The Effect of Fine Fescue Species and Seeding Rate in No-Mow Areas

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Introduction

- Reducing the amount of resources used for maintenance of turfgrasses is a theme that is increasing among turfgrass users.
- Consumers are willing to pay a premium for attributes like low irrigation requirements and infrequent mowing (Yue et al., 2012).
- In Northern states, fine fescues species are often used for low-input areas and recommended for "No-Mow" situations.
- Five different fine fescue species are commonly used in low maintenance mixtures: Chewings fescue = CHF (*Festuca. rubra* ssp. *fallax*), hard fescue = HDF (*F. brevipila*), sheep fescue = SHF (*F. ovina*), slender creeping red fescue = SLCRF (*F. rubra* ssp. *litoralis*), and strong creeping red fescue = STCRF (*F. rubra* ssp. *rubra*).
- Previous research has found seed size differences among species and cultivars of the fine fescues (Fairey and Lefkovitch, 1996), making comparisons among fine fescue species and cultivars potentially confounded if seeding is not done based on number of Pure Live Seeds (PLS) for a given area.
- The correct seeding rate and species to use could vary depending on the users desired aesthetics, maintenance requirements, and site use.

Objectives

1) Evaluate five commonly-used fine fescue species for their suitability to be maintained with minimal mowing.

2) Determine a seeding rate based on number of PLS cm^{-1} for fine fescue "No-Mow" to maintain adequate quality without excessive biomass.

Materials & Methods

- Design
  - 5 species x 6 seeding rate factorial (Table 1)
  - 2015 Trial planted August 26, 8 replications of 1.5 x 3.0 m plots
  - 2017 Trial planted August 19, 4 replications of 1.5 x 1.5 m plots
- Management
  - *Irrigation* - provided for establishment only
  - *Fertility* - at seeding with 48.8 Kg ha-1 of P_2O_5
  - *Protection* - Plots covered with Futerra® establishment blankets
  - *Mowing* - 8.9 cm during planting year, annually at 14 cm with biomass removed at the end of July for subsequent years
  - *Herbicides* – Applied to control prohibited noxious weeds: Canada thistle (*Cirsium arvense* L.) (MDA, 2018)
- Data
  - Turfgrass quality - (1-9, 9=ideal, 5= minimally acceptable)
  - Seedhead density - (3 sets of 0.09 m^{-2} counts per plot)
  - Lodging - (1-5, 1= 100% lodged)
  - Establishment – (1-9, 9 = fully established)
  - Weed Incidence and Living Turf Cover – Seasonally to assess plot make up using line intersect (data not shown)
- Data Analysis
  - Data was analyzed as a factorial with ARM (Gylling Managemnt Inc.) with main effects separated by means comparison using Fisher's LSD at α=0.05 when no interaction occurred (Table 2).
  - Fisher's LSD calculated to make treatment comparisons at α=0.05 (Table 3, Figure 1 & 2).

Table 1. Fine fescue species and Pure Live Seed (PLS) seeding rates used for a 2015 and 2017 "No-mow" trial .

			Weight of PLS per area range			
			2015		2017	
Species[2]	Cultivar	PLS cm^{-2}	lbs 1000ft $^{-2}$	Kg ha^{-2}	lbs 1000ft $^{-2}$	Kg ha^{-2}
CHF	Compass	0.125, 0.25, 0.5, 1.0, 2.0, 3.0	0.32 to 7.68	15.6 to 375.1	0.29 to 7.01	14.3 to 342.3
HDF	Beacon		0.23 to 5.50	11.2 to 268.6	0.23 to 5.55	11.3 to 270.9
SHF	Marco Polo		0.28 to 6.69	13.6 to 326.6	0.24 to 5.76	11.7 to 281.4
SLCRF	Seabreeze GT		0.31 to 7.34	14.9 to 358.4	0.26 to 6.33	12.9 to 309.0
STCRF	Navigator II		0.33 to 7.85	16.0 to 383.3	0.30 to 7.17	14.6 to 349.9

Table 2. Main effect of species and Pure Live Seed (PLS cm^{-1}) seeding rate for establishment, weed percentage and lodging from 2015 "No-mow" trial separated by Fishers LSD (p = 0.05).

