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ARIZONA Grain Research & Promotion Council

DESERT DURUM®

Chairman's Report

By David Sharp, Roll

Feast followed by frustration (and "what else is new?) might well describe the attitude of Arizona grain (especially durum) growers in late 2015, considering the bi-polar market circumstances what we've encountered over the past year and a half. However, the existing mind-set of Arizona growers may differ according to where they farm – see our sustainability report (page 4).

Early in the 2014 decision period, ahead of planting the 2015 durum crop, we saw offered prices to be sufficiently attractive that Arizona growers planted over 140,000 acres of Desert Durum®, the most since 2008, according to USDA figures. Why? Because the domestic milling industry, in particular, needed a reliable source of high quality 2015 durum grain supplies at the earliest possible time in 2015 (June-July), following evidence that unfavorable weather conditions resulted in widespread poor grain quality from the 2014 harvest in the northern U.S. and Canadian production regions.

This demand led to reasonably profitable price offerings ahead of the southwestern desert planting season for the 2015 crop and a 93% increase in Arizona's harvested durum acreage over 2014, according to USDA figures. Also, California's 2015 harvest of Desert Durum® jumped by at least 100% over 2014.

While most durum producers banked expected normal returns from their 2015 crops, the usual stress-free efforts of some growers to deliver as expected were adversely affected by nature, by their production practices, and by regulatory imperatives. Reasons included untimely and rarely-experienced rains at maturity that bleached grain color to discounted price levels and, in some locales, rains and sprinkler irrigation during the wheat flowering period that encouraged Karnal bunt (KB) activity, leading to detection of the fungus in more fields than usual inside the regulated area. As a result, a portion of the 2015 durum crop ended up returning a fraction of pre-harvest expectations.

However, growers who participated in the KB risk pools offered by our grain handlers limited their losses due to KB incidence. Meanwhile, growers who suffered from unusual grain quality discounts experienced first-hand the issues that often plague wheat growers in other regions of the country.

What about the 2016 crop?

Well, now we experience the frustration that can be caused by the commodity markets – particularly those that involve a global supply-demand arena. While we Desert Durum® growers reaped a relative 2015 crop feast due to the disastrous 2014 season harvest conditions in the northern U.S. and Canadian durum regions, we now see a virtual empty plate in terms of price offerings for the 2016 crop because the northern durum growers faced no quality issues from their own 2015 crops. Furthermore, northern U.S. durum production was over one-third higher in 2015 than in recent seasons. So, supplies are adequate

Chairman – *Continued on page 3*

Desert Durum® grain's water footprint defies global estimates

U of A study finds the water footprint sustainability "metric" of growing durum wheat in AZ to be very favorable compared to global calculations for the state

Results of an academic study to determine a realistic and accurate "water footprint" metric for durum grain grown in Arizona's desert climate indicate that the state's current real water footprint is much smaller (more favorable) than the perceived footprint value for Arizona that has been assumed by some potential Desert Durum® buyers in both the domestic and international communities. Water footprint is an important component of the "sustainability" perceptions assigned to raw material supply sources. The study determined that Arizona's average water footprint for producing durum grain is about 78% of that published for Arizona by an internationally-recognized footprint calculator and only 60% of that source's water footprint estimate for global durum production.

Sustainability philosophies that embrace water footprint estimates are now seen to increasingly influence attitudes of many levels of buyers about the nature and acceptability of production practices in the origins of the durum wheat they buy for milling semolina flour and making pasta. The study, conducted by Dr. George Frisvold, agricultural economist at the University of Arizona, was funded by the AGRPC as part of its published research grant program.

The study findings appear to support concerns, expressed in AGRPC's 2014 newsletter, that sustainability metrics derived from generalized data rather than local data can erroneously categorize, even stigmatize, crops produced in a specific locality as well as the characteristics of their production resources, such as water source. The study also found that, while recent reports conclude that Arizona's durum water footprint is large, they exhibit unexplained data-use anomalies that lead to overstating Arizona's durum water footprint and understating it for durum grown elsewhere.

Portions of the report's executive summary and selected report details can be found elsewhere in this newsletter, along with some references and notice of how to access the complete report.

What's Inside……

A message to Arizona's grain growers

The Arizona Grain Research and Promotion Council was created in 1986 by the Arizona legislature as a producer-funded and producer-directed program to assist in developing the state's grain industry to be more productive and profitable. The council participated in the State's sunset review re-authorization process during 2012 and 2013. The 2013 Arizona legislature passed legislation, signed by the governor, which has extended the council's existence and assessing authority until 2023.

Programs and projects in which the council may engage include:

1. Cooperation in state, regional, national or international activities with public or private organizations or individuals to assist in developing and expanding markets and reducing the cost of marketing grain and grain products.

2. Participation in research projects and programs to assist in reducing fresh water consumption, developing new grain varieties, improving production and handling methods and in the research and design of new or improved harvesting or handling equipment.

3. Any program or project that the council determines appropriate to provide education, publicity or other assistance to facilitate further development of the Arizona grain industry.

