Irrigation Practices and Solum Barley Test Weight and Yield, 2002

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Summary

Solum is a barley adapted to one or two irrigations but the grain produced is often low in test weight. Studies were conducted on two commercial farms near Maricopa and Coolidge in an effort to verify data from previous studies suggesting that delaying the first post-emergence irrigation until boot increases test weight compared to earlier irrigation, but does not affect yield. The irrigation treatments consisted of 1) two irrigations – planting and boot, or 2) three irrigations – planting, 5- to 6-leaf stage, and heading (grower standard). The irrigation treatments had no effect on grain yield, test weight, kernel weight, or lodging at either location, but delaying the second irrigation until boot reduced plant height at Coolidge. Despite the lack of positive results from these studies, applying the second irrigation at boot may still be preferable to earlier applications because of reduced plant height and the risk of lodging. We have not been able to measure a benefit from a third irrigation for Solum barley in these or previous studies.

Introduction

Solum was released in 1992 as a low input barley for reduced water use conditions. Typically one or two irrigations are applied, and other cultural inputs are minimal. A disadvantage of Solum that has become more apparent recently is the grain tends to be low in test weight. In previous studies with two irrigations (premergence and postemergence) at the Maricopa Agricultural Center, applying the postemergence irrigation at tillering (0ttman and Rogers, 2001) or early joint (Ottman and Rogers, 2000) resulted in lower test weight than applying the postemergence irrigation at boot. Delaying the postemergence application until boot resulted in yields similar to earlier postemergence irrigation applications.

The purpose of this work is to confirm on commercial farms that delaying the first postemergence irrigation of Solum until boot results in increased test weight compared to applying the first postemergence irrigation earlier.

Materials and Methods

Solum barley irrigation studies were conducted on the farms of Bryan Hartman (Maricopa) and Paul Ollerton (Coolidge). The crop was managed using standard commercial practices for Solum barley. The experimental design at both locations was a complete block with four replications and two irrigation treatments. The irrigation treatments of 1) two irrigations – planting and boot, or 2) three irrigations – planting, 5 to 6 leaf stage, and heading (grower standard). The grain was harvested with a commercial combine and the grain weighed in the field with a weigh cart. Grain yield is expressed on an "as is" moisture basis. Plant height was recorded at harvest and no lodging was observed at either site. Two grain samples were taken per plot, and test weight and seed weight were determined from these samples.

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Results and Discussion

The 2002 Solum barley growing season from January through April was dry with an above average maximum temperature and a below average minimum temperature (Table 2). The amount of precipitation in the 2002 growing season at Maricopa was the lowest ever recorded by AZMET since its inception in 1987, and precipitation at the Coolidge station was the second lowest. The mean daily maximum temperature for the growing season ranked 14 out of 16 at Maricopa and 15 out of 16 at Coolidge. The mean daily minimum temperature ranked the second lowest out of 16 seasons for both locations. The net effect of the 2002 weather was to produce a crop that did not tiller well due to lack of rainfall and was delayed in development due to the low temperatures.

The irrigation treatments had no effect on grain yield, test weight, kernel weight, or lodging at either location (Table 2). However, withholding the second irrigation until boot resulted in a shorter plant at the Coolidge location. Irrigation timing did not affect test weight and other crop characteristics in these studies as in other studies, but the lack of a yield response to delaying the second irrigation until boot or to applying a third irrigation are consistent. In a study conducted at the Maricopa Agricultural Center in 2000, delaying the second irrigation until boot compared to early jointing resulted in higher test weight, larger kernels, shorter plants, and less lodging (Ottman and Rogers, 2000). In a similar study conducted at the same location in 2001, delaying the second irrigation until boot compared to tillering (but not jointing) resulted in higher test weight and larger kernels, but plant height and lodging were not affected (Ottman and Rogers, 2001).

The lack of response to irrigation timing in the present studies may be explained by: 1) The previous studies were also not consistent since applying the second irrigation at boot resulted in increased test weight compared to jointing one year and tillering the other, 2) The previous studies were planted on December 4 and 16 compared to January 2 and 3 for the present studies, 3) Rainfall during the growing season for the previous studies totaled 1.97 to 4.01 inches compared to 0.04 to 0.36 inches for the present studies, and/or 4) The previous studies were planted on flat ground but one of the present studies (Maricopa) was planted on beds.

