

## Simple Lawn Irrigation Measurement Training for Master Gardeners and Homeowners

### Abstract

For municipalities across Oklahoma and the southern United States, maximum domestic water usage occurs during July and August, and up to 50% of this water is used outdoors. There is a need to conserve water resources through reduced outdoor irrigation. The objective of the Extension project described here was to teach Oklahoma Master Gardeners a simple technique to effectively measure lawn irrigation output through simple irrigation audit workshops. Seventy-six Master Gardeners participated in three simple irrigation audit workshops across Oklahoma. The results suggest that simple irrigation workshops can significantly increase Master Gardener knowledge of home lawn irrigation system output.

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## Introduction

Outdoor water conservation is important for municipalities throughout the United States. As urban and suburban sprawl increases in Oklahoma, large areas of previously non-irrigated pasture and/or croplands are being converted to irrigated homeowner and commercial landscapes. The consequential increase in irrigated lawn areas across Oklahoma will result in increased landscape water use. There is a need to conserve Oklahoma water resources through reduced outdoor water use.

## Outdoor Water Use in Oklahoma

Oklahoma City currently treats about 341 million liters of water per day to serve approximately 0.5

million people, with historical peak consumption of 715 million liters per day, which occurred in July 1999 (City of Oklahoma City, 2009). Water use in Oklahoma City is expected to increase by at least 2% per year (City of Oklahoma City, 2009). The City of Tulsa also treats about 340 million liters of water per day to serve approximately 0.5 million people, with a historical peak daily use at 719 million liters per day, which occurred in July 1999 (City of Tulsa, 2009). For municipalities across Oklahoma, maximum domestic water usage occurs during the months of July and August. This is also the time of year that Oklahoma citizens are likely to have the highest demand for water to irrigate turfgrass and landscape plants. Water use tends to increase with the sophistication of lawn irrigation equipment (Lyman, 1992; Renwick & Archibald, 1998; Cavanagh, Hanemann, & Stavings, 2002; Syme, Shao, Po, & Campbell, 2004). Those with in-ground sprinkler systems use 35% more outdoor water, and if the system has an automatic timer, they use 47% more water than homeowners without an in-ground sprinkler system (Mayer et al., 1999). Therefore, increasing citizen knowledge of proper home lawn irrigation practices, including measurement of irrigation system output, is important for providing acceptable quality yards while conserving water resources.

## Oklahoma Master Gardeners

The Oklahoma State University (OSU) Master Gardener Program is a voluntary educational program designed to meet gardening needs in the community. Its specific aim is to provide information and technical assistance in the areas of gardening and landscape horticulture through the use of qualified and certified volunteers. Applicants receive up to 60 hours of formal training from OSU Extension professionals in plant science, horticulture, and gardening. After training is completed, each Master Gardener volunteers at least 40 hours of assistance to their OSU County Extension Office. As part of their volunteer service, Master Gardeners assist their county Extension educator in responding to horticultural questions from homeowners.

## Lawn Irrigation

One of the most common lawn extension questions received from homeowners during the summer is "How long should I irrigate my lawn," but the volume of applied irrigation water cannot be directly measured in units of time. In order to answer the question, "How long should I irrigate my lawn," one needs to determine the irrigation system output by volume. For precipitation and irrigation, total volume is most commonly expressed in terms of total inches, and the irrigation volume applied over time can be determined as inches per hour. Typically, this can be achieved through a professional irrigation system audit. Kopp, Cerny-Koenig, and Lopez (2007) increased professional and large landscape water user knowledge of proper turf irrigation and professional irrigation audits through a series of full-day workshops.

While a professional irrigation audit takes into account several complicated factors and mathematical calculations, a "simple" irrigation audit can be performed by any homeowner with a basic knowledge of mathematics. Although the simple irrigation audit is not as precise or accurate as a professional irrigation audit, the "simple" process can give every homeowner a good estimate of his or her irrigation output in inches per hour. It was hypothesized that simple irrigation audit training could be an effective tool to teach citizens how to obtain an estimate of irrigation output in inches per hour. Therefore, the objective of the Extension project described here was to teach Oklahoma Master

Gardeners a simple technique to effectively measure lawn irrigation output through simple irrigation audit workshops.

