Furrow Irrigation

UCDAVIS COLLEGE OF AGRICULTURAL & ENVIRONMENTAL SCIENCES

info sheet

What is furrow irrigation?

Furrow irrigation involves running water in small, slopped channels or "furrows" between plant rows or raised beds (Figure 1). Water moves from the furrow into the crop ***root zone*** (Figure 2 and Figure 3).

Figure 1. Corn field under furrow irrigation (*Source: UC Drought Management Program)*

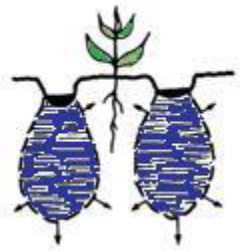

Figure 2. Vertical and lateral water movement within soil in furrow irrigation (*Source: UC Publication "Furrow Irrigation" by James C. Marr)*

Water losses in furrow irrigation

- **Deep percolation** refers to water that moves below the root zone and is greater at the beginning of the furrow than at the end.
- **Run-off** is water that runs off the end of the furrow instead of infiltrating into the field.

Both sources of water losses can be minimized with proper management.

Key aspects in furrow irrigation management

1) **Field slopes** should be between 0.05 - 0.5% (a height difference of 5 cm to 50 cm in 100 m). If the slope is too high, then soil can be eroded as water runs too quickly.

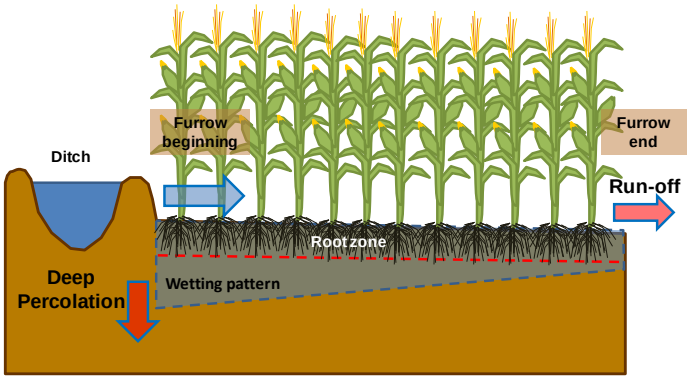

Figure 3. Wetting pattern observed in furrow irrigation *(Source: IPO CA&ES, UC Davis).*

2) **Furrow length** depends on factors affecting infiltration rate (soil texture) and the amount of time the water is running over the soil (field slope and furrow length).
   a. **Furrow length and texture.** In long furrows, more deep percolation losses occur at the top of the field since the water needs more time to get to the end of the row. Generally furrow length should not exceed 200m on sandy soils and about 400m on medium-textured soils.
   b. **Field slope.** As slope increases, water reaches the end of the field quicker. However, with high field slopes, soil erosion can be a problem. The steeper the land, the shorter the furrows should be.

3) **Furrow spacing** is affected by the movement of water sideways from the furrow. Rows need to be closer in sandier soils (e.g., 30-60cm) while they can be wider in clay soils (e.g., 75-150cm) although the crop also influences row spacing.

4) **Flow rate** should be high enough to move water quickly to the furrow end to minimize deep percolation, without causing soil erosion. Once water in the furrows nears the end of the furrow, the water flow may be decreased to minimize run-off. Depending on slope and soil texture, it may range between 1 L/s to 12 L/s per furrow.

5) **Water distribution and irrigation uniformity** are improved by land leveling.

6) **Irrigation scheduling**

	Objective	What's important
How long to irrigate	Irrigate to fill the root zone at the end of the furrow while minimizing water losses.	For a given soil texture, design furrow length to run water quickly to the field end while limiting deep percolation and run-off at the end of the furrow.
How often to irrigate	Limit plant water stress by matching available soil moisture with water use.	Available soil moisture depends on crop rooting depth and the capacity of the soil to hold water (higher in clay soils, lower in sandy soils). Water use depends on crop growth and weather affecting crop water use.

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References: Irrigation Water Management: Irrigation methods (FAO) http://www.fao.org/docrep/S8684E/S8684E00.htm; Managing Furrow Irrigation Systems http://www.ianrpubs.unl.edu/epublic/live/g1338/build/#target2; Hanson, B. *et al*, 1994. Water management Series Publication number 93-02: Surge Irrigation.