Applying a third irrigation at heading did not result in a statistically significant increase in grain yield at either location in the present study. Even if we were certain that the yield increases were real and not due to random error, the increased production of 309 lbs/acre (Maricopa) and 149 lbs/acre (Coolidge) would not pay for the cost of the third irrigation. Barley is priced at about $5.10 cwt this year and the increased production due to the third irrigation is worth $15.76/acre at Maricopa and $7.60 per acre at Coolidge. A 6-inch irrigation costs $17/acre for water and $5/acre for labor for a total of $22/acre.

The optimum irrigation strategy for Solum barley has not been devised. Nevertheless, we must keep in mind that barley was bred for one or two irrigations and, in four studies, we have not proven that a third irrigation is beneficial. The first irrigation is applied near planting time but the optimum timing of the second irrigation is not clear. Rainfall, availability of subsoil water, and growing season conditions will probably influence the optimum timing of the second irrigation. Based on the information we have to date, applying the second irrigation at boot may decrease plant height and the risk of lodging and result in the best chance of achieving acceptable test weight.

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Table 1. Cultural information for the Maricopa and Coolidge locations.

	Maricopa	Coolidge
Soil texture	Clay loam	Sandy loam
Previous crop	Cotton	Fallow
Germination irrigation	January 3, 2002	January 2, 2002
Seeding rate	40 lbs/acre	70 lbs/acre
Beds or flat	Beds	Flat
Border size	100 ft x variable (772 to 1356 ft)	50 ft x 1200 ft
Fertilizer	None	---
Harvest area	20 ft x plot length	50 ft x 1100 ft
Harvest date	May 20, 2002	May 18, 2002

Table 2. Climatic data for Maricopa and Coolidge during the 2002 growing season compared to the long-term average. The 2002 climate data was obtained from AZMET and the long-term averages from weather station data summarized by the Western Regional Climate Center from 1961-1990.

Climate variable	Unit	Year(s)	Jan	Feb	Mar	Apr	Jan-Apr
				Maricopa			
Max Temp. (ºF)	ºF	2002	67	74	77	88	76
	Rank of 16	2002	12	15	9	13	14
	ºF	1987-2002	66	70	76	85	74
Min Temp. (ºF)	ºF	2002	34	35	40	54	41
	Rank of 16	2002	7	1	1	16	2
	ºF	1987-2002	36	39	44	51	42
Ppt. (in)	ºF	2002	0.04	0.00	0.00	0.00	0.04
	Rank of 16	2002	3	1	1	1	1
	ºF	1987-2002	0.66	0.78	0.81	0.28	2.53
				Coolidge			
Max Temp. (ºF)	ºF	2002	67	74	77	89	77
	Rank of 16	2002	12	15	13	15	15
	ºF	1987-2002	66	71	76	85	75
Min Temp. (ºF)	ºF	2002	32	34	38	52	39
	Rank of 16	2002	2	1	1	16	2
	ºF	1987-2002	35	39	43	49	41
Ppt. (in)	ºF	2002	0.12	0.00	0.12	0.12	0.36
	Rank of 16	2002	7	1	4	7	2
	ºF	1987-2002	0.80	0.83	0.87	0.36	2.86

Table 3. The influence of irrigation practices on grain yield, test weight, kernel weight, plant height, and lodging of Solum barley.

Location	First irrigation	Second irrigation	Third irrigation	Grain yield	Test weight	Kernel weight	Plant height	Lodging
				lbs/acre	lbs/bu	g/1000	inches	%
Maricopa	Planting (Jan 3)	Early Boot (Mar 25)	None	1565	43.2	45.3	18.9	0
	Planting (Jan 3)	5-leaf (Feb 25)	Heading (Apr 6)	1874	43.9	47.2	20.4	0
			LSD† (5%)	NS‡	NS	NS	NS	NS
Coolidge	Planting (Jan 2)	Boot (Mar 25)	None	2794	43.9	41.8	26.0	0
	Planting (Jan 2)	6-leaf (Mar 4)	Heading (Apr 3)	2943	44.5	40.4	32.8	0
			LSD (5%)	NS	NS	NS	4.9	NS

† LSD (5%) = least significant difference assuming a 5% chance that differences are due to random error.
‡ NS = not significant assuming a 5% chance that differences are due to random error.

References

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