“Spotlight on Sorghum: New Markets – Expanded Uses – New Developments”
January 21, 2016
What a difference a year makes

Our new normal. I get more excited.
Observations

- we are fighting above our weight class
- we have to make our crop more valuable
- consumer demand is king
- sorghum is making noise. This is making some uncomfortable.
- Leadership Sorghum
- strategy
$330,000 invested on sugarcane aphid
record research investment overall
China pace
  Started in 2012 (3k MT)
  8.3 million MT in 14/15
ethanol
Who We Are

What We Do
The Sorghum Checkoff is a producer funded program intended to improve the sorghum industry for the benefit of producers.
Strategic Model

Producer Profitability

Demand Enhancements

Productivity Enhancements
Building Productivity

- Over the Top Grass Control
- Yield Developments & Enhancement
- Seed Innovation
- Informational Management
Forage
CA ethanol
Conservation
UPPER REPUBLICAN
Develop & adopt a water conservation management plan that provides maximum flexibility while reducing overall actual use, in concert with GMD 4, to extend the aquifer life and economic well-being by January 1, 2017. Utilize a time-phased implementation approach, not less than 2 years or greater than 5 years, to phase in conservation measures to lessen economic impacts & allow user transition. Conservation Plan shall address all types of use while considering flexibility tools & overall actual reduction.

SOLOMON-REPUBLICAN
Within the next two years, develop a clearinghouse of technical tools, agreements & agency personnel for use in maintaining practices for Solomon-Republican region waters. An example could be the marketing contract for Keith Sebelleus Reservoir/Almena Irrigation District that reached an agreement to convert irrigation to recreation use.

SMOKY HILL-SALINE
Reduce sediment & TSS concentrations within the lakes & streams within the Smoky Hill-Saline Region. Method of attaining goal can include the continued support of BMP implementation for practices which reduce sediment runoff. Focus BMP implementation within priority areas identified in Big Creek Middle Smoky Hill River Watersheds 9 Element Watershed Protection Plan. Timeframe of implementation: Complete by 2040 - Final year of 9 Element Watershed Protection Plan is 2034. Result of efforts: 26% reduction of TSS concentrations on the Smoky Hill River at Ellsworth as noted within the 9 Element Watershed Protection Plan. Remove sediment-impaired waters from KDHE TMDL list.

GREAT BEND PRAIRIE
Achieve water use sustainability within the Great Bend Prairie Regional Planning Area by 2025 with a starting point being no new net depletions that includes a reasonable raising or lowering of the water table based on average weather conditions.

UPPER SMOKY HILL
By 2025, reduce irrigation use by 25% based on recent average pumping history per water right. Allow water right transfers & other flexibilities as long as a net reduction is achieved. In addition, annual water use for all irrigation users will not exceed net irrigation requirement for that county.

EQUUS-WALNUT
Implement & maintain watershed protection activities to maintain regional reservoir storage capacity for an additional 100 years beyond the design life.

RED HILLS
Reduce the rate of water use by 10% throughout the region collectively by 2025. Conservation should be

CIMARRON
If individuals elect to conserve then they would be afforded flexibility (e.g. - allowing quantities to be moved, water bank movement, water conservation areas, etc.) Individuals may choose to remain with reduced water use.

SMOKY HILL-SALINE
Reduce sediment & TSS concentrations within the lakes & streams within the Smoky Hill-Saline Region. Method of attaining goal can include the continued support of BMP implementation for practices which reduce sediment runoff. Focus BMP implementation within priority areas identified in Big Creek Middle Smoky Hill River Watersheds 9 Element Watershed Protection Plan. Timeframe of implementation: Complete by 2040 - Final year of 9 Element Watershed Protection Plan is 2034. Result of efforts: 26% reduction of TSS concentrations on the Smoky Hill River at Ellsworth as noted within the 9 Element Watershed Protection Plan. Remove sediment-impaired waters from KDHE TMDL list.

GREAT BEND PRAIRIE
Achieve water use sustainability within the Great Bend Prairie Regional Planning Area by 2025 with a starting point being no new net depletions that includes a reasonable raising or lowering of the water table based on average weather conditions.

