Evaluation of Selfed and Open Pollinated Progeny of Tall Fescue for Turf

Keith Rincker, Ken Diesburg
Southern Illinois University Carbondale

Introduction

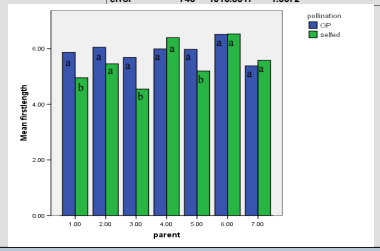
Tall fescue (*Festuca arundinacea* Shreb.) is a popular turfgrass in the transition zone and northern climates. Tall fescue is deep rooting with good drought and heat tolerance. In addition, it is normally open pollinated, but has a degree of self-compatibility. Self pollination can be used to produce progeny with segregated alleles. Deleterious recessive alleles can then be selected against. Buckner and Fergus (Buckner and Fergus, 1960) suggest that selection within inbred lines of tall fescue may be successful for improved palatability of cattle. Our long-term goal is to find if selection from selfed progeny is more effective than open pollinated progeny. This research specifically evaluates the selfed and open pollinated progeny in different turf characteristics.

Materials and Methods

SIU turf-type tall fescue germplasm was used. In 2006, 16 parents within a polycross were used to obtain selfed and open pollinated progenies. To achieve this, separate clonal plants were left to open pollinate. Seven parents produced enough selfed and open pollinated progeny to be included in the field evaluations. The length of the first leaf blade was measured to obtain an estimate of seedling vigor. Counting the number of leaves when each plant tillered and again counting leaves 13 days later obtained a measurement of leaf production rate. Greenhouse data was treated as a completely randomized design. Progenies were transplanted to the field in a randomized complete block design in March of 2007 at two locations, Horticulture Research Center in Carbondale, IL and Angus Links Golf Course in Windsor, IL. Mature leaf blade length, width and number of seedheads were measured. Measurements were also taken on plant spread and ratings of turf quality, color, density, and disease resistance. Data were analyzed using PROC GLM in SAS.

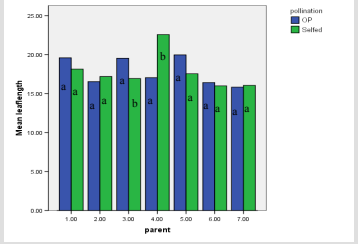
Seedling Vigor

Source	DF	SS	MS	F value	p-value
parent	6	154.2907	25.7151	18.81	<0.0001
pollination	1	30.2408	30.2408	22.12	<0.0001
parent*pollin	6	58.7880	9.7980	7.17	<0.0001
error	743	1015.8317	1.3672		



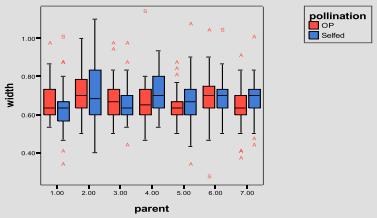
Mature Leaf Blade Length

Source	DF	Type III SS	Mean Square	F Value	Pr > F
location	1	3037.1002	3037.1002	142.30	<.0001
rep	3	546.7986	182.2662	8.54	<.0001
location*rep	3	55.0337	18.3446	0.86	0.4619
parent	6	1238.3346	206.3891	9.67	<.0001
location*parent	6	95.9644	15.9941	0.75	0.6101
rep*parent	18	453.2994	25.1833	1.18	0.2723
location*rep*paren	18	418.8806	23.2711	1.09	0.3579
pollination	1	1.1168	1.1168	0.05	0.8191
location*pollinatior	1	4.3027	4.3027	0.20	0.6536
rep*pollination	3	40.7617	13.5872	0.64	0.5917
locatio*rep*pollinat	3	35.5267	11.8422	0.55	0.6451
parent*pollination	6	1063.9762	177.3294	8.31	<.0001
locati*parent*pollin	6	96.8169	16.1361	0.76	0.6048
rep*parent*pollinat	18	535.1983	29.7332	1.39	0.1283
loca*rep*paren*pol	18	498.2826	27.6824	1.30	0.1831
error	559	11930.7045	21.3429		



