

Kansas State University initiated the Center for Sorghum Improvement in 2001. The Center's coordinated interdisciplinary research efforts have led to the development of sorghum germplasm and parent lines with improved stalk quality, grain yield potential and drought tolerance. In 2006, these efforts were expanded to a regional scale with the development of the Great Plains Sorghum Improvement and Utilization Center (GPSIUC). The GPSIUC extends the interdisciplinary concept to include K-State, Texas Tech University, and Texas A&M University, integrating the combined expertise and resources of these three universities. The focus of the center is on genetic improvement, production systems to enhance water and nutrient use, innovative strategies to provide improved weed control, utilization of sorghum in human food products, animal feed, and as a bioenergy and industrial feedstock, plus marketing, and policy analysis in support of the US sorghum industry.

### Relevance

Goals of the new checkoff's increased cash resources will expand existing research and education programs, particularly in genetic improvement and sorghum utilization. Sorghum is one of the most drought tolerant crops in the world, offering many potential advantages as a food, feed and bioenergy crop, and could be a key to

sustaining viable rural economies in the Great Plains. The wide diversity of sorghum types (sweet, forage, silage, grain) offer tremendous potential for many uses, but need to be evaluated and have varieties developed for important food, feed and industrial uses. The absence of gluten in sorghum grain offers huge opportunities for the development of new food products aimed at the population suffering from gluten intolerance. Systems for production, harvesting, transportation, and storage of sorghum products, feedstocks, and co-products have to be developed to meet the needs of the bio-energy industry, while optimizing the use of our natural resources and protecting the environment. Expanded research on genetic improvement, production and usage will result in new technologies and information to increase grain and forage sorghum production and processing efficiencies, reduce costs through the production and processing chain, and improve the U.S. sorghum industry's global competitiveness.



## RECORD YIELD & OVER-THE-TOP HERBICIDES LEAD TRANSITION INTO NATIONAL CHECK-OFF

Kansas' total yield of 224 million bushels was up 10 million bushels from last year. It ranks Kansas first nationally again with 58.6 percent of the nations' total sorghum crop. With the reports of a final state yield of a record 88 bushels per acre, grain sorghum has strung together two strong, productive years. The Kansas Commission takes pride in the total industry results as it invests check-off dollars heavily into production research and breeding on a National level. "We have been consistent production leaders and have led the way for our grower funded programs in Kansas to improving our crop and profitability," said Jeff Casten, KGSC Chairman from Quenemo.

Wanting more tools for weed and grass herbicide management options for sorghum producers, the Commission started investing check-off dollars into programs to produce sorghum varieties resistant to many common herbicides used on other crops ten years ago. After surveys, and dwindling planted acreage, producers have requested weed control. Kansas State University (KSU) started researching solutions to the problem. Dr. Kassim Al-Khatib, Professor of Agronomy at KSU, says because sorghum is grown in primarily dry regions, preplant herbicides can perform poorly or fail without adequate precipitation. There are herbicides that can be applied after the crop is established to control weeds, but these products can potentially harm the crop as well. "There is a considerable need for over-the-top grass control in sorghum," said Al-Khatib. KSU has identified traits resistant to herbicides such as Acetolactate synthase and Acetyl co-enzyme-A carboxylase (ACCCase) in some sorghum varieties. The Kansas Grain Sorghum Commission has invested about \$200,000 in the past three years for registrations and the preliminary testing through EPA for those herbicides. Proud of the science, but investing check-off dollars to insure that that science reaches Kansas grain sorghum fields have been the pri-

mary goal recently. The KSU Center for Sorghum Improvement and their team are working on sorghum genome marking, research in genetics, crop physiology, and production for the future technology that will be used in the next decade.

"This new technology will allow producers outstanding weed control and flexibility in crop rotations," says Al-Khatib. Reports from KSU has this product proceeding with the EPA IR4 registrations of Nicosulfuron and Rimsulfuron for use on ALS tolerant sorghum and quizalofop-P-ethyl for ACCase inhibitor tolerant sorghum. Growers could potentially see this new technology available by 2010, as it has been licensed to DuPont.

The Kansas legislative check-off was suspended on July 1, 2008 when the new national check-off began. This past year has seen the formation of a new national board, now called the United Sorghum Checkoff Program (USCP). It has five Kansans on the Board, with three of those being Commissioners. Bill Greving of Prairie View was elected Chairman, Jeff Casten of Quenemo serves as Secretary, and Gary Kilgore of Chanute is the other Commission member. Earl Roemer from Healy and Greg Shelor of Mineola are the other Kansans on USCP. USCP has been busy organizing, and the Commission was able to garner a contract to bridge the transition period for its research projects. Pass back funds to Kansas was distributed for the first time in December 2009. Programs will be able to continue as the structure is now in place with the national check-off.

