AGRI-FACTS
Practical Information for Alberta's Agriculture Industry

April 2011 Agdex 149/561-1

Irrigation Scheduling for Canola in Southern Alberta

Irrigation management is about controlling the rate, amount, and timing of applied irrigation water in a planned and efficient manner. With good irrigation management, a canola 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 moisture 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, and net 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.

Depletion of soil water to less than 60 per cent of available can result in reduced seed yield and quality.

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 vigorous growth and replenishes and increases available soil water content in the entire root zone during the pre-flowering growth stages. Such a strategy will allow modern sprinkler irrigation systems to keep up to crop demand during the peak water use period, which typically occurs during the flowering and fruit-formation growth stages.

Crop-specific irrigation management strategies are usually applied to adjust for the following differences among crops:

- effective root zones
- sensitivity to water stress
- types (cool versus warm-season)
- vulnerability to diseases at various crop growth stages
- response to soil fertility levels
- plant population/densities
- physiologic maturity (timing of last irrigation)
- potential income

Canola water needs

Canola uses water for growth and cooling purposes. The water requirement or evapotranspiration (ET) for canola depends on variety, plant architecture, growth stage, canola type (Polish or Argentine), canopy density, climatic conditions, and irrigation and crop management.

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Canola grown under optimal conditions (well-fertilized, well-irrigated, well-drained soils, pest-free stand, and uniform and optimum canopy) requires from 400 to 480 mm of water per growing season in southern Alberta.

Average canola water use ranges from 0.1 mm per day soon after emergence to nearly 7 mm per day during flowering and early pod development stages (Figure 1).

Canola roots grow to an effective water extraction depth of 100 cm in a well-developed soil. Root distribution is concentrated near the surface; hence, canola obtains about 70 per cent of its seasonal water from the upper 50 cm of the active root zone of 100 cm. The active root zone changes from a few millimetres at emergence to a maximum depth of 100 cm at the flowering growth stage.

Irrigation scheduling strategy

Effective canola irrigation scheduling uses soil water levels in the root zone as a measure for starting and stopping irrigations. Adequate soil water is critical for canola during the emergence, vegetative (pre-flowering: rosette, elongation, and bud), flowering, and pod-set (silique-set) growth stages. Ideally, soil water content in the 0 to 50-cm depth should be greater than 60 per cent of available at planting.

Canola needs to have sufficient water for germination and root and leaf development during the early stages of growth. If seeded in a dry seedbed (less than 60 per cent of available in the 0 to 50-cm depth) in late April before irrigation water is available, the first and subsequent irrigations (15 mm per irrigation event) should be applied as soon as irrigation water is available in early May.

These irrigations should be light and frequent to maintain a moist soil surface, prevent crusting, and encourage rapid emergence and early root and leaf development. However, if canola is seeded in a moist soil (i.e. available soil water of greater than 60 per cent), irrigation before the emergence growth stage should be avoided because it may lead to soil crusting, which results in problems with crop emergence, hence, reduced plant populations and reduced seed yield.

Water is essential for canola growth during most of its growth stages but more critical during the flowering period (about 30 days). To ensure that ample water is available to canola during the vegetative (seedling, rosette, and elongation) growth stages, available soil water should not be depleted to less than 60 per cent in the upper 50 cm of the 100-cm root zone.

Irrigation water applied during the vegetative growth stages should meet crop water requirements and build up soil water to near field capacity in the 50 to 100-cm zone for later crop use during the peak water use period when flowering and pod-setting and development are occurring.

Inadequate soil water (less than 60 per cent of available) during the canola growing season results in reduced root growth, leaf area, plant leaf retention, number of branches per plant, number of flowers forming per plant (due to reduced flowering period), number of seeds per pod, seed weight, and seed yield and oil content. More importantly, water stress during the flowering and pod set and development growth stages results in large yield losses.

