CALIFORNIA LANDSCAPE CONTRACTORS ASSOCIATION: FINAL REPORT

Grasscycling As a Tool for Reducing Green Waste and Fertilizer Use on Tall Fescue Lawns in California

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Introduction

Both homeowners and professional turfgrass managers potentially burden municipal landfills with green waste and waste fertilizer by removing mowing lawn clippings. Grasscycling, the immediate return of mown grass to the rhizosphere, can reduce both green waste and turfgrass fertilizer needs.

This study was undertaken to determine the effects of grasscycling on a tall fescue lawn under California conditions. Specific questions included: 1) Is clipping yield affected?, 2) Is the quality/color of the turf affected? , and 3) What is the minimum amount of fertilizer that can be applied without reducing turf quality?

Experimental Design

A tall fescue (*Schedonorus phoenix* [Scop.] Holub. Syn., *Festuca arundinacea* Schreb.) research plot was established on the University of California, Davis campus in 2008 (Figure 1). Two factors were studied: 1) type of mowing technique (mulched clippings versus caught -removed clippings) and 2) rate of nitrogen fertilization (1, 2 and 4 lb N/1000ft^2/year). Mowing treatments were performed using a Black & Decker Model 1200 rechargeable electric mower that was capable of catching grass clippings (catch treatment) or mulching the clippings (mulch treatment) (Figure 2). Based on clipping yield data collected we estimated 0.7, 1 and 1.8 lb N/1000ft^2/year were removed from plots receiving 1, 2 and 4 lb N/1000ft^2/year, respectively. There was no significant difference in clipping yields throughout the year between the two mowing treatments. NDVI (Normalized Difference Vegetation Index) , which is an objective, quantitative measure of turfgrass color, dropped below the acceptable level (0.6, scale = 0 to 1.0) during the winter and late-summer months for the 1, 2 and 4 lb N/1000ft^2/year rates; the 4 lb N/1000ft^2/year rate never dropped below the 0.6 threshold. Soil Electrical Conductivity increased with increasing fertilizer rates. No other soil characteristic measured (e.g. organic matter, total N, total C, NO_3^- or NH_4^+) was affected by either the fertilizer or mowing treatments. When tall fescue was growing rapidly very little if any nitrogen moved passed the root-zone. Total nitrogen in leaf tissue increased as fertilizer rate increased during the summer months. Mowing technique did not affect total nitrogen in leaf tissue.

Results - Clipping Yield

Clipping yields between “catch” and “mulch” treatments were not significantly different from one another during the early stages of this research project. However, after about 18 months (March, 2011) the “mulch” treatment (pooled over all fertilizer treatments) began to have significantly higher clipping yields than the “catch” treatment (Figure 3).

Results - NDVI (Normalized Difference Vegetation Index, a measure of turfgrass color)

Instead of using subjective color ratings (usually 1-9), the color of the turfgrass was objectively and quantitatively measured each month using a FieldScout TCM 500 NDVI Turf Color Meter (Spectrum Technologies, Inc.). Figure 4 shows the NDVI response over time. As expected, with an increasing rate of fertilizer the overall NDVI means increased. An NDVI of 0.6 was set as the threshold for minimally accepted color. The NDVI values for all treatment combinations except one (Mulched: 4-lb) dropped below accepted threshold at various times of the year.

Results - Fertilization Recommendation

Linear regression was applied for both clipping yield and NDVI color results (Table 1). This mathematical analysis provided a way to predict how much less fertilizer could be applied to a mulching lawn to get the same growth and color response of a non-mulching (catch) lawn. To reach the color value at 4 lb N/1000ft^2/year rate using catching methods, a 3.6 lb N/1000ft^2/year rate could be applied to tall fescue turf when grasscycling. To reach the same clipping yield at 4 lb N/1000ft^2/year rate using catching methods, a 3 lb N/1000ft^2/year rate could be applied when grasscycling. Thus, grasscycling reduced the need for nitrogen fertilizer by 0.4 lb (10%) for color and 1.1 lb (27%) for clipping yield.

Conclusions

1. Grasscycling can lead to higher clipping yields: After an initial period of establishment (approximately 24 months), plots mowed with a mulching mower had higher clipping yields than plots where clippings were removed.

