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ARIZONA
Grain Research &
Promotion Council

DESERT DURUM®

Chairman's Report

By David Sharp

Ho-hum. This past year has been a non-starter in terms of AGRPC's legal and legislative concerns and processes – there weren't any for the first time in the eight years of my chairmanship. We should hope that such a non-eventful period remains the norm. Time will tell.

My brother and I did not grow much wheat in 2014. We grabbed an opportunity to grow corn silage instead of durum wheat due to the comparative economics of the two crops when planting decisions had to be finalized a year ago. But, the same comparison has us planting considerable wheat again in 2015.

Aside from conducting business in a routine manner that hadn't been experienced for years, the Council also did not have the privilege of entertaining any U.S. Wheat Associates' foreign trade teams comprised of potential durum buyers this past year. And, although it is AGRPC's turn to send a representative on a USW board trip to potential buying regions, we traded our FY 2015 board team slot for potential AGRPC member participation in a FY 2016 trip to a more suitable destination than Asia.

The National Pasta Association will hold its 2015 annual meeting at the Wigwam Resort in Litchfield Park in March 2015. This should be an excellent opportunity to promote Desert Durum® to the nation's pasta industry and we are going to participate as a sponsor, possibly in conjunction with the California Wheat Commission.

2014 crop comments

USDA says that only 32,000 acres of barley were harvested in Arizona this past season, down over 50% from 2013. This was the lowest AZ barley acreage since 2007, driven down by low corn grain prices. But, reported barley yield was 6,000 lbs/acre, up slightly from 2013 and 19% greater than 2012. Arizona's average barley yields usually trail only those reported for Colorado, but ours were virtually identical to Colorado's in 2014.

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"Sustainability" of desert grain production is an emerging factor in customers' buying decisions

By Allan B. Simons and George B. Frisvold

Most folks who operate a business in the desert southwest's agricultural production chain are focused on the normal tasks of planning, planting, irrigating, feeding, harvesting, and selling their crops and/or animal products in accordance with familiar variables of input cost and market reward. The annual cycle of ag business in this part of the country has seldom been significantly affected by other than short-term weather and/or market anomalies.

Nevertheless, the concept of "sustainable agriculture" has the potential to dramatically influence how desert grain production is viewed in terms of its externally-perceived degree of social and environmental responsibility. The concept has already caused some major Desert Durum® customers to re-evaluate their buying priorities based on predetermined "sustainability metrics" related to desert grain production, such as carbon footprint and water footprint.

What is "sustainable agriculture?"

"Sustainable agriculture" might be a concept that defies definition, in the minds of some. Nevertheless, the U.S. Congress provided us with the following definition in the 1990 "Farm Bill." Under that law, "…The term sustainable agriculture means an integrated system of plant and animal production practices having a site-specific application that will, over the long term:

- Satisfy human food and fiber needs;
- Enhance environmental quality and the natural resource base upon which the agricultural economy depends;
- Make the most efficient use of non-renewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls;
- Sustain the economic viability of farm operations;
- Enhance the quality of life for farmers and society as a whole." (1)

The producers' plight

Agricultural producers in a particular environment might consider imposition of such long-term outcomes on their operations to be burdensome and even unwarranted. For example, how do producers in a specific site cope with being categorized, in the particular system aspects listed above, according to standards drawn by unknown parties applying so-called "metrics" that may or may not be valid for that specific site? Most likely, such metrics have instead been generalized or simplified to serve a global range of similar-seeming sites or cultural circumstances.

Sustainability – *Continued on page 4*

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 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 that can be obtained from the council.

The council's quarterly meetings are open to the public. Meeting dates and locations 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 in August 2014 (L-R): Paul (Paco) Ollerton, Michael Edgar, Jason Walker, Jason Hardison, David Sharp, Larry Hart, and Eric Wilkey.

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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.

AGRPC funds development of "Plant" kit using grains for subject matter in Farm Bureau's "Ag in the Classroom" program

The AGRPC has provided initiative and financial support for the development of an educational curriculum kit focusing on grain crops for use in the Arizona Farm Bureau's "Ag in the Classroom" (AITC) program beginning in 2015.

AITC has now begun its seventh year of providing a free standards-based curriculum kit dealing with agriculture to teachers and schools across the state. The program began in the 2008-2009 school year and reached 70,000 parents, teachers, and students in 2013-2014. The program's objective is to increase agricultural awareness in K-6th grade classrooms and beyond with curricula and programs that are consistent with Arizona's College and Career Readiness Standards that help students and teachers be successful. The standards focus on science, technology, engineering, and mathematics (STEM) in a cross-curricular manner.

AGRPC noticed that a grain crops kit covering barley and wheat, in particular, was not among the ten curriculum kits that made up the AITC commodity lineup in 2013-2014. Those individual kits used apples, pumpkins, cattle, sheep, horses, Arizona fruits and veggies, Arizona Five Cs, poultry, cotton, and dairy as the subject matter for teaching STEM skills. Since barley and wheat annually comprise approximately 12%-15% of the Arizona's irrigated crop acreage (sometimes more), AGRPC asked Farm Bureau to come up with a proposal for funding a kit that will expose students and teachers to the state's sophisticated grain production sector. The Council subsequently agreed to fund development of a "Plant" kit that will focus on cereal grains. The initial grant is for $5,490.

Plant Kit proposal details and why "plant" and not "grain?"

Ms. Katie Aikins, Associate Director of Education at Arizona Farm Bureau, submitted the proposal. Ms. Aikins develops the material administered by the AITC program. She spends much of her time in classrooms across the state presenting the AITC lessons and materials.

The proposal explained, to the Council's satisfaction, that teachers are faced with a multitude of choices as they select learning materials. Therefore, meaningful subject matter identities are a crucial aspect of the attractiveness of those lessons. Ms. Aikins's experience tells her that the general term "plants" will appeal to teachers more than will "grains." Nevertheless, the lessons will use cereal grains as the examples of plants in the lessons.

The timeline for developing the project begins in November 2014 and extends through July 2015, making it available for schools in August 2015. The AGRPC will be available to consult on the subject matter. Initially, four separate kits will be prepared that include teacher and student materials appropriate for grades 2-6. Replenishment costs for kit materials will be an ongoing minor expense.

