INNOVATION® zoysiagrass

Innovation® Zoysia White Paper

Sod Solutions® Professionals

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Introduction

Innovation® Zoysiagrass, a new zoysiagrass cultivar under the experimental designation KSUZ 0802, was released jointly by the breeding programs of Texas A&M University and Kansas State University in 2015. This medium-to-fine bladed variety was developed to improve upon the industry standard, Meyer (*Zoysia japonica*-type). Meyer Zoysia was released in 1952 and is widely used for its excellent cold hardiness in the transition zone.

The transition zone is the area of the United States where winters are extremely cold and summers are very hot. In this area, cool season turfgrasses like bluegrass and fescue are available as well as warm season varieties like bermuda and zoysia. Success for grasses in this area of the country revolves around being able to not only survive in these temperature extremes—but to thrive in them.

As impressive as Meyer has been over the years, it has its disadvantages. As a *Zoysia japonica*, Meyer has a more coarse and therefore wider leaf blade. While its tolerance for cold temperatures is good, it is more susceptible to disease and to the bluegrass billbug. Some current issues end-users see with Meyer Zoysia include:

- Overall turfgrass quality
- Establishment rate
- Recovery from divots in golf
- Sod recovery
- Large patch disease resistance
- Billbug resistance
- Fall color retention and spring green-up
- Shade tolerance

Looking to improve on the standard, researchers crossed a Meyer-type *Zoysia japonica* with a *Zoysia matrella*, a variety which is finer-bladed and possesses a more dense canopy. The result was Innovation Zoysia, a grass that features a good resistance to cold, disease and insects, while offering the finer leaf blades in demand today and a better overall turfgrass quality. Innovation features a rapid establishment grow-in and damage recovery rate. It has an extended fall color and earlier spring green up while offering a level of shade tolerance found in the finer bladed varieties.

Why Zoysia?

Aside from improved characteristics and performing well in the transition zone, producers as well as end-users from the golf, commercial and residential landscape markets still may ask why they might use zoysia specifically. Zoysiagrass, especially when compared to cool season turfgrasses, is going to provide irrigation savings along with other significantly reduced management expenses. Generally, zoysias have less pest management overall. A study conducted in 2008 by Jack Fry and others compare creeping bentgrass with zoysiagrass, specifically for golf course fairways located in the transition zone. As demonstrated in Table 1 below, some significant differences include that of irrigation expenses and disease control. In 2008, the total savings that were seen on an annual basis from zoysia was about $100,000.

CULTURAL PRACTICE	CREEPING BENTGRASS	ZOYSIAGRASS	DIFFERENCE (BENTGRASS – ZOYSIA)
Mowing	$8,802	$6,288	$2,514
Irrigation	$55,459	$32,737	$22,722
Fertilization	$9,701	$4,850	$4,851
Disease Control	$52,946	$4,390	$48,556
Weed Control	$12,342	$1,705	$10,637
Insect Control	$12,378	$4,236	$8,142
Cultivation	$2,400	$1,200	$1,152
Total	**$154,028**	**$55,406**	**$98,622**

Table 1 Fry, Kennelly, St. John, 2008. GCM. May

Zoysia can offer many benefits over other fine-bladed varieties like bermudagrass. From a maintenance perspective, zoysia typically offers better shade tolerance, a better density, less mowing and generally requires less overall maintenance. Zoysia's blades are more upright than bermuda, often providing a tighter, more compact appearance.

Origins

Innovation was chosen for its fine texture and cold tolerance. Innovation (KSUZ 0802 tested as TAES 5311-26) is an F_1 interspecific hybrid derived in 2001 from a cross between a *Zoysia matrella* named 'Cavalier', the female parent, and an ectotype, Anderson 1, a *Zoysia japonica*, derived from Chinese common. Cavalier is a high quality, fine textured *Zoysia matrella* cultivar, but Cavalier lacked the cold hardiness to be used in the upper transition zone. Chinese common, however, had the sought-after cold hardiness characteristic, but not the fine textured characteristic. Anderson 1 was a descendant from a test plot of *Zoysia japonica* cultivar Chinese common established from seed. Over an extended period of time, two ecotypes became dominant and were identified as Anderson 1 and Anderson 2. Crosses were made with both ecotypes, but Anderson 1 derivatives were generally better performing.

Initially, more than 800 individual, genetically different hybrids were developed at Texas A&M AgriLife Research – Dallas in 2001. Grasses were planted in Manhattan, KS in 2004 and evaluated for quality and winter survival between 2004–2006. Innovation (KSUZ 0802) was one of 31 hybrids selected for further evaluation at Manhattan in 2007 and 2008 under golf course conditions. These 31 were later narrowed to seven hybrids, including Innovation (KSUZ 0802), which were evaluated at nine locations in the transition zone under typical lawn or golf course fairway management conditions from 2009–2012. The locations were Wichita and Manhattan, KS; Columbia, MO; Fletcher and Jackson Springs, NC; Stillwater, OK; Knoxville, TN; Virginia Beach and Blacksburg, VA; and Dallas, TX.

Researchers first planted hundreds of experimental grasses in Manhattan, KS, in 2004 and evaluated them for quality and winter survival through 2006. Innovation (tested as KSUZ 0802) was among 31 hybrids selected for further evaluation under golf course conditions in Manhattan in 2007 and 2008. Researchers culled 31 down to the seven most promising, with Innovation passing muster through each cut. The top seven underwent evaluation at ten locations in the transition zone from 2009 to 2012:

Winter Hardiness

Innovation is a warm season variety, but has repeatedly demonstrated cold hardiness equivalent to Meyer—the standard in transition zone cold hardy choice since its 1952 release. Meyer showed a 99 percent survival rate following the severe Manhattan, KS winter of 2013. That rate was matched by Innovation while others succumbed to the freeze. EMPIRE® Turf, a *Zoysia japonica* for example, saw a 78 percent survival rate in the same winter while Zeon®, a *Zoysia matrella* type, saw 72 percent survival rate. At the same time, a number of experimental *Zoysia matrella* selections experienced below 50 percent survival.