The council consists of seven members appointed by the governor for three-year terms. Members must be residents and producers in the state and they serve without compensation. Producers seeking consideration for appointment to the council may contact the Arizona Department of Agriculture's council administrator (602-542-3262).

The council has established a check-off fee of $.025/cwt. ($.50/ton) on the barley and wheat of all classes that is produced in Arizona and sold "...for use as food, feed or seed or produced for any industrial or commercial use." Thus, all grain of these kinds is subject to the assessment when it is first sold to a buyer or "first purchaser".

Check-off fees are collected by the "first purchaser" and remitted to the council, in care of the Arizona Department of Agriculture. While producers bear primary responsibility for paying the fee, this liability is discharged if the fee is collected by the first purchaser.

Producers may request a refund within 60 days of paying the fee by submitting the appropriate refund request form available from the council.

The council's quarterly meetings are open to the public. Meeting dates and agendas can be obtained from the ADA council administrator's office.

Producers of grain in Arizona are urged to contact any council member with comments or ideas pertaining to the council's mission or activities.

AGRPC Members (L-R): Paul (Paco) Ollerton, Michael Edgar, Jason Walker, Jason Hardison, David Sharp, Larry Hart, and Eric Wilkey.

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AGRPC's FY 2015 Financial Statement

Beginning fund balance	$112,731
Income items:	
Assessments	$157,275
Investment income	1,162
Less refunds to producers	(4,071)
Net income	$154,366
Total operating fund balance	$267,097
Expenses	
Executive Director (1)	$18,000
ADA Administration	7,500
U.S. Wheat Associates	29,100
Travel & Meeting	7,187
Desert Durum® Quality Survey	3,845
Trade Teams	0
Annual Newsletter	2,739
Promotion & advertising	22,714
Research Project	25,814
Miscellaneous	25
Total expenses	$116,924
Ending fund balance	$150,173

Note: Fiscal years are from July 1- June 30
(1) Contract with Allan B. Simons

Desert Durum® Production and Export Volumes in Marketing Years 2013 and 2014 (ending May 31)

The following figures were derived from reports of the USDA/NASS, USDA/GIPSA. Figures are in metric tons (2,2046 lb. /metric ton)

Production	2013 Crop	2014 Crop
	(Metric tons)	
Arizona	205,388	229,551
Southern California	86,667	45,252
Total	**292,055**	**274,803**

Export destinations	2014 MY	2015 MY
	(Metric tons)	
Italy	95,311	126,000
Nigeria	41,404	16,317
Total	**136,715**	**142,317**

Chairman – *Continued from page 1*

or better, resulting in lower prices for everyone.

Compounding matters, cheap corn grain prices cause local offerings for feed barley to provide little incentive for planting that crop. We know that much of the incentive to plant barley is related to what feeders and dairies must pay to import corn into Arizona. In fact, 2015 barley acres and production were barely 50% of those in 2014, with continued dismal prospects for 2016.

What about our "sustainability" reputation?

Regardless of our personal attitudes about the legitimacy of the sustainability mantra that seems to be driving the purchasing practices of many buyers in the food chain, I think that we must recognize that the concept will continue to grow and affect our circumstances. Therefore, the AGRPC sponsored a study by a well-recognized U of A economist, Dr. George Frisvold, to characterize the efficiency of Arizona's water usage in growing barley and wheat. A summary of his findings, based on local data accumulated by the USDA and other independent sources, is presented elsewhere in this newsletter.

Briefly, the report concludes that Arizona producers have reduced our irrigation water usage to grow barley and wheat by about 30% over the past 30 years – amounting to a yearly volume reduction equivalent to 40% of the annual water deliveries to all customers in Tucson – equal to about 370,000 people. Also, the report concludes that adoption of the annual rotation of produce and wheat, as widely practiced in Yuma County, has reduced per acre water use by 24-56% compared to other cropping patterns in the area. Furthermore, our wheat-vegetable rotations increase economic water productivity, which is the dollar value of crop production per acre-foot of water consumed, by 9-21 times. Finally, careful consideration of the real water footprint of Desert Durum® is well below the global perception.

The AGRPC will be considering how to publicize these and other findings of the study in order to emphasize the efficiencies and practices adopted by our industry in terms of sustainability and just plain production economics. There has been much publicity in recent times about the future of Arizona's water supplies and how agriculture may fare in future negotiations. We need to make sure that our voice is heard.

In regard to the more general topic of the overall importance of agriculture in Arizona's economy, the AGRPC has commissioned a broader study to estimate those factors, to be conducted by Dr. Frisvold and his assistant. A description of the project can be found elsewhere in this newsletter.

Quality, quality, quality

AGRPC spends a significant sum each year to characterize the quality of Arizona's Desert Durum® crop. The efforts include handlers collecting samples by variety as trucks arrive at handler facilities, followed by compositing those samples from all regions of the state. The composites are sent to the California Wheat Commission (CWC) laboratory to be analyzed for milling and pasta-making qualities. Finally, the AGRPC and the CWC jointly publish a detailed report for use by our handlers, their customers, and U.S. Wheat Associates for export promotion.