Species	Establishment[1]	% Weeds[2]	Lodging[3]
CHF	5.8b	9.3b	2.3bc
HDF	4.2d	14.5a	2.8ab
SHF	4.6c	12.6a	3a
SLCRF	6.2a	6.3c	2.2c
STCRF	6.1ab	7.6bc	3.1a
LSD (p=0.05)	0.3	2.2	0.5

Seed Rate	Establishment[1]	% Weeds[2]	Lodging[3]
0.125	3.1e	19.4a	1.9c
0.25	4.1d	12.6b	1.9c
0.50	5.1c	9.1c	2c
1.0	6.2b	7.8cd	3b
2.0	6.8a	6.7de	3.7a
3.0	7.1a	4.9e	3.8a
LSD (p=0.05)	0.3	2.4	0.6

[1] Establishment = 1 to 9 rating with 9 representing a plot that is fully established (30 Sept. 2015)
[2] % Weeds = visual estimate of percentage of plot covered by weeds (22 April 2016)
[3] Lodging = 1 to 5 rating, 1 represents all seedheads lodged and 5 represents no lodged seedheads (20 June 2016)

Table 3. Thousand Seed Weight (TSW) of species used in the 2014 National Turfgrass Evaluation Program (NTEP) fine fescue trials.

NTEP Entry #	Name	Species[1]	TSW^{-1} (grams)	Seeds per Pound	Seeds per Kilogram
28	BAR 6FR 126	CHF	0.8053uv	563,800	1,241,850
16	Radar	CHF	0.8454u	537,040	1,182,907
39	Cascade	CHF	0.9660qr	469,991	1,035,223
31	RAD-FC44	CHF	1.0514lmn	431,795	951,090
27	BAR VV-VP3-CT	CHF	1.0957jkl	414,356	912,679
20	PPG-FRC 114	CHF	1.1142jk	407,476	897,525
25	Castle	CHF	1.1373ij	399,182	879,256
38	DLFPS-FRC/3057	CHF	1.2444ef	364,827	803,584
23	Compass II	CHF	1.2477ef	363,884	801,507
40	DLF-FRC 3338	CHF	1.3487cd	336,633	741,482
13	Resolute	HDF	0.7705v	589,228	1,297,858
12	Gladiator	HDF	0.8194u	554,098	1,220,480
36	PST-4BND	HDF	0.8418u	539,320	1,187,931
8	MNHD-14	HDF	0.8529tu	532,286	1,172,436
42	Beudin	HDF	0.8959st	506,739	1,116,165
17	Beacon	HDF	0.9715q	467,331	1,029,362
14	Sword	HDF	0.9790pq	463,727	1,021,424
1	Minimus	HDF	1.0007opq	453,682	999,300
4	DLFPS-FL/3066	HDF	1.0410mno	436,140	960,661
19	Jetty	HDF	1.1053jk	410,767	904,773
5	DLFPS-FRC/3060	HDF	1.2015fgh	377,869	832,310
6	DLFPS-FL/3060	HDF	1.3593cd	334,002	735,686
10	Quatro	SHF	0.5847w	776,433	1,710,205
15	Seabreeze GT	SLCRF	0.9183rs	494,405	1,088,998
26	BAR FRT 5002	SLCRF	1.0748klm	422,414	930,427
21	SeaMist	SLCRF	1.1748hi	386,440	851,191
35	PST-4BEN	STCRF	1.0205nop	444,891	979,936
3	7C34	STCRF	1.0303mno	440,670	970,638
34	PST-4RUE	STCRF	1.1020jk	411,988	907,462
29	C14-OS3	STCRF	1.1192jk	405,638	893,475
9	DLFPS-FRR/3068	STCRF	1.1409ij	397,931	876,501
18	Navigator II	STCRF	1.1843ghi	383,341	844,363
24	Kent	STCRF	1.2209e-h	371,864	819,085
7	DLFPS-FRR/3069	STCRF	1.2261efg	370,280	815,594
33	PST-4DR4	STCRF	1.2350ef	367,626	809,749
2	Marvel	STCRF	1.2623e	359,661	792,205
11	Boreal	STCRF	1.2675e	358,178	788,939
37	PST-4ED4	STCRF	1.3294d	341,501	752,205
30	RAD-FR33R	STCRF	1.3341d	340,304	749,569
32	RAD-FR47	STCRF	1.3931c	325,904	717,849
22	Cardinal II	STCRF	1.4452b	314,138	691,934
41	DLF-FRR 6162	STCRF	1.6099a	282,009	621,166
	LSD (p=0.05)		0.0485		

[1] Thousand Seed Weight calculated as the mean weight of four sets of 1000 seeds.