2. Grasscycling can lead to higher NDVI (color) values: NDVI values from plots treated with 4 lb N/10000ft^2/year and mowed with a mulching mower never dropped below the critical value of 0.6. NDVI values for the 1 and 2 lb N/10000ft^2/year fertilizer treatments dropped below the critical value in mid-winter and mid-summer.

3. Grasscycling can lead to reduced need for nitrogen fertilizer: A fertilizer application reduction of between 10 and 27% for color and clipping yield, respectively, can be realized on tall fescue turf in California.

Table 1. Normalized Difference Vegetation Index (NDVI) color response and clipping yield values for the mulch and catch treatments in response to varying levels of N fertilizer.

Nitrogen Rate (lb N/1000ft^2/yr		**1**	**2**	**4**	**Regression Equation**
NDVI	**mulch**	0.61	0.64	0.68	$y = 0.0004x + 0.6$ $R^2 = 0.99$
	catch	0.61	0.64	0.67	$y = 0.0004x + 0.6$ $R^2 = 0.99$
Clipping Yield (g m^2/week)	**mulch**	849.4	1531.9	3214.1	$y = 16.2x + 8.3$ $R^2 = 0.99$
	catch	819.5	1198.9	2332.4	$y = 10.5x + 252.8$ $R^2 = 0.99$

Figure 1. Plot plan of the research area on the UC Davis campus showing a randomized complete block design.

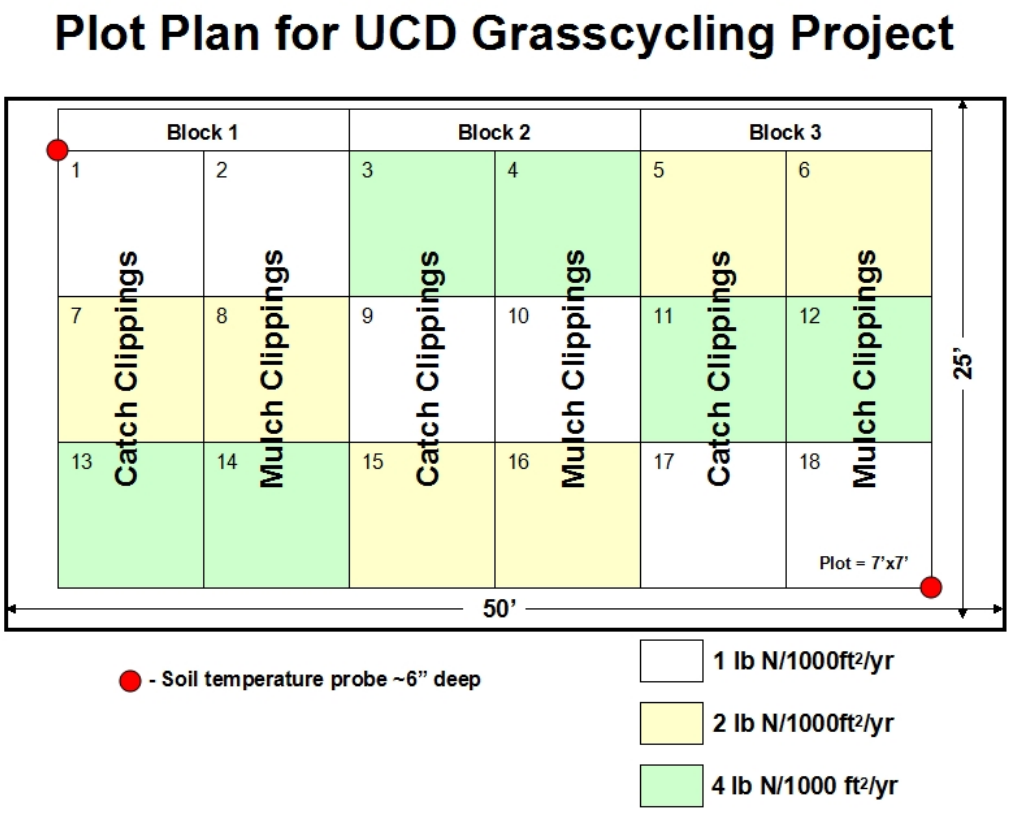

Figure 2. A Black & Decker®, battery operated mulching mower was used for all mowing treatments. The mower's battery was charged using a solar panel (see top of tool shed) and Sungrow® charge regulator (inset).

