonia								X	X	
Pedigree				X					X	X
PENN RK 4	X	X	X	X		X	X		X	X
Raptor II			X					X	X	X
Rebel IV			X	X	X			X	X	X
Rembrandt					X					
Renovate			X							
Rhambler SRP				X			X	X		
Rocket			X	X		X		X	X	X
Shenandoah Elite			X	X	X		X	X	X	X
Shenandoah III	X		X		X		X	X	X	
Sidewinder			X				X	X	X	X
Skyline			X	X				X		
Speedway			X	X			X	X	X	X
Spyder LS		X			X	X	X	X		
SR 8650			X		X			X	X	
Tahoe II			X							
Talladega			X	X	X		X	X	X	X
Tarzanne			X	X			X	X	X	X

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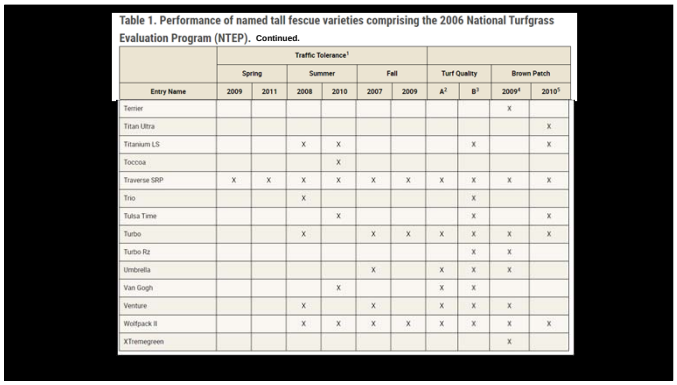

Table 1. Performance of named tall fescue varieties comprising the 2006 National Turfgrass Evaluation Program (NTEP). Continued.

	Traffic Tolerance[1]									
	Spring		Summer		Fall		Turf Quality		Brown Patch	
Entry Name	2009	2011	2008	2010	2007	2009	A[2]	B[3]	2009[4]	2010[5]
Terrier									X	
Titan Ultra										X
Titanium LS			X	X				X		X
Toccoa				X						
Traverse SRP	X	X	X	X	X	X	X	X	X	X
Trio			X					X		
Tulsa Time				X				X		X
Turbo			X		X	X	X	X	X	X
Turbo Rz								X	X	
Umbrella					X		X	X	X	
Van Gogh				X			X	X		
Venture			X		X		X	X	X	
Wolfpack II			X	X	X	X	X	X	X	X
XTremegreen									X	

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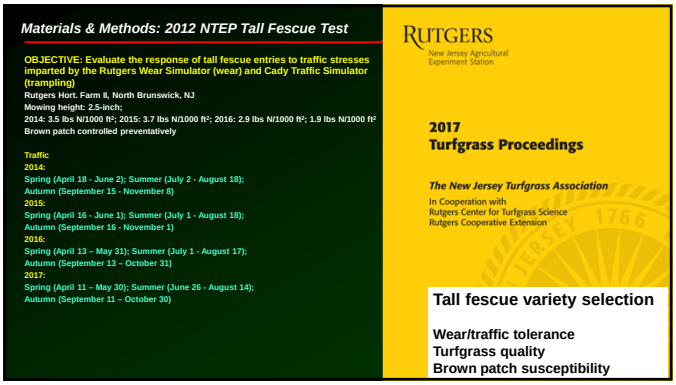

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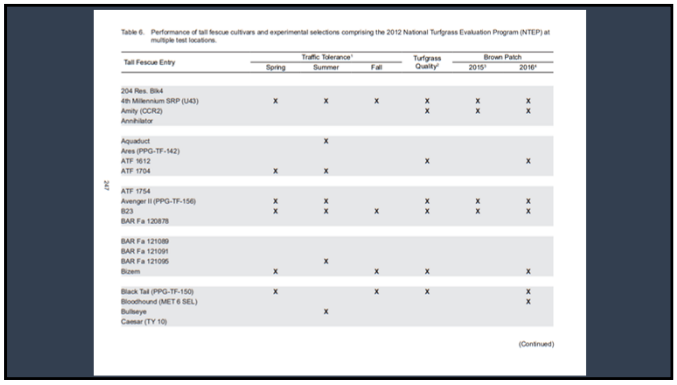

Table 6. Performance of tall fescue cultivars and experimental selections comprising the 2012 National Turfgrass Evaluation Program (NTEP) at multiple test locations.