## Simple Irrigation Audit Workshops

Three simple irrigation audit workshops were completed across Oklahoma. The 4-hour workshops were conducted in Oklahoma City (Oklahoma County), Tulsa (Tulsa County), and Claremore (Rogers County), Oklahoma. The Oklahoma County workshop had 22 participants, the Tulsa County workshop had 27 participants, and the Rogers County Workshop had 27 participants, for a total of 76 Master Gardener participants. The workshop format included a 2.5-hour classroom portion and a 1.5-hour outdoor demonstration. The classroom presentation covered key aspects of outdoor water use, turfgrass and landscape plant selection and management, lawn irrigation practices, and lawn irrigation system auditing. The outdoor presentation was a step-by-step, hands-on demonstration of the simple lawn irrigation audit procedure.

Pre-workshop surveys were given to each participant at the beginning of the workshop prior to any presentations to assess prior subject knowledge. After completing the workshop, participants were asked to complete a post-workshop survey to assess participant gain in knowledge and workshop effectiveness. At the end of the workshop, participants were given nine irrigation water measuring cups and were instructed to complete the simple irrigation audit in their home lawns. After completing the simple irrigation audits in their home lawn, participants were asked to report their irrigation output in inches per hour to the county Extension educator. Participants were also asked to note the uniformity of their irrigation system by measuring the differences in the volume of water collected in each of their measuring cups.

## Statistical Analysis

The surveys collected both qualitative and quantitative data through the use of descriptive survey questions, Likert-type scale questions (where 1 = strongly disagree, 2 = disagree, 3 = uncertain, 4 = agree, and 5 = strongly agree), and open-ended questions where participants were able to give open, non-guided responses. Quantitative analysis was completed using SAS 9.1 (SAS Institute Inc., Cary, NC). The PROC SURVEYFREQ procedure was used to analyze pre-survey response data. The PROC GLM procedure was used to determine the analysis of variance (ANOVA) between pre-survey and post-survey results among the three counties. There was no county x survey interaction for 10 of 12 survey questions, and those results were pooled and presented accordingly. When the criteria for ANOVA were met at  $P=0.05$ , mean separation tests were performed using Duncan's multiple range test at the 0.05 significance level. Qualitative data was analyzed similar to the methods employed by Moss (2011), which were based on mixed-method procedures described by Creswell and Plano-Clark (2007).

## Results and Discussion

All participants who completed the surveys at the three locations were Master Gardeners. In Oklahoma County, 22 participants completed both the pre- and post-survey. In Tulsa County, 27

participants completed the pre-survey, while 26 completed the post-survey. Twenty-six participants completed both the pre- and post-survey in Rogers County. Also, all participants who completed the post-surveys also reported back their individual simple irrigation audit results.

Eighty-percent of respondents watered their lawn during the summer, while 65% stated they believed most Oklahoman's irrigate their landscape during the summer (Table 1). Of those who water their lawn during the summer, 49% used an automatic irrigation system, 48% used a water hose with a sprinkler attached, and 3% used a water hose to water by hand. On the pre-survey, respondents stated they watered their yard on average 2 days per week in Oklahoma and Tulsa Counties and 1 day per week in Rogers County. Regardless of county, the average respondent lawn watering time was 40 minutes per irrigation event. However, only 18% of all respondents stated they knew how much water they applied to yard during each irrigation event (Table 1).

