

Cultural management practice appraisal for least disruptive thatch control in ultradwarf bermudagrass golf greens

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Introduction

Ultradwarf bermudagrasses have fine leaf blades, short internodes, high shoot densities, rapid recuperative potentials, and prostrate growing heights. Although these traits are desirable for putting greens, they contribute to an accumulation of dead and decaying plant material, known as thatch. When maintained at appropriate levels, thatch provides a cushioning region that protects living plant material. Negative aspects arise when excessive amounts of thatch and mat, the product of intermingling among thatch and soil particles, begin to accumulate within this section. Thatch and mat decrease water and gaseous exchange into and out of the soil layer, increase disease pressure, reduce efficacy of pesticide applications, and generate a greater occurrence of ball roll inconsistencies on putting greens. Current strategies for thatch management include hollow- and needle-tine aeration and vertical mowing at frequent intervals. These practices offer effective measures of thatch control, but greatly disrupt playability and decrease aesthetics of golf greens. The goal of this research was to assess the practicability of incorporating less-disruptive cultural management strategies for thatch control.

Materials and Methods

Description and Timing of Treatment Applications

A two year study was conducted on USGA specification 'Champion' and 'MiniVerde' ultradwarf bermudagrass putting greens in Starkville, MS. The experiment was arranged in a randomized complete block split-plot design with three replications. Cultural management practices were whole plots (2.1 by 2.4 m) and seasonal fungicide program applications were split plots (2.1 by 1.2 m). Cultural management treatments were initiated on 8 and 12 June 2012 and 2013, respectively. Management practices were vertical mowing (VM) weekly, VM weekly with slicing, spiking, or scarifying incorporated once every fourth week, and slicing, spiking, or scarifying once every fourth week. Seasonal fungicide applications were made once monthly from June through October of each year.

Data Collection

Split-plots were monitored for symptoms of dollar spot and evaluated for turfgrass color twice monthly from June to November. Color ratings were collected with a FieldScout® TCM 500 Normalized Difference Vegetative Index (NDVI) turf color meter. Thatch measurements were recorded on soil profile samples (7 by 2.5 cm) every other month from June 2012 until June 2014.

Results and Discussion

Disease Occurrence

For dollar spot, cultivar × year × time and cultural management practice were significant and are presented in Fig. 2A and B, respectively. At three of the six rating periods in 2012 and one of the six rating periods in 2013, MiniVerde outperformed Champion, with respect to mean number of dollar spot infection centers. In consideration of cultural management practices, the greatest occurrence of dollar spot was in plots that received weekly vertical mowing applications. When slicing, spiking, or scarifying practices were incorporated once monthly, the number of dollar spot infection centers was significantly reduced. Likewise, a significant reduction in dollar spot occurrence was observed when applications of slicing, spiking, or scarifying were applied once monthly.

NDVI

The four factor (cultivar × cultural management practice × year × time) interaction significantly affected NDVI. At numerous evaluation periods, on both ultradwarf cultivars, once monthly applications of slicing, spiking, or scarifying and incorporating slicing, spiking, or scarifying applications with vertical mowing applications significantly increased NDVI when compared to weekly vertical mowing applications, with respect to mean NDVI ratings (Table 1).

Thatch

Thatch depth was affected by the three factor (cultivar × cultural management practice × time) interaction. As shown in Fig. 4A, significant differences were observed between cultivars; however, they were aperiodic. Similarly, significant differences were observed at various time points among cultural management practices on both Champion and MiniVerde (Fig. 4B). These differences are not of a consistent nature and it should be noted that both grass cultivars behave similarly with respect to mean thatch depth.

