April/May Cotton Newsletter

Crop Water Requirements

Review of the Swisher Spring Ag Conference

Although attendance was down due to nice weather and surmounting field tasks, the educational components of the program were very top notch. Although not cotton related, I was fascinated in the interest of attendees about grazing forages such as hay grazer, millet, triticale, and forage sorghum. All of the information regarding these species can be accessed at our office, or we can email them to you. The other interesting program was delivered by Dr. Jourdan Bell regarding the Cotton/Wheat Rotational Systems. I'll highlight some of what she covered in this newsletter, along with other pertinent information related to figuring out what the cotton water requirements are. Lastly, I would like to thank the Swisher County Noxious Weed District for providing the wonderful meal, prepared by Jeff's Restaurant. We look forward to offering more educational programs for you and would like to have you in attendance if it works with your schedule!

Determining Crop Water Requirements

Under some situations, we will need to increase the amount of irrigation to compensate for water lost due to the inefficiencies of the system. **K_C** is the crop coefficient corresponding to the current stage of growth.

Table 1. Cotton Crop Coefficients

GROWTH STAGE	K_C	DAYS AFTER PLANTING
Seeding	.07	0 – 10
1st Sqr	.22	32 – 40
1st Bloom	.44	55 – 60
Max Bloom	1.10	70 – 90
1st open	1.10	105 – 115
25% open	.83	115 – 125
50% open	.44	135 - 145
95% open	.44	140 - 150
Pick	.10	140 - 150

Here is how we can use crop coefficents to determine crop water requirements. First we must know what the potential evapotranspiration (PET) is for Swisher County, which is 26", for the average growing

season. The following is a formula to begin the process of understanding the crop water requirements for cotton. We can utilize information from the chart below to help as well.

First, we multiply the PET times the crop coefficient using the following equation. Let's assume that we're trying to figure out what the crop water requirement is during the period of the first bloom. In the example below, I will use a 5 day PET total of 1.25". I get this from the average daily amount needed at this time of .25" x 5 days.

PET x **Kc** = **crop water requirements** (Example 1)

where:

PET is the sum of daily PET over the time period of interest, such as the 5-day total, the weekly total, etc.

Kc is the crop coefficient corresponding to the current stage of crop growth.

Example 1: the 5-day PET total is 1.25 inches. My cotton is in the "first bloom" growth stage. What are the water requirements? (Note: from Table 1, the "first bloom" crop coefficient is .44)

1.25 inches x .44 = .55 inches

Thus, I need to apply .55 inches to replace the water used by the cotton in the last 5 days. This formula is extremely helpful in figuring crop water requirements at crucial times in the different development stages of the crop. Also, it is important to understand that you know what your cotton needs, so instead of guessing on water needs, become more familiar with requirements at each stage, especially since many of you in Swisher County are working with less than ideal amounts of water.

Next, let's look at how crop water requirements are affected by rainfall and irrigation efficiency. With rainfall, we know that not all the moisture received goes to the plant for use. This is largely dependent on soil type, how long and hard the rain fell, and current soil moisture levels. In irrigation scheduling, the term "*effective rainfall*" refers to how much of rainfall is infiltrated and stored in the root zone. Effective rainfall must be estimated for each field and each time it rains. The irrigation requirement determined with equations should be reduced by the amount of effective rainfall. Also, it may be a good idea to use soil moisture monitoring devices, such as watermark sensors to determine soil moisture levels and to know when irrigations should be re-started following the rainfall event.

For irrigation efficiency, we know that there is not an irrigation system which is 100% efficient. For instance, under a pivot system factors including nozzle type, hose length, and wind can all be deciding factors on how much water is lost or saved. For sprinkler irrigation systems, losses can be anywhere from 10% to 40% of the water in the air before the water reaches the ground. The amount of water lost to spray drift is referred to as the application efficiency. For drip and surface irrigation system, the biggest concern is how evenly distributed the water is over the field. This is referred to as the distribution efficiency. The term overall efficiency is a combination of both the application and distribution efficiencies. The normal ranges in on-farm overall efficiencies are listed in the table.

Table 2. Typical Overall On-Farm Efficiencies

System	Overall Effeciency
Surface	0.50 - 0.80
a. average	0.50
b. land leveling and delivery pipeline meeting design standards	0.70
c. tail water recovery with (b)	0.80
d. surge	0.60 - 0.90[1]
Sprinkler	0.55 - 0.75[3]
Center Pivot	0.55 - 0.90[3]
LEPA	0.90 - 0.95
Drip	0.80 - 0.90[2]

1. Surge has been found to increase efficiencies 8% to 28% over non-surge furrow systems.

2. Trickle systems are typically designed at 90 percent efficiency; short laterals (<100ft) or systems with pressure compensation emitters may have higher efficiencies.

3. Under low wind conditions.

It may be necessary to increase the amount of irrigation water in order to compensate for poor irrigation system efficiency. Table 2 gives the typical ranges of on-farm irrigation systems.

So, in this next example let's use the information from the first equation we did.

To adjust for irrigation system efficiency, use the following equation:

PET x **Kc** ÷ **Eff** = **irrigation water requirements** (Example 2)

where:

Eff is the overall efficiency of the irrigation system.

Example 2. I am irrigating with a low-pressure center pivot. I estimate that my overall system efficiency is 85%. What are my irrigation water requirements for the cotton in Example 1?

1.25 inches x .44 ÷ 0.85 = .65 inches

In conclusion, this month's newsletter was designed to give you tools to assist you in knowing the crop water requirements for cotton and how to strategically design an irrigation scheduling plan for your operation. Since water resources are a depleting resource, especially in areas of the High Plains, a strong plan for how you use the water that you do have is recommended. Research for this update was provided by Dr. Jourdan Bell, Texas A&M AgriLife Extension Agronomist and the Texas ET Network.

For more information regarding this topic, please call the Swisher County – Texas A&M AgriLife Extension Office at (806) 995-3726 or email at: john.villalba@ag.tamu.edu

Also, to sign up for important reminders about upcoming programs and events, I invite you to utilize our Swisher County Producers Remind program. To get these useful reminders sent to your phone, please follow these steps:

1. Text @623540 to (906) 762-4139
2. When the system replies to you, send a reply message with your first and last name.
3. Once you do that, you are on the system, and will receive all information that I send out to the group.