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TO: Blue Ribbon Funding Task Force for Water Resource Management

FROM: Kansas Cotton Association & Plains Cotton Cooperative Association

RE: Comments on funding demands pertaining to the Long-Term Vision for the Future of Water Supply in Kansas (The Vision).

On behalf of the Kansas Cotton Association (KCA) and Plains Cotton Cooperative Association (PCCA), we want to thank you for allowing us to share our thoughts on the water funding initiative. The KCA is a 12 year old organization whose purpose is to protect the interest and resources of farmers by creating a desire to grow cotton in Kansas through research, promotion and education. PCCA is a 63 year old, farmer-owned, cotton marketing cooperative. Since 1996, an estimated 125 Kansas growers have produced over one million bales of cotton in the southern part of the state. With new technologies on the horizon and cotton's water conservation benefits, we believe cotton can be part of the solution to the depleting aquifer.

Because of our history of working with farmers, we have a strong sense of conservation and efficient use of natural resources, especially water. We appreciate Governor Brownback's efforts to form a long-term water vision for this state and feel that cotton, as a less water intensive crop, can be an important component of reducing the irrigation draw on Kansas' groundwater supply. Both KCA and PCCA have met with the Kansas Department of Agriculture as recently as April 12, 2016, to discuss how cotton can play a role in the water vision and to develop a growth strategy for the industry.

We also appreciate the efforts of this task force in identifying funding mechanisms and strategies. We have been part of the policy discussion relative to the water vision and the growth strategy and welcome the opportunity to be part of future funding discussions. We look forward to working together to develop specific ideas about how to create opportunities for Kansas farmers through growing cotton.

We look forward to expanding the tremendous investments in farming, ginning, storage, and logistics already made in Kansas cotton production. We want to thank you again for allowing us to submit our comments at this time and wish you all the best in your efforts to develop a financial strategy to fund water resource management and protection.

Kansas State University Research and Extension

Water Funding Priorities

There is Good News and Bad News--First, the Good News

The First Congressional District of Kansas is ranked 1st among the 435 congressional districts in the United States in terms of the value of agricultural products marketed at over $12 billion (2007 Census of Agriculture, USDA, NASS). The district accounts for 84% of the Kansas total ($14.4 billion) and contains the top five Kansas counties for agricultural sales. Those counties (1st to 5th: Scott, Haskell, Finney, Gray, and Grant) account for 24% of the state's total. All of those counties are in western Kansas, and all are dependent upon irrigation from the Ogallala Aquifer. The counties overlying the Aquifer account for roughly two-thirds of the state's agricultural economic value. **Simply stated, this region of Kansas is an indispensible driver of the Kansas economy.**

Now, the Bad News

The Ogallala Aquifer underlying this indispensible driver of the Kansas economy is rapidly being depleted. The Ogallala Aquifer was first utilized for irrigation in the 1940s and was rapidly developed over the following three decades. Generally speaking, the current use is ten times the rate of natural recharge. Withdrawals greatly exceeding recharge rates have resulted in deeper water tables, reduced saturated thickness and lower well yields. From predevelopment to 2007, average water level in the Ogallala Aquifer in Kansas was reduced by 22.6 feet. In certain areas in Kansas, farmers have already abandoned irrigation due to inadequate supply and in other areas, reduced well yields have impacted crop yields and have and will continue to adversely impact the economic well being of farmers and communities. It is clear that current rates of water use will deplete that portion of the Aquifer overlaying western Kansas. **As wells are abandoned and as water yields decline because water from the Aquifer becomes less available in one county, then another, and another…what then; what will sustain economic viability in the county and of western Kansas?**

How Did We Got In this Predicament

Use of the Ogallala has made the Kansas economy particularly dependent on water and irrigated crops, with more than 2 million cattle in feedlots (2011 Kansas Farm Facts, USDA NASS, Kansas Field Office) and irrigated crop revenues exceeding $600 million annually (2003). Corn has historically has been the most widely grown crop under irrigation in western Kansas and has become the feed of choice for western Kansas beef feedlots. Winter wheat and sorghum, crops that have lower water requirements, are adapted to western Kansas. However, in recent years, new investments by private companies have greatly

increased corn yields, particularly under irrigation. In contrast, far less private and public investment in research in improving wheat and grain sorghum have led to reduced farmer reliance on those crops. Irrigated corn acreage has approximately doubled over the past 20 years, compared to substantial reductions in wheat and grain sorghum acres. This increase in corn acreage and decrease in wheat and sorghum will continue unless there is an increased commitment to public funding of research for improvement of wheat and sorghum genetics and production practices. Improved varieties/hybrids of wheat and sorghum and improved irrigation technology and management will lead to increased acreage and reduce the irrigation water requirement from the Ogallala Aquifer and lessen or even eliminate the adverse economic impact as water resources become more limited for irrigation. **Kansas State University believes that water availability is the most critical issue facing Kansas and possibly the entire country in the coming decades.**

