

Additional sources of detritus production would result from (1) natural leaf drop below the baseline trimming height of four feet, (2) natural leaf drop from above the baseline trimming height previous to trimming and (3) flower and seed production from above and below the baseline.

Arboreal folivore feeding on leaves was significantly higher on the trimmed lower growing mangrove foliage compared to taller growing untrimmed mangrove.

Sampling locations and testing for mineral content of leaves indicated that fertilizer from developed home sites was not detected and thereby, not influencing growth rates.

Observation of flower and seed production for all mangrove species trimmed was noted to flourish below the four foot trimmed height.

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1996-1997 OVERSEED TRIALS ON FAIRWAY AND PUTTING GREEN BERMUDAGRASS¹

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Abstract. Thirty-seven cool-season turfgrasses were overseeded on a 'Tifway' bermudagrass fairway and on a 'Tidwarf' bermudagrass putting green at Gainesville, FL. Studies were established from 25 to 27 October 1996 and terminated on 30 May 1997. In the fairway test, grasses with best seasonal turf quality scores, which averaged 6.4 on a scale of 1 to 9 where 9 = best, included perennial ryegrass cultivars, 'Academy'; 'Gator II'; 'HWY'; 'LRFB7'; 'MB45'; 'Plaisir'; 'Premier II'; 'Resort'; a blend of equal parts of 'Image', 'Lynx', and 'Pegasus' perennial ryegrass; and a mixture of 80% 'Citation III' perennial ryegrass with 20% 'Winterplay' rough bluegrass. In the putting green test, grasses with best seasonal turf quality scores, which averaged 6.5, included 'BARUSA Pt4' rough bluegrass; a mixture of 80% 'Citation III' perennial ryegrass with 20% 'Winterplay' rough bluegrass, and a mixture of 60% 'Sabre II' rough bluegrass with 40% 'AT 90163' colonial bentgrass. Serious bermudagrass competition during establishment as well as during the relatively warm winter growing season account for the atypical results in both overseed studies.

Throughout the southern United States, golf courses, sports turfs, and some home lawns are overseeded annually with cool-season turfgrasses during winter months. This practice results in live, green, turf ground covers and improves playing surfaces when bermudagrass or other warm-season turfgrasses go dormant (Turgeon, 1996). Turfgrass breeders and seed producers continue to develop new grasses resulting in numerous cool-season grasses for overseeding. In addition

to new cultivars, seed producers also formulate new grass mixtures and blends. Timely trials are needed to evaluate performance and to provide information to potential users of these grasses (Anderson and Dudeck, 1994; Anderson and Dudeck, 1995; Anderson et al., 1995, Anderson and Dudeck, 1996). The objective of these studies was to evaluate suitability of selected cool-season turfgrass species, cultivars, mixtures, and blends for winter overseeding of a bermudagrass putting green and a fairway in north Florida.

Materials and Methods

Research plots were located at the G. C. Horn Turfgrass Field Laboratory, Gainesville, FL. Two separate but concurrent studies were conducted during the 1996-1997 winter period: one under fairway conditions and another under putting green conditions. Thirty-seven entries of cool-season grasses listed in Table 1 were overseeded on a 'Tifway' bermudagrass (*Cynodon* spp.) fairway on 25 Oct. 1996. The same grasses were overseeded on a 'Tidwarf' (*Cynodon* spp.) bermudagrass putting green on 27 Oct. 1996. Bermudagrass control plots, which were not overseeded, were included in both studies.

Prior to seeding, the putting green site was topdressed with an Arredondo fine sand (loamy, silicious, hyperthermic Grossarenic Paleudult), which was identical to underlying soil. Topdressing rate was 7.4 ft³ per 1000 sq ft (approximately one-eighth inch of soil). The fairway site was scalped to 0.5 inch with a mower and was not topdressed before overseeding.

A shaker bottle was used to hand seed all plots accurately and uniformly within a 4 by 6 ft seeder box. Small seeded grasses such as bentgrass (*Agrostis* spp.) and bluegrass (*Poa* spp.) were diluted with a small amount of soil prior to hand seeding. Perennial ryegrass (*Lolium perenne*) was seeded at a rate of 15 pure live seed (PLS) per square inch on the fairway and 50 PLS per square inch on the putting green (Table 2). Bluegrass and Red fescue (*Festuca rubra trichophylla*) were seeded at a rate of 30 PLS per square inch on the fairway and 100 PLS per square inch on the putting green. Bentgrass was seed-

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Table 1. Cool-season turfgrasses with their composition and seed source that were overseeded during the 1996-1997 winter period at Gainesville, FL.