Desert Durum® varieties are developed to exhibit both high grain yield and the superior grain, milling, and pasta-making qualities that are achievable in the unique production environment that we enjoy. This environment is conducive to producing consistently high quality grain each season when Arizona producers provide the cultural resources to take advantage of the innate capabilities of the varieties that our plant breeding partners give us.

The AGRPC urges all Arizona growers to help maintain the reputation of Desert Durum® as the most reliably high quality durum grain produced in the world. This objective means providing the attention and nutrient inputs needed to achieve high HVAC and satisfactory protein content. And, optimizes producer returns as determined by market forces.

Expressions of gratitude

Arizona Department of Agriculture staffers who assist the Council in various ways include Assistant Director Brett Cameron and Council Administrator Lisa James. Lisa is completing her twelfth year serving as the AGRPC's primary liaison with the Department. She handles open meeting compliance issues, most of our official correspondence and documentation, and financial record-keeping with expertise and good humor. We are fortunate to have her on our team. In addition, Assistant Attorney General Aaron Thompson guides us through various regulatory issues.

Finally, I continue to appreciate the AGRPC's association with Executive Director Al Simons, who is completing his 21st year in the role of supporting AGRPC activities and representing the Council within Arizona and elsewhere.

Mark Killian, long-time AZ official and farmer, becomes Ag Department director

Mark W. Killian was appointed Director of the Arizona Department of Agriculture in April 2015. Mr. Killian served as chairman, vice chairman, and treasurer of the Arizona Board of Regents from 2010 until October 2015. He was previously director of the Arizona Department of Revenue and served for 14 years in the Arizona State Legislature, including as Speaker of the House and House Majority Leader.

Mr. Killian also is involved in family farming and ranching enterprises, overseeing the stewardship of 1,700 acres of farmland in Arizona, and is the current chairman of the Green Reservoir Flood Control district and the Santa Cruz River Alliance. His family previously farmed in the Chandler and Laveen areas. Mr. Killian earned a Bachelor's Degree in business administration with a specialization of real estate and urban planning from Arizona State University in 1981.

Mr. Killian attended the AGRPC quarterly meeting in April and has expressed interest and support for the council's activities. He has been pro-active in urging participation of the agricultural community in addressing the many current and future issues that face the industry. He inaugurated a "roundtable" gathering of over 200 ag community participants that was held in early December to address these issues, with plans for this to be an annual affair.

Developing Sustainability Metrics for Water Use in Arizona Small Grain Production – A Report to the AGRPC

By George B. Frisvold, Ph.D. Extension Specialist & Professor
Depart. of Agricultural & Resource Economic, Univ. of Arizona

Editor's note: This article is condensed from the Executive Summary and Results and Discussion of the full report, which contains the complete reference list. Obtain the full report from the AGRPC's executive director or the following web site: **https://agriculture.AZ.gov/Arizona-grain-research-and-promotion-council-0**

What is the issue and what did the study consider?

Grain buyers and consumers increasingly evaluate their potential grain purchases in terms of "sustainability metrics" such as a water "footprint" - the quantity of water from all sources that is consumed by a crop in the production of a fixed quantity of grain in a specified region.

The global conventional wisdom is that grains grown in Arizona leave a very large water footprint, while relying on water supplied from sources other than rainfall, so are less sustainably-produced than are grains grown in lower water footprint regions. This perception has already manifested itself in the apparent reluctance of some potential Desert Durum® buyers to continue to source their durum supplies from Arizona.

This study estimated a number of sustainability measures for water use in Arizona small grain production including: water application intensity, water productivity, irrigation efficiency, water economic productivity, and water footprint. The study also evaluated how grain production, particularly as part of grain-vegetable crop rotations, enhances the regional sustainability of agricultural production in the arid Southwest. Finally, the study evaluated estimates of Arizona durum wheat's water footprint reported in popular water footprint calculators. It identified several methodological and data errors in these calculators that lead to an over-estimate of the water footprint of Arizona's durum wheat production. A more accurate localized calculation of Arizona's water footprint is presented.

Water application intensity

Among all crops grown in Arizona, wheat and barley have relatively low water application rates. According to 2013 USDA survey data, an average of only 3.1 acre-feet/acre (AF/A) of irrigation water are now applied to the state's wheat and barley crops. This is 26% lower than Arizona's average application rate of 4.2 AF/A across all crops (Table 1) and 10% less than the 1984 average of 3.45 AF/A applied to wheat and barley.

The drop in water application intensity over 30 years (1984-2013) represents about 37,000 AF on equivalent acreage – enough to supply 40% of all the potable water delivered to Tucson Water customers in 2013 – about 376,000 residential customers.

Water productivity

Water productivity describes the quantity of grain produced per unit of water applied. USDA data indicate that wheat yields have grown 22% from 25.1 to 30.6 bushels/AF applied over the period 1984 to 2013. Barley yields grew 21% from 34.8 bushels to 42.1 bushels/AF applied over the same period.

