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Diversification of the Forage Seed Industry in Wisconsin

A report on the potential for turfgrass seed production

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INTRODUCTION

Internationally, the turf grass seed industry represents a $750,000,000 annual market. Most of the US turf grass seed production occurs in the Pacific Northwest, mainly in the Willamette Valley of Oregon. Large acreages of turf grass seed production will need to be relocated out of this region due to legislation restricting turf grass seed production practices.

Northern Wisconsin has the resources and potential for profitable turf grass seed production. The decline of the dairy industry in this region has left many potentially productive acres of cropland idle. A large percentage of this vacant cropland may be well suited for turf grass seed production and, with proper management, could provide additional farm income with a minimum of time and investment capital. In addition to land availability, producers in this region also have most of the equipment needed for seed production. At its simplest, a turf grass seed producer will need tillage equipment to prepare a fine seed bed, a drill to sow seed, fertilizer application equipment, chemical spraying equipment, and harvesting equipment. Seed cleaning and marketing resources are available within the region.

Some farmers in northern Wisconsin are already involved in seed production of other species. The birdsfoot trefoil (*Lotus corniculatus* L.) seed production industry is well established in this region. The addition of turf grass seed production into rotations with birdsfoot trefoil seed production would benefit production of both species. Broadleaf weed control in birdsfoot trefoil seed production fields is difficult while grass weed control is more easily achieved. The opposite is true for turf grass seed production: broadleaf weeds are easy to control while grass weeds are difficult to control. A producer using a birdsfoot trefoil/turf grass rotation might be able to control (or at least reduce) the hard to control weeds associated with each species prior to establishing a production field.

MATERIALS and METHODS

Yield trials were conducted at three locations in Ashland and Bayfield Counties, WI, during 1991 to 1993. One location was at University of Wisconsin Ashland Agricultural Research Center (ASH). The soil type at this location is a Manistee loamy sand. The second experimental site was located on a Hibbing silty clay loam soil at Deer Creek Seed Company (DC), Ashland, WI. The third site (PEN) was located on a farm approximately 1 mile south of Mason, WI, on a Badriver clay loam. The sites selected for this trial are representative of the birdsfoot trefoil seed production region in northern Wisconsin. Sites similar these may be suitable for agricultural diversification into turf grass seed production.

Twenty-six turf cultivars representing seven species were evaluated at all locations (Table 1). At each location, plots were arranged in a randomized complete block with four replicates. Individual plots measured 5.5 x 15 ft and contained either 4 or 11 rows (6 and 18 inch row spacings, respectively) depending on the row spacing for each species (Table 1). Plots were established at ASH on 12 July, 1990, at DC on 6 August, 1990, and at PEN on 19 July, 1990. All seed was sown using a drill set to plant at depth of between 0.125 and 0.25 inches. All plots were fertilized and limed to soil test recommendations prior to establishment.

Split applications of nitrogen were utilized throughout the study. Timing of split applications coincided with specific stages of plant physiological development. Fall applications were made to promote tiller formation while spring applications were made at green-up and jointing to help stimulate plant growth and to maximize yield. The fall application was made approximately 2 weeks following harvest. Table 2 outlines the fertilizer schedule used in this study.

Buctril® (3,5-dibromo-4-hydroxybenzonitrile) herbicide was applied in May 1991 and 1993 at 1.25 pt per acre to control broadleaf weeds. Poast® (2-[1-(ethoxyimino) except the tall fescue entries had filled in the inter-row spaces. Thus, in 1992 and 1993, four linear feet of a single row was harvested from the tall fescue entries, while four square feet was harvested from all other entries. All locations were harvested for seed in 1991 and 1993, while only the ASH location was harvested in 1992. At harvest, seed heads were clipped from the plant and allowed to dry at ambient temperature. After seed heads were dry, seed was thrashed from seed heads by hand and sieved through the appropriate screens to remove trash. Final clean seed was then obtained by cleaning seed with a seed blower (General Seed Blower®) and seed yields determined.

