FUNDAMENTALS OF IRRIGATION

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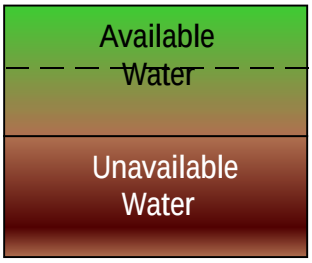
Nothing will affect production in a management plan more than providing adequate irrigation. Different soil types hold various amounts of water. Once gravitational water has flowed out of a saturated soil, it is at "field capacity" (the capacity of the soil to hold moisture is full). The water plants can extract is called available water. However, by the time all the available water is used, the plants are dead. About half of the water in a soil at field capacity is held so tightly that plants cannot extract it. That half is called unavailable water. To avoid plant stress, irrigate when half of the available soil water is used up.

SOIL WATER



- Field capacity

+ Irrigate to prevent plant stress

- Plants die

- No water left in soil

When to irrigate?

In all soils other than sand, a rough check on soil moisture can be done using the Soil Ball Method. Dig a small hole and remove a handful of soil from 6 to 12 inches deep. Squeeze the soil into a ball. Then, open your hand and bounce the ball (in the palm of you hand). If it remains in a stable shape, the soil has more than 50 percent of its available water. If it crumbles, it needs irrigation.

How long to irrigate?

In general, irrigate clay soils for longer periods, and sandy or rocky soils for short periods. Soils with a finer particle size, like clay, hold more water than coarse soils, like sand. It takes approximately 1 inch of water to refill one foot of clay or loam soil. It only takes 0.5 inches of water to recharge a foot of sandy soil.

Knowing the application rate or soil intake rate are important in calculating how long to run the irrigation system.

Sprinkler: To determine the application rate of a sprinkler, place straight-sided containers under the sprinkler system for an hour, then average the depth of water in the containers. From this the inches/hour can be determined. Periodically check sprinkler uniformity.

Flood: To estimate the amount of water absorbed per hour under flood irrigation, refer to the intake rate for the particular soil type as listed in Table 1.

The length of time the irrigation system runs will determine how much water is applied. There is no point in filling the soil profile with water to a depth greater than the crop roots can reach.

Table 1. AVAILABLE WATER

SOIL TEXTURE	WATER AVAILABLE FOR USE BETWEEN IRRIGATIONS (50% OF AVAILABLE WATER)	INTAKE RATE[1] INCHES/ HOUR
Sand	0.5 inch/foot	1.0-3.0
Loam	1.0 inch/foot	0.3-0.8
Clay	1.0 inch/foot	0.01 - 0.2

Adapted from: **Sprinklers, Crop Water Use and Irrigation Time**, Weber County, Utah State University Extension, ENGR/BIE/WM/14, April 2001.

[1]Normal ranges. Intake rates vary greatly with soil structure and structural stability.

Table 2. MANAGED ROOT DEPTH AND WATER USE		
CROP	**ROOTING DEPTH* (FT)**	**WATER INCHES USED/WEEK** (May through September)**
Alfalfa	4	1 - 2
Corn	3.5	0.75 - 1.75
Small Grains	3	1 - 2
Pasture Grass	2	1 - 1.5
Turfgrass	1 (or less)	0.75 - 1.25

*Adapted from: **Sprinklers, Crop Water Use and Irrigation Time**, Weber County, Utah State University Extension, ENGR/BIE/WM/14, April 2001.

Adapted from **Consumptive Use of Irrigated Crops in Utah, Utah Agricultural Experiment Station Research Report No. 145. October 1994.

Consider a **pasture** in loam soil. The loam is estimated to absorb 0.5 inches (average intake rate of 0.3 - 0.8) of water per hour (Table 1). Since loam soils need to be irrigated with **1inch of water/ foot** (Table 1), and pasture **roots are 2 feet deep**, (Table 2), **apply 2 inches of water**.

Sprinkler: If the sprinkler system puts out 0.25 inches of water per hour, run it for 8 hours to apply 2 inches. (0.25 inches/hour x 8 hours ' 2 inches)

Flood: Since 2 inches of water will need to be applied, and the soil absorbs 0.5 inches/hour, water should flood the soil for 4 hours. (0.5 inches/hour x 4 hours ' 2 inches)

How often to irrigate?

Utah Weather Bureau data indicates that alfalfa uses 1 to 2 inches of water per week during the irrigation season of May through September. The majority of **alfalfa** roots are in the top 4 feet of soil. If it is growing in a loam soil, it will have access to 1 inch of usable water per foot. Thus, it has a potential soil water reservoir of 4 inches of water to draw from without suffering drought-stress. In the middle of the summer when alfalfa is using 2 inches of water a week, it needs to be **irrigated every 2 weeks with 4 inches of water**. In contrast, **turfgrass** has a 1-foot rooting depth, and in the same soil needs to be **irrigated once a week with 1 inch of water,** or **twice a week with 0.5 inches**. ***Developed March 2003***

FOR MORE INFORMATION:

Utah State University Extension
http://extension.usu.edu/drought/

Utah Division of Water Rights home page:
http://nrwrtl.nr.state.ut.us/ then select "Publications" and then "Consumptive Use Tables".

Utah State University web site: sprinkler management information at http://extension.usu.edu/publica, then select "Irrigation Engineering".

WATER UNITS & CONVERSIONS

one cubic foot	=	7.48 gallons
one acre inch	=	3630 cubic feet
	=	27,154 gallons
one acre foot	=	12-acre inches
	=	43,560 cubic feet
	=	325,851 gallons
450 gal./minute	=	1 acre inch/hour
	=	1 cubic foot/second

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