

Cultural Management for Height Reduction of Tifgreen 328 Bermudagrass Greens

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Abstract

Tifgreen bermudagrass (328) has been used for greens in the Southwest for 40 years. Decreased mowing heights desired for tournament events can result in loss of turf quality and performance. A series of mowing and rolling events were devised and executed on a Tifgreen turf mowed at 5/32", in order to minimize the potential negative affects of a reduced mowing height of 1/8". All treatments were executed prior to mowing the turf at the new reduced height of 1/8". Significant treatment effects resulted from combinations of mowing and rolling for ball speed distance, when averaged over three evaluation dates. When averaged over all three evaluation dates, the single mow/no roll treatment [1x mow/0 roll] had the least ball roll distance (BRD) values. Mowing/rolling combinations which resulted in either three or four operations on Day 1 (1x mow/2x roll, 2x mow/2x roll and 2x mow/ 1x roll) had slightly greater BRD values than the operations which included two operations (2x mow/0x roll and 1x mow/1x roll). BRD values decreased from Day 1, Day 2 and Day 4 from 81.2", 80.3" to 73.4", respectively when average over all treatments. Single mowing at 5/32", followed by either a double or single rolling event prior to mowing to the new height of 1/8" on Day 1, resulted in the longest BRD values for Days 1 and 2. The effect of all cultural management treatments was diminished by Day 4.

Introduction

Tifgreen bermudagrass (Tif 328) has been planted on greens in the Southern United States for almost 40 years. As a versatile grass it is mowed comfortably at 3/16" and as low as 1/8" with regular rolling. Its internode length and medium shoot density usually does not lend it to prolonged mowing at 5/32" or less. Height reductions, especially below 5/32", often result in some degree of scalping and a stemmy appearance, often leading to reduced stand density. A series of mowing and rolling combinations were devised to test which cultural management program(s) would allow a successful immediate reduction from 5/32" to 1/8", as determined by ball roll distance (BRD) and turfgrass color, quality and potential scalping effects.

Materials and Methods

A nine year old Tifgreen bermudagrass constructed to USGA construction specifications (with choker layer and full tile drainage) was used to evaluate the cultural management treatments of multiple mowings, rolling or combinations of the two for facilitating an effective strategy for reducing mowing heights with minimal greens disturbance in appearance.

The green was previously overseeded in the fall of 1998 with plots consisting of *Poa trivialis*, fine fescues, with and without perennial ryegrass. The green received 10, 5.2 and 7.0 lbs./M of N,P,K from May 1999 until September 20. Ferramec was applied six times at 4 ounces of product/M. The green was mowed at 5/32" six times a week from

January to late July when the mowing height was raised to 3/16" for two weeks to promote quick fill in of the Tifgreen after the exit of the overseed. In early August the green was returned to 5/32".

A series of mowing and/or rolling treatments were devised to reduce the mowing height from 5/32" to 1/8" without loss of turf performance or visual scalping. Turf performance was assessed by measuring ball roll distance (BRD) and scoring plots for turfgrass color and quality on the day of treatment completion (Day 1). Ball roll distance was again measured two days later (Day 2, Day 4, respectively). The turf was mowed on days 1, 2, 3, 4 at 1/8" which was the new reduced mowing height (from 5/32"). All treatments appeared three times on a RCB field design.

Treatments were applied as follows from the base mowing height of 5/32" on Day 1. The treatment sequence is identified by the number of mowing events at 5/32" followed by the number of rolling events.

- | | |
|-------------------------------------|------------------|
| 1. Double mow at 5/32", no rolling | [2x mow/0 roll] |
| 2. Single mow at 5/32", single roll | [1x mow/1x roll] |
| 3. Single mow at 5/32", double roll | [1x mow/2x roll] |
| 4. Double mow at 5/32", single roll | [2x mow/1x roll] |
| 5. Double mow at 5/32", double roll | [2x mow/2x roll] |
| 6. Single mow at 5/32", no roll | [1x mow/0 roll] |

In all cases, the turf was mowed first, followed by the rolling event. This completed the treatment combination. Immediately after the treatments were executed, all the turf was then mowed again, at the new height of 1/8". The mower used was a 22" walk behind Series 5 Toro Tournament mower. Rolling was achieved by using an 875 lb. Brower roller, 30" width.

All field data was analyzed using the analysis of variance technique using SAS software. The treatment means separation statistic used was Bonferroni's protected LSD value which can be used only if the "treatment" effect in the ANOVA is significant at the P level of 0.05, or less. Orthogonal contrasts were devised to compare the effects of mowing and rolling events and times of occurrence. These are discussed in the text only when warranted. A full split-plot analysis of variance was utilized for BRD over the three days, with "days" as the main plot and "treatments" as the sub-plot. Analysis for "treatments" on day 1, 2 and 4 were conducted for BRD, and again for color and quality on Day 1 only, as a RCBD only.