To find out more about the Arizona Farm Bureau AITC Program, go to the web at *www.azfb.org* and click on the tractor and books logo. Questions regarding the program can be directed to Katie Aikins at *katieaikins@azfb.org*.

AGRPC'S FY 2014 Financial Statement and FY 2015 Budget

	FY 2014 Actual	FY 2015 Budget (1)
Beginning fund balance	$50,785	$112,731
Income items:		
Assessments	$182,920	$129,765
Investment income	1,088	1,200
Less refunds to producers	(3,642)	(7,192)
Net income	$180,366	$147,769
Total operating fund balance	$231,151	$236,504
Expenses		
Executive Director (2)	$18,000	$18,000
ADA Administration	7,500	7,500
U.S. Wheat Associates	30,400	29,100
Travel & meeting	3,779	12,000
Desert Durum® Quality Survey	5,014	5,000
Trade teams	4,913	2,000
Annual newsletter	1,777	2,500
Promotion & advertising	12,474	15,000
Research projects	34,563	40,000
Miscellaneous	0	1,000
Total expenses	$118,420	$132,100
Surplus or (Deficit) on yearly income	$61,946	($8,327)
Ending fund balance	$112,731	$104,404

Note: Fiscal years are from July 1-June 30
(1) Effective April 22, 2014
(2) Contract with Allan B. Simons

Katie Akins of Arizona Farm Bureau displays a curriculum kit from the Ag In The Classroom program.

Sustainability - *Continued from page 1*

Furthermore, the evaluation of a site's system ranking is likely to involve a degree of subjectivity, considering the broad scope of human nature, philosophies, and cultural perspectives. Put simply, those most closely engaged in the local practice of agriculture typically have little to say about how their specific sites are initially categorized on any particular globally-referenced sustainability scale. Therefore, if the concept that "a buyer is always right" is to be honored, local producers should be justified in assuring that the grounds for buyers' sustainability judgments reflect site-specific reality rather than generalized perceptions of those sites and production practices.

Current perceptions of Arizona's grain production sustainability

The most notable issue driving the desert southwest's sustainability picture for growing grain concerns the topic of water – particularly its sources. Other concerns include the amount of water needed for growing a crop and its fate after being applied to the crop. All of these local circumstances are calculated for a range of environments where grain is grown, using metrics founded on both environmental philosophy and, likely, broadly-derived crop-use efficiency evidence. The resulting conclusion is that desert grain production under irrigation deserves a relatively unfavorable sustainability rating, largely due the nature of its "water footprint."

Although something of an oxymoron term, "water footprint" refers generally to humanity's appropriation of freshwater resources (2). For pasta production specifically, water footprint refers to the liters of water needed to put a kilogram of cooked pasta in a package. In total, it accounts for every step of the process from growing the crop, to milling the wheat, to extruding and packaging the pasta, and others in between. The global average water footprint for producing pasta is said to be 1,850 liters/kg (2). The specific figure for Arizona's desert environment is not readily available. However, since water consumption in virtually all of the stages of pasta production following grain production is relatively universal, Arizona's site-specific metrics for irrigated durum apparently yield a rather negatively-viewed water footprint.

The reasoning that supports the negative water footprint may include such assumptions as: 1) most of the water we use does not fall directly from the sky onto the crops, but must be transported from other locales; 2) our crops use excessive water per unit of grain production – presumably due to higher ambient temperature, which contributes to; 3) an excessive amount of water vapor (a heat-trapping greenhouse gas) that enters the atmosphere through evapotranspiration, thus contributing to climate change; and 4) eventually our water supplies must be shared with other clientele who have priorities on its use. These assumptions, and more, may be wrapped into a perspective that resonates somewhat negatively with durum customers who have committed to operating their businesses according to a self-imposed sustainability philosophy.

As producers of very high-quality durum grain, perhaps the challenge for Arizona growers is to independently verify that the assumptions employed in calculating the grain production portion of the water footprint assigned to our durum are *valid for this specific environment*. If we can demonstrate that the practices and other realities of our irrigated grain-producing culture are more favorable than those commonly assumed, might we be able to improve global sustainability assessment of Arizona grain production? This is a question that the AGRPC will investigate via a grant awarded to the University of Arizona.

AGRPC's seeks to define Desert Durum® sustainability

The AGRPC has been made aware that the sustainable agriculture movement has the potential to significantly affect future markets for durum produced in the desert. Therefore, it recently solicited research proposals that would focus on the accuracy of the so-called "metrics" that may employed globally to assess the water footprint and other aspects of our desert grain production system.

The solicitation drew one proposal, from the University of Arizona, entitled "Developing Sustainability Metrics for Water Use in Arizona Grain Production." The project will be led by Dr. George Frisvold, Professor and Extension Specialist in the Department of Agricultural and Resource Economics. Frisvold has gained extensive experience in researching and developing sustainability metrics for cotton production that are specifically related to water use, via annual grant renewals from Cotton, Incorporated. The AGRPC readily agreed to fund it in the requested amount of $6,574. The scope and objectives of the proposal are presented elsewhere in this newsletter.

(1) USDA. 2007. Sustainable Agriculture: Definition and Terms. Alternative Farming Systems Information Center. www.nal.usda.gov/afsic/pubs/terms/srb9902.shtml.

(2) Mekonnen, M.M. and A.Y. Hoekstra. 2011. National Water Footprint Accounts: The Green, Blue and Grey Water Footprint of Production and Consumption. UNESCO-IHE, Institute of Water Education.

(3) Water Footprint Network. 2014. Product Gallery. www.waterfootprint.org.

Allan B. Simons, Ph.D., is the Executive Director of the Arizona Grain Research and Promotion Council. George Frisvold, Ph.D., is Professor and Extension Specialist, Department of Agricultural and Resource Economics, College of Agriculture and Life Sciences, University of Arizona, Tucson.

NOTE: All opinions stated in this article are solely those of the authors. They have not been discussed, adopted, or endorsed by the AGRPC.

