UCRTRAC Accumulative Research Summary
Section B: Impact of Turfgrass Chemicals and Fertilizers on the Environment
Project 4

Title: A Survey of Professional Turfgrass Managers in Southern California Concerning Their Use of Turfgrass Best Management Practices.

Objective: To assess the current perception of implementation of selected turfgrass BMPs and to determine whether or not those perceptions and implementations differed 1) between turfgrass advisors and managers, and 2) between general and sports turfgrass managers.

- This project was one part of a larger study, "The Development of Irrigation and Nitrogen Fertilization Programs on Tall Fescue to Facilitate Irrigation-Water Savings and Fertilizer-Use Efficiency" (see Chapter One, Project VII).

- Professionals from the turfgrass industry were surveyed at the UCR Turfgrass Research Conference and Field Day in Fall 1998 and 1999. A total of 381 surveys were collected during both years (305 surveys were used in the data set). The survey instrument consisted of two sections: the first section requesting basic information about conference participants, and the second section gauging their activities and perceptions of eight BMPs (Table 1).

- For more information concerning the methods see HortTechnology 12:498-504.

Location: UCR Turfgrass Research Conference and Field Day during Fall 1998 and 1999.

Duration: 2 years

Funding Source: California Department of Food and Agriculture, Fertilizer Research and Education Program (CDFA-FREP)

Findings:

- The vast majority of respondents were from southern California, and they had an average of 13 years of experience in the turfgrass industry (Table 2).

- Eighty-eight percent of the respondents indicated they were always or usually responsible for turfgrass management decisions or recommendations at their site.

- Turfgrass managers, especially sports turfgrass managers, were found to be most committed to implementing the BMPs in the survey (Tables 3 to 6).

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- Overall, survey respondents considered BMPs in the survey to be important and not highly difficult to implement.

- Limitations to the adoption of BMPs were lack of financial backing, employee education, and necessary time, all of which could be remedied with sufficient commitment of resources by the turfgrass industry.

- More information concerning findings can be found in HortTechnology 12:498-504.

Status: A 2-year study was completed. Information associated with this study was presented at UCR Turfgrass Research Conference and Field Day and at an annual meeting of CDFA-FREP. Information associated with this study was published in abstracts of the two presentations, *Better Turf Thru Agronomics*, and in a scientific journal article.

Table 1. Survey questions given at the University of California, Riverside, Turfgrass Research Conference and Field Day in the fall of 1998 and 1999.

SECTION 1

1. Did you complete this survey in 1998?
Given in 1999 survey only. Choices: yes; no; or not sure.

2a. Which of the following indicates how you are primarily involved with turfgrass (choose only one)?
Choices: golf course management; professional consulting/horticulture advising; manufacture/sales of turfgrass-related products; public (government/public property) site management; private (commercial/residential) site management; sports turfgrass management; sod production; turfgrass seed production; turfgrass research; or other.

2b. Number of years you have been involved with the activity checked above?

2c. What is the county and state where you primarily perform this activity (please specify one county)?

3. How often are you responsible for making decisions or recommendations about turfgrass management practices (turfgrass selection, irrigation practices and system maintenance, fertilization programs, mowing, pesticide applications, etc.)?
Choices: always; usually; rarely; or never.

4. If you manage turfgrass, please indicate the turfgrass species at your site (check all that apply).
Choices: bermudagrass; tall fescue; creeping bentgrass; perennial ryegrass; kikuyugrass; annual bluegrass; St. Augustinegrass; Kentucky bluegrass; zoysiagrass; and other(s).

SECTION 2

5. Examine each of the best management practices (BMPs) described below and note whether or not you consider it to be an important management practice, whether or not you are currently performing the practice, whether or not you are likely to either continue or initiate this practice in the future, and whether or not you feel the practice is easy or very difficult to carry out.
Responses for each BMP (see below) given on 1 to 5 scale for the following: importance (1 = not, 5 = very); doing this now? (1 = never, 5 = always); likely to continue/start? (1 = not likely, 5 = very likely); difficulty level (1 = easy, 5 = very hard).