Since the ASH site was the only location harvested in all three years we analyzed the data two different ways. The first analysis was conducted on data obtained only from the ASH location. This data was analyzed as a split plot in time (repeated measures over years). The second analysis was performed on the combined data from all locations and years and was also analyzed as a split plot in time (combined over locations). All mean comparisons were based on LSD (0.05) as outlined by Cochran and Cox for a split-plot design (Cochran W.G., and G.M. Cox. 1957. Experimental Design. 2nd ed. John Wiley and Sons, New York.). Seed yields are reported as pounds of clean seed per acre.

Upon the request of companies entering turf grass species in this study, cultivar names are kept confidential. Throughout the results and discussion entries are referred to by entry numbers.

contamination in Foundation or Certified turf grass seed classes. For example, the current Wisconsin bluegrass standards are given in table 3.

Weeds can be controlled if appropriate control measures are taken. Proper long term crop rotations prior to turf grass seed production will help control perennial grass and broadleaf weeds. These weeds are much harder to control once the turf grass seed production field is established. Once the production field is established herbicide applications will help reduce both annual and perennial weed populations. If these measures are taken, growers should be able to produce a high quality turf grass seed crop.

Harvest dates

When averaged over locations and years, significant differences were found between entries for harvest date (Table 4). The earliest maturing entries were the fine fescues (chewings, sheep, and red fescues), followed by Kentucky bluegrass, and tall fescue, perennial ryegrass, and timothy. In general, there was no difference between harvest dates for the fine fescue, Kentucky bluegrass, and tall fescue entries. The perennial ryegrass entries matured approximately 13 to 18 days later than the fine fescue entries. Timothy was the latest maturing entry, it matured 62 days later than the fine fescues.

Within species, only the perennial ryegrass entries showed significant variability in maturity (Table 4). Entries 21, 22, 24, and 25 were significantly later maturing (4 to 5 days) than entries 20, 23, and 24. Thus, the perennial ryegrass entries tested in this trial exhibited more variability in maturity than the other species.

Differences in maturity found between entries and within species can provide turf grass seed producers an opportunity to select a turf grass species/cultivar best suited to their farm operation. Species, and to a lesser extent cultivars, can be selected require good weather conditions during pollination for maximum seed production. Pollination of some of these species occurred in mid June and the weather conditions during this time in 1992 and 1993 was cool, wet, and overcast. In addition, weed competition in 1992 and 1993 and diseases in 1993 may have also reduced seed yields. The year x entry interaction indicates that entries differed in their response to environmental change. For example, entry 26 did extremely well in 1991 and relatively poor in 1992 and 1993 while entry 15 did relatively poor in 1991 and performed well in 1992 and 1993 (Table 9).

Fall dormancy (data taken in the fall of 1992) did not appear to be strongly related to seed yield in 1993 ($r^2 = 0.17$). Of the entries exhibiting the greatest degree of fall dormancy (tall fescue, perennial ryegrass, and timothy) only tall fescue entries produced satisfactory seed yields at in 1993. However, more study is needed to determine if a relationship exists between fall dormancy and seed yield for these turf species.

Generally, when averaged over years, the tall fescue and perennial ryegrass entries tended to be superior to the other species (Table 9). When averaged over years, tall fescue entries produced yields between 638 and 937 pounds per acre, perennial ryegrass 536 to 847 pounds per acre, Kentucky bluegrass 179 to 720 pounds per acre, chewings fescue 435 to 490 pounds per acre, red fescue 331 pounds per acre, sheep fescue 490 pounds per acre, and timothy 359 pounds per acre.

Variability in seed yield within a species may allow producers to select and produce a high seed yielding cultivar out of a low yielding species. For example, the bluegrasses tend to be lower yielding than either the perennial ryegrass or tall fescue entries; however, entry 9, a Kentucky bluegrass, produced yields statistically similar to most of the perennial ryegrass and tall fescue entries. Our results indicate that with adequate testing a producer can select a high seed yielding cultivar of tall fescue, perennial ryegrass, or Kentucky bluegrass and obtain satisfactory yields.

establishment. In general, by the third production year profitable seed yields for most entries was not attainable. In the literature it is recommended that some seed harvests of some species be taken for only 2 years following the establishment year. Perennial ryegrass is noted to give excellent yields the first year following establishment after which yields decline rapidly with age. By the third year following establishment seed yields are often reduced to the extent that economic yields are not possible. Our results are similar. We obtained excellent perennial ryegrass seed yields in the year following establishment, reduced yields in the second year following establishment, and even lower seed yields the following year.

