

'Intercross' Ryegrass

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SUMMARY

'Intercross' intermediate ryegrass (*Loium multiflorum* x *L. perenne* Lam.) was developed by Texas AgriLife Research at the Texas AgriLife Research and Extension Center at Overton, Texas. The main attributes of Intercross are a darker green leaf color compared to Axcella, Axcella 2, Panterra and Gulf. Darker leaf color is more evident late in spring in Texas (April). Turf quality ratings are good from November until early May and then decline. Transition of Intercross is similar to Panterra and Axcella 2, and much earlier than most intermediate or perennial ryegrass cultivars. Intercross was approved for release in 2010 by Texas AgriLife Research and Texas A&M University. Intercross is a diploid ryegrass where $2n = 2x = 14$ chromosomes. Intercross should be labeled as an intermediate ryegrass, indicating it has some characteristics of an annual and some characteristics of a perennial ryegrass. The line has been evaluated in turf overseeding trials at Overton for the past three years.

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Annual and perennial ryegrass is differentiated by three main and several minor characters. Annuals have awns and perennials do not. Root tips (10 days after germination) of annuals typically fluoresce under a dark light, and perennials do not, and annuals have rolled leaf vernation and perennials are folded. When considering turf grass, perennials are normally shorter or dwarfier, have narrower and shorter leaves, and have a darker green leaf color. Perennials act as a perennial in a cooler environment; however in Texas perennials die in June or July, while annuals die in May. Therefore in overseeded warm-season turf, perennials often are too competitive and can damage the permanent warm-season turf-grass. Intermediates are derived from crossing an annual with a perennial. Intercross is an intermediate type and has some characteristics of both annuals and perennials. Intercross has narrow leaves with dark green color, however it has rolled leaf vernation, and roots are about 90% fluorescent. Intercross was bred to utilize some of the high turf quality traits of perennials, while maintaining an early transition character of annuals.

Breeding History: Intercross comes from a cross of Axcella x 01-ARG (intermediate) made by D. J. Floyd from Pickseed West, Inc., at Albany, Oregon during the growing season of 2000-2001. In 2001-2002 seed of the F1 was grown in rows at Overton and allowed to cross-pollinate. In 2002-2003 this germplasm was grown as a space plant population at Overton. Sixteen plants with dark green leaves and good turf quality were transplanted to pots near the greenhouse for cross-pollination. These plants were inoculated for crown rust and 3 plants were susceptible and were removed, leaving 13 plants to cross-pollinate and produce seed which was labeled TXR2004-TF-1. In 2003-2004, seed of TXR2004-TF-1 was sent to the Oregon State Seed Testing Laboratory and screened of seedling fluorescence. Non-fluorescent seedlings were returned to Overton and planted in a space planted nursery. Plants not exhibiting good turf

characteristics and those with long awns were removed prior to pollination. Remaining plants cross-pollinated and produced seed and seed was labeled TXR2004-TF-PR. In 2004-2005, seed from this population was again screened in the Oregon State Seed Testing Laboratory and non-fluorescent seedlings were returned and planted in a space planted nursery. Plants with best uniform dwarfy and good turf-grass quality were allowed to cross-pollinate and produce seed. Seed from 25 early maturing plants were bulked. This bulk was labeled TXR2005-TF-PRES. In 2005-2006, 300g of seed were sent to Turf Merchants, Inc. at Tangent, Oregon, grown in rows and increased for seed. Fifty-one pounds of seed was returned from Oregon and labeled TXR2007-TF-PR-A and is the germplasm described in this release proposal and is to be named 'Intercross' intermediate ryegrass.

Overseeding trials were conducted at Overton during the growing seasons of 2007-2008 and 2008-2009. Soil had a pH of 7.0. Pre-seeding fertilizer application of 85 kg N, 40 kg P₂O₅ and 85 kg K₂O ha⁻¹ was made. Plots were top-dressed with 2 kg N, 15 kg P₂O₅ and 15 kg K₂O ha⁻¹ every 60 days after overseeding. Ryegrass was overseeded onto 'Princess 77' bermudagrass sod in 1.3 x 1.3 m² plots in late October of each year. Seeding rate was 18.5 lb/1000 sq ft for annual and intermediate ryegrass (including Intercross) and 16.5 lb/1000 sq ft for perennial ryegrass. After seeding, test site was sprinkle irrigated 30 min daily for 7 days to insure germination and establishment of seedlings. Turf was mowed at a height of 1.0 inch on a weekly basis throughout trial. Data was recorded on numerous plant variety protection (PVP) data points; however will be reported in report only on pertinent plant characters in Table 1. In the overseeding trial, data was recorded on % stand, turf color rating, turf height, turf density, turf quality, and transition date of ryegrass and bermudagrass during the late spring. Data were

analyzed by SAS with a randomized complete block analysis with 3 replications each year. Means are compared via computation using of the LSD (0.05).