Tall Fescue Entry	Traffic Tolerance[1]			Turfgrass Quality[2]	Brown Patch	
	Spring	Summer	Fall	2015[3]	2016[4]	
204 Res. Blk4						
4th Millennium SRP (U43)	X	X	X	X	X	X
Amity (CCR2)				X	X	X
Annihilator						
Aquaduct		X				
Ares (PPG-TF-142)						
ATF 1612				X		X
ATF 1704	X	X				
ATF 1754						
Avenger II (PPG-TF-156)	X	X		X	X	X
B23	X	X	X	X	X	X
BAR Fa 120878						
BAR Fa 121089						
BAR Fa 121091						
BAR Fa 121095		X				
Bizem	X		X	X		X
Black Tail (PPG-TF-150)	X		X	X		X
Bloodhound (MET 6 SEL)						X
Bullseye		X				
Caesar (TY 10)						

(Continued)

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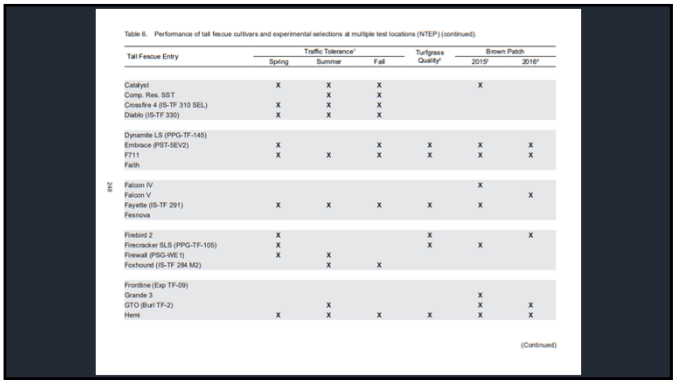

Table 6. Performance of tall fescue cultivars and experimental selections at multiple test locations (NTEP) (continued).

Tall Fescue Entry	Traffic Tolerance[1]			Turfgrass Quality[2]	Brown Patch	
	Spring	Summer	Fall	2015[3]	2016[4]	
Catalyst	X	X	X		X	
Comp. Res. SST		X	X			
Crossfire 4 (IS-TF 310 SEL)	X	X	X			
Diablo (IS-TF 330)	X	X	X			
Dynamite LS (PPG-TF-145)						
Embrace (PST-5EV2)	X		X	X	X	X
F711	X	X	X	X	X	X
Faith						
Falcon IV					X	
Falcon V						X
Fayette (IS-TF 291)	X	X	X	X	X	
Fesnova						
Firebird 2	X			X		X
Firecracker SLS (PPG-TF-105)	X			X	X	
Firewall (PSG-WE1)	X	X				
Foxhound (IS-TF 284 M2)		X	X			
Frontline (Exp TF-09)						
Grande 3					X	
GTO (Burl TF-2)		X			X	X
Hemi	X	X	X	X	X	X

(Continued)

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Table 6. Performance of tall fescue cultivars and experimental selections at multiple test locations (NTEP) (continued).

Tall Fescue Entry	Traffic Tolerance[1] Spring	Summer	Fall	Turfgrass Quality[2]	Brown Patch 2015[3]	2016[4]
Hot Rod (Burl TF-136)	X	X	X		X	X
Houndog 8 (IS-TF 307 SEL)				X		
Hover (Burl TF-69)		X	X			
Inspiration (PST-R5NW)		X				
IS-TF 276 M2						
IS-TF-272						
IS-TF-287		X	X			
IS-TF-311	X	X	X		X	X
JS 809		X	X			
JS 818						
JS 819						
JS 825						
JS 916	X	X	X			
K12-05						
K12-13			X			
K12-MCD		X			X	
Kentucky 31						
Kingdom (CB1)						
Leonardo (LTP-FSD)					X	
Maestro (T31)		X	X		X	X

(Continued)

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Table 6. Performance of tall fescue cultivars and experimental selections at multiple test locations (NTEP) (continued).

