IRRIGATION SCHEDULING IN LONG-TERM BURIED DRIP

Clint Shock, Scott Jaderholm, and Cedric Shock
Malheur Experiment Station
Oregon State University
Ontario, OR, 2001

Summary

Trials were initiated to demonstrate the continuous use of drip tape from a single installation through one or more complete crop rotations. Tape was buried 9 inches deep, where a sequence of crops could be planted to establish the viability of long term use of tape in the same field without removal. Onions, wheat, and sugar beets are being grown in rotation in successive years on 3-acre plots. Mint is being grown on an additional 3 acres with long-term subsurface drip-irrigation (SDI). These plots have been established and are being monitored at Ontario Farms, Ontario in cooperation with David Blaylock.

Introduction

Until recently, all drip irrigation installations in Malheur County have been for only one season. After the end of the season the drip tape has been removed and discarded. The current trial seeks to produce a sequence of crops using the same drip tape.

Permanent drip plots at Ontario Farms from north to south are as follows:

Plot 1, 3.32 acres, mint in 2001, mint in 2000;

Plot 2, 3.34 acres, wheat in 2001, sugar beets in 2000;

Plot 3, 3.35 acres, onion in 2001, wheat in 2000;

Plot 4 3.37 acres, sugar beets in 2001, onions in 2000.

Watermark Soil Moisture Sensors have been used for managing soil water in potatoes and irrigation scheduling by growers in Malheur County since the late 1980's and that use has expanded to onions and other crops. We have shown that onion yield and grade (Shock et al. 2000) and the growth of poplar trees (Shock et al. 2002) are closely related to irrigation scheduling and maintenance of soil water potential (SWP) within narrow bounds.

Watermark readings have been recorded manually with a 30 KTCD meter (Irrometer Co., Inc., Riverside, CA), transferred to computer files, and graphed manually or by computer to demonstrate whether the SWP was wetter or drier than the irrigation criteria for the particular crop. It is easier for the grower to see the SWP in graphical form,

because the relative position (wet or dry) is clearer and the rate of drying over time makes more sense as a graph.

Soil moisture data loggers with graphic displays (AM400 Soil Moisture Data Logger with Graphic Display (M.K. Hansen Co., East Wenatchee, WA) “Hansen units” were tested for ease of interpretation for irrigation scheduling at the Malheur Experiment Station and in growers’ fields.

Materials and Methods

Soil Moisture Monitoring in 2001

Six granular matrix sensors (GMS, Watermark Soil Moisture Sensors, Irrometer Co., Inc., Riverside, CA) were installed at 8-inch depth (depth to the bottom of the sensor) in mint, onion, and sugar beet fields. The GMS were installed directly in the center of the crop rows. Sensors were installed with the aid of a 7/8-inch-diameter soil probe. Each sensor was pressed to the bottom of the soil probe hole with an insertion wire, 2 oz of water were poured into the hole, soil was gently packed above the sensor, and the soil was left level with little trace of installation except the wires coming out of the soil.

An additional 50 to 125 ft of wire was added to each of the GMS before installation and attachment to the Hansen units. This extra wire allowed the grower to spread the sensors over a wider area of the field. Insulation was stripped off of the GMS wire and the GMS was connected to 18-gauge wire using a butt connector adapter (4*260-5,3M Highland) and shrink tubing (3KH56-7, W.W. Grainger). The other end of the wire was connected to the Hansen unit. Six GMS and one temperature probe were connected to the Hansen unit starting at the double portal reading no. 1 and finally the temperature probe was connected to portal no. 7.

The Hansen units were mounted on 4- by 6-inch posts, and set facing to the north. The posts themselves were placed in an area that was judged to be representative of the entire field.

Results and Discussion

Mint

The SWP was readily maintained very wet in the permanent drip-irrigated plot containing mint (Fig. 1). It is difficult to interpret the soil water management because an ideal SWP criteria has not been established for mint. The field may have been too wet during June from June 12 through June 26 (day 163 through day 177). In late July the field was intentionally allowed to dry for harvest. The abrupt drop in SWP starting in mid-August (day 225) is a reflection of the end of the irrigation season.

Onions

Ideal SWP for drip-irrigated onions is known to be -20 kPa (Shock et al. 2000). Although the surface of the soil appeared rather dry, the field remained wet all season in the onion root zone (Fig. 2). During June (through day 180) the soil remained

excessively wet in spite of the appearance of being too dry on the surface. Prolonged periods of very wet soil are conducive to the loss of soil available N and N fertilizer by denitrification and leaching losses. Consequently, it is possible that the onions in this field suffered from N deficiency. The abrupt drop in SWP starting in mid-August (day 224) is a reflection of the end of the irrigation season.

Sugar beets

It is difficult to interpret the soil water management because an ideal SWP criteria has not been established for sugar beets, but the ideal may be in the range of -40 kPa. Most probably the field was irrigated fairly close to the ideal through mid July (Fig. 3). The remainder of the irrigation season the soil remained close to saturation.

The experience from these trials points out a difficulty in scheduling irrigations with permanent buried drip. The surface of the soil may not appear to be wet, even immediately following an irrigation. Irrigation scheduling based on experience is an inadequate guide. The data available from the visual displays on the Hansen units was not integrated into the irrigation decision making.

References

Shock, C.C., E.B.G. Feibert, M. Seddigh, and L.D. Saunders. 2002. Water requirements and growth of irrigated hybrid poplar in a semi-arid environment in Eastern Oregon. Western Journal of Applied Forestry. 17:46-53.

Shock, C.C., E.B.G. Feibert, and L.D. Saunders. 2000. Irrigation criteria for drip-irrigated onions. HortScience. 35:63-66.

Figure 1. Soil water potential at 8-inch depth in mint with permanently buried drip tape as measured by six GMS recorded by a Hansen unit on Ontario Farms, Malheur Experiment Station, Oregon State University, Ontario, OR 2001.

Figure 2. Soil water potential at 8-inch depth in onions with permanently buried drip tape as measured by six GMS recorded by a Hansen unit at Ontario Farms, Malheur Experiment Station, Oregon State University, Ontario, OR 2001.

Figure 3. Soil water potential at 8-inch depth in sugar beets with permanently buried drip tape as measured by six GMS recorded by a Hansen unit on Ontario Farms, Malheur Experiment Station, Oregon State University, Ontario, OR 2001.