

Performance and Transition Date of a Turf-type Annual Ryegrass in Comparison to Perennial Ryegrass and Fine Fescues

L.R. Nelson¹, J. Crowder, and H.B. Pemberton

ADDITIONAL INDEX WORDS. *Lolium multiflorum*, *L. perenne*, *L. rigidum*, chewing fescue, overseeding, transition date, turf quality

SUMMARY. Perennial ryegrass (*Lolium perenne*) has traditionally been used to overseed warm-season grasses in the southern U.S. when warm-season sods are dormant due to chilling temperatures. In this study we investigated overseeding turf-type annual ryegrass (two cultivars of *L. multiflorum* and one cultivar of *L. rigidum*) and chewing fescue (*Festuca rubra* var. *commutata*) as well as perennial ryegrass onto a warm-season common bermudagrass (*Cynodon dactylon*) sod. The objective was to compare turf quality, turf color, and transition date of turf-type annuals with perennials and other cool-season grasses. Results for turf quality indicated that the annual ryegrass cultivars 'Axcella' and 'Panterra' (*L. multiflorum*) compared very well with perennials through March; however, in April and May, perennials were superior for quality. 'Hardtop' fine fescue is a hard fescue (*F. ovina* var. *duriuscula*). It was inferior to the annuals for turf quality from December to April when the annuals began to die. For turf color, annuals had a lower rating compared to dark green perennials such as 'Premier II', 'Derby Supreme', or 'Allstar'. 'Panterra' was darker compared to 'Axcella' in March and April. Chewing fescue was intermediate in color compared to annuals and perennials. For turf height, 'Axcella' was taller than 'Panterra', which were both taller than the perennials, and the fine fescues were shorter than the perennials. For transition in

the spring, the annuals had a shorter transition and died about 1 month earlier than the perennials. 'Transtar' (*L. rigidum*) had an earlier transition than the other annuals. The perennials tended to have a longer transition period. The fescues had a very long transition period and were similar to the perennials.

Ryegrasses are widely used as a temporary turfgrass throughout the southern region of the U.S. for overseeding dormant warm-season grasses (Duble, 1996). Bruneau et al. (1985) compared the merits of perennial, annual, and intermediate ryegrasses and several other cool-season species when overseeding bermudagrass. Their information is excellent; however, they were referring to forage type annuals rather than an improved turf-type annual. Perennial ryegrass has excellent turf quality for characters such as turf texture and color. Annual ryegrass in the past has had poor turf quality for some characters, such as fineness of leaves (turf texture), color, and too vigorous growth. Through a vigorous selection turf breeding program, turf quality of annual ryegrass has significantly been improved for turf texture and for dwarf growth character. Color has also been improved; however, color of the new annual turf selections 'Axcella' and 'Panterra' remains less desirable than dark green perennial turf cultivars.

Annual ryegrass cultivars used in the past have been commonly known to have an advantage over perennial ryegrass in that they have an earlier transition date when overseeded into warm-season sods. Transition and turf quality of new annual turf cultivars has not been reported. Transition of overseeded winter grasses back to the warm-season turf is a major problem in the southern U.S. Poor transition can exist both when ryegrass dies much earlier than bermudagrass growth begins (Johnson, 1991) or if the cool-season grasses persist long after the warm-season grass begins to grow. Knoop (1987) reported that warm-season grasses manufacture and store carbohydrates during the summer that are necessary for the grass to survive the winter. If carbohydrate levels are depleted during warm periods in the dormant season, and cool wet spring conditions favor the cool-season

grasses, transition will be too late and problems will occur (Knoop, 1987). Under these conditions, the warm-season grass may winterkill and lose much of its stand.

