IMPACT
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Water and energy losses due to leaks and worn nozzles on set-move systems

AT A GLANCE

Measured water losses on 30 lines averaged 26% due to leaks and worn or incorrectly-sized nozzles. Proper system maintenance can help mitigate water supply reduction effects.

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

A 2012 University of Idaho study was conducted to quantify the level of water and power loss due to leaks, worn nozzles and poor system application uniformity on 30 wheel lines and 30 center pivot laterals. On each identified set-move line, all leaks larger than 0.1gallon per minute (gpm) were measured and classified into one of a number of categories. Water pressure at the beginning and end of the line, and flow from each sprinkler head was also measured. Water loss and power cost due to leaks from the 30 wheel lines tested are shown in Table 1. Losses from the few hand lines tested showed higher losses. Water losses due to worn or wrong nozzle size are shown in

Figure 1 (left) gasket leak in mainline (right) missing nozzle. Costs for surface water pressurization and 300' lift. WH Neibling.

Table 2. Table 3 shows the cost per acre of a 13% reduction in irrigation for most of the high acreage crops grown in the affected area.

Table 1. Average excess water applied and added power cost due to leaks for 850 sprinkler heads and drain valves tested.

System	Avg. excess water applied, %	Avg. added power use, kWh/ac (for 2000h)
Thunderbird wheel line	11.6	144 ($11.38)
Standard wheel line	16.3	203 ($16.04)
Average	14.0	174 (13.70)

University of Idaho, U.S. Department of Agriculture, and Idaho counties cooperating.
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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. As shown in Tables 1 and 2, average water loss due to leaks and worn nozzles was 26.4% of system capacity, suggesting that good system maintenance can help mitigate water supply reduction effects.

Table 2. Average excess water applied and added power cost due to worn or wrong sized nozzles for 850 sprinkler heads and drain valves tested.

System	Wrong nozzle size Number (%)	Avg. excess water applied by wrong size or worn nozzles, %	Avg. added power use, kWh/ac for 2000h (cost, $/ac)
Standard wheel line	55 (11)	**13.6**	148 ($11.69)
Thunder-bird wheel line	11 (3.2)	**11.1**	156 ($12.32)
Average	(7.1)	**12.4**	152 ($12.00)

Table 3. Estimated cost per acre for yield reduction due to a 13% drop in irrigation pumping in the settlement area.

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. sug-ar	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

Cooperators and Co-Sponsors
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FOR MORE INFORMATION

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-15hneibling-leaks.pub
12/15