Stated another way, the amount of water needed to produce 100 bushels of wheat and barley declined 18% and 17%, respectively, between 1984 and 2013.

Table 1. Average number of acre-feet (AF) of irrigation water applied to an acre of Arizona crops in 2013.

Beans	2.2	Other hay (non-alfalfa)	3.9
Corn for grain	3.0	Corn for silage	4.1
Vegetables	3.1	Arizona average*	4.2
Wheat & barley	3.1	Other crops	4.2
Grain sorghum	3.3	Cotton	4.5
Pastureland	3.5	Alfalfa (perennial)	5.4
Orchards	3.6	* Weighted for county acreage	
Source: USDA/NASS Farm and Ranch Irrigation Survey, 2013			

Irrigation efficiency

According to USDA survey data, in 2013, Arizona growers (of all crops) spent $53.3 million on new irrigation equipment, facilities, land improvements, and computer technology. This amounted to investments in irrigation improvements of $151 per acre and $42,939 per farm. Of this $53.3 million, $12.2 million were investments primarily to conserve water, while another $1.1 million was devoted to conserving energy.

A recent study of cropping patterns in the Yuma, AZ vicinity highlights how irrigation investments and changes in cropping systems have combined to reduce water consumption per acre (Noble, 2015). Wheat production has played an important role in this system transition. State-level data published by USDA reports water use in terms of acre-feet applied, but these data do not consider consumptive water use – water removed from available supplies without return to the hydrological system. Noble (2015) documented patterns of total consumptive water use, including the amount of water transpired during plant growth plus water that evaporates from the soil and plant surfaces in the cropped area – termed evapotranspiration.

Yuma-area growers have improved irrigation efficiency and conserved water by implementing better water management practices and constructing water-saving distribution systems. These rotations avoid using irrigation water during most of the hot summer months when evapotranspiration is highest.

Table 2. Estimated crop consumptive water use in the Yuma, AZ area (inches of evapotranspiration/acre).

	Wheat/ lettuce	Wheat/ broccoli	Citrus	Cotton	Alfalfa
Wheat	20	20	-	-	-
Lettuce	12	-	-	-	-
Broccoli	-	18	-	-	-
Citrus	-		50	-	-
Cotton	-		-	53	-
Alfalfa	-		-		72
Total	32	38	50	53	72
Source: Noble (2015)					

Table 2 presents the absolute water consumption achievable when growing winter vegetable – wheat rotations compared to perennial or summer season culture. Water consumption for a wheat/lettuce rotation is 32 inches per acre and 38 inches per acre for a wheat/broccoli rotation. These have partially replaced citrus, alfalfa, and cotton cropping, perennial or summer season crops, with fall/winter/spring rotations, so consumptive water use has declined by 24% - 56%, due significantly to not having to irrigate in the hottest summer months

Sustainability – *Continued on page 5*

Sustainability – *Continued from page 4*

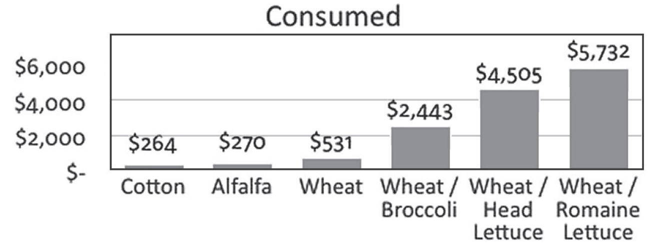
or year-around crops that consume 50 to 72 inches of water per acre (expressed as ETc).

Economic water productivity

The UN Food and Agriculture Organization (FAO) defines economic water productivity as the monetary value generated from each unit of water consumed. However, isolated crop-specific measures of water use or productivity often ignore the fact that crop rotations and multi-cropping systems are particularly important factors for evaluating economic water productivity.

Figure 1 compares the water economic productivity of several cropping systems in the Yuma area, where growers have dramatically increased their economic productivity by switching to wheat/vegetable rotations. Gross revenue for wheat alone was $531/AF - double that of cropping patterns it has partially replaced - cotton and alfalfa. When a field is devoted to a multi-crop system, such as produce followed by wheat, the economic productivity of that field is several orders of magnitude greater than when it grows any single field crop. A wheat/broccoli rotation can generate $2,443/AF of water applied, while wheat/lettuce rotations generate $4,505 to $5,732/AF. So, Yuma growers have been able to increase their water economic productivity by 9 to 21 times by switching to these rotations. Wheat continues to be a critical rotation crop with vegetables and is the second largest acreage crop in Yuma County.

Figure 1. Water Economic Productivity: Gross Revenue Per Acre-Foot of Water Consumed



Sources: Noble (2015); Arizona Agricultural Statistical Bulletin (2014); author's calculations

Comparative water footprint calculators

Water footprint estimates calculate the amount of water consumed per unit of output. Water consumed is divided among three types. "Green water" refers to consumptive use of rainwater stored in the soil after subtracting out losses from runoff, evaporation, and deep percolation. Thus, the amount of green water used by a crop in a given area will be less than the area's total amount of precipitation. Next, "blue water" refers to consumptive use of water applied via irrigation from ground and surface-stored sources. "Grey water" refers to polluted water, which is "the volume of freshwater that is required to assimilate the load of pollutants based on existing ambient water quality standards " (Mekonnen and Hoekstra, 2011, pg. 1578).