Tall Fescue Entry	Traffic Tolerance[1] Spring	Summer	Fall	Turfgrass Quality[2]	Brown Patch 2015[3]	2016[4]
Marauder						
Memphis (GO-DFR)			X			
Meridan (PST-5GRB)	X	X	X	X		
MET 1				X	X	X
MET-3					X	X
Michelangelo (LTP-FSDPDR)		X	X		X	X
Nightcrawler (IS-TF 285)	X	X	X			
Olympus (RAD-TF-88)	X	X	X			
Paramount (PPG-TF-137)		X		X	X	X
PPG-TF-115						
PPG-TF-135	X				X	X
PPG-TF-138						
PPG-TF-169						
PSG-88P2	X	X	X			
PSG-GSD		X			X	
PSG-PO1					X	
PSG-TT4						
PST-5BPO		X	X			
PST-5BRK					X	X
PST-5DZP						

(Continued)

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Table 6. Performance of tall fescue cultivars and experimental selections at multiple test locations (NTEP) (continued).

Tall Fescue Entry	Traffic Tolerance[1] Spring	Summer	Fall	Turfgrass Quality[2]	Brown Patch 2015[3]	2016[4]
PST-5EX2		X	X		X	X
PST-5MVD						X
RAD-TF-83						
RAD-TF-89	X	X	X			
RAD-TF-92	X	X	X			
Rain Dance (PST-5SDT)		X				
Raptor III (ZW 44)	X	X	X	X	X	X
Rebel V (ATF 1736)						
Rebounder (Pick-W43)			X	X	X	X
Reflection (U45)	X	X	X	X		X
Regenerate	X	X	X	X	X	X
Rhambler 2 SRP (LSD)	X	X	X	X	X	
Rhizing Moon (IS-TF 305 SEL)						
Rockwell (LTP-TWUU)	X	X		X	X	X
Rowdy (SRX-TPC)	X	X		X	X	X
Saffilo (PST-5SALT)						
Screamer LS (PPG-TF-148)						X
Standout (IS-TF-308 SEL)			X	X	X	X
Supersonic (PPG-TF-170)		X	X		X	X
Swagger (PST-5ROS)		X			X	

(Continued)

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Table 6. Performance of tall fescue cultivars and experimental selections at multiple test locations (NTEP) (continued).

Tall Fescue Entry	Traffic Tolerance[1] Spring	Summer	Fall	Turfgrass Quality[2]	Brown Patch 2015[3]	2016[4]
Technique (RZ2)	X	X	X	X	X	X
Temple (DZ1)	X	X	X		X	X
Temptation (OR-21)						
Terrano					X	
Thor (PPG-TF-157)				X	X	X
Thunderstruck (TD1)						
Titanium 2LS (PPG-TF-152)	X			X	X	X
Traverse 2 SRP (W45)				X	X	X
Trending (IS-TF 269 SEL)		X				X
Turfway (IS-TF 282 M2)						
Unitus (IS-TF 289)						
Valkyrie LS (PPG-TF-172)	X	X	X	X		X
W41	X					
Warhawk						
Wichita (PPG-TF-151)					X	X
Xtender (PPG-TF-139)	X		X			X

[1] Entries marked with an 'X' indicate best average uniformity of turf cover (top statistical ranking) after traffic during spring 2013-2017, summer 2013-2017, and autumn 2013-2017. Trial was conducted at the Rutgers Horticultural Research Farm II, North Brunswick, NJ
[2] Entries marked with an 'X' exhibited the best average turfgrass quality (top statistical grouping) during 2013 to 2017 at Rutgers Horticultural Research Farm II, North Brunswick, NJ
[3] Entries marked with an 'X' had the least average brown patch (top statistical grouping) in 2015 across four locations (Raleigh, NC; Adelphia, NJ; Stillwater, OK; Knoxville, TN). Data available at ntep.org/data/f112/f12_16-5/f1216531.txt
[4] Entries marked with an 'X' had the least average brown patch (top statistical grouping) in 2016 across six locations (Storrs, CT; West Lafayette, IN; Lexington, KY; College Park, MD; Raleigh, NC; Adelphia, NJ). Data available at ntep.org/data/f112/f12_17-8/f1217030.txt

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Tall fescue & Kentucky bluegrass mixtures

Tall fescue + Kentucky bluegrass sod common in New Jersey and mid-Atlantic

- **90% Tall fescue and 10% Kentucky bluegrass (by weight)**
  Approximately 50% Tall fescue and 50% Kentucky bluegrass (seed count)

or

- **80% Tall fescue and 20% Kentucky bluegrass (by weight)**
  Approximately 30% Tall fescue and 70% Kentucky bluegrass (seed count)

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Tall fescue & Kentucky bluegrass sod mixtures

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Tall fescue & Kentucky bluegrass sod mixtures

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Mitigating summer patch damage: Tall fescue & Kentucky bluegrass mixtures