Characteristics

Plant characters which differentiate Intercross from recent Texas AgriLife Research releases are shown in Table 1. Intercross differs from ‘Panterra’ (Nelson et al., 2004) by having less tillers/plant, but is similar to ‘Axcella’ (Nelson et al., 2001) and ‘Axcella 2’ (Nelson et al., 2007). Plant height of Intercross was 81 cm, which was shorter than Axcella, and Panterra, but taller than Axcella 2. Intercross is much shorter than the forage type ‘Gulf’ (Weihsing, R.M., 1963) ryegrass, or the old turf cultivar Froghair. Flag leaf collar height of Intercross was 44 cm and it also was lower compared to Axcella and Panterra, but higher than Axcella 2. Flag leaf length of Intercross was 46 cm, which was less than Axcella, but longer than Axcella 2, and similar to Panterra. Leaf sheath length of Intercross was 39 cm which was less than Axcella and Panterra, and just 2 cm longer than Axcella 2. Heading date of Intercross is 14 days later than Axcella and Panterra, but similar to Axcella 2. Intercross is not infected with a fungal endophyte (Moon et al., 2000).

Performance

Tables 2 through 7 provide information on turf quality of Intercross compared to several annuals, and an intermediate control (PSG-QT) and a perennial ryegrass (Brea) variety. Turf color of Intercross in 2008 was good and similar to Panterra and Axcella 2 until the April 14 rating when Intercross had a higher or better color rating (Table 2). This indicated that it holds its color longer in the late spring. Intercross’s color rating was not as good as PSG-QT or Brea, two very good cultivars. In 2009 (Table 5), the color rating of Intercross was better than Panterra and Axcella 2 in both February and April ratings. It was equal to LH08, an intermediate

and slightly less than Brea. For turf height (5 days after mowing at 2.5 cm), Intercross was not different from Panterra, Axcella 2 or PSG-QT, but was taller than the perennial Brea (Table 2). Intercross was much shorter than the forage-type variety Gulf. Tables 3 and 6 provide a turf quality (on a 1 to 9 rating, where 5 = acceptable and 9 =best) information at 2 week intervals throughout the season. Turf quality of Intercross was very good throughout the season until May when quality began to diminish and by late May quality was poor. Turf quality of Intercross in 2008 compared favorably with Axcella 2 and Panterra and the intermediate PSG-QT; however was rated lower than Brea at several of the dates. In 2009 (Table 6), Intercross had higher turf quality ratings compared to Axcella and Axcella 2, but was similar to Panterra. It was similar, but slightly better than intermediate LH08 throughout the growing season. Tables 4 and 7 provide information on transition date (death) of both the ryegrass entry and regrowth or transition of green bermudagrass back into to the turf sod. The transition date on Intercross in 2008 (Table 4) began in early May and by May 8, was at 43% living and by May 28 it was reduced to 13 %. The transition percentages of Intercross were not significantly different from Axcella 2 or Panterra; however, it appears that Intercross had a low number of plants surviving into June. Both the PSG-QT (intermediate) and Brea (perennial) transitioned out from mid-May until late June. In 2009 (Table 7), Intercross transitioned somewhat later, starting in mid-May and by June 12, only had 4% of plants remaining. It was slower to transition than the annuals Axcella 2 and Panterra in 2009. It also transitioned somewhat slower than LH08 intermediate ryegrass in 2009. It did transition faster than BREA perennial ryegrass. In regard to transition of bermudagrass back into turf in 2008, transition was similar to the annuals (Table 5). Compared to BREA and PSG-OT, Intercross allowed about 2 weeks earlier green-up, or transition of

bermudagrass. In 2009 the transition of bermudagrass back into turf after Intercross was later than after annuals, but earlier than BREA perennial ryegrass.

Availability

Breeder Seed of Intercross will be maintained by Texas AgriLife Research. Turf Merchants, Inc. has an exclusive license for production of a licensed cultivar as Foundation Class Seed Stock and to produce and sell Intercross as a licensed product. Seed of Intercross ryegrass will become commercially available in 2010. Intercross will be submitted for Plant Variety Protection under P.I. 658507. All seed requests should be sent to the corresponding author during the period of protection by the Plant Variety Protection Certificate. Seed of this release is deposited in the National Plant Germplasm System, where it will be available after the expiry of the Plant Variety Protection for research purposes, including development and commercialization of new cultivars. It is requested that appropriate recognition be made if the cultivar contributes to the development of new germplasm or cultivars.

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Table 1. Plant characters in which Intercross differs from other ryegrass genotype in 2007-2008 space planted PVP nursery.