Entry	Components			
	Mix/Blend (%)	Cultivar	Species'	Source
Academy	100	Academy	PR	Pratum Co-op Warehouse
Barcrown	100	Barcrown	RF	Barenbrug HOLLAND
BARUSA Pt4	100	BARUSA Pt4	RB	Barenbrug USA
Blend 1	33	Imagine	PR	Olsen-Fennell Seeds, Inc
	33	Lynx	PR	
	33	Pegasus	PR	
Blend 2	33	ICE	PR	Olsen-Fennell Seeds, Inc
	33	ET	PR	
	33	PI	PR	
Catalina	100	Catalina	PR	Pure Seed Testing
Charger II	100	Charger II	PR	Pure Seed Testing
Danish Common	100	Common	RB	Pickseed West, Inc.
Eagle Blend	33	Assure	PR	Lesco
	33	Commander	PR	
	33	Williamsburg	PR	
Fuzzy	100	Fuzzy	RB	Olsen-Fennell Seeds, Inc.
Gator II	100	Gator II	PR	International Seeds
GK 3way Blend	33	Brightstar	PR	Pure Seed Testing
	33	Charger	PR	
	33	Sunrye	PR	
HWY	100	HWY	PR	Olsen-Fennell Seeds, Inc.
Imagine	100	Imagine	PR	Olsen-Fennell Seeds, Inc.
Juwel	100	Juwel	PR	Duetsche Saatveredelung
Lipoa	100	Lipoa	KB	Deutsche Saatveredelung
Livonne	100	Livonne	PR	Deutsche Saatveredelung
LRFB7	100	LRFB7	PR	Lofts Seed
MB45	100	MB 45	PR	Scotts Company
Mix 1	20	Winterplay	RB	Pure Seed Testing
	80	Citation III	PR	
Mix 2	40	AT 90163	AT	International Seed
	60	Sabre II	RB	
Pageant	100	Pageant	PR	Pratum Co-op Warehouse
Pearl	100	Pearl	PR	Pratum Co-op Warehouse
Penn A-4	100	Penn A-4	CB	Tee-2-Green
Penn G-2	100	Penn G-2	CB	Tee-2-Green
Penn G-6	100	Penn G-6	CB	Tee-2-Green
Plaisir	100	Plaisir	PR	Deutsche Saatveredelung
Premier II	100	Premier II	PR	Barenbrug USA
Pt A	100	Pt A	RB	Barenbrug HOLLAND
PT B-93	100	PT B-93	RB	Pickseed West, Inc.
PT I-93	100	PT I-93	RB	Pickseed West, Inc.
Resort	100	Resort	PR	Lesco
Roadrunner	100	Roadrunner	PR	Pure Seed Testing
Southshore	100	Southshore	CB	Sunbelt Seed
Top Hat	100	Top Hat	PR	International Seed
TTAR	100	TTAR	PR	Olsen-Fennell Seeds, Inc
Winterplay	100	Winterplay	RB	Pure Seed Testing

'AT' = Colonial bentgrass, *Agrostis tenuis*; CB = Creeping Bentgrass, *Agrostis palustris*; RF = Red fescue, *Festuca rubra trichophylla*; KB = Kentucky Bluegrass, *Poa pratensis*; RB = Rough Bluegrass, *Poa trivialis*; PR = Perennial ryegrass, *Lolium perenne*.

ed at a rate of 45 and 150 PLS per square inch on the fairway and green, respectively. After seeding, both sites were top-

Table 2. Cool-season turfgrass seed quality, bulk and pure live seed (PLS) number per pound, and seeding rate for overseed trials at Gainesville, FL during the winter of 1996 to 1997.

Entry	Purity (%)	Germ (%)	Seed		Seed Rate'	
			Bulk	PLS	Green	Fairway
			(no./lb)		(lb/1000 ft²)	
Academy	97.5	94.5	246,978	227,581	31.6	9.5
Barcrown	96.8	90.0	1,194,736	999,994	7.2	2.2
BARUSA Pt4	92.5	85.0	2,400,000	1,887,000	7.6	2.3
Blend 1	98.6	86.8	230,000	196,851	36.3	10.8
Blend 2	97.3	97.3	230,000	198,512	36.0	10.8
Catalina	98.8	93.0	273,165	250,995	28.7	8.6
Charger II	99.5	97.0	217,537	209,956	34.3	10.3
Danish Common	92.2	89.0	1,853,061	1,518,936	9.5	2.8
Eagle Blend	97.0	90.0	250,000	218,228	32.7	9.9
Fuzzy	97.9	87.0	1,759,772	1,498,085	9.6	2.9
Gator II	98.3	90.0	260,400	230,470	31.2	9.4
GK 3way Blend	98.6	94.0	253,253	234,820	31.9	3.2
HWY	97.5	89.5	230,000	200,663	35.9	10.8
Imagine	98.2	86.5	230,000	195,429	36.8	11.1
Juwel	99.0	92.0	267,058	243,236	29.6	8.9
Lipoa	93.8	88.3	2,172,061	1,799,533	8.0	2.4
Livonne	99.0	92.0	324,285	295,541	24.4	7.3
LRFB7	95.8	91.2	274,659	239,968	30.0	9.0
MB45	98.6	93.0	240,000	220,075	32.7	9.8
Mix 1	97.5	92.2	238,215	214,143	28.7	8.6
Mix 2	98.21	91.3	1,170,000	1,043,406	5.9	1.8
Pageant	99.6	90.0	224,000	200,753	35.9	10.8
Pearl	98.9	95.0	288,898	271,434	26.5	8.0
Penn A-4	99.1	97.0	7,000,000	6,728,890	3.2	1.0
Penn G-2	98.0	98.0	7,000,000	6,722,800	3.2	1.0
Penn G-6	98.8	93.0	7,000,000	6,433,182	3.4	1.0
Plaisir	95.0	90.0	230,000	196,650	36.6	11.0
Premier II	96.5	90.0	245,000	212,783	33.8	10.2
Pt A	92.6	93.0	3,492,307	3,007,505	4.8	1.4
PT B-93	99.1	80.0	1,991,228	1,401,825	10.3	3.1
PT I-93	96.5	85.0	2,030,411	1,665,445	8.6	2.6
Resort	99.1	90.0	250,000	222,975	32.3	9.7
Roadrunner	98.2	94.0	208,640	192,591	37.4	11.2
Southshore	98.0	98.0	7,000,000	6,722,800	3.2	1.0
Top Hat	99.2	96.0	270,000	257,230	28.0	8.4
TTAR	97.0	92.2	230,000	205,704	35.0	10.5
Winterplay	98.5	97.0	2,654,970	2,536,691	5.7	1.7

'see text for PLS seeding rate.

dressed at 7.4 ft³ per 1000 ft² with Arredondo fine sand to cover seed. Preventative fungicides and insecticides were applied throughout the studies to minimize disease and insect problems. Light irrigation was applied twice daily for two weeks fol-

Table 3. Maximum, minimum, average, and departure from normal air and soil temperatures (°F) at 4-inch depth during the first four weeks of establishment following overseeding on 26 Oct. 1996 at Gainesville, FL'.