The Water Footprint Network (WFN) provides estimates of water footprints for commodities, including durum wheat (**http://waterfootprint.org/en/water-footprint/product-water-footprint**). The site reports how much water is used (in cubic meters, m^3) to produce one metric ton (1 MT = 2,205 lbs.) of grain. Other recently published efforts, including some by the author of this AGRPC study, have reported water footprints for Italy and/or Arizona, among other regions. The footprints reported vary widely, both across and within regions (Table 3).

Significant anomalies exist for the footprint numbers in the cited regions. It appears that the WFN is systematically overstating green water use, particularly for Arizona. Some of the discrepancies may involve how precipitation is measured and how local production processes are characterized. Oddly, the WFN does not report water footprint for Sicily, a major Italian durum-growing region, which possesses one of the highest water footprints, thus biasing Italy's footprint downward.

The WFN's reporting of a total water footprint of 1,403 m^3/MT for Arizona durum includes a green water portion that implies a total effective rainfall of nearly 12 inches/acre/year, grossly over-estimating what falls on the state's durum crops. Correcting effective rainfall amounts for Arizona's durum growing counties sharply lowers the estimated green water portions of the state's footprint, as indicated in Table 3. Thus, digging into the localized accurate statistics for precipitation, grain yields, and irrigation rates leads to the conclusion that ***Arizona's Desert Durum® water footprint is not only much lower than common perceptions, but is much lower than many other durum-producing regions.***

Table 3. Comparative water footprint estimates in m^3/MT of durum wheat grain production.

Region	Green Water	Blue Water	Grey Water	Total Footprint
Global Avg. (WFN)	1,277	342	207	1,827
Italy (WFN)	1,188	16	187	1,391
Italy (1)	748	525	301	1,574
Italy (2)	1,175	N/R	192	*1,367
Arizona (3)	399	848	156	1,403
Arizona average (4)	97	848	156	1,101
Yuma County, AZ (5)	71	670	156	897

* Total footprint in Ruini et al. calculations omit blue water.
(1) Aldaya and Hoekstra (2010)
(2) Ruini, et al. (2013) –avg. of S, Middle, N Italy (arithmetic)
(3) Ruini et al. (2013) and WFN
(4) Author's calculation - weighted avg. of 4 primary counties
(5) Author's calculation

Effects of crop abandonment on water footprint calculations

WFN's water footprint estimates are determined using harvested areas, thus ignoring the fertilizer, water, and other resources lost when portions of planted crops are abandoned, as occurs with variable regularity in rain-fed production regions. Irrigation is a key factor in limiting crop abandonment. Including abandoned inputs in water footprint calculations serves to increase the footprint of non-irrigated crops in comparison to Arizona's low (1%-2%) abandonment rate. The full report describes this correction factor in detail.

Some writings imply that blue water possesses a higher opportunity cost than green water and, perhaps, should be applied to higher-value uses than crop production. This perspective discounts the fact that sustainability footprints of all descriptions on abandoned crop acreages are infinitely large because the inputs, natural and applied, produce nothing.

Small grains 2015 research grant report

Development and field-testing of sensor-based algorithms for N-fertilizer management of Arizona durum wheat

(Principal investigator: Dr. Pedro Andrade-Sanchez, Associate Professor and Specialist, Precision Agriculture, U of A CALS, Maricopa Ag Center)

This project was the culmination of several years' focus on testing commercially-available precision agriculture technology for its capacity to perform variable-rate application of nitrogen (N) fertilizer in irrigated durum wheat in Maricopa, AZ. The technology tested in this study included active-light canopy reflectance and displacement sensors, as well as GPS-based rate-controllers for application equipment.

Multiple years of experimental data on sensor output and corresponding plant conditions were first needed to develop an algorithm specific to the conditions and yield goals of Central Arizona. Application equipment and experimental testing of N rates by time of application and amount began in 2011, funded by the AGRPC, provided consistent results that supported the feasibility of using active sensors in ground application systems to control the timing and delivery of N fertilizer in order to optimize production of durum wheat.

The test in 2015 included 4 combinations of N fertilizer amounts and application timing. Close monitoring of soil and plant (lower stem) nitrates and plant biomass was carried out during the early phases of crop development, followed by yield evaluations at maturity.

The 2015 efforts resulted in only small differences in grain yield due to amount and timing of N application. There was a trend of increasing yield by shifting higher N amounts towards the flowering stage but these differences were not statistically significant at the 95% probability level. Protein content was slightly higher for treatments with larger N applications near the tillering growth stage, but these differences were not significant at the same level. (**Editor:** The 95% probability level for significance suggests that there was more than 5% probability that the results obtained were due to chance; not necessarily that the treatments had no effect.)

