LATE SEASON WATER MANAGEMENT FOR SOFT WHITE WINTER WHEAT

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INTRODUCTION

There are more questions regarding late season water management than any other small grain topic as the irrigated crop approaches the soft dough stage. Previous water management research has focused primarily on vegetative or early reproductive growth stages. We know less of the water requirements at growth stages approaching maturity, other than that the need for water is not as great as with earlier growth stages.

Many recommendations for late season water management use the soft dough stage as a reference point. Part of the difficulty in determining when to shut the water off is that there is confusion as to what constitutes the soft dough stage. The soft dough stage has been defined in several ways to facilitate its determination such as the following:

(1) a thumbnail impression of the kernel disappears,
(2) grain contents of the kernel are firm and not easily squeezed out between thumb and forefinger,
(3) the kernel has lost its green color,
(4) the kernel moisture content is 50%,
(5) the kernel has reached its maximum fresh weight and the wheat embryo is clearly visible.

Kernels within a wheat canopy are seldom at precisely the same stage of development which further complicates the identification of the soft dough stage. Kernels at the middle of each head develop earlier than the kernels at the top or bottom of the head. For wheat plants that have several tillers, kernels from heads of the primary stem or first tiller develop earlier than the kernels from younger more recently developed tiller heads.

An irrigation that does not improve wheat yield or quality is a waste of time, energy, and water. Unnecessary irrigation increases costs of production and reduces financial returns to producers. This study was designed to evaluate the late season moisture requirements of soft white winter wheat grown in a Greenleaf silt loam soil.

METHODS

Field experiments were conducted in 1986 and 1987 at the University of Idaho Parma Research and Extension Center. Two soft white winter wheat varieties, (Stephens and Nugaines) fertilized with 0, 150 or 300 lb N/A were fall planted and uniformly furrow irrigated as needed until the early soft dough stage. The studies were conducted on a Greenleaf silt loam soil which can store approximately 5 inches of available moisture in the 0-24" depth.

In this study, the early soft dough stage was estimated by examining kernels from the center of the most prominent heads. Kernels within the remainder of the canopy were less mature. The soft dough stage occurred about June 26 in 1986 and June 19 in 1987. At this stage there was no perceptible change in upper wheat leaf color. The canopy was green and only the lowest leaves had senesced. Awns and heads had begun to lose their green color. Kernels collected from head centers had begun to lose but still retained appreciable green pigment. Very little milk could be pressed from the collected kernels using the thumb and forefinger. The kernel shape was resilient to pressing with the thumbnail.

At early soft dough the wheat was sprinkler irrigated with 0 to 2.8 inches of water in 1986 and 0 to 1.9 inches of water in 1987. Soil moisture depletion was measured from the early soft dough stage to maturity. Grain yield was measured at maturity and the harvested grain was used to determine test weight, the weight of 200 kernels and protein. The results averaged over the two years are shown in Table 1.

RESULTS AND DISCUSSIONS

Irrigation at the early soft dough stage did not affect production, protein, kernel moisture at harvest or two hundred kernel weight. Quality was adversely affected by the soft dough irrigation. Test weight was not affected in 1986 but was significantly reduced in 1987 when lodging increased with irrigation at the early soft dough stage (data for individual years not shown). Furthermore, the percentage of black-tipped kernels was practically doubled with late season irrigation.

Moisture depletion averaged 2.4 and 1.6 inches of soil water in 1986 and 1987, respectively, from wheat that was not irrigated at the soft dough stage. Approximately half the depletion occurred in the first foot of soil. Total moisture loss (including water added) for the wheat irrigated at early soft dough was 6.0 and 3.0 inches of water in 1986 and 1987, respectively. There was greater moisture loss from the irrigated wheat than from the wheat that was not irrigated at early soft dough. However, the increased moisture loss did not result in increased yield.

CONCLUSION

The soft dough stage is considered that stage in the development of wheat when the kernel has reached its maximum fresh weight. The yield is fixed and no matter what we do at or beyond that point we are not going to increase the weight of the harvested grain. With this in mind there is little justification for irrigating at or beyond the soft dough stage. Moisture use decreases rapidly and the wheat plant is increasingly insensitive to moisture stress beyond the soft dough stage. Avoiding irrigation at the soft dough stage or beyond in silt loam soils will reduce production costs, may improve quality and should increase financial returns to producers.

Table 1. Mean grain yield, protein, test weight, moisture, kernel weight and black tip of soft white winter wheat as affected by irrigation at soft dough, nitrogen applied preplant and variety. Data for 1986 and 1987 combined.

Treatments	Yield bu/A	Protein %	Test Weight lb/bu	Moisture %	200 Kernel Wt g	Black Tip %
Irrigation (in) 1986 1987						
0 0	119	10.6	58.7	6.97	8.3	3.7
0.9 0.3	117	10.2	59.0	6.85	--	--
2.0 1.1	116	10.4	58.9	6.90	8.5	6.0
2.5 1.7	115	10.4	58.8	6.90	--	--
2.8 1.9	117	10.4	58.3	7.01	8.6	6.0
Nitrogen (lb/A)						
0	93	8.5	59.0	7.12	6.8	4.9
150	132	10.4	59.4	6.85	8.4	5.2
300	124	12.1	57.8	6.81	7.9	5.6
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Variety						
Stephens	124	10.6	57.7	6.97	9.6	4.7
Nugaines	110	10.2	59.8	6.87	7.3	5.7
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*, **, *** -- Significant at the 10, 5 and 1% levels of probability.

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