When averaged over years and entries, no differences were observed between the ASH and DC sites (Table 8). There was, however, a significant difference between the DC and PEN sites, but not between the ASH and PEN sites. Average turf grass seed yields were 585, 564, and 494 pounds per acre for the DC, ASH, and PEN sites, respectively. Our results suggests that significant differences exist between sites. Thus, site selection can have a large impact on turf grass seed yields.

Results from DC and PEN were similar to the results obtained at ASH (Table 10). At all locations, perennial ryegrass and tall fescue entries performed well. When averaged over locations and years similar results were obtained (Table 10). Generally, the perennial ryegrass and tall fescue entries performed better than the Kentucky bluegrass, fine fescues, and timothy entries. However, some entries of lower yielding species did yield as well as some of the greater yielding species. For example entry 9, a Kentucky bluegrass, performed well at all locations and produced as well as most of the tall fescue and perennial ryegrass entries. This same species also had the lowest yielding entry at all locations when averaged over years.

When averaged over years, locations, and entries within a species, the average yields in this trial were :

our analysis of profitability on the average clean seed yields of species and on a range of contract prices paid to producers for a particular species.

Sheep fescue and Kentucky bluegrass usually receive the greatest average contract prices while the lowest average contract prices are paid for tall fescue and perennial ryegrass cultivars (Table 11). Using the average species yields obtained in this study, gross income per acre ranged from a low of $124 per acre for red fescue grown at a low contract price to a high of $370 per acre for Kentucky bluegrass grown at a high contract price (Table 11). A better estimate of gross income for the producer would be average gross income based on average contract prices for a species. This scenario would simulate gross returns for an average cultivar grown at an average contract price. When this estimate is used, gross income ranged from $ 141 to $ 300 per acre for the red fescue and sheep fescue, respectively. It should be noted that individual proprietary cultivars of any of the species except the red fescue have the ability to return gross incomes in excess of $ 200 per acre.

Net income from turf grass seed production can be estimated by the producer by subtracting the production cost per acre from the gross return per acre. In our judgment, net returns would probably be in the neighborhood of $100 to $150 per acre for an average yielding turf grass cultivar (assuming establishment costs of $125/ac spread over three production years and an annual production cost of $85/ac). Lower net returns would be realized if low yields or low contract prices were achieved.

Conclusions

Northern Wisconsin has potential as a turf grass seed production region. Producers should select cultivars that are well adapted to their area. Both species and cultivars within species vary with respect to yield, maturity, winter hardiness, and ease of establishment. In general, perennial ryegrass and tall fescue seem to have the

Table 2. Fertilizer applications to turf grass seed plots and timing of applications.

N (lb/ac)	year	application method / timing
40	1990	broadcast and incorporated at planting
40	1991	broadcast at greenup
40	1991	broadcast at jointing
40	1992	broadcast early fall
40	1993	broadcast at greenup
40	1993	broadcast at jointing

Table 5. Percent stand of 26 turf grass entries planted at Ashland Agricultural Research Station in 1990 and harvested for seed from 1991-1993 (average of 4 replicates ± SE).

Entry	% stand		
	1991	1992	1993
1	65 ±8	96 ±3	98 ±4
2	77 ±5	93 ±9	100 ±0
3	11 ±9	74 ±10	100 ±0
4	73 ±15	98 ±3	97 ±8
5	74 ±11	99 ±3	95 ±6
6	59 ±31	100 ±0	100 ±0
7	81 ±5	100 ±0	100 ±0
8	72 ±7	91 ±5	100 ±0
9	67 ±2	86 ±3	97 ±2
10	31 ±30	80 ±9	52 ±15
11	91 ±6	84 ±5	72 ±5
12	50 ±24	86 ±6	85 ±7
13	93 ±3	99 ±3	100 ±0
14	96 ±1	96 ±3	100 ±0
15	91 ±4	94 ±5	100 ±0
16	90 ±2	94 ±3	100 ±0
17	89 ±6	94 ±3	100 ±0
18	90 ±2	95 ±4	85 ±3
19	81 ±7	95 ±4	72 ±4
20	93 ±4	89 ±5	98 ±4
21	96 ±2	90 ±4	100 ±0
22	93 ±1	89 ±5	100 ±0
23	88 ±6	78 ±13	100 ±0
24	87 ±5	84 ±3	65 ±12
25	95 ±3	90 ±4	72 ±14
26	92 ±3	94 ±3	100 ±0

