Buffalograss $avings
August 10, 2017

Forward (apology). *This is a long one – sorry. If you do nothing else, please review Table 1 on the last page of this Turf iNfo, which is a cost comparison analysis based on the study I've outlined below.*

Fairways makeup the largest intensively managed acerage on golf courses, and are subsequently ideal for resource-use-efficiecy initiatives. Fairways comprised of creeping bentgrass, perennial ryegrass, or Kentucky bluegrass are commonly preferered over buffalograss, primarily because most endusers prefer darker green turf for more months out of the year. However, this species preference also seems to be perpetuated by cognative biases against buffalograss from its years of use in low-maintenance areas. We tend to forget that buffalograss responds to increased management levels, and, while it will persist with little to no management, provides a much better turf will slight increases in fertilizer and water inputs (Figure 1).

Figure 1. Color of an improved buffalograss cultivar (*left*) compared to that of Kentucky bluegrass (*right*) when managed under fairway conditions at the University of Nebraska-Lincoln East Campus turf research plots.

It's important to point out right away that I understand buffalograss isn't for every golf course. Some have the resources to meet very high expectations of their clientel – these facilites often provide meticulously groomed cool-season turfgrass fairways in our region. However, some, if not the majority of, facilities have fewer resources and aren't able to keep cool-season fairways optimally playable during challenging Nebraska summers full of stresses from regular play, heat, drought, fungi, insects, etc. Some facilites just need a reliable playing surface that is appealing, but, most importantly, that can persist in heat with few pesticides and little WATER if rain is fleeting. For these facilities, there may not be a better fairway turf than buffalograss.

This is the central idea behind one of our current projects funded by the United States Golf Association where we are evaluating fairways comprised of creeping bentgrass, Kentucky bluegrass, or buffalograss under a spectrum of management conditions. Just one year into the study, we've already shown what most expected to see – creeping bentgrass and Kentucky bluegrass look great when intensively managed, but buffalograss outperforms these species under the input-limited end of the spectrum. We believe end users will be more likely to adopt buffalograss with hard numbers that display its performance and potential resource-use efficiency. To that end, I thought it would be useful to detail the savings we've seen so far this year with buffalograss fairways in our study.

Management conditions. We established the three species in 2016. Experimental management began in May of 2017, and consisted of different levels and combinations of irrigation, fertilizer, and pest control treatments. To achieve 36 different management scenarios, we separated large plots of three species (20 ft × 30 ft) into 12 smaller plots (5 ft × 10 ft) (Figure 2). Within each species, six of the twelve plots were irrigated to standard reference evapotranspiration (ETo) replacement (i.e. 80% ETo for creeping bentgrass and Kentucky bluegrass or 60% ETo for buffalograss), and the other six received no supplemental irrigation. Then, we divided each set of six plots into three sets of two plots for fertilizer treatments. Two plots were left unfertilized, two received "standard" fertilizer (1 lb N/1,000 ft^2 in May, Sept., Oct. and Nov. for creeping bentgrass and Kentucky bluegrass; 1 lb N/1,000 ft^2 in June and July for buffalograss), and two were fertilized with 0.25 lbs N/1,000 ft^2 when quality approached an unacceptable level. We then controlled weeds, diseases, and insects with "standard" measures in one of the two plots within each fertilizer level, and left the other plot untreated. This complicated design made it possible for us to evaluate every possible combination of our chosen treatments within each turf species.

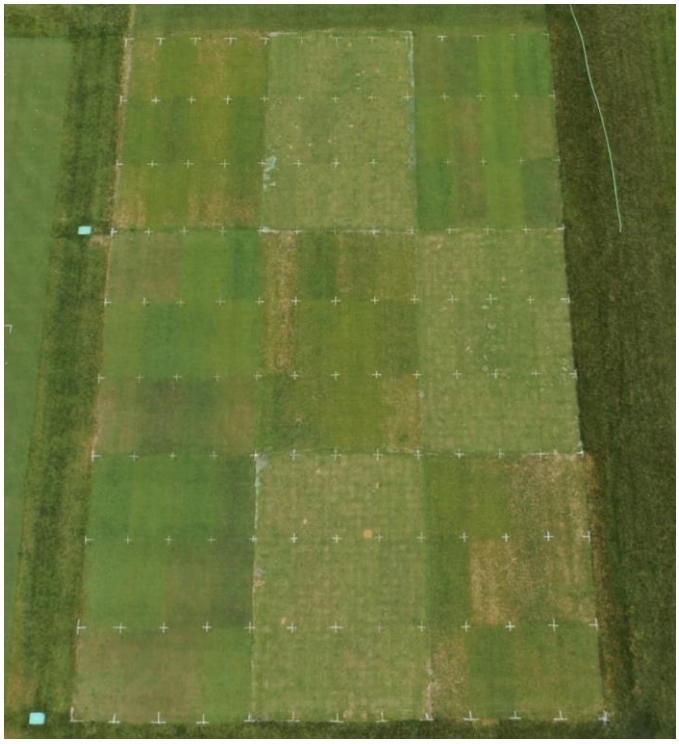

Figure 2. The research area on east campus contains three replicated blocks of creeping bentgrass, Kentucky bluegrass, and buffalograss under 12 management scenarios.

