

Final Report

Arizona Grain Research and Promotion Council

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Survey of Durum Production Practices

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Survey of Durum Production Practices, 2006

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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 two regions: West (Yuma and La Paz counties) and Central (Maricopa, Pinal, and Pima counties). These two regions represent about 95% of the durum acreage. We obtained responses from 85 out of an estimated 170 durum growers (50%) representing 40,580 out of 70,000 acres (58%). Durum was grown following vegetables (42%), cotton (41%), lettuce (12%), or other crops. The predominant soil texture was a sandy clay loam (47%), followed by sandy loam (30%) and clay loam (16%). Herbicide was applied on 52% of the acreage. The major varieties were Kronos (26%), Ocotillo (20%), Alamo (16%), and Orita (16%). Flood irrigation systems accounted for 87% of the acreage, followed by furrow (11%). The crop was typically irrigated 6 times. The average planting date (irrigation applied) was December 27 in the Central region and January 4 in the West region. The seed was planted at an average rate of 160 lbs/acre. Phosphorus was applied to only a quarter of the acreage, but when it was applied, the rate averaged 65 lbs P_2O_5 /acre. Nitrogen rate averaged 224 lbs N/acre. Increased yield was associated with previous crops other than cotton in the West region, certain varieties, lack of herbicide application, planting in January in the West region and November or December in the Central region, a seeding rate between 100 and 160 lbs N per acre, and an N rate between 200 and 300 lbs N per acre. Increased grain protein was associated with a previous crop of vegetables or lettuce in the West region, lack of herbicide application in the Central region, manure application, clay loam or sandy clay loam soil, December planting in the West region, lack of phosphorus application, and fewer irrigations. 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 2006 was developed and sent to growers in two regions of Arizona: West (Yuma and La Paz counties) and Central (Maricopa, Pinal, and Pima counties). These two regions contained

about 70,000 of the 74,000 acres of durum in the state in 2006, or about 95% of the durum acreage. We obtained responses from 85 out of an estimated 170 durum growers (50%) representing 40,580 out of 70,000 acres (58%). 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 2006 was roughly split between the West (56%) and Central (44%) regions, and grain yield was higher in the West region (Table 1). The county with the greatest percentage of the acreage was Yuma (50%) followed by Pinal (23%) and Maricopa (17%). Grain yield was highest in Yuma and Pinal Counties, and grain protein was not different among counties.

Durum was most often planted after vegetables (42%), cotton (41%) or lettuce (12%). The highest yields and protein in the West region were obtained after vegetables or lettuce.

The top four varieties in terms of percentage of acreage were Kronos (26%), Ocotillo (20%), Alamo (16%), and Orita (16%). Several varieties were grown in both regions, but some such as Alamo 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, both yield and protein were highest in Alamo in the West and 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 did not receive a herbicide application. Grain yield and protein (in the Central region) was slightly higher in the when herbicide was not applied. Insecticide was only applied to 1% of the acreage. Plant growth regulator (PGR) to control lodging was applied to less than 1% of the acreage. Manure or compost was applied to 14% of the acreage overall, and was associated with higher protein in the West region.

The predominant irrigation system is border flood (73%) followed by level basin (14%) and furrow (11%). Grain protein was higher in the border compared to level basin system. I believe there may be some confusion among the respondents about the definition of border flood and level basin irrigation, so these results may not be representative.

Durum was grown predominantly on sandy clay loam soil (47%) followed by sandy loam (30%) and clay loam (16%) soil. Grain protein was lower on sandy loam soil compared with clay loam and sandy clay loam.

The average planting date was January 4 in the West region and December 27 in the Central region. The highest yields were obtained with a January planting date in the West region and November or December planting date in the Central region. Higher grain protein was obtained with earlier planting dates in the West region.

The average seeding rate was 160 lbs seed/acre. Highest yields were reported for seeding rates between 100 and 159 lbs seed per acre.

The average nitrogen rate was 224 lbs N/acre. The highest grain yield was associated with nitrogen rates between 200 – 299 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 quarter of the durum acreage received P fertilizer, but a higher percentage of the acreage in the Central region 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 65 lbs P₂O₅/acre. Application of P fertilizer in the Central region 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 6.2. 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 previous crops other than cotton in the West region, certain varieties, lack of herbicide application, planting in January in the West region and November or December in the Central region, a seeding rate between 100 and 160 lbs N per acre, and an N rate between 200 and 300 lbs N per acre. Increased grain protein was associated with a previous crop of vegetables or lettuce in the West region, lack of herbicide application in the Central region, manure application, clay loam or sandy clay loam soil, December planting in the West region, lack of phosphorus application, and fewer irrigations.