Table 7. Percent stand of 26 turf grass entries planted at Deer Creek Seed Co. (DC) in 1990 and harvested for seed in 1992 and 1993 (average of four replicates ± SE).

Entry	% stand 1991	1992	1993
1	. .	91 ±8	52 ±8
2	. .	88 ±3	56 ±14
3	. .	83 ±3	54 ±16
4	. .	93 ±7	52 ±16
5	. .	95 ±6	50 ±15
6	. .	93 ±9	50 ±16
7	. .	93 ±5	52 ±17
8	. .	94 ±8	54 ±15
9	. .	93 ±3	54 ±14
10	. .	85 ±4	35 ±10
11	. .	89 ±3	72 ±9
12	. .	69 ±10	77 ±12
13	. .	74 ±13	56 ±10
14	. .	78 ±16	52 ±10
15	. .	70 ±14	54 ±13
16	. .	85 ±7	52 ±15
17	. .	76 ±18	52 ±10
18	. .	78 ±7	77 ±11
19	. .	81 ±8	73 ±9
20	. .	83 ±16	65 ±8
21	. .	84 ±6	66 ±5
22	. .	80 ±4	67 ±16
23	. .	86 ±5	64 ±16
24	. .	80 ±4	65 ±13
25	. .	86 ±8	65 ±15
26	. .	78 ±19	65 ±16

Table 9. Turf grass seed yields of 26 entries planted at Ashland Agricultural Research Station (ASH) in 1990 and harvested for seed from 1991 to 1993.

Entry	1991	1992	1993	Average
	(lbs/ac)			
1	1299	180	7	495 fg
2	944	120	200	421 gh
3	420	85	33	179 i
4	1165	134	12	437 gh
5	754	162	45	320 ghi
6	721	108	32	287 hi
7	739	132	43	305 hi
8	935	214	102	417 gh
9	1464	401	295	720 cd
10	745	161	170	359 gh
11	655	330	8	331 ghi
12	1175	249	45	490 fg
13	1032	1147	633	937 a
14	996	650	267	638 def
15	965	1213	558	912 ab
16	802	926	490	739 bcd
17	682	888	406	659 def
18	1135	333	3	490 fg
19	1076	219	11	435 gh
20	1560	682	59	767 abcd
21	1678	363	74	705 cde
22	1233	376	0	536 ef
23	1397	625	173	731 cd
24	1324	885	78	762 abcd
25	1638	699	201	846 abc
26	1764	388	43	731 cd

Table 11. Clean seed contract prices, average turfgrass seed yields from a three year trial conducted in northern Wisconsin, and projected gross income paid to turfseed producers.

Species	Contract price range†			Average yield‡	Gross income		
	Low	High	Average		Low	High	Average
	($/lb)			(lb/ac)	($/ac)		
Chewings fescue	0.35	0.45	0.40	526	184	237	210
Kentucky bluegrass	0.55	0.95	0.75	389	214	370	292
Perennial ryegrass	0.25	0.35	0.30	749	187	262	225
Red fescue	0.35	0.45	0.40	353	124	159	141
Sheep fescue	0.70	0.95	0.83	364	255	346	302
Tall fescue	0.25	0.30	0.28	714	179	214	200
Timothy			0.55	367			202

† Estimates of contract prices per pound of clean seed were obtained from companies with contracted acreages of turfgrass seed production in 1993.

‡ Yield averages were calculated from variety trials conducted at three locations in northern Wisconsin (1991-1993).