August 14, 2013

Kentucky bluegrass:
A05-361

Tall fescue & Kentucky bluegrass:
Falcon V & A05-361

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Tall fescue & Kentucky bluegrass sod mixtures

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Tall fescue and Kentucky bluegrass mixture research

RUTGERS
New Jersey Agricultural Experiment Station

2018
Turfgrass Proceedings

The New Jersey Turfgrass Association

In Cooperation with
Rutgers Center for Turfgrass Science
Rutgers Cooperative Extension

Park, B.S., H. Samaranayake, and J.A. Murphy. 2017. Response of tall fescue and Kentucky bluegrass mixtures to wear. Int. Turf. Soc. Res. J. 13(1):346-352.

Park, B.S., H. Samaranayake, and J.A. Murphy. 2019. Tall fescue and Kentucky bluegrass mixture research. Rutgers Turf. Proc. 50:251-257.

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Response of Tall Fescue and Kentucky Bluegrass Mixtures to Wear

Research Objective:

To assess the performance and species composition of tall fescue and Kentucky bluegrass mixtures containing newer cultivars and subjected to autumn wear

Rutgers Hort. Farm No. 2
North Brunswick, NJ

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Materials and methods: Tall fescue & Kentucky bluegrass mixtures

Test area seeded in September 2010

- Four tall fescue varieties
  - Falcon V, Mustang 4, Justice, Greenkeeper
- Two Kentucky bluegrass varieties
  - Midnight II (Compact-Midnight Type) and Blue Note (Compact-America Type)

  Two Kentucky bluegrass experimental selections
  - A05-344 (Shamrock Type), A05-361 (Mid-Atlantic Type)
- Seeding rates: GOAL - Each plot receives ~ 2000 seeds/1.0 ft^2
  - Kentucky bluegrass ~ 2,177,000 seeds/1.0 pound (Beard, 2002)
    - 0.92 lbs/1000 ft^2
  - Tall fescue ~ 227,000 seeds/1.0 pound (Beard, 2002)
    - 8.8 lbs/1000 ft^2
  - Mixtures: 90% Tall fescue & 10% Kentucky bluegrass by weight
    Kentucky bluegrass ~ 1000 seeds/1.0 ft^2 (0.46 lbs/1000 sq ft^2)
    Tall fescue ~ 1000 seeds/1.0 ft^2 (4.4 lbs/1000 ft^2)
- Wear (RWS): Autumn 2011 (14 passes); Autumn 2012 (14 passes); Autumn 2013 (14 passes)
- 2011: 3.7 lbs N/1000 ft^2; 2012: 2.3 lbs N/1000 ft^2; 2013: 3.1 lbs N/1000 ft^2

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Species population assessments

Twenty-four selected leaves from each plot were visually identified in July 2012, August 2013 and 2014.

Plots were divided into 1/3rd sections and a device equipped with eight vertically-movable tines was positioned in each 1/3rd section.

Tines were lowered to identify leaves.

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Tall fescue populations of species mixtures as affected by tall fescue, Kentucky bluegrass, and wear in 2012, 2013 and 2014.

Main Effects	July 2012	August 2013	August 2014
		%	
TALL FESCUE (TF)			
Falcon V + KBG	71	66 a	71 a
Mustang 4 + KBG	70	65 a	66 ab
Justice + KBG	71	67 a	70 a
Greenkeeper + KBG	65	58 b	61 b
KENTUCKY BLUEGRASS (KBG)			
None	100 a	100 a	100 a
Midnight II + TF	48 c	36 d	37 c
Blue Note + TF	50 c	46 c	44 c
A05-361 + TF	72 b	69 b	75 b
A05-344 + TF	75 b	69 b	79 b
WEAR			
No Wear	70	65	69
Wear	68	63	65
Source of Variation			
TF	ns	*	*
KBG	***	***	***
TF x KBG	ns	ns	ns
W	ns	ns	ns
TF x W	ns	ns	ns
KBG x W	ns	ns	ns
TF x KBG x W	ns	ns	ns

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Conclusions: Tall fescue & Kentucky bluegrass mixtures

Wear

Autumn wear had no effect on species composition.

Kentucky bluegrass and tall fescue selection

Kentucky bluegrass cultivars capable of producing exceptional turf quality (e.g. Midnight II and Blue Note) can reduce tall fescue composition of mixes well below 50%.

'Blue Note' Kentucky bluegrass
Compact-America Type

'Midnight II' Kentucky bluegrass
Compact-Midnight Type

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