Figure 3. Clipping yield data of the two mowing treatments ("catch" and "mulch") over all fertilizer levels from May, 2010 to June, 2011. Red arrows show when fertilizer was applied. Means separated using Scheffe's Test, p=0.05. NS = Not Significant.

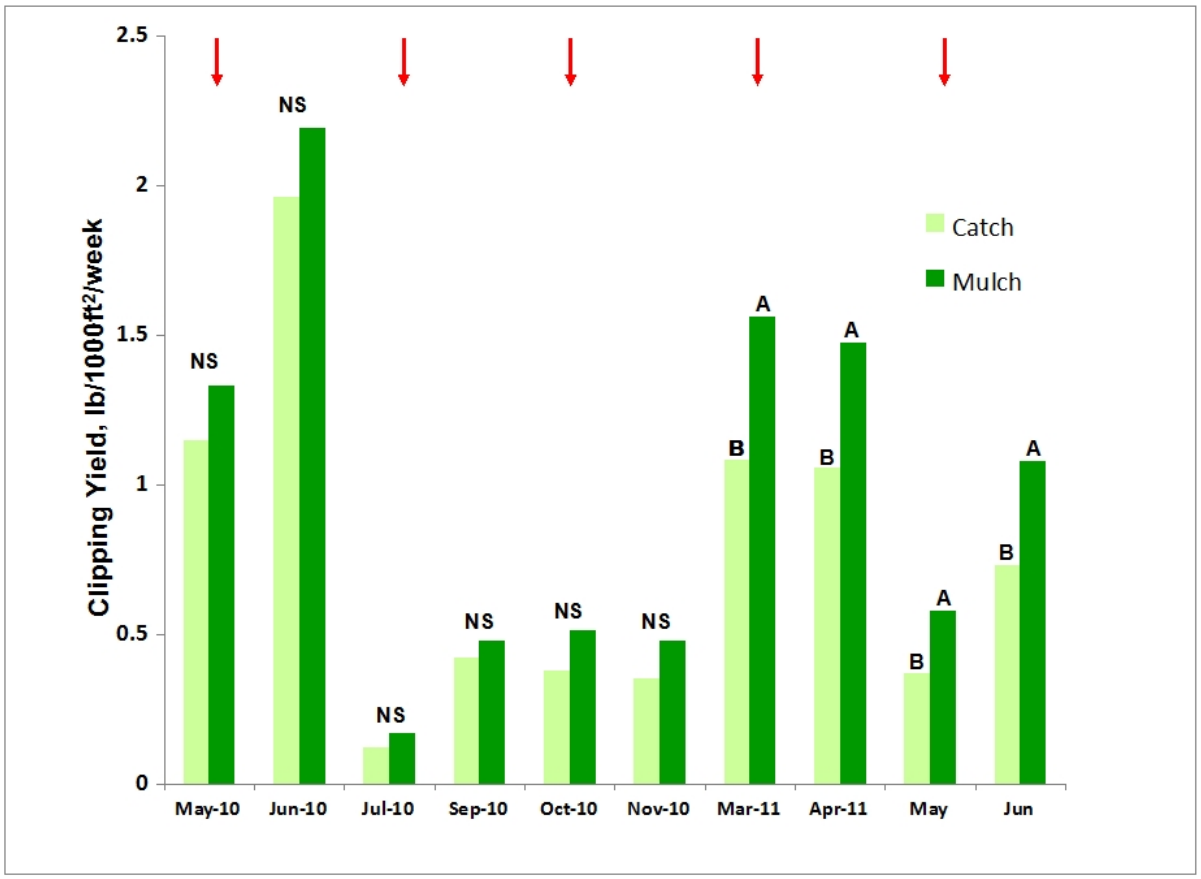

Figure 4. NDVI response over time of the "catch" and "mulch" mowing treatments for the three fertilizer treatments (1, 2 and 4 lb N/1000ft^2/yr). Red arrows indicate when fertilizer was applied. Vertical bar in each panel = 1 LSD.