Week	Location	Actual Temp.			Departure from 29-year Mean		
		Max.	Min.	Mean	Max.	Min.	Mean
1	Air	87.1	60.0	73.6	7.9***	3.7**	5.8***
	Soil	80.0	74.6	77.3	5.8***	5.2***	5.5***
2	Air	80.4	52.3	66.4	2.8	-2.2	0.3
	Soil	74.9	67.6	71.2	2.6*	0.1	1.3
3	Air	67.1	42.1	54.6	-8.9**	-10.4*	-9.7**
	Soil	66.3	61.1	63.7	-4.1**	-4.4**	-4.2***
4	Air	74.1	52.9	63.5	-0.5	1.8	0.7
	Soil	69.9	65.9	67.9	1.2	1.9	1.6

'Recorded at Agronomy Farm, University of Florida campus.
*, **, *** Significant at the 0.05, 0.01, 0.001 probability levels, respectively.

Table 4. Maximum, minimum, average, and departure from normal air and soil temperature (°F) at 4-inch depth during the 1996-1997 overseed season at Gainesville, FL.^a

Month	Location	1996-1997			Departure from 29-year Mean		
		Max.	Min.	Mean	Max.	Min.	Mean
Oct.	Air	87.3	61.2	74.2	7.7***	4.4**	6.1**
	Soil	79.0	74.0	76.5	4.4**	4.2**	4.3**
Nov.	Air	74.4	50.3	62.3	-1.2	-1.9	-1.6
	Soil	70.6	65.2	67.9	0.7	0.1	0.4
Dec.	Air	68.9	44.5	56.7	-1.6	-1.9	-1.7
	Soil	61.9	56.8	59.3	-1.6*	-2.1*	-1.9*
Jan.	Air	68.9	44.8	56.8	-0.1	0.8	0.4
	Soil	63.3	58.5	60.9	2.4**	2.6**	2.5**
Feb.	Air	73.8	49.5	61.6	2.8*	4.0**	3.4**
	Soil	67.4	61.1	64.2	4.2***	3.3***	3.8***
Mar.	Air	81.4	57.5	69.4	4.7***	6.5***	5.6***
	Soil	76.1	69.1	72.6	6.2***	5.9***	6.1***
Apr.	Air	78.6	53.6	66.1	-3.9**	-2.6	-3.2**
	Soil	77.0	69.5	73.2	-0.5	-0.5	-0.5
May	Air	85.4	61.6	73.5	-2.2**	-1.3	-1.8*
	Soil	83.4	75.6	79.5	-0.4	-0.5	-0.4

^aRecorded at Agronomy Farm, University of Florida campus.

*, **, *** Significant at the 0.05, 0.01, 0.001 probability levels, respectively.

lowing seeding. This was then reduced to once per day to replace water loss from evapotranspiration (Penman, 1948).

The putting green test was mowed five times a week at a height of 0.19 inch. Clippings were removed only from the putting green. The fairway test was mowed five times a week at a height of 0.5 inch. Both studies were fertilized every two weeks at a rate of 0.5 lb of nitrogen per 1000 ft² with a granular fertilizer having a 3-1-2- or 4-1-2 ratio of N-P-K.

Data were gathered on rate of establishment, which was based on visual estimates of percent overseed cover by two or three independent observers. These ratings were taken every three or four days for the first three weeks after seeding, then they were taken twice monthly for the remainder of the study. Rate of ground cover was calculated after Maguire (1962) as the sum of average weekly ground cover estimates for the first three weeks. Since many cover estimates in the first weeks had zero values and since many plots had little or no annual bluegrass, percentage data were first transformed using a square root transformation (Little and Hills, 1978). Data from square root or arcsine transformations of percentage data were then retransformed back to percentages for tabular presentation. Cover₅₀ values, which indicate days to 50% overseed ground cover, were calculated with a 95% probability as previously described (Anderson and Dudeck, 1995). From Nov. through May, turf quality estimates were recorded once every two weeks by two to three different observers. These scores were summarized and presented in tabular form as monthly averages. A rating scale from 1 to 9 was used where 1 = poor and 9 = best turf quality. Turf color was visually rated by several observers from Oct. 1996 through Apr. 1997. A scale of 1 = yellow green and 5 = dark green color was used. Dollar spot and percentage of annual bluegrass infestation was evaluated in Mar. 1997. Dollar spot was visually rated on a scale of 1 to 9 where 1 = no disease and 9 = most disease incidence.

Both studies were randomized complete block designs with four replications. All data were subjected to analysis of variance and means were separated using the Waller-Duncan k-ratio *t*-test at 5% level of probability. A paired *t*-test was used to test differences between air and soil temperatures with 29-year means.

Table 5. Average weekly ground cover estimates and cover rate of cool-season grasses after overseeding a 'Tifdwarf' bermudagrass putting green on 27 Oct. 1996 at Gainesville, FL.

