

## **THE INFLUENCE OF IRRIGATION METHOD (SOLID-SET SPRINKLER OR DRIP) ON THE INCIDENCE AND SEVERITY OF BACTERIAL DISEASE IN ONIONS GROWN IN NORTHEAST CALIFORNIA.**

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Overhead sprinkler irrigation is often referenced as the primary means for bacterial disease spread in onions grown in arid climates. A study was conducted in 2021 and 2022 at the Intermountain Research and Extension Center (IREC) in Tulelake, CA to compare the incidence and severity of bacterial disease under sprinkler and drip irrigation. The experiment was a split-plot randomized design with drip and solid-set sprinkler as the main plot treatments and inoculated and non-inoculated in mid-August as the split-plot treatments. The entire study area was irrigated with solid-set sprinklers from planting until the 5-leaf stage to facilitate uniform onion germination and chemigation of herbicides for weed control. After the 5-leaf stage, irrigation treatments were imposed for the remainder of the growing season. Irrigation was scheduled using a combination of crop evapotranspiration and soil moisture monitoring. The total amount of irrigation water and irrigation frequency were similar for both irrigation methods. In 2022, environmental sensors were placed in each irrigation plot from August to September to monitor relative humidity, air temperature, and leaf wetness on an hourly basis in the onion canopy. Soil moisture was also monitored from July to harvest hourly in every plot both years.

Foliar bacterial disease severity and the incidence of bulb rot were considerably higher for solid-set sprinkler irrigation compared to drip irrigation both years (Tables 1 and 2). Total bulb yield was higher for drip compared to solid-set sprinkler both years (Tables 1 and 2). Bacterial inoculation in mid-August did not affect bacterial disease in 2021. In 2022, the concentration of bacteria applied at inoculation was increased compared to 2021, and inoculation increased the incidence of bulb rot and decreased total bulb yield compared non-inoculation (Table 2).

Environmental sensors in 2022 revealed leaf wetness in sprinkler irrigation was much higher during August and September compared drip irrigation (figure 1) while relative humidity and air temperature were similar between irrigation methods (figures 2 & 3). Drip irrigation had a greater influence on rewetting the soil between irrigations compared to sprinkler irrigation resulting in more uniform and wetter soil moisture during the growing season both years (figures 4 & 5).

Study results suggest that extended leaf wetness within the onion canopy may be an important driver for increasing the incidence and severity of bacterial disease in onions, and drip irrigation may be an effective management tool for decreasing bacterial disease in irrigated onions grown in the arid Western US.

**Table 1. Bacterial Disease and Onion Yield Evaluations at IREC in 2021.**

Treatment	Foliar bacterial disease incidence AUDPC <sup>y</sup>	Foliar bacterial disease severity AUDPC	Total bulb yield t/A	Average bulb size ounces	Bulb rot incidence %	Onion stand # / bed ft
Solid-set Sprinkler Irrigation	339a <sup>z</sup>	269a	48.5b	9.5b	22.25a	11.3a
Drip Irrigation	96b	24b	59.1a	11.1a	0.67b	11.8a

<sup>y</sup> Area Under Disease Progress Curve values for leaf blight incidence and severity were calculated based on weekly visual ratings from 10 Aug to 13 Sep.

<sup>z</sup> Treatment means with the same letter within columns are not significantly different according to Tukey's HSD test.

**Table 2. Bacterial Disease and Onion Yield Evaluations at IREC in 2022.**

Treatment	Foliar bacterial disease incidence AUDPC <sup>y</sup>	Foliar bacterial disease severity AUDPC	Total bulb yield ton/acre	Average bulb size ounces	Bulb rot incidence %	Onion stand #/bed ft
Solid-set sprinkler irrigation	583a <sup>z</sup>	125a	55.2a	9.5a	7.9a	13a
Drip irrigation	84b	7b	58.0b	9.8a	0.3b	13a
<i>P-value</i>	<i>.0007</i>	<i>.0011</i>	<i>.0484</i>	<i>.54</i>	<i>.002</i>	<i>.65</i>
Inoculated	395a	83a	56.0	9.6a	6.8a	13a
Non-inoculated	272a	49a	57.3b	9.6a	1.4b	13a
<i>P-value</i>	<i>.057</i>	<i>.058</i>	<i>.0072</i>	<i>.61</i>	<i>.0002</i>	<i>.55</i>
Sprinkler inoculated	696a	158a	54.5a	9.4a	13.0a	13a
Sprinkler noninoculated	470a	92a	56.0a	9.5a	2.8b	13a
Drip inoculated	94a	8a	57.5a	9.7a	0.5b	13a
Drip non-inoculated	75a	6a	58.5a	9.8a	0b	13a
<i>Interaction P-value</i>	<i>0.051</i>	<i>0.059</i>	<i>0.722</i>	<i>0.98</i>	<i>0.0006</i>	<i>0.93</i>

<sup>y</sup> Area Under Disease Progress Curve values for leaf blight incidence and severity were calculated based on weekly visual ratings from 4 Aug to 8 Sep.

