

# Survey of Durum Production Practices, 2007

M. J. Ottman  
University of Arizona

## Summary

*Durum growers were surveyed in cooperation with the USDA's National Agricultural Statistics Service to determine production practices and their effects on yield and protein in the 2006 growing season. The survey was conducted in three regions: West (Yuma and La Paz counties), Central (Maricopa, Pinal, and Pima counties), and East (Cochise and Graham counties). Most of the durum in Arizona is grown in these three regions. We obtained responses from 83 out of an estimated 166 durum growers (50%) representing 46,331 out of 79,000 acres (59%). Durum was grown following cotton (41%), vegetables (27%), lettuce (16%), or other crops. The major varieties were Orita (30%), Kronos (25%), Ocotillo (16%), and Sky (11%). Herbicide was applied on 64% of the acreage. Flood irrigation systems accounted for 69% of the acreage, followed by furrow (17%). The crop was irrigated 6-7 times on average. The predominant soil texture was a sandy clay loam (36%), followed by sandy loam (35%) and clay loam (12%). The average planting date (germination irrigation applied) was December 21 in the Central region, January 4 in the West region and February 7 in the East region. The seed was planted at an average rate of 165 lbs/acre. Phosphorus was applied to only a third of the acreage, but when it was applied, the rate averaged 71 lbs P<sub>2</sub>O<sub>5</sub>/acre. Nitrogen rate averaged 224 lbs N/acre. Increased yield was associated with amendment application in the West region; certain varieties, amendment application, seeding rate between 120 and 159 lbs/acre, and nitrogen rate over 200 lbs N/acre in the Central region; and a seeding rate between 140 and 159 lbs/acre in the East region. Increased grain protein was associated with a previous crop of lettuce, lack of phosphorus application, and irrigation number in the West region; and a seeding rate of 140 to 159 lbs/acre and lack of phosphorus application in the East region. This survey documents associations, not cause-and-effect relationships, among durum production practices, yield, and protein.*

## Introduction

Research on agricultural practices has traditionally been done in small plots by varying one aspect of management, called the treatment, and keeping all else constant. Clear conclusions can be drawn using this approach, but the applicability of the results is limited to the specific location and set of growing conditions. A method of conducting research that allows wider applicability of results is to correlate agricultural practices and yield from a large number of fields. The question is often asked how the top producers obtain high grain yield and protein. The problem with this approach is the accuracy of the information provided and the fact that correlation does not establish a cause-and-effect relationship. Nevertheless, some useful knowledge may be gained using survey methodology.

## Procedures

A survey of durum production practices in 2007 was developed and sent to growers in three regions of Arizona: West (Yuma and La Paz counties), Central (Maricopa, Pinal, and Pima counties), and East (Cochise and Graham

counties). These two regions contained virtually all acres of durum in the state in 2007. We obtained responses from 83 out of an estimated 166 durum growers (50%) representing 46,331 out of 79,000 acres (59%). The information requested on the survey included town, previous crop, variety, herbicide applied, insecticide applied, PGR applied, manure or compost applied, irrigation system, soil texture, planting date, seeding rate, fertilizer application, and number of irrigations applied. The survey responses were statistically analyzed using analysis of variance.

## **Results and Discussion**

Durum acreage in 2007 was roughly split between the West (53%), Central (43%), and East (4%) regions, and grain yield and grain protein were similar among regions (Table 1). The county with the greatest percentage of the acreage was Yuma (45%) followed by Pinal (24%) and Maricopa (16%). Grain yield was highest in Yuma County and grain protein was highest in Cochise County.

Durum was most often planted after cotton (41%), vegetables (27%), or lettuce (16%). The highest protein in the West region was obtained after lettuce.

The top four varieties in terms of percentage of acreage were Orita (30%), Kronos (25%), Ocotillo (12%), and Sky (11%). Orita was grown in all regions, but some such as Havasu were predominantly grown in the West region and others such as Ocotillo were predominantly grown in the Central region. Of the top 4 varieties mentioned above, yield was highest for Kronos in the Central region. However, there were other varieties that were not grown as widely that had either higher yield or protein.

Herbicide was applied to most of the acreage in the West region, whereas most of the acreage in the Central region and half the acreage in the East did not receive herbicide. Insecticide was only applied to 1% of the acreage. Plant growth regulator (PGR) to control lodging was applied to 2% of the acreage. Manure or compost was applied to 10% of the acreage overall, and was associated with higher yield.