Summary

The treatments in this study (VM weekly, VM weekly with slicing, spiking, or scarifying incorporated once every fourth week, and slicing, spiking, or scarifying once every fourth week) behaved similarly with respect to thatch management. However, weekly applications of VM yielded significantly reduced NDVI and significantly increased occurrence of dollar spot, compared to other treatments in the study. A best management program for thatch control could include two approaches. The first approach consist of incorporating a slicing, spiking, or scarifying application once every fourth week into a once weekly vertical mowing program. The second approach, which offers the best plant health relative to NDVI and dollar spot occurrence, consist of slicing, spiking, or scarifying once every fourth week.

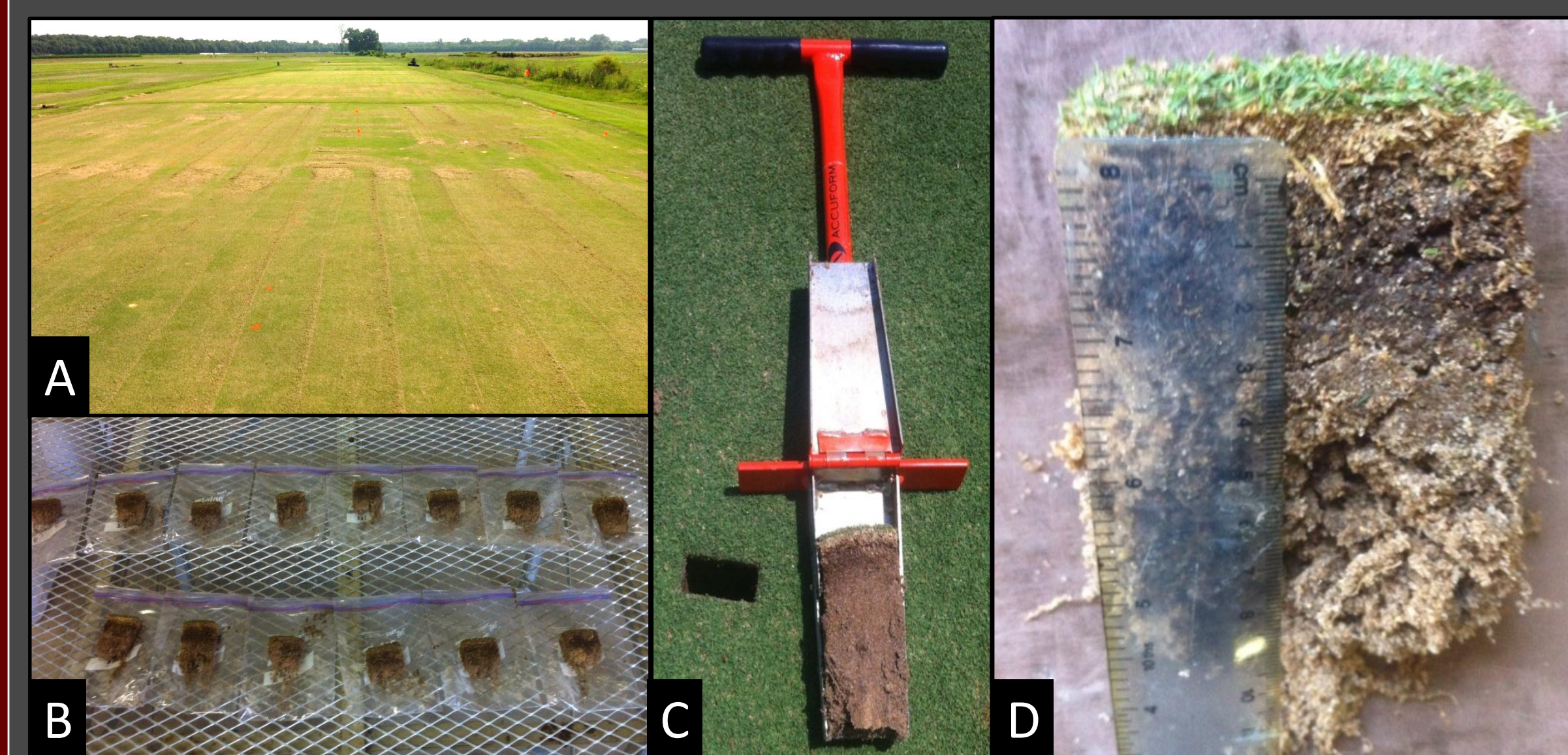


Figure 1. (A) Initiation of study on 8 June 2012, (B) soil profile samples prepared for uncompressed thatch depth ratings, (C) soil profile sample from ultradwarf bermudagrass green, (D) measurement of soil profile sample for uncompressed thatch depth.