The experiment in 2015 evaluated the potential gains of sensor-based management in soils with only moderately-low deficiency levels of N, a condition common in Arizona fields. The results showed that residual N in the soil had a buffering effect that reduced the impact of N treatments on crop development and yield.

The photo below provides a glimpse of the equipment that is used to monitor plant growth and meter liquid N fertilizer applications.

2015 Arizona Karnal Bunt Survey Results

Data released by the USDA/APHIS in Phoenix on August 26, 2015 revealed that 36 of the 502 wheat fields located in Arizona's KB quarantine areas tested positive for Karnal bunt (KB) at the 2015 harvest. The majority of positive fields of durum wheat were located in the Maricopa/Stanfield area south of Phoenix. Wheat was planted on 22,479 acres within the quarantined area this past season, up from 7,244 acres in 2014, when just one of 178 fields tested positive. The 2015 crop's regulated area totaled 206,367 tillable acres, all located in portions of La Paz, Maricopa, and Pinal Counties. This total was about 14,229 tillable acres less than in 2014. No positive fields were located in La Paz County. The KB quarantine was implemented in 1996 after samples from 17 Arizona wheat fields were determined to contain bunted kernels. The pathogen has been recognized as a federal quarantine pest since about 1983.

The substantial increase in positive KB findings in 2015 has been attributed mostly to unusual and untimely rain showers during the wheat flowering period and to the use of overhead sprinklers for irrigation of some fields.

KB quarantine regulations now enforced by APHIS-PPQ require that wheat fields located within the regulated areas be sampled and examined for bunted kernels before harvest. Grain from fields in which bunted kernels are found must be treated and used as animal feed. In 2015, the number of bunted kernels found in samples from the positive fields ranged from 1-749. However, all but two of the samples produced less than 100 bunted kernels and 19 samples yielded less than 10 bunted kernels. A sample consists of 4 lbs. of grain containing approximately 35,000 kernels.

Fields found to be KB-positive are designated as regulated fields and all other fields and land located within a three-mile radius fall into the KB quarantine area if they are not already in it.

Regulated fields can achieve deregulation according to a protocol that involves tillage and/or negative KB sampling of host crops for a total of five years. Deregulation of a field may eliminate surrounding fields and land from quarantine status, depending on the proximity of nearby regulated fields. At least 24 regulated fields qualified for deregulation after the 2015 season, according to APHIS. While these releases led to removal of some areas from regulation, the 2015 findings resulted in expansion of the regulated area in other localities.

Growers may contact APHIS/PPQ in Phoenix to determine the potential regulated status of their fields and cultural requirements to remove them from regulation (Phone 602-431-3216). Growers also may access a University of Arizona brochure that details management practices that may minimize the likelihood of KB infection in their host crops, or contact the AGRPC executive director to obtain a copy **https://extension.arizona.edu/sites/extension.arizona.edu/files/pubs/az1287-2015.pdf.**

This annual report and newsletter of the Arizona Grain Research and Promotion Council was edited and published by the AGRPC's contracted Executive Director, Allan B. Simons. Phone: 520-429-1221. E-mail: absimons42@yahoo.com.

Contact the Arizona Department of Agriculture to obtain remittance and refund forms. 1688 W. Adams, Phoenix, AZ 85007. Phone: 602-542-3262. Fax: 602-364-0830. Lisa James - Council, Board, and Commission Administrator. E-Mail: ljames@azda.gov.

Research projects funded for 2015-2016

AGRPC has agreed to fund the following research projects from the FY 2016 budget. The principal investigator on projects 16-01 through 16-08 is Dr. Michael J. Ottman, Extension Agronomy Specialist and Professor, CALS, Tucson. The supporting investigator on Projects 16-01, 16-03, 16-05, 16-06, and 16-07 is Dr. Rick Ward, Bud Antle Endowed Chair and Director, Maricopa Ag Center (MAC), CALS.

16-01: Chemical control of lodging in small grains ($2,864)

Objective: To evaluate the effects of the plant growth regulator (PGR) Palisade® on plant height, lodging, grain yield, and grain quality of a durum wheat variety in both commercial field-scale and small plot conditions..

Rationale: Lodging poses a serious risk in small grain production, contributing to increased disease severity, reduced grain yield and quality, and reduced harvest efficiency. Growers may consider applying a PGR to reduce crop height and stiffen the straw, making small grains more resistant to lodging.

Palisade® has been evaluated as a growth regulator on wheat in Yuma for two years. Results indicate that this PGR has promise, but more data are needed to draw meaningful conclusions since lodging occurred in only one of the two years. This experiment will complete procedures planned for the 2015 season that were not funded due to personnel changes.

Procedures: The effects of Palisade® application on plant height, lodging, and grain yield and quality of durum wheat (Kronos variety) will be determined in small plots at MAC under conditions of both medium and high water and N fertilizer levels. The medium level will receive 6-7 irrigations and about 190 lbs. N/acre while the high level will receive 11-12 irrigations and about 370 lbs. N/acre. The PGR will be applied between Feekes growth stages 5 (leaf sheath erect) and 8 (last leaf just visible) according to the timing on the label. In addition, a commercial field near Casa Grande will receive six strips of PGR by aerial application, alternating with untreated strips.