The predominant irrigation system was border flood (37%) followed by level basin (32%) and furrow (17%). Yield and grain protein were not affected by irrigation system.

Durum was grown predominantly on sandy clay loam soil (36%) followed by sandy loam (35%) and clay loam (12%) soil. Yield and grain protein were not affected by soil texture.

The average planting date was January 7 in the West region, December 21 in the Central region, and February 7 in the East region. Yield and grain protein were not affected by planting date.

The average seeding rate was 165 lbs seed/acre. Highest yields were reported for seeding rates between 120 and 159 lbs seed per acre in the Central and East regions, and highest protein in the East region was reported for seeding rates between 140 and 159 lbs/acre.

The average nitrogen rate was 224 lbs N/acre. The highest grain yield in the Central region was associated with nitrogen rates over 200 lbs N/acre. The response of the durum crop to nitrogen fertilizer depends on several factors that were not included in this survey, such as initial soil nitrogen content.

Only about a third of the durum acreage received P fertilizer, but a higher percentage of the acreage in the Central and East regions received P fertilizer than in the West region presumably due to adequate soil P in the West from vegetable production. When P fertilizer was applied, the average phosphorus rate was 71 lbs P<sub>2</sub>O<sub>5</sub>/acre. Application of P fertilizer in the West and East regions was associated with lower grain protein, but again, response to P fertilizer is also influenced by other factors, such as soil P.

The average number of irrigations applied was 6.5. The number of irrigations applied was not associated with yield, but there was a weak trend for higher protein with fewer irrigations in the West.

This survey has shown that there are some associations between the various durum production practices and grain yield and protein, but these associations do not imply a cause-and-effect relationship. Side by side comparisons are the best way to evaluate the direct effect of varieties, fertilizer rates, or irrigation practices. Nevertheless, increased yield was associated with amendment application in the West region; certain varieties, amendment application, seeding rate between 120 and 159 lbs/acre, and nitrogen rate over 200 lbs N/acre in the Central region; and a seeding rate between 140 and 159 lbs/acre in the East region. Increased grain protein was associated with a previous crop of lettuce, lack of phosphorus application, and irrigation number in the West region; and a seeding rate of 140 to 159 lbs/acre and lack of phosphorus application in the East region.

### **Acknowledgements**

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Table 1. Number of survey respondents (N), grain yield, grain protein, and percentage of acres represented by various durum production practices in Arizona.

