Evapotranspiration and Precipitation in Kansas: Part II

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In my last article I described some of the fundamental aspects of evapotranspiration (ET) and how climate and landscape factors (vegetation type and soil water content) determine rates of ET. Evapotranspiration as you recall is the sum of water lost to the atmosphere from transpiration from plants and evaporation from the soil. ET is important because along with gains from precipitation it determines the irrigation requirements in turfgrass. I also discussed the extreme variability in Kansas' weather from year to year and how "average" weather conditions don't necessarily mean that much when estimating ET in any given year. In this article I want to touch on another source of variability in ET in Kansas along with some more practical aspects of estimating ET in turfgrasses.

The "continental climate" in Kansas is highly variable not only from one year to the next, but also from the east to the west. For example, average annual precipitation ranges from 45 inches in the humid southeast to around 15 inches in the semi-arid west. However, potential ET is the opposite and is significantly higher in western Kansas primarily because of low relative humidity and high winds. Before I proceed further, let me refresh your memories on a couple of definitions. Potential ET is defined as the maximum theoretical amount of ET from a surface given the existing climatic conditions, and can be calculated from weather station data. Another term that is coming more into use is reference ET. Reference ET is similar to potential ET except that it is adjusted for various "crops" (turfgrasses, for example). Reference ET is closely related to potential ET, so for the purposes of this discussion let's stay with potential ET. Average potential ET ranges from about 56 inches per year in eastern Kansas to nearly 68 inches per year in the western part of the state. This is important because irrigation requirements are dependant upon the amount of potential ET minus the amount of precipitation received at any given location. Because precipitation is lower and potential ET is higher in western Kansas, irrigation requirements will likely be greater in that part of the state.

To illustrate the point let's look at actual climatic data from 4 locations in opposite corners of the state, Parsons (southeast), Powhattan (northeast), Colby (northwest), and Garden City (southwest). Table 1 shows average summertime (June to August) precipitation and potential ET (PET) over the period from 1990 to 2001. Notice the lower amounts of precipitation in Colby (10.63 inches) and particularly Garden City (6.95 in) compared with Parsons (11.73 in) and Powhattan (13.12 in). Conversely, summertime PET was 7 to 8 inches greater in the west than in the east. The column labeled "deficit" is simply the difference in inches between precipitation and potential ET and potential ET and gives an indication of the amount of irrigation that would be needed during the summer to supply the demands of PET. As you can see, the deficit in the west is nearly 2 to 3 times greater than in the east. Note: these values are not actual amounts that you should plan for irrigation of your turf in an average summer because actual irrigation amounts may vary considerably by location, turf species, and the weather during any given summer. But these values do give an indication of the variability in precipitation, potential ET, and irrigation demands across the state of Kansas.

So what about the more practical aspects about using ET as an indicator of irrigation needs in turfgrasses? An excellent article on ET and irrigation in turfgrasses appeared in the November 2002 issue of Golf Course Management by someone most of you know or know of, and that is our own Dr. Jack Fry. I will not attempt to go into the detail he did in that article. For those who

may be interested, Dr. Fry's article gives a great description of estimating irrigation needs for your turfgrass based on ET and precipitation amounts. My comments are more for how you can obtain accurate data to plug into the models and equations to estimate ET.

First, you will need access to accurate weather data. A convenient option which is primarily for golf course superintendents is to have your own weather station to obtain accurate measurements of precipitation, solar radiation, relative humidity, air temperature, and windspeed at your location. Placement of your weather station is crucial. Do not place the weather station in areas that are sheltered from the wind, shaded by trees or buildings, or in a microclimate that may affect air temperatures or even relative humidity or precipitation. These locations will be unrepresentative of your site and will result in inaccurate weather data and estimates of irrigation needs. In addition, environmental sensors on weather stations need calibrated every one or two years, so routine maintenance is important for obtaining accurate data. Some added benefits of having a weather Service (NWS) records; you may find consistent differences because of local topography; 2) Soil temperatures may affect timing of pesticide applications (for example, preemergance crabgrass control); and 3) You can observe the concurrence of disease outbreaks with specific environmental conditions.

Obviously it is not possible for all of you to have weather stations at your specific sites. Weather information may be available from local NWS websites, NOAA weather radio, or perhaps a public weather station in your community. The Kansas State Weather Data Library (found at website: <u>http://www.oznet.ksu.edu/wdl/</u>) contains a wealth of information on weather and ET, precipitation and other weather data in Kansas, and also lists the website addresses of NWS offices in Kansas (Topeka, Kansas City, Wichita, Goodland, and Dodge City). The Office of Kansas Agricultural Statistics puts out a weekly publication called "Kansas Crop Weather" although that data may be a bit dated by the time you receive it. Finally, Dr. Fry's article in GCM (Nov 2002) lists several turf ET calculator websites that may be helpful for turfgrass managers in estimating irrigation needs.

I wanted to make a final comment on precipitation. Often such tasks as irrigation timing or fertilizer and pesticide applications may depend upon the possibility of precipitation in the near future. Therefore, it is important to understand the meaning of forecasts by the NWS. I spoke with a meteorologist with the NWS in Wichita who explained how forecasts are developed. When estimating the "percent chance of precipitation" in an area, there are really 2 considerations. The first is the percent chance that you will get wet, which is probably what most of us think of when we hear the forecast. However they also must estimate the percent chance that a system will move into your area which is not always easy to do over a wide area. They also indicate whether precipitation will be heavy or light, which refers to intensity. Thunderstorms are generally associated with heavy rainfall while broader storms may generate lighter intensity precipitation in general. Either way, you always have to couch it with the unpredictability of our weather in Kansas. As the saying goes, climate is what you expect and weather is what you get. And when it comes to weather, we have to take what we get.

Averages (inches; 1990-2001) Summer (June – August)			
Location	Precipitation	РЕТ	Deficit
Parsons	11.73	21.21	-9.48
Powhattan	13.12	21.53	-8.42
Colby	10.63	28.11	-17.48
Garden City	6.95	29.19	-22.58

Table 1: Average precipitation, potential ET (PET), and precipitation deficit in inches during summer (June through August).