Genotype	Number tillers/plant	Plant height cm	Flag Leaf collar cm	Flag Leaf length cm	Leaf Sheath length cm	Heading Date
Intercross	125	81	44	46	39	May 4
Axcella	116	95	51	53	46	April 21
Axcella 2	102	75	39	35	37	May 2
Panterra	167	93	51	46	44	April 21
TXR 2004-TFEM	91	80	40	38	39	-
Gulf	117	96	54	60	47	April 27
Froghair	81	100	58	53	49	-
Mean	114	89	48	47	43	-
LSD (0.05)	27.3	4.3	2.7	2.9	1.8	-

Data recorded in plant variety protection nursery at Overton in 2007-2008 season.

Table 2. Overseeded turf plots at Overton, Texas, 2007-2008. Data reported are percent stand, turf color ratings, turf height and turf density.

Entry	Ryegrass Type	% Stand 21 Nov	Turf Color 9 Jan	Turf Color 17 Mar	Turf Color 14 Apr	Turf Ht cm 26 Feb	Turf Density 14 April
Gulf	AR	93	4.0 ^a	4.0 ^a	4.7 ^a	5.7 ^b	4.7 ^a
Axcella	AR	93	5.0	5.0	4.3	4.7	4.7
Axcella 2	AR	95	6.7	6.3	5.3	3.3	6.0
Panterra	AR	80	6.0	6.0	5.0	4.7	5.3
Intercross	IR	85	6.3	5.7	6.0	4.3	6.3
TXR2004-TF-EM	AR	85	6.7	6.0	6.7	4.3	6.3
PSG-QT	IR	87	8.0	8.0	8.0	3.7	8.3
Brea	PR	83	8.0	8.0	7.0	3.0	8.7
Ck (Not overseeded)	--	0	1.0	0.0	1.0	0.0	1.0
Mean		78	6.0	6.0	6.0	4.0	6.0
LSD		14	0.94	0.68	1.55	1.30	1.06

^aTurf color and turf density were rated on a 1 to 9 rating where 9 was best.

^bTurf height was measured 5 days after mowing and is in centimeters.

Experiment was overseeded on 23 October 2007. AR = annual ryegrass, PR = perennial ryegrass and IR = intermediate ryegrass. Annual ryegrass was seeded at 18.5 lb/1000 sq ft. Perennial ryegrass was seeded at 15.6 lb/1000 sq ft.

Table 3. Turf quality ratings at Overton, Texas in 2007-2008. Ratings are on a 1 to 9 scale where 9 = best.

Entry	Type	Turf Quality Rating (1-9) on Following Dates									
		21 Nov	6 Dec	14 Jan	8 Feb	26 Feb	17 Mar	14 Apr	1 May	15 May	22 May
Gulf	AR	7.0	5.3	5.0	4.7	5.6	4.6	5.0	4.6	4.0	4.7
Axcella	AR	7.3	6.3	6.0	6.7	5.7	5.7	5.3	4.3	4.7	4.3
Axcella 2	AR	8.0	7.0	6.3	6.7	7.3	6.7	6.0	6.3	5.7	5.0
Panterra	AR	6.7	6.3	6.3	6.0	7.0	6.3	5.3	5.3	5.0	4.7
Intercross	IR	7.0	6.0	5.6	6.0	6.7	6.3	5.3	4.7	5.3	4.7
TXR2004-TF-EM	AR	7.0	6.7	5.7	6.3	6.7	6.7	5.7	5.3	5.3	4.7
PSG-QT	IR	7.0	6.7	5.7	6.3	7.7	7.3	7.0	7.0	7.0	7.0
Brea	PR	7.7	7.3	6.3	6.3	7.3	7.3	8.0	7.3	7.7	7.3
Ck (not overseeded)		3.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.7	2.6
Mean		7.0	6.0	6.0	6.0	7.0	6.0	6.0	5.0	6.0	5.0
LSD (0.05)		1.5	1.2	0.79	1.9	1.7	1.6	0.8	0.9	0.8	0.9

Experiment was overseeded on 24 October 2007. AR = annual ryegrass, PR = perennial ryegrass and IR = intermediate ryegrass.

Table 4. Percent ryegrass (RG) and percent bermudagrass (BG) in plots on different dates during transition period at Overton, Texas in 2008.

