Intensive Cereal Management for Durum Production, Buckeye, 1996

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Introduction

Intensive cereal management (ICM) has been practiced in Europe for years and has become popular in the eastern United States. This management system uses high yielding varieties, high seeding rates, high nitrogen rates, plant growth regulators, foliar fungicides, and other pesticide applications as required. The high yields obtained with this system is usually thought to pay for the increased input costs. Arizona has the highest wheat yields in the US due to irrigation and the skill of the growers. However, our state average yields are not near the theoretical maximum, or near yields of top growers in good years. Intensive cereal management may provide the key to yield increases in the future. Due to our relative freedom from diseases and pests, fungicides and pesticides are not part of intensive cereal management in Arizona. The main components of intensive cereal management as it applies to our conditions are high seeding rates, high nitrogen rates and application of a plant growth regulator to prevent crop lodging. The purpose of this study was to determine the potential of intensive cereal management to increase yield and profitability in irrigated wheat production in the desert southwest.

Procedure

A field trial was established at H-4 farms in Buckeye, AZ during the 1995-96 crop season on a sandy loam soil. The previous crop was cotton. The seedbed was prepared by cutting the stalks, disking, ripping, disking, blading, and forming the border ridges. A total of 54 pounds of nitrogen and 67 pounds of phosphate per acre were applied preplant as 16-20-0. The durum cultivar Duraking was planted at a rate of 175 pounds of seed per acre on 20 December 95. A total of 34.68 inches of irrigation water was applied in 10 irrigations using the border flood method on the following dates: 20 Dec (2.68 inches), 1 Jan (2.84 inches), 11 Feb (2.84 inches), 25 Feb (3.94 inches), 8 Mar (3.52 inches), 23 Mar (3.52 inches), 1 Apr (3.52 inches), 9 Apr (3.66 inches), 20 Apr (3.66 inches), 29 Apr (4.50 inches). On 14 Mar, 1 inch of rain was recorded.

The field was divided into eight plots 2.71 acres in size (1192 ft. x 99 ft.) consisting of three borders each at the first post-plant nitrogen application date on 12 Feb. Four of the plots were controls or grower standard practice, and the other four in alternating strips were the ICM treatment. The experimental design was a complete block with two treatments and four replications. The standard farm practice received 50 pounds of nitrogen per acre as UN32 in the irrigation water on 11 Feb, 25 Feb, and 1 Apr. The ICM treatment received 100 pounds of nitrogen per acre as UN32 in the irrigation water on 11 Feb and 25 Feb, and 50 pounds of nitrogen per acre on 1 Apr. Thus, total nitrogen fertilizer including the preplant application was 204 pounds of nitrogen per acre for the standard farm practice and 304 pounds of nitrogen per acre for the ICM treatment. The ICM plots were treated with Cerone (Ethephon) on 8 Mar at pre-boot (Feekes stage 9) at a rate of 0.5 pt/acre. The material was applied with a ground rig that ran down the middle of each border. The rig was run over the control plots without spraying to simulate any damage from running over the plants.

The plots were harvested on 23-24 May 96 with a commercial combine. The grain from the combine was augered into trucks which were weighed on truck scales and yield calculated based on the area. Plant height was measured at harvest. A sample of grain analyzed for test weight, kernel weight, hard vitreous amber count (HVAC), and protein. Kernel weight and HVAC were determined from 10 grams of hand picked kernels. Protein was determined using a NIR whole grain analyzer on a 12% moisture basis.

Discussion

Grain yield and kernel characteristics are presented in Table 1. We were not able to detect a difference in yield, plant height, test weight, kernel weight, or HVAC due to ICM. Grain protein, however, was increased by nearly 2 percentage points in the ICM treated plots probably due to the extra 100 pounds of nitrogen applied per acre to this treatment. The ICM plots were darker green during the growing season as a result of the added nitrogen. No lodging was observed. The ICM plots appeared slighlty shorter in height, but the difference was not significant.

The crop budgets as presented in Table 2 shows that ICM was not economical in this case. This analysis is performed assuming that the yield differences were real even though we were not able to detect differences statistically. The grain from the standard farm practice is discounted due to protein below 13% and the grain from the ICM plots are paid a premium for protein above 13%. A premium or discount of $0.17 per cwt per % protein above or below 13% is assigned. The ICM treatments had higher costs and less income due to lower yields, even though a premium was paid for increased protein in this treatment.

Intensive cereal management does not appear to hold much promise, especially in the absence of lodging. This experiment will be repeated since definite conclusions cannot be drawn from a single site and year.

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Table 1. Grain yield and kernel characteristics as influenced by intensive cereal management.

Treatment	Grain yield	Plant height	Test weight	1000 kernel weight	Hard vitreous amber count	Grain protein
	lbs/acre	inches	lbs/bu	grams	%	%
Standard farm practice	5777	34	61.5	44.8	100	12.8
Intensive cereal management	5397	33	60.0	42.9	100	14.7
Statistical difference (5%)	No	No	No	No	No	Yes

Table 2. Crop budgets: These numbers were generated from information provided by the grower and from budgets and custom rates obtained from the Maricopa County Crop Budgets.

		Standard farm practice	Intensive cereal management
Operating expenses	Soil preparation ($/acre)	89	89
	Planting and seed ($/acre)	46	46
	Irrigation ($/acre)	91	91
	Fertilizer ($/acre)	111	140
	Growth regulator ($/acre)	0	20
	Harvest/Haul ($/acre)	52	51
	Total ($/acre)	389	437
Income	Yield (lbs/acre)	5777	5397
	Grain protein (%)	12.8	14.7
	Price received ($/cwt)	8.47	8.79
	Total ($/acre)	489	474
Return over operating expenses	Total ($/acre)	100	37