	West (Yuma and La Paz)				Central (Maricopa, Pinal, Pima)				East (Cochise and Graham)				All (West, Central, East)			
	N	Yield	Pro- tein	Acres	N	Yield	Pro- tein	Acres	N	Yield	Pro- tein	Acres	N	Yield	Pro- tein	Acres
		lbs/a	%	%		lbs/a	%	%		lbs/a	%	%		lbs/a	%	%
<b>Region</b>																
West	32	6425	13.0	53	.	.	.	.	.	.	.	.	32	6425	13.0	53
Central	.	.	.	.	42	5960	13.1	43	.	.	.	.	42	5960	13.1	43
East	.	.	.	.	.	.	.	.	6	5958	13.6	4	6	5958	13.6	4
<i>Significance</i>		---	---			---	---			---	---			NS	NS	
<b>County</b>																
Yuma	28	6554	13.2	45	.	.	.	.	.	.	.	.	28	6554	13.2	45
Pinal	.	.	.	.	30	6182	13.2	24	.	.	.	.	30	6182	13.2	24
Maricopa	.	.	.	.	8	5468	13.1	16	.	.	.	.	8	5468	13.1	16
La Paz	4	5520	11.3	8	.	.	.	.	.	.	.	.	4	5520	11.3	8
Pima	.	.	.	.	4	5284	12.8	3	.	.	.	.	4	5284	12.8	3
Cochise	.	.	.	.	.	.	.	.	4	5938	14.0	2	4	5938	14.0	2
Graham	.	.	.	.	.	.	.	.	2	6000	13.0	1	2	6000	13.0	1
<i>Significance</i>		+	**			*	NS			NS	NS			*	*	
<b>Previous crop</b>																
Cotton	2	5400	9.0	3	36	6020	13.1	36	2	6000	13.0	1	40	5988	13.0	41
Vegetables	12	6372	13.0	27	.	.	.	.	.	.	.	.	12	6372	13.0	27
Lettuce	13	6613	13.5	16	.	.	.	.	.	.	.	.	13	6613	13.5	16
Alfalfa	1	5078	12.0	5	2	4760	13.7	4	.	.	.	.	3	4866	13.1	9
Mixed	2	6850	13.5	1	2	5400	.	2	.	.	.	.	4	6125	13.5	4
Durum	1	7400	13.0	1	.	.	.	.	2	5500	13.5	2	3	6133	13.3	2
Corn	1	6200	12.8	1	.	.	.	.	2	6375	15.0	1	3	6317	13.9	1
Peppers	.	.	.	.	1	6800	12.8	1	.	.	.	.	1	6800	12.8	1
Watermelon	.	.	.	.	1	6500	14.0	0	.	.	.	.	1	6500	14.0	0
<i>Significance</i>		NS	**			NS	NS			NS	NS			NS	NS	
<b>Variety</b>																
Orita	4	6351	12.8	14	5	5264	13.3	13	4	5888	13.8	3	13	5790	13.3	30
Kronos	10	5724	12.2	18	8	6657	12.9	7	.	.	.	.	18	6139	12.5	25
Ocotillo	.	.	.	.	14	6079	13.4	12	.	.	.	.	14	6079	13.4	12
Sky	.	.	.	4	8	5544	12.8	5	2	6100	13.0	1	10	5655	12.8	11
Havasu	4	6940	13.0	8	.	.	.	.	.	.	.	.	4	6940	13.0	8
Alamo	6	6850	13.6	5	.	.	.	.	.	.	.	.	6	6850	13.6	5
Westbred 881	2	6700	13.3	3	.	.	.	.	.	.	.	.	2	6700	13.3	3
Kofa	6	6783	14.0	2	.	.	.	.	.	.	.	.	6	6783	14.0	2
Crown	.	.	.	.	5	5760	13.1	2	.	.	.	.	5	5760	13.1	2
Mohawk	1	.	12.7	1	.	.	.	.	.	.	.	.	1	.	12.7	1
Matt	.	.	.	.	1	6000	.	.	.	.	.	.	1	6000	.	1
Duraking	1	.	13.5	0	.	.	.	.	.	.	.	.	1	.	13.5	0
Platinum	.	.	.	.	1	6500	14.0	.	.	.	.	.	1	6500	14.0	0
<i>Significance</i>		NS	NS			+	NS			NS	NS			NS	NS	

Table 1 (Con'd). Number of survey respondents, grain yield, grain protein, and percentage of acres represented by various durum production practices in Arizona.

	West (Yuma and La Paz)				Central (Maricopa, Pinal, Pima)				East (Cochise and Graham)				All (West, Central, East)			
	N	Yield	Pro- tein	Acres	N	Yield	Pro- tein	Acres	N	Yield	Pro- tein	Acres	N	Yield	Pro- tein	Acres
		lbs/a	%	%		lbs/a	%	%		lbs/a	%	%		lbs/a	%	%
<b>Herbicide applied</b>																
No	9	6767	12.8	8	31	6033	13.2	26	3	6183	13.7	2	43	6197	13.1	36
Yes	23	6291	13.1	45	11	5755	13.1	17	3	5733	13.5	2	37	6087	13.1	64
Significance		NS	NS			NS	NS			NS	NS			NS	NS	
<b>Insecticide applied</b>																
No	30	6413	13.0	52	42	5960	13.1	43	6	5958	13.6	4	78	6134	13.1	99
Yes	2	6600	12.8	1	.	.	.	.	.	.	.	.	2	6600	12.8	1
Significance		NS	NS		---	---			---	---				NS	NS	
<b>PGR applied</b>																
No	31	6565	13.0	51	42	5960	13.1	43	5	5950	13.8	3	78	6200	13.1	98
Yes	1	2100	13.0	2	.	.	.	.	1	6000	13.0	0	2	4050	13.0	2
Significance		**	NS		---	---			---	---				**	NS	
<b>Manure or compost applied</b>																
No	29	6314	13.0	50	36	5829	13.1	37	6	5958	13.6	4	71	6038	13.1	90
Yes	3	7500	13.4	3	6	6750	13.2	7	.	.	.	.	9	7000	13.3	10
Significance		+	NS		*	NS			---	---				**	NS	
<b>Irrigation system</b>																
Border	11	6151	12.7	13	18	5961	13.2	24	.	.	.	.	29	6033	13.0	37
Level basin	16	6602	13.2	28	7	6136	13.4	4	.	.	.	.	23	6461	13.3	32
Furrow	3	6800	13.2	3	15	5839	12.9	13	2	6000	13.0	1	20	5999	12.9	17
Sprinkler	1	6903	13.8	8	.	.	.	.	4	5938	14.0	2	5	6131	14.0	10
Drip	1	5000	.	3	2	6250	14.0	2	.	.	.	.	3	5833	14.0	4
Significance		NS	NS		NS	NS			NS	NS			NS	NS		
<b>Soil texture</b>																
Sandy clay loam	7	6440	12.2	16	19	5924	13.4	17	4	5800	13.3	3	30	6028	13.1	36
Sandy loam	12	6472	13.5	13	15	5859	12.9	21	2	6275	14.0	1	29	6141	13.2	35
Clay loam	7	6780	12.7	12	1	6400	13.5	0	.	.	.	.	8	6733	12.8	12
Silty clay loam	4	5551	13.5	10	4	6425	13.3	2	.	.	.	.	8	5988	13.4	12
Silty loam	2	6600	13.0	2	3	5928	12.5	3	.	.	.	.	5	6197	12.7	5
Significance		NS	NS		NS	NS			NS	NS			NS	NS		