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 Co.) | | | | Central (Maricopa, Pinal, and Pima Co.) | | | | All (West and Central) | | | |
|----------------------|-------------------------------|-------|---------|-------|--|-------|---------|-------|---------------------------|-------|---------|-------|
| | N | Yield | Protein | Acres | N | Yield | Protein | Acres | N | Yield | Protein | Acres |
| | | lbs/a | % | % | | lbs/a | % | % | | lbs/a | % | % |
| Region | | | | | | | | | | | | |
| West | 38 | 6392 | 13.4 | 56 | . | . | . | . | 38 | 6392 | 13.4 | 56 |
| Central | . | . | . | . | 47 | 5898 | 13.3 | 44 | 47 | 5898 | 13.3 | 44 |
| <i>Significance</i> | | --- | --- | | | --- | --- | | * | | NS | |
| County | | | | | | | | | | | | |
| Yuma | 33 | 6506 | 13.4 | 50 | . | . | . | . | 33 | 6506 | 13.4 | 50 |
| Pinal | . | . | . | . | 25 | 6197 | 13.5 | 23 | 25 | 6197 | 13.5 | 23 |
| Maricopa | . | . | . | . | 15 | 5507 | 13.2 | 17 | 15 | 5507 | 13.2 | 17 |
| La Paz | 5 | 5640 | 13.5 | 6 | . | . | . | . | 5 | 5640 | 13.5 | 6 |
| Pima | . | . | . | . | 7 | 5666 | 12.8 | 4 | 7 | 5666 | 12.8 | 4 |
| <i>Significance</i> | | * | NS | | | + | NS | | ** | | NS | |
| Previous crop | | | | | | | | | | | | |
| Vegetables | 20 | 6434 | 13.4 | 38 | 1 | 5180 | 12.5 | 4 | 21 | 6375 | 13.3 | 42 |
| Cotton | 5 | 5940 | 12.9 | 6 | 40 | 5983 | 13.3 | 35 | 45 | 5978 | 13.2 | 41 |
| Lettuce | 12 | 6627 | 13.5 | 12 | . | . | . | . | 12 | 6627 | 13.5 | 12 |
| Durum | . | . | . | . | 3 | 4400 | 14 | 4 | 3 | 4400 | 14 | 4 |
| Chile | . | . | . | . | 1 | 8000 | 13 | 1 | 1 | 8000 | 13 | 1 |
| Sorghum | . | . | . | . | 1 | 4500 | 12.3 | 1 | 1 | 4500 | 12.3 | 1 |
| Alfalfa | . | . | . | . | 1 | 7000 | 13 | 0 | 1 | 7000 | 13 | 0 |
| Corn | 1 | 5000 | 14.5 | 0 | . | . | . | . | 1 | 5000 | 14.5 | 0 |
| <i>Significance</i> | | + | + | | | ** | NS | | ** | | NS | |
| Variety | | | | | | | | | | | | |
| Kronos | 9 | 6194 | 13.2 | 16 | 9 | 6912 | 13.4 | 10 | 18 | 6553 | 13.3 | 26 |
| Ocotillo | . | . | . | 0 | 17 | 5866 | 13.4 | 20 | 17 | 5866 | 13.4 | 20 |
| Alamo | 8 | 6769 | 13.6 | 16 | . | . | . | 0 | 8 | 6769 | 13.6 | 16 |
| Orita | 5 | 6460 | 12.9 | 7 | 6 | 5497 | 13.3 | 9 | 11 | 5935 | 13.1 | 16 |
| WPB881 | 4 | 5874 | 13.4 | 7 | 1 | 4500 | 12.3 | 1 | 5 | 5599 | 13.2 | 8 |
| Kofa | 4 | 6225 | 13.8 | 4 | . | . | . | 0 | 4 | 6225 | 13.8 | 4 |
| Sky | . | . | . | 1 | 6 | 5877 | 12.8 | 2 | 6 | 5877 | 12.8 | 3 |
| Duraking | 3 | 7033 | 13.3 | 2 | . | . | . | 0 | 3 | 7033 | 13.3 | 2 |
| Crown | . | . | . | 0 | 4 | 5100 | 13.7 | 2 | 4 | 5100 | 13.7 | 2 |
| Havasú | 1 | 6400 | 13.4 | 1 | . | . | . | 0 | 1 | 6400 | 13.4 | 1 |
| Matt | . | . | . | 0 | 1 | 6000 | . | 1 | 1 | 6000 | . | 1 |
| Reva | 1 | 8600 | . | 1 | . | . | . | 0 | 1 | 8600 | . | 1 |
| RoyalII | 1 | 5000 | 14.5 | 0 | . | . | . | 0 | 1 | 5000 | 14.5 | 0 |
| BR0202W | 1 | 4220 | 13.7 | 0 | . | . | . | 0 | 1 | 4220 | 13.7 | 0 |
| <i>Significance</i> | | * | ** | | | ** | + | | + | | ** | |