Now, How Do We Get Out of This Predicament

We suggest that we must begin NOW to prolong the life of the Aquifer and to adopt crop and livestock production systems that sustain economic viability of western Kansas as the water table declines and/or conservation measures are imposed. Further, we suggest that it is within our power to identify dry land cropping systems and limited irrigation strategies that not only support the livestock industry in western Kansas, but also maintain a vibrant economy, an expanding populous, and preserve both surface and ground water resources for the future. We maintain that **wheat and sorghum**, the two crops noted above and already well-known by Kansas growers, can play an integral role in achieving those goals.

Kansas State University has long been a national leader in signature programs focused on **wheat, sorghum and irrigation technologies**. But, more work is needed to direct these programs squarely on the water dilemma in western Kansas. Now is the time for the State to invest in continued development and production expertise around these vitally important commodities. As agricultural research and development are estimated to leverage about $20 in value for every $1 invested, it is anticipated that a state initiative around these vitally important commodities will pay the state back many fold in growth and economic vitality in the coming decades.

Directing Signature K-State Assets to Tackle the Water Problem

Funding is sought to support integrated programmatic efforts focused on sorghum and wheat as a part of rotational cropping systems well-suited to dry land and limited irrigation production in the soils and climate of western Kansas. New base funding will expand programmatic efforts of the Great Plains Sorghum Improvement and Utilization Center, the Wheat Genetic and Genomic Resources Center, and the water conservation research and extension effort in western Kansas. We have three overarching goals

for this investment. One goal is to increase sorghum and wheat technology and planted acres en route to a systematic transition to predominately dry land and limited irrigation cropping systems in western Kansas. The second overarching goal is to substantially expand the use of sorghum as: both a grain and forage feed for cattle; a feedstock for renewable fuel production; and as an ingredient in gluten-free food products. The third goal is to increase water use efficiency through improved irrigation and production technologies, leading to substantially reduced water use while maintaining or increasing economic output.

Specific Center and Areas to be Impacted

***Great Plains Sorghum Improvement and Utilization Center*.** The Great Plains Sorghum Improvement and Utilization Center is located at Kansas State University. It is obvious that an important focus should be on grain sorghum as it is one of the most important dry land crops in the Kansas and the Central Great Plains. Sorghum is economically important in areas characterized by low and erratic rainfall and high temperatures that limit the production of other summer crops. In this way, the **Great Plains Sorghum Improvement and Utilization Center is the only center of it's kind in the US**. Goals of the Center include: 1) Improve the agronomic characteristics, yield potential, food, and feed value of grain sorghum through plant breeding and genetic improvement; 2) develop new uses for grain 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 suitability for use in biofuel production; 3) develop environmentally and economically sustainable cultural practices that increase the profitable production of high quality grain sorghum with unique functional properties.

***Wheat Genetic and Genomic Resource Center (WGGRC)*.** The internationally-recognized WGGRC is located at Kansas State University. The WGGRC is a pioneering center without walls serving the wheat research community to ensure the free availability of germ plasm, genetic and genomic resources, and knowledge for sustainable and profitable wheat crop production. **There is no other center in the world that has the WGGRC's unique collection of genetic materials, expertise and track record for wheat genetics research, manpower training and their application for wheat crop improvement.** The WGGRC has established a national and international network to conduct and coordinate genetic studies in wheat. Genes for host-plant resistance to viral, bacterial, fungal, and insect pests and abiotic stresses are identified, transferred to agronomically useful breeding lines, and deployed.

Improving Irrigation and Production Technologies. Over the past several decades, K-State research and extension/outreach thrusts focused on topics such as subsurface drip irrigation, water policy, irrigation management, particularly evapotranspiration-based irrigation timing, and other production management areas. Clearly these research and extension programs in irrigation management and water use efficiency have been very successful. For example, farmer adoption of K-State research results on

crop production and irrigation technology has led to significant increases in economic productivity per unit of water applied. In southwest Kansas, irrigation water use efficiency for corn has increased over the last 30 years by a value of 0.16 bushels/inch/year. Yields have essentially doubled while total water applied has been reduced slightly. New investments are needed to continue to increase water use efficiency and direct the focus of research towards grain production under dry land and limited irrigation scenarios. Work is also needed on alternative crops that can be grown under dry land conditions to expand and diversify the economic base in that region of the state.

