January 3, 2006

2005 Lawn Irrigation Experiment

This experiment was undertaken by Colorado Master Gardener, Richard Himmel, and was sanctioned by the Colorado State University Cooperative Extension Offices in Adams County. The purpose of the experiment was to determine the efficacy for residential homeowners to apply scientific methods to summer lawn irrigation. Could they use precipitation rate information for their irrigation systems along with Front Range historical ET to determine the applicable run times for their systems, apply those run times to their watering regimen with the goal of conserving water, saving money and having a green lawn?

APPROACH: In June 2005, 8 residential homes in the Hunters Glen subdivision of Thornton were contacted and agreed to be part of a 2-month (July and August) experiment to conserve water, promote a healthy, green lawn and save money. The experiment would also determine the efficacy and usability of a scientific method to measure the precipitation rate of each homeowner's irrigation system and to convert those rates to run time (in minutes) for each zone. Water savings were to be compared to each Homeowner's water usage during the same period in 2004 and previous years. The cooperation and assistance of the City of Thornton was used to access residential water records to determine past water consumption.

Each homeowners' irrigation system was audited for its respective precipitation rate and the figures were recorded. A chart was developed that converted those rates to run time based upon historic evapotranspiration (ET) along the Front Range for each of the irrigation months which include May – October (Atchs 1 & 2). Each Homeowner was instructed how to use the ET and precipitation rate figures to determine run time for each month based on the audit of their system.

Precipitation rate is the rate at which an irrigation system delivers water to the lawn, measured in inches per hour. Evapotransporation (ET) is the amount of water given up by a plant through evaporation and normal transpiration processes, measured in inches per week. ET varies by temperature, wind, humidity, direct sunlight and shade. For plants to remain healthy, the amount of ET given up by a plant must be replaced by an equivalent amount of supplemental irrigation.

Homeowners' were asked to adjust their irrigation systems to comply with the run times derived from the chart; and, to adjust the times based upon changes in ET throughout the summer months. If a summer rainstorm provided water to the lawn, the homeowner was asked to adjust the watering schedule to consider the storm water. Homeowners were also asked to water after 9pm and before 6am. If unable to do so, they were requested to water when the sun was down or very low in the sky. No further contact was required with participating Homeowners as they were assumed to have conscientiously adjusted their systems accordingly.

FACTORS AFFECTING THE OUTCOME: Homeowner systems were not always in optimum condition. They were evaluated "as is" and were not optimized as part of the audit. Some homeowners' had sprinkler zones that significantly overlapped adjacent zones; others had broken or malfunctioning sprinkler heads; some zones were obstructed by yard structures; and some participants had zones that were inoperative or turned off due to leaks or broken lines and one homeowner did not participate.

The summer of 2004 was significantly cooler and wetter than was 2005. Average temperatures were only 78.5F and precipitation measured 6.13 inches, compared to 84.5F and precipitation of only 1.7 inches respectively in 2005. The 2002 and 2003 summers were more representative of the temperatures and precipitation experienced in 2005; and therefore are more comparable for the purposes of this experiment.

Water restrictions in Hunters Glen went into effect in 2003 and many residents continued using those guidelines in succeeding years even when watering restrictions became voluntary.

The age and options of individual irrigation controllers varied widely among participating homeowners. Many had original systems that did not permit adjustments below 5 or 10-minute increments. However, most systems allowed more than one watering cycle on a given day allowing the second run to approach within a couple of minutes of the desired run time. Homeowners were encouraged to error on the low side of a zone's run time for conservation reasons.

Previous years may have resulted in erratic watering of individual lawns due to the uncertainty associated with not knowing how much water the lawn needed as opposed to how much water was allowed through watering restrictions. Either uncertainty could result in a brown, patchy and highly stressed lawn. As a result, homeowners were inclined to water to the limit of their authorization and accept whatever result the lawn produced.