16-03: Clipping small grains to increase subsequent grain yield ($9,606)

Objective: To determine the effect of clipping before stem elongation on yields of durum wheat and barley in Arizona.

Rationale: Wheat is commonly grown as a dual-purpose crop in the Southern Great Plains, where the early vegetative growth is grazed then allowed to mature into a grain crop. Grazing can be detrimental to the subsequent grain crop if extended into the stage where the growing point is compromised. However, properly-managed grazing may have negligible to positive effects on subsequent grain yield. The potential advantage of such dual purpose management is a net revenue increase from the combined yields of forage and grain.

We hypothesize that clipping will increase tillering of grain plantings in grain crops, with increased grain yields, and add to potential revenue as generated by the vegetative clippings.

Procedures: A trial testing the effect of clipping on wheat and barley will be established on large plots (47 ft x 800 ft) at MAC. The treatments will consist of 2 planting dates (October and December) and 4 varieties (2 durum and 2 barley). The October planting date will be clipped at early jointing. Clippings will be removed from the field to simulate grazing or green chop. Thereafter, the clipped and non-clipped plots will be treated identically until grain harvest. Data collection will consist of forage yield and quality after clipping and, for the grain crops, dates of heading, flowering, plant height, lodging, grain yield, test weight and protein.

16-04: Wheat and barley growth stage and water use calculator ($4,500)

Objective: To develop a web-based application that calculates small grain growth stage, water use, and irrigation timing based on a grower's weather input.

Rationale: The timing of most crop production inputs depends on growth stage. Herbicides, insecticides, and growth regulators must be applied within a certain range of crop growth to be most effective and/or avoid crop damage. Fertilizer should be applied by certain stages of growth to achieve optimum grain protein content. The timing of all irrigations depends on the water use of the crop and available soil water. Crop growth stage, water use, and irrigation timing can be predicted using AZMET weather variables and inputs from the user. Prediction of crop growth stage and irrigation timing can be especially useful as a planning tool.

Procedures: An existing web-based program called "Mobile Cotton" (**https://cals.arizona.edu/mobilecotton/user**) will be the framework for developing a wheat and barley growth stage and water use calculator. This program is compatible with all devices, including cell phones, tablets, and computers. Mobile Cotton is a product of the web development team at the Communications and Cyber Technologies Department in the U of A CALS, which will develop the proposed small grain calculator. Growers will enter location of the closest AZMET station, crop planting date, and variety in a drop-down menu in order to predict growth stage and irrigation dates. Soil texture and previous irrigation date will also be required to predict the timing of the next irrigation.

16-05: Can the yield of late-planted small grains be maintained by water and nitrogen rates? ($9,595)

Objective: To evaluate the effects of nitrogen and water rates on grain yields and quality of late-planted wheat and barley.

Rationale: Wheat and barley are often planted at later than optimum timing. Higher seeding rates on late-planted small grains do not always achieve the desired effect due to shorter growing seasons, higher than optimum temperatures, and unavoidable water stress - all potentially reducing yields.

Partial compensation for lower yield potential from late plantings may be achieved by increasing water and nitrogen rates beyond those applied at more optimal planting dates..

Procedures: A trial measuring the effects of water and nitrogen rates on late-planted wheat and barley will be established on large plots (47 ft x 800 ft) at the Maricopa Ag Center. The treatments will consist of 2 planting dates (December 15 and February 1) and 2 varieties (1 durum and 1 barley) grown at 3 input levels of water and N (low, medium, and high). The water levels corresponding to low, medium and high will be a soil water water depletion of 35, 50, and 65%, respectively, using AZSCHED or similar irrigation scheduling software. The N fertilizer levels corresponding to low, medium, and high will be 67%, 100%, and 150% of optimum, respectively, determined from soil sampling and plant analysis. Data collection will consist of dates of heading, flowering, plant height, lodging, grain yield, test weight, and grain protein.

Research Projects – *Continued on page 8*

Research Projects – *Continued from page 7*

16-06: Late season N application method effect on grain protein ($10,451)

Objective: To evaluate the effect of late season nitrogen application method on grain protein.

Rationale: Nitrogen (N) fertilizer is normally applied at flowering time to boost grain protein content. The fertilizer is usually applied as UAN32 in irrigation water, or as a foliar or granular formulation. While foliar N application is not tied to irrigation water application, granular N is cheaper and is usually distributed more uniformly than liquid forms applied in the irrigation water. However, some evidence exists that foliar N gets into the plant more efficiently than granular forms of N.