Request: $5,000,000 in recurring base funding to Extension Systems Ag Research Programs (ESARP)

This new investment will be directed into three broad, but overlapping areas: support of faculty positions; facility upgrades; and resources for operating expenses.

Faculty Support--$3 million. A significant percentage of this request will be directed to support people who will focus their passion and expertise on impacts that will assist in sustaining economic viability in western Kansas where water availability will eventually dictate changes in cropping and livestock systems. Our long term goal would be to recruit and retain faculty in key positions within the wheat and sorghum variety development pipeline and irrigation and production technology development that are world class scholars in their disciplines and a select few that would be potential candidates for membership in the National Academy of Sciences. Scientific support and training personnel will also be key in defining K-State as a world-wide leader in each of these areas. Therefore, we also will hire research assistants, postdoctoral fellows, and graduate research assistants to provide the necessary staff support for the research and extension programs.

A few of the faculty/staff positions to be added:

- Two assistant/associate/full professors with expertise in plant molecular genetics (one focused on wheat, the other on sorghum)
- One assistant/associate professor with expertise in plant breeding (focused on sorghum breeding)
- One assistant professor with expertise in sorghum germplasm resources/conversion
- One assistant/associate professor with expertise in sorghum genetic marker development
- One assistant professor with expertise in water policy and economics
- One new assistant/associate professor (research/extension responsibilities), stationed at the Colby Experiment Station with responsibilities for increasing adoption of new irrigation technologies
- Three extension assistant professors to work directly with extension agents, industry personnel and farmers.

Additional faculty support will emphasize: weed control in sorghum; cropping systems (sorghum and alternative crops); beef cattle nutrition (sorghum utilization); rumen metabolism; forage sorghum/post-harvest preservation/silage technology; feed science (sorghum processing); milling/bakery science (sorghum utilization); food science with an emphasis on food product development; water policy and usage; farm management economics. An on-the-ground team (3) of water extension specialists (extension assistant professors) will be hired and have responsibility for working directly with county/district extension agents, farmers and industry personnel to increase the rate of water conservation technology adoption. These personnel will work similarly to the current K-State extension watershed specialist program that has been proven over the past 10 years to be highly effective in helping farmers adopt new technologies leading to improved water quality. It is envisioned that these water specialists/agents will be co-located in Groundwater Management District Offices (GMDs) in western Kansas, so to maintain a close relationship with the GMDs.

Facility Upgrades--$1.5 million. We will systematically upgrade and modernize both laboratory and field equipment in Manhattan, Hays, Colby, Garden City, and Tribune. Priority projects impacting the areas of focus include, but are not limited to: complete modernization of plant growth chambers; expansion and modernization of greenhouse space in Hays and Manhattan; modernization of laboratories in Call Hall (rumen metabolism), Throckmorton (plant sciences), and Schellenberger Halls (grain sciences); new, advanced irrigation equipment and upgrades; upgrade and modernization of planting and harvesting equipment.

Operating--$0.5 million. Recurring funding will be necessary as flex resources for faculty start-up packages and as a flexible pool of funds for market equity and retention of key faculty.

Milestones and Impacts

By 2025, we anticipate that emphasis on yield, water use efficiency, stress tolerance, cropping systems management, and irrigation management will result in the following aggressive goals around wheat, sorghum, and alternative crops:

- Sorghum hybrids and wheat varieties will be available as economically viable cropping choices for growers with access to limited water inputs
- Sorghum hybrids and wheat varieties will be available that provide stable yield potential for growers with access to limited water inputs
- Sorghum or sorghum byproducts will become dominant ingredients in the formulation of feedlot and dairy diets for production systems in western Kansas

- Economic modeling and water policy development that will predict paths to economic sustainability in western Kansas as counties transition to dry land and limited irrigation cropping systems
- The proposed work will enhance recent changes in water law that will make water conservation more likely
- Forage sorghum varieties will be the feedstock of choice grown in western Kansas for cellulosic production of biofuel
- Sorghum will be the grain of choice for ethanol production in western Kansas
- Adoption of new irrigation and production technologies will lead to great economic output in western Kansas
- Pumping of water from the Ogallala Aquifer for production of commodity grains in western Kansas will be reduced by an average of 1% per year relative to 2015 irrigated production
- Cropping systems research will identify alternative crops that support economic sustainability and that can be adapted to currently used cropping rotations in western Kansas

For addition information contact: John Floros (floros@ksu.edu) Dean and Director, Daryl Buchholz (dbuchhol@ksu.edu), Associate Director, Ernie Minton (eminton@ksu.edu), Associate Dean, Research or Dan Devlin (ddevlin@ksu.edu), Director, KCARE

Long-Term Vision for the Future of Water Supply in Kansas:

Technology Needed to Improve Water Use Efficiency at Livestock Facilities

Livestock production is an important and substantial part of the Kansas economy. This is especially true in Western Kansas, where most of the large feeding facilities and processing plants are located. The climate of the High Plains is favorable for livestock production, especially for cattle. The rural population of the area makes it feasible to build and operate large livestock facilities that take advantage of economies of scale. A beneficial economic relationship has become established between feed grain and forage producers and livestock feeders. The presence of large numbers of livestock creates a demand for feed, which improves the basis for local producers that are located far from terminal markets. An abundant feed supply keeps the livestock operations efficient and competitive.