CULTIVAR OR PROGENY	PERCENTAGE SURVIVAL MAY 21, 2013
Meyer (Z. japonica)	100 a*
Innovation (Z. japonica x Z. matrella)	99 a
EMPIRE (*Z. japonica*)	78 bc
Zeon (*Z. matrella*)	72 bc
FAES 1317 (*Z. matrella*)	19 gh
CXZ 1109 (*Z. matrella*)	0 h

Table 2

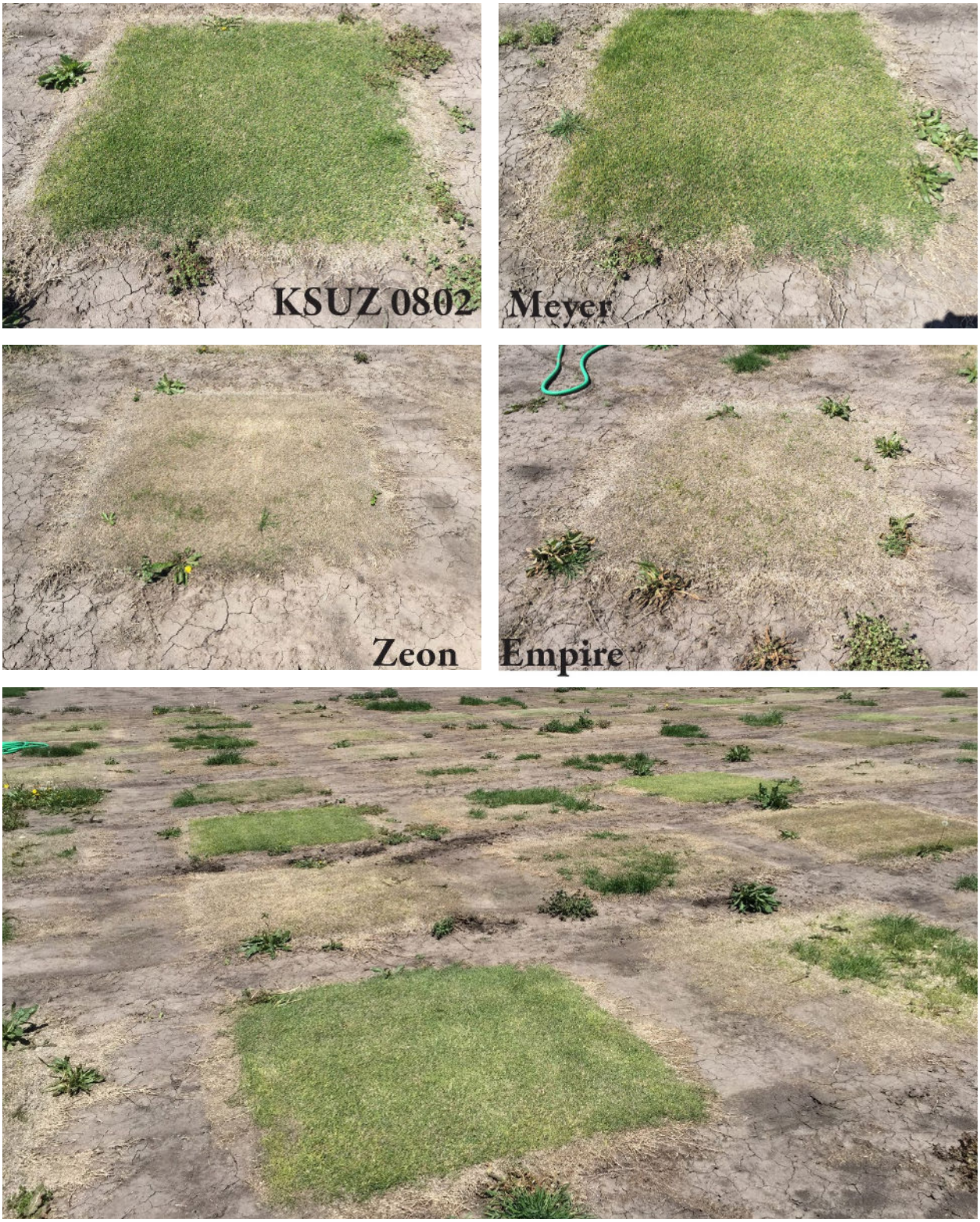

Figure 1: KSUZ 0802 and Meyer are among only a few zoysiagrasses that have no winter injury hardiness in May 2015 at Manhattan, KS

Furthermore, controlled freezing tolerance studies at K-State revealed that lethal temperature that kill 50 percent of the tillers in Innovation was statistically similar to Meyer in two consecutive winters. Based upon the results from research, Innovation can be used as far north as Zone 6a on the USDA Plant Hardiness Zone Map below (Figure 2).