Entry	% Cover @ Week			Cover Rate ^a	Cover ₅₀ ^b
	1	2	3		
Plaisir	22.0	44.3	27.7	54.0 a	85 ± 44
Mix 1	5.9	41.6	69.8	49.8 ab	15 ± 2
Danish Common	3.1	41.7	53.8	41.8 bc	28 ± 15
BARUSA Pt4	0.6	34.3	67.3	40.2 c	15 ± 2
Fuzzy	0.6	35.7	65.0	40.1 c	16 ± 2
PT B-93	0.5	34.5	66.0	39.6 cd	16 ± 2
Mix 2	0.4	30.0	66.1	37.4 c-e	15 ± 3
Winterplay	0.7	30.4	62.7	36.9 c-f	16 ± 4
PT I-93	0.4	30.8	62.7	36.8 c-g	16 ± 3
Livonne	15.2	24.2	24.6	35.8 c-h	—
Top Hat	11.4	25.4	32.9	35.4 c-i	57 ± 14
Penn G6	0.2	22.6	67.3	33.9 c-j	16 ± 4
Blend 1	7.7	27.0	37.2	33.7 c-k	63 ± 20
HWY	6.7	25.1	41.5	33.3 c-k	54 ± 19
Premier II	6.2	24.5	38.0	31.2 d-l	52 ± 17
MB45	8.1	22.7	33.7	30.8 e-m	58 ± 15
Penn A4	0.1	21.2	59.4	30.6 e-m	17 ± 3
Pageant	6.4	23.2	35.7	30.3 e-m	63 ± 19
LRFB7	8.6	19.7	31.7	29.2 e-m	56 ± 12
Southshore	0.2	20.9	53.4	28.5 f-n	28 ± 14
Roadrunner	9.5	20.1	24.3	28.5 f-n	—
Penn G2	0.1	20.2	53.1	28.0 g-n	25 ± 11
Charger II	10.2	20.8	21.0	27.8 h-n	—
Gator II	8.2	20.4	25.4	27.1 h-n	77 ± 16
Eagle Blend	7.2	22.0	25.6	26.8 i-n	78 ± 13
Blend 2	4.9	24.2	29.1	26.8 i-n	58 ± 11
Academy	9.0	20.6	21.2	26.5 j-o	—
Imagine	4.4	19.9	35.5	26.4 j-o	66 ± 20
Pt A	0.1	19.6	48.5	26.2 j-o	41 ± 19
GK 3way Blend	5.6	19.6	28.3	25.0 k-o	67 ± 14
Resort	8.1	18.3	17.9	23.4 l-o	87 ± 14
Catalina	4.4	18.7	27.2	23.0 l-o	79 ± 17
Lipoa	0.0	14.8	46.0	22.9 l-o	39 ± 18
TTAR	8.0	18.3	14.9	22.3 m-o	—
Pearl	4.6	17.2	26.5	22.2 m-o	—
Barcrown	1.1	16.4	32.5	20.3 no	53 ± 13
Juwel	4.8	16.1	13.8	17.7 o	—
MSD ^c	3.9	7.4	11.1	8.8	—

^aCover rate = Sum of mean weekly percent ground cover estimates during the first three wk after overseeding. Mean of twelve observations.

^bCover₅₀ = Days to 50% overseed cover in first 90 days after seeding.

^cRetransformed means with the same letter are not significantly different (*P* = 0.05) using Waller-Duncan k-ratio *t*-test.

^dMSD = Minimum significant difference (*P* = 0.05) using Waller-Duncan k-ratio *t*-test.

Results and Discussion

Seed number per pound varied widely among cultivars within species (Table 2). Seed number per bulk pound varied from 208,640 to 324,285 for 'Roadrunner' and 'Livonne' perennial ryegrass, respectively. Similarly, seed number per pound varied from 1.7 to 3.5 million for 'Fuzzy' and 'Pt A' rough bluegrass, respectively. Therefore pure live seed (PLS) content was used to equate seeding rates within grass species.

The first week following seeding was abnormally warm with significantly higher maximum, minimum, average air and soil temperatures compared to our 29-year mean temperatures (Table 3). This allowed for serious bermudagrass competition until the third week after seeding when both air and soil temperatures averaged 10 and 4 degrees below normal. Air and soil temperatures returned to normal during the fourth week after seeding. Bermudagrass competition during

Table 6. Monthly and seasonal means for turf quality of overseed grasses grown during 1996-97 on a 'Tifdwarf' bermudagrass putting green at Gainesville, FL.

