Reduce Water and Energy Use and Disease Pressure with Low Elevation Spray Application (LESA)

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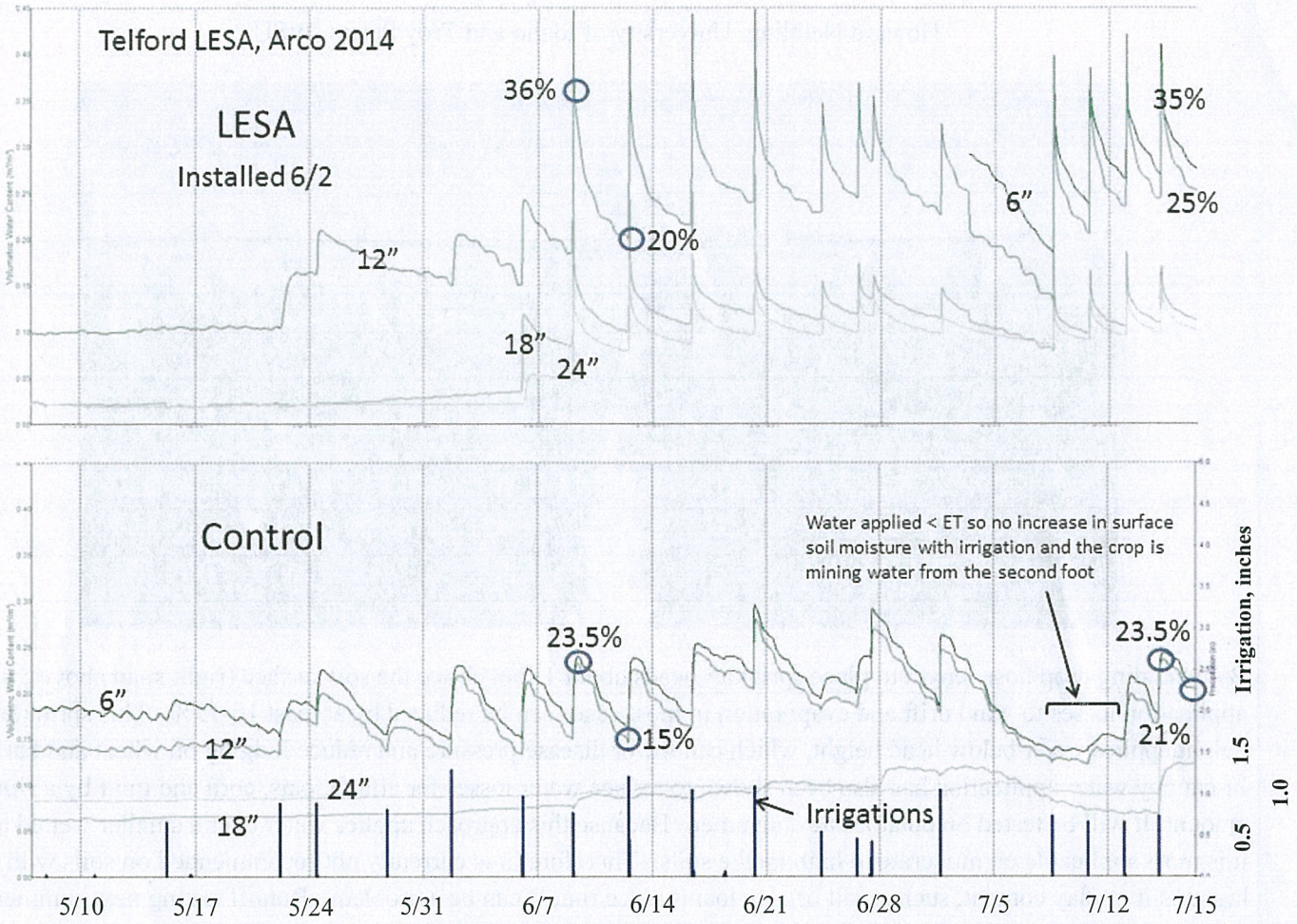
By extending drop hose length to place sprinkler heads about 1 foot above the soil surface (right span above), water application losses to wind drift and evaporation in most cases can be reduced by at least 10-15%. This sprinkler height applies water below head height, which can lower disease pressure and reduce lodging on wheat and barley. In-canopy water application has also been shown to reduce water losses for alfalfa, oats, corn and mint by a similar amount. It will be tested on potatoes next summer. Because this approach applies water over a smaller wetted area, it is most applicable on moderate to high intake soils. Therefore, it is currently not recommended on soils with higher silt or clay content, such as silt or clay loams since runoff can be a problem. Runoff testing next summer will help determine soil textures and slopes appropriate for this technology.