UPPER ARKANSAS
Extend the usable lifetime of the Ogallala Aquifer for at least 25 years in the planning region through the promotion of multiple Local Enhanced Management Areas (LEMAS), Water Conservation Areas (WCAs) & other incentive-based programs. Slow the depletion of the Ogallala Aquifer by 25% in 10 years in the planning region maximizing the opportunity to make use of emerging technologies. Encourage conservation through added flexibility. Find additional sources of water & a place to store water for irrigation & recharge. Increase the opportunity to use wastewater for other beneficial uses. Increase education of aquifer conditions.

RED HILLS
Reduce the rate of water use by 10% throughout the region collectively by 2025. Conservation should be
<table>
<thead>
<tr>
<th>Item</th>
<th>Water Use (in/ac)</th>
<th>Yield (bu/ac)</th>
<th>Cash Flow ($/ac)</th>
<th>Cash Flow ($/in)</th>
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</table>

Bill Golden, KSU
Preliminary data**
Building Demand

- International Markets
- Consumer Markets
- Livestock Nutrition
- Specific Attribute Id and New Use Development
- Bio-fuels Enhancements
- Co-product Development
- Supply Chain Facilitation
Attribute Based Marketing

- Reduced environmental impact
- Meat and fat quality enhancing properties
- Gluten free, ancient grain, fit the health conscious population
- Low glycemic index
- Comparable starch values for ethanol production
- High protein levels to reduce high cost inputs
- Antioxidants for enhanced health of animals
- Palatability
Sorghum Industry Basics
14.55 Million MT Current Mkt Yr

32.4% Increase from 2014
US Sorghum Planted Acres

Millions

Compiled from USDA Data

Approved by AMS

Compiled from USDA Data
US Sorghum Production (MMT)
Sorghum Usage

2014 - Pre China Purchasing
- 31% Ethanol Market Share
- 40% Export Market Share
- 27% Livestock Feeding Industry Market Share
- 2% Food Industry Market Share

2015 - Post China Purchasing
- 12% Livestock Feeding Market Share
- 10% Ethanol Market Share
- 3% Food Industry Market Share
- 2% Pet Food Industry Market Share
- 2% Other Market Share
# PRX Forecast Summary, Major Crops, New Crop Year

**PRX_A1_Overview_Start_New, GTB-16-01, Jan-12-15**

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<td>PRX 16-17</td>
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<td>103</td>
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<td>of which, fuel ethanol</td>
<td>mil bu 5197</td>
<td>5237</td>
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<tr>
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<td>US Farm Price</td>
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**PRX supply-demand factors are based on independent analysis, and will frequently be different than USDA’s.**

©2016 The ProExporter Network®. The analysis above is not intended as a trade recommendation. The analysis and forecasts are based on available public data and on the best judgment of PRX, but cannot be guaranteed to conform to future reality.
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<th>Item</th>
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<th>11-12</th>
<th>12-13</th>
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<td>32</td>
<td>53</td>
<td>55</td>
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<td>73</td>
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<td>69</td>
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<td>Production</td>
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<td>Supply</td>
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<td>528</td>
<td>525</td>
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<td>241</td>
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<td>483</td>
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<tr>
<td>Carry-out</td>
<td>mil bu</td>
<td>32</td>
<td>53</td>
<td>55</td>
<td>41</td>
<td>27</td>
<td>23</td>
<td>15</td>
<td>34</td>
<td>18</td>
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<td>25</td>
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<tr>
<td>Disappearance (Use)</td>
<td>mil bu</td>
<td>311</td>
<td>476</td>
<td>470</td>
<td>397</td>
<td>360</td>
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<td>255</td>
<td>374</td>
<td>448</td>
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<tr>
<td>Feed/Residual Use</td>
<td>mil bu</td>
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<td>165</td>
<td>232</td>
<td>127</td>
<td>125</td>
<td>78</td>
<td>92</td>
<td>93</td>
<td>80</td>
<td>171</td>
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<tr>
<td>Industrial Use</td>
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<td>45</td>
<td>34</td>
<td>95</td>
<td>105</td>
<td>83</td>
<td>85</td>
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<td>Total Use</td>
<td>mil bu</td>
<td>158</td>
<td>199</td>
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<td>184</td>
<td>163</td>
<td>98</td>
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<td>Foreign Exports</td>
<td>mil bu</td>
<td>-153</td>
<td>-277</td>
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<td>-152</td>
<td>-55</td>
<td>-71</td>
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<td>US Farm Price</td>
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<td>329</td>
<td>408</td>
<td>320</td>
<td>322</td>
<td>502</td>
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<td>633</td>
<td>428</td>
<td>400</td>
<td>350</td>
<td>302</td>
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<tr>
<td>As share of corn</td>
<td>pct</td>
<td>108%</td>
<td>97%</td>
<td>79%</td>
<td>91%</td>
<td>97%</td>
<td>96%</td>
<td>92%</td>
<td>96%</td>
<td>109%</td>
<td>100%</td>
<td>98%</td>
</tr>
</tbody>
</table>
What’s Trending Now