Table 1. Mean normalized difference vegetative index response to cultivar selection and cultural management practice on ultradwarf bermudagrass turf managed at 3.175 mm in Starkville, MS during the months of June to November of 2012 and 2013.

	2012					
	Jun	Jul	Aug	Sept	Oct	Nov
Champion	NDVI					
Vertical Mow (VM)	0.587 bc [†]	0.697 d	0.747 b	0.718 b	0.635 c	0.555 c
VM + Slice	0.609 ab	0.745 bc	0.758 ab	0.737 ab	0.656 bc	0.563 c
VM + Spike	0.588 cb	0.744 bc	0.770 a	0.748 ab	0.683 abc	0.598 c
VM + Scarify	0.566 c	0.735 c	0.760 ab	0.739 ab	0.683 abc	0.598 bc
Slice	0.631 a	0.768 ab	0.767 ab	0.768 a	0.733 a	0.644 a
Spike	0.644 a	0.774 a	0.772 a	0.758 a	0.719 a	0.610 ab
Scarify	0.640 a	0.761 abc	0.760 ab	0.757 a	0.699 ab	0.588 bc
MiniVerde	NDVI					
Vertical Mow (VM)	0.577 c	0.745 b	0.761 b	0.705 b	0.620 b	0.575 bed
VM + Slice	0.606 bc	0.763 ab	0.770 ab	0.731 ab	0.653 ab	0.598 abc
VM + Spike	0.604 bc	0.768 ab	0.780 ab	0.724 ab	0.646 ab	0.573 cd
VM + Scarify	0.623 ab	0.764 ab	0.779 ab	0.733 ab	0.627 ab	0.539 d
Slice	0.624 ab	0.768 ab	0.767 ab	0.732 ab	0.675 a	0.619 ab
Spike	0.610 bc	0.773 a	0.778 ab	0.746 a	0.676 a	0.635 a
Scarify	0.658 a	0.769 ab	0.784 a	0.743 a	0.667 ab	0.600 abc
	2013					
	Jun	Jul	Aug	Sept	Oct	Nov
Champion	NDVI					
Vertical Mow (VM)	0.702	0.760	0.721 b	0.672 b	0.663	0.488
VM + Slice	0.694	0.763	0.736 ab	0.683 b	0.657	0.501
VM + Spike	0.705	0.751	0.745 a	0.698 ab	0.661	0.491
VM + Scarify	0.702	0.739	0.748 a	0.699 ab	0.626	0.459
Slice	0.719	0.770	0.745 a	0.719 ab	0.688	0.519
Spike	0.716	0.763	0.747 a	0.723 ab	0.669	0.470
Scarify	0.718	0.769	0.750 a	0.737 a	0.680	0.488
MiniVerde	NDVI					
Vertical Mow (VM)	0.719	0.762	0.716 b	0.690	0.611 c	0.447
VM + Slice	0.721	0.756	0.739 a	0.703	0.633 bc	0.506
VM + Spike	0.730	0.774	0.747 a	0.714	0.662 abc	0.515
VM + Scarify	0.730	0.760	0.745 a	0.705	0.662 abc	0.522
Slice	0.745	0.764	0.743 a	0.734	0.673 ab	0.509
Spike	0.746	0.772	0.737 ab	0.709	0.679 ab	0.520
Scarify	0.740	0.778	0.749 a	0.743	0.697 a	0.534

