Managing Your Soil Moisture

Shelley Woods

Soil and Water Research Scientist Irrigation Management Branch Irrigation & Farm Water Division Alberta Agriculture and Forestry

Irrigated Crop Production Update January 17, 2018 Lethbridge, AB

Aberta .

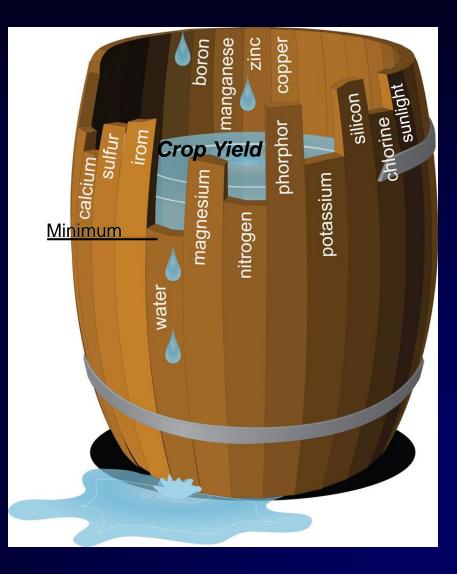
Agriculture and Forestry

Outline

- Step-by-Step Soil Moisture Management
 - 1. Make a decision
 - 2. Understand your irrigation system
 - 3. Understand your soil
 - 4. Understand your crop water requirements
 - 5. Understand the impacts of weather
 - 6. Put it all together
 - 7. Evaluate and adjust



Liebig's Law of the Minimum (1873)



Decrease in potential crop yield and quality

- Insufficient water
 - Water stress during reproductive stage (fewer seeds)
 - Premature ripening
 - Light kernel weight
- Excess water
 - Restricted root growth (insufficient soil air)
 - Promotion of crop disease (moist conditions)
 - Lodging (excess forage production)
 - Environmental/economic issues
 - Wasted water (runoff, evaporation, drainage)
 - Nutrient loss
 - Unnecessary cost (water, energy)
 - Public perception

<u>Step 2</u>: Understand Your Irrigation System

Irrigation System Factors Affecting Soil Moisture Management

- Flow rate
 - What is the gallonage of your pivot? 900 GPM?
 - Is your pivot output what it should be?
- Efficiency
 - What is your application efficiency?
- Uniformity
 - Are you getting uniform coverage along your pivot?
- Equipment function
 - Have your pump impellers been adjusted to any changes in flow rate?
 - Do you have a variable frequency drive if you are using variable rate irrigation?

Gross and Net Irrigation Applications

| Days to complete circle | US Gallons/minute | | | | | | | |
|-------------------------------|------------------------------|------|--------|------|------|------|--|--|
| | 700 | 800 | 900 | 1000 | 1100 | 1200 | | |
| | Gross water application (mm) | | | | | | | |
| 1 | 7.1 | 8.1 | 9.1 | 10.1 | 11.1 | 12.1 | | |
| 2 | 14.2 | 16.2 | 18.2 | 20.2 | 22.2 | 24.2 | | |
| 3 | 21.3 | 24.3 | → 27.3 | 30.3 | 33.3 | 36.3 | | |
| 4 | 28.4 | 32.4 | 36.4 | 40.4 | 44.4 | 48.4 | | |

| Days to complete circle | US Gallons/minute | | | | | | | |
|-------------------------------|----------------------------------------------|------|---------------------|------|------|------|--|--|
| | 700 | 800 | 900 | 1000 | 1100 | 1200 | | |
| | Net water application (mm) at 85% efficiency | | | | | | | |
| 1 | 6.0 | 6.9 | 7.7 | 8.6 | 9.4 | 10.3 | | |
| 2 | 12.1 | 13.8 | 15 <mark>.</mark> 5 | 17.2 | 18.9 | 20.6 | | |
| 3 | 18.1 | 20.7 | 23.2 | 25.8 | 28.3 | 30.9 | | |
| 4 | 24.1 | 27.5 | 30.9 | 34.3 | 37.7 | 41.3 | | |