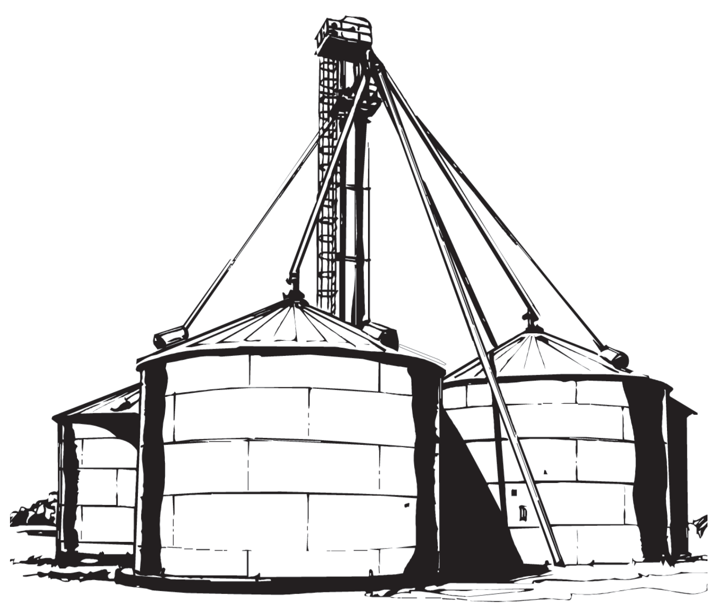
Procedures: Late season N application methods will be applied to large plots (47 ft x 800 ft) at MAC. Treatments will consist of 2 durum varieties and 4 N-application regimens: 1) fertigation with UAN 32; 2) granular application with urea; 3) foliar with liquid urea; and 4) a zero late-N check. The late season N rate will be about 50 lbs. N/acre after the crop has received about 200 lbs. N/acre up to this point. The late season N application will be split between flowering and milk stage to avoid leaf burning from the foliar N application. Data collection will consist of: dates of heading, flowering, and maturity; plant height and lodging; and grain yield, test weight, and protein.

16-07: Evaluation of Palisade® as a plant growth regulator in durum ($7,092)

Objective: To evaluate the effects of Palisade on plant height, lodging, and grain yield.

Rationale: Many growers battle with lodging in wheat and barley and are considering the use of plant growth regulators to help them reduce lodging. This project will provide data on the potential benefits of the PGR Palisade®. This project will complement Project 16-01.

Procedures: The PGR will be applied to durum wheat (Kronos variety) at Maricopa Ag Center, on a small plot experiment consisting of 8 pairs of treated and untreated plots in two borders, one with medium and the other with high water and fertilizer levels. Data collection will consist of plant height, lodging, grain yield, test weight, grain protein, total yield, and harvest index.



16-08: Small grains variety testing ($7.795)

Objective: To evaluate performance and traits of small grain varieties grown at Maricopa.Ag Center.

Rationale: Although seed companies provide variety characteristics, there is still a need for unbiased testing of varieties overseen by an independent entity such as the U of A.

Procedures: Commercially available varieties of durum (about 12) and barley (about 6) will be planted at MAC around December 15 (2 replications) and February 1 (2 replications). on large plots (20 ft x 800 ft). Measurements will include: dates of heading, flowering, and maturity; plant height and lodging; and grain yield, protein, and test weight.

The AGRPC has awarded the following grant to principal investigators Dr. George B. Frisvold, Extension Specialist and Professor, and Ashley Kerna of the Department of Agricultural and Resource Economics, CALS, Tucson.

16-09: The contribution of grain production to Arizona's economy ($18,821)

Objective: To determine the total contribution of Arizona's grain industry to the state's economy.

Rationale: Agricultural producers wishing to communicate the importance of their industries to Arizona's economy need credible evidence of the complete scope of their contributions, including the results of the multiplier/ripple effects on peripheral segments of the economy such as purchase of production inputs, sale of production outputs, and expenditures of industry wages.

Procedures: This project will address all aspects of economic productivity related to Arizona's grain industry by applying the well-established IMPLAN model to examine and estimate the overall direct and indirect contribution of Arizona's grain industry to the state's economy.

The following grant was awarded to Arizona Grain, Inc. and principal investigator Wesam AbuHammad, durum breeder.

16-10: The use of interspecific hybridization breeding method to improve lodging resistance in durum wheat (*Triticum turgidum L. var. durum*) ($12,200)

Objective: To improve straw strength and lodging resistance of durum wheat by transferring those traits from triticale chromosomes.

Rationale: Lodging, a natural phenomenon in small grains, can be costly in terms of reduced yield, increased harvest costs, and reduced grain quality. Improving the standability of elite durum lines by utilizing the superior standability of triticale, a man-made wheat - rye product, should benefit the entire Arizona durum industry.

Procedures: Four durum wheat varieties will serve as the maternal parents in crosses with pollen from a hexaploid triticale line that has demonstrated superior lodging resistance. Pollinated wheat spikes will be dissected, with the embryos rescued and transferred to a growth medium until reaching a transplantable size. The resulting F-1 hybrid plants will be grown in a greenhouse and used as the female in backcrosses with the durum wheat varieties. Selections of subsequent progeny for standability and quality will continue to be backcrossed with elite durum lines to eventually produce new durum varieties with high yield, quality, and improved lodging resistance. The process is expected to require several years.