

IMPACT

University of Idaho
Extension

Kimberly Research and Extension Center
208.308.5192, Fax: 208.423-6699
3806N 3600E, Kimberly, ID 83341

Modification of center pivot irrigation systems with water-saving LESA technology

AT A GLANCE

New center pivot irrigation technology can reduce the water supply required to grow a crop by 15-30%, depending on crop and location, thus stretching limited water supplies.

The Situation

Our water supply experiences of the past few years may be a preview of more serious conditions to come. Although the timing and severity of water supply reduction will vary with location, general trends indicate that future supplies will be limited to some degree. Settlement provisions of a long-standing lawsuit between surface water users and groundwater appropriators requires reduction in ground water pumping of approximately 13% in about one million irrigated acres in Southern Idaho. Therefore, adoption of changes in irrigation equipment design and management that conserve water while maintaining crop yield and quality will help minimize the long-term impact on irrigated agriculture.

Our Response

LESA (Low Elevation Spray Application) center pivot modification

In 2013 - 2015 joint University of Idaho/Washington State University measurements showed that sprinkler package designs which applied water in the crop canopy delivered almost twice the water to the soil surface on hot, windy days relative to traditional sprinkler placement (Figure 1). Adjacent spans of LESA and conventional sprinkler mounting were tested on 7 pivots in Idaho and a number more in NV, WA and OR.



Figure 1 (left) traditional sprinkler head arrangement (right) LESA sprinkler placement about 1 foot above the ground. WH Neibling.

Program Outcomes

Seasonal water savings were 20-30% relative to the existing sprinkler packages (typically rotator, wobbler etc. mounted about 5-7 feet above the ground). Water savings are due to less evaporation and wind drift loss of irrigation water as it falls from the pivot, and to reduction in evaporation of water caught on plant leaves that evaporates and never reaches the soil. Additional benefits may include reduced lodging and the ability to keep developing grain heads drier and therefore minimize head disease conditions. Although this approach of mounting sprinkler heads about 1 ft above the ground saved considerable water, it is most effectively used on sandy or other high-infiltration soils where surface runoff is not an issue. Extreme care must be taken if this approach is used on silt loam or other low-infiltration soils, or on fields with slopes in excess of about 1%. Additional testing is underway this year to determine the soil and slope limits for use of this practice. Application

efficiency (water pumped that gets into the soil) is currently estimated at 90-92%. This compares to 60-70% for hand and wheel lines and 80-85% for traditional low pressure center pivots.

Current estimates are that at least 200,000 to 300,000 of the approximately 1 million acres impacted by the surface water/ground water appropriator settlement are suitable for conversion to the LESA approach. This acreage may expand with further testing and concept refinement.

Table 1 shows the estimated cost per acre of 13% reduction in irrigation for most of the high acreage crops in the affected area. Crop water use is the 30-year average from the Kimberly AgriMet weather station. Water use and potential savings will vary somewhat (usually less than 5-10%) for most other Snake River Plain locations. This assumes that currently these crops are fully irrigated. Published information for yield reduction due to water stress was used (FAO 33).

Table 1. Estimated cost per acre for yield reduction due to a 13% drop in irrigation pumping in the settlement area that could be avoided by using LESA pivot modification.

crop	Idaho irrigated acres	total water use, inches	13% cut-back, inches	yield penalty for 13% cutback	units	Drop in crop value for 13% less irrig. \$/ac.
alfalfa	800,000	39.3	5.11	1.02	Tons	209.47
malting barley	467,500	23.6	3.07	17.30	bu/ac	102.30
sugar beets	174,000	30.6	3.98	1989	lb. sugar	218.43
grain corn	80,000	25.1	3.26	32.63	bu/ac	137.05
silage corn	235,000	24	3.12	4.37	T/ac	165.98
potato	320,000	25.5	3.32			0.00
spring wheat	410,000	23.6	3.07	19.24	bu/ac	96.18
winter wheat	265,000	24.2	3.15	21.01	bu/ac	105.04

Potatoes were shown with no cutback since they are quite water-sensitive, with water stress producing significant reduction in yield and quality. Therefore, if cutback requirements for potatoes were shifted to the remaining crops, the average cutback would be about 15-16%, depending on acres of each crop on a specific farm. Current growing season estimates for pumping reduction due to LESA modification

range from 15-30% for the growing season in a number of tests over a 4-state area. Therefore, use of this method could considerably help mitigate irrigation cut-back requirements.

Cooperators and Co-Sponsors

This project was funded by the Bonneville Power Administration (BPA). Cooperators on the project included Dr. Troy Peters, P.E., WSU and Richard Stroh, P.E., BPA Idaho Falls.

FOR MORE INFORMATION

Dr. Howard Neibling, P.E. Water Management Engineer
 Kimberly Research and Extension Center
 3806N 3600E
 Kimberly, ID 83341
 Phone: 208.308.5192
 Fax: 208.423.6699
 E-mail: hneiblin@uidaho.edu
 Web: www.uidaho.edu/extension/drought

29-15hneibling-LESA.pub
 12/15