Entry	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Seasonal	
								Mean	CV ^a
				Rating ^a					(%)
Mix 1	6.1	7.5	8.6	8.2	6.8	5.2	3.5	6.70 a ^a	27
BARUSA Pt4	6.0	8.0	9.0	8.2	6.4	3.0	1.8	6.38 ab	39
Mix 2	4.2	5.9	7.9	8.6	8.3	5.6	3.5	6.34 ab	35
Fuzzy	5.4	7.3	8.6	8.0	6.2	4.0	2.6	6.21 b	34
Southshore	3.6	5.6	7.5	8.4	8.8	5.8	3.8	6.19 b	37
Penn G-6	3.6	5.7	7.6	8.2	8.5	5.8	3.5	6.13 bc	38
Penn A-4	3.7	5.8	8.2	8.7	8.9	4.5	2.9	6.10 bc	41
Danish Common	5.6	5.9	6.1	6.9	7.9	5.0	4.4	6.02 b-d	26
Winterplay	4.6	6.7	8.4	7.6	6.1	4.6	2.8	6.00 b-d	32
Penn G-2	3.2	5.2	7.2	8.1	8.6	5.2	3.1	5.79 c-e	43
HWY	4.6	4.1	5.5	6.7	7.1	6.9	5.6	5.68 d-f	29
PT B-93	5.1	7.1	8.3	7.0	4.1	2.9	1.8	5.49 e-g	42
Lipoa	3.2	4.7	6.6	7.1	6.3	5.8	5.1	5.48 e-g	30
PT I-93	4.9	6.8	8.4	7.1	4.2	3.0	2.8	5.47 e-h	40
Premier II	3.8	4.0	5.4	6.2	6.8	7.0	6.0	5.43 e-h	29
Barcrown	3.2	4.1	6.2	7.2	7.8	5.4	4.8	5.42 e-h	37
Blend 2	4.3	4.2	5.2	6.0	6.4	6.4	5.8	5.36 f-i	25
Imagine	4.0	4.2	5.0	6.0	6.5	6.4	5.6	5.26 g-j	25
Pt A	3.2	4.8	6.8	7.2	6.2	4.8	3.4	5.22 g-j	34
Blend 1	4.4	3.9	4.6	5.8	6.3	6.6	5.7	5.22 g-j	26
MB45	3.8	3.7	5.0	6.0	6.4	6.8	6.0	5.20 g-k	29
LRFB7	3.4	3.6	5.3	6.0	6.2	6.7	6.3	5.18 g-k	31
Top Hat	4.2	3.8	5.0	6.2	6.4	6.3	4.7	5.13 g-l	30
Pagent	4.1	3.9	4.6	5.7	6.6	6.3	4.8	5.12 g-l	29
Gator II	4.0	3.5	4.4	5.6	6.7	6.6	5.7	5.10 h-l	32
Academy	4.0	3.2	4.4	5.6	6.3	6.6	6.5	5.02 i-m	34
Eagle Blend	3.7	3.5	4.2	5.5	6.4	6.5	5.8	4.98 j-m	32
Catalina	3.6	3.4	4.4	5.4	6.3	6.8	5.7	4.94 j-m	31
Plaisir	4.1	3.5	3.7	5.3	6.6	6.4	5.6	4.92 j-m	33
GK 3way Blend	3.4	3.1	4.4	5.8	6.5	6.4	5.9	4.92 j-m	36
Livonne	3.8	3.6	3.9	5.2	6.2	6.1	5.6	4.82 k-n	30
Roadrunner	3.9	3.4	4.0	5.0	5.8	6.4	5.8	4.78 l-n	31
Resort	3.7	2.8	4.0	5.2	6.5	6.8	6.1	4.78 l-n	39
Charger II	3.9	3.2	4.0	5.4	6.2	6.2	5.1	4.76 l-n	33
Pearl	3.2	3.1	4.0	5.2	5.9	6.4	5.8	4.66 mn	33
TTAR	3.5	2.6	3.6	5.2	6.0	6.0	5.1	4.45 no	39
Jewel	3.5	2.9	1.2	4.0	5.7	6.0	5.2	4.24 o	37
Bermudagrass Check	1.0	1.0	1.2	1.0	1.1	2.3	2.8	1.37 p	49
MSD ^a	0.6	0.6	0.6	0.5	0.8	0.6	0.9	0.38	—

^aCV = Coefficient of variation is a measure of relative variation around season mean expressed in percent. Mean of 30 ratings.

^aQuality visually rated 1 to 9 where 9 = best turf quality.

^aSeasonal means followed by same letter are not significantly different ($P = 0.05$) using Waller-Duncan k-ratio t test. Mean of 120 observations.

^aMSD = Minimum significant difference ($P = 0.05$) using Waller-Duncan k-ratio t -test.

the first two weeks following seeding was the reason for poor establishment of most grass entries, especially ryegrass, in both studies. Above normal soil temperatures during Jan., Feb., and Mar. allowed for continued bermudagrass competition in both tests throughout the entire 1996-97 study period (Table 4).

Putting green study

Rate of ground cover establishment varied widely between overseeded grasses (Table 5). Overseeded grasses with best rate of ground cover, which averaged 52%, included 'Plaisir' perennial ryegrass and 'Mix 1'. Establishment rates for these and all other grasses, however, were very poor as predicted cover₅₀ values were 85 ± 44 and 15 ± 2 days, respectively. This was due to continued bermudagrass competition.

Grass entries having best seasonal mean turf quality scores, which averaged 6.5, included 'BARUSA Pt4', 'Mix 1',

and 'Mix 2' (Table 6). All overseeded grasses had better seasonal mean turf quality compared to bermudagrass check plots that were not overseeded.

Grass entries having darkest green color scores, which averaged 4.9, included 'LRFB7', and 'MB45' perennial ryegrass (Table 7). 'PT B-93' rough bluegrass was most susceptible to Dollar spot having a mean rating of 8.0 out of a possible 9.0 score (Table 7). Annual bluegrass varied between overseeded grasses from 0.1 to 15.3% (Table 7). Highest estimate of 15% occurred in bermudagrass check plots that were not overseeded.

Fairway study

'Plaisir' perennial ryegrass had best establishment rate of all grasses, but predicted cover₅₀ was 30 ± 12 days because of bermudagrass competition (Table 8).

Grasses with best seasonal turf quality scores, which averaged 6.4, included 'Academy', 'Blend 1', 'Gator II', 'HWY',

Table 7. Turf color, Dollar spot disease, and annual bluegrass ratings in overseed grasses grown in 1996-97 on a 'Tifdwarf' bermudagrass putting green at Gainesville, FL.

