



Florida's Green Industries Best Management Practices Education Program

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The Green Industries Best Management Practices (GIBMP) Educational Program was developed for commercial lawn care providers in Florida in 2002. The training covers plant selection, fertilization, irrigation, and pesticide practices as well as regulations covering the industry. Class attendees who received a score of 75% or better on the post test are awarded a "Certificate of Completion" in the BMPs. For the period from 2003 through June 2010, 6700 workers were certified in the BMPs. Pre and post test scores indicated that average knowledge increase from the training ranged from 15.9% to 23.7%. Follow up surveys indicated that attendees made some practice changes, including increased use of slow release nitrogen (N), leaving untreated buffer zones around water bodies, and increased soil testing. It is difficult at this time to assess if this program has caused a reduction in nitrate or phosphorus levels in ground or surface waters resulting from lawn and landscape fertilization.

The Green Industries Best Management Practices (GIBMP) education program was developed in 2002 (Florida Department of Environmental Protection, 2002). Legislation (State of Florida, 1999) required the Florida Department of Environmental Protection (FDEP) to provide training in BMPs for urban nonpoint source pollution, including pollution that might result from lawn care activities. The program was a partnership between FDEP, the University of Florida Institute of Food and Agricultural Sciences (IFAS), and several key industry organizations. The training was initially voluntary and many attendees were there primarily for the pesticide applicator Continuing Education Units (CEUs) provided. Beginning in 2007, a number of county and municipal fertilizer ordinances went into effect requiring certification in this training for commercial fertilizer applicators.

In 2009, legislation was passed (State of Florida, 2009) requiring that all commercial fertilizer applicators be certified in the GIBMPs in order to obtain the Limited Certificate for Urban Landscape Commercial Fertilizer Application to be required by January 2014. In addition, the legislation solidified efforts by authorizing IFAS and FDEP to cooperatively provide training and testing in urban landscape BMPs. These events have led to a rapid and large expansion in the scope and applicability of the program, with an estimated 120,000 Green Industry Professionals requiring certification in the GIBMPs by Jan 2014.

The objectives of the program were multiple, including certification of commercial horticulture, lawn care, and landscape workers in the GIBMPs and certification of county Extension faculty, qualified industry workers, and others to be trainer providers of the program. It was also envisioned that the program would provide a model training program to be used by local governments or other agencies and would raise awareness of environmental concerns relating to landscape and lawn care maintenance. The ultimate

intended impact of the program is reduction of possible nonpoint source pollution from nutrients applied to lawns and landscapes.

Materials and Methods

The training currently contains five modules, including the Program Overview, Lawn and Landscape BMPs, Fertilization BMPs, Irrigation BMPs, and Pesticide Safety BMPs.

Beginning in 2004, pre and post tests were developed to assess attendees increase in knowledge. Participants who received a minimum score of 75% on the post-test were awarded "Certificates of Completion" in the BMP training. Class evaluations were given following the trainings and the responses summarized. A follow-up survey was developed to assess change in practices as a result of the training and was sent out to approximately 400 attendees 6–12 months after the class.

Trainings were typically held at County Extension offices. Agents were given trainer instructions in "Train the Trainer" sessions. After successfully hosting two trainings and demonstrating mastery of the content, agents were certified as trainers and were qualified to deliver the program for attendee certification. In 2005, a Spanish version of the program became available. Partnerships were later expanded to include the National Estuarine Research Reserves (NERR), of which there are three in Florida. Regional Training Coordinators were hired to implement the program at these facilities.

Results and Discussion

CERTIFIED TRAINERS. As of 30 June 2010, there were 139 certified trainers, including 79 IFAS Extension agents in 39 counties. There were 4 additional IFAS trainers (2 Spanish), 13 from FDEP, local government, or the NERRs, and 39 from industry.

ATTENDANCE AND CERTIFICATION. The number of attendees of classes held at County Extension offices was fairly consistent

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Table 1. Attendance and summaries of annual results for the Green Industries Best Management Practices Education Program.