Results and Discussion

Ball Roll Distance:

Overall Day and Treatment Responses:

The main effects of treatments (averaged over all three days) and DAY (averaged over all six treatments) was highly significant. There was no significant treatment by day interaction. This meant that the treatments had a real effect on ball roll distance, ball roll distance changed with the day of measurement, and the same treatments tended to rank similar in performance from day to day. "Days 1 and 2" produced the greatest BRD mean values (80.3" and 81.2", respectively), while BRD decreased to 73.4" by Day 4 (Table 1).

Treatments (averaged over all 3 days) provided a mean BRD difference of 5 inches, ranging from 75.8" to 80.0". When averaged over 3 days of ball roll measurements, the single mow--no roll treatment [1x mow/0x roll] produced the lowest BRD values (75.8"). All other treatments produced BRD values of 77.8" to 80.0". The single mow/double roll and the double mow/double roll treatments produced similar overall BRD values (80.0" and 79.4", respectively). The effect of double mowing (without rolling) produced greater ball speeds than single mowing, without rolling. These two mowing treatments (without rolling) produced mean 3 day average BRD values of 78.3" and 75.8", respectively. It is interesting to note that "treatments" which included any mowing and rolling treatments which summed to 3 or 4 practice events (includes 1 or 2 multiple events combinations each) produced greater average BRD values compared

to those which summed two events only (double mow or 1 mow/1 roll). Also, any combination of preparatory mowing and rolling produced greater ball speeds than the single mowing (no rolling) only events, (Table 1) when averaged for BRD over all three measurement days.

Treatment Effects on Day 1, Day 2 and Day 4:

Day 1

The overall "treatment effect" was not significant on Day 1 for BRD. The F ratio of 2.24 for the treatment main effect (5/17df) was $P=0.12$. The contrast for treatments which included any and all rolling showed a significant increase when compared to treatments which included no rolling (regardless of mowing events).

Thus, rolling showed an increase in BRD based on the performance of all treatments which included some form of rolling (once or twice) when compared to treatments which did not include any rolling whatsoever. Single mowing only (no rolling) produced the slowest ball roll distance on Day 1 (76.5"). Double mowing (without rolling) produced BRD values within one inch of the highest ranking treatments of 1x mow/2x roll, and 2x mow/1x roll. The double treatment of 2x mow/2x roll was slightly smaller for BRD values (Table 1). This may be due to reduced foliage results from the double mowings which occurred prior to rolling. This would increase the stem to leaf ratio, prior to rolling. Perhaps reduced verdure from that treatment produced intermediate BRD values on Day 1. Ball roll distance ranged from 76.5" to 82.4".

Day 2

On Day 2 (two days after treatment were applied), the treatment affect was statistically significant. Mean BRD values for treatments ranged from 79.7" to 84.4", right after the turf was mowed at the new height of 1/8" for the second day. The turf that was previously "double rolled" (and mowed either once or twice at 5/32" previously before the height reduction to 1/8") tended to have the greatest BRD. The 1x mow/2x roll, and 2x mow/2x roll treatment had mean BRD values of 84.4" and 83.8", respectively. Treatments mowed one time, followed by either a single roll, or no rolling at all, produced the lowest BRD values (79.2" - 79.7"). On Day 2, the double mowed/no roll treated turf (2x mow/0x roll) had lesser BRD values then both of the treatments which were double rolled.

Day 4

On Day 4 (three full days after the initial treatments were executed), the treatment effect had "wore off". BRD values for treatments averaged from 71.2" to 74.3" which was statistically non-significant (Table1).

Turfgrass Color and Quality:

Immediately after treatments were executed on the beginning of Day 1, small but subtle differences were observed for turfgrass color and quality. Mean color scores ranged from 6.3 to 7.3 among treatments (Table 2). Both of the treatments which included a double roll treatment (1x mow/2 x roll, 2x mow/ 2x roll) had slightly darker color scores on Day 1. This may in part be from compression of the leaves and stems which would produce an enhanced color affect from leaves overlapping within the canopy. Another possibility is that double mowing may slightly injure leaves and stems, resulting in some cell rupturing. Internal "water soaking" could result in a temporally darker color. Again, the treatment affect was not significant for turfgrass color (Table 2).

Mean turfgrass quality scores among treatments ranged from 7.0 to 7.7. Although the treatment effect was not significant for overall quality, it is of interest to note that treatments which received the least number of mowing/rolling combinations ranked higher in quality than those which received 3 or 4 total sequence events. This is most likely a function of direct mechanical contact on the plots since plots mowed once (no roll), mowed twice (no roll) or mowed once and rolled once all had mean quality values of 7.7. All remaining treatments (1x mow/2x roll; 2x mow/ 2x roll; 2x mow/1x roll) which received a greater degree of "contact" mechanical passes had slightly (but not statistically different) lesser mean quality values of 7.3-7.0.