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, and the California Department of Agriculture

Production	2012/2013	2013/2014
	(Metric tons)	
Arizona	183,000	206,600
California*	132,000**	87,100**
Total	**315,000**	**293,700**

Imperial Valley only* * Estimate*

Export destinations	2012/2013	2013/2014
	(Metric tons)	
Italy	140,004	95,311
Nigeria	48,136	41,404
Total	**188,140**	**136,715**

Chairman – *Continued from page 1*

Durum acres harvested in 2014 were reported to be 72,000, just 2,000 less than in 2013. However, average yield was reported to be 6,660 lbs / acre, up 540 lbs / acre from the previous year. I've heard reports of Arizona growers harvesting either side of 7,000 lbs / acre, most with adequate protein. AGRPC's records suggest that the state's harvested acreage was actually greater than the USDA figure. Our handlers report that overall quality of the durum crop was average for Arizona, which means excellent in comparison with durum from other origins.

Arizona growers also harvested about 7,000 acres of non-durum wheat this past season. USDA says that this acreage was split about equally between hard red and hard white classes.

Prospects for 2015 grain crops

The 2015 crop season appears to setting up unfavorably for barley plantings and favorably for durum plantings, according to knowledgeable sources. We farm in an era when both national and international market conditions affect our local markets. The current low domestic price of corn forces down barley values in Arizona, while domestic cotton prices discourage growers from planting our historical mainstay crop. Taken together, these circumstances are likely to free up Arizona acres for planting durum at a time when advance pricing is quite favorable. High local durum values are probably being driven partly by rainy weather that has damaged grain quality in the northern U.S. and Canadian wheat crops, making our early summer durum crops more attractive. These considerations suggest that Arizona durum acres could hit 100,000 in 2015, while barley acres will decline from 2014's low plantings.

Diversified grain-growing opportunities may be available

Anyone who has farmed long-term in Arizona recalls the occasional new crop opportunities that have come along, trumpeted as "the next big crop" or whatever (jojoba, guayule, sesame, etc.). But, the need for a complete market chain to generate the resources needed to develop an industry for long term viability and volume can't be ignored. Nevertheless, a couple of modest options for growing grains other than our modern commercial feed barley and milling wheat varieties may attract some Arizona growers. Both situations would appear to service growing local demands.

Heritage grains. AGRPC has been approached to fund research about the agronomics of growing standard-height "heritage" barley and wheat strains that have been collected and maintained by a non-profit organization based in Tucson. Recent news items appearing in The Arizona Republic have described the growing local demand from artisanal bakers for the unique flours produced from some of these grain lines by Hayden Flour Mills. The miller has told the newspaper and AGRPC sources that demand for the flour that he produces cannot be met for lack of grain supply. The mill has recently been relocated from downtown Phoenix to the Queen Creek farm of former AGRPC member Steve Sossaman. Sossaman and several other producers are currently growing the heritage strains. The current demand cited by the miller would require several thousand acres of annual heritage grain production. So, there could be some nice rewards for growers who are willing to assume the probable risks associated with growing barley and wheat lines that have little commercial production history in Arizona.

Malting barley. Recent contact from a local investor who is interested in developing a new craft beer brewing enterprise in the Phoenix area has rekindled discussion of producing malt barley in the state. The enterprise reportedly also possesses advance orders for enough beer to need a modest commercial-scale malting and brewing operation and desires to source Arizona-grown malt barley. Considerations such as business legitimacy, pricing and contracts, suitable varieties, and seasonal storage need to be considered as events progress. However, this enterprise and other similar ones underway in the state may offer some alternatives for grain growers.

Quality, quality, quality

The Council spends a significant sum to characterize the quality of Arizona's annual Desert Durum® crop. The efforts include collecting samples by variety as trucks arrive at elevators, then compositing them by variety 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 yield and superior grain qualities that are achievable in the unique production environment we enjoy in Arizona. This environment is conducive to growing 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 producers to help maintain the reputation of Desert Durum® as the most reliably high quality durum grain in the world. This means providing the attention and nutrient inputs needed to achieve high HVAC and satisfactory protein content.

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 eleventh 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. Assistant Attorney General Casey Cullings guided us through various regulatory issues over the past several years. Casey has moved on to a different role with the AG's office. We welcome his successor, Aaron Thompson.

Finally, I continue to appreciate the AGRPC's association with Executive Director Al Simons, who is completing his 20th year in the role of supporting AGRPC activities and representing the Council within Arizona and elsewhere.

AGRPC to participate in 2015 National Pasta Association meeting in Arizona

The National Pasta Association (NPA) has announced that its 2015 annual meeting will be held March 8-10 at the Wigwam Resort in Litchfield Park, AZ. The annual affair is most often held in Florida, rarely venturing to this corner of the country. Most program details were not available at press time.

AGRPC plans to buy a meeting sponsorship in order to provide local expertise and increased exposure to the "Gem of the Southwest" – our Desert Durum® grain. The U.S. domestic pasta industry usually consumes over 50% of annual Desert Durum® production. Furthermore, some of the largest U.S. pasta producers and brands are owned by firms who are evaluating their grain purchases according to "sustainability metrics" that are now being studied with AGRPC funding.

NPA to feature Arizona "water footprint" expert as speaker

AGRPC urged NPA to consider Dr. George Frisvold, U of A Professor of Agricultural and Resource Economics, as an expert on the "water footprint" associated with producing grain in the desert. NPA subsequently invited Dr. Frisvold to discuss how water is used to produce grain crops in Arizona and to present his findings from research funded by the AGRPC. Details of his proposal are presented elsewhere in this issue.

Research projects funded for 2014-2015

AGRPC has funded the following research studies to be conducted during the 2014-2015 crop season:

1) Development and field testing of sensor-based algorithms for N-fertilizer management of AZ durum wheat ($10, 527).

Principle investigator: Dr. Pedro Andrade-Sanchez, U of A Associate Professor/Specialist, Precision Agriculture, Maricopa.

A significant quantity of nitrogen (N) fertilizer is required to produce high yields of durum wheat with adequate protein in Arizona soils. However, wheat exhibits rather low N-use efficiency (NUE), particularly where irrigation can leach the nutrient below root level. Nitrogen fertilizer is an energy-intensive, expensive material that should be carefully managed to ensure high productivity and quality within economical limits and minimum environmental footprint.

Technologies or practices that reliably determine crop needs for N at specific growth stages across variable soils will likely increase NUE and, therefore, profitability of crop production. Precision agriculture techniques can reduce the use of N fertilizer without sacrificing productivity and quality.