Johnson (1975) applied the herbicide pronamide to overseeded perennial ryegrass and successfully reduced the growth of the ryegrass and allowed bermudagrass to be more competitive. Spring management practices of reducing mowing height, delaying fertilization, and reducing soil moisture (Bruneau et al., 1985; Meyers and Horn, 1970; Palmertree, 1975) can also influence the transition of cool-season grasses. Horgan and Yelverton (2001) reported that cultural treatments such as biweekly vertical mowing, scalping, core cultivation, and vertical mowing/scalping or two application timings of ammonium nitrate (NH_4NO_3) had some effect on transition date of 'Gator' and 'Derby Supreme' perennial ryegrass in North Carolina. They reported, however, that cultural treatments alone may not consistently enhance natural transition of perennial ryegrass to bermudagrass. Improved hardy, perennial ryegrasses that have been utilized to overseed warm-season sods will eventually die, but may live until the middle of the summer, and can reduce the quality of warm-season grass stands.

Sifers and Beard (1993) conducted research on the effects of heat stress for both air and soil temperatures on inter- and intraspecific species of cool-season turfgrass. They indicated that some species avoided heat stress by enhanced evapotranspirational cooling, and this increased turf survival to temperatures in excess of 43 °C (109.4 °F). They also reported that of the species examined, tall fescue (*F. arundinacea*), kentucky bluegrass (*Poa pratensis*), bentgrass (*Agrostis gigantea*), and perennial ryegrass were more heat tolerant, with rough bluegrass (*P. trivialis*) and bentgrass the least tolerant. Since annual ryegrass normally transitions earlier than all of the above species, it should have a significant advantage for the health and maintenance of the warm-season turf.

The objectives of this study were to determine the performance and turf quality and color of new selections of overseeded turf-type annual ryegrass compared to perennial ryegrass and chewing fescue, with special emphasis on spring transition.

Texas A&M University Agricultural Research & Extension Center, P.O. Box 200, Overton, TX 75684.

¹To whom reprint requests should be addressed; e-mail address: lr-nelson@tamu.edu

Materials and methods

Two experiments were conducted in 2001–02 and one experiment in 2002–03 at the Texas A&M University Agricultural Research and Extension Center, Overton. The experiments were located in a well-established common bermudagrass stand. The test site was a loamy, siliceous, thermic Grossarenic Paleudults Darco soil with a pH of 6.0. In 2001–02, Expt. A was planted on 22 Oct. 2001, while Expt. B was planted 2 weeks later on 5 Nov. In Expt. A, ‘Axcella’ and ‘Panterra’ annual ryegrass cultivars were compared with the perennial ryegrass cultivar Premier II. All entries had 90% or higher germination under laboratory conditions. Seeding rates were 12.2, 9.8, 7.3, and 4.9 kg/100 m² (25, 20, 15, and 10 lb/1000 ft²) for both Expts. A and B. In Expt. B, ‘Axcella’ and the annual TXR2001-6 were compared to the perennial ‘Derby Supreme’ and Showboat (a blend of 70% ‘Derby Supreme’ and 30% ‘Axcella’). Prior to seeding, the bermudagrass sod was mowed to a height of 1.27 cm (0.5 inch). After overseeding, plot area was watered by sprinkler irrigation for about 30 min daily for 7 d to ensure that good stands were achieved. After ryegrass plants had been established, all plots were mowed with a rotary mower at a height of 1.27 cm on a weekly basis in the fall, winter, and early spring. During mid-March to late April, plots were mowed every 5 d. Data were recorded for percent coverage and turf quality rating as judged by visual ratings (1 to 9, where 9 was best) through 23 Apr.

Turf color ratings (9 was best for dark green color) were recorded each month from December to April. Turf height was recorded on 31 Mar., 5 d after mowing, to compare plant height of the entries in each experiment. Percent coverage of ryegrass was recorded to judge transition date from 23 Apr. to 19 June.