- Gluten-free
- Ancient/Whole Grain
- Organic
- Craft foods
- Traceability
- Sustainability
- Eco Friendly
- Local
- Fermented/Sprouted
- Food Box
Sorghum – Food Market Potential

@ 192 lbs (Flour & Cereal) per person for ~ 325 Million People (USA) =

- 1.2 Billion Bushels
- 10% = 120 Mbu
- (Currently < 10Mbu)
General Drivers

- Label conscious consumer
- Health conscious consumer
- Low food costs
- Availability of food dollars
- Selection availability
Gluten-Free

- $10.5 billion dollar industry
- $23.9 billion dollars by 2020
- Breads, cookies and snacks are largest category
- more than 1,600 new products / year
- 56% of consumers say they prefer it
Why Gluten Free

- Health
  - Celiac disease
  - Gluten sensitive
  - Wheat allergy
  - Autistic spectrum disorders
Antioxidants
Like most grains, sorghum contains polyphenols, which are compounds found in plants that fight pathogens and harmful ultraviolet light. Research has shown that polyphenols play a role as antioxidants in the body. Antioxidants are responsible for fighting free radicals in the body.

Diabetes defense
Phenols in sorghum help to inhibit glycation, which is a process that raises blood sugar. Early glycation has been shown to be a contributor to diabetes complications.

Policosanols
The outer waxy coating of sorghum contains compounds called policosanols, which are made up of strings of long-chain alcohols. Research studies have shown that varieties of policosanols have lowered bad cholesterol, raised good cholesterol, and lowered the risk for plaque buildup in the arteries. Sugar cane, beeswax, and yams also contain policosanols in their outer coatings.

3-Deoxyanthoxyanins (3-DXA)
3-DXA is a compound mostly found in the darker sorghum varieties. Some research studies have shown that this compound (in extract form) is effective in slowing cancer cell growth, particularly various (GI) cancer cells. Research on 3-DXA is fairly limited as of publication, but a few studies have shown promising results.
Sorghum Forms of Use

- Whole grain
- Pearled grain
- Whole grain flour
- Pearled grain flour
- Popped
- Colored varieties
- Syrup
- Crisps
- Rolled
- Extracts
- Certified Organic
Who Is In This Game?

- Private Companies
  - NuLife
  - Bobs Red Mill
  - Sage V Foods
  - SKS
  - Kansas Organic

- Major Companies
  - ADM
  - Cargill
  - Bay State Milling
  - Scoular
Building Demand

Studies:

Swine study indicates current sorghum has 98% value to corn.

Poultry study indicates no adverse affects to growth rate or feed conversion.
Crop Improvement

- Higher yields. World record yield contest. at 239.85 bushels per acre, which is a new world record non-irrigated sorghum yield.
- Breeding technology
- Double haploid
Sorghum Pricing
Figure 1. Kansas Grain Sorghum Seasonal Price Index – Last 15 Marketing Years (MY 1999/00 – “Old Crop” MY 2014/15) plus “New Crop” MY 2015/16 Estimates (Source: KSU www.AgManager.info)
Grain Sorghum Basis, 01-13-2016

Basis = Cash Price - Nearby Futures Price

CBT Corn Mar Futures Price: $3.58

$/Bushel

- .04
- .58
- .59
- .61
- .63
- .64
- .65
- .67
- .70
- .74

www.agmanager.info
K-State Research and Extension
New Crop Sorghum Bids

Though end-of-year ledger maneuvers made this week small on balance, China made a significant purchase of over 1.9 million bushels. Japan also purchased over 700,000 bushels, and Mexico and South Korea made purchases as well. Basis was mostly steady on the week. Here are this week’s spot and new crop 2016 bids (respectively, where applicable):