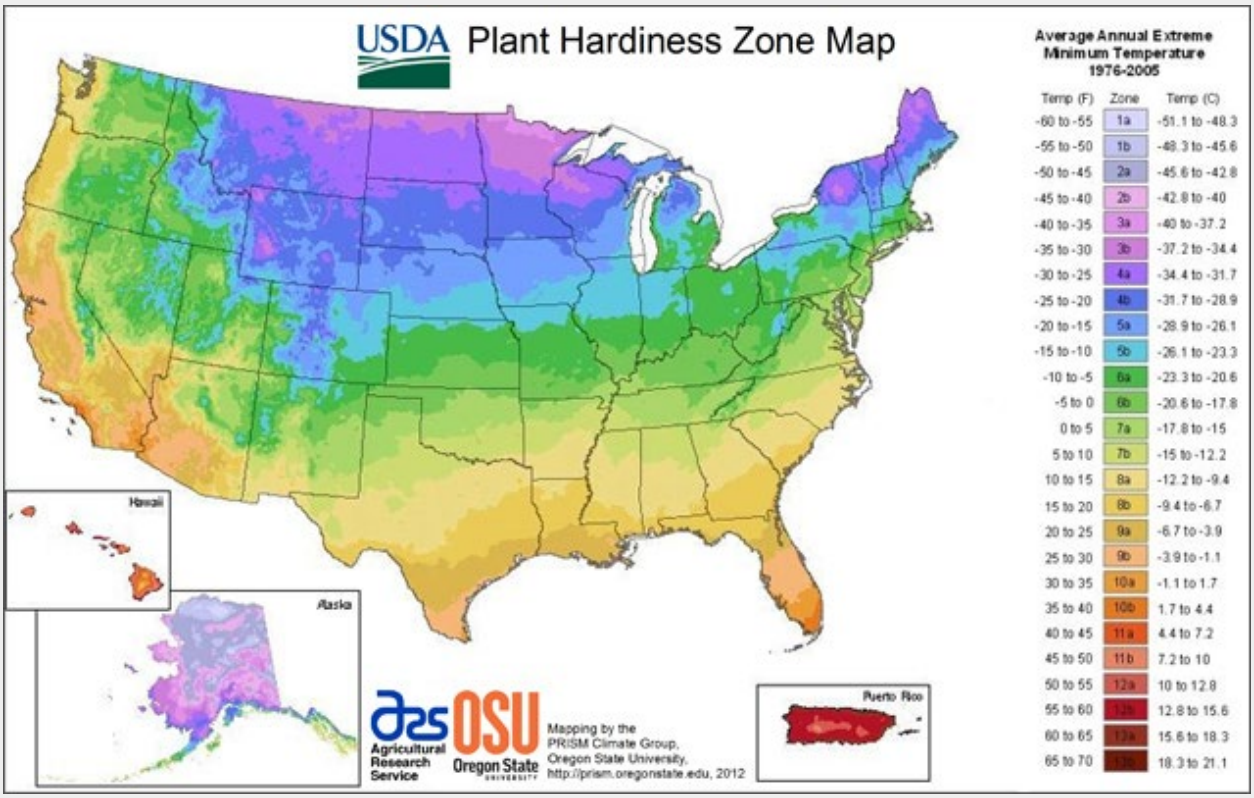

Figure 2

Image from: https://planthardiness.ars.usda.gov/PHZMWeb/#

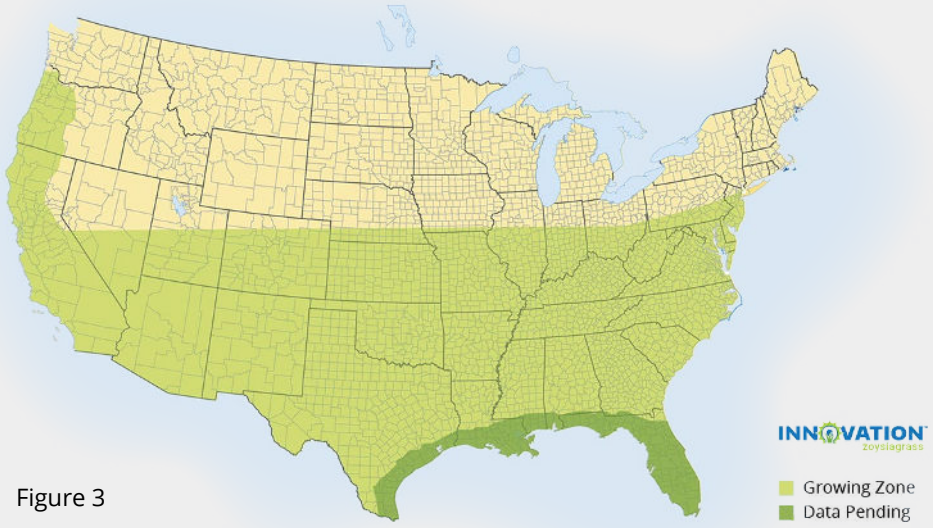

Figure 3

In layman's terms, Innovation proved its suitability for regions as far north as zone 6a on the USDA Plant Hardiness Zone Map—the same as the industry's best. However, the largest difference seen was not in cold hardiness but in turfgrass quality. The average turf quality of Innovation at lawn height—typically 6.1 on a scale of 1 to 9—proved better than that of Meyer—5.5 on the same scale. Results were consistent at tests sites in KS, NC, OK, TX and VA. At fairway height, meanwhile, Innovation averaged 6.9 compared to Meyer at 5.6 at testing locations in KS and OK.

In general, Innovation (KSUZ 0802) has a finer leaf texture and better density relative to Meyer, which results in better overall turf quality (Figure 4).

Figure 4: Meyer (Left) vs. Innovation (Right)

Characteristics & Features

- Dark Green Color
- Medium to Fine Texture
- Rapid Growth
- Cold Hardy
- Bluegrass Billbug Resistant
- Blocks Well

In the first days of the research that led to Innovation, more than 800 individual, genetically different zoysiagrass hybrids were developed at Texas A&M AgriLife Research Center in Dallas in 2001. Grasses were planted in Manhattan, KS in 2004 and evaluated for quality and winter survival between 2004 and 2006.

Figure 5

Innovation was one of 31 hybrids selected for further evaluation at Manhattan in 2007 and 2008 under golf course conditions. These 31 were later narrowed to seven hybrids, including Innovation, which were evaluated at nine locations in the transition zone under typical lawn or golf course fairway management conditions from 2009 to 2012.

Morphological Description

As noted in The Release of KSUZ 0802 research document published by the Journal of Plant Registrations, stolon internodes of Innovation (KSUZ 0802) were longer than Chisholm, Emerald and Meyer but similar to Zorro (Table 3). Stolon internode diameter of Innovation was narrower than Chisholm, similar to Meyer and wider than Emerald and Zorro, whereas stolon node diameter of Innovation was similar to both Chisholm and Meyer but wider than Emerald and Zorro. Leaf blade lengths of Innovation were shorter than Meyer, similar to Emerald and Zorro and longer than Chisholm. Leaf blade widths of Innovation were finer than Chisholm and Meyer but coarser than Emerald and Zorro. Flag leaf lengths of Innovation were longer than Emerald and Zorro but similar to Meyer. Inflorescence lengths of Innovation were shorter than Meyer, longer than Zorro and similar to Chisholm and Emerald.

Morphology of KSUZ 0802 and commercial zoysiagrass cultivars Chisholm, Emerald, Meyer and Zorro at Dallas, TX

Cultivar†	Stolon‡			Leaf blade§		Flag leaf length¶	Inflorescence length#
	Internode length	Internode diameter	Node diameter	Length	Width		
	mm						
KSUZ 0802	22.3 a††	1.4 b	2.8 a	96.5 b	2.9 c	8.0 a	24.7 b
Chisholm	16.4 c	1.8 a	2.8 a	73.6 c	3.7 a	–	25.5 b
Emerald	16.2 c	1.2 c	2.1 b	107.0 b	2.0 d	3.6 bc	22.9 b
Meyer	18.2 bc	1.5 b	2.7 a	169.5 a	3.4 b	5.6 ab	41.0 a
Zorro	21.2 ab	1.2 c	2.3 b	104.5 b	1.8 d	1.8 c	19.4 c

† Cultivars were grown in a greenhouse maintained at 26°C day and 18°C night temperature and 70% humidity from Oct. 2014 through Mar. 2015 and were watered as needed three to four times per week. All replicate pots were moved outside on April 2015 to assess morphology under natural field conditions. Data were collected in 2015 on 14 Jan. 14 and 31 Mar. for all traits except leaf blade width, which was measured on 23 June.

‡ Internode length and diameter were measured from 12 samples between the fourth and fifth nodes of the longest stolons. Node diameter was measured from the fourth node.

§ Leaf blade length was measured from 12 samples on the third-youngest leaf for each cultivar; leaf blade width was measured 15 mm above the leaf collar from 12 samples on the third-youngest leaf for each cultivar.

¶ Flag leaf length was measured from the collar to the tip of the leaf. Sample number varied by cultivar but was collected from a minimum of five (KSUZ 0802) and a maximum of nine (Emerald and Zorro). Meyer was measured from eight samples. Flag leaves on Chisholm were not measured.

Inflorescence length was measured from 12 samples for each of the commercial checks and 9 samples of KSUZ 0802.

†† Means within a column followed by the same letter(s) are not significantly different at $P \leq 0.05$.