This project utilizes new technology to sense crop N needs and to dispense prescribed rates of N fertilizer. The three basic components of the package are: 1) application technology that is now commercially available; 2) crop biomass/vigor monitoring by sensors; and 3) mathematical algorithms that determine N application according to crop condition and location in the field.

This project expects to utilize equipment and previous evidence obtained with AGRPC funding. Experimental data gathered at Maricopa will be used to formulate an algorithm for variable-rate N application. An experimental plan will be created to test the timing and quantity factors associated with the N-application algorithm. Outcomes from sensor-based and conventional N management systems will be compared. The work will be conducted at the Maricopa Ag Center.

2) Developing sustainability metrics for water use in Arizona grain production ($6,574).

Principle investigator: Dr. George Frisvold, U of A Professor and Extension Specialist, Agricultural and Resource Economics, Tucson. Cooperating investigator: Dr. Michael J. Ottman, U of A Professor and Extension Specialist, Plant Sciences

Major grain purchasers, including those who buy Desert Durum®, are adopting buying practices according to a range of "sustainability metrics" such as carbon footprint and water footprint. The marketability and prices of Arizona's durum grain may increasingly depend on how these crops are produced and evaluated in terms of such sustainability metrics. To date, the water footprint metrics applied to Arizona grain production by outside agencies may overstate water use if they do not properly account for the difference between water diversion and consumptive use by crops.

One goal of this project is to evaluate estimates of Arizona's wheat production water footprint as utilized in various global reports in order to assess whether they accurately reflect use of water and other resources.

Another goal is to trace adoption of irrigation system improvements and irrigation efficiency over time. A new USDA Farm and Ranch Irrigation Survey report will provide evidence for this phase.

A third goal is to assess the role of grain production in sustainably balancing water supply and demand in the Lower Colorado River Basin. While grain crops grown in the desert typically consume more water per unit produced than grain crops grown in cooler regions, desert-grown grains require less water than most other desert-grown crops. This study will quantify the role of wheat and other grains in reducing water use in Arizona relative to non-grain crops.

Small grains research grant reports

Note: All research reports were submitted by scientists in the College of Agriculture and Life Sciences (CALS) at the University of Arizona.

Reports 1, 2, and 5 were submitted by Dr. Mike Ottman, Extension Agronomy Specialist and Professor, CALS, Tucson.

Reports 3 and 4 were submitted by Dr. Pedro Andrade-Sanchez, Associate Professor/Precision Agriculture Specialist, CALS, Maricopa, with Dr. Ottman as co-author.

1) 2014: Small grains variety testing

Barley and wheat varieties were tested in small plots this year in Maricopa, Arizona City, and Yuma as part of the on-going effort to assess commercial varieties and experimental lines in terms of yield potential, relative maturity, quality, and other characteristics. Small plot trials provide an indication of comparative varietal potential but cannot replace on-farm comparisons. A summary of commercial varieties' performance across all locations monitored by the U of A in 2014 is posted online at <http://ag.arizona.edu/pubs/crops/az1265.pdf>. The complete results for 2014 can be obtained from the AGRPC.

2) 2014: Small Grain Advisory

A *Small Grain Advisory* was developed for 12 locations in Yuma, La Paz, Mohave, Maricopa, Pinal, Pima, and Graham Counties and distributed on a bi-weekly basis on the World Wide Web. The advisories began in January and ended in May. Weather data from AZMET were used to estimate crop growth stage and water use throughout the season. This was the 12th year in which the advisory was developed and distributed. Nine advisories were developed and placed on the web *http://ag.arizona.edu/forageandgrain/smalladv.html*.

3) 2011-2014: Combined Report - Determination of optimal planting configuration for low-input and organic barley and wheat production in Arizona

Markets for organic barley and wheat are expanding. Weed control is a major problem when growing organic barley and wheat. In a study conducted at the Larry Hart Farm near Maricopa over a period of 4 years, organic barley and durum wheat were planted with 6-inch drill row spacing and compared with wider row spacings of 30 inches (2011-2012) and 20 inches (2013-2014) that allowed for weed cultivation.

Weed pressure was relatively high in 2011, with canary grass as the primary weed at about 20% of the total biomass at maturity in the 6-inch spacing. Other years, weed pressure was relatively low, with Palmer amaranth and mallow as the primary weeds, comprising less than 5% of the total biomass near maturity. Cultivation in the 20- and 30- inch row spacing was effective in reducing the weed population levels to much lower than those measured in the 6-inch spacing without cultivation.

The wide row spacings resulted in reduced light interception and delayed crop growth compared to the drilled spacing. Light interception with the sun directly overhead and the crop in the early part of grain fill averaged 73% for the 6-inch spacing and 50% for the wider spacings. Plant biomass at the early growth stages for wider spacings was roughly half of the narrow spacing, but the biomass differences between row spacing lessened as the season progressed.

Planting in 20-inch or 30-inch rows generally resulted in a reduction in yields compared to 6-inch row spacing in these trials (Fig. 1). The yield reduction was much less in 20- inch rows than in 30- inch rows. The yield reduction from planting in wider rows was greater for barley than wheat.

Grain quality as measured by test weight, protein, and HVAC (durum) was higher in wide row spacing when differences were detected, as occurred in about half of the cases.

In summary, weed pressure was reduced by cultivating low input and organic barley and wheat planted in 20- to 30-inch rows, but grain yields were usually compromised in wide spacings in this study, despite reduction in weeds. It is conceivable that, at some level of weed pressure, having the ability to cultivate to control weeds in organic wheat and barley may be the difference between having a harvestable crop or not, but we did not experience this critical level of weed pressure.