**Table 1.**

Lawn Irrigation Perceptions and Practices of Oklahoma Master Gardeners Participants in Three Counties Prior to Attending a Simple Irrigation Audit Training Workshop

| Survey Statement   | Oklahoma     |      | Tulsa |      | Rogers |      | Average |      |
|--|--------------|------|-------|------|--------|------|---------|------|
|  | ------%----- |      |       |      |        |      |         |      |
|  | Yes          | No   | Yes   | No   | Yes    | No   | Yes     | No   |
| I water my lawn during the summer.   | 91 a         | 9 b  | 85 a  | 15 b | 65 a   | 35 a | 80 a    | 20 b |
| I believe most Oklahoma homeowners water their lawn during the summer.   | 73 a         | 27 b | 67 a  | 33 a | 58 a   | 42 a | 65 a    | 35 b |
| I irrigate my lawn during the summer and I know approximately how much water I apply to the lawn in inches per hour. | 20 b         | 80 a | 30 b  | 70 a | 4 b    | 96 a | 18 b    | 82 a |
| Means followed by the same letter within a row for an individual county are not significantly different at P=0.05.   |              |      |       |      |        |      |         |      |

After attending the workshop, participants changed from "uncertain" to "agree" that they could define the phrase "simple lawn irrigation audit" (Table 2). Also, workshop participants changed from "disagree" to "agree" that they knew how to conduct a simple lawn irrigation audit (Table 2).

Similarly, 85% responded "yes" when asked if they believed that performing the simple irrigation audit was relatively easy, and 90% responded "yes" when asked if they feel more comfortable about knowing how much to water their yard each week. These results suggest that the workshop was effective for increasing Master Gardener knowledge and ability to perform the simple irrigation audit for home lawns. Master Gardener participants "disagreed" with the statement "I believe watering the lawn during the summer is a waste of water" before and after attending the workshop (Table 2). Similarly, participants were "uncertain" both before and after attending the workshop for the statements "I believe there should be laws or restrictions for lawn watering during the summer in Oklahoma" and "I believe there should not be laws or restrictions for lawn watering during the summer in Oklahoma" (Table 2).

**Table 2.**

Knowledge and Perceptions of Oklahoma Master Gardener Participants Before and After Attending a Simple Irrigation Audit Training Workshop†

| Statement   | Pre-survey |      | Post-survey |      |
|---|------------|------|-------------|------|
|   | Mean       | SD   | Mean        | SD   |
| I can clearly define the meaning of the phrase "simple lawn irrigation audit".  | 2.72       | 0.99 | 4.18***     | 0.67 |
| I know how to conduct a simple lawn irrigation audit  | 2.41       | 0.99 | 4.32***     | 0.62 |
| I believe watering the lawn during the summer is a waste of water.  | 2.37       | 1.12 | 2.35 NS     | 1.07 |
| I believe there should be laws or restrictions for lawn watering during the summer in Oklahoma.   | 2.80       | 1.26 | 3.22 NS     | 1.27 |
| I believe there should not be laws or restrictions for lawn watering during the summer in Oklahoma.   | 3.05       | 1.30 | 2.84 NS     | 1.27 |
| † Means are based upon a five-point Likert-type scale where 1 = strongly disagree, 2 = disagree, 3 = uncertain, 4 = agree, and 5 = strongly agree.<br>*** indicate significance at the P = 0.0001 level and NS indicates no significant difference between pre-survey responses and post-survey responses within a row. |            |      |             |      |

After attending the workshop, participants "agreed" with the statements "I believe a simple irrigation audit can help me to conserve water while irrigating my lawn during the summer," "I believe a simple irrigation audit can help me to save money while irrigating my lawn during the summer," and "I believe a simple irrigation audit can help me to protect the environment while irrigating my lawn during the summer" (Table 3). Respondents were also asked to respond to the open-ended

statement "I believe a simple lawn irrigation is important for water conservation in Oklahoma because." The most typical responses included "to not waste water," "it can save water/money and plants," "it makes one more aware of wasted water," "you can be more accurate on the amount of water used," "to conserve water," "it will save water, money, and time," "too many people waste clean, fresh water," "it is more economical," "time and cost," "it cuts down on waste," "water is a precious commodity," and "knowledge can be obtained as to amount of frequency of water used to irrigate for needs of plants in landscape and consequences of over watering."