The BMPs:

a) water conservation [reference evapotranspiration (ET_o)-based water budgets, seasonal adjustments of irrigation clocks, irrigation system checks, etc.]
b) fertility program development (fertilization based on plant species, type of use, and seasonal and climatic requirements, soil type; use of appropriate fertilizer type, amount, and frequency of application)

c) turfgrass selection [choose species and cultivars that, for example, require less water, possess more tolerance to stress (including pests) or possess other traits that would result in the successful management of turfgrass, etc.]

d) mowing program development (mowing height/frequency based on species/cultivar requirements, plant growth and/or stress, etc.)
e) integrated pest management (managing the "most healthy" turfgrass as possible via sound agronomic principles as the best prevention to pests, defining threshold pest activity/amount prior to pesticide applications, etc.)
f) protecting ground water and surface water from potential contamination from turfgrass chemicals and fertilizers
g) protecting non-target plants, animals and humans from the potential toxic effects of turfgrass chemicals
h) protecting native habitats during turfgrass construction and maintenance

6. What factor(s) have limited your ability to adopt BMPs in the past (check all that apply)?
Choices: cost/financial limitations; availability of BMP information; lack of organization/planning; government regulations; employee skill level; time; BMPs not considered important; no personal authority to implement BMPs; client/owner/public unaware of or disinterested in BMPs; and other(s)

7. Which of the following fertilization practice(s) do you consistently perform (check all that apply)?
Given in 1999 survey only. Choices: apply appropriate amount of nitrogen (N) specific for turfgrass species and requirements of turfgrass use; apply different combinations of slow- and fast-release N sources according to seasonal growth and expected rainfall; apply N based on seasonal growth patterns and need; apply phosphorus and potassium relative to annual N applied; conduct soil fertility tests every 1 to 2 years; and avoid fertilizing prior to rain.

8. Which of the following irrigation practice(s) do you consistently perform (check all that apply)?
Given in 1999 survey only. Choices: irrigate according to weather station/soil moisture sensor data; check system operating pressures; adjust irrigation clocks at least every 3 months; check irrigation systems for proper function; cycle irrigation on slopes to prevent runoff; and size nozzles for balanced precipitation on rotor systems.

Table 2. Information concerning respondents surveyed over two years at the University of California, Riverside, Turfgrass Research Conference and Field Day.

Turfgrass industry job classification	Respondents		Category		Average number of years of experience	Frequency of decision-making	
	Number	Percent	Advisor/ manager	General/ sports turfgrass		Always /usually	Rarely /never
						--------- % --------	
Public (government/public property) site management	124	41	Manager	General	13	89[z]	11
Golf course management	59	19	Manager	Sports	14	85	15
Private (commercial/residential) site management	24	8	Manager	General	11	96	4
Manufacture/sales of turfgrass-related products	18	6	Advisor	–	14	83	17
Professional consulting/horticultural advising	14	5	Advisor	–	16	93	7
Sports turfgrass management	13	4	Manager	Sports	14	92	8
Sod production	12	4	–	–	8	75	25
Turfgrass research	4	1	Advisor	–	18	100	0
Turfgrass seed production	4	1	–	–	15	75	25
Other	7	2	–	–	10	100	0
Multiple classifications	25	8	–	–	15	84	16
Total[y]	305	100			13	88	12

[z] Percentages under always/usually and rarely/never total 100% of respondents for a given turfgrass industry job classification.

[y] Includes one survey respondent that did not answer the question regarding turfgrass industry job identification.

Table 3. Influence of job and turfgrass management categories on the perception of factors limiting the adoption of best management practices (BMPs) of survey respondents.