Source: Dr. Ross McKenzie

Step 3: Understand Your Soil

Soil Characteristics Affecting Soil Moisture Management

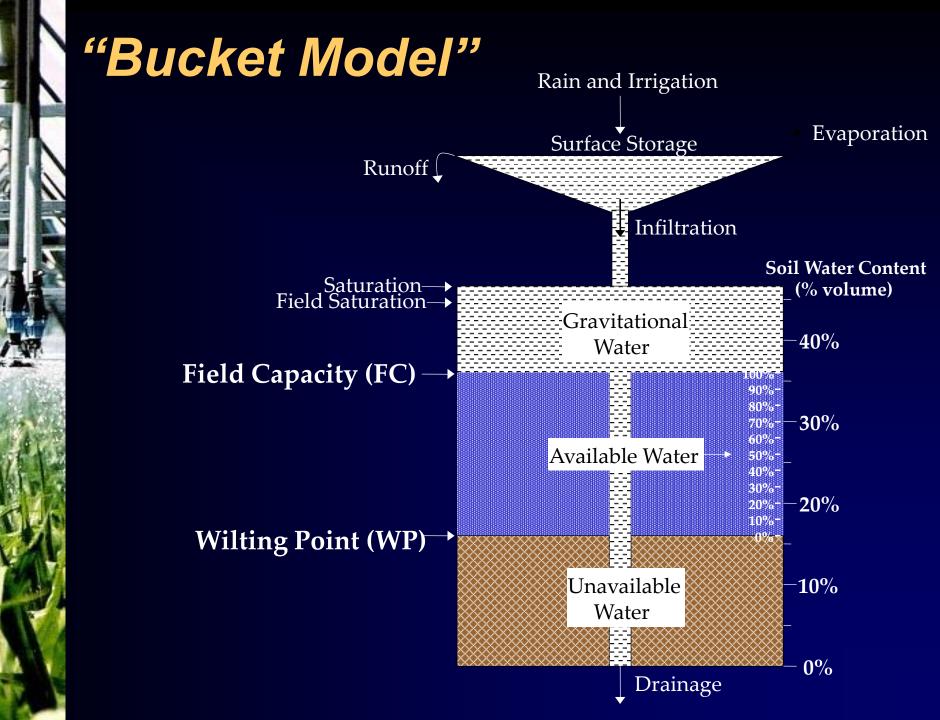
- Spring soil moisture content and soil moisture throughout the growing season
- Soil texture
 - Plant available water (AW)
 - Permanent wilting point (WP)
 - Field capacity (FC)
 - Saturation
 - Gravitational water
 - Unavailable water
 - Infiltration rate
- Soil layers/horizons

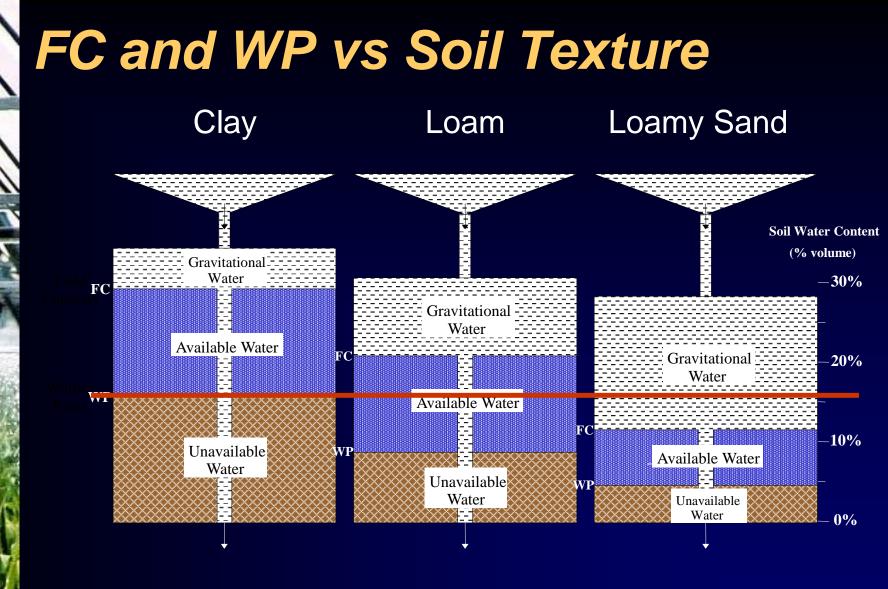


Soil Texture

Soil texture also affects:

- susceptibility to wind/water erosion
- potential problems with crusting/water logging
- tillability/drawbar pull





Soil Water Content 17% by volume

Methods for Determining Soil Moisture

- Remote sensing (drone or satellite imagery)
- Soil moisture probes (connected or wireless)
- Dutch auger and hand feel method

https://www.nrcs.usda.gov

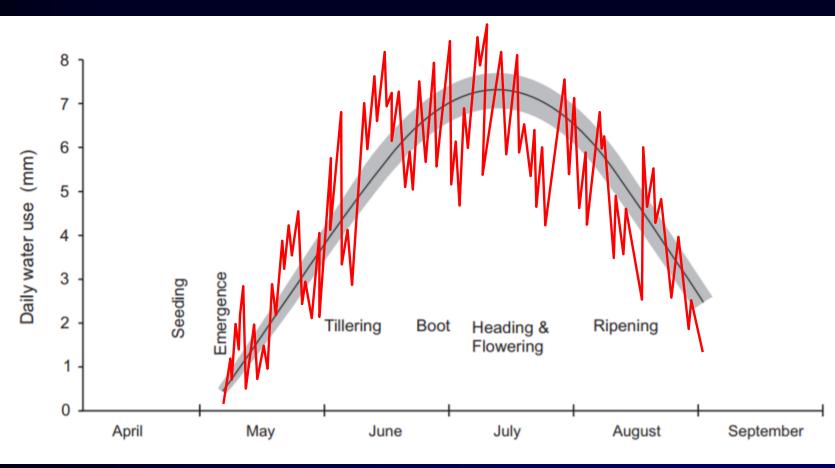
<u>Step 4</u>: Understand Your Crop Water Requirements

Crop Factors Affecting Soil Moisture Management

- Crop type and variety (effective root zone)
- Stage of growth
- Plant population density and health
- Weeds and insect pests
- Target yield (fertility)
- Crop quality requirements
- Impacts of irrigation down-times (haying & spraying)

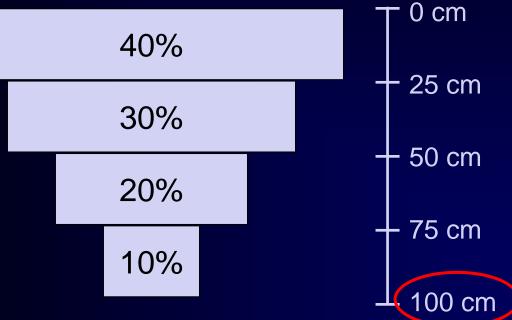
Daily Crop Water Use

Spring Wheat in Southern Alberta



Crop Water Use by Depth For a mature crop

Water Use by Depth

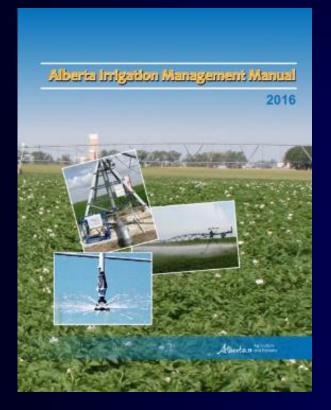


- Most water used by mature plants occurs in the surface 50 cm
- Remember this is affected by growth stage

Crop Water Use Publications

- Irrigation Management Manual
- Irrigation Scheduling Fact Sheets

http://www.demofarm.ca





July 2011

Agdex 121/561-1

Irrigation Scheduling for Alfalfa Hay in Southern Alberta

Depletion of soil

water to less

than 60 per cent

of available can

result in reduced

alfalfa hay yield

and quality.

I rrigation management is about controlling the rate, amount, and timing of applied irrigation water in a planned and efficient manner. With good irrigation management, an alfalfa hay crop can have high yield and quality potential.