Year	No. of classes	Attendees	No. certified	Pre-test avg	Post-test avg	% Increase
2003	11	375	NA	NA	NA	NA
2004	13	530	302	66.6	81.1	21.7%
2005	12	340	278	68.0	81.8	20.3%
2006	15	340	309	71.2	84.8	19.1%
2007	23	1031	957	68.6	84.8	23.7%
2008	56	1833	1629	71.0	82.3	15.9%
2009	108	3778	3225	70.2	85.9	22.4%
Totals	238	8227	6700			
NERR						
2007	8	145	138	42.4	60.7	43.0%
2008		310	282	57.0	84.9	48.9%
2009	7	349	252	NA	80.6	NA
Totals	15	804	672			
Industry						
2007	3	47	46	73.5	87.8	19.5%
2008		363	298	66.8	84.7	26.8%
2009	18	350	327	71.4	88.7	24.2%
Totals	21	760	671			
Grand Total	274	9631	8043			

from 2003 through 2006 (Table 1). Not all county programs filed the necessary paperwork for attendees to receive the Certificate of Completion in 2004, so the number of attendees certified for that year was low. In 2007, local fertilizer ordinances in southwest Florida that required applicators to have the training resulted in an increased number of trainings and attendees. Average attendance per class increased to 45 per class in 2007 in response to the local ordinances. In 2008 and 2009, as more classes were offered, average attendance per class declined to 33 and 35, respectively.

The percentage of attendees who passed the post-test and received Certificates of Completion ranged from 82% to 93% for years 2005 through 2009. The increase in knowledge as measured by pre and post test scores ranged from 15.9% in 2008 to 23.7% in 2009 in classes given in English at the County Extension offices. The increase in scores at the NERR, where many of the classes were taught in Spanish, was 43% and 48.9%, respectively, in 2007 and 2008. Increase in knowledge from industry conducted trainings ranged from 19.5% to 26.8%. It is anticipated that the number who pass the post test to receive the Certificates may continue to decline as the ordinance requirements will bring in an influx of attendees who may have had little formal education, who do not typically attend Extension office programs, or those for whom English is not a first language.

PROGRAM EVALUATIONS. When program attendees were asked if they would recommend the BMPs to their employees and clients, many responded enthusiastically, but there was some reluctance to do so until local and pending state regulations generated a greater acceptance of the program and practices by 2008 (Table 2). In all years, a large percentage of respondents stated that the class provided them increased knowledge in the subject material, particularly in 2003, 2008, and 2009. Similarly, in 2003, 2008, and 2009, a very high number of attendees stated that they “would use or already use BMPs.”

Individual responses to the evaluations reveal a broad range of reactions to the program. For example, in 2004, one attendee stated that he would not use BMP practices in his business and in

2006, 2% of respondents were not sure if they would use them. Overall, however, positive comments were most common, with many individuals stating that they had learned new information, that the presentations were informative and enjoyable and that the overall program was good.

FOLLOW-UP SURVEY. Four sets of follow up surveys were sent to attendees. The first two were sent statewide in 2006 and 2007 and responses from both years are compiled (Table 3). There were a total of 23 responders. 72.7% were very satisfied with the BMP training. A higher percentage (63.6%) reported incorporating slow release nitrogen (N) into their fertilization programs after the class, compared to 36.4% that had used slow release sources before the class. No respondents claimed to use only quick-release N sources either before or after the program. Fifty percent of responders applied N at the recommended rates before and after the class, but there was a smaller percentage applying N at the highest rate after the class. The percentage of responders who occasionally applied fertilizer prior to heavy rainfall was reduced from 27.3% to 9.1% after the class, with no reports of application prior to heavy rain in the often or always categories. More responders reported leaving a buffer zone around water bodies after the class than prior to the training. Use of deflector shields on spreaders and soil phosphorus (P) testing also increased after

Table 2. Summary of BMP training evaluations.