<sup>z</sup> Treatment means with the same letter within columns are not significantly different according to Tukey's HSD test.

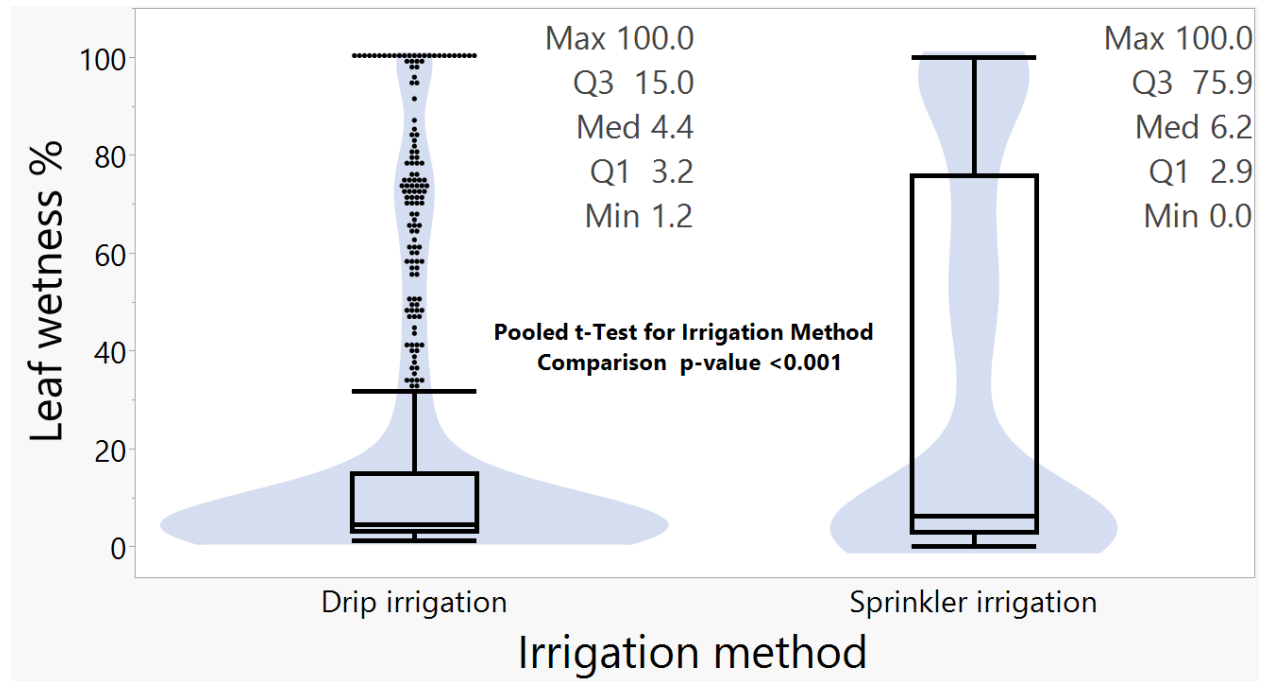


Figure 1. Distribution of % leaf wetness (Hobo leaf wetness smart sensor) in onion canopy from August 1 to September 27, 2022.