The 2002–03 experiment was seeded onto a common bermudagrass sod on 18 Oct. 2002. The bermudagrass sod had been mowed to a plant height of 1.27 cm prior to overseeding. Seeding rates were 9.8 kg/100 m² for ‘Axcella’, ‘Panterra’, and ‘Transtar’ annual ryegrass, ‘Hardtop’ fine fescue, and BAR CHF 8FUSI chewing fescue. BAR Lp 2002, ‘Bargold’, ‘Derby Supreme’, and ‘Allstar’ perennial ryegrass cultivars were seeded at 7.3 kg/100 m². The study was fertilized according to soil test and topdressed with N at a rate of 0.5 kg/100 m² (1 lb/1000 ft²) per month. After overseeding, the test was sprinkler irrigated (or watered by natural rainfall) for 7 d to ensure germinating seed were not desiccated. Plots were mowed with a reel mower from November to March and thereafter with a rotary mower at a mowing height of 1.27 cm. Turf quality ratings were recorded on several dates as noted in Table 1. A numerical rating (1 to 9) for turf appearance assigned to each plot was a combination turf density, leaf fineness, color, uniformity, and overall appearance. Data were also recorded for percent stand 10 d after overseeding, turf color on three dates, freeze damage on a 0 to 9 rating where 0 = no damage, turf height in centimeters, and transition date. Transition date was

for percent coverage of the ryegrass on the individual plots.

Data in all experiments were analyzed according to a randomized complete-block design, with whole plots being a turf cultivar. There were four replications in all experiments. Differences between means were separated according to least significant difference at the 0.05 level of probability.

Results and discussion

Good stands were obtained in 2001 for all entries in both experiments and there were no differences between cultivars. In 2002, there were differences between cultivars for percent stand 10 d after overseeding (Table 1). ‘Transtar’, ‘Derby Supreme’, ‘Bargold’, ‘Panterra’, and ‘Axcella’ had good stands. ‘Allstar’ perennial ryegrass, ‘Hardtop’ fine fescue, and BAR CHF 8Fusi chewing fescue had a lower percent stand than other entries in the experiment. The stand on ‘Hardtop’ affected turf quality ratings throughout the growing season.

Turf quality ratings in 2001–02 in Expt. A (Table 2) were good for all entries on 9 Nov. Some small differences were noted on 9 Dec.; however, no differences were apparent on 18 Feb. On 23 Apr., ‘Premier II’ was superior as the annuals had begun to transition out. In Expt. B (which was planted 2 weeks later), similar results were obtained (Table 3), with no differences until 23 Apr. when the perennial ‘Derby Supreme’ had the best turf quality rating followed by Showboat and the annuals. Showboat (a blend) was intermediate for turf quality to the perennial and the annuals. Turf quality

Table 1. Percent stand and turf quality ratings of several entries of annual and perennial ryegrass, fine and chewing fescue and *Lolium rigidum* ryegrass on several dates during 2002–03.

Entry ^a	Stand (%)	Turf quality rating ^b						
		28 Oct.	18 Dec.	28 Jan.	19 Feb.	11 Mar.	3 Apr.	17 Apr.
Panterra	90 a ^c	6.4 bc	6.3 a	7.0 ab	7.8 a	6.3 bc	7.0 abc	7.0 bc
Axcella	89 a	7.5 a	6.3 a	7.5 a	7.0 a	6.0 cd	6.3 c	5.8 d
BAR Lp 2002	71 bc	5.7 cd	5.2 def	6.0 c	6.8 bc	7.5 a	7.8 a	8.2 a
Bargold	85 ab	7.0 ab	6.2 abc	7.2 ab	7.5 ab	7.5 a	7.5 ab	8.0 ab
Hardtop	41 d	4.2 e	4.2 f	4.8 e	6.5 cd	5.5 cd	6.5 c	5.5 d
BAR CHF 8 Fusi	66 c	4.7 de	4.7 ef	5.8 c	6.2 d	5.3 d	6.3 c	7.0 bc
Derby Supreme	83 ab	7.0 ab	6.0 abc	7.0 ab	7.8 a	7.0 ab	7.8 a	7.0 bc
Allstar	73 bc	6.7 abc	5.5 cde	6.5 bc	7.5 ab	7.0 ab	7.5 ab	8.2 a
Transtar	95 a	7.0 ab	4.8 ef	6.5 d	6.8 bc	3.8 e	5.0 d	2.5 e

^aTurf quality rated from 1 to 9, where 9 was best.

