Drought Management
FACTSHEET

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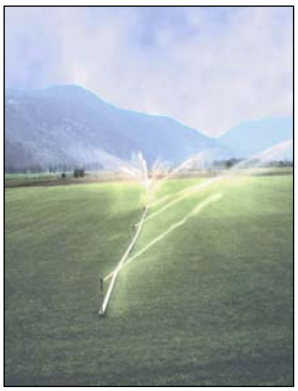
IRRIGATION DECISIONS WITH LIMITED WATER

Irrigate All Area Partially or Partial Area Fully ?

Irrigation Decisions to Make with Limited Water



When irrigation water is limited due to drought, a decision will have to be made to irrigate all acres with reduced water, or part of the acreage with the full water required, leaving some acres as dryland. In making this decision, consider these main points:

- the type of crop, (e.g., forage, cereal, vegetable, etc.)
- age and vigour of the stand
- the severity of the water restriction
- the soil water storage capacity
- the likelihood of precipitation

For some crops, such as grains or many fruit and vegetable crops, there are critical periods where moisture stress may seriously impact yield or quality of the crop. In those situations, partial irrigation of the entire crop may still result in major losses due to lack of grain filling or unacceptable quality of produce. In such a case, the only logical decision is to fully irrigate a reduced acreage.

In the case of forage crops, where the vegetative part of the crop is harvested, there is not a well defined critical period for moisture on established stands, and the response to water is essentially linear, within the normal productive potential of the crop:

Irrigating a portion of acreage fully:

- **will produce as much total yield as irrigating the full acreage partially**
- **and can reduce overhead costs as well**

Example Alfalfa Field: Irrigate All or Partial Acreage

This discussion is to help forage crop producers decide what to do with the available water on an established alfalfa crop, with the following assumptions for this example site.

Field, crop yields and values:

- the field is a 100 acres of alfalfa in the southern interior of BC
- sprinkler irrigation is used with efficiency of 70% (normal for sprinkler irrigation)
- timing of irrigation makes no difference to crop response
- dryland alfalfa yield of 3/4 ton per acre provides 2 animal unit months(aum) per acre grazing
- an animal unit month is valued at $20 per aum
- hay is valued at $100 per ton

With normal water available:

- irrigation application is 30 inches/season
- a yield of 5 tons per acre (6 inches of water required per ton hay)
- total normal yield for 100 acres, full irrigation, is 500 tons; at $100 per ton = $50,000

With reduced water available:

- water supply is from a reservoir which is at 65% of capacity
- available water is reduced to 65% of the 30 inches or 19.5 inches
- crop yield is reduced to 65% of the 5 tons per acre or 3.25 tons per acre

SITUATION 1: FIELD WITH NORMAL SOIL MOISTURE IN SPRING

65% irrigation is applied to 100 acres

- yield is 3.25 tons per acre = a total yield of 325 tons at $100 per ton =$32,500

Crop Return - partial irrigation of all acres = $32,500

OR

100% irrigation is applied to 65 acres

- yield is 5 tons per acre = a total yield of 325 tons at $100 per ton = $32,500
- dryland yield from 35 acres at 3/4 tons per acre, grazed, provides 2 aum per acre at $20/aum = $40 per acre x 35 acres = $1,400

Crop Return– fully irrigation on partial acres = $33,900

In addition to a higher crop return, irrigating and harvesting only 65 acres, rather than 100, would also reduce costs. Typical direct costs per acre for production and harvesting are $116 per acre. Reducing acreage to 65 from 100 would save 35 acres x $116= $4060. (from Planning for Profit BCMAFF factsheet Agdex 120-810). Some additional costs for grazing (eg stock water) would have to be considered that would partially reduce these savings.

Reduced Costs - partial acres irrigated ~ $4,060

Total "Return" – partial acreage fully irrigated = $37,960
(note this is not all a cash return but some reduced expenses)

In this scenario, fully irrigating a part of the acreage provides the best return. The advantage of some return from dryland production ($1400) and reduced costs ($4060) provides a benefit of over $5000 as compared to irrigating the full acreage partially.

SITUATION 2: FIELD WITH LOW SOIL MOISTURE (DRY) IN SPRING

If water is only 65% of normal, yield would be 325 tons, for a total return of $32,500, as in the previous example.

However, if available storage capacity is less than 50%, studies have shown there would be no measurable yield. Under that scenario, in the preceding examples, there would be no dryland yield, but it would still be more economical to irrigate a portion of the acreage fully to reduce irrigating and harvesting costs.

Other Points

- if good soil water storage capacity exists in the spring, **and there will be water available later in the season,** then it may be best to reduce or eliminate irrigation for the first crop when evapotranspiration is lower, and still get close to a normal yield on first cut - this will save water for later in the season when demand is higher
- it is important to remember that in a 3 cut system, the first cut is over 40% of the yield
- if the normal yield is 5 tons per acre, the first cut will be about 2 tons per acre
- if evapotranspiration was constant throughout the season, to produce 2 tons would require 10-12 inches of water
- choosing the most productive fields to irrigate will further improve overall farm yield

Late Season Water Restrictions

In the southern interior of BC, full water is often available for the first two cuts, but may be restricted later in the season, for example, by August. Under these conditions, the savings from not irrigating and harvesting the full acreage are modest, as they only apply to one cut, but the decision to irrigate all or part of the area needs to consider the following factors:

- what yield can be expected with full irrigation?
- how much is water restricted?
- do you have the option of grazing late season growth?

If water is restricted by 50%, for example, and the normal late season yield is 2 tons per acre (typical of high producing locations - 1.5 tons per acre harvested and 0.5 tons per acre grazed in the fall), a reduced yield of 50% would be only 1 ton/acre total, which may not be economic to harvest. As in the previous examples, it is best to fully irrigate 50% of the acreage, allowing the balance to go into drought induced dormancy. Late season drought can improve winter survival.

If your normal late summer-fall yield is less than 2 tons per acre (typical of higher elevation areas), **partial irrigation of the entire area**, which only produces 6 to 8 inches of growth **may be worse than no irrigation**, as it places the crop in a low carbohydrate root reserves going into winter, increasing the risk of winter kill. Even though normal yields with full irrigation are light, (3/4 to 1+ tons per acre) it still makes sense to fully irrigate part of the acreage, especially if grazing is an option, and allow the balance to go dormant to improve winter hardiness.

Summary

Based on the assumptions used for these examples, it is more economic to irrigate a portion of the alfalfa acreage fully, than to partially irrigate the full acreage:

- benefits come from reduced irrigating and harvesting costs on a smaller acreage with a normal yield, plus potential for dryland production from the un-irrigated acreage
- alfalfa has excellent drought tolerance is not likely to die during one season of drought
- drought induced dormancy can also improve winter survival

If the decision is to irrigate only a portion of the alfalfa acreage, consider the age of the stand, which fields are most productive, and the suitability for grazing when making the decision as to which fields to irrigate:

- irrigate your younger, more productive stands and go to dryland production on older and/or lower yielding fields
- consider other, lower water use crops for part of your acreage See Factsheet No.6 in this series ***Alternate Forage Crops When Irrigation Water Is Limited.***

This management decision may only be necessary in the latter part of the season, when most water shortages occur in the southern interior of BC.

Information for this Factsheet was partly derived from an article by Utah Farm Management Specialists found at this web site:
http://extension.usu.edu/files/engrpubs/biewm35.pdf

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