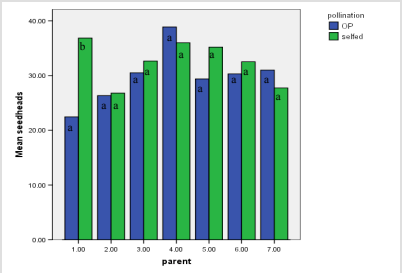
Mature Leaf Blade Width

Source	DF	Type III SS	Mean Square	F Value	Pr > F
location	1	0.8921	0.8921	81.73	<.0001
rep	3	0.0322	0.0107	0.98	0.4000
location*rep	3	0.0266	0.0089	0.81	0.4879
parent	6	0.3050	0.0508	4.66	0.0001
location*parent	6	0.0753	0.0126	1.15	0.3320
rep*parent	18	0.2826	0.0157	1.44	0.1075
location*rep*paren	18	0.1744	0.0097	0.89	0.5939
pollination	1	0.0033	0.0033	0.30	0.5819
location*pollinatior	1	0.0156	0.0156	1.43	0.2325
rep*pollination	3	0.0112	0.0037	0.34	0.7958
locatio*rep*pollinat	3	0.0408	0.0136	1.24	0.2927
parent*pollination	6	0.1657	0.0276	2.53	0.0200
locati*parent*pollin	6	0.0530	0.0088	0.81	0.5631
rep*parent*pollinat	18	0.0926	0.0051	0.47	0.9695
loca*rep*paren*pol	18	0.2229	0.0124	1.13	0.3140
error	559	6.1020	0.0109		



Number of Seedheads

Source	DF	Type III SS	Mean Square	F Value	Pr > F
location	1	84542.0042	84542.0042	298.43	<.0001
rep	3	8455.2721	2818.4240	9.95	<.0001
location*rep	3	2010.1728	670.0576	2.37	0.0701
parent	6	5979.4953	996.5826	3.52	0.0020
location*parent	6	1338.5825	223.0971	0.79	0.5799
rep*parent	18	5700.2983	316.6832	1.12	0.3301
location*rep*paren	18	4335.5015	240.8612	0.85	0.6403
pollination	1	1197.7367	1197.7367	4.23	0.0402
location*pollinatior	1	148.5151	148.5151	0.52	0.4693
rep*pollination	3	1063.2557	354.4186	1.25	0.2905
locatio*rep*pollinat	3	1374.2562	458.0854	1.62	0.1844
parent*pollination	6	5176.6311	862.7719	3.05	0.0061
locati*parent*pollin	6	1504.2916	250.7153	0.89	0.5055
rep*parent*pollinat	18	6515.4058	361.9670	1.28	0.1962
loca*rep*paren*pol	18	5361.5091	297.8616	1.05	0.3995
error	547	154956.9167	283.2850		



Results

In the greenhouse, three families (#1,3,5) were found to have smaller S_1 seedlings, but there were no significant effects in the rate of leaf production. One S_1 family (#4) has longer mature leaves (OP= 17.1cm compared to S_1= 22.5cm) while another family (#3) has shorter leaves (OP= 19.5cm compared to S_1= 17.0cm) and yet another S_1 family (#1) had a larger average number of seedheads (OP= 22.4 compared to S_1= 36.8). A greater range of seedling vigor and leaf blade width was found in five families. In leaf production, leaf blade length, and number of seedheads we only found three families with greater range.

Summary

Greater range was found in some S1 families, which was expected. This suggests that improvement through selfing is possible. We did not see as many differences in means that we hoped for, but we did see many differences among and some within families. Since tall fescue is a hexaploid, expression of recessive traits is not as great as it would in a diploid. Therefore, it is possible that more generations of selfing are needed. We did observe self incompatibility in many families, since only 7 parents produced enough seedlings to be included in the research. Selection from the progeny is still important because the progeny can pass on favorable genes.

Conclusion

There was sufficient variability trait expression to warrant selection from both S_1 and OP progenies. Any influence between S_1 and OP selection remains to be seen in subsequent generations.

References

Buckner, R.C., and E.N. Fergus. 1960. Improvement of Tall Fescue for Palatability by Selection within Inbred Lines. Agron. J. 52:173-6

Acknowledgements

Thanks to the Illinois Turfgrass Foundation for funding this research. We would also like to thank Angus Links Golf Course and Turf Innovations for there cooperation.

Contact Info

Address: Southern Illinois University, Plant and Soil Science 4415, Carbondale, IL 62901; E-mail: keithr02@yahoo.com