[†] Turf color, measured with a FieldScout® TCM 500 NDVI turf color meter
[†] Within each sampling date, for a given cultivar, means followed by the same letter are not significantly different according to Fisher's LSD test at $p \leq 0.05$

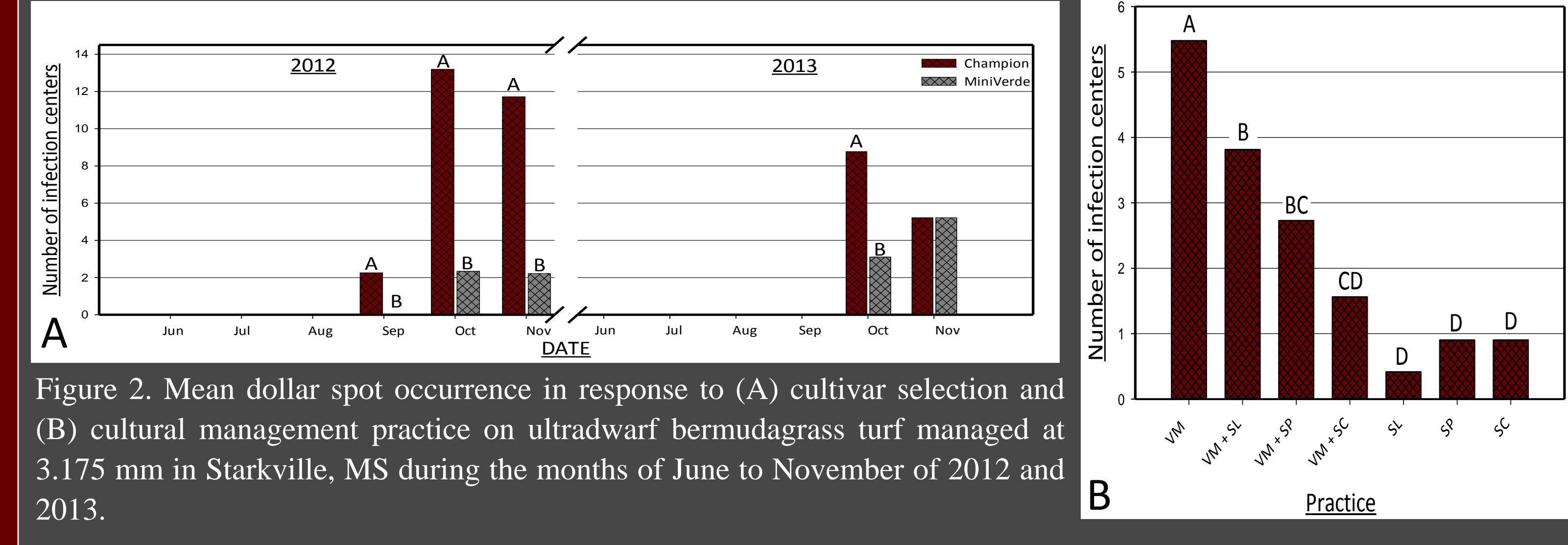


Figure 2. Mean dollar spot occurrence in response to (A) cultivar selection and (B) cultural management practice on ultradwarf bermudagrass turf managed at 3.175 mm in Starkville, MS during the months of June to November of 2012 and 2013.