Entry	Color Rating ^a	Disease	Weeds ^c (%)
LRFB7	4.94 a ^c	1.0 g	5.2 bc
MB45	4.81 ab	1.0 g	2.5 c-g
Pearl	4.62 bc	1.0 g	3.0 c-g
Catalina	4.41 cd	1.0 g	1.4 d-g
Premier II	4.41 cd	1.0 g	1.5 d-g
Roadrunner	4.38 c-e	1.0 g	4.1 b-e
Top Hat	4.34 c-e	1.0 g	4.9 b-d
Blend 2	4.31 d-f	1.0 g	7.1 b
GK 3way Blend	4.28 d-g	1.0 g	3.5 b-g
Imagine	4.22 d-g	1.0 g	1.8 c-g
HWY	4.09 e-h	1.0 g	1.6 c-g
Charger II	4.03 f-i	1.0 g	2.4 c-g
Blend 1	4.00 g-j	1.0 g	2.4 c-g
Academy	3.88 h-j	1.0 g	3.2 b-g
Pagant	3.84 h-j	1.0 g	1.6 c-g
Resort	3.84 h-j	1.0 g	2.4 c-g
Gator II	3.81 h-j	1.0 g	1.8 c-g
Eagle Blend	3.78 ij	1.0 g	2.0 c-g
Lipoa	3.72 j	1.0 g	3.9 b-f
Penn G-6	3.41 k	1.0 g	1.6 c-g
Penn G-2	3.38 kl	1.0 g	1.5 d-g
Southshore	3.34 kl	1.0 g	0.9 e-g
TTAR	3.31 k-m	1.1 g	2.2 c-g
Juwel	3.28 k-m	1.0 g	2.2 c-g
Penn A-4	3.28 k-m	1.0 g	0.6 e-g
Winterplay	3.09 l-n	3.9 cd	0.4 fg
PT B-93	3.03 mn	8.0 a	0.8 e-g
Mix 1	3.03 mn	3.5 de	0.1 g
PT I-93	2.97 no	7.2 b	0.6 e-g
Plaisir	2.94 no	1.0 g	3.0 c-g
Livonne	2.81 n-p	1.0 g	2.5 c-g
Barcrown	2.69 o-q	1.0 g	1.5 d-g
BARUSA Pt4	2.53 pq	3.1 e	0.1 g
Pt A	2.53 pq	4.2 c	0.2 g
Fuzzy	2.53 pq	4.1 c	0.4 fg
Mix 2	2.50 q	2.0 f	0.8 e-g
Danish Common	1.62 r	1.0 g	1.1 d-g
Bermudagrass Check	—	—	15.3 a

^aAnnual bluegrass weed infestation visually estimated in Mar. 1997. Mean of 8 ratings.

^bColor visually rated from Oct. 1996 to Apr. 1997 on scale of 1 = yellow green and 5 = dark green color. Mean of 28 ratings. Dollar Spot disease visually rated in Mar. 1997 from 1 to 9 where 1 = none and 9 = most disease incidence. Mean of 8 ratings.

^cMeans within columns followed by same letter are not significantly different ($P = 0.05$) using Waller-Duncan k-ratio *t*-test.

Table 8. Average weekly ground cover estimates and cover rate of cool-season grasses and days to 50% cover after overseeding a 'Tifway' bermudagrass fairway on 25 Oct. 1996 at Gainesville, FL.

Entry	% Cover @ Week			Cover Rate ^c	Cover ₅₀ ^d
	1	2	3		
Plaisir	11.9	39.1	49.9	48.1 a ^c	30 ± 12
Livonne	9.4	31.7	42.8	39.6 b	38 ± 13
Resort	6.7	32.0	45.7	38.0 bc	37 ± 16
Blend 1	4.7	35.0	46.0	37.6 b-d	38 ± 16
LRFB7	6.1	32.5	45.2	37.4 b-d	36 ± 14
HWY	5.2	31.7	46.5	36.7 b-d	37 ± 16
Mix 1	2.7	31.8	52.4	36.1 b-d	27 ± 12
Roadrunner	6.1	31.2	41.9	35.9 b-d	40 ± 15
MB45	2.4	30.4	44.3	35.4 b-e	37 ± 15
BARUSA Pt4	6.1	29.6	41.9	35.0 b-e	39 ± 14
Imagine	2.9	33.6	45.1	35.0 b-e	38 ± 16
Eagle Blend	2.6	29.5	45.2	34.9 b-f	38 ± 16
TTAR	3.7	29.8	45.0	33.8 b-g	45 ± 18
Academy	4.9	28.9	42.7	33.7 b-g	39 ± 15
Gator II	4.8	28.9	42.6	33.4 c-g	41 ± 16
Top Hat	4.5	28.9	42.8	33.3 c-g	40 ± 15
Charger II	6.0	27.6	39.9	33.1 c-g	41 ± 15
Juwel	3.4	31.4	40.4	32.7 c-h	43 ± 16
GK 3way Blend	3.7	27.4	43.8	32.3 c-h	40 ± 17
Catalina	2.9	28.9	43.7	32.1 c-h	40 ± 16
Premier II	2.9	29.8	42.5	32.0 c-h	41 ± 16
Blend 2	3.3	28.2	41.4	31.4 d-h	40 ± 15
Pearl	2.1	26.5	41.9	29.5 e-i	42 ± 16
PT I-93	0.4	24.4	47.3	28.5 f-i	39 ± 18
Danish Common	0.8	23.5	44.7	27.6 g-i	43 ± 18
PT B-93	0.2	22.2	46.0	26.7 hi	39 ± 18
Winterplay	0.1	22.5	44.9	26.5 hi	41 ± 18
Fuzzy	0.1	20.9	40.7	24.3 ij	42 ± 16
Pt A	0.2	19.4	42.7	24.0 ij	45 ± 20
Mix 2	0.1	21.1	38.4	23.6 ij	48 ± 18
BARUSA Pt4	0.1	15.5	32.3	18.6 jk	54 ± 16
Southshore	0.6	14.7	29.7	18.4 jk	62 ± 16
Lipoa	0.0	13.5	30.5	17.1 kl	71 ± 20
Penn A4	0.1	11.1	19.4	12.7 k-m	—
Penn G2	0.4	10.5	16.1	11.4 lm	—
Barcrown	0.3	10.6	12.9	10.0 m	—
Penn G6	0.1	6.9	11.0	7.7 m	—
MSD ^a	1.6	6.0	9.6	6.2	—