The depletion of the Ogallala aquifer is well known and is of utmost concern in Western Kansas. Extensive research efforts have been directed toward increasing irrigation efficiency and decreasing water use. This is logical since irrigation represents the vast majority of groundwater use in the region. However, as depletion limits the amount of groundwater available is specific locations, it becomes imperative to implement efficiency and conservation measures to extend the water supply of high-value facilities, such as beef cattle feed yards and dairies. While feed can be and is readily imported to a feeding facility, it is rarely feasible to import the quantities of water needed to sustain large numbers of livestock. Therefore, there is a need for technology that will increase water use efficiency and allow for reuse of wastewater. A very limited amount of research and technology development has been dedicated to water use in livestock facilities. This technology is a critical component of any long range plan that would stabilize the livestock production sector in Western Kansas.

One unique aspect of the open-lot cattle feed yard and dairy facilities in Western Kansas is the amount of wastewater generated and captured by each facility. Discharges of stormwater runoff from these facilities are prohibited by state and federal regulations. All runoff must be contained in wastewater retention ponds located within the boundaries of the facility. Even in the dry climate of Western Kansas, the average annual runoff volumes amount to millions of gallons of water. This runoff is considered to be wastewater because it comes in contact with livestock manure and may transport both manure and soil particles to the wastewater retention pond. This wastewater is typically used for irrigation. The runoff quantities represent a substantial portion of the average annual water consumption by livestock confined in the facility. This wastewater is a potential resource that, if reused, could decrease the demand for water supplied by groundwater pumping. Having this resource available would provide a more secure water supply and likely extend the life of the livestock facility.

Some technology exists that can be used to treat this wastewater. The methods include distillation, mechanical filtering and chemical treatment, and a combination of filtering technologies that includes the use of thin membranes and reverse osmosis processes. All of these technologies are expensive, complicated, and require considerable maintenance. At this point in time, they have been determined to be infeasible for livestock facilities. New technologies have been identified which are potentially feasible for livestock wastewater treatment. One technology uses a proprietary process that vaporizes wastewater and recovers a large portion of it as clean water, with the remainder being a concentrated wastewater solution. This process has been tested to treat wastewater to levels satisfactory for human consumption in military applications. The treatment level for livestock consumption is less stringent and no information is available

for this application. Research needs include: (1) determination of process modifications to achieve treatment and water quality levels suitable for livestock consumption, (2) determination of scalability to provide the production of treated water required at a livestock facility, and (3) quantification of energy requirements to power the process at a feasible rate.

Recommendation: Research and develop wastewater treatment technologies which provide water quality and quantity suitable for livestock consumption to promote reuse of wastewater generated by livestock facilities.

Estimated research cost: $800,000 - $1,000,000

Discharges from overflow water tanks are another source of wastewater generated by livestock facilities. These discharges occur in the winter months when the tanks that supply water for livestock consumption are set to produce small overflows to prevent freezing. Our experience indicates that these overflows typically represent 5 to 15 percent of the wastewater generated by an open-lot facility.

There are a number of different devices installed in the tanks to produce these overflows. Some are simple valves that produce small continuous flows. Others are valves controlled by thermocouples that open and close based upon water temperature. All of these devices have functional limitations and typically require frequent maintenance. Some specific needs and goals have been identified that would result in reduced overflow volumes and water conservation:

1. Develop a mechanical device to open and close an overflow valve that is not susceptible to plugging or failure. Plugging with sand particles is an important issue in some locations.

2. Develop electronic sensors and controls to open and close overflow valves based upon temperature conditions. One desired feature is to have the valve open when the water temperature is less than 33 degrees F and then close when the temperature rises above this level.

3. Develop sensors to determine when water tanks are frozen or flowing at excessive rates. In the case of frozen conditions, the sensor would alert staff to take actions to thaw the tank. Detection of an excessive flow rate would signal a device malfunction and alert staff to repair the device.

Recommendation: Research and develop sensors, controls and mechanical devices that will reliably control and limit wintertime overflows from livestock water supply tanks.

Estimated research cost: $300,000 - $500,000

Respectfully submitted,

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