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University of Nebraska Selected to Manage the New Sorghum/ Millet and Other Grains CRSP

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Dr. John Yohe, INTSORMIL CRSP Program Director, has announced that the University of Nebraska (UNL) has been selected as the Management Entity for the new Sorghum/Millet and Other Grains CRSP. The award was based on national competition among U. S. universities. This CRSP is funded through a Leader with Associates Cooperative Agreement instrument as opposed to a grant under which INTSORMIL was funded since 1979. The INTSORMIL CRSP, Managed by UNL in partnership with Kansas State University, Purdue University, Texas A&M University, UNL and West Texas A&M University, ends June 30, 2007. The Leader with Associates Cooperative Agreement is effective as of September 30, 2006 and ends September 29, 2011. Estimated cost for the five year cooperative agreement is $9,000,000. Dr. Yohe will be the Program Director of the Sorghum/Millet and Other Grains CRSP. The following excerpts from the proposal submitted to USAID describe the new program.

INTRODUCTION

Sorghum and pearl millet are poised to be the major grains of the 21st Century in the semi-arid tropics. Significant research advances have been made with resultant technologies starting to be exploited in pilot programs in several regions. Domestic markets for food and feed are increasing rapidly. Success in research and development shows that sorghum and pearl millet are moving from subsistence to cash crops. There are increasing opportunities for farmers producing the staple food crops to participate in new markets and increase their incomes.

The **overall vision** for the Sorghum, Millet, and Other Grains CRSP will be to improve food security, enhance farm income, and improve economic activity in the major sorghum- and pearl millet-producing countries of Africa and Central America.

The **overall approach** will focus on increasing food security and promoting market development of sorghum and pearl millet products for developing and transforming countries. Targeted basic and applied research, education/short-term training, and technology transfer will promote adoption and economic impact. The approach will involve regional, interdisciplinary, multi-organizational teams.

The CRSP will respond with research on production and utilization of "orphan crops" such as fonio, finger millet and teff, in sorghum-/millet-based cropping systems as associate awards from USAID Missions become available.

PROGRAM OBJECTIVES

- Facilitate the growth of rapidly expanding markets for sorghum and pearl millet
- Improve the food and nutritional quality of sorghum and pearl millet to enhance marketability and consumer health
- Increase the stability and yield of sorghum and pearl millet through crop, soil, and water management while maintaining or improving the natural resources of soil (land) and water

- Develop and disseminate information on the management of biotic stresses in an integrated system to increase grain yield and quality in the field and in storage
- Enhance the stability and yield of sorghum and pearl millet through use of genetic technologies
- Enhance global sorghum and pearl millet genetic resources and the conservation of biodiversity
- Develop effective partnerships with national and international agencies engaged in the improvement of sorghum and pearl millet production and the betterment of people dependent on these crops for their livelihoods

IPM ACTIVITIES

The fourth and fifth objectives include emphasis on IPM activities. To fulfill the fourth objective, an integrated system of management of biotic (disease, insect, weed, and bird) pests is required to increase grain yield and quality of sorghum, pearl millet, and other grains in the field and reduce storage losses in a sustainable way that prevents pesticide residues and harm to non-target organisms, including humans.

Measurable impacts to be generated:

- Understanding of pest biology and ecology in diverse habitats to develop economically profitable and environmentally sustainable IPM programs
- Development of pest management strategies, including biological and cultural controls and plant resistance, which will reduce yield and quality loss

- Protection against storage pests to increase sorghum and pearl millet grain quality
- Use of computer models to predict occurrence of and response to pest outbreaks

To fulfill the fifth objective, this CRSP will conduct research on the primary production and utilization constraints of sorghum and pearl millet. The CRSP will focus on maximizing production and value of grain and forage for use in human consumption and animal nutrition. Important abiotic constraints for sorghum and pearl millet (tolerance to heat and drought stress, acid soil, and cold temperatures) and biotic constraints (*Striga*, sorghum midge, greenbugs, grain molds, and various leaf, stalk, and storage pests) will be addressed.

During the last 10 years, the changing world of privatization, mergers, and acquisitions of the global seed industry, coupled with diminishing public resource support to Future Harvest Centers, has resulted in less investment in sorghum and pearl millet genetic enhancement research globally. The private sector has opted to increase its research investments into commodities with marketable GMO products (maize, soybean, and cotton) at the expense of crops such as sorghum and pearl millet. Resource support by USAID will allow the Sorghum, Millet, and Other Grains CRSP to become an international center of excellence that will drive research, knowledge, and technology generation for genetic enhancement of sorghum and pearl millet.