^b‘Panterra’, ‘Axcella’, and ‘Transtar’ are annual ryegrass cultivars; BAR Lp 2002, ‘Bargold’, ‘Derby Supreme’, and ‘Allstar’ are perennial ryegrasses; ‘Hardtop’ is a fine fescue; and BAR CHF 8Fusi is a chewing fescue.

^cMeans within columns not followed by the same letter differ at the 0.05 level as judged by least significant difference.

Table 2. Turf quality ratings on Expt. A for annual and perennial ryegrass entries at Overton, Texas, in 2001–02.

Entry ^y	Turf quality rating ^z			
	9 Nov.	9 Dec.	18 Feb.	23 Apr.
Axcella	6.8 a ^x	8.1 a	7.6 a	6.6 c
Panterra	6.4 a	7.5 b	7.3 a	7.4 b
Premier II	6.8 a	8.1 a	7.2 a	8.0 a

^zTurf quality rated from 1 to 9, where 9 was best.
^y'Axcella' and 'Panterra' are annual ryegrass cultivars; and 'Premier II' is a perennial ryegrass.
^xMeans within a column not followed by the same letter differ at the 0.05 level as judged by least significant difference.

ratings in 2002–03 (Table 1) were similar for 'Panterra', 'Axcella', 'Bargold', 'Derby Supreme', 'Allstar', and 'Transtar' from December and February with BAR Lp 2002, 'Hardtop', and BAR CHF 8Fusi having lower turf quality ratings. On 11 Mar., all entries had good turf ratings; however, 'Panterra', 'Derby Supreme', 'Bargold', 'Allstar', and 'Axcella' were similar but rated higher than other entries. On 3 Apr., 'Transtar' had a low turf quality rating and 'Hardtop' and BAR CHF 8Fusi had slightly lower ratings than BAR Lp 2002, 'Bargold', 'Derby Supreme', and 'Allstar'. 'Panterra' and 'Axcella' were intermediate in turf rating. On 17 Apr. and 2 May, turf quality of the annuals had begun to decline due to their early transition. 'Panterra' was superior to 'Axcella' and both were superior to 'Transtar'. The perennials were superior to the annuals for turf quality late in the spring season.

Turf height (Tables 4 and 5) in 2001–02, 5 d after mowing, indicated that in Expt. A 'Premier II' had a slower growth rate than 'Panterra' and 'Panterra' had a slower rate than did 'Axcella'. In Expt. B, 'Derby Supreme' had the lower plant height, while 'Axcella' and Showboat were not different. Plant height data 7 d after mowing for 2002–03 (Table 6) indicated annuals 'Axcella' and 'Panterra' had higher turf height; however, they were not significantly taller than some of the perennials. BAR Lp 2002, 'Hardtop' fine fescue, and BAR CHF 8 Fusu chewing fescue were shortest. These data indicate that 'Axcella' and 'Panterra' grow slightly faster than the perennials 'Derby Supreme' and 'Premier II'. Also, 'Panterra' has a reduced growth rate compared to 'Axcella'.

Turf color ratings for 2001–02 (Tables 4 and 5) in Expt. A indicate that 'Premier II' had a darker green color than the annuals. Early in the

Table 3. Turf quality ratings in Expt. B for annual and perennial ryegrass entries at Overton, Texas, in 2001–02.

Entry ^y	Turf quality rating ^z			
	20 Nov.	19 Dec.	18 Feb.	23 Apr.
Axcella	4.6 a ^x	7.1 a	6.7 a	5.1 d
Derby Supreme	5.5 a	7.4 a	6.6 a	7.8 a
Showboat	5.8 a	7.4 a	6.6 a	6.4 b
TXR2001-6	5.1 a	7.1 a	6.5 a	5.6 c

^zTurf quality rated from 1 to 9, where 9 was best.
^y'Axcella' and TXR2001-6 are annual ryegrasses; 'Derby Supreme' is a perennial ryegrass; and Showboat is a blend.
^xMeans within a column not followed by the same letter differ at the 0.05 level as judged by least significant difference.