In the month of August, a week of temperatures over 90 degrees caused ET to increase beyond that provided by the original chart and a supplemental letter was provided to each participant to adjust their run times accordingly (Atch 3).

RESULTS: Water usage for the 2005 season did not compare favorably to the usage of 2004. Only 2 participants experienced a reduction in the amount of water used by 1,000 and 2,000 gallons, respectively. The average increase for each of the 7 participants was 7,140 gallons (One homeowner did not participate and was excluded from the results). This was not a desired outcome considering the purpose of the experiment was to demonstrate that a scientific approach to irrigation would conserve water and save money. However, when compared to the years 2003 and earlier, which were more comparable in temperature and precipitation to the summer of 2005, the results were quite favorable.

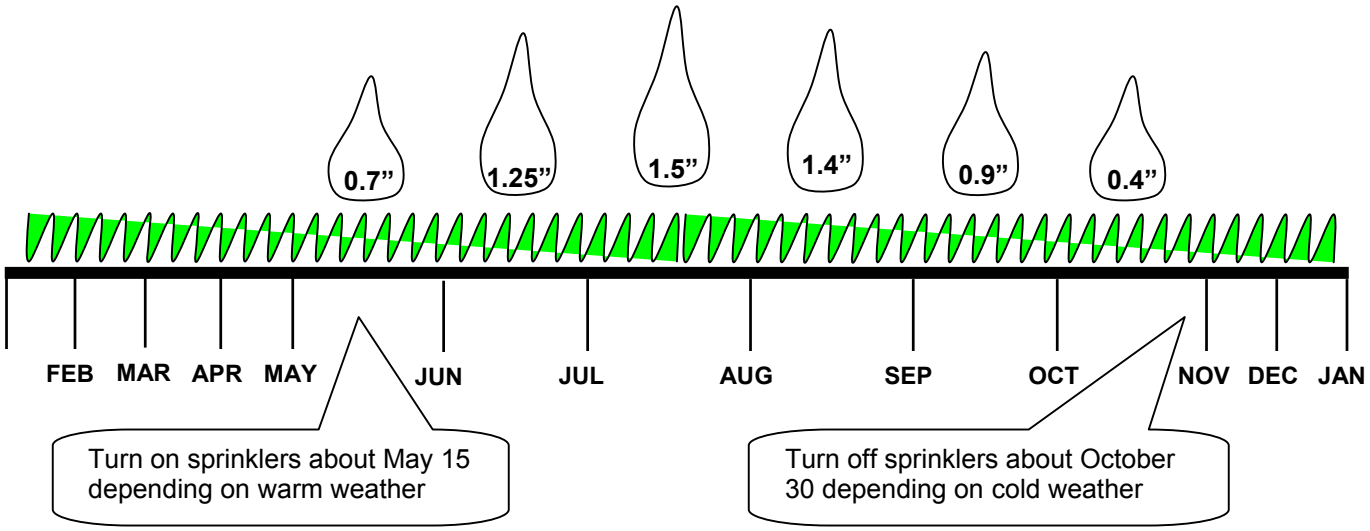
Compared to 2003 usage, each of the 7 participating homeowners experienced on average, a 12,000-gallon savings in water usage during the period, which equated to an average savings of $18.54 per month. Comparison of water consumption for the same period in 2001, and 2002 to that in 2005 revealed some reductions but none were as dramatic as those in 2003. This variation is likely due to the uncertainty surrounding how much water the lawn needed versus how much was allowed through water restrictions. In the absence of definitive guidance from municipal authority, homeowners' irrigation practices relied on their judgment up to the limit of water restrictions and lawn condition. As a result of the methods employed in this experiment, all homeowners experienced a reduction in water consumption. They all had a savings on their water bills and maintained a green lawn throughout the summer.

