Effects of Mowing Height, Fertilizer, and Trinexapac-ethyl on Ball Lie of Tifsport Bermudagrass – 2008 Data

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Photo by Mike Richardson

Golfer striking a ball from a short-cut lie

Summary. Ball lie describes how a golf ball comes to rest in the turf canopy following a stroke. Ball lie is often considered uniform and adequate on the tee box or if it comes to rest in the fairway, but in the intermediate or deep rough, ball lie is variable. This 2-year project was conducted to investigate how different management techniques affect how a ball is positioned within the canopy of the turf. Different mowing heights, fertilizer rates, and trinexapac-ethyl (Primo) rates were applied to Tifsport bermudagrass and were evaluated to determine how they affected ball lie. On all rating dates, ball lie improved as mowing height decreased. There was an interaction between mowing height and Primo, with Primo having a positive effect on ball lie at higher mowing heights, but no effect at lower mowing heights. Nitrogen fertilization did not affect ball lie.

Abbreviations: TE, trinexapac-ethyl; DIA, digital image analysis

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A golf ball is more easily hit when the ball has a clean lie on the top of the canopy of closely cut, uniform turf. Golf ball lie is affected by several different factors, most importantly the height at which the turf is mown (Cella and Voigt, 2001). A golf ball's lie is often defined as the amount of the golf ball that remains above the turfgrass canopy after the ball comes to rest. The Lie-N-Eye is a device developed at the University of Illinois to evaluate the lie of a golf ball. The Lie-N-Eye uses a Vernier caliper attached to a base to measure the amount of ball above the canopy. This device was designed to measure turfgrass maintained between 0.75 and 1.0 inch. A second, similar device, called the Lie-N-Eye II, was developed to measure shorter cut turf between 0.375 and 0.625 inch (Cella et al., 2004). The Lie-N-Eye was initially tested with several different varieties of Kentucky bluegrass (*Poa pratensis*). It was successful in measuring differences in ball lie in varieties that were mowed at 0.875 inch (Cella and Voigt, 2001; Cella et al., 2005).

The use of digital image analysis (DIA) has changed the way data can be collected in turfgrass research. Recently, a device was designed and tested at the University of Arkansas that measures ball lie in turfgrass systems using DIA (Fig. 1, Richardson et al., 2007). With the development of this simplified technique, the opportunity to study cultivar differences and cultural practice effects on golf ball lie is now possible.

The objective of the current study was to determine the effect of mowing height, nitrogen rate, and trinexapac-ethyl (TE) on golf ball lie in Tifsport bermudagrass (*Cynodon dactylon* x *C. transvaalensis*).

Materials and Methods

This study was conducted over a two-year period at the University of Arkansas Agricultural Research and Extension Center in Fayetteville. Tifsport bermudagrass was established from sod in the spring of 2006 on a silt loam soil and cultural treatments were initiated in the fall of 2006. The experimental design was a strip-split-plot, with nitrogen rate and mowing height as strip factors and TE (Primo Maxx, Syngenta Professional Products, Greensboro, N.C.) as the split plot. Following establishment, three different mowing heights (0.5, 1.0, and 1.5 inch) were initiated and maintained by mowing three times weekly throughout the growing season with clippings returned. Three different nitrogen fertilizer rates (0.5, 1.0, and 1.5 lb N/1000 ft^2/month) were applied as urea (46-0-0) every two weeks at half the monthly rate. Trinexapac-ethyl was applied at three different rates, including 6 oz/A every four weeks, 3 oz/A every two weeks, and an untreated control. Application volume for TE was 30 gal/A and all treatments were applied with a CO_2-propelled backpack sprayer.

For analysis of golf ball lie, three golf balls were rolled onto each plot and digital images were taken of each ball using the device developed at the University of Arkansas, which measures the percentage of the golf ball that is above the canopy (Richardson et al., 2007). Ball lie data were collected on 19 July, 29 July, and 10 August in 2007, and 11 August and 8 September in 2008.

Results and Discussion

There was a significant mowing height effect on ball lie on all three evaluation dates in 2007 and both evaluation dates in 2008, and when averaged across dates within each year. In addition, there was also a significant TE × mowing height interaction on four of the five dates and when averaged across dates within each year.