Data collected. We collect visual estimates of turfgrass quality weekly, rate disease, weed, and insect incidence as needed, and mow individual plots only when needed. By mowing plots individually, we are able to estimate the average number of mowings each surface would require annually to subsequently determine fuel, labor, and time inputs. We are also recording total irrigation, fertilizer, and pesticide use.

Irrigation. We've had 18 in. of rain and 22 in. of reference ET since May 11th. At face value, you might think we haven't needed to irrigate since our accumulated ET only exceeds total precipitation by 4 in. However, we've had several rain events that have exceeded 1.0 in., and a few that even exceeded 2.0 in. Much of this precipitation was unable to soak into our soils, which have an approximate infiltration rate of 0.5 in./hr. To account for this effect after a heavy rain event, we withheld ET replacement until soil volumetric water content was slightly above our predetermined wilt point. In reality, we've had to irrigate standard ET replacement plots with 9.6 in. for our cool-season grasses (creeping bentgrass and Kentucky bluegrass) and 6.8 in. for buffalograss. Based on water rates in Lincoln ($1.85/748 gal), that equates to $642.32/acre (259,705 gal water/acre) or $455.07/acre (183,997 gal water/acre) to irrigate cool-season grasses or buffalograss to respective standard ETo replacement values. However, even during the doughtiest parts of the season thus far, our unirrigated buffalograss plots have only barely begun to show signs of drought stress. Had we irrigated our well-watered buffalograss plots only to prevent visual stress, we could have easily irrigated half as much, potentially reducing the figure to $227.54/acre.

Further, assuming we could tolerate a small amount of stress, we could have skipped the irrigation all together, and seen only minor differences in quality among irrigated or unirrigated buffalograss this year.

Fertilizer. For an entire season, we'll fertilize our cool-season grasses under the standard fertility regimen with 4 lbs N/1,000 ft^2/year, and buffalograss under standard fertility will receive 2 lbs N/1,000 ft^2/year. With urea (46-0-0) valued at $18 per 50 lbs bag, this equates to $136.36/acre to fertilize the cool-season grasses, and $68.18/acre to fertilize buffalograss. Threshold-based plots have received five applications (1.25 lbs N/1,000 ft^2) so far this season, for all species. This would equate to $42.61/acre so far this year. I expect that we'll continue to make threshold-based applications into fall for all species. My guess is buffalograss plots will get something close to the standard 2 lbs N/1,000 ft^2/year, whereas the cool-season grasses will get less than their equivalent standard, while maintaining similar quality. Letting the turf "tell" you when it needs N results in savings, even for cool-season species. Last, I would caution any quick to expect huge fertilizer savings from a buffalograss conversion, and encourage them to fertilize to get the quality they desire, which may be more than historically recommended. A little more N will improve buffalograss quality, especially during drought stress according to our data.

Pests. All pest control plots under the standard regimen received a preemergence herbicide application ($25.31/acre/application) this spring and one postemergence herbicide application for broadleaf weeds ($13.55/acre/application). Additionally, our cool-season grasses have received four fungicide applications to control dollar spot ($28.18/acre/application) (Figure 3), and creeping bentgrass plots required one application of

Figure 3. Dollar spot development on plots of creeping bentgrass (*left*) and Kentucky bluegrass (*right*) where pesticides were not applied.

mefenoxam to control an outbreak of *Pythium* blight ($84.91/acre/application). Buffalograss has not been treated with fungicides.

Mowing. Irrigation level has been the greatest predictor of mowing requirement – no surprise. What may surprise you is that buffalograss has been mowed with the greatest frequency, regardless of management level. We've mowed buffalograss plots 22 to 25 times over all management levels so far this year – even unirrigated, unfertilized plots. Plots of our cool-season grasses that are well-watered and under standard or threshold-based fertilizer regimens have had a similar mowing frequency. Over all management levels, creeping bentgrass plots have been mowed five to 21 times, and Kentucky bluegrass plots have been mowed 13 to 24 times – quite the range. While this may be counterintuitive, I think it's a good thing. This means that buffalograss is growing when we need it to, so it can take summer play. These figures are somewhat skewed because they don't yet account for the dormancy period of buffalograss in early spring and late fall when cool-season grasses are still growing. When this is accounted for, I believe mowing frequencies will even out over species, and the cool-season grasses may end up having been mowed most often throughout an entire season. Mowing frequencies will differentially affect budgets, depending on hourly wages, fuel cost and efficiencies of equipment, etc.