Limiting factor	Job category[z]			Turfgrass management category[y]			All survey respondents[x]
	Advisor	Manager	χ^2	General	Sport	χ^2	
	------- *% yes*[w] -------			------- *% yes*[w] ------			*% yes*[w]
Cost/financial limitations	54	59	0.27[NS]	60	57	0.13[NS]	58
Employee skill level	25	39	2.02[NS]	38	40	0.05[NS]	37
Time	25	36	1.41[NS]	38	34	0.27[NS]	35
Availability of BMP information	32	21	1.81[NS]	21	22	0.02[NS]	21
Lack of organization/planning	14	22	0.95[NS]	26	14	3.94[*]	21
Government regulations	7	19	2.52[NS]	21	15	0.99[NS]	18
No personal authority to implement BMPs	14	20	0.50[NS]	23	14	2.18[NS]	19
BMPs not considered important	18	6	4.63[*]	9	2	3.66[+]	8
Other	11	5	1.27[NS]	4	9	2.84[+]	7

[z] Total number of respondents: 234.
[y] Total number of respondents: 206.
[x] Total number of respondents from all job classifications: 275.
[w] Respondents could check ("yes") for as many of the listed factors limiting the adoption of BMPs as applied to their situation.
[NS],[+],[*] Nonsignificant or significant at $P \leq 0.10$ or 0.05, respectively, by the chi-square test of independence in a 2x2 frequency table.

Table 4. Influence of job and turfgrass management categories on the reported frequency of consistently performing selected fertilization best management practices (BMPs) by survey respondents.

Fertilization BMP	Job category[z]			Turfgrass management category[y]			All survey respondents[x]
	Advisor	Manager	χ^2	General	Sport	χ^2	
	------- *% yes*[w] -------			------- *% yes*[w] ------			*% yes*[w]
Apply appropriate amount of nitrogen specific for turfgrass species and requirements of turfgrass use	33	60	0.89[NS]	46	83	11.95[***]	61
Apply nitrogen based on seasonal growth patterns and need	33	59	0.81[NS]	54	69	2.01[NS]	59
Apply different combinations of slow- and fast-release nitrogen sources according to seasonal growth and expected rainfall	67	52	0.26[NS]	43	66	4.51[*]	53
Conduct soil fertility tests every 1 to 2 years	0	36	1.68[NS]	23	57	10.73[***]	37
Apply phosphorus and potassium relative to annual nitrogen applied	33	25	0.10[NS]	20	34	2.44[NS]	26
Avoid fertilizing prior to rain	0	11	0.37[NS]	9	14	0.63[NS]	12

[z] Total number of respondents: 94 (data available for 1999 survey only).

[y] Total number of respondents: 91 (data available for 1999 survey only).

[x] Total number of respondents from all job classifications: 107 (data available for 1999 survey only).

[w] Respondents could check ("yes") for as many of the listed fertilization BMPs as applied to their situation.

[NS],[*],[***] Nonsignificant or significant at $P \leq 0.05$ or 0.001, respectively, by the chi-square test of independence in a 2x2 frequency table.

Table 5. Influence of job and turfgrass management categories on the reported frequency of consistently performing selected irrigation best management practices (BMPs) by survey respondents.

Irrigation BMP	Job category[z]			Turfgrass management category[y]			All survey respondents[x]
	Advisor	Manager	χ^2	General	Sport	χ^2	
	------- *% yes*[w] -------			------- *% yes*[w] ------			*% yes*[w]
Check irrigation systems for proper function	67	88	1.13[NS]	87	89	0.05[NS]	86
Adjust irrigation clocks at least every 3 months	100	69	1.36[NS]	81	49	10.67[***]	68
Size nozzles for balanced precipitation on rotor systems	33	61	0.90[NS]	67	51	2.07[NS]	62
Cycle irrigation on slopes to prevent runoff	67	58	0.08[NS]	61	54	0.41[NS]	55
Irrigate according to weather station/soil moisture sensor data	33	51	0.34[NS]	43	63	3.49[+]	49
Check system operating pressures	33	40	0.06[NS]	39	43	0.14[NS]	41

[z] Total number of respondents: 92 (data available for 1999 survey only).
[y] Total number of respondents: 89 (data available for 1999 survey only).
[x] Total number of respondents from all job classifications: 103 (data available for 1999 survey only).
[w] Respondents could check ("yes") for as many of the listed irrigation BMPs as applied to their situation.
[NS],[+],[***] Nonsignificant or significant at $P \leq 0.10$ or 0.001, respectively, by the chi-square test of independence in a 2x2 frequency table.