This inverse relationship between turfgrass color and quality may support the hypothesis that cell disruption from enhanced multiple treatments occurred (darker color, with uneven appearance resulting in lower visual quality).

Plots were similar in appearance on Day 2 and Day 4, and no additional data was taken beyond Day 1. No scalping occurred during the course of this test.

Conclusions

1. Significant treatment effects resulted from combinations of mowing and rolling (designed to reduce the base mowing height from 5/32" to 1/8") for ball speed distance, when averaged over three evaluation dates.
2. When averaged over all three evaluation dates, the single mow/no roll treatment [1x mow/0 roll] had the least

ball roll distance (BRD) values.

3. Mowing/rolling combinations which resulted in either three or four operations on Day 1 (1x mow/2x roll; 2x mow/2x roll; and 2x mow/ 1x roll) had slightly greater BRD values than the operations which included only two operations (2x mow/0x roll and 1x mow/1x roll).
4. BRD values decreased from Day 1, Day 2 and Day 4 from 81.2", 80.3" to 73.4", respectively when average over all treatments.
5. Single mowing at 5/32", followed by either a double or single rolling event (prior to mowing at the new height of 1/8") on Day 1, resulted in the longest BRD values for Days 1 and 2.
6. The effect of all cultural management treatments was diminished by Day 4.
7. No visual scalping occurred in the test.

Table 1. Mean ball roll distance¹ of Tifgreen 328 bermudagrass after cultural management practices² executed for reducing effective mowing height from 5/32" to 1/8".

TREATMENT COMBINATION ³ (NUMBER OF EVENTS)		BALL ROLL DISTANCE (INCHES)			
MOWING 5/32"	ROLLING	DAY 1 ⁴	DAY 2 ⁴	DAY 4 ⁴	GRAND AVG. ⁵
1	0	76.5	79.7	71.2	75.8
2	0	81.4	80.2	73.2	78.3
1	1	79.8	79.2	74.3	77.8
1	2	82.4	84.4	73.2	80.0
2	1	81.6	79.9	74.1	78.6
2	2	80.1	83.8	74.2	79.4
TEST MEAN ⁶		80.3	81.2	73.4	78.3
LSD VALUE ⁷		4.44	4.1	3.5	2.1
TRT P VALUE ⁸		0.12	0.05	0.40	0.01

¹Mean of six observations per plot, three plots per treatment. N=18 observations per observation day. Grand average mean of N=54 observations. Ball roll distances measured on all days at the reduced height of 1/8".

²Cultural management comprised of various mowing and rolling treatments to reduce height from 5/32" to 1/8".

³Number of mowing events at 5/32":Number of rolling events. Post treatments followed by immediate mowing to 1/8" on days 1, 2, 4.

⁴Day 1 = Day of treatment execution; Day 2 = 48 hours after treatment execution; Day 4 = 74 hours after treatment execution.

⁵Grand average = Average of all treatments for all three evaluation dates following treatment execution.

⁶Test Mean = Mean of all treatments on each of three evaluation days.

⁷LSD Value = Mean separation statistic. Means which differ numerically greater than the LSD value are significantly different from each other.

⁸Probability of F ratio for "treatment" affect in ANOVA occurring by chance alone. F = (MS trt/MS error); P significance of 0.05, or less.

Table 2. Mean turfgrass color¹ and quality² scores of Tifgreen bermudagrass after cultural management practices³ executed for reducing effective mowing heights from 5/32" to 1/8".

TREATMENT COMBINATION ⁴ (NUMBER OF EVENTS)		COLOR DAY 1	QUALITY DAY 1
MOWING	ROLLING	SEPTEMBER 21, 1999	SEPTEMBER 21, 1999
1	0	6.7	7.7
2	0	6.3	7.7
1	1	6.7	7.7
1	2	7.3	7.3
2	1	6.7	7.0
2	2	7.0	7.3
TEST MEAN ⁵		6.8	7.4
LSD VALUE ⁶		--	--
TREATMENT P VALUE ⁷		0.77	0.77

¹Color scores 1-9, 1 = dead, 9 = best possible. Values are the mean of three replications.

²Quality scores 1-9, 1 = dead, 9 = best possible. Values are the mean of three replications.

³Cultural management comprised of various mowing and rolling treatments to reduce height from 5/32" to 1/8".

⁴Combination of mowing at 5/32", rolling with 875 lbs. roller, followed immediately by mowing to 1/8" with Toro Series 5 Tournament mower.

⁵Test Mean = Mean of all treatments on each of three evaluation days.

⁶LSD Value = Mean separation statistic. Means which differ numerically greater than the LSD value are significantly different from each other.

⁷Probability of F ratio for "treatment" affect in ANOVA occurring by chance alone. $F = (MS\ trt/MS\ error)$; P significance of 0.05, or less.