Irrigation management

The goal of irrigation management is to use available irrigation water effectively in managing

and controlling the soil water environment of crops to do three things: promote the desired crop response, minimize soil degradation, and protect

water quality. Proper irrigation management requires a

good understanding of a number of factors:

- soil fertility (crop nutritional requirements)
 soil-water-plant relationships
- crop type
- crop sensitivity to water stress
- crop growth stages
- availability of a water supply
 climatic factors that affect crop water use such as
- rainfall, temperature, humidity, wind speed, and ne radiation
- irrigation system capabilities and limitations

Equipped with such knowledge, an irrigator can develop a workable and efficient irrigation scheduling program. Strategies

A workable and efficient irrigation management strategy should be crop-specific. Crop-specific irrigation management strategies mean available water is used efficiently to meet a specific crop's water requirements for maximum water productivity.

Generally, the goal is to ensure that water is available at germination and in early development by applying light, frequent irrigations (if there is no rainfall). This method promotes vigoror

replenishes and increases available soil water content in the entire root zone during the establishment year.

In the following years of production, applying full irrigations to maintain adequate soil water content is essential for promoting vigorous growth, high yield, and a desirable hay quality. The aim of this irrigation strategy is to replensish and increase available soil water content in the entire root zone starting as early as possible in spring and throughout the growing eason.

Such a strategy will allow modern sprinkler irrigation systems to keep up to crop demand during the peak water-use period, which bypically occurs during the early bloom growth stage in late June (for the first cut), early August (for the second cut), and after a killing frost in the fall (for the third cut).

<u>Step 5</u>: Understand the Impacts of Weather

Weather Factors Affecting Soil Moisture Management

- Precipitation
 - Amount
 - Intensity (infiltration)
- Potential evaporation rate
 - Temperature
 - Solar radiation
 - Wind speed/duration
- Disease risk
 - Relative humidity

Alberta Weather Information

 Irrigation Management Climate Information Network (IMCIN)

http://www.imcin.net

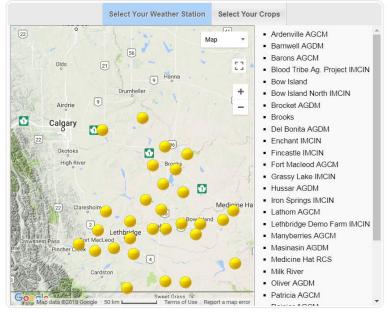
IRRI-Cast: Crop Water Use Report

https://agriculture.alberta.ca/acis/imcin/irricast.jsp



IRRI-Cast: Crop Water Use Report

Brought to you by the Alberta Climate Information Service (ACIS)



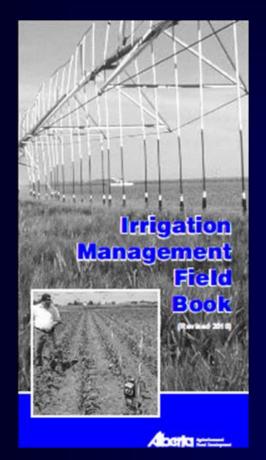
The IRRI-Cast report provides up to date crop water use information for specific crops in the selected station growing area. The IRRI-Cast also provides an expected crop water use forecast for the next five days.

Step 6: Put It All Together

 Choose a method to integrate the irrigation system, soil, crop, and climate information in order to determine your best rate, amount, timing (RAT) of irrigations

*Cheque Book Method*Irrigation Management Field Book

http://www.demofarm.ca



Get a free copy at our display booth

Go to demofarm.ca for a PDF version

Irrigation Management Models

- Alberta Irrigation Management Model (AIMM) http://agriculture.alberta.ca/acis/imcin/aimm.jsp
- Irrigation Scheduler App

http://weather.wsu.edu/is/



Irrigation Training Courses



Step 7: Evaluate and Adjust

 Determine what worked well, what didn't work, how best to proceed next year



Contact information:

Shelley Woods Research Scientist – Soil & Water Irrigation and Farm Water Division ARD, Lethbridge Phone: 403-381-5839 shelley.a.woods@gov.ab.ca

1berta

Agriculture and Forestry