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## Kansas State University Center for Sorghum Improvement

Grain sorghum is one of the most important dryland crops in the Central Great Plains of the United States. Sorghum is economically important in areas where low and erratic rainfall and high temperature limit the production of other summer crops. The U.S. is the largest producer of grain sorghum in the world with nearly 7 million acres of grain production in 2007.

Despite the national and international importance of this crop for farmers in drought prone environments, many public and private sorghum research positions and programs are being lost to downsizing and corporate consolidation. At least 10 public sorghum research positions have been lost to attrition in the last decade. It is more difficult to assess the loss of private research positions, but the support for private sorghum research programs is clearly much lower than it was even five years ago. Consequently, these programs are becoming more reliant on public research programs to address new or recalcitrant research problems. This ominous trend undermines the economic stability of those farmers that rely on this crop to maintain profitability of their farms. This is particularly significant in light of water shortages for irrigation that are predicted in the near future.

## Center of Excellence for Sorghum Improvement

In light of the importance of grain sorghum for farmers in the United States, Kansas State University established a Center of Excellence for Sorghum Improvement to provide the critical mass of students and scientists needed to maintain and improve this important crop resource. Research programs in four departments that will specifically focus their research efforts on sorghum improvement have been identified. These scientists are dedicated to sorghum and will work as an interdisciplinary team to address the most important sorghum production constraints. The investment of salary and base support by Kansas State University for this center exceeds \$1,000,000 annually. In addition, the Kansas Sorghum Check-off Fund contributes over \$200,000 from farmer grain sales to research in sorghum each year. Hopefully the recent creation of the National Sorghum Check-off Program will bring more research funds to bear on sorghum production and utilization problems.

## Objectives

The original research objectives addressed in this project were identified through discussions with Great Plains sorghum producers and commercial sorghum

breeders. Each research objective addresses a specific sorghum production problem. Interactions are being developed with researchers in private industry to ensure that results from basic research projects are rapidly incorporated into private sorghum breeding programs. K-State also has an extremely active extension program that will work to educate sorghum producers about the most profitable and cost-effective strategies for sorghum production.

1. Improve the agronomic characteristics, yield potential and feed value of sorghum through plant breeding and genetic improvement. As new uses for sorghum are developed, apply this knowledge to breeding new sorghum hybrids, which will better fit these end-use requirements.
2. Develop new uses for sorghum in food and non-food applications, emphasizing the grain's desirable characteristics such as absence of gluten and low glycemic index, as well as its suitability for use in biofuel production.
3. Identify more efficient sorghum production and management strategies which will enhance water and nutrient use efficiency and provide farmers additional options for the control of weeds and other pests.

## Successes to Date

1. Development and release of ALS and ACCase herbicide resistant parent lines to the seed industry. This will allow chemical control of late emerging weeds, especially grasses which has not been a viable option to sorghum growers before. Technology should be available to growers in 2010.
2. Development and release of "stay green" breeding lines to the seed industry to reduce lodging among sorghum hybrids.
3. Development of active crop sensor nitrogen recommendations to improve N use efficiency. This technology was first available to Kansas growers in 2008.
4. Development of new human food products such as waffle mixes, donut mixes, and other sorghum flour based products.

## KGSC Funded Projects – FY 2010

The Kansas Grain Sorghum Commission allocated check-off funds in the areas of research, foreign market development, domestic market development, promotion, and education.

Below is a listing of projects funded by the Kansas Grain Sorghum Commission for FY 2010— July 1, 2009 through June 30, 2010.

### Research Funding

Development and Utilization of Sorghum as a Feedstock for Biofuel Production KSU-Principal Investigator Donghai Wang .....	<b>\$21,000</b>	Breeding Grain Sorghum for Improved Dryland Production KSU-Principal Investigator Tesfga Tesso .....	<b>\$69,800</b>
Enhancing Sorghum Yield and Profitability through Nitrogen Management KSU-Principal Investigator David Mengel .....	<b>\$18,000</b>	<b>TOTAL RESEARCH</b> .....	<b>\$ 220,000</b>
Improving Drought Tolerance in Sorghum through Association Mapping KSU-Principal Investigator Jianming Yu .....	<b>\$60,000</b>	Market Development, Promotion, and Education Funding US Grains Council .....	<b>\$6,000</b>
Screening Sorghum Germplasm for Drought and Heat Tolerance KSU-Principal Investigator P.Vara Prasad .....	<b>\$33,000</b>	<b>Funded Projects Total</b> .....	<b>\$226,000</b>
Evaluation of Strip-Tillage for Grain Sorghum in Kansas KSU-Principal Investigator Keith Janssen .....	<b>\$6,300</b>		
Extension and Applied Research Programs for Kansas Grain Sorghum Production KSU-Principal Investigator Kraig Roozeboom .....	<b>\$5,400</b>		
Management Systems for Grain Sorghum Production under Dryland and Limited Irrigation Conditions KSU-Principal Investigator Barney Gordon .....	<b>\$6,500</b>		

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