^aCover rate = Sum of mean weekly percent ground cover estimates during the first three wk after overseeding. Mean of thirteen observations.

^bCover₅₀ = Days to 50% overseed cover in first 90 days after seeding.

^cRetransformed means with the same letter are not significantly different ($P = 0.05$) using Waller-Duncan k-ratio *t*-test.

^dMSD = Minimum significant difference ($P = 0.05$) using Waller-Duncan k-ratio *t*-test.

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Table 9. Monthly and seasonal means for turf quality of overseed grasses grown during 1996-1997 on a 'Tifway' bermudagrass fairway at Gainesville, FL.

Entry	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Seasonal	
								Mean	Cv ^a
								Rating ^a	
									(%)
Mix 1	5.6	5.5	7.6	8.4	8.0	6.6	4.8	6.60 a*	27
Blend 1	5.8	5.6	6.5	7.7	8.1	7.0	5.6	6.51 ab	22
HWY	5.4	5.4	6.6	7.8	8.2	7.2	5.7	6.48 ab	23
Plaisir	6.3	5.7	6.8	7.4	7.4	6.6	5.4	6.45 a-c	19
Gator II	5.5	5.4	6.3	7.4	8.2	7.2	5.9	6.45 a-c	23
Resort	5.7	5.0	6.6	7.8	7.4	6.8	5.8	6.34 a-d	22
Academy	5.7	5.1	6.5	7.3	7.4	6.9	5.7	6.29 a-d	21
LRFB7	5.9	5.2	6.6	7.6	6.9	6.6	5.8	6.26 a-d	20
MB45	6.2	5.2	6.2	7.2	7.2	6.6	5.6	6.21 a-e	20
Premier II	5.3	5.1	6.4	7.4	7.4	6.8	5.8	6.21 a-e	21
Blend 2	5.8	5.2	6.4	7.2	6.7	6.7	5.8	6.19 b-e	19
Catalina	5.1	5.0	6.2	7.2	7.7	7.1	5.8	6.18 b-e	23
TTAR	5.1	4.8	6.2	7.5	7.9	6.6	5.7	6.18 b-f	25
Pagent	5.5	5.3	6.4	7.2	6.7	6.4	5.9	6.15 b-g	19
Imagine	6.4	5.4	6.2	7.0	6.6	6.3	5.2	6.13 b-g	18
Eagle Blend	5.4	4.8	6.2	7.3	7.2	6.6	5.8	6.11 b-g	22
Fuzzy	4.2	4.9	7.2	8.1	8.4	6.5	4.0	6.08 c-h	36
Charger II	5.7	4.9	6.0	7.2	6.8	6.4	5.7	6.03 d-i	21
Top Hat	5.4	5.3	6.2	7.0	6.2	6.6	5.5	5.98 d-j	20
Livonne	5.6	5.2	6.6	7.2	5.9	6.1	5.3	5.98 d-j	21
GK 3way Blend	4.8	4.5	5.9	7.3	7.8	6.8	5.9	5.97 d-j	27
Roadrunner	5.2	4.7	6.2	7.0	6.5	6.3	5.6	5.82 e-k	22
Mix 2	3.9	4.5	6.5	7.6	8.0	6.6	4.4	5.79 f-k	36
Winterplay	3.6	4.5	7.1	7.8	7.8	6.5	4.2	5.78 g-k	37
PT I-93	4.3	4.8	6.9	7.4	6.9	6.0	4.2	5.69 h-l	31
PT B-93	4.2	4.6	6.8	7.3	7.2	6.4	4.3	5.68 h-l	34
Pearl	4.6	4.6	5.8	6.9	6.7	6.3	5.4	5.66 i-l	25
Juwel	4.8	4.6	6.1	7.0	6.4	5.9	5.4	5.62 j-m	23
Danish Common	3.9	4.1	6.1	7.3	8.3	6.1	3.8	5.55 k-m	40
Pt A	3.3	3.9	5.9	6.8	7.8	6.6	4.2	5.34 lm	40
BARUSA Pt4	3.1	3.8	5.6	7.0	8.0	6.2	4.1	5.22 mn	41
Southshore	3.9	3.8	4.6	5.5	7.2	6.3	4.9	5.05 n	37
Lipoa	3.0	3.5	4.0	5.3	6.3	5.9	5.2	4.58 o	35
Penn A-4	3.1	2.8	3.4	5.2	5.0	5.4	4.6	3.95 p	38
Barcrown	3.6	2.7	3.5	3.6	4.3	4.5	5.0	3.77 pq	34
Penn G-6	3.6	2.7	3.1	3.1	3.6	4.6	4.7	3.56 pq	36
Penn G-2	3.3	2.3	3.2	3.8	4.3	4.5	4.2	3.54 q	39
Bermudagrass Check	1.4	1.2	1.6	1.2	1.4	2.3	3.6	1.70 r	57
MSD*	0.9	0.5	0.6	0.6	1.4	0.8	0.6	0.40	—

^aCV = Coefficient of variation is a measure of relative variation around seasonal mean expressed in percent. Mean of 29 ratings.^bQuality visually rated 1 to 9 where 9 = best turf quality.^cSeasonal means followed by same letter are not significantly different ($P = 0.05$) using Waller-Duncan k-ratio t test. Mean of 116 observations.^dMSD = Minimum significant difference ($P = 0.05$) using Waller-Duncan k-ratio t -test.