Year	Will recommend BMPs	Class provided increase in knowledge	Will use or already use BMPs
2003	NA	96%	98%
2004	65%	52%	75%
2005	43%	65%	56%
2006	43%	59%	46%
2007	49%	65%	65%
2008	84%	98%	99%
2009	81%	98%	99%

the class. Number of fertilizer applications and total N applied was confounded by audience category (i.e., golf course vs. lawn care or pest control), making it difficult to draw conclusions on that impact.

Fifty-seven percent indicated that vegetative debris was kept and used (composted or mulched) on site and 88% reported that grass clippings were left on lawns (data not shown). Eighty-eight percent reported using mulches.

Questions on irrigation practices indicate that respondents

adjusted irrigation in accord with rainfall and soil moisture and that irrigation systems were calibrated and inspected regularly. There was no quantitative measure of how attending the BMP program might have changed these practices.

There were slight increases in use of IPM, better diagnostics before spraying, and keeping pesticides locked following the class. 100% of responders reported that they always mixed and loaded pesticides away from water bodies, both before and after the class.

Table 3. Results of follow up surveys sent out in 2006 and 2007. Responses are averages of both years.

2006	11					
2007	12					
Industry Segment	Pest Control	Lawn Care	Golf or Sports Turf	Other		
(%)	16.6	33.3	27.8	23.3		
Satisfaction with BMP Training	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied	
(%)	72.7	9.1	18.2	0	0	
N Source Used	Before BMP QRN	Before BMP SRN	Before BMP-Both	After BMP QRN	After BMP SRN	After BMP-Both
(%)		63.6	36.4		46.1	53.9
Annual N Turf Applied	1-2 lb/1000	3-4 lb/1000	5-6 lb/1000	7-8 lb/1000	9-10 lb/1000	11-12 lb/1000
% Before BMP	0	50	16.7	0	0	33.3
% After BMP	0	50	0	16.7	0	16.7
# Times N Applied to Shrub/Tree	1	2	3	4 or more		
% Before BMP	28.5	14.3	28.6	14.3		
% After BMP	16.6	16.6	33.2	16.6		
Fertilization Prior to Heavy Rain	Never	Rarely	Occasionally	Often	Always	
% Before BMP	54.5	18.2	27.3	0	0	
% After BMP	63.6	27.3	9.1	0	0	
Fertilization Based on Soil Test	Never	Rarely	Occasionally	Often	Always	
% Before BMP	27.3	18.2	36.4	9.1	9.1	
% After BMP	18.2	18.2	36.4	9.1	18.2	
Buffer Zones Around Water	Never	Rarely	Occasionally	Often	Always	
% Before BMP	40	0	20	20	20	
% After BMP	40	10		10	40	
Deflector Shields Used	Never	Rarely	Occasionally	Often	Always	
% Before BMP	0	11.1	0	33.3	55.6	
% After BMP	0	11.1	0	11.1	77.8	
Soil Tests Done For	pH	P	Other Nutrients	None		
% Before BMP	50	12.5	31.3	6.3		
% After BMP	44.4	22.2	31.3	5.6		
IPM Practice	Never	Rarely	Occasionally	Often	Always	
% Before BMP	0	0	9.1	27.3	63.6	
% After BMP	0	0	9.1	9.1	72.7	
Pesticide Application Based only on Diagnosis	Never	Rarely	Occasionally	Often	Always	
% Before BMP	0	9.1	9.1	18.2	63.6	
% After BMP	0	0	18.2	9.1	72.7	
Mix and Load Pesticides Away From Water Bodies?	Never	Rarely	Occasionally	Often	Always	
% Before BMP	0	0	0	0	100	
% After BMP	0	0	0	0	100	

Surveys sent to attendees of Sarasota County trainings from 2006-07 and 2008 indicate that a high percentage of attendees felt that the BMP program created a positive public image, saved money, reduced liability, and was a useful marketing tool (Tables 4, 5). 71.4% of responders reported that they regularly attended programs at the Extension office.