Table 1 (Con'd). Number of survey respondents, grain yield, grain protein, and percentage of acres represented by various durum production practices in Arizona.

	West (Yuma and La Paz)				Central (Maricopa, Pinal, Pima)				East (Cochise and Graham)				All (West, Central, East)			
	N	Yield lbs/a	Pro- tein %	Acres %	N	Yield lbs/a	Pro- tein %	Acres %	N	Yield lbs/a	Pro- tein %	Acres %	N	Yield lbs/a	Pro- tein %	Acres %
<b>Planting date</b>																
December	11	6560	12.8	15	29	6009	13.1	36	1	6000	13.0	1	41	6156	13.0	51
January	13	6480	13.1	24	4	5669	12.5	7	.	.	.	.	17	6289	12.9	31
February	4	6450	13.3	10	2	5750	13.5	4	3	5917	14.5	2	9	6117	13.6	17
March	.	.	.	.	.	.	.	.	1	6000	13.0	0	1	6000	13.0	0
Significance		NS	NS			NS	NS			NS	NS			NS	NS	
<b>Seeding rate (lbs/a)</b>																
100-119	1	7500	14.0	1	.	.	.	.	.	.	.	.	1	7500	14.0	1
120-139	9	6411	13.4	9	3	6467	13.5	1	.	.	.	.	12	6425	13.4	10
140-159	4	6570	13.0	11	8	6653	13.4	8	2	6375	15.0	1	14	6589	13.4	20
160-179	8	6488	12.7	10	14	5770	13.1	20	.	.	.	.	22	6031	13.0	30
180-200	8	6053	12.9	20	15	5576	13.0	17	3	6000	13.0	2	26	5772	13.0	39
Significance		NS	NS			*	NS			+	**			+	NS	
<b>Nitrogen rate (lbs N/a)</b>																
0-99	.	.	.	.	1	3000	13.4	4	.	.	.	.	1	3000	13.4	4
100-199	9	6556	13.6	12	9	5467	13.5	7	2	5600	14.0	2	20	5970	13.6	21
200-299	16	6379	12.9	32	25	6143	13.0	30	4	6138	13.5	2	45	6226	13.0	64
300-499	5	6148	12.3	8	6	6557	13.3	3	.	.	.	.	11	6371	12.9	11
Significance		NS	NS			**	NS			NS	NS			**	NS	
<b>Phosphorus applied</b>																
No	26	6486	13.2	43	19	5967	13.3	23	3	5917	14.5	2	48	6245	13.3	68
Yes	6	6163	12.0	10	23	5955	13.0	21	3	6000	13.0	2	32	5998	12.9	32
Significance		NS	*			NS	NS			NS	*			NS	+	
<b>Number of irrigations</b>																
<6	10	6696	13.6	8	12	6123	12.9	15	4	5800	13.3	3	26	6294	13.2	25
6	6	6896	13.0	13	14	5802	13.3	10	1	6000	13.0	1	21	6124	13.2	23
7	6	6177	12.1	8	7	5839	12.8	8	.	.	.	.	13	5995	12.5	16
>7	8	5800	13.4	22	9	6084	13.5	13	1	6550	15.0	0	18	5984	13.5	36
Significance		NS	+			NS	NS			NS	NS			NS	*	

Significance: Statistical significance or probability that differences observed are due to chance. NS = not significant at the 10% probability level, + = significant at the 10% probability level, \* = significant at the 5% probability level, and \*\* = significant at the 1% probability level.