Table 3

Characteristics at Lawn Height (3.8–6.4 cm)

Establishment and Recovery after Sod Harvest

Innovation (KSUZ 0802) showed similarities to Meyer at seven of the nine locations including KS, MO, two areas of NC, OK, TN, TX and two areas of VA (Table 4). Innovation had higher plot coverage compared with Meyer in Wichita, KS and Knoxville, TN. The average across all nine locations showed that the establishment of Innovation (74 percent) was similar to Meyer (67.2 percent), but did have a greater establishment rate than Meyer. Innovation was in the top statistical group in all nine locations, whereas Meyer was only a top performer in five of the locations. Innovation had greater stolon initiation rate (5.0 week 1) than Meyer (2.9 week 1) in 2007 at Manhattan and had similar rates in 2008. Innovation and Meyer had similar stolon elongation rates in 2007 and 2008. Both had similar stolon branching rates in 2007, but Meyer had higher stolon branching rates than Innovation in 2008. As part of the same study, Innovation, planted from vegetative plugs in June 2007 and 2008 at Manhattan exhibited the same level of plot coverage in September of each year compared to Meyer. Generally, *Zoysia japonica* has been shown to display faster establishment rates and aggressive growth and regrowth characteristics compared with *Zoysia matrella*. These results show that Innovation, a finer-textured interspecific hybrid, exhibits similar stolon growth characteristics and establishment rates when compared to Meyer.

***Real world applications on sod farms post 2018 are demonstrating that Innovation has a considerably faster establishment rate than Meyer.

Establishment of KSUZ 0802 and two commercial zoysiagrass cultivars at nine locations.

Cultivar	Establishment (% plot cover)†									
	KS1	MO	NC1	NC2	OK	TN	TX	VA1	VA2	TPI‡
	%									
KSUZ 0802	87.5 a§	79.7 ab	55.0 a	68.3 a	71.0 a	97.3 a	73.3 a	63.3 ab	70.2 a	9
Chisholm	86.7 a	85.0 a	51.7 a	70.0 a	79.0 a	99.2 a	70.0 a	74.0 a	74.4 a	9
Meyer	76.2 b	76.0 b	41.7 a	45.0 a	81.3 a	91.2 b	73.3 a	53.0 b	67.1 a	5

† Entries were planted in summer 2009, except in two North Carolina locations, which were planted in summer 2010. Establishment was visually assessed as a percentage of plot cover from 0 to 100%. Means were determined from 2010 data across three replications at seven locations: Wichita, KS (KS1) (June–Oct.), Fletcher, NC (NC1) (Oct.), Jackson Springs, NC (NC2) (Oct.), Stillwater, OK (Apr., June–July, Sept. –Oct.), Knoxville, TN (June–Aug., Sept. [twice], Oct.), Virginia Beach, VA (VA1) (Apr.–May, July–Sept.), and Blacksburg, VA (VA2) (May–Aug.). Means presented for Columbia, MO, are averages from 2009 (Oct.–Nov.), and means presented for Dallas, TX, are averages from 2012 (June).

‡ TPI (turfgrass performance index) was determined as the number of times each cultivar appeared in the top statistical group.

§ Means in a column followed by the same letter(s) are not significantly different according to Fisher's Protected LSD test ($P \leq 0.05$).

Table 4

Turf Quality

A significant (P < 0.05) cultivar × year effect for turf quality occurred in four locations (Wichita, KS, Stillwater, OK, Dallas, TX and Blacksburg, VA) (Table 5). The turf quality of Innovation was superior to Meyer in Wichita, KS (2010 and 2012), Jackson Springs, NC, Stillwater, OK (2011 and 2012), Dallas, TX (2011) and Blacksburg, VA. Innovation quality was similar to Meyer in Wichita, KS (2011), Columbia, MO (2010), Stillwater, OK (2010), Knoxville, TN and Virginia Beach, VA and similar to Meyer in Fletcher, NC. Innovation was in the top statistical group in 15 of 16 analyses compared with Meyer, which scored a turfgrass performance index (TPI) of 6.

Turf quality of KSUZ 0802 and two commercial zoysiagrass cultivars at nine locations maintained at lawn height of cut (3.8 to 6.4 cm).

Cultivar	Turf quality†																TPI‡
	KS1			MO	NC1	NC2	OK			TN	TX		VA1	VA2			
	2010	2011	2012				2010	2011	2012		2011	2012		2010	2011	2012	
	1–9																
KSUZ 0802	5.3 a§	5.6 a	4.5 a	6.1 a	7.4 a	5.7 a	5.0 a	7.1 a	7.1 a	6.6 a	4.6 b	3.0 ab	7.2 a	5.7 a	6.5 a	6.2 a	15
Chisholm	5.1 a	5.2 a	5.3 a	6.2 a	5.4 b	5.4 ab	5.1 a	6.0 b	6.0 b	6.5 a	5.5 a	3.7 a	6.9 a	5.4 ab	6.3 a	5.6 b	12
Meyer	3.9 b	5.2 a	3.3 b	5.3 a	7.3 a	5.0 b	5.1 a	6.1 b	6.1 b	6.5 a	3.6 c	2.3 b	7.0 a	4.7 b	4.9 b	5.1 b	6

† Turf quality was assessed on a 1-to-9 scale, where 1 = poor, and 9 = ideal. Means were determined across three replications at nine test locations: Wichita, KS (KS1), 2010 (May–Sept.), 2011 (Ma –Sept.) and 2012 (May–Sept.); Columbia, MO, 2010 (May, July), 2011 (June), and 2012 (Sept.); Fletcher, NC (NC1), 2011 (June–Sept.) and 2012 (May–Oct.); Jackson Springs, NC (NC2), 2011 (May–Oct.) and 2012 (May–Oct.); Stillwater, OK, 2010 (May, Aug.–Oct.), 2011 (May–Oct.), and 2012 (Apr.–July, Oct.); Knoxville, TN, 2010 (July–Aug., Sept. [twice], Oct.) and 2011(May–June, Aug.–Sept.); Dallas, TX, 2011 (May–Oct.) and 2012 (May [twice], June); Virginia Beach, VA (VA1), 2010 (Aug.–Sept.), 2011 (May–Oct.), and 2012 (May–Oct.); and Blacksburg, VA (VA2), 2010 (July–Aug., Sept. [twice], Oct.), 2011 (May–Sept.), and 2012 (May–Oct.). Years are presented separately for locations with a significant cultivar × year interaction in the ANOVA.

‡ TPI (turfgrass performance index) was determined as the number of times each cultivar appeared in the top statistical group.

§ Means in a column followed by the same letter(s) are not significantly different according to Fisher's protected LSD test ($P \leq 0.05$).

Table 5

Leaf Texture

A significant (P < 0.05) cultivar × year effect for leaf texture occurred in Fletcher, NC, because cultivars performed differently across years (Table 6). Innovation had a significantly finer leaf texture than Meyer in six analyses (Wichita, KS, Columbia, MO, Fletcher, NC [2011], Knoxville, TN, Dallas, TX and Blacksburg, VA). Innovation had a statistically similar leaf texture to Meyer in five analyses (Fletcher, NC, Jackson Springs, NC, Stillwater, OK and Virginia Beach, VA). Innovation was in the top statistical group in all 11 analyses compared with Meyer (TPI = 5).