The Sarasota County surveys had 59 and 85 respondents, respectively, for 2006–07 and 2008. Both years reported that a high percentage (64.9% and 68.2%, respectively) of responders were very satisfied with the program. In 2008, 2.4% were dissatisfied. Reductions in fertilizing prior to heavy rainfall were reported in both years. Soil testing prior to fertilization increased in both years. Those who reported always leaving buffer zones around water bodies increased from 58.1% to 96.8% in 2006–07 and from 47.1% to 79.3% in 2008. Use of deflector shields likewise increased from 38.2% to 72.2% and from 57.6% to 73.5% in 2006-07 and 2008, respectively. Soil testing for P increased from 12.5% to 22.2% in 2006–07 and all soil testing increased in 2008. Both years’ responses indicated that there was an increase in use of slow-release N after the class (73.2% after vs. 39.3% before in 2006–07 and 65.4 vs. 38.8% in 2008) (data not shown).

Increases in use of IPM and obtaining correct diagnosis were

less than in the previous surveys. In 2006–07, IPM use increased from 63.6% to 72.7% and from 29.8% to 46.3% in 2006-07 and 2008, respectively. Correct diagnosis prior to spraying increased from 63.6 to 72.7% and from 33.3% to 37.8% in 2006-07 and 2008, respectively. In 2006–07 keeping pesticides locked increased from 74.5% to 89.1% and mixing and loading pesticides away from water bodies rose from 89.1% to 100%. In 2008, keeping pesticides locked increased from 76.2% to 81.9%, while mixing away from water bodies increased only from 76.2% to 78.6%.

As in the previous survey, responders indicated that irrigation was adjusted in accord with rainfall and soil moisture and that irrigation systems were calibrated and inspected regularly. Again, there was no quantitative measure of how attending the BMP program might have changed these practices.

While it is too early to assess changes to water quality in response to this educational program, it is clear that the industry has noted the importance of complying with the GIBMPs. Following initial reluctance on the part of some to embrace the concepts or promote the program, the regulatory events that have unfolded at both local and state levels have led to more widespread acceptance of the practices and the program in general. Additionally, as public awareness of the program has grown, “GIBMP Certi-

Table 4. Results of follow-up survey sent to Sarasota County attendees in 2006–07.

Respondents	59				
Industry Segment	Pest Control	Lawn Care	Golf or Sports Turf	Other	
(%)	10.5	35.1	3.5	50.9	
Satisfaction with BMP Training	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied
(%)	64.9	35.1	0	0	0
Fertilization Prior to Heavy Rain	Never	Rarely	Occasionally	Often	Always
% Before BMP	35.1	28.1	28.1	7.0	1.8
% After BMP	63.2	28.1	8.8	0	0
Fertilization Based on Soil Test	Never	Rarely	Occasionally	Often	Always
% Before BMP	35.7	19.6	21.4	10.7	12.5
% After BMP	16.1	16.1	21.4	23.2	23.2
Buffer Zones Around Water	Never	Rarely	Occasionally	Often	Always
% Before BMP	48.1	87.5	100	85.7	58.1
% After BMP	81.5	12.5	0	57.1	96.8
Deflector Shields Used	Never	Rarely	Occasionally	Often	Always
% Before BMP	20.0	10.9	10.9	20.0	38.2
% After BMP	5.6	1.9	0	20.4	72.2
Soil Tests Done For	pH	P	Other Nutrients	None	
% Before BMP	52.7	16.4	32.7	40.0	
% After BMP	67.3	29.1	50.9	21.8	
IPM Practice	Never	Rarely	Occasionally	Often	Always
% Before BMP	9.3	5.6	18.5	25.9	40.7
% After BMP	1.9	0	3.7	33.3	61.1
Pesticide Application Based Only On Diagnosis	Never	Rarely	Occasionally	Often	Always
% Before BMP	1.9	1.9	16.7	27.8	51.9
% After BMP	3.7	0	9.3	20.4	66.7
Mix and Load Away From Water Bodies	Never	Rarely	Occasionally	Often	Always
% Before BMP	0	0	3.6	7.3	89.1
% After BMP	0	0	0	0	100

Table 5. Results of follow-up survey sent to Sarasota County attendees in 2008.