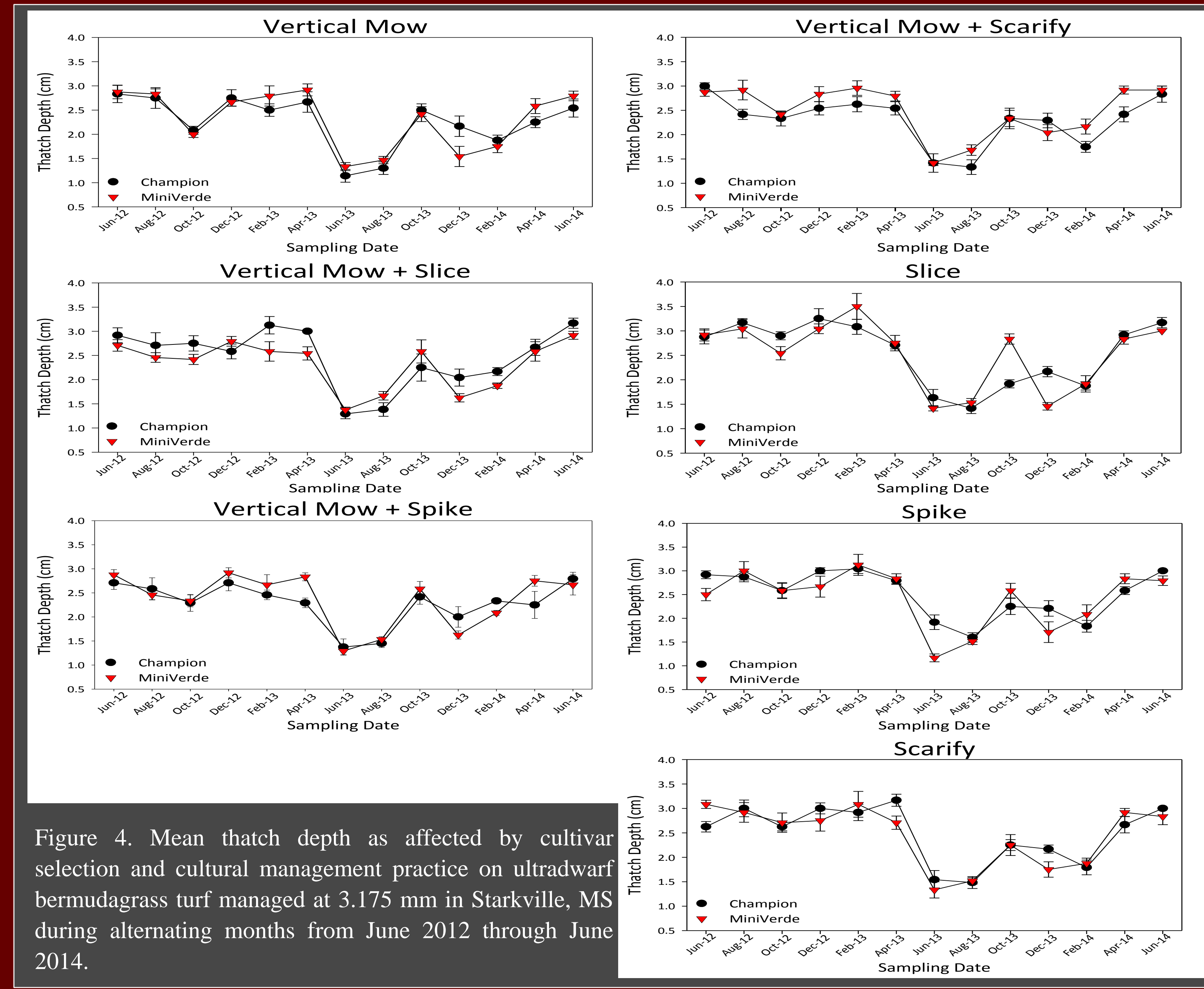


Figure 4. Mean thatch depth as affected by cultivar selection and cultural management practice on ultradwarf bermudagrass turf managed at 3.175 mm in Starkville, MS during alternating months from June 2012 through June 2014.