Table 10. Turf color, Dollar spot disease, and annual bluegrass ratings in overseed grasses grown in 1996-97 on a 'Tifway' bermudagrass fairway at Gainesville, FL.

Entry	Color Rating ^a	Disease	Weeds ^c (%)
LRFB7	5.00 a ^a	1.0 b	7.5 d-g
MB45	4.95 ab	1.0 b	5.1 d-g
Blend 2	4.90 a-c	1.0 b	10.6 c-g
Premier II	4.88 a-d	1.0 b	5.9 d-g
Roadrunner	4.82 a-e	1.0 b	12.1 c-g
Imagine	4.79 a-e	1.0 b	10.5 c-g
Pearl	4.74 b-f	1.0 b	9.5 c-g
Catalina	4.66 c-g	1.0 b	5.0 d-g
GK 3way Blend	4.64 d-g	1.0 b	3.0 d-g
Charger II	4.61 e-h	1.0 b	18.5 b-e
Top Hat	4.59 e-h	1.0 b	10.5 c-g
HWY	4.51 f-h	1.0 b	2.6 d-g
Blend 1	4.46 gh	1.0 b	5.0 d-g
Academy	4.39 hi	1.0 b	7.9 d-g
Gator II	4.38 hi	1.0 b	3.5 d-g
Eagle Blend	4.21 ij	1.0 b	18.4 b-f
Pagent	4.20 ij	1.0 b	17.2 b-g
Resort	4.10 j	1.0 b	6.1 d-g
Lipoa	3.55 k	1.0 b	11.5 c-g
Plaisir	3.48 kl	1.0 b	14.4 c-g
Mix 1	3.40 kl	1.0 b	7.2 d-g
TTAR	3.40 kl	1.0 b	9.1 d-g
Livonne	3.38 kl	1.0 b	15.1 b-g
Juwel	3.29 l	1.0 b	18.3 b-f

Table 10. (Continued) Turf color, Dollar spot disease, and annual bluegrass ratings in overseed grasses grown in 1996-97 on a 'Tifway' bermudagrass fairway at Gainesville, FL.

Entry	Color Rating ^a	Disease	Weeds ^c (%)
PT B-93	3.02 m	4.4 a	3.1 d-g
Penn G-6	3.02 m	1.0 b	32.5 ab
Penn A-4	2.95 mn	1.0 b	27.8 a-c
PT I-93	2.89 mn	4.6 a	2.6 d-g
Barcrown	2.81 m-o	1.0 b	18.8 b-d
Southshore	2.80 m-o	1.0 b	3.4 d-g
Penn G-2	2.80 m-o	1.0 b	34.4 ab
Winterplay	2.78 no	1.5 b	3.9 d-g
BARUSA Pt4	2.62 op	1.0 b	1.9 e-g
Fuzzy	2.58 op	1.2 b	0.4 fg
Mix 2	2.49 p	1.6 b	2.4 d-g
Pt A	2.16 q	1.8 b	1.1 e-g
Danish Common	1.70 r	1.0 b	0 g
Bermudagrass	—	—	45.0 a
Check			

^aAnnual bluegrass weed infestation visually estimated in Mar. 1997. Mean of 8 ratings.

^bColor visually rated from Nov. 1996 to Apr. 1997 on scale of 1 = yellow green and 5 = dark green color. Mean of 32 ratings. Dollar Spot disease visually rated in Mar. 1997 from 1 to 9 where 1 = none and 9 = most disease incidence. Mean of 8 ratings.

^cMeans within columns followed by same letter are not significantly different ($P = 0.05$) using Waller-Duncan k-ratio *t*-test.

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SANTA ROSA SPECIALTY CUT FLOWER TRIALS

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Abstract. Specialty cut flowers are a potential alternative crop for Northwest Florida producers. During the fall of 1994 a cut flower trial/demonstration area was established in central Santa Rosa County. The three year project was designed to determine which species/cultivars could be successfully grown outdoors, under local environmental conditions. Over 50 different species/cultivars were evaluated, including both cool season and warm season flowers. An informal marketing survey was also conducted in order to determine if locally produced cut flowers were acceptable by local florists and their customers. Forty species were productive, and twelve in the trials provided consistent high quality and yield. Zinnia, ager-

tum and lisianthus were outstanding performers. Several challenges and limitations were encountered under field conditions. High light conditions apparently resulted in the production of excessively short, thick stems on some species. Extreme weather conditions, such as high winds, heavy rains, hail and extreme cold sometimes reduced the quality and consistent supply of flowers. Based upon these trials, the profitable production of cut flowers has great potential, but the species/cultivars for outdoor production must be carefully chosen. The use of greenhouses and/or shade houses will be necessary for some cut flower crops, if consistent quality and volume is required.

Introduction

Cut flowers are believed to have good potential as an alternative crop in North Florida. The demand is high, as indicated by the presence of over 300 retail florists and 2 large wholesale florists in the area consisting of Escambia and Santa Rosa Counties. Most flowers are currently being imported from the Western United States and South America.

Advisory committees and other interested individuals indicated that there was interest in an educational effort aimed