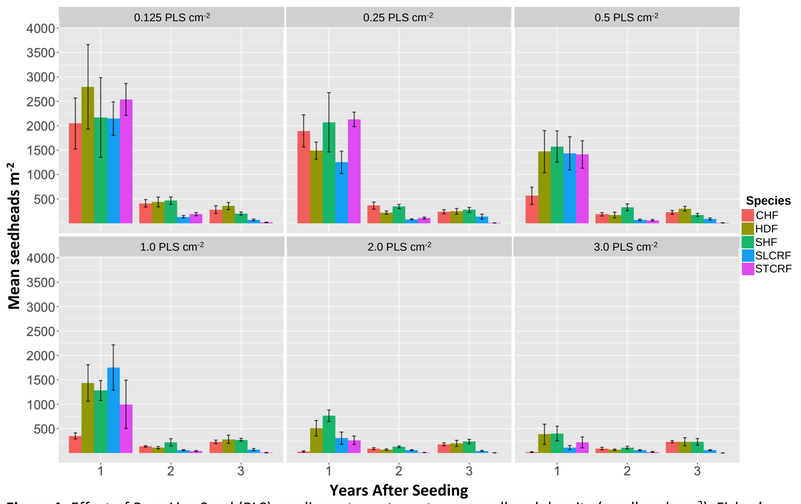

Figure 1. Effect of Pure Live Seed (PLS) seeding rate and species on seedhead density (seedheads m^{-2}). Fisher's LSD (α=0.05) of 312.2 was calculated for comparing species, years and seeding rates. Error bars = standard error.

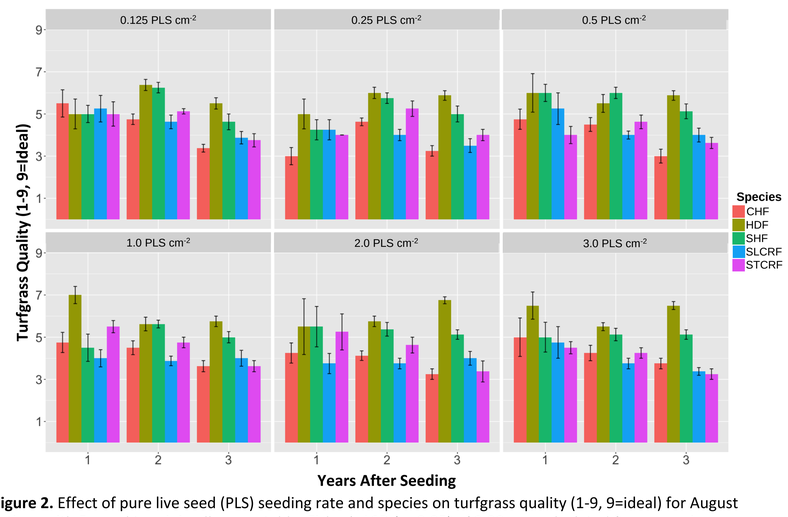

Figure 2. Effect of pure live seed (PLS) seeding rate and species on turfgrass quality (1-9, 9=ideal) for August ratings with 5 equal to minimally acceptable. Fisher's LSD (α=0.05) of 0.99 was calculated for comparing species, years and seeding rates. Error bars = standard error.

Citations

Fairey, N.A., and L.P. Lefkovitch. 1996. Ploidy and cultivar group differences in the thousand-seed weight of red fescue (*Festuca rubra* L.) Can. J. of Plant Sci., 76(3): 465-467. doi: 10.4141/cjps96-082

Minnesota Department of Agriculture (MDA). 2018. Minnesota Noxious Weed List. Retrieved from http://www.mda.state.mn.us/plants-insects/minnesota-noxious-weed-list

Yue, C., Hugie, K., and Watkins, E. 2012. Are consumers willing to pay more for low-input turfgrasses on residential lawns? evidence from choice experiments. J. of Agr. and Appl. Econ., 44(4): 549-560. doi: 10.1017/S107407080002410X