Table 6. Influence of job and turfgrass management categories on the perception and commitment to eight best management practices.

Perception/commitment to best management practices	Job category[z]			Turfgrass management category[y]			All survey respondents[x]
	Advisor	Manager	χ^2	General	Sports	χ^2	
	------- *% high*[w]------			----- *% high*[w]----			*% high*[w]
Importance							
Water conservation	69	83	3.53^{+}	84	81	0.35^{NS}	79
Fertility program development	81	82	0.06^{NS}	78	90	4.70*	83
Turfgrass selection	61	75	3.26^{+}	74	79	0.80^{NS}	75
Mowing program development	53	82	15.07***	81	83	0.16^{NS}	79
Integrated pest management (IPM)	58	73	3.09^{+}	70	78	1.38^{NS}	73
Protecting water sources from chemicals and fertilizers	69	77	1.04^{NS}	77	78	0.01^{NS}	75
Protecting non-target plants, animals and humans from chemicals	69	84	4.16*	84	82	0.22^{NS}	82
Protecting native habitats during construction/maintenance	53	66	2.49^{NS}	61	76	4.82*	64
Frequency of current implementation							
Water conservation	44	60	3.26^{+}	57	67	1.73^{NS}	56
Fertility program development	64	57	0.56^{NS}	48	76	15.98***	61

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Turfgrass selection	44	45	0.01^{NS}	42	53	2.31^{NS}	47
Mowing program development	39	67	10.73***	64	74	0.16^{NS}	64
Integrated pest management (IPM)	42	49	0.60^{NS}	41	65	11.86***	49
Protecting water sources from chemicals and fertilizers	56	54	0.03^{NS}	48	67	6.82**	52
Protecting non-target plants, animals and humans from chemicals	58	74	3.80*	72	78	0.76^{NS}	71
Protecting native habitats during construction/maintenance	36	48	1.68^{NS}	43	57	3.64^{+}	45
Likelihood to continue/start implementation							
Water conservation	53	73	5.85*	74	69	0.58^{NS}	68
Fertility program development	64	66	0.06^{NS}	59	79	8.37**	69
Turfgrass selection	53	55	0.06^{NS}	54	57	0.16^{NS}	55
Mowing program development	39	68	11.12***	66	71	0.47^{NS}	65
Integrated pest management (IPM)	42	58	3.23^{+}	52	69	6.02**	57
Protecting water sources from chemicals and fertilizers	64	62	0.06^{NS}	61	64	0.19^{NS}	62
Protecting non-target plants, animals and humans from chemicals	58	75	4.06*	74	75	0.01^{NS}	71

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Protecting native habitats during construction/maintenance	36	55	4.64*	50	67	5.45*	53
Difficulty level							
Water conservation	33	30	0.12NS	34	24	2.37NS	30
Fertility program development	25	22	0.18NS	22	22	0.01NS	22
Turfgrass selection	39	34	0.31NS	30	43	3.83*	33
Mowing program development	31	23	1.04NS	25	18	1.33NS	24
Integrated pest management (IPM)	39	37	0.06NS	36	38	0.02NS	37
Protecting water sources from chemicals and fertilizers	36	36	0.00NS	39	31	1.33NS	35
Protecting non-target plants, animals and humans from chemicals	28	30	0.10NS	33	25	1.50NS	30
Protecting native habitats during construction/maintenance	28	31	0.14NS	26	40	4.40*	32

[z] Total number of respondents: 256.

[y] Total number of respondents: 220.

[x] Total number of respondents from all job classifications: 305.

[w] Responses originally on a 1 to 5 scale (5 = highest) with 1 to 3 coded as "moderate/low" and 4 to 5 as "high."

NS,+,*,**,*** Nonsignificant or significant at $P \leq 0.10$, 0.05, 0.01, or 0.001, respectively, by the chi-square test of independence in a 2x2 frequency table.