



University of Idaho
Extension

Canyon County, 501 Main Street, Caldwell, ID 83605; 208-459-6003; Fax: 208-454-6349

Nitrate and Water Use Efficiency in Onion Production under Drip and Furrow Irrigation

The Situation

Groundwater sampling in Canyon County, ID indicates that nitrate nitrogen ($\text{NO}_3\text{-N}$) concentrations are mostly within health standards, but are on the rise. Groundwater sampling in Washington County, ID indicates that $\text{NO}_3\text{-N}$ concentrations are frequently above health standards and are increasing. High nitrate concentrations in groundwater used for drinking may cause several health problems, one of which is "blue baby" syndrome. The Idaho Department of Environmental Quality has identified several potential sources of nitrate contamination in Treasure Valley groundwater. Deep percolation of irrigation water containing nitrogen from cropland has been identified as one of those sources. Onion production has been determined to have one of the highest $\text{NO}_3\text{-N}$ leaching potentials. Approximately 9,000 acres of onions are grown in the Treasure Valley of Idaho.

Onion production is a potential source of nitrate contamination because onions are shallow-rooted, require frequent irrigations during the season, and typically receive large amounts of nitrogen fertilizer. Excess water, especially with furrow irrigation, can move nitrates through the root zone into ground water. More efficient irrigation of onions could reduce this possible source of nitrate contamination to ground water in Canyon and Washington Counties.

Our Response

In collaboration with local onion growers, demonstration projects were established to compare water and nitrogen use efficiencies (WUE and NUE) between furrow and drip irrigated onions using research recommendations developed at the University of Idaho and Oregon State University. The project was conducted over five growing seasons.

Soil moisture monitoring equipment was installed in furrow and drip irrigated commercial onion fields in both Canyon and Washington Counties at the start of each production season. Moisture monitoring equipment was used to help schedule irrigations and to keep soil moisture within recommended values¹. Collected data was used to compare irrigation efficiency of furrow and drip irrigation systems.

Throughout each growing season additional data were collected including soil nitrate, onion tissue nitrate, water use, fertilizer applications, soil nitrate mineralization, crop yield and bulb sizes. The data were used to compare WUE and NUE between the furrow and drip irrigated fields. In addition to data collected for comparisons, specific treatments were introduced during the last three years, these treatments included:

1. Furrow irrigation (Furrow Control) using the grower's customary fertility and irrigation practices.
2. Furrow irrigation (Furrow Treatment) using research based fertility recommendations^{2,3}.

3. Drip irrigation (Drip) using research-based fertility recommendations^{2,3} and irrigation scheduling recommendations¹.



Drip Irrigated Onion Field

Program Outcomes

Onion growers are more aware of the benefits of using proper irrigation scheduling and fertility practices as a result of this project. This was accomplished through field demonstrations, presentations at commodity schools, publications and visiting with growers and crop consultants.

We have seen increased WUE in the drip field, increased NUE in all fields, and yield increases in the drip field. Increased efficiencies mean higher yield per unit of applied water and nitrogen. For example, in 2007 the drip irrigated onion field yielded 30.8 cwt. of onions per inch of water, while the furrow irrigated field average WUE was 20.2. The yield response came from growers' awareness of when to irrigate to meet the onion crop's water needs. This was made possible by using soil moisture monitoring equipment. Since this work began, over 327 soil moisture monitors have been installed in Idaho fields.

Through soil, water, and tissue sampling, growers are learning they can use less N fertilizer to raise their onion crops. This is especially true for growers switching from furrow to drip irrigation systems to irrigate onions. Data collected in Idaho in recent years indicates that growers using drip systems to irrigate onions apply approximately 162 pounds of N fertilizer per acre. Growers using furrow irrigation

apply approximately 274 pounds N fertilizer per acre, a difference of 112 pounds per acre above the N applications of drip irrigation users. Through testing of water extracted from beneath the onion root zone, we have shown less nitrogen leaches from the top one-foot of soil from drip irrigated fields as compared to furrow irrigated fields. With about 9,000 acres of onions grown in the Treasure Valley of Idaho this could have significant implications for future groundwater quality.

Cooperators

Jerry Neufeld, University of Idaho Extension—
Canyon County
Steve Reddy, University of Idaho Extension—
Washington County

¹Shock, C.C., Feibert, E.B.G., & Saunders, L.D. 2000. Irrigation Criteria for Drip Irrigated Onions. HortScience. 35:63-66.

²Brown, B. 2000. Onions. Southern Idaho Fertilizer Guide. CIS 1081. University of Idaho. Moscow, ID.

³Sullivan, D.M., Brown, B.D., Shock, C.C., Horneck, D.A., Stevens, R.G., Pelter, G.Q., & Feibert, E.B.G. 2001. Nutrient Management for Onions in the Pacific Northwest. PNW 546. Oregon State University. Corvallis, OR.

For More Information

Jerry Neufeld, Extension Educator
University of Idaho Extension—Canyon County
501 Main Street
Caldwell, Idaho 83605
208-459-6003
Fax: 208-454-6349
E-mail: jerryn@uidaho.edu