UCRTRAC Accumulative Research Summary
Section G: The Ability to Respond to Sudden Research and Education Industry Needs
Project 1

Title: The Effect of Fall Renovation Treatments on PM_{10} Emissions During Raking of Debris Following Scalping of Common Bermudagrass Fairways Prior to Overseeding.

Objective:

- To measure the effect of fall renovation treatments on PM_{10} emissions during raking of debris following scalping of common bermudagrass fairways prior to overseeding.

- To measure the effect of fall renovation treatments on the percent green bermudagrass coverage before and after overseeding fairways with perennial ryegrass.

- Four treatments:
  1. Dry: 21 days irrigation off, then scalp and rake same day.
  2. Dry-wet: 22 days irrigation off, then wet, scalp, and rake same day.
  3. Primo: 7 days irrigation off, apply Primo, then 3 days later scalp and rake same day.
  4. Reward: 1 day irrigation off, apply Reward, then 2 days later scalp and rake same day.

- Four replicate plots per treatment; individual plot size $\approx$ 0.5 acre; plots arranged over 14 fairways.

- Activities associated with renovation were the same as those practiced on the golf course.

- A Toro Rake-O-Vac was used for raking and it was equipped with two PM_{10} samplers to measure PM_{10} emission rate.

Location: The Springs Club, Rancho Mirage, CA.

Duration: One season.

Funding Source: NA
(Note: Considerable assistance from Dennis Fitz and Mike Kocour and their staff).

Findings:

Treatment Effect on PM_{10} Emissions

- The dry-wet treatment had significantly lower PM_{10} emissions than the dry treatment (Table 1). These data show that the wetting (syringing) of debris resulting from scalping

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with a minimal amount of water (0.02 inch) followed by immediately raking is an effective best management practice (BMP) for reducing PM_{10} emissions and dust. It should be noted that dry and dry-wet treatments were within the range of dry-down procedures practiced on Coachella Valley golf courses.

Treatment Effect on Percent Green Bermudagrass Coverage

- The dry and dry-wet treatments had the lowest percent green bermudagrass coverage among the treatments on 4 Oct. (2 days before initiation of scalping and raking activities) (Table 2). These data would be expected since the interval between irrigation off and scalping and raking was 21 days (dry) and 22 days (dry-wet).

- There was a nonsignificant trend for the dry and dry-wet treatments to have the lowest percent green bermudagrass coverage through 24 November. These data suggest that a dry-down period prior to overseeding was the most effective treatment (vs. Primo or Reward treatments) for reducing bermudagrass competition during the fall transition from bermudagrass to overseed turfgrass.

Summary

The dry treatment was the worst case for PM_{10} emissions at 99 g/mile. Our dry treatment would be considered a rather dry condition by most golf course superintendents. The width of the reel or bush for a Rake-O-Vac is 61 inches.

This rate = 160.8 g PM_{10}/acre
= 3.54 lb PM_{10}/10 acre
= 12.39 lb PM_{10}/The Springs Club (though there are 125 acres of fairways and roughs that are scalped, only 35 acres of fairways are swept)

It is true that the above PM_{10} emission rates do not compare to an average day in the Coachella Valley where 49 tons PM_{10} are produced.

However, the Hi-Lo Desert GCSA has the opportunity to continue to provide leadership in being good stewards of the environment and practice a best management practice (BMP) of syringing debris before raking and significantly reducing PM_{10} emissions. The operators of the rakers may also appreciate the reduction of dust.

Status: A one-season study was completed and a Final Report was prepared. Information associated with this study was presented at the Hi-Lo Desert GCSA Educational Seminar. Information associated with this study was published in the *Rub of the Green* and *Better Turf Thru Agronomics*. An article has been submitted to *Golf Course Management*.

Table 1. The effect of four fall renovation treatments in 1999 on PM_{10} emissions during raking of debris with a Toro Rake-o-Vac traveling at 6 miles per hour following scalping of common bermudagrass fairways prior to overseeding at The Springs Club, Rancho Mirage, CA.

Treatment	PM_{10} emission rate		Interval between irrigation off and scalp/rake (day)
	g/mile	g/minute	
Dry	99.0 a[z]	9.9 a	21
Primo	65.4 a	6.5 a	10
Dry-wet	1.2 b	0.1 b	22
Reward	2.2 b	0.2 b	3[y]
LSD, P=0.05	50.7	5.1	–
CV (%)[x]	78.5	78.5	–

[z] Means followed by the same letter are not significantly different, Fisher's protected least-significant-difference (LSD) test, P=0.05.

[y] Note: unplanned 5-minute irrigation (0.06 inch water) on the day of scalping and raking.

[x] CV is the coefficient of variation, a unitless calculation for the amount of variation in the population of measurements. Visual ratings, clipping yields, and root weight measurements normally have CVs in the range of 2 to 5, 15 to 25, and 40 to 60, respectively.

Table 2. The effect of four fall renovation treatments in 1999 on the percent green bermudagrass coverage and turfgrass coverage during the fall that is in conjunction with the overseeding of common bermudagrass fairways at The Springs Club, Rancho Mirage, CA.

	Date[z]				Date
	Percent green bermudagrass coverage				Percent turfgrass coverage
Treatment	4 Oct.	11 Oct.	19 Oct.	24 Nov.	11 Oct.
Dry	17 c[y]	2 b	22 b	57 bc	81 c
Primo	67 b	5 a	34 b	72 ab	96 ab
Dry-wet	34 c	3 ab	30 b	56 c	86 bc
Reward	97 a	2 b	50 a	80 a	99 a
LSD, P=0.05	21	2	14	15	10
CV (%)[x]	25.6	42.9	27.4	15.1	7.5

[z] Oct. 4 = Before any treatment plots were scalped and raked.
Oct. 11 = Day of seeding, 2 days after the completion of all treatment plots being scalped and raked.
Oct. 19 ≈ 7 days after seeding.
Nov. 24 ≈ 43 days after seeding.

[y] Means followed by the same letter are not significantly different, Fisher's protected least-significant-difference (LSD) test, P=0.05.

[x] CV is the coefficient of variation, a unitless calculation for the amount of variation in the population of measurements. Visual ratings, clipping yields, and root weight measurements normally have CVs in the range of 2 to 5, 15 to 25, and 40 to 60, respectively.