One span of this pivot located on the Mark Telford farm near Arco, Idaho was converted to LESA by extending sprinkler drop hoses to locate serrated plate spray heads about one foot above the soil surface. Wetted diameter of the spray heads with 10 psi regulators was about 15 feet. Spacing between drop hoses was cut in half, from about 9 feet to about 4.5 feet (span on the right above). Measurements under a similar nozzle arrangement in Northern Nevada last year indicated no application uniformity advantage by reducing nozzle spacing from 4-5 feet to about 30 inches. Nozzles were sized to apply the original application rate. Since the number of nozzles doubled, the sprinkler discharge for each sprinkler was halved with the new nozzle and drop package. The existing drops and nozzles were left in place on the remaining pivot spans (left span above). Approximate cost per drop is $30-$35. The LESA system was installed on June 2, 2014 in the crop of spring grain.

Soil moisture sensors were placed at depths of 6, 12, 18 and 24 inches in the two pivot spans shown to measure differences in water content in the root zone. The 6" sensor on the LESA span was added about the first of July. Four sensors and a rain gage were connected to a data logger under the "control" span. Four sensors were connected to another logger under the LESA span. This arrangement allowed soil moisture measurement every 15 minutes at each depth to detect differences in soil profile moisture content between the two spans. This information is shown in the figure below where the difference in the amount of irrigation water reaching the soil surface and wetting the root zone can be seen. The soil sensor readings for the LESA span are shown on the top half of the figure and readings for the control span are shown on the bottom half. The vertical blue lines across the bottom are the individual irrigations. Sensor tracings for each depth (6, 12 18 and 24 inches) are labeled for both sets of data. Although the volumetric water content of the soil (left vertical axis) and irrigation (right vertical axis) are very small and hard to read, a few points have been labeled to show differences between the two treatments.



Following irrigation on 6/9, the LESA water content reading at one foot rose to 36% by volume. Because of crop use, it dropped to 20% before the next irrigation began. Corresponding readings for the control span were 23.5% maximum and 15% minimum for the same dates. Readings after the 7/13 irrigation at one foot depth were 35% by volume for the LESA span and 23.5% by volume for the control span.

Ending readings on 7/15 were 25% for the LESA span and 21% for the control. One effect of the higher application efficiency for the LESA span relative to the control can be seen between the dates spanned by the bracket (during the 3rd and 4th irrigations from the end). During this time, water applied by the control span was less than crop water use, so soil moisture in the 6 and 12 inch depths did not increase with irrigation for the 4th from end irrigation and only slightly for the 3rd from end irrigation. Water content in the 18 inch depth dropped due to mining of water by the crop. Compare this response to that under the LESA span, where water content at all depths responded to each irrigation and both maximum and minimum water content stayed nearly constant as the water applied could meet crop needs.

The figure above clearly shows the result of lower water loss due to reduced wind drift and evaporation losses, which provided more water to the soil surface for profile wetting and crop use. Soil moisture samples were taken 9/26/14 at 2 locations under the LESA and control spans at 6-inch intervals to 2 feet (limited by rock). They show about a 10% more water accumulated in the root zone under LESA. Full analysis of the change in stored water will probably show more than 10% growing season water savings with the LESA span.

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