- Cargill Houston  old: +55, new: +0
- TMA Canton  old: -45, new: -50
- DeLong Edgerton  new: +0
- AgMark Concordia  old: -52, new: -60
- Aurora Coop Superior  old: -55, new: -45
- WB Johnston Enid  new: -30

STILL EXPORT DEMAND
China trip Nov. 2015
FoodChina Conference Mission
Guangdong Province

- GDP similar to Los Angeles
- largest importer/exporter
- most billionaires in China
### U.S. Sorghum Exports

#### Table 8—U.S. feed grain exports by selected destinations (1,000 metric tons) 1/, 1/14/2016

<table>
<thead>
<tr>
<th>Export and country/region</th>
<th>2013/14</th>
<th>Sep-Nov</th>
<th>2014/15</th>
<th>Sep-Nov</th>
<th>2015/16</th>
<th>Sep-Nov</th>
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<td>Sorghum China (Mainland)</td>
<td>4,263</td>
<td>359</td>
<td>8,371</td>
<td>1,860</td>
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<td>Sub-Saharan Africa</td>
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<td>484</td>
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<td>Japan</td>
<td>293</td>
<td>115</td>
<td>72</td>
<td>31</td>
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<td>Mexico</td>
<td>251</td>
<td>146</td>
<td>21</td>
<td>6</td>
<td>49</td>
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<tr>
<td>All other countries</td>
<td>112</td>
<td>2</td>
<td>17</td>
<td>4</td>
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<tr>
<td>Total 2/</td>
<td>5,362</td>
<td>848</td>
<td>8,965</td>
<td>2,125</td>
<td>2,874</td>
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1/ Grain only. Market year (September-August for corn and sorghum, June-May for barley) and market year to date.
2/ Totals may not add due to rounding.


Date run: 1/13/2016
Introduction

The U.S. Grains Council Sorghum Early Harvest Quality Report 2015/2016, published later this fall, is designed to help international buyers of U.S. sorghum understand the quality of U.S. commodity sorghum harvested and marketed during the earliest part of the 2015/2016 marketing year. This preliminary Early Harvest Quality Report presents basic results from the first samples received from the early harvest sampling area and begins to lay the foundation for the quality reflected in the final Early Harvest Quality Report.

The U.S. Grains Council is pleased to introduce reports that will become annual measurements of quality of the U.S. sorghum crop. The Early Harvest Quality Report will be followed by the U.S. Grains Council Sorghum Late Harvest and Export Cargo Quality Report 2015/2016. The Late Harvest and Export Cargo Quality Report will reflect the quality of two surveys. The first survey will be of the U.S. commodity sorghum entering the merchandising channel the remainder of the 2015 harvest season. The second survey will be of U.S. commodity sorghum as it is assembled for export early in the marketing year. The Early Harvest Quality Report and the Late Harvest and Export Cargo Quality Report are intended to provide reliable information on U.S. sorghum quality from the farm to export based on a transparent and consistent methodology. The value of these reports to all stakeholders will increase over time as the information becomes more familiar and as year-to-year patterns in the U.S. sorghum marketing system begin to appear.
Is it any wonder...
JCI: China Major Grain and Byproducts Import Further Decreases in November, But Sorghum Rises
Beijing

- 21 million people
- (NYC = 8.4 m)
Growing appetite

Factory of the world

Prefer corn/sorghum
Domestic stockpile – 1 yr
World Sorghum Trade

<table>
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<th>TY Exports</th>
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<td>953</td>
<td>954</td>
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<td>1,500</td>
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### Balance Sheet

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<td>Avg. Farm Price ($/bu) 2/</td>
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<td>4.03</td>
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### USA YGS Export destinations

December 07, 2015

**United States Department of Agriculture**

**Foreign Agricultural Service**

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<thead>
<tr>
<th>Area/Partners of Destination And Commodities Exported</th>
<th>January - December Cumulative To Date Quantities</th>
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<td>------------------------------------------------------</td>
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<tr>
<td><strong>Partner</strong></td>
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<td>Grand Total</td>
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<td>China</td>
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<td>Japan</td>
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<td>Ethiopia(*)</td>
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<td>Djibouti</td>
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<td>Chad</td>
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<td>Spain</td>
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Sorghum’s Future
Enhancing the Crop

The Sorghum Checkoff’s Crop Improvement program is committed to investing in new genetic technologies that will deliver greater field-level profitability. Genetic advancements remain a primary focus of the checkoff. In 2014, investments were made in research geared toward double haploids, elite breeding and new genetic lines, as well as maintaining and developing relationships with private and public breeding sectors.