Table 4. Plot turf color rating and turf height in Expt. A for annual and perennial ryegrass entries at Overton, Texas, in 2001–02.

Entry ^x	Turf color rating ^z				Turf ht ^y (cm)
	9 Dec.	18 Feb.	31 Mar.	23 Apr.	31 Mar.
Premier II	9.4 a ^w	8.8 a	8.2 a	9.0 a	5.6 c
Panterra	6.8 b	7.0 b	5.8 b	6.9 b	6.1 b
Axcella	6.7 b	7.0 b	4.6 c	5.8 c	6.8 a

^zTurf color ratings were on a 1 to 9 scale, where 9 was dark green.
^yTurf height was measured in cm 5 d after mowing (1.0 cm = 0.39 inch).
^x'Axcella' and BAR Lm 1001b are annual ryegrasses; and 'Premier II' is a perennial ryegrass.
^wMeans within columns not followed by the same letter differ at the 0.05 level as judged by least significant difference.

Table 5. Plot turf color rating and turf height in Expt. B for annual and perennial ryegrass entries at Overton, Texas, in 2001–02.

Entry ^x	Turf color rating ^z				Turf ht ^y (cm)
	19 Dec.	18 Feb.	31 Mar.	23 Apr.	31 Mar.
Axcella	7.7 a ^w	7.0 b	4.7 c	5.5 c	7.0 a
Derby Supreme	8.0 a	8.2 a	7.4 a	7.7 a	6.2 c
Showboat	8.0 a	8.0 a	5.9 b	6.9 b	7.1 a
TXR2001-6	7.7 a	7.0 b	5.8 b	5.7 c	6.7 b

^zTurf color ratings were on a 1 to 9 scale, where 9 was dark green.
^yTurf height was measured in cm 5 d after mowing (1.0 cm = 0.39 inch).
^x'Axcella' and TXR2001-6 are annual ryegrasses; 'Derby Supreme' is a perennial ryegrass; and Showboat is a blend.
^wMeans within columns not followed by the same letter differ at the 0.05 level as judged by the least significant difference.

Table 6. Turf color, freeze damage, and plant height ratings of annual and perennial ryegrass, fine and chewing fescue and *Lolium rigidum* during 2002–03 at Overton, Texas.

Entry ^w	Turf color ratings ^y			Freeze damage ^z	Plant turf ht ^x (cm)
	28 Jan.	11 Mar.	17 Apr.	27 Jan.	30 Apr.
Panterra	6.0 d ^v	5.5 e	6.8 e	2.5 ab	8.0
Axcella	6.1 d	5.5 e	6.0 f	2.0 bc	8.8
BAR Lp 2002	7.5 abc	8.2 ab	8.5 ab	2.8 ab	5.8
Bargold	6.8 cd	7.2 bcd	7.5 d	2.0 bc	6.5
Hardtop	7.8 ab	7.0 cd	7.5 d	2.0 bc	5.8
BAR CHF 8 Fusu	7.5 abc	7.5 bcd	7.7 cd	1.8 c	5.5
Derby Supreme	6.8 cd	7.7 bc	8.2 bc	2.3 abc	7.2
Allstar	8.3 a	9.0 a	9.0 a	1.8 c	7.2
Transtar	5.0 e	5.0 e	5.0 g	3.0 a	---u

^zFreeze damage was rated from 0 to 9, where 0 = no damage.
^yTurf color ratings were on a 1 to 9 scale, where 9 = dark green.
^xTurf height was measured 5 d after mowing (1.0 cm = 0.39 inch). 'Transtar' was already dead.
^w'Panterra', 'Axcella', and 'Transtar' are annual ryegrass cultivars; BAR Lp 2002, 'Bargold', 'Derby Supreme', and 'Allstar' are perennial ryegrasses; 'Hardtop' is a fine fescue; and BAR CHF 8 Fusi is a chewing fescue.
^vMeans within columns not followed by the same letter differ at the 0.05 level as judged by least significant difference.
^uPlant height not recorded for 'Transtar' due to its early transition.