Leaf texture of KSUZ 0802 and two commercial zoysiagrass cultivars at nine locations maintained at lawn height of cut (3.8 to 6.4 cm).

	Leaf texture†											
Cultivar	KS1	MO	NC1			NC2	OK	TN	TX	VA1	VA2	TPI‡
			2010	2011	2012							
	1–9											
KSUZ 0802	7.4 a§	6.0 a	7.0 a	8.0 a	8.0 a	6.9 a	6.7 a	7.7 a	6.0 a	7.7 a	6.7 a	11
Chisholm	5.2 b	4.0 c	5.7 b	5.0 c	5.7 b	5.1 b	2.0 b	5.0 c	4.7 c	3.7 b	3.3 c	0
Meyer	5.7 b	5.0 b	7.0 a	7.0 b	7.7 a	7.6 a	5.3 a	6.7 b	5.5 b	6.7 a	5.0 b	5

† Leaf texture was assessed once each year on a 1-to-9 scale, where 1 = very coarse, and 9 = very fine. Means were determined across three replications at nine test locations: Wichita, KS (KS1), 2010 (Sept.), 2011 (July), and 2012 (July); Columbia, MO, 2009 (Oct.); Fletcher, NC (NC1), 2010 (Oct.), 2011 (Aug.), and 2012 (July); Jackson Springs, NC (NC2), 2010 (Oct.), 2011 (July), and 2012 (July); Stillwater, OK, 2009 (Sept.); Knoxville, TN, 2009 (Sept.); Dallas, TX, 2011 (May) and 2012 (May); Virginia Beach, VA (VA1), 2010 (July); and Blacksburg, VA (VA2), 2010 (July). Years are presented separately for locations with a significant cultivar × year interaction in the ANOVA.

‡ TPI (turfgrass performance index) was determined as the number of times each cultivar appeared in the top statistical group.

§ Means in a column followed by the same letter(s) are not significantly different according to Fisher's protected LSD test ($P \leq 0.05$).

Table 6

Genetic Color

A significant cultivar × year interaction for genetic color was not present at any of the nine locations (Table 7). The genetic color of Innovation was similar to Meyer in Jackson Springs, NC; Knoxville, TN; Dallas, TX and Blacksburg, VA and superior (darker green) to Meyer in Stillwater, OK. Innovation was in the top statistical group in all nine locations as compared to Meyer (TPI = 8).

Genetic color of KSUZ 0802 and two commercial zoysiagrass cultivars at nine locations maintained at lawn height of cut (3.8 to 6.4 cm).

Cultivar	Genetic color†									
	KS1	MO	NC1	NC2	OK	TN	TX	VA1	VA2	TPI‡
	1–9									
KSUZ 0802	5.7 a§	7.3 a	7.2 a	5.8 a	8.0 a	7.3 a	7.0 a	7.3 ab	5.7 a	9
Chisholm	4.4 b	5.8 b	4.8 b	5.5 a	7.3 ab	7.7 a	7.0 a	7.0 b	6.0 a	5
Meyer	6.1 a	7.3 a	7.3 a	6.7 a	7.0 b	6.3 a	7.7 a	8.0 a	4.3 a	8

† Genetic color was assessed on a 1-to-9 scale, where 1 = brown/dead, and 9 = dark green. Means were determined across three replications at nine test locations: Wichita, KS (KS1), 2010 (Sept.), 2011 (July), and 2012 (July); Columbia, MO, 2011 (June) and 2012 (Sept.); Fletcher, NC (NC1), 2011 (Aug.) and 2012 (July); Jackson Springs, NC (NC2), 2011 (July) and 2012 (July); Stillwater, OK, 2009 (Sept.); Knoxville, TN, 2009 (Sept.); Dallas, TX, 2011 (June); Virginia Beach, VA (VA1), 2011 (July); and Blacksburg, VA (VA2), 2010 (July). In the ANOVA, cultivar × year interaction was not significant for any location.

‡TPI (turfgrass performance index) was determined as the number of times each cultivar appeared in the top statistical group.

§ Means in a column followed by the same letter(s) are not significantly different according to Fisher's protected LSD test ($P \leq 0.05$).

Table 7

Spring Green-Up

For spring green-up, a significant ($P < 0.05$) cultivar × year effect occurred in three locations (Wichita, KS, Knoxville, TN and Blacksburg, VA) (Table 8). The spring green-up of Innovation was similar to Meyer in seven analyses (Wichita, KS [2010], Columbia, MO, Fletcher, NC, Stillwater, OK, Knoxville, TN, Dallas, TX and Virginia Beach, VA). Innovation was superior to Meyer in Wichita, KS (2012) and Blacksburg, VA. In Jackson Springs, NC, Meyer had superior spring green-up compared with Innovation.

Overall, Innovation was in the top statistical group 12 times compared with Meyer's 10.

Spring green-up of KSUZ 0802 and two commercial zoysiagrass cultivars at nine locations maintained at lawn height of cut (3.8 to 6.4 cm).

Cultivar	Spring green-up†													
	KS1			MO	NC1	NC2	OK	TN		TX	VA1	VA2		TPI ‡
	2010	2011	2012					2010	2011			2011	2012	
	1–9													
KSUZ 0802	4.3 a§	6.7 a	5.3 a	6.8 a	7.8 a	5.2 b	2.8 a	6.3 a	9.0 a	4.0 a	6.0 a	5.0 a	8.0 a	12
Chisholm	4.3 a	5.3 b	3.7 b	8.1 a	7.7 a	7.2 a	3.0 a	7.3 a	9.0 a	4.7 a	5.8 a	4.0 ab	8.0 a	11
Meyer	3.0 a	7.3 a	4.0 b	6.8 a	7.8 a	6.7 a	3.3 a	6.2 a	9.0 a	4.7 a	6.2 a	2.7 b	6.7 b	10

† Spring green-up was assessed once during the spring as the overall plot color on a 1-to-9 scale, where 1 = brown/dead, and 9 = dark green. Means were determined across three replications at nine test locations: Wichita, KS, 2010 (Apr.), 2011 (Apr.) and 2012 (May); Columbia, MO, 2010 (Apr., May [twice]) and 2011 (June); Fletcher, NC (NC1), 2011 (Apr.) and 2012 (Apr); Jackson Springs, NC (NC2), 2011 (Apr.) and 2012 (Mar.); Stillwater, OK, 2010 (Mar., Apr.); Knoxville, TN, 2010 (Apr. [twice]) and 2011 (Apr.); Dallas, TX, 2011 (Mar.); Virginia Beach, VA (VA1), 2010 (Mar.), 2011 (Apr./Mar.), and 2012 (Mar.); and Blacksburg, VA (VA2), 2011 (Apr.) and 2012 (Apr.). Years are presented separately for locations with a significant cultivar × year interaction in the ANOVA.