$1.2 Million Invested

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<th>$800,220</th>
<th>$264,885</th>
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<tr>
<td>Identification of inducer line-first component in a sorghum double-haploid program</td>
<td>Integrating germplasm from sorghum conversion program in elite breeding</td>
<td>Improved availability and distribution of sorghum genetic resources</td>
<td>Maximizing recombination between elite and exotic lines</td>
</tr>
</tbody>
</table>

DuPont Pioneer | Texas A&M AgriLife Research | USDA/ARS | University of Illinois |

Double Haploids
In 2014, the Sorghum Checkoff partnered with DuPont Pioneer to discover an advanced breeding technology known as double haploids, which will be made available to all breeding companies. This research project is significant due to the fact it shaves years off of pre-breeding developments. This means new genetic technology makes it to your seed bag more quickly. This is the checkoff’s first investment toward development of this advanced genetic tool.

New Genetics
144 new sources of genetics were released in 2014 through a conversion program conducted by Richardson Seeds, MMR Genetics and USDA/ARS. Wild-type sorghum varieties were converted into genetic lines that can be easily incorporated into any established breeding program. The release of these new genetics means a new pool of untapped sorghum genetics that can unlock new potential for sorghum.

Focus on Relationships
The Sorghum Checkoff held strategic meetings with 6 major seed and chemical companies to discuss opportunities for improving sorghum. Developing relationships with key entities is crucial to the future success of sorghum.

Seed tour
The 2014 tour showcased the sorghum seed industry to sorghum growers and agricultural media. The tour emphasized the need for solutions that lead to a more viable and profitable crop.

Multiseed
In partnership with USDA-ARS, multiseed was made available to public and private breeders. Multiseed genetics offer up to three times the number of seeds on a sorghum head compared to traditional genetics.

Genetic Mapping
Texas A&M University completed a research project in 2014 to develop genetic maps of private and public industry germplasm in comparison to the entire sorghum genome.
Crop Improvement

- Section 18s
- Seed industry consolidation
- Not being transgenic
- Board strategy and investment
- Double haploid
- Seed Innovation challenges
  - Game has changed
  - Regulatory system
    - Chemicals, insecticides, seed treatments
    - Uncertainty
    - Geneflow
    - Pollinator health
- Section 18 submitted in TX
- Dr. Bean as a resource
- management and thresholds
- investment on your behalf
  - $330,000 invested on sugarcane aphid
- scouting
- DOE invests $62.5 million in calendar ’15 – 10 projects – more to come?
- Ethanol plants back in sorghum – normal 120 million bushels. Maybe 150/160
- California ethanol plants now railing sorghum from Nebraska
- RFS unclear. Lawsuit. EPA has made some improvement
- Will continue to have discussions with ethanol plants
Latest RFP –

✓ 114 pre-proposals
✓ 37 full proposals
✓ invested $6.198 million

DOE Funding
Sorghum – Pet Food Markets

- IAMS
- EUKANUBA
- PET WANTS
- HILL’S/SCIENCE DIET
- NEWMAN’S OWN ORGANIC
- BLACKWOOD
- ADIRONDACK
- VICTOR
- VERUS
- Other Brands = Cool Canine, Muenster Natural, Mr. Buck’s

1. Primary Ingredient
2. Premium Ratings (Dog Food Advisor)
Continue to ramp up food segment.

New Uses

End-user Education
Setting the Bar

Yield per Acre

- Currently, the 15 year (2000/15) average yield is 61.95 bu/acre
- By 2020 the average yield must increase to 75 bu/acre
- By 2025 the average yield must increase to 100 bu/acre

Planted Acres

- Currently, the 15 year (2000/15) average planted acres is 7,672,625
- By 2020 the average planted acres must increase to 10 million acres
- By 2025 the average planted acres must increase to 15 million acres

Demand

- By 2020 build consistent, reliable demand of 650 million bushels and hold carry to <5%
- By 2025 build consistent, reliable demand of 1.25 billion bushels and hold carry to <5%

Value

- Currently, the 15 year (2000/15) average national value of sorghum to corn has been -4.6%
- By 2025 build demand in competitive markets to reach a national value of <-2.0%