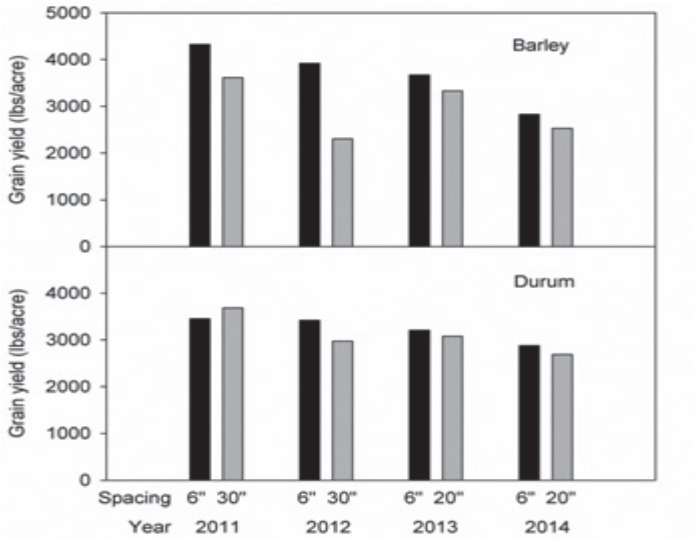

Fig 1. Row spacing effect on grain yield of organic barley and durum in a study conducted at the Larry Hart Farm near Maricopa for 4 crop years from 2011-14. Row spacing of 6 inches was used all years and was compared to 30 inches in 2011- 2012 and 20 inches in 2013-2014.

4) 2014: Sensor-based management of nitrogen of irrigated durum wheat in Arizona

Nitrogen use efficiency (NUE) in irrigated high-input wheat production is an area of concern due to N losses associated with fertility, irrigation, and tillage management. Restricted use of N fertilizer may improve NUE but yield potential would usually be compromised. An improved management option will make use of new sensing technology capable of detecting in-field variation of plant size and nutritional status, thus enabling site-specific management of fertility inputs. Field-ready hardware can provide for automatic variable-rate dispensing of fertilizers, but a computer algorithm needs to be developed in order to provide instructions to the rate controller.

Commercial-grade technology has been tested in Maricopa as part of this study, including active-light canopy reflectance and displacement sensors, as well as GPS-based rate controllers for application equipment. Application equipment and experimental testing of N rates by time of application and amount have been tested for three consecutive years since 2011 in Maricopa, AZ with consistent results indicating the feasibility of using active sensors in ground application systems to control the timing and delivery of N fertilizer to optimize production of durum. Experimental data on sensor output and corresponding plant conditions will be used to develop an algorithm specific to the conditions and yield goals of Central Arizona.

5) 2013-2014: Combined Report - Effect of Planting Date on Wheat Yield in Yuma

Planting dates are known to affect wheat yields. Previous research has shown that the optimum planting date in Yuma is December 15 to January 15. Wheat is sometimes sown later than this in the Yuma area, and earlier planting dates had not been tested. To test a wide range of planting dates, six varieties (*Duraking, Havasu, Kronos,* and *WB-Mead* durums, plus *Joaquin* and *Yecora Rojo* bread wheats) were tested at two seeding rates (160 and 240 lbs/A) and six planting dates (at the beginning

Planting date – *Continued on page 8*

Planting date – *Continued from page 7*

of each month) from November through April for two seasons (2013 and 2014) at the Yuma Valley Agricultural Center. All planting dates received 250 lbs N/acre split among application at pre-plant (100 lbs N/acre), jointing (100 lbs N/acre), and flowering (50 lbs N/acre). Irrigations were applied as needed and were as frequent as every two weeks until the middle of April when irrigation frequency increased to every week. This report summarizes the two-year results of this study.

Planting date affected yield (Fig. 2) and most other plant characteristics measured in this study. In 2013, grain yield decreased with each successive planting date, from 6,517 lbs/acre (Nov. 4) to 3,590 lbs/acre (Apr. 5), when averaged over varieties and seeding rates. In 2014, grain yield peaked at the Jan. 9 planting date (6,878 lbs/acre). Plant height was correlated with yield. Lodging was highest at the December planting in 2013 and at the November planting in 2014. The number of days required to reach heading, flowering, and maturity decreased with later plantings (Fig. 3). Test weight and seed weight were correlated with yield and decreased on either side of the January planting in 2014, but no such relationship was found in 2013. HVAC was 98% or greater for all planting dates. Grain protein was generally greater at later planting dates in 2014, but no significant differences were found in 2013.

Some interactions between variety and planting date were detected, meaning that not all varieties responded to planting date in a similar fashion. Planting date x variety interactions were detected: 1) in 2013 for heading, flowering, maturity, seed weight, and HVAC, but not for grain yield, plant height, lodging, or test weight; and 2) in 2014 for all variables measured except grain protein. An interaction example is that late maturing varieties Duraking and WB-Mead performed relatively better in November plantings than April plantings.

Seeding rates of 160 and 240 lbs seed/acre had no effect on grain yield or any of the other plant characteristics measured in this study. There were no planting date x seeding rate interactions, so seeding rate had no effect on yield at all planting dates. This result contrasts with the view that higher seeding rates are needed to maintain yields at later planting dates.

The varieties tested in this study differed in yield and all other characteristics measured except grain protein in 2014. The highest yielding variety was *Duraking*, tallest was *WB-Mead*, lowest in lodging was *WB-Mead*, earliest maturing was *Yecora Rojo*, highest test weight was *Duraking*, and largest seed was *Kronos*.

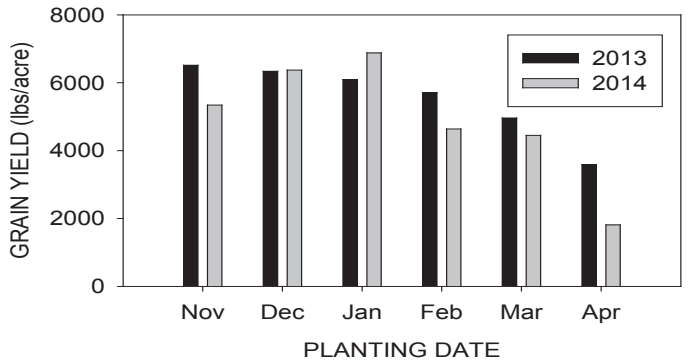

Fig 2. Planting date effect on grain yield of wheat in a study conducted at the Yuma Valley Agricultural Center in 2013 and 2014. Yields are an average of 6 varieties and 2 seeding rates.

In summary, the highest wheat grain yields in Yuma can be obtained from plantings in early December to early January. Later planting, especially in early April, results in considerably reduced yields. Growers should consider shorter-season varieties for later plantings. Use of higher seeding rates at later planting dates is not supported by this study, in contrast to results obtained in studies conducted in other areas.