Development of genetic technologies to address these constraints will focus on deployment of genes for tolerance to biotic and abiotic stresses into locally adapted, high-yielding cultivars and hybrids. Plant-breeding efforts will focus on identifying and transferring useful genes derived from landraces or other genetic resources into improved cultivars through conventional phenotypic selection or DNA marker-assisted selection. During deployment of improved cultivars and hybrids, links with potential end-users will ensure demand and acceptance of the grain or forage products developed. Plant breeding programs will benefit from recent and ongoing advancements in DNA genotyping and marker technologies.

Transgene or other biotechnologies are being developed to enhance traits. These genetic technologies will be used for crop improvement as they are developed within this program or become available through collaborating partner programs.

Measurable impacts to be generated:

- Greater knowledge of the genetic inheritance of important traits and the genes involved in expression of these traits
- Reduced production constraints through use of genetic technologies
- Release of cultivars and hybrids with higher yield, improved adaptation to biotic and abiotic stresses, and enhanced value for end-users in target environments
- Open exchange and distribution of genetic resources of these crops

IPM ISSUES

Disease, insect, weed, and bird pests of sorghum, pearl millet, and other grains annually cause hundreds of millions of dollars in damage and costs for control. Persistent, major pests of sorghum and pearl millet include many insects, pathogens, and *Striga*. Other pests annually fluctuate in abundance and the damage they cause.

The parasitic weed *Striga* ("witchweed") is the scourge of agriculture in much of Africa and parts of Asia. It also is present in the United States and could become a pest problem. *Striga* attacks the major cereal grains and legumes in Sub-Saharan Africa, significantly reducing the already low yields of subsistence farmers. *Striga is* the major reason that sorghum and pearl millet productivity has remained at a subsistence level. For many decades, research on *Striga* targeted eradication, suppression, or breeding for cultivars that support fewer emerged *Striga* plants. Decades of such effort have led to few successes. More recently, basic research efforts at U.S. universities focusing on the fundamental biology of the parasite led to better understanding of the enemy. This new knowledge, in turn, led to on-farm successes in the field that are being expanded slowly throughout Africa. Newly derived biotechnological information integrated with basic agronomic practices of water conservation and soil fertility led to development of an intervention program dubbed Integrated Striga Management (ISM). In this program, the synergistic effects of improved *Striga*-resistant cultivars, use of modest amounts of nitrogen fertilizers, and water conservation using tied-ridges resulted in a dramatic reduction in infestation by *Striga* and an increased grain yield of sorghum on farmers' fields in several countries in Eastern Africa.

Changes from traditional cultural practices and/or landrace cultivars can result in changes in pest population and damage. Pest problems have greater impact because of the higher economic value and quality concerns of value-added grains. Stored grain pests are likely to become even more problematic, particularly in humid areas, when grain is stored for longer periods to seek better prices through organized

inventory credit systems currently being implemented. Pest management strategies are needed to provide sustainable solutions to pest problems without relying on chemical controls that can adversely affect non-target organisms, including humans, and the environment. An integrated, multi-faceted, ecological system of pest management strategies used when pest abundance or damage exceeds economic thresholds will improve nutrition and health, maximize soil and quality, and help mitigate post-harvest constraints, enhance productivity and livelihoods of people in marginal areas, and improve food quality and safety without relying on chemical controls and associated pesticide residues.

The Sorghum, Millet, and Other Grains CRSP will study and develop integrated pest management strategies against major pests of sorghum and pearl millet and be prepared to prevent outbreaks into new areas. Research on existing and potential pests will be organized in an integrated and multidisciplinary way with scientists in allied sciences to evaluate and develop cultural controls, biological controls, and molecular techniques for sustainable management of pests. For example, sorghum and pearl millet cultivars adapted for production in agriculturally marginal lands and with high-yield and food/feed qualities will be developed and transferred to end-users by a team of plant breeders, entomologists, plant pathologists, cereal chemists, and technology transfer agents.

TRAINING AND CAPACITY BUILDING

Teams of collaborating-country and U.S. scientists and technology transfer agents, including agronomists, plant breeders, entomologists, plant pathologists, economists, and weed scientists, are needed to develop and transfer integrated crop management technology. Teams of cereal chemists, entomologists, plant pathologists, and plant breeders are needed to solve pest problems of grain in storage. Pest management scientists are needed to develop procedures and computer models to be able to forecast and respond to evolving pest problems and outbreaks. Pest biology and adaptation to diverse production systems must be understood to develop sustainable management strategies. Technology transfer agents are needed to work in conjunction with the other scientists to disseminate information to end-users.

The overall strategy for the Sorghum, Millet, and Other Grains CRSP is to strengthen the capacity of both, institutions and individuals, with the objective of developing a sustainable approach to grain production research and technology transfer. The Sorghum, Millet, and Other Grains CRSP will stress two important concepts in capacity building of institutions: (a) Build upon past successes of the INTSORMIL CRSP and (b) Create links and working relationships with other agencies up and down the supply chain.