Table 7. Percent living ryegrass coverage over plots in Expt. A at Overton, Texas, on different dates in 2002.

Entry ^z	Ryegrass coverage (%)						
	23 Apr.	2 May	9 May	13 May	29 May	7 June	19 June
Axcella	96 ^y b ^x	78 b	42 b	18 b	0 b	0 b	0 b
Panterra	97 b	79 b	43 b	14 b	0 b	0 b	0 b
Premier II	99 a	95 a	94 a	91 a	86 a	50 a	0.5 a

^zAxcella^y and Panterra^y are annual ryegrass cultivars; and Premier II^y is a perennial ryegrass.

^yRatings were recorded as a percentage of whole plots.

^xMeans within columns not followed by the same letter differ at the 0.05 level as judged by least significant difference.

Table 8. Percent living ryegrass coverage in Expt. B for annual and perennial ryegrass at Overton, Texas, on different dates in 2002.

Entry ^z	Ryegrass coverage (%)						
	23 Apr.	2 May	9 May	13 May	29 May	7 June	19 June
Axcella	94 ^y c ^x	34 c	13 c	10 b	0 c	0 b	0 c
Derby Supreme	98 a	75 b	74 a	74 a	60 a	41 a	2 a
Showboat	95 b	80 a	73 a	72 a	49 b	38 a	1 b
TXR2001-6	95 b	36 c	23 b	14 b	1 c	0 b	0 c

^zAxcella^y and TXR2001-6 are annual ryegrasses; Derby Supreme^y is a perennial ryegrass; and Showboat is a blend.

^yRatings were recorded as a percentage of whole plots.

^xMeans within columns not followed by the same letter differ at the 0.05 level as judged by least significant difference.

growing season Panterra^y and Axcella^y were similar; however, by 31 Mar. and 23 Apr. Panterra^y had a better color rating than Axcella^y. In Expt. B on 19 Dec., color differences were nonsignificant. On 18 Feb., Derby Supreme^y and the blend Showboat (70% Derby Supreme^y) were not different, while Axcella^y was rated lower for color. On 31 Mar. and 23 Apr., Derby Supreme^y was best, followed by the blend and Axcella^y. On 23 Apr., the annuals Axcella^y and TXR2001-6 had begun to transition out and their color was degraded. In 2002–03 significant differences were noted for color on all dates (Table 6). Allstar^y had the darkest green color rating on each date. Transtar^y had the

lowest color rating of all entries in the study. Panterra^y and Axcella^y were not different on 28 Jan and 11 Mar.; however, on 17 Apr. Panterra^y had a slightly darker green color. Perennials BAR Lp 2002, Derby Supreme^y, and Bargold^y had a darker green color rating than did the annuals on the 11 Mar. and 17 Apr. rating. Hardtop^y and BAR CHF 8 Fusu were intermediate in color rating but maintained their color late in the spring.

Transition date as estimated by percent coverage of green living ryegrass over several dates is shown in Tables 7 and 8 for 2001–02 and Table 9 for 2002–03. In Expt. A, transition or death of some plants began as early as 23 Apr. when a significant difference

was noted. Axcella^y and Panterra^y were not different, but transitioned out rapidly during May and by 13 May had less than 20% living plants. They were completely dead by 29 May. Premier II^y had a much slower transition but had 86% living plants on 29 May. Premier II^y transitioned out rapidly in June 2002 and was dead by 19 June. In Expt. B, Axcella^y transitioned similarly to Expt. A, and was dead by 29 May. Derby Supreme^y was similar to Premier II^y in Expt. A. The blend Showboat did not have an advantage (early transition) over the perennial Derby Supreme^y. This is an indication that the 70% Derby Supreme^y and 30% Axcella^y had too high a percentage of the perennial to affect the transition date. Perhaps a 1:1 blend would be more suitable for changing the transition date to be intermediate between the annual and the perennial. In 2002–03, the transition date was similar for the annuals Panterra^y and Axcella^y as they began to die early in May and all plants were nearly dead by 29 May. Transtar^y was even earlier, as it was dead by 15 May. The perennial ryegrass cultivars had a slower and longer transition, but tended to be 50% dead by early June but survived until late June. Hardtop^y fine fescue and BAR CHE 8 Fusu chewing fescue were very similar, died gradually, and survived until late June.