Respondents	85					
Industry Segment	Pest Control	Lawn Care	Golf or Sports Turf	Other		
(%)	14.0	52.3	5.8	27.9		
Satisfaction with BMP Training	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied	
(%)	68.2	29.4	NA	2.4	0	
N Source Used	Before BMP QRN	Before BMP SRN	Before BMP-Both	After BMP QRN	After BMP SRN	After BMP-Both
(%)	8.2	38.8	45.9	4.9	65.4	23.5
Fertilization Prior to Heavy Rain	Never	Rarely	Occasionally	Often	Always	
% Before BMP	22.4	27.1	27.1	14.1	1.2	
% After BMP	48.8	26.8	13.4	2.4	0	
Fertilization based on Soil Test	Never	Rarely	Occasionally	Often	Always	
% Before BMP	23.5	21.2	29.4	15.3	4.7	
% After BMP	15.9	7.3	39.0	20.7	12.2	
Buffer Zone Around Water	Never	Rarely	Occasionally	Often	Always	
% Before BMP	8.2	9.4	9.4	17.6	47.1	
% After BMP	6.1	0	1.2	6.1	79.3	
Deflector Shields Used	Never	Rarely	Occasionally	Often	Always	
% Before BMP	11.8	3.5	5.9	5.9	57.6	
% After BMP	2.4	0	2.4	4.8	73.5	
Soil Tests Done For	pH	P	Other Nutrients	None		
% Before BMP	59.5	25.0	31.0	22.6		
% After BMP	69.4	31.8	37.6	15.3		
IPM Practice	Never	Rarely	Occasionally	Often	Always	
% Before BMP	9.5	7.1	16.7	27.4	29.8	
% After BMP	3.7	1.2	11.0	26.8	46.3	
Pesticide Application Based Only On Diagnosis	Never	Rarely	Occasionally	Often	Always	
% Before BMP	4.8	2.4	16.7	28.6	33.3	
% After BMP	4.9	2.4	20.7	20.7	37.8	
Mix and Load Away From Water Bodies	Never	Rarely	Occasionally	Often	Always	
% Before BMP	2.4	0	1.2	1.2	76.2	
% After BMP	2.4	0	0	0	78.6	

field” has become a marketing tool. Support of the program from industry leaders statewide has helped to enhance participation and compliance among the industries.

In terms of changing industry behavior, there are numerous indicators that participants have incorporated BMPs that may have a direct impact on water quality into their work practices. Some of these that directly impact water quality include:

- Decreased fertilizer application prior to heavy rainfall
- Increased use of non-fertilized buffer zones around water bodies
- Increased use of deflector shields on spreaders
- Increased soil testing, particularly for soil P
- Proper calibration of fertilizer and pesticide application equipment

There were less clear results of behavior change on fertilizer application frequency, timings, and rates from the survey. Smaller changes were seen in adoption of IPM pesticide BMP practices in all years.

Personal communication with numerous attendees over the

years indicated that the majority of the program attendees welcomed the information provided and that many were previously unaware of many of the potential implications of their activities on quality of ground and surface waters. Many attendees indicated that they had not considered the watershed concept in correlation with their activities. The majority were willing to be seen as positive environmental forces and to make needed changes in practices to be in compliance.

This program has undergone modifications as needed to accommodate the changes in educational requirements mandated by local or state regulations. Secured systems have been developed for certifying and licensing fertilizer applicators. Infrastructure for grading tests and issuing certificates has been expanded to accommodate current and future needs of the program. Other states implementing similar GIBMPs have looked to Florida as a model for educational content and could perhaps also follow the guidelines developed for delivery of a regulated educational program such as this one.

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