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 Co.) | | | | Central (Maricopa, Pinal, and Pima Co.) | | | | All (West and Central) | | | |
|----------------------------------|-------------------------------|-------|---------|-------|--|-------|---------|-------|---------------------------|-------|---------|-------|
| | N | Yield | Protein | Acres | N | Yield | Protein | Acres | N | Yield | Protein | Acres |
| | | lbs/a | % | % | | lbs/a | % | % | | lbs/a | % | % |
| Herbicide applied | | | | | | | | | | | | |
| No | 10 | 6572 | 13.4 | 10 | 39 | 6058 | 13.4 | 38 | 49 | 6163 | 13.4 | 48 |
| Yes | 28 | 6328 | 13.4 | 45 | 8 | 5115 | 12.7 | 7 | 36 | 6059 | 13.2 | 52 |
| <i>Significance</i> | | * | NS | | | * | + | | | * | NS | |
| Insecticide applied | | | | | | | | | | | | |
| No | 37 | 6430 | 13.4 | 56 | 46 | 5910 | 13.3 | 43 | 83 | 6142 | 13.3 | 99 |
| Yes | 1 | 5000 | 14.5 | 0 | 1 | 5318 | 12 | 1 | 2 | 5159 | 13.3 | 1 |
| <i>Significance</i> | | NS | NS | | | NS | + | | | + | ** | |
| PGR applied | | | | | | | | | | | | |
| No | 37 | 6451 | 13.4 | 56 | 47 | 5898 | 13.3 | 44 | 84 | 6141 | 13.3 | 100 |
| Yes | 1 | 4220 | 13.7 | 0 | . | . | . | . | 1 | 4220 | 13.7 | 0 |
| <i>Significance</i> | | * | NS | | | --- | --- | | | + | NS | |
| Manure or compost applied | | | | | | | | | | | | |
| No | 35 | 6383 | 13.3 | 52 | 34 | 5959 | 13.2 | 35 | 69 | 6174 | 13.3 | 86 |
| Yes | 3 | 6501 | 14 | 4 | 13 | 5738 | 13.4 | 10 | 16 | 5881 | 13.5 | 14 |
| <i>Significance</i> | | NS | ** | | | NS | NS | | | NS | * | |
| Irrigation system | | | | | | | | | | | | |
| Border | 28 | 6276 | 13.5 | 42 | 29 | 5862 | 13.3 | 31 | 57 | 6066 | 13.4 | 73 |
| Level basin | 9 | 6686 | 12.9 | 12 | 4 | 6377 | 13.3 | 2 | 13 | 6591 | 13 | 14 |
| Furrow | . | . | . | . | 14 | 5834 | 13.2 | 11 | 14 | 5834 | 13.2 | 11 |
| Sprinkler | 1 | 7002 | 14 | 2 | . | . | . | . | 1 | 7002 | 14 | 2 |
| <i>Significance</i> | | NS | ** | | | NS | * | | | NS | NS | |
| Soil texture | | | | | | | | | | | | |
| Sandy clay loam | 16 | 6506 | 13.5 | 34 | 13 | 5557 | 13.1 | 13 | 29 | 6080 | 13.3 | 47 |
| Sandy loam | 13 | 6534 | 13.2 | 12 | 25 | 5895 | 13.3 | 18 | 38 | 6113 | 13.3 | 30 |
| Clay loam | 7 | 6225 | 13.3 | 9 | 6 | 6580 | 13.6 | 7 | 13 | 6389 | 13.4 | 16 |
| Sand | . | . | . | . | 1 | 6000 | 12.9 | 5 | 1 | 6000 | 12.9 | 5 |
| Silt loam | 1 | 5000 | 14.5 | 0 | 1 | 6508 | 13.1 | 1 | 2 | 5754 | 13.8 | 1 |
| Silty clay loam | . | . | . | . | 1 | 5600 | 13 | 1 | 1 | 5600 | 13 | 1 |
| Clay | 1 | 5300 | 13 | 0 | . | . | . | . | 1 | 5300 | 13 | 0 |
| <i>Significance</i> | | 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 Co.) | | | | Central (Maricopa, Pinal, and Pima Co.) | | | | All (West and Central) | | | |