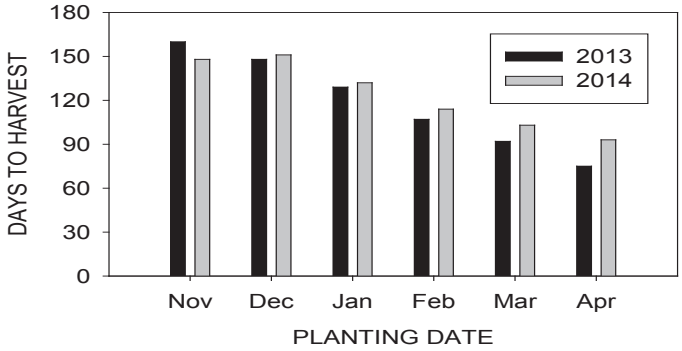

Fig 3. Planting date effect on days to harvest of wheat in a study conducted at the Yuma Valley Agricultural Center in 2013 and 2014. The figures are an average of 6 varieties and 2 seeding rates. Days to harvest are estimated by adding 2 weeks to the date of physiological maturity.

27 AGRPC members & their years of service

The Arizona Grain Research and Promotion Council held its first meeting in January 1986. Since then, 27 growers have served upon appointment by the governor of Arizona. The Council was comprised of nine members from inception until 2006 when the complement was reduced to seven members. The dedicated growers who have served the industry and their terms of service are listed here. Service years refer to the majority of a calendar year.

Russell E. Schlittenhart – Eloy: 1986-1999 (Chair '86-'99)
Gregory C. Wuertz – Casa Grande: 1986-2003 (Chair '00-'02)
Edward Hooper – Casa Grande: 1986-1992
Robert R. Woodhouse – Roll: 1986-1989
Arnott K. Duncan III – Goodyear: 1986-1992
R. Gale Pearce – Arizona City: 1986-1987
James Palmer – Thatcher: 1986-1991
Richard A. Bryce – Thatcher: 1986-1991
James Cuming – Yuma: 1986-1993
Stephen J. Sossaman – Queen Creek: 1987-1998
David L. Sharp – Roll: 1989- present (Chair '07- present)
Richard Cooley – Farmers Marketing, Inc.: 1992-1993
Barkley Seed, Inc.: 1994-1996
Stephen Leffler – Barkley Seed, Inc.: 1992-1994
Richard Eaton – Litchfield Park: 1993-1998
Robert Layton – Queen Creek: 1993- 1999
John Skelley – Arizona Grain, Inc.: 1994-2001
Michael Kelly – Farmers Marketing, Inc.: 1994-1996
Bryan Hartman – Stanfield: 1997-2001
Michael Edgar – Barkley Seed, Inc.: 1997- present
Noah Hiscox – Coolidge: 2000-2005
Paul Ollerton – Casa Grande: 2000- present (Chair '05)
Arthur Heiden – Buckeye: 2001-2010 (Chair '03-'04)
Eric Wilkey – Arizona Grain, Inc.: 2003- present (Chair '06)
Larry Hart – Stanfield: 2003- present
Dwight Harder – Chandler: 2006-2008
Jason C. Walker – Casa Grande: 2010- present
W. Jason Hardison – Palo Verde: 2011- present

Profiles of Arizona's three plant breeding enterprises

Editor's Note: Proprietary grain breeding firms have thrived in Arizona since the 1980s. The character and personnel of the businesses have evolved in recent years, particularly since the last time they were profiled in this newsletter in 1999. The three existing programs were asked to prepare brief updated profiles of their operations. Their submissions are presented here, with gratitude for their efforts.

Arizona Plant Breeders, Inc.

By Eric Wilkey

Arizona Plant Breeders, Inc. (APB) is nearing its 25th anniversary year of operation as a plant breeding and research company. Founded in 1989 by Dr. Albert Carleton, APB today is operated as a wholly-owned subsidiary of Arizona Grain, Inc. APB's headquarters is located at Arizona City AZ. APB recognizes that changes are occurring in Arizona production agriculture and these changes are presenting new opportunities to producers if the right genetics are available in the marketplace. APB continues its tradition of servicing the market with improved performance in high quality durum wheat lines, high output barley varieties, specialty grains, and forage crops.

PROGRAM SCOPE

Research programs are in progress for three distinct regions in the U.S. The desert southwest locales of Arizona and California are served by research nurseries at Casa Grande and Yuma, Arizona and El Centro, California. APB grows research nurseries at Five Points and Woodland in California's Central Valley and also utilizes the University of California at Davis branch experiment station network for extensive evaluation. The third region is the Pacific Northwest area of Washington, Oregon and Idaho where the company uses several locations to develop varieties suited for those environments. APB material is also evaluated in several foreign countries with similar growing conditions to the regions just mentioned.

BREEDERS and STAFF

APB employs experienced, highly qualified plant breeders and a dedicated staff that includes:

Dr. Albert Carleton - Plant Breeder: Barley/Specialty Grains
Mr. Oliberio Cantu - Plant Breeder: Forages/Spring Wheat
Dr. Wesam Abuhammad - Plant Breeder: Durum Wheat and Director of Laboratory Operations
Mr. Rick Wood - Operations Manager
Mr. Nathan Purden - Field Technician
Mr. Shane White – Field Technician

PRIORITIES

The breeding and research programs have continued to develop and release durum wheat lines that deliver yield and quality traits valuable to the farmer customer while improving their milling performance for the end user. The program focuses on keeping durum wheat as an economically valuable crop and milling product in the Desert Southwest for the foreseeable future. Genetics that can address water consumption, salt tolerance, high protein, and the reduction of heavy metals in the harvested crops are a few of our priorities.

Forage crops have also become a significant focus of the breeding effort in recent years as the demand for high output quality forages is being driven by the western livestock sector. APB has many new products that will be arriving to the market in the next few years to address this need.

Specialty grains are a growing niche in the southwest, so APB has put considerable effort into these crops in recent years. The results are promising and should soon coincide with the growth in these markets.

ARIZONA PLANT BREEDERS

APB plant breeder Wesam Abuhammad

APB plant breeders Dr. Al Carleton and Oly Cantu (L-R).

