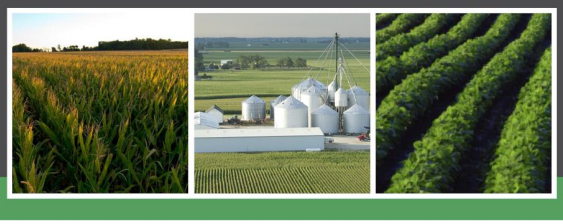

Agronomic Spotlight

# Late Season Irrigation in Corn in the Great Plains

**Corn plants require 5 to 5.5 inches of water from dent to physiological maturity. There are several methods to estimate the amount of water needed, including a moisture deficit system, soil sampling, and online tools. If irrigation is continued beyond physiological maturity, it is simply an added expense with no yield benefit.**

## WHAT TO CONSIDER

In the semi-arid regions of the Great Plains, irrigation is required for corn to help achieve maximum yield potential. Proper irrigation management can increase and stabilize crop yields from year-to-year, as opposed to the unpredictability of dryland acres. Irrigation should be carefully managed, especially during the critical growth stages in corn. Water stress should be avoided from tassel emergence (VT) through dough stage (R3), as these are the most sensitive growth stages for water stress. Yield may also be reduced if there is water stress during ear size determination, which begins at the V6 growth stage. Irrigating corn plants up to physiological maturity (R6) can help maximize yield potential; however, there is no benefit to irrigating after R6.

## YIELD IMPACT

Water use in corn peaks before the dough stage, at about 2.25 inches a week. This amount decreases to about 1.4 inches per week after dent, and continues to decrease as the plant approaches physiological maturity (black layer). Below is a description of the effects of moisture stress during the growth stages leading to physiological maturity:

Figure 1. Center pivot irrigation system.

- **Milk growth stage (R3)** occurs about 20 days after silking. If moisture stress occurs during or prior to R3, kernel abortion near the tip of the ear may occur, as energy is concentrated to the base of the ear.

- **Dent stage (R5)** occurs about 40 days after silking. Kernels are still developing and gaining test weight during this time, and will continue to gain weight for about 14-20 more days, unless stress slows maturity. If irrigation is terminated too early under hot and dry conditions, yield may be reduced. Early termination can also cause the plant to remobilize carbohydrates from vegetative tissues to fill kernels, therefore reducing stalk quality.

- **Physiological maturity (R6)** occurs when the abscission layer or "black layer" forms at the base of each kernel. At this point, the corn kernels have reached their maxiumum dry weight at about 28 to 35% moisture content. If hot and dry weather persists, irrigation will have no effect beyond this stage and leaves and stalks will die quickly.

**Table 1. Average Water Use for Given Growth Stages to Maturity. Colorado State University.**

| Corn Growth Stage | Approximate Days to Maturity | Approximate ET (inches) to Maturity |
|---|---|---|
| Blister (R2) | 45 | 11.5 |
| Dough (R4) | 35 | 8.5 |
| Beginning Dent | 24 | 5.5 |
| Full Dent (R5) | 14 | 3.0 |
| Maturity (R6) | 0 | 0.0 |

Bauder, T., et al. 2003. Best management practices for Colorado corn. Extension bulletin XCM574A. Colorado State University Cooperative Extension.

**Table 2. Normal Water Requirements for Corn Between Various Stages of Growth and Maturity in Nebraska.**

| Corn Growth Stage | Approximate Days to Maturity | Water Use to Maturity (inches) |
|---|---|---|
| Dough (R4) | 34 | 7.5 |
| Beginning Dent (R4.7) | 24 | 5.0 |
| 1/4 Milk Line (R5) | 19 | 3.75 |
| 1/2 Milk Line (R5) | 13 | 2.25 |
| 3/4 Milk Line (R5) | 7 | 1.0 |
| Maturity (R6) | 0 | 0.0 |

Younts, C. D. et al. 2008. Predicting the last irrigation of the season. NebGuide,G1871, University of Nebraska-Lincoln Extension.

**Table 3. Allowable Soil Water Depletion at Maturity for Different Soil Types**

| Soil Texture | Minimal Allowable Soil/Water Balance (inches/root zone) |
|---|---|
| Fine sands | 1.4 |
| Loamy sands | 1.6 |
| Sandy loams | 2.2 |
| Loam | 3.4 |
| Silty loams | 3.6 |
| Clay loams | 2.9 |

Bauder, T., et al. 2003. Best management practices for Colorado corn. Extension bulletin XCM574A. Colorado State University Cooperative Extension.

# MANAGEMENT OPTIONS

## Irrigation Scheduling Tools

There are several methods to help with irrigation scheduling. Soil sampling, tensiometers or other soil moisture sensing devices, and the utilization of a moisture deficit accounting system can all be used to aid in irrigation scheduling. Corn roots can reach a depth of 6 feet or more after silking, but most of the water exctracted is within the top 3 feet of soil, which is the depth that sampling should occur. An accounting system that determines the allowable soil moisture deficit can also help determine irrigation amounts and timing. Water applied, rainfall, crop usage, temperature, and evaporation are all factors used when determining the soil moisture deficit. There are several online university models that can help with irrigation scheduling. Examples include:

- **Kansas:** http://www.bae.ksu.edu/mobileirrigationlab/
- **Missouri:** http://agebb.missouri.edu/weather/reports/cwu/
- **Nebraska:** http://cropwatch.unl.edu/irrigationmetercalculator
- **Oklahoma:** http://www.mesonet.org

## When to Terminate

Keep in mind that although water requirements decrease as the plant gets closer to maturity, the plant still requires about three inches of total water from full dent (R5) to maturity (Table 1).[1,2] This amount doesn't have to all come from the irrigation system as some will come from available soil water in the root zone supplied by previous irrigations and rainfall. Farmers can estimate the final irrigation by determining the water use needed to reach maturity from the present growth stage (Tables 1 and 2). Colorado State University (Table 1) and the University of Nebraska-Lincoln (Table 2) water requirement recommendations differ slightly, as they are based on their respective regions. If available soil moisture equals or exceeds the water requirement to reach maturity, additional irrigation is not required. If using a moisture deficit accounting system, the farmer should use their calculations to determine when to terminate irrigation. In addition to saving water and irrigation expenses, leaving the soil dry in the fall may have other advantages, like resisting compaction from heavy harvesting equipment better than wet soils. Dry soils also allow more room for storing off-season precipitation. Research from the University of Nebraska-Lincoln suggests to start drying the soil down four to six weeks prior to maturity with the target of having the soil dried down to about 40% of available water by crop maturity.[2] The minimal allowable soil/water balance for various soil types, according to Colorado State University is listed in Table 3.

Maintaining proper soil moisture until plants reach physiological maturity is important to minimize stress and maximize yield potential.


Sources

[1]Bauder, T., Waskom, R., Schneekloth, J., Alldredge, J., Ortiz, M., Fields, D., Reick, N. 2003. Best management practices for Colorado corn. Extension bulletin XCM574A. Colorado State University Cooperative Extension. http://www2.cde.state.co.us

[2]Yonts C. D., Melvin, S., Eisenhauer. 2008. Predicting the last irrigation of the season. NebGuide,G1871, University of Nebraska- Lincoln Extension. http://www.ksre.ksu.edu/

[3]Rogers, D. 2007. Irrigation. Corn Production Handbook. Bulletin C560. Kansas State University. http://www.ksre.ksu.edu/

[4]Licht, M.,Abendroth L., Elmore, R., Boyer, M., Marlay, S. 2011. Corn growth and development. PMR 1009. Iowa State University Extension.


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