Conclusions

The results from the 2002–03 experiment were similar to the results from 2001–02. Panterra^y demonstrated that it is similar to Axcella^y in early establishment, turf quality, freeze resistance, and in transition date. The data also indicated that by April, Panterra^y had a slightly darker green color

Table 9. Percent living ryegrass cover over plots during May and June 2003 at Overton, Texas.

Entry ^z	Ryegrass coverage (%)								
	2 May	9 May	15 May	22 May	29 May	4 June	13 June	20 June	30 June
Panterra	78 bc ^y	21 ef	16 d	7 e	1 e	0 e	0 d	0 c	0 b
Axcella	55 d	37 de	16	4 e	1 e	0 e	0 d	0 c	0 b
BAR Lp 2002	97 a	80 ab	64 ab	56 ab	51 ab	46 ab	45 ab	31 a	4 a
Bargold	95 ab	75 abce	53 bc	36 bcd	21 cd	13 cde	10 cd	3 c	1 b
Hardtop	74 cd	48 d	50 bc	38 bcd	29 bcd	24 cd	21 cd	9 bc	2 b
BAR CHE 8 Fusu	88 abc	58 bcd	48 bcd	46 bc	33 bcd	28 bc	25 cd	9 bc	1 b
Derby Supreme	88 abc	55 cd	57 bc	54 b	43 bc	28 bc	28 bc	25 ab	2 b
Allstar	97 a	86 a	91 a	84 a	69 a	60 a	59 a	29 a	4 a
Transtar	13 e	6 f	0 e	0 e	0 e	0 e	0 d	0 c	0 b

^zPanterra^y, Axcella^y, and Transtar^y are annual ryegrass cultivars; BAR Lp 2002, Bargold^y, Derby Supreme^y, and Allstar^y are perennial ryegrasses; Hardtop^y is a fine fescue; and BAR CHE 8 Fusu is a chewing fescue.

^yMeans within columns not followed by the same letter differ at the 0.05 level as judged by least significant difference.

and was somewhat slower in growth than was 'Axcella'. Both 'Panterra' and 'Axcella' are somewhat lower in turf quality than good perennial ryegrass turf cultivars; however, they do have good and acceptable turf quality and their early transition date is a significant advantage in the transition of a overseeded cool-season grass back to a warm-season turfgrass.

Literature cited

Bruneau, A.H., J.M. DiPaola, W.M. Lewis, W.B. Gilbert, and L.T. Lucas. 1985. Overseeding bermudagrass turf. N.C. Agr. Ext. Serv. AG-352.

Duble, R.L. 1996. Turfgrasses, their management and use in the southern zone. Texas A&M Univ. Press, College Station.

Horgan, B.P. and F.H. Yelverton. 2001. Removal of perennial ryegrass from overseeded bermudagrass using cultural methods. *Crop Sci.* 41:118-126.

Johnson, B.J. 1975. Transition from overseeded cool-season grass to warm-season grass with pronamide. *Weed Sci.* 24:309-311.

Johnson, B.J. 1991. Influence of herbicides on spring transition of bermudagrass greens overseeded with perennial ryegrass. *Georgia Agr. Expt. Stn. Res. Bul.* 403.

Knoop, W.E. 1987. Enhancing spring transition. *Lawn Servicing* 4(2):11.

Meyers, H.G. and G.C. Horn. 1970. Transition from overseeded to permanent warm-season grasses. *Golf Superintendent* 38(1):62-65.

Palmertree, H.D. 1975. Management of overseeded greens during spring transition period. *Golf Superintendent* 43(3):27-29.

Sifers, S.I. and J.B. Beard. 1993. Comparative inter- and intra-specific leaf firing resistance to supraoptimal air and soil temps in cool-season turfgrass. *Intl. Turfgrass Soc. Res. J.* 7:621-628.