‡ TPI (turfgrass performance index) was determined as the number of times each cultivar appeared in the top statistical group.

§ Means in a column followed by the same letter(s) are not significantly different according to Fisher's protected LSD test ($P \leq 0.05$).

Table 8

Fall Color Retention

Data for fall color retention were collected at six of the nine test locations (Table 9). In three of the locations (Wichita, KS, Columbia, MO and Jackson Springs, NC), fall color retention ratings for cultivars varied significantly across years. No significant differences were observed for fall color retention between Innovation and Meyer in Columbia, MO, Fletcher, NC, Jackson Springs, NC (2012), Stillwater, OK or Dallas, TX. Innovation was statistically similar to Meyer in Wichita, KS (2012) and Jackson Springs, NC (2011). Fall color retention is a desirable trait extending the green appearance of the turf stand into the autumn season; however, early fall dormancy and associated loss of green color (low fall color retention ratings) has been shown to be directly related to increased freezing tolerance (Fry and Huang, 2004).

Spring green-up of KSUZ 0802 and two commercial zoysiagrass cultivars at nine locations maintained at lawn height of cut (3.8 to 6.4 cm).

	Fall color retention†											
Cultivar	KS1		MO			NC1	NC2			OK	TX	TPI‡
	2010	2012	2009	2010	2011		2010	2011	2012			
	1–9											
KSUZ 0802	3.7 b§	2.2 ab	3.8 a	5.5 a	3.7 a	7.0 a	6.3 b	3.8 b	6.0 a	4.3 a	4.3 a	8
Chisholm	5.7 a	1.8 b	4.3 a	5.3 a	4.3 a	5.8 a	6.0 b	6.5 a	7.3 a	4.7 a	5.0 a	9
Meyer	4.0 b	3.1 a	3.0 a	5.7 a	4.7 a	7.0 a	8.7 a	5.0 ab	7.3 a	5.0 a	3.7 a	10

† Fall color retention was assessed once during the fall on a 1-to-9 scale, where 1 = brown/dead, and 9 = dark green. Means were determined across three replications at six test locations: Wichita, KS (KS1), 2010 (Oct.) and 2012 (Oct., Nov. [twice]); Columbia, MO, 2009 (Oct., Nov.), 2010 (Oct. [twice]), and 2011 (Oct.); Fletcher, NC (NC1), 2010 (Oct.) and 2012 (Oct.); Jackson Springs, NC (NC2), 2010 (Oct.), 2011 (Oct., Nov.), and 2012 (Oct.); Stillwater, OK, 2010 (Oct.); and Dallas, TX, 2011 (Nov.). Years are presented separately for locations with a significant cultivar × year interaction in the ANOVA.

‡ TPI (turfgrass performance index) was determined as the number of times each cultivar appeared in the top statistical group.

§ Means in a column followed by the same letter(s) are not significantly different according to Fisher's protected LSD test ($P \leq 0.05$).

Table 9

Innovation for Golf

Innovation is ideal for tees, fairways, collars, approaches and roughs.

- Mowing at 0.5 inches or slightly lower has been researched and Innovation performs well
- Innovation recovers faster than Zeon and Meyer giving it an advantage in high wear areas

Characteristics at Fairway Height (1.3 cm)

Innovation and Meyer were maintained at a fairway height in Manhattan, KS (KS2) and Stillwater, OK (Table 10). In Stillwater, OK, the turf quality of Innovation was similar to Meyer in 2010 but was superior in 2011 and 2012. In Wichita, KS, Innovation was similar to Meyer in 2008, but in 2009, 2010 and 2011, Innovation was statistically superior to Meyer. When cut at fairway height, Innovation also had finer leaf texture than Meyer in Stillwater, OK and Wichita, KS. The genetic color of Innovation as assessed in Manhattan, KS, was similar to Meyer in 2009 and 2010 but lighter green in 2011. Spring green-up of Innovation in Stillwater, OK, was slower than Meyer. The fall color retention was the same for the cultivars in both locations. Recovery of Innovation from stolons and rhizomes as determined by percentage area covered after sod harvest in Manhattan (2008 and 2009) and Olathe, KS (2009 and 2010), was similar to Meyer.

Performance of KSUZ 0802 and two commercial zoysiagrass cultivars mowed at fairway height (1.3 cm) at two locations.

Cultivar	Turf quality†							Leaf texture‡		Genetic color§			Spring green-up¶	Fall color retention#		Billbug damage††		TPI‡‡
	KS2				OK			KS2	OK	KS2			OK	KS2	OK	KS2		
	2008	2009	2010	2011	2010	2011	2012			2009	2010	2011				2009	2010	
	1–9															%		
KSUZ 0802	8.0 a§§	6.3 a	7.1 a	7.2 a	5.4 a	7.6 a	6.6 a	8.0 a	7.3 a	5.0 a	4.0 a	2.7 b	3.7 b	4.0 a	5.7 a	14.1 b	2.8 b	14
Chisholm	6.0 b	5.9 a	6.5 a	6.6 a	4.9 a	6.2 b	6.1 b	5.0 c	2.0 c	4.8 a	4.0 a	4.0 a	3.0 b	4.6 a	5.3 a	0.0 c	0.0 b	11
Meyer	7.0 ab	4.8 b	5.5 b	5.6 b	5.0 a	6.1 b	5.6 c	6.3 b	4.7 b	5.3 a	5.3 a	4.0 a	5.5 a	4.1 a	5.7 a	31.7 a	12.2 a	8

† Turf quality ratings were assessed on a 1-to-9 scale, where 1 = poor, and 9 = ideal. Means were determined across three replications at two test locations: Manhattan, KS (KS2), 2008 (Sept.), 2009 (June–Aug.), 2010 (May–Sept.), and 2011 (May, July–Sept.); and Stillwater, OK, 2010 (May, Aug., Sept., Oct.), 2011 (May–Oct.), and 2012 (Apr.–July, Oct.). Years are presented separately for locations with a significant cultivar × year interaction in the ANOVA.

‡ Leaf texture was assessed once each year on a 1-to-9 scale, where 1 = very coarse, and 9 = very fine. Means were determined across three replications at two test locations: Manhattan, KS (KS2), 2008 (Sept.), 2009 (June), and 2011 (Aug.); and Stillwater, OK, 2009 (Sept.).

§ Genetic color was rated on a 1-to-9 scale, where 1 = light green, and 9 = dark green, in Manhattan, KS (KS2), 2009 (Apr., June), 2010 (Apr. [twice]), and 2011 (Apr.).

¶ Spring green-up was assessed on a 1-to-9 scale, where 1 = brown/dead, and 9 = dark green, in Stillwater, OK, 2010 (Mar.–Apr.).

Fall color retention was assessed once during the fall on a 1-to-9 scale, where 1 = brown/dead, and 9 = dark green. Means were determined across three replications at two test locations: Manhattan, KS (KS2), 2008 (Oct., Nov.), 2009 (Oct.), 2010 (Oct.), and 2011 (Oct.); and Stillwater, OK, 2010 (Oct.).