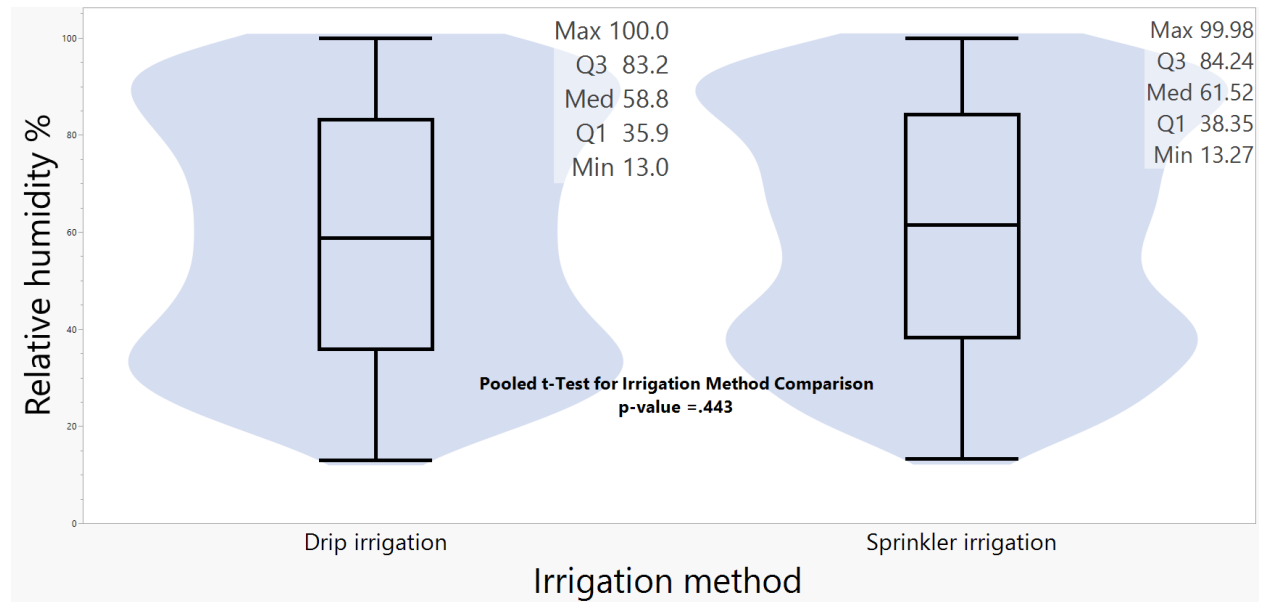
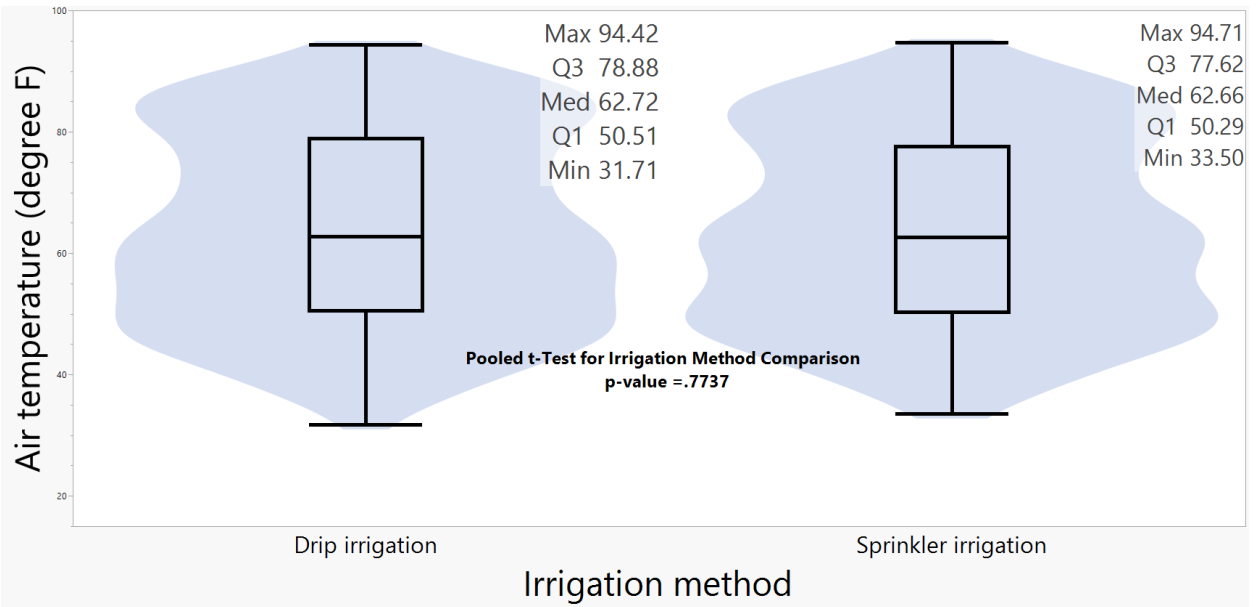
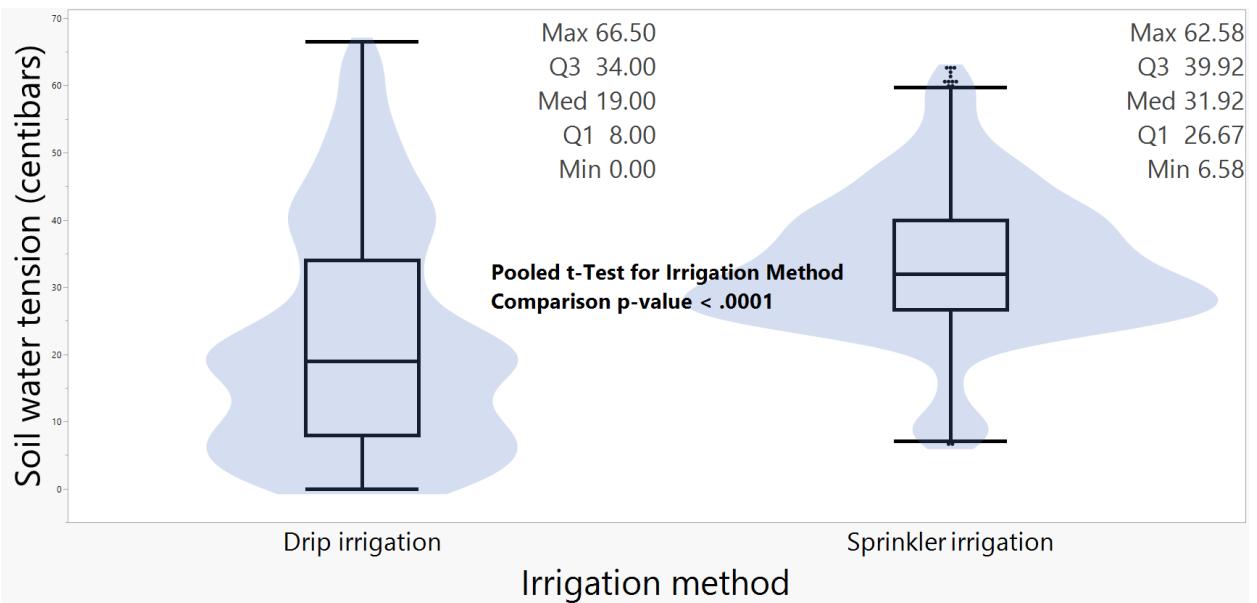


