ONION IRRIGATION MANAGEMENT STRATEGIES

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Onion crops are highly sensitive to underwatering or overwatering. This article discusses dry bulb onions grown in Oregon and Washington.

In order to produce a high-yield with marketable qualities such as a larger bulb size, single-centeredness and long shelf life, irrigation must be carefully scheduled and closely monitored. In Oregon, research at Malheur Experiment Station has shown that a single episode of moderate water stress (higher than 60 cb) any time from the four-leaf stage to the eight-leaf stage can result in reduced bulb single-centeredness (Shock, Feibert, Jensen, & Klauzer, 2010). With these facts in mind, it is tempting to err on the side of overwatering; however, overwatering can rot the crop, either in the field or on the shelf.

> "With other crops, you can have deficit irrigation and still get 95 percent of the yield, but with onions you have to irrigate with precision. You have trade-offs with deficits and quality in either overshooting or undershooting the mark."
>
> *— Dr. Clinton Shock, Oregon State University Emeritus Professor of Crop and Soil Science*

Irrigation and onion growth cycle

Seeded onions should be watered almost immediately after planting. During the first two to three months after emergence, water demand is fairly low. The rooting depth of onions is shallow compared to other crops. Research suggests water uptake occurs only within the top 10 inches of soil; this is the active root zone (Yara, n.d.). Light, frequent irrigation events should be applied when the plants are small. Water applications should increase as plants and roots increase in size (Hemphill, 2012).

Water demand gradually increases with bulb enlargement. Peak irrigation generally occurs during advanced stages of bulb growth, especially during hot weather. Once bulbs attain the desired marketable size, irrigation should cease. Drying the crop in the field helps increase shelf life.

Irrigation scheduling

There are several ways to determine and manage onion crop water needs. One way is to calculate evapotranspiration (ET). The amount of water transpired by plant and evaporated from soil equals ET, and that amount should be replaced by irrigation. As the plant grows, foliage becomes denser and leaf area increases, which leads to more transpiration and increased irrigation needs. ET is a function of many variables including solar radiation, wind, air temperature and humidity. ET data is often available from weather stations in specific production regions.

Once ET is calculated, it can be combined with a checkbook calculation to determine how much irrigation is needed. The checkbook method compares irrigation to balancing a checkbook, where the soil is the bank account and water is added or taken away. Rain and irrigation are deposits, while water used by the crop and water evaporated from the soil (ET) are withdrawals.

The checkbook method can be used with sensors, or estimated with environmental observation data. The goal is to estimate the amount of available water in the crop root zone and prevent the crop from

experiencing water stress (Melvin & Yonts, 2009). The checkbook method helps growers determine when and how much to irrigate. The checkbook method relies on key measurements:

- Soil texture and water-holding capacity of the soil
- Allowable water depletion
- Net ET (accumulated ET minus irrigation and rainfall)

Soil texture and the crop coefficient determine allowable water depletion (the amount of water that can be removed from soil without causing water stress for the crop). Silt and clay are fine-textured soils and hold more water than coarse-textured soils such as sand. Sandy soils require more frequent irrigation.

In fields where soil textures vary, farmers using the same allowable depletion for an entire field will be either overwatering finer textured areas or underwatering coarser textured areas. An alternative is to use variable rate irrigation (VRI). With this method, mapped field data can be used to determine factors related to water holding capacity, yield productivity and specify optimum locations for soil moisture monitoring. Irrigation prescriptions can then be created for specific zones within a field.

Once allowable water depletion is known, it can be used to determine when and how much to irrigate. In Table 1, the allowable depletion for onions in sandy loam soil is 0.6 inches. Begin with the previous day's net ET, add the current day's forecasted ET and subtract forecasted rainfall. If the total is more than 0.6, irrigation is needed (Shock, Feibert, Jensen, & Klauzer, 2010).

For example, look at the data in Table 1. It was determined that irrigation was needed on July 4 by taking July 3's net ET (0.59) and adding it to the forecasted ET for July 4 (0.44). The total is 1.03, which is more than the allowable depletion of 0.6. Replace only the soil's allowable depletion rate (0.6 inches in our example) in a single irrigation event. Sandy soils have lower allowable depletion rates, resulting in lighter, more frequent irrigation events. Additionally, the irrigation application rate should not exceed the infiltration rate of the soil.

Although onion is a sensitive crop, careful irrigation scheduling will lead to success, both in overall yield and marketable traits. Careful scheduling includes monitoring ET data, which is often available from local weather stations, and rainfall in order to determine when to irrigate before the crop experiences water stress.

Table 1: Checkbook irrigation scheduling for onion in silt loam soil

Date (July)	Daily Forecasted ET	Rain	Irrigation	Net ET*	Action
1	0.38	0.00	0.00	0.38	
2	0.40	0.00	0.60	0.18	Irrigated
3	0.41	0.00	0.00	0.59	
4	0.44	0.00	0.60	0.43	Irrigated
5	0.40	0.00	0.60	0.23	Irrigated
6	0.33	0.50	0.00	0.06	

Rain, irrigation and ET listed in inches/day
** Net ET equals accumulated ET minus irrigation and rainfall*

Recommended irrigation systems

Center pivot systems are a good choice because they generally have one of the lowest per-acre installation costs, are easy to operate and are energy-efficient because they operate at a low-pressure. Reinke dealers can recommend specific irrigation systems to fit individual fields. The Reinke brand provides a variety of VRI solutions for all kinds of budgets, from sector VRI that segments the pivot path into pie-like sectors, to the combination of sector and zone VRI, which allows more than 300,000 independently managed zones within the field. Find a Reinke dealer near you at www.reinke.com/find-a-dealer.html.

References

Hemphill, D. (2010). Onion, dry bulb — eastern Oregon. *Oregon State University*

Melvin, S., & Yonts, D.C. (2009). Irrigation scheduling: Checkbook Method. *University of Nebraska Lincoln Extension*

Shock, C.C., Feibert, E., Jensen, L., & Klauzer, J. (2010). Successful onion irrigation scheduling. *Oregon State University & Malheur Experiment Station.*

Yara United States, (2017). Agronomic principles.