As expected, shorter mowing heights improved ball lie on all evaluation dates (data not shown). These results follow a similar trend to what was seen by Hanna (2008). At the 0.5-inch mowing height, an average of 92.0% of the ball was above the canopy, while ball lie at the 1.0- and 1.5-inch mowing height was 89.1 and 77.1% above the canopy, respectively.

As reported earlier (McCalla et al., 2008), there was a significant TE × mowing height interaction on the first two evaluation dates in 2007 and when averaged across all three evaluation dates. At the 0.5-inch mowing height, there was no significance difference in ball lie between the

TE treatments (Table 1). However, when the mowing height was raised to either 1.0 or 1.5 inch, the TE-treated plots generally had more favorable ball lie compared to the untreated check (Table 2), which is likely due to the increased turfgrass density from TE treatments.

The data from the 2008 season were similar to the first, in that there was a significant TE x mowing height interaction on all dates and when averaged across dates. At the 0.5-inch mowing height, there was no significant difference between any of the TE treatments on either rating date or when both dates were averaged (Table 2). At the 1.0-inch mowing height, the untreated check produced a significantly worse ball lie than either the 3- or 6-oz TE treatments on the 11 August rating date. However, ball lie at the 1.0-inch mowing height was not improved by TE treatments on the 8 September date or when the two dates were averaged (Table 2). At the highest mowing height (1.5 inch), TE improved ball lie on both evaluation dates and when averaged across evaluation dates. As observed in the 2007 study (McCalla et al., 2008), there were no significant differences between any of the nitrogen treatments in relation to ball lie.

In summary, mowing height had a significant effect on ball lie across all rating dates, which is similar to results reported earlier on Kentucky bluegrass (Cella and Voigt, 2001) and in bermudagrass (McCalla et al., 2008). The growth regulator, TE, also improved ball lie, but only when the turf was maintained at a higher height of cut (1.0 or 1.5 inch). Increasing nitrogen fertilizer rate had no significant effect on ball lie in Tifsport bermudagrass. Therefore, golf course superintendents can improve golf ball lie on bermudagrass by maintaining low mowing heights or from applications of TE on intermediate and rough mowing heights (≥1.0 inch). More work is ongoing to see how cultivar and other cultural practices impact ball lie.

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Table 1. Interaction effect of mowing height and trinexapac-ethyl (TE) applications on ball lie in Tifsport bermudagrass in 2007.

Mowing height	TE	19 July	29 July	10 August	Avg.
(inch)	(oz product / A)	----------% of ball above canopy----------			
0.5	0	96.3	91.4	88.3	92.0
	3	96.5	91.2	89.3	92.3
	6	96.2	90.3	88.3	91.6
LSD (0.05)[z]		ns [y]	ns	ns	ns
1.0	0	91.4	86.8	86.1	88.1
	3	94.1	89.1	86.2	89.8
	6	92.9	89.2	86.0	89.4
LSD (0.05)		ns	1.6	ns	1.3
1.5	0	75.9	69.4	76.7	74.0
	3	82.9	77.3	78.9	79.7
	6	78.1	77.0	77.4	77.5
LSD (0.05)		6.5	5.5	ns	4.0

[z] Least significant difference (P=0.05) for comparing means within a mowing height and date.

[y] ns, not significant.

Table 2. Interaction effect of mowing height and trinexapac-ethyl (TE) applications on ball lie in Tifsport bermudagrass in 2008.

Mowing height	TE	11 Aug.	8 Sept.	Avg.
(inch)	(oz product / A)	----------% of ball above canopy----------		
0.5	0	93.8	94.7	94.3
	3	95.2	93.9	94.5
	6	94.9	93.2	94.1
LSD (0.05)[z]		ns [y]	ns	ns
1.0	0	84.2	90.5	87.3
	3	88.9	89.6	89.3
	6	90.7	88.2	89.4
LSD (0.05)		3.6	ns	ns
1.5	0	39.6	40.8	40.2
	3	54.8	53.2	54.0
	6	54.1	54.2	54.2
LSD (0.05)		10.1	10.8	10.1

[z] Least significant difference (P=0.05) for comparing means within a mowing height and date.

[y] ns, not significant.