Sorghum Grain Production Under Natural Rainfall With Minimum Irrigation In Cochise County, Arizona

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Summary

A late planted sorghum grain production test in Cochise County under varying amounts of irrigation water supplemental to natural rainfall utilized only about 64% of the usual average pounds of irrigation water used per pound of grain sorghum produced. The late planting date of July 20 to utilize natural rainfall resulted in only half of the normal full season yield. This reduced yield caused the normal costs of production to exceed income.

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The Cochise County, Arizona, field crop budget for grain sorghum production in Cochise County presents the county average yield of full season irrigated grain sorghum on better type soils at 7000 pounds per acre and using 42 inches of irrigation water. The usual planting date is in May. Long term weather data show that about half of the annual rainfall is received in July, August and September.

A field yield test was planned near Cochise, Arizona for a late June (1980) planting in order to maximize the advantage from these summer rains. A number of logistical problems prevented this June planting date. The actual test was planted dry and irrigated up on July 18 through 21.

The soil type in the experimental area is classified as McAllister Loam. The sorghum grain production capability of this soil is about 5,500 pounds per acre on a full season basis. Research data from Marana, Arizona (1968) indicated the yield for a past mid-July planting as only about half of the maximum full season potential. Our expected maximum yield was 2750 pounds per acre. Three different levels of irrigation were applied during the ensuing 1980 crop season.

The yield test results are presented in Table 1. There were no real differences in grain yield from two, three or four irrigations. The two additional irrigations contributed little or no additional yield. Rainfall was adequate to make the crop. The irrigation and rainfall dates and amounts are presented in Table 2. The grain yields of 2600 to 2700 pounds per acre were as expected and realistic for the test conditions.

Other plant measurements among irrigation treatments for plant height, head exsertion, bushel test weight and seed size were nearly identical among all irrigation treatments. Moisture stress would tend to reduce one or more of these characters so there was very little if any moisture stress on the minimum irrigation treatment of only two irrigations.

A number of water utilization data have been calculated from irrigations applied and rainfall received and are presented in Table 3. These calculations indicate that the pounds of irrigation water applied in the first two irrigations (Treatment No. 1) per pound of grain produced was only two-thirds of the irrigation water normally applied per pound of grain produced under full season production. These data indicate that the ratio of pounds of irrigation water applied per pound of grain produced could be reduced but at the expense of lower total yields.

The lower yields from later plantings made to maximize the input of natural rainfall or from fewer but better managed irrigations would likely not pay for all of the usual full range of field production operations. A minimum tillage regime with its reduced costs may partially meet the reduced income from lower yields.

The Arizona Electric Power Company (AEPCO) is recognized for helping make this test possible.

Table 1. Grain Yield and Other Agronomic Field Data From a Late Planted Variable Irrigation Test Near Cochise, Arizona. 1980.

Treatment No.	*1 Treatment	*2 Plant Height, Inches	*3 Head Exsertion, Inches	Head Length, Inches	Grain Yield Lbs/Acre	Yield In % of Highest Treatment	Test Weight Lbs/Bu	Grams Per 1000 Seed
1	2 Irrigations	32.25	5.75	9	2602	95%	51.45	21.82
2	3 Irrigations	33.--	6.--	9	2746	100%	54.--	23.72
3	4 Irrigations	33.38	6.125	9	2573	94%	51.85	20.92

*1 - DK A25a, an early maturity hybrid grain sorghum, was planted dry on July 15 and irrigated up between July 18 and 21. The crop reached 50% bloom on September 11 or about 54 days from first irrigation.
*2 - Average height in inches to the top of the plant head.
*3 - Average distance in inches from the upper leaf collar to the bottom of the head.

Table 2. Irrigations and Rainfall Received By Late Planted Grain Sorghum Near Cochise, Arizona. 1980.

Treatment No.	Irrigation No.	Irrigation Date	Irrigation Inches	Rainfall Date	Rainfall Inches
1	1	July 18-21	6.	Aug 9	1.
	2	Aug 3-5	4.	Aug 13-14	3.
				Aug 24	.50
2	3	Aug 30-31	4.	Sept 6-7	.75
3	4	Oct	3.		
Total:			17.		5.25
Grand Total (Irrigation + Rain):					22.25

Table 3. Water Utilization Data From Late Planted Sorghum Grain Production Near Cochise, Arizona. 1980.

	Irrigation Treatments		
	1	2	3
Acre Inches of Rainfall Received:	5.25	5.25	5.25
Acre Inches of Irrigation Water Applied:	10.--	14.--	17.--
Total Acre Inches of Water Applied:	15.25	19.25	22.25
Rainfall as % of Total Water Applied:	34%	27%	24%
Gallons of Water Applied Per Acre:			
- from rainfall:	142,560	142,560	142,560
- from irrigation:	271,542	380,160	461,622
Total Gallons:	414,102	522,720	604,182
Grain Yield In Pounds Per Acre:	2602	2746	2573
Gallons of Water Used to Produce a Pound of Grain:			
- from rainfall:	55	52	55
- from irrigation:	104	138	179
From Total Water:	159	190	234
Pounds of Water to Produce a Pound of Grain:			
- from rainfall:	459	434	459
- from irrigation:	867	1150	1492
From Total Water:	1326	1584	1951

Pounds of Water to Produce a Pound of Grain -
From Cochise County Crop Budget of 7000 pound/acre Yield for Full Season:

- from average rainfall for May - Sept. of 7.70 in:	249
- from average irrigation of 42 in:	1358
From Total Water Available to Crop:	1607

Pounds of Irrigation Water Used to Produce a Pound of Grain of the 3 Irrigation Treatments Compared to the Cochise Co. Crop Budget Irrigation Figures:

	Percent of County Crop Budget Data
Irrigation Treatment 1	64%
Irrigation Treatment 2	85%
Irrigation Treatment 3	110%