Bottom line. Best quality in our research plots this year has obviously been associated with ET-based irrigation, standard or threshold-based fertilizer applications, and standard pest control strategies. Creeping bentgrass and Kentucky bluegrass plots fitting this description have had the greatest quality. Creeping bentgrass and Kentucky bluegrass that received ET-based irrigation and standard pest control strategies are in the next highest category. Slightly below this category is buffalograss – all buffalograss. No matter what we've done (or not done) to buffalograss this year, average quality has been similar thus far, and only slightly less than more intensively managed cool-season grasses. Lesser-managed cool-season plots round out the bottom of the quality list and include those where we haven't controlled diseases (regardless of other factors), those that are unirrigated but receive some level of fertility, and those that haven't been watered or fertilized. Buffalograss fairways may not be for everyone, but the investment of a conversion may be worthwhile for facilities struggling to fund fungicide and water budgets. See Table 1 on the next page for our cost analysis thus far.

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Table 1. Cost comparison analysis for maintaining creeping bentgrass, Kentucky bluegrass, or buffalograss fairways based on preliminary results from a University of Nebraska-Lincoln study (data from 10 May to 8 August 2017).

Turf Species	Irrigation	Fertilizer	Pest Control?	Est. Total Cost (per/acre)	Relative Quality Level
Creeping bentgrass	**80% ETo** *9.6 inches* *259,705 gal/acre* *$642.32/acre*	**4 lbs N/1,000ft²/year** *$136.36/acre*	**Yes** *$236.49/acre*	*$1015.17*	***Highest***
			No *$0.00/acre*	*$778.68*	***Low***
		Threshold-based *$42.61/acre*	**Yes** *$236.49/acre*	*$921.42*	***Highest***
			No *$0.00/acre*	*$684.93*	***Low***
		Unfertilized *$0.00/acre*	**Yes** *$236.49/acre*	*$878.81*	***High***
			No *$0.00/acre*	*$642.32*	***Lower***
	No supplemental *0.0 inches* *0 gal/acre* *$0.00/acre*	**4 lbs N/1,000ft²/year** *$136.36/acre*	**Yes** *$236.49/acre*	*$372.85*	***Lower***
			No *$0.00/acre*	*$136.36*	***Lower***
		Threshold-based *$42.61/acre*	**Yes** *$236.49/acre*	*$279.10*	***Lower***
			No *$0.00/acre*	*$42.61*	***Lower***
		Unfertilized *$0.00/acre*	**Yes** *$236.49/acre*	*$236.49*	***Lowest***
			No *$0.00/acre*	*$0.00*	***Lowest***
Kentucky bluegrass	**80% ETo** *9.6 inches* *259,705 gal/acre* *$642.32/acre*	**4 lbs N/1,000ft²/year** *$136.36/acre*	**Yes** *$151.58/acre*	*$930.26*	***Highest***
			No *$0.00/acre*	*$778.68*	***Low***
		Threshold-based *$42.61/acre*	**Yes** *$151.58/acre*	*$836.51*	***Highest***
			No *$0.00/acre*	*$684.93*	***Low***
		Unfertilized *$0.00/acre*	**Yes** *$151.58/acre*	*$793.90*	***High***
			No *$0.00/acre*	*$642.32*	***Lower***
	No supplemental *0.0 inches* *0 gal/acre* *$0.00/acre*	**4 lbs N/1,000ft²/year** *$136.36/acre*	**Yes** *$151.58/acre*	*$287.94*	***Lower***
			No *$0.00/acre*	*$136.36*	***Lower***
		Threshold-based *$42.61/acre*	**Yes** *$151.58/acre*	*$194.19*	***Lower***
			No *$0.00/acre*	*$42.61*	***Lower***
		Unfertilized *$0.00/acre*	**Yes** *$151.58/acre*	*$151.58*	***Lowest***

			No *$0.00/acre*	*$0.00*	***Lowest***
Buffalograss	**60% ETo** *6.8 inches* *183,997 gal/acre* *$455.07/acre*	**2 lbs N/1,000ft²/year** *$68.18/acre*	**Yes** *$38.86/acre*	*$562.11*	***Medium high***
			No *$0.00/acre*	*$523.25*	***Medium high***
		Threshold-based *$42.61/acre*	**Yes** *$38.86/acre*	*$536.54*	***Medium high***
			No *$0.00/acre*	*$497.68*	***Medium high***
		Unfertilized *$0.00/acre*	**Yes** *$38.86/acre*	*$493.93*	***Medium high***
			No *$0.00/acre*	*$455.07*	***Medium high***
	No supplemental *0.0 inches* *0 gal/acre* *$0.0/acre*	**2 lbs N/1,000ft²/year** *$68.18/acre*	**Yes** *$38.86/acre*	*$107.04*	***Medium high***
			No *$0.00/acre*	*$68.18*	***Medium high***
		Threshold-based *$42.61/acre*	**Yes** *$38.86/acre*	*$81.47*	***Medium high***
			No *$0.00/acre*	*$42.61*	***Medium high***
		Unfertilized *$0.00/acre*	**Yes** *$38.86/acre*	*$38.86*	***Medium***
			No *$0.00/acre*	*$0.00*	***Medium***