CONCLUSION: Residential homeowners can significantly improve water conservation during the irrigation season by using a scientific method to determine the precipitation rate of their irrigation systems. Using evapotranspiration information provided by Colorado State University, Denver Water and other municipal sources and a simple conversion chart, homeowners can establish irrigation run times that correspond to the <u>needs</u> of their lawns and thereby conserve water and the cost of irrigation. The challenge will be to educate willing homeowners in the methodology of determining their systems precipitation rate and then providing them with a run time chart to adjust their system during the summer months.

Determining Precipitation Rate

1. Place 6 IDENTICAL, straight-sided, flat-bottom containers between sprinkler heads in a zone
2. Turn on the sprinklers for exactly 10 minutes
3. Pour all the water into a single container
4. Use a ruler to measure the depth of the water in the container – this is the precipitation rate for one hour in inches
5. Write down the number near your controller for future reference
6. Repeat Steps 1 thru 5 for each irrigation zone

Weekly Lawn Watering Requirements – May thru October
Historic Evapotranspiration (ET)



Atch 1

For more information contact the Colorado State University Cooperative Extension Office in Adams County at: 303 637-8100

May 2005

Sprinkler Run Time Table

(Minutes PerWeek)

	Water To Be Applied (Inches Per week)					
	May 0.7	June 1.3	Jul 1.5	Aug 1.4	Sep 0.9	Oct 0.4
Precipitation Rate For Each Zone	**Sprinkler Run Time (Minutes Per Week)**					
1/4	168	312	360	336	216	96
1/2	84	156	180	168	108	48
3/4	56	104	120	112	72	32
1	42	78	90	84	54	24
1 1/4	34	62	72	67	43	19
1 1/2	28	52	60	56	36	16
1 3/4	24	45	51	48	31	14
2	21	39	45	42	27	12
2 1/4	19	35	40	37	24	11
2 1/2	17	31	36	34	22	10
2 3/4	15	28	33	31	20	9
3	14	26	30	28	18	8

Select the precipitation rate for your sprinkler zone along the left column and move right until you are in the column of the amount of water to be applied. This is the number of minutes to run your sprinkler. Example: Your sprinkler applies water at 1 1/2 inches per hour and you want to apply 0.7 inches. It takes 28 minutes per week to apply this amount.

The ground will absorb the water better if you split your time into equal parts. In the above example, water all zones for 1/2 their run time then repeat. Deep watering is preferable to shallow watering as it allows water to penetrate the root zone to greater depth. For more information go to www.ext.colostate.edu and select Fact Sheet 7.199.

Atch 2

July 18, 2005

Dear Survey Participant,

If you have been wondering whether or not our lengthy string of days over 90 degrees has effected your lawn the answer is, yes. However, it isn't cause for concern if your lawn doesn't exhibit signs of stress such as "footprinting" or have a blue-purple color prior to each watering. Dr. Kloski, from CSU has repeatedly advised that a very nice lawn can be maintained on 80% of ET. With no changes to your watering schedule at an ET of 1.5" per week, you are at 86% of ET and your lawn should be doing fine with the hot weather. Nevertheless, if you are concerned about its appearance or if it exhibits signs of stress, you may want to increase the amount of water you are currently applying for a short period until the daily temperature drops into the high 80s on a daily basis with just an occasional peak into the low 90s.

Denver Water has posted on its web site: www.water.denver.co.gov, that the July ET rate is 1.75" per week. If you choose to increase your watering time, the formula for determining those times is:

$$\text{Run Time Minutes} = \frac{\text{ET}}{\text{Precipitation Rate}} \times 60$$

You may also use the table below for applicable run times:

Precip Rate (Inches)	Run Time	Precip Rate (Inches)	Run Time
1/2	210	1 1/2	70
3/4	140	1 7/8	56
1	105	2	53
1 1/4	84	2 1/4	47
1 1/3	81	2 1/2	42
1 3/8	76		

If you have any questions feel free to contact me at 303 453-1975 and thank you for your participation.

Sincerely yours,

Rich Himmel
Master Gardener
CSU Cooperative Ext., Adams County

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