Drought Management
FACTSHEET

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FORAGE CROPS AND IRRIGATION MANAGEMENT IN DROUGHT CONDITIONS

Key Points

1. Plant water use (primarily by evapotranspiration) should be understood by irrigators.
2. Irrigation management should be tied to evapotranspiration for effective water use.

Evapotranspiration (ET)

Water from precipitation or irrigation is available to the soil and crop, but some is 'lost' from the soil surface by *evaporation*. Some water enters the soil where it comes into contact with the crop root system and some of this is 'lost' by *transpiration* as it moves through the plant and evaporates from the leaf and other plant surfaces (note water is only 'lost' in so much as it is no longer available for plant growth).

Evapotranspiration (ET) is the total water 'lost' from soils by soil evaporation and plant transpiration. ET is important in drought conditions and irrigation management because this represents the amount of water that must be replaced by precipitation or irrigation to maintain crop growth. Crop yield relates directly to ET. For more information on ET: http://ianrpubs.unl.edu/irrigation/g992.htm

8 Key Points of Forage Crop Water Use

1 ET is the primary use of water by forage crops. In the **hottest and driest areas** of the southern Interior, alfalfa water use (when water is not limited) is:

- 5 to 6 inches of water to produce one ton of alfalfa
  - a yield of 6 tons per acre per season requires 30 to 36 inches of water
- this 'matches' ET which is about 36 inches per year
- 4076 tons of water per acre
- 45 tons of water per acre per day
- a ton of hay harvested at 12% moisture contains 240 lbs water

2 ET is not constant through out the growing season. ET is lowest in early spring, peaks in mid-summer and declines in late summer and fall. In the dry southern Interior valleys of BC:

- ET is less than 0.2 inches per day in April and May
- it increases through June to mid-September to 0.2 to 0.3 inches per day
- Peak ET during the hottest times of July-August can exceed 0.4 inches per day
- it declines from mid-September through October to less than 0.1 inch per day

3 Water use efficiency. It is highest when the water supplied to plants (by irrigation, precipitation or ground water) approximates evapotranspiration.

4 Yield response to water is linear. In heavier soils, soil moisture storage from fall-winter precipitation may be sufficient to produce almost normal first cut yields. This assumes adequate root depth and full soil moisture storage capacity. **In a three cut system**, the first cut makes up approximately 40% of total forage yield.

5 Excess water does not produce extra yield.

6 Plant water stress. It results in reduced ET and reduced yield because of reduced carbon dioxide conductance into the leaves. This yield cannot be made up by irrigating more than necessary following the stress!

7 Severe plant water stress. It can occur when available soil moisture is below 50%

8 Moderate moisture stress. Under these conditions, alfalfa and many adapted grasses (e.g. orchardgrass, tall fescue, bromegrass, and wheatgrasses) have the ability to go into drought induced dormancy. If carbohydrate reserves are adequate, growth can resume when moisture returns.

10 Key Points of Irrigation Management

1 Check available soil moisture in the spring. If the root zone is at field capacity (wet), and if you have stored water which can be used later in the season, delay irrigation until soil moisture indicates irrigation is required. Save the water for use when crop ET is higher. In the spring, about one third of an acre-foot of water will produce a ton of alfalfa, while later in hot, dry weather, it will take one half an acre-foot to produce one ton of hay.

2 Using surface water that is not backed up by storage. Ensure you irrigate sufficiently to fill the soil to field capacity, to take advantage of the soils ability to store water. Stored soil water can be used by deep rooted crops like alfalfa for growth when irrigation is halted for harvest or when application rate does not keep up with ET. Pivot irrigation systems, which may be operated at a low application rate, should be slowed to ensure maximum application rate.

3 Yield response is linear. It takes 6 inches of water (on average), to produce a ton of alfalfa. Less water/ton is required in the spring, when ET is lower, and more is required during peak times for ET in the summer. Refer to:

www.Farmwest.com for daily ET values in your area.

4 Limited irrigation water. Consider irrigating only that portion of your acreage for which you have adequate water for full production. Studies indicate that this is more economic than partially irrigating the full acreage. Refer to:

Factsheet No. 4 in this series ***Irrigation Decisions With Limited Water***.

5 Water use efficiency and plant growth. It is greatest when water supplied to plants approximates evapotranspiration. This suggests that irrigation may be most efficient when the application rate can at least match ET; if your system cannot keep up during peak ET periods, it may make sense to not irrigate during these periods if water is short, allowing the crop to go dormant. Resume irrigation when ET drops, assuming adequate water is available. (More research is required to determine if this management makes economic and biological sense. Risks include loss of yield and plant loss if the drought extends over a long period of time).

6 Prevent over irrigation. Use better management of irrigation water. Monitor soil moisture; learn how to manage irrigation scheduling, record water budget data.

Refer to Factsheet 619.000-1

Soil Water Storage Capacity and Available Soil Moisture

http://www.al.gov.bc.ca/resmgmt/publist/600series/619000-1.pdf

Tensiometer

For scheduling information, refer to these Factsheets, available at the web site below:
Factsheet #577.100-1 ***Irrigation Scheduling Techniques***
Factsheet #577.100-2 ***Irrigation Scheduling with Tensiometers***
Factsheet #577.100-3 ***Sprinkler Irrigation Scheduling using a Water Budget Method***
http://www.al.gov.bc.ca/resmgmt/publist/Water.htm#waterconserv

7 Improve the uniformity of distribution and the efficiency of irrigation systems. Too much water in one area results in run-off or drainage below the root zone, or possible flooding of the crop. A well designed system should have good uniformity, but many systems have changed or worn over the years. Ensure nozzles are not worn, allowing excessive water to flow onto the crop.

Flow control nozzles can be used to ensure the nozzle output gallons stay within the desired range (a flexible orifice contracts if pressure increases, maintaining a set flow). They cost about $4 each, versus less than $1 each for a standard nozzle, but can conserve water, reduce pump costs, etc. for some systems.

8 Delaying irrigation until a canopy is formed. This will reduce evaporation from the soil which may be more efficient.

9 The first cutting has relatively low ET with fast growth rates. Mid-summer cuttings occur at maximum ET and fast growth rates, while late summer-fall ET and growth rates are moderate. Applied water use efficiency may be greater in spring and late summer-fall periods.

10 Do not over irrigate new seedings. New seedings have limited root growth and leaf area and therefore much lower evapotranspiration rates. More frequent application of smaller water quantities are recommended for new seedings until a complete canopy is formed

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