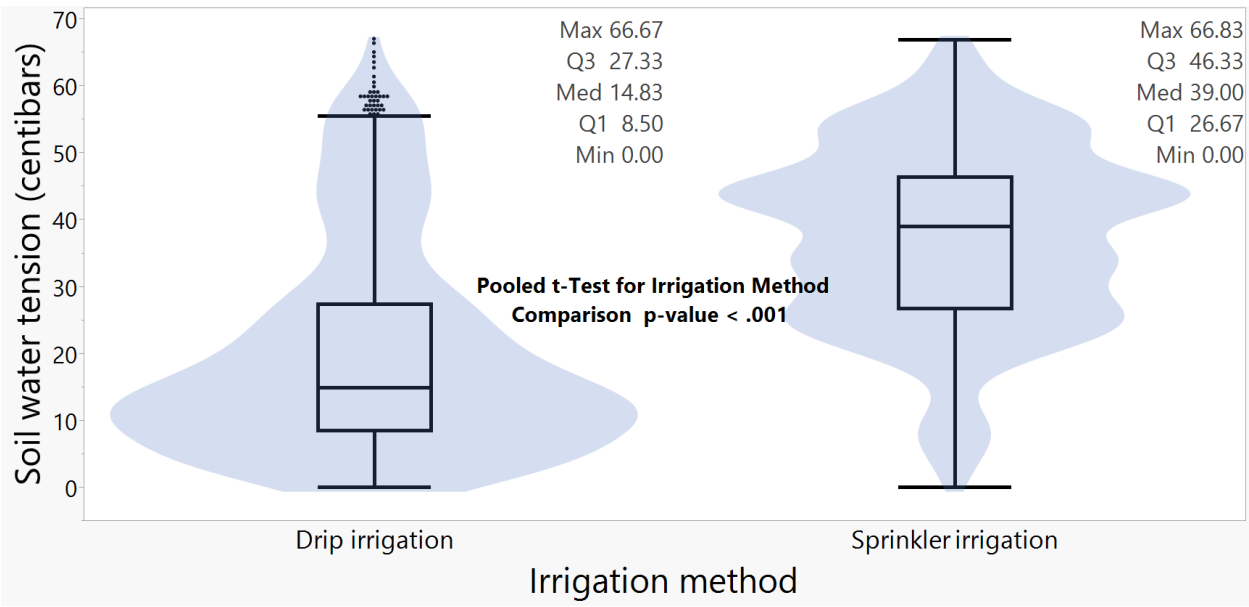
Figure 2. Distribution of % relative humidity (Hobo RH smart sensor) in onion canopy from August 1 to September 27, 2022.



**Figure 3. Distribution of air temperature (Hobo temperature smart sensor) in onion canopy from August 1 to September 27, 2022.**



**Figure 4. Distribution of soil moisture at 8 inch depth (Irrometer Watermark sensor) in onions from July 13 to September 18, 2021. Lower soil water tension indicates wetter soil moisture.**



**Figure 5. Distribution of soil moisture at 8 inch depth (Irrrometer Watermark sensor) in onions from July 13 to September 27, 2022. Lower soil water tension indicates wetter soil moisture.**