†† Billbug damage was assessed as a percentage of plot damage in 2009 (July and Aug.) and 2010 (June–Sept.) in the Manhattan, KS, location (Fry and Cloyd, 2011).

‡‡ TPI (turfgrass performance index) was determined as the number of times each cultivar appeared in the top statistical group for traits rated 1–9 and in the bottom statistical group for billbug damage.

§§ Means in a column followed by the same letter(s) are not significantly different according to Fisher's protected LSD test ($P \leq 0.05$).

Table 10

Meyer is susceptible to bluegrass billbug injury. Data collected at Manhattan, KS, demonstrated that Innovation had significantly less bluegrass billbug damage than Meyer in 2009 and 2010. The freezing tolerance studies conducted at Manhattan, KS, showed Innovation had an LT50 statistically similar to Meyer in both 2007 and 2008. Observed LT50s ranged from −8.4 to −10.3°C for Innovation and from −10.7 to −12.0°C for Meyer. These results support the suitability of Innovation for golf course tees and fairways maintained at low mowing heights.

Average turf quality of Innovation (average rating of 6.1 on a 1 to 9 scale) was higher than Meyer (average rating of 5.5) maintained at lawn height in Wichita, KS; Jackson Springs, NC; Stillwater, OK; Dallas, TX; and Blacksburg, VA. At fairway height, quality of Innovation (average of 6.9) was superior to Meyer (average of 5.6) at the two locations it was evaluated – Manhattan, KS and Stillwater, OK.

Figure 6: Innovation Zoysia at University of Louisville Golf Club in May of 2020

Innovation Offers a Solution

The goal in the development of Innovation Zoysia was to take an industry standard in Meyer and improve on it. The result of 15 years of research was a variety which possesses a grow-in rate from sprigs that is much faster than Meyer. Innovation also features better golf adaptability, allowing a mowing height at the farm that transitions well for golf course fairways and tees. For example, mowing at 0.75 inches with a reel mower makes golf course adaptation much faster. Innovation has an improved resistance to the bluegrass billbug and has a finer texture, a dense canopy to cut down weed pressure and an improved overall turf quality.

INNOVATION® zoysiagrass

How Does Innovation Compare to Meyer?

TRAIT	RESULT
Freezing Tolerance	Equal
Texture	Finer
Density	Higher
Overall Quality	Higher
Establishment Rate and Recovery After Harvest	Faster
Large Patch	Equal
Bluegrass Billbug Resistance	Better
Fall Color, Spring Green Up	Some locations retain fall color longer; Some locations green up slower
Shade	Better

Table 11

How Does Innovation Compare to EMPIRE?

Innovation offers some advantages over the world's most popular zoysiagrass EMPIRE® Zoysia. Like Meyer, EMPIRE is a *Zoysia japonica* that can also be used in golf, commercial and residential applications. Innovation has a finer leaf texture, equal resistance to disease pressure and an equal resistance to billbugs. However Innovation surpasses EMPIRE with a better density, an improved color retention in fall and spring, a better freezing tolerance and better shade tolerance. As a finer-textured zoysia, Innovation will require slightly more maintenance than EMPIRE.

How Does Innovation Compare to Zeon?

In comparison to Zeon Zoysia, Innovation has a slightly wider blade width. Innovation tends to have a more vertical growth habit allowing it to “stripe” better in a landscape and improves playability for golf. Becasue of its more vertical growth habit, Innovation has a cleaner cut when mowing while Zeon tends to fray at its tips. This creates a slightly softer feel underfoot.

Testimonials and Reactions

Turfgrass producers across the country love this grass for its rapid grow-in times and its ease to harvest and lay down in its new location. What that means for the consumer is a tough, beautiful grass that establishes quickly in its new environment and features the ability to recover from damage rapidly.

> "The turf's just doing great. We love the way it handles. The texture is incredible; very little scrap. It's blocking up beautifully. It's handling well and it looks like it's transitioning well to the job sites."
>
> **— Bill Nimmer, Nimmer Turf Farm, Ridgeland, SC**

International Innovation Growers

Grama Pontal
Campo Grande, MS Brazil

Paradello Green
Brescia, Northern Italy

“It holds together really good. It has good tensile strength. It has a nice, soft touch to it. I also grow Emerald (Zoysia) and it grows back faster than the Emerald. We have a good spring green-up on the Innovation. It’s been a good grass for us and we are looking forward to seeing what it does in the future.”

— Myles Kubicek, Kubicek Turf Farms, Wharton, TX

Summary

Innovation's freezing tolerance, spring green-up and fall color retention are equivalent to Meyer, but it has a finer leaf texture than Meyer. Innovation is also superior to Meyer for turfgrass quality and for resistance to bluegrass billbug damage. Innovation is well suited for use on golf course fairways and tees, home lawns and other recreational areas in the transition zone and south.

Sod Solutions Pro

Sod Solutions has been researching, developing and releasing to the market new turfgrass varieties for the past 27 years. Our new professionally focused arm of the company, Sod Solutions Pro takes that industry knowledge and puts it to use, facilitating large-scale turfgrass projects from beginning to end.

From our decades in the industry, we know that choosing a grass for a variety of landscape challenges can make or break a project. Different landscapes, geographies, applications and even soil pH levels could call for different grass varieties. Each cultivar has specific features (like shade tolerance) that make them more suitable for certain applications than others. Our mission is to make sure the right grass is being used in the right location to produce the best long-term success for our clients.

SELECTION CONSULTING:

Our team of turf experts will help inform you of the turfgrass options suitable for your project location, educate you on the pros and cons of each product, answer your technical questions, and connect you with real professional users to provide a complete understanding and confidence in the product you choose to specify. We also offer lunch and learns onsite as well as online webinars to educate your staff on turfgrass options.

SPECIFICATION WRITING:

We will create specifications for submission with the project scope and the grass variety that you have selected.

PRODUCT SOURCING:

No job is too large or too small. Sod Solutions Pro has a dedicated network of over 250 turf farms worldwide. From small parks to entire communities and golf courses, we can source projects from one or multiple farms if need be. Whether you are in the initial budgeting stage or need to order grass immediately, the Sod Solutions Pro team will provide you with availability data and pricing for your project.

DELIVERY / INSTALLATION LOGISTICS:

Sod Solutions Pro will find the farm, schedule the delivery and manage the installation of the grass when you need it. Door to door, we take the burden of grass logistics to a new technological level with our proprietary farm management software, Turf Logistics.

FINANCING:

We work with banking infrastructure to take on the financial strain of financing large grassing projects. Our fees are minimal and worth the headaches it reduces for your team.

MAINTENANCE CONSULTING:

Having issues with the health and vitality of your existing grass? Let our team of experts assist with on-site visits, problem diagnosis, and solutions. We will get to the bottom of the issues and lay out a plan to fix the problems.