APB Operations Manager Rick Wood

Second Nature Research, LLC

By Donny Gray

Second Nature Research, LLC (SNR) is a Yuma, Arizona-based company formed by Barkley Seed, Inc. to facilitate its small grains research efforts following the acquisition of Monsanto Company's durum wheat research program in August, 2014.

The main focus of SNR will be to develop high quality, high yielding, and identity-preserved durum wheat varieties for planting in the desert southwest. It will continue the desert-adapted breeding program that began in Arizona in 1976 as Western Plant Breeders, Inc., which later flourished as WestBred, LLC under the ownership of Barkley Seed, Inc. before WestBred was sold to Monsanto Company in 2009.

The durum germplasm originally developed and tested by the re-acquired program resulted in the release of numerous varieties that changed how durum grown in the southwestern desert is marketed. Varieties such as *WestBred 881, Kofa, Tacna, Havasu, WB-Mead, WB-Mohave, Orita*, and *Havasu* have raised the bar for yield and quality to levels that are envied by durum producers and consumers around the world.

Second Nature Research, LLC is committed to developing new varieties that will maximize farm gate value to the grower. We still maintain the philosophy that the quality of our desert durum wheat results from an interaction between our desert environment and excellent genetics.

Breeding efforts for Second Nature Research, LLC will be directed in Yuma, Arizona by Donny Gray. Gray has been working with the Desert Durum® germplasm base since early 2006, formerly under long-time breeding program leader Kim Shantz. Gray is a graduate of the University of Arizona with a B.S. in Ag System Management and a minor in Crop Production. He is also a graduate of the Plant Breeding Program.at the University of California, Davis.

Donny Gray – Second Nature Research plant breeder

World Wide Wheat, LLC

By Dr. Charles Ntiamoah

World Wide Wheat (W^3), headquartered in Phoenix, Arizona, is a private independently-owned plant breeding company that was founded by Sheldon E. Richardson in 1996. W^3 develops new and improved varieties of wheat, barley, and oats. W^3 employs the Male Sterile Facilitated Recurrent Selection (MSFRS) breeding methodology started by W^3's pioneer plant breeder Rex Thompson of blessed memory. This method allows for high numbers of crossing activities per year (20,000 – 50,000), resulting in numerous recombinations of widely varied genes. These genetic enhancements are achieved through natural and non-GMO methodologies.

As one of the largest private plant breeding companies in the world, W^3 conducts annual breeding and testing operations on a global scale in countries such as Argentina, Australia, Belize, Canada, France, Ghana, Greece, Italy, Mexico, Peru, and Spain.

These global shuttle operations allow identification and verification of numerous diverse new and improved varieties in a shorter period of time for various environments: 2-4 years compared to the 10-12 years usually needed to develop varieties through the normal pedigree method.

World Wide Wheat officers Kirk Kroloff (L) and Sheldon Richardson.

W³'s customer base is made up of domestic and internationally recognized food manufacturers, millers, chemical companies, seed production companies, cooperative farmer groups, and food ingredient suppliers. W³ works closely with its client base and partners to:

- Develop high-yielding varieties which are made available to farmers.
- Develop high input or drought tolerant, disease resistant varieties.
- Maintain and continuously enhance its extensive germplasm base.
- Tailor varieties with desired characteristics and traits for customers.
- Develop varieties with enhanced health attributes.

Dr. Charles Ntiamoah: Principal Plant Breeder / Director of Research & Development.

Successes in growing W³ varieties in tropical countries such as Ghana and Belize are a powerful testament to the potential of W³'s germplasm to help feed the world, particularly if "Impact Investors" (those investing to make reasonable profits while benefitting mankind) and / or philanthropic partners can be identified. W³ is dedicated to excellence and the development of new and improved varieties of cereal grains that are suitable for grower, processors, and consumers. W³ seeks ways to help feed the world, especially in developing countries.

W³'s established Desert Durum® varieties include *Duraking, Platinum, Crown, Topper, Bravadur, Q-Max,* and *Utopia*. New W³ durums in line for registration include *Huinca* and *Araucano* (for Argentina), *D6575D* and *D1636* (for Greece). W³ bread wheat varieties include *Cavalier, BR0202W, BR7030W, FV2808, Roydon,* and *Rexon*.

W³ has a unique business model that has allowed the company to work efficiently together with its global centers partners. W³'s employee force is as follows:

- Mr. Sheldon Richardson: President / Chairman / Marketing Executive
- Mr. Kirk Kroloff: Vice President / Customer Contracts Director
- Ms. Julie Therriault: Office Manager / General Administration
- Dr. Charles Ntiamoah: Principal Plant Breeder / Director of Research & Development
- Dr. Sheetal Karnik: Molecular Scientist / Director of Innovation
- Mr. James Feeney (B.Sc): Field Operations Manager & Breeding Assistant
- Mr. Eric Norton (M.Sc): Agronomist & Breeding Assistant
- Partner employee assistance at all global nursery centers

2014 Arizona Karnal bunt survey results

Data released by the USDA/APHIS in Phoenix on June 22 revealed that just one of the 178 wheat fields located in Arizona's KB quarantine areas tested positive for Karnal bunt (KB) in 2014. The field contained durum wheat and was located in the Peoria area west of Phoenix. Wheat was planted on 7,244 acres within the quarantined area this past season, up from 6,495 acres in 2013, when four fields tested positive. The 2014 regulated area totaled 128,584 tillable acres, all located in portions of La Paz, Maricopa, and Pinal Counties. This total was about 100,000 tillable acres less than in 2013.

The KB quarantine was implemented in 1996 after many Arizona wheat fields were found to harbor the fungus and bunted kernels were observed in many samples. The pathogen has been listed as a federal quarantine pest since about 1983.

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 2014, the sample from the positive field yielded two (2) bunted kernels. A sample consists of four pounds of grain containing approximately 35,000 kernels

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

Individual 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 45 regulated fields newly qualify for deregulation after the 2014 season, according to APHIS. These releases should result in significant reduction in the total regulated area.