Entry	1 May		8 May		15 May		22 May		28 May		10 June		18 June	
	% RG	% BG	% RG	% BG	% RG	% BG	% RG	% BG	% RG	% BG	% RG	% BG	% RG	% BG
Gulf	90	7	46	33	33	37	10	53	10	63	0	88	0	98
Axcella	83	7	53	32	33	37	5	50	3	67	0	92	0	100
Axcella 2	96	3	63	33	43	38	8	40	13	63	0	85	0	95
Panterra	88	10	40	35	35	40	10	52	5	77	0	97	0	100
Intercross	90	7	43	35	33	37	17	47	13	67	2	88	0	97
TXR2004-TF-EM	87	4	40	32	30	40	8	50	10	57	0	90	0	95
PSG-QT	99	1	94	4	93	6	83	12	87	13	43	37	8	45
Brea	99	1	96	4	96	4	90	6	85	12	43	40	10	47
Ck (not overseeded)	0	22	0	60	0	63	0	65	0	68	0	97	0	100
Mean	82	7	53	30	44	34	26	42	26	55	10	80	2	87
LSD (0.05)	6.4	5.1	12.6	13.3	12.3	14.3	9.8	10.2	13.8	19.5	21.4	22.1	12.0	18.8

Experiment was planted on 23 October 2007.

Table 5. Overseeded turf plots at Overton, TX 2008-09. Data reported are percent stand and turf color for two dates.

Variety	Ryegrass Type	% Stand 24 Nov	Turf Color 11 Feb	Turf Color 22 Apr
Gulf	AR	93.7	4.3 [†]	3.7 [†]
TXR2004-TF-EM	IR	94.0	6.0	5.3
Axcella	AR	83.3	5.3	4.3
Axcella 2	AR	86.7	5.3	4.7
Panterra	AR	94.3	5.7	4.7
LH08	IR	93.0	6.3	7.0
Intercross	IR	90.0	6.7	7.0
BREA	PR	88.3	7.7	8.0
Ck (not overseeded)	-	0.0	1.0	1.3
Mean		81	6.0	6.0
LSD (0.05)		8.9	0.8	0.8

[†]Turf color was rated on a 1 to 9 scale where 9 = best. Experiment was overseeded on 22 Oct, 2008; AR = annual ryegrass, seeded at 18.5 lb/1000 sq ft, IR = intermediate ryegrass seeded at 18.5 lb/1000 sq ft, and PR = perennial ryegrass seeded at 16.5 lb/1000 sq ft.

Table 6. Turf quality ratings at Overton, TX in 2008-09. Ratings were on a 1-9 scale, where 9 = best.

Variety	Ryegrass Type	Turf Quality 26 Nov	Turf Quality 9 Dec	Turf Quality 8 Jan	Turf Quality 29 Jan	Turf Quality 11 Feb	Turf Quality 8 Mar	Turf Quality 26 Mar	Turf Quality 6 Apr
Gulf	AR	4.3	5.7	5.3	4.3	3.7	4.3	4.7	4.0
TXR2004-TF-EM	IR	5.7	7.3	6.7	6.7	7.0	6.7	6.3	6.7
Axcella	AR	4.3	5.3	5.3	5.3	6.0	5.7	5.0	5.0
Axcella 2	AR	5.0	5.7	5.7	5.3	5.7	6.0	6.0	6.0
Panterra	AR	6.0	6.7	6.7	7.3	7.3	7.3	6.3	6.3
LH08	IR	6.0	6.3	6.3	6.0	6.3	6.0	6.7	7.0
Intercross	IR	5.0	5.7	6.7	7.3	7.3	7.0	7.0	7.3
BREA	PR	4.7	5.0	6.7	6.0	6.3	4.7	6.3	6.0
Ck (not overseeded)	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Mean		5.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
LSD (0.05)		1.2	1.3	1.2	1.4	1.2	1.5	1.1	1.4

[†]Experiment was overseeded onto a bermudagrass sod on 22 Oct 2008. AR = annual ryegrass, IR = intermediate ryegrass, PR = perennial ryegrass.

Table 7. Transition of ryegrass to bermudagrass at several dates at Overton, TX in 2009. % RG = percent ryegrass and % BG = percent bermudagrass at the date shown.

Variety	1 May		7 May		14 May		22 May		1 June		12 June	
	% RG	% BG	% RG	% BG	% RG	% BG	% RG	% BG	% RG	% BG	% RG	% BG
Gulf	95	4	91	5	62	15	38	37	2	63	0	83
TXR2004-TF-EM	96	3	89	7	15	28	7	35	0	78	0	85
Axcella	93	6	85	8	27	37	2	53	0	75	0	92
Axcella 2	97	2	85	8	33	30	5	45	2	83	0	97
Panterra	94	3	82	8	17	33	2	47	0	67	0	90
LH08	100	0	97	1	82	12	60	18	5	47	0	60
Intercross	100	0	98	2	90	7	73	16	25	40	4	67
BREA	100	0	100	0	95	5	75	13	47	27	17	42
Ck (not overseeded)	0	15	0	15	0	47	0	50	0	80	0	95
Mean	97	3	91	5	53	21	33	70	11	60	3	77
LSD (0.05)	3	2	6	3	22	12	26	19	16	19	9	15

Experiment was planted on 22 Oct 2008.