Request a Free Lunch & Learn

Our team endorses the use of natural grass whenever possible due to its environmental benefits. But to be successful, the “right grass” needs to be used in the “right place”. We can be an asset in this education and would be happy to come out to your offices or virtually host a “lunch and learn” seminar to discuss the different factors that go into finding the right grass. We will share with you both knowledge and widely adopted strategies that can be helpful in your future projects. Also, as part of our “lunch and learn” we will assign one of our team members at Sod Solutions Pro to be your personal consultant for any future grass questions you may encounter during upcoming projects. Always feel free to reach out to them.

WHAT’S INCLUDED

- 1–2 hour webinar on various grass specific topics
- The benefits of grass and how to select the right grass for the right application
- The options of different grasses such as commodity vs. proprietary grasses
- Grass Growing Zone Map - where grasses can grow

KEY BENEFITS

- Keep you and your colleagues up to date on the latest from the turfgrass industry
- Understand trends and what to look for when specifying a grass
- Make sure you get the right grass for the right application

SodSolutionsPro.com/Lunch-and-Learn

Request a Free Quote

The Sod Solutions Professionals team delivers sod and installation services for commercial landscape projects, golf courses, sports fields and housing developments across the globe. Our team can help you select the right products and methods for your project, coordinate delivery and logistics and offer financing options. Our deep industry experience and network of farms and installers ensure that your project is done right the first time with the highest level of quality and service.

SodSolutionsPro.com/Quote-Request

Golf Grasses

From the tee box to the green, Sod Solutions Pro turfgrass varieties cover courses around the world; grasses developed to play at a championship level.

Developed in Australia in the 1990s, Celebration has become one of golf's premiere grasses worldwide. Celebration's pedigree features a two-decade proven track record of success. Its strengths are highlighted in its exceptional root system and rapid recovery time. Celebration has the best documented shade tolerance for a bermuda variety and features a unique, dark blue-green color.

Developed for its cold tolerance by breeders at Oklahoma State University, Latitude 36 is one of the most striking bermudagrasses on the planet. Latitude 36 has a very fine texture and outstanding quality making it a favorite for golfers for ball roll and overall playability. Latitude 36 is found on courses from South Florida to the upper reaches of the transition zone.

Released in 2011, NorthBridge is a tough bermudagrass cultivar known for its cold tolerance and especially its early spring green-up. Its tensile strength and aggressive rooting make it a durable choice for golf courses where rapid damage recovery is important. NorthBridge exhibits a tight, fine-textured appearance and dark green color. Like Latitude 36, NorthBridge will also grow upwards into the transition zone.

Known for its cold tolerance, Innovation Zoysia is a finer bladed zoysia variety that is quick to recover from damage. Innovation was developed to challenge the upper regions of zoysia adaptability to cold temperatures while maintaining exceptional quality and appearance. Innovation is resistant to the bluegrass billbug and is dark green in color.

A staple of the commercial and golf world since the early 2000s, EMPIRE Zoysia has set the standard for a course bladed zoysia variety for golf courses. EMPIRE can be cut down at fairway and tee box heights, but used at taller heights in the roughs to create beautiful, yet challenging links. EMPIRE features drought and heat tolerance that make it a perfect fit for the southern U.S.

If you need a grass for a putting surface, Sunday fits the bill with some of the best genetic stability on the market, meaning that genetic grass mutations won't happen. Getting a consistent look and roll on a green is key and Sunday has proven stable for over 30 years. Its root density and length are hallmark features allowing this grass to survive some low temperatures. Sunday is an ultra-dwarf variety, but can be managed like a dwarf bermuda, which allows for use from low to high end facilities. It can be cut and maintained as low as .080 inches to deliver quick speeds on a stimpmeter.

Sports Grasses

Fields around the country and across the globe have used Sod Solutions Pro grass brands to cover championship events for the past three decades. Exceptional surfaces, impeccable performance and a beautiful appearance elevate our grasses to the forefront of any sports discussion, from the smallest fields to the largest stadiums.

Aussie origins explain why Celebration is one of the toughest bermduagrasses on the market today for sports. Celebration features some of the most rapid recovery on the market today. It also has the highest level of shade tolerance for a bermuda variety, which makes play possible with shade from stadium overhangs. Celebration features an exceptional root system and a unique dark, blue-green color. Celebration has been featured in the Olympics and on fields of the World Cup.

A favorite of college stadiums across the U.S., Latitude 36 was developed for its cold tolerance and texture. Its fine, compact growth habit makes Latitude 36 one of the most striking bermudagrass varieties in the world, both from the field level and in the stands. Latitude 36 is found on fields from balmy South Florida to Pennsylvania and everywhere in-between.

Longer green seasons were in mind when NorthBridge Bermudagrass was released in 2011 by Oklahoma State University. NorthBridge cuts down on overseeding needs thanks to an early spring green-up. But its cold tolerance is only one trait that has made this popular in professional sports stadiums. The tensile strength and aggressive rooting make NorthBridge a durable choice for football or horse racing, where rapid damage recovery is important. NorthBridge exhibits a tight, fine-textured appearance and dark green color.

Commercial and Residential Grasses

For almost three decades, Sod Solutions Pro has focused on research and development of superior turfgrasses for commercial, residential, golf and sports uses. We have found that putting the right grass in the right landscape is the most important factor in its long-term success. Our varieties were developed to solve the needs of end-users across the spectrum.

Palmetto is the most sold patented turfgrass in the world with more than two billion sq. ft. sold. Selected for better color and finer texture, Palmetto demonstrates superior shade, cold, frost, heat and drought tolerance.

CitraBlue, the newest grass from the University of Florida was developed to solve lawn disease issues and to be a dramatic improvement over Florida's most common grass, Floratam St. Augustine. Not only is its disease resistance improved, but it also may be one of the top grasses for shady landscapes and it features a distinct blue color.

Celebration is a deep blue-green turfgrass that has finished best in numerous university research studies for wear tolerance and recovery, drought resistance and tolerance and bermudagrass shade tolerance.

Latitude 36 was developed to stretch the limits of bermudagrass adaptability in the North and is a top quality rated bermudagrass nationally. Latitude 36 shows resistance to spring dead spot and is one of the most cold-hardy bermudagrasses on the market.

NorthBridge is tough. Its tensile and root strength can handle heavy amounts of traffic and recover from damage quickly. NorthBridge features outstanding cold tolerance and early spring green-up. It is fine textured and dark green in color.

EMPIRE is a revolutionary medium-bladed, dark green zoysiagrass. It features excellent wear tolerance, requires less mowing and chemical applications and is chinch bug resistant. EMPIRE truly is "The Proven Zoysia®".

Innovation is a versatile zoysia. Developed by researchers at Kansas State and Texas A&M University, Innovation is very cold tolerant. It is a finer bladed zoysia and is incredibly soft. This grass is suitable for the southern two-thirds of the United States.