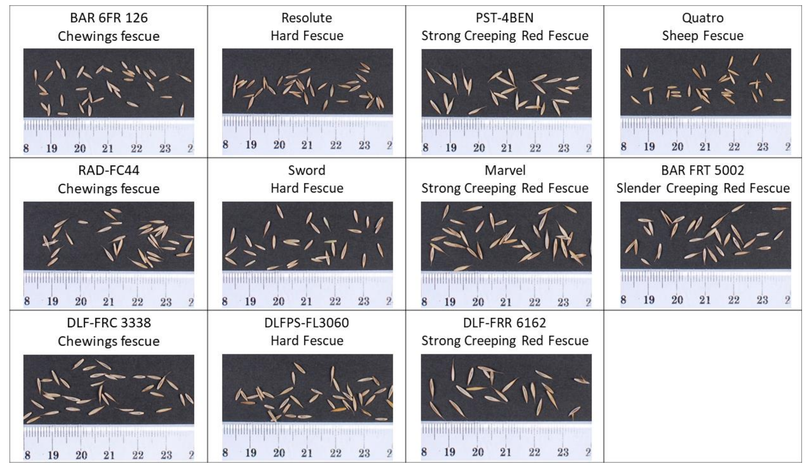

Figure 3. Variation in seed size between and within fine fescue species from the 2014 National Turfgrass Evaluation Program fine fescue trials . Ruler units in centimeters.

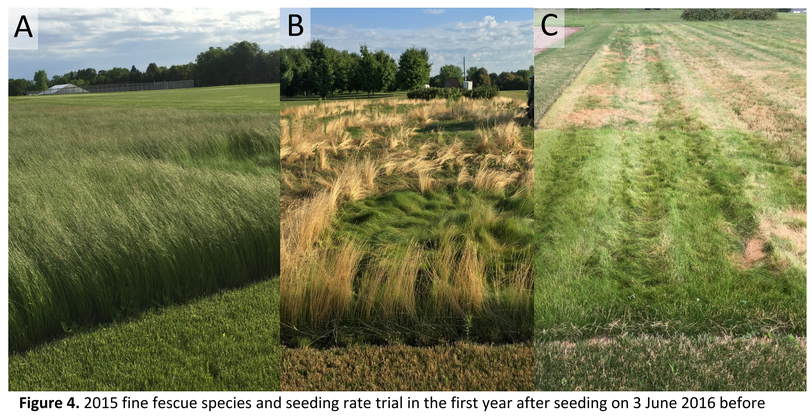

Figure 4. 2015 fine fescue species and seeding rate trial in the first year after seeding on 3 June 2016 before lodging (A), 26 July 2016 after lodging (B), and 10 August 2016 after biomass is cut to 14cm and removed (C).

Results

- Cultivars used in the 2014 NTEP fine fescue trials differed significantly in thousand seed weight, with a difference of over a million seeds kg^{-1} between the smallest and largest seeds (Fig. 1).
  - Seed lot differences were accounted for with planting year (Table 1).
- There was a significant main effect of species and seeding rate for establishment, weed incidence and seedhead lodging (Table 2).
  - *Establishment* - Slender creeping red fescue established significantly better than all plots except strong creeping red fescue. Increasing seed rate significantly increased establishment.
  - *Weed Incidence* - Sheep and hard fescue had significantly more weeds than the other species. Increasing seed rate significantly decreased the percentage of weeds.
  - *Lodging* - Sheep fescue had significantly less lodging than slender creeping red fescue and Chewings fescue. High seeding rates of 2.0 and 3.0 PLS cm^{-1} had significantly less lodging than all lower rates.
- In the first year after seeding, seeding rate had the largest influence on the number of seedheads produced with an inverse relationship between the two. As seeding rate increased, number of seedheads decreased (Fig. 1).
  - Chewings fescue produced almost no seedheads at both 2.0 and 3.0 PLS cm^{-1}.
  - Hard fescue and strong creeping red fescue produced the highest density of seedheads at 0.125 PLS cm^{-1}.
- In the second and third years after seeding, seedhead density decreased across seeding rates and species (Fig. 1).
  - 0.125 PLS PLS cm^{-1} resulted in the greatest reduction in density .
  - Strong creeping red fescue had no seedhead production at 3.0 PLS cm^{-1} and minimal seedhead production at all other seeding rates in year three.
- Turfgrass quality varied with species and seeding rate for the August rating date in each reproductive year (Fig.2).
  - Hard fescue maintained acceptable turfgrass quality across all seeding rates and years.
  - Hard fescue followed by sheep fescue, had the highest turfgrass quality regardless of seeding rate in the third reproductive year.

Conclusions

- With the observed variation in seed size among fine fescues, seed recommendations should shift from weight of PLS for a given areas to number of PLS cm^{-1}.
- Hard fescue at the 2.0 and 3.0 PLS cm^{-1} shows promise as a turfgrass which can be maintained with a single mowing during reproductive years. The high seeding rate limits weeds, reduces seedhead density and maintains turfgrass quality. Future research needs to answer whether all hard fescue cultivars will behave similarly in Minnesota and other Northern locations.