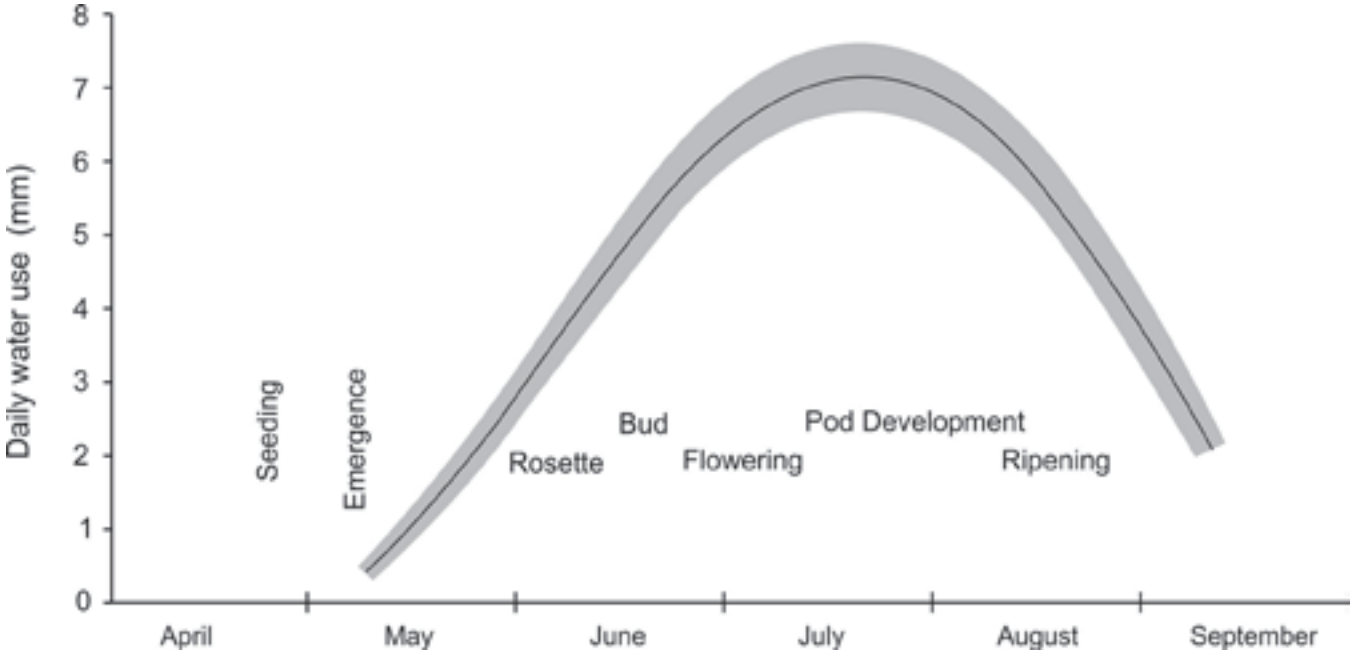

Figure 1. Daily water use during different growth stages of irrigated canola in southern Alberta. Shaded area indicates variation in canola water use depending on plant type, cultivar, and climatic conditions.

Canola roots reach maximum extension during the flowering growth stage. To ensure that soil water is adequate throughout the root zone, the monitoring depth of the root zone should be increased from 50 cm to 100 cm, and soil water should not be depleted to less than 60 per cent of available (i.e. allowable depletion should not be greater than 40 per cent of available).

Increasing the irrigation management root zone from 50 cm to 100 cm at the flowering growth stage requires less frequent and larger irrigation volumes and results in increased water availability to the mature canola roots. This practice also increases the time between irrigations, keeping the canola canopy dry and discouraging the growth of fungal diseases such as sclerotinia stem rot.

For effective control of sclerotinia, this irrigation strategy should be coupled with the appropriate application of registered fungicides, starting at 20 to 30 per cent bloom. Terminate irrigation activities if sclerotinia growth is severe.

Under a disease-free environment, the last irrigation to replenish the canola root zone water content to field capacity should occur when the earliest pods begin to ripen in August.

Soil texture

Irrigation amounts required to replenish the root zone once allowable depletion soil water level is reached will vary with soil texture and growth stage (Table 1).

Conclusion

Using suitable irrigation strategies with canola can mean a healthy crop with high yield and quality potential. In addition to ensuring that the canola crop is well-fertilized and well-protected from pests, growers are encouraged to properly manage irrigation by regularly monitoring soil water to ensure that the availability of water does not become a limiting factor in producing a high-yielding canola crop.

Applying irrigation just before the available soil water is depleted to 60 per cent at any canola growth stage and replenishing available soil water near field capacity in appropriate root zones will greatly assist in producing a high-quality and high-yielding canola crop.

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Table 1. Soil texture-based estimation of total available water and water amounts per irrigation event for canola during the canola growing season

Soil texture	50-cm root zone (Seedling, rosette and elongation growth stages)		100-cm root zone (Flowering, pod-set, and pod development growth stages)	
	Total available water (mm)	Water required to replenish soil to field capacity at 40% allowable depletion (mm)	Total available water (mm)	Water required to replenish soil to field capacity at 40% allowable depletion (mm)
Loamy sand	57	**23**	114	**46**
Sandy loam	70	**28**	140	**56**
Loam	90	**36**	180	**72**
Sandy clay loam	76	**30**	152	61
Silt loam	100	**40**	200	**80**
Clay loam	100	**40**	200	**80**
Silty clay loam	110	**44**	220	**88**
Sandy clay	86	**35**	172	**69**
Silty clay	106	**43**	212	**85**
Clay	96	**39**	192	**77**

04/11/200