**Table 3.**  
Perceptions of Oklahoma Master Gardener Participants After Attending a Simple Irrigation Audit Training Workshop†

| Statement  | Post-survey |      |
|--|-------------|------|
|  | Mean        | SD   |
| I believe a simple irrigation audit can help me to conserve water while irrigating my lawn during the summer.                                      | 4.38        | 0.52 |
| I believe a simple irrigation audit can help me to save money while irrigating my lawn during the summer.  | 4.31        | 0.58 |
| I believe a simple irrigation audit can help me to protect the environment while irrigating my lawn during the summer.                             | 4.34        | 0.63 |
| † Means are based upon a five-point Likert-type scale where 1 = strongly disagree, 2 = disagree, 3 = uncertain, 4 = agree, and 5 = strongly agree. |             |      |

There was no county by audit results interaction, and the average irrigation output from all respondents was 0.65 inches per hour. In the workshop pre-survey, only 18% responded "yes" to the statement "I irrigate my lawn during the summer and I know approximately how much water I apply to my lawn in inches per hour." After the workshop, 100% of participants conducted the simple irrigation audit in their home lawns and reported their lawn irrigation output results in inches per hour. Therefore, the simple home irrigation audit workshop significantly increased participant knowledge of their home lawn irrigation output in inches per hour from 18% to 100% (P = 0.0001). Last, after the workshop, 100% of respondents indicated they would be willing and able to teach homeowners in their respective counties the simple irrigation audit technique.

### Conclusions

The results of the study reported here suggest that simple irrigation workshops can increase Master Gardener knowledge of home irrigation system output. Prior to attending the workshop, participants did not have a clear understanding of how to measure home lawn irrigation output. However, 80% of participants stated they watered their lawns during the summer with an average watering time of 40 minutes per irrigation event. In Oklahoma and Tulsa counties, participants stated they watered an

average of 2 days per week, or a total of 80 minutes per week. Based on the average irrigation system output of 0.65 inches per hour, respondents watered on average 0.87 inches of water per week. However, irrigation audit results ranged from 0.18 to 2.5 inches per hour. The majority of lawns in Oklahoma are bermudagrass, which has an average irrigation requirement of approximately 1 inch of water per week during the summer.

Using these data, Master Gardener participants can teach homeowners to alter their irrigation practices to apply the proper quantity of water to their lawns during the growing season. Future work should track Master Gardener's adoption of the simple irrigation audit practices over the long-term and should assess the effectiveness of Master Gardeners in extending the information to additional homeowners in their counties.

## References

- Cavanaugh, S. M., Hanemann, W. M., & Stavings, R.N. (2002). *Muffled price signals: Household water demand under increasing-block prices*. FEEM Working Paper No. 40.2002.
- Creswell, J. W., & Plano Clark, V. L. (2007). *Designing and conducting mixed methods research*. Thousand Oaks, CA: SAGE Publications, Inc.
- City of Oklahoma City. (2009). *Oklahoma City Utility Services*. Retrieved from: <http://www.okc.gov/Water/>
- City of Tulsa. (2009). *City of Tulsa Utility Services*. Retrieved from: <http://www.cityoftulsa.org/CityServices/Water/>
- Kopp, K. L., Cerny-Koenig, T., & Lopez, R. (2007). Educating large landscape water users. *Journal of Extension* [On-line], 45(1) Article 11AW6. Available at: <http://www.joe.org/joe/2007february/iw6.php>
- Lyman, R. A. (1992). Peak and off-peak residential water demand. *Water Resources Research*, 28, 2159-2167.
- Mayer P. W., DeOreo, W. B., Opitz, E. M., Kiefer, J. C., Davis, W. Y., Dziegielewski, B., & Nelson, J. O. (1999). Residential end uses of water. Denver, CO: American Water Works Association.
- Moss, J. Q. (2011). An undergraduate summer research and mentorship experience for underrepresented students in the agricultural sciences. *NACTA Journal*, 55, 32-37.
- Renwick, M. E., & Archibald, S. O. (1998). Demand side management policies for residential water use: who bears the conservation burden? *Land Economics*, 74, 343-359.
- Syme, G. J., Shao, Q., Po, N., & Campbell, E. (2004). Predicting and understanding home garden water use. *Landscape Urban Planning*, 68, 121-128.

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