|------------------------------------|-------------------------------|----------------|--------------|------------|--|----------------|--------------|------------|---------------------------|----------------|--------------|------------|
| | N | Yield lbs/a | Protein % | Acres % | N | Yield lbs/a | Protein % | Acres % | N | Yield lbs/a | Protein % | Acres % |
| Planting date | | | | | | | | | | | | |
| November | 1 | 6400 | 14 | 2 | 3 | 6167 | 13 | 5 | 4 | 6225 | 13.3 | 7 |
| December | 17 | 6399 | 13.5 | 12 | 28 | 6154 | 13.3 | 29 | 45 | 6246 | 13.4 | 41 |
| January | 17 | 6526 | 13.3 | 40 | 10 | 5196 | 13.2 | 8 | 27 | 6033 | 13.2 | 48 |
| February | 3 | 5600 | 13.2 | 2 | 3 | 5206 | 12.8 | 2 | 6 | 5403 | 13 | 3 |
| <i>Significance</i> | | + | ** | | | + | NS | | | + | NS | |
| Seeding rate (lbs/a) | | | | | | | | | | | | |
| 100-119 | 2 | 8100 | 14.5 | 1 | 2 | 5659 | 12 | 1 | 4 | 6880 | 13.3 | 2 |
| 120-139 | 10 | 6458 | 13.3 | 8 | 5 | 6080 | 13.3 | 4 | 15 | 6332 | 13.3 | 11 |
| 140-159 | 8 | 6428 | 13.3 | 25 | 12 | 6165 | 13.4 | 12 | 20 | 6270 | 13.4 | 38 |
| 160-179 | 12 | 6210 | 13.3 | 11 | 11 | 5709 | 13.5 | 11 | 23 | 5970 | 13.4 | 22 |
| 180-200 | 6 | 6033 | 13.5 | 10 | 17 | 5805 | 13.1 | 17 | 23 | 5865 | 13.2 | 27 |
| <i>Significance</i> | | NS | NS | | | + | NS | | | ** | * | |
| Nitrogen rate (lbs N/a) | | | | | | | | | | | | |
| 0-99 | 3 | 7200 | 14.2 | 2 | 6 | 5133 | 13.4 | 4 | 9 | 5822 | 13.7 | 6 |
| 100-199 | 13 | 6274 | 13.3 | 16 | 10 | 5264 | 13.1 | 14 | 23 | 5835 | 13.2 | 30 |
| 200-299 | 12 | 6716 | 13.4 | 21 | 23 | 6454 | 13.1 | 20 | 35 | 6544 | 13.2 | 40 |
| 300-499 | 9 | 5983 | 13.3 | 17 | 8 | 5663 | 13.6 | 6 | 17 | 5832 | 13.5 | 23 |
| <i>Significance</i> | | + | ** | | | ** | NS | | | + | NS | |
| Phosphorus applied | | | | | | | | | | | | |
| No | 28 | 6272 | 13.5 | 47 | 27 | 5755 | 13.3 | 28 | 55 | 6018 | 13.4 | 76 |
| Yes | 10 | 6730 | 13 | 8 | 20 | 6091 | 13.2 | 16 | 30 | 6304 | 13.1 | 24 |
| <i>Significance</i> | | NS | ** | | | NS | + | | | NS | NS | |
| Number of irrigations | | | | | | | | | | | | |
| <6 | 13 | 6695 | 13.5 | 13 | 20 | 5606 | 13.2 | 16 | 33 | 6035 | 13.4 | 29 |
| 6 | 13 | 6465 | 13.4 | 29 | 11 | 5917 | 13.5 | 9 | 24 | 6214 | 13.5 | 37 |
| 7 | 7 | 6158 | 13.2 | 7 | 6 | 6548 | 13.4 | 5 | 13 | 6338 | 13.3 | 13 |
| >7 | 5 | 5744 | 13.4 | 6 | 10 | 6070 | 12.9 | 14 | 15 | 5961 | 13.1 | 21 |
| <i>Significance</i> | | NS | * | | | NS | NS | | | NS | NS | |
| All | 38 | 6392 | 13.4 | 56 | 47 | 5898 | 13.3 | 44 | 85 | 6119 | 13.3 | 100 |

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.