Wheat and Barley Varieties for Arizona 2014

Written by

Dr. Michael J. Ottman
University of Arizona
Cooperative Extension

DURUM

Crown is high-yielding, tall with good lodging resistance, late, and intended for the identity preserved market.
Duraking is a high-yielding, late variety with good lodging resistance and high test weight and is intended for the general purpose market.
Havasu has intermediate yield potential, medium protein, high test weight and is intended for the identity preserved market.
Helios is a high-yielding, early maturing variety with good color and milling characteristics.
Kronos is an early-maturing variety with medium yields and is intended for the general purpose market.
Ocotillo is a high quality durum similar to WestBred 881 except is later, taller, and has a larger head.
Orita is a full season variety with high yield potential, good lodging resistance, and high grain protein content.
Platinum has high yield potential, high HVAC, short stature and is intended for the identity preserved market.
Q-Max is a selection from Crown that is later in maturity and higher yielding.
Ria is intermediate in yield potential and quality.
Sky is a short-statured variety with good quality characteristics.
Tiburon is a low cadmium variety with very good lodging resistance, high yield potential, and good quality characteristics.
Topper is a late maturing, high-yielding, tall variety with good lodging resistance, high test weight, and general purpose quality.
WB-Mead is a late maturing, high-yielding variety with good lodging resistance and is intended for the identity preserved market.
WB-Mohave is a high-yielding, medium maturing variety with good quality characteristics.
Westmore HP is most similar to Kronos except it is higher yielding, has smaller kernels, and the semolina is more yellow.

BARLEY

Baretta is a full-season, high-yielding variety.
Chico is a full-season, high yielding variety with excellent lodging resistance.
Cochise is a short-season, high-yielding variety intended as a replacement for Barcott.
Commander is a full-season, high-yielding variety with good lodging resistance.
Kopious is a short-season, high-yielding variety with excellent lodging resistance.
Max is a very full-season, high-yielding variety.
Nebula is a full-season, high-yielding variety with high test weight.
Poco is a very short-season, lodging resistant variety developed for double cropping.

WHEAT

Cavalier has higher yield potential and later in maturity than Yecora Rojo.
Joaquin is a high yielding variety similar in maturity to Yecora Rojo with good protein and excellent baking characteristics.
WB-Joaquin Oro is similar to Joaquin with high yield potential but with better stripe rust resistance ability, very good test weight and very good baking and milling characteristics.
WB-9229 is widely adaptable variety with good yield potential combined with stripe rust resistance, very high protein and exceptional milling and baking characteristics.
Yecora Rojo is an early-maturing variety with stable yields and desirable quality characteristics.

***Mention** of a particular variety or company does not constitute endorsement by the University of Arizona Cooperative Extension.*

Summary of Small Grain Variety Characteristics for Arizona (2014)[1]

Variety	Breeding source[2]	Grain yield	Test weight	Seed weight	Height	Lodging	Heading	Maturity[3]	Grain protein	HVAC
		lbs/acre	lbs/bu	g/1000	inches	%	date	date	%	%
BARLEY										
Baretta	APB	6456	52.0	44.5	31	16	3/21	4/30	11.6	•
Chico	HSG	6187	51.8	37.6	28	0	3/20	5/01	11.2	•
Cochise	HSG	6078	52.1	38.0	30	14	3/12	4/26	11.2	•
Commander	WWW	6156	51.0	42.6	31	11	3/23	5/02	11.5	•
Kopious	APB	6450	52.7	43.7	30	2	3/14	4/26	11.6	•
Max	WWW	6413	51.9	44.7	31	20	3/26	5/05	11.1	•
Nebula	HSG	6161	52.6	46.7	33	14	3/19	4/29	12.1	•
Poco	AC	4478	51.1	37.6	22	0	2/26	4/10	•	•
DURUM										
Crown	WWW	6562	60.7	49.3	37	8	3/29	5/08	13.6	98
Duraking	WWW	6960	63.4	46.8	34	8	3/27	5/07	13.0	98
Havasu	SNR	6540	63.9	51.6	35	23	3/25	5/04	13.5	98
Helios	APB	6662	63.1	46.7	35	10	3/23	5/04	13.1	97
Kronos	APB	6503	62.7	54.0	35	31	3/23	5/04	13.4	97
Ocotillo	APB	6229	63.0	49.2	37	16	3/25	5/06	14.1	99
Orita	SNR	6725	61.7	52.1	35	7	3/29	5/07	14.3	98
Platinum	WWW	6602	62.6	44.3	32	13	3/27	5/06	13.1	98
Q-Max	WWW	6609	60.9	48.3	38	7	3/30	5/09	13.2	97
Ria	WWW	6464	62.6	45.5	36	17	3/29	5/07	13.3	96
Sky	APB	6273	61.3	43.9	33	21	3/25	5/07	13.3	99
Tiburon	APB	6606	62.2	56.9	34	7	3/27	5/07	14.0	97
Topper	WWW	6945	63.9	43.9	37	11	3/31	5/09	12.7	97
WB-Mead	SNR	6926	62.5	47.7	36	7	4/01	5/09	13.9	99
WB-Mohave	SNR	6984	63.4	49.7	35	23	3/26	5/06	14.0	99
Westmore HP	APB	6582	62.7	44.4	34	40	3/24	5/05	14.1	99
WHEAT										
Cavalier	WWW	6481	62.6	44.6	32	11	3/29	5/03	13.5	99
Joaquin	WB	7083	63.9	44.4	35	8	3/23	4/30	13.7	98
WB-Joaquin Oro	WB	6441	62.8	42.9	34	7	3/20	4/26	14.9	97
WB-9229	WB	6637	64.3	39.4	36	18	3/28	5/02	14.4	97
Yecora Rojo	UC	6211	62.7	44.4	32	9	3/25	4/30	13.8	98

[1] Since not all varieties were in each test, performance was summarized using least-squares means. Most of this information is derived from trials conducted in Maricopa, Pinal, and Yuma Counties planted in late November through mid-January. Actual variety performance may differ from these results.
[2] Breeding source: AC=Anderson Clayton, APB = Arizona Plant Breeders, HSG = Highland Specialty Grains, SNR = Second Nature Research, WB = WestBred, WWW = World Wide Wheat, UC = U. of California.
[3] Maturity: Physiological maturity, which is about 2 weeks before harvest ripe stage.