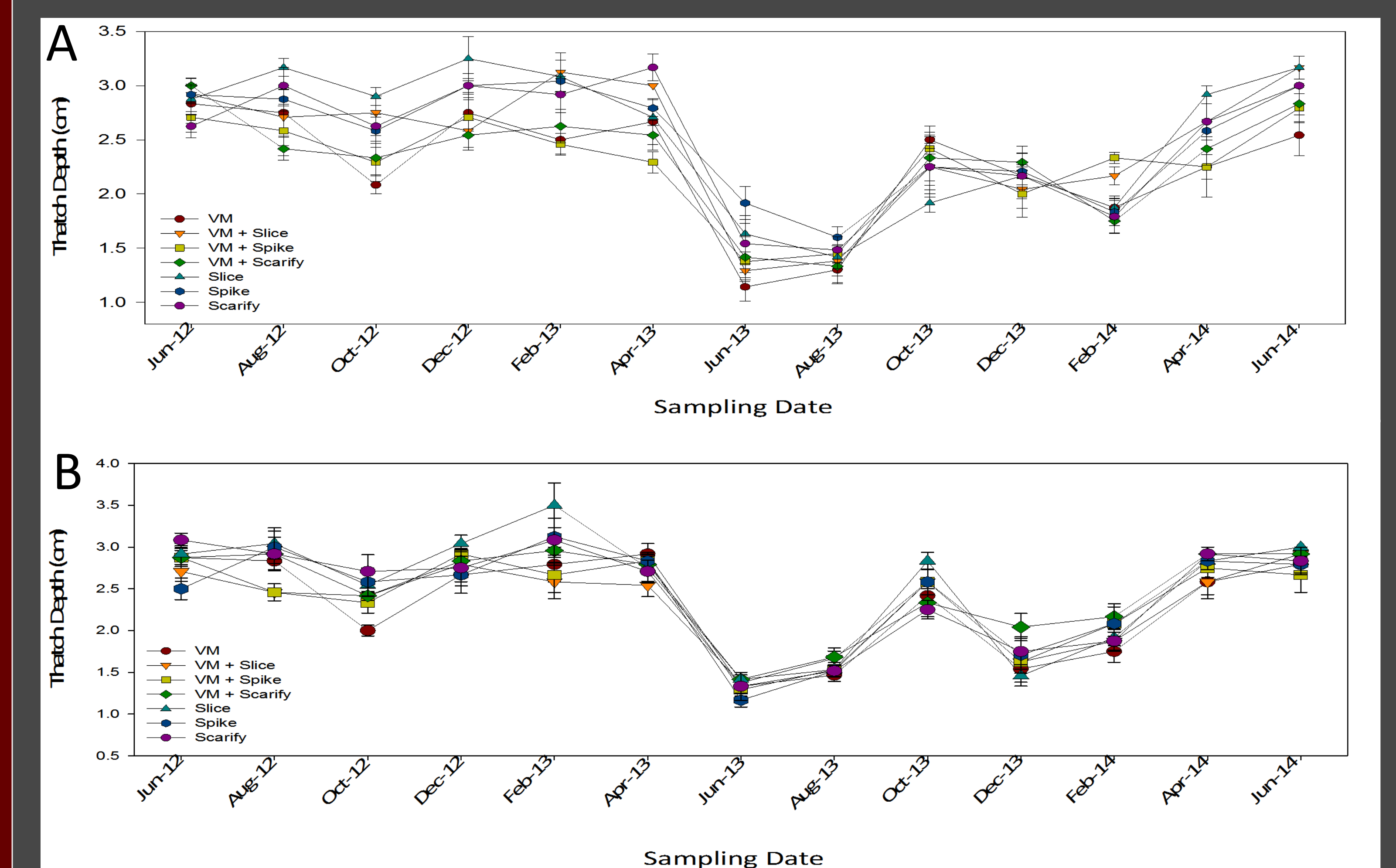


Figure 4. Mean thatch depth as affected by cultural management practice on (A) Champion ultradwarf bermudagrass turf and (B) MiniVerde ultradwarf bermudagrass turf managed at 3.175 mm in Starkville, MS during alternating months from June 2012 through June 2014.

