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## ASARECA-INTSORMIL: Regional Sorghum Research and Development Workshop, September 2–6, 2012, Executive Hotel, Adama, Ethiopia

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# ASARECA- INTSORMIL

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## Regional Sorghum Research and Development Workshop

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September 2 – 6, 2012

Executive Hotel  
Adama, Ethiopia

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FROM THE AMERICAN PEOPLE



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**ASARECA-INTSORMIL**  
**Regional Sorghum Research & Development Workshop,**  
**September 2 - 6 2012**  
**Executive Hotel**  
**Adama, Ethiopia**

**Expected Outcomes**

1. Sorghum researchers better informed of individuals and activities in the Region;
2. Sorghum research priorities and development opportunities identified;
3. Strategic and operational plans for regional collaboration developed with assignment of roles/responsibilities and identification of existing and potential resources, including funding.

**September 2**

**Arrival/Registration and Check-in beginning at 1:00 p.m.**

**September 3, Monday**

- |              |   |
|--------------|---|
| 8:00         | <b>Moderator: Dr. Fina Opio</b>   |
| 8:05         | <b>Welcome by Dr. Getachew Ayana (Center Director of Melkassa Agricultural Research Center)</b>       |
| 8:25         | <b>Opening by Dr. Adefris T/Wold (EIAR Director of Crops Research)</b>                                |
| 8:35         | <b>Introduction of Participants:</b>  |
| 9:05         | <b>Overviews by ASARECA, INTSORMIL, ICRISAT&amp;HOPE, &amp; USAID</b>                                 |
| 10:00        | <b>Break</b>  |
| 10:20 – 1:55 | <b>Thematic Area Overviews: Issues, Obstacles and Opportunities (Bio-physical and Socio-economic)</b> |
| 10:20        | <b>Tesfaye Tesso: Sorghum Constraints and Preferences</b>   |
| 11:00        | <b>Erbaugh/Larson/Makindara/Kilima: Input Supply, Marketing, Utilization</b>                          |
| 11:40        | <b>Kaizzi, Mgonja, Mgonja: Technology Transfer &amp; Achieving Adoption</b>                           |
| 12:20        | <b>Lunch</b>  |

**Moderator: Dr. Charles Wortmann**

- 1:15 **Fina Opio and African university faculty: Human & Institutional Capacity for Sorghum Research & Development**
- 1:55 **Potential Opportunities/Strategic Initiatives:** (plenary) Individuals write on 10x20 cm cards and post on wall
- 2:30 **Small Group Inter-Disciplinary Discussion to Prioritize Potential Opportunities: Topic facilitators and recorders move from group to group**
- 3:00 **Break**
- 3:15 **Small Group Inter-Disciplinary Discussion to Prioritize Potential Opportunities Continued**
- 5:40 **Break**

## **September 4, Tuesday**

**Moderator: Mark Erbaugh**

- 8:00 **Plenary Session with Small Group Reporting on Prioritization of Opportunities:**
- 9:00 **Small Group Inter-Disciplinary Discussion to Develop Priority Opportunities: Topic facilitators and recorders move from group to group**
- 10:20 **Break**
- 10:35 **Small Group Inter-Disciplinary Discussion to Develop Priority Opportunities, continued**
- 11:55 **Afternoon's Activities**
- 12:15 **Lunch**
- 1:15 **Visit Melkassa Agricultural Research Center**

## **September 5, Wednesday**

**Moderator: Curt Weller**

- 8:00 **Synthesis reports by facilitators/ recorders on priority opportunities. Discussion. Introduction to Logic Model Development**
- 10:00 **Break**
- 10:15 **Logic model development: disciplinary small groups**
- 12:15 **Lunch**

- 1:15 **Logic model development: disciplinary small groups**
- 2:45 **Plenary session: presentation of the logic models**
- 3:30 **Break**
- 3:15 **Wind-up; finalization of logic models**
- 6:00 **Reception and Ethiopian coffee ceremony**

## **September 6, Thursday**

**Depart for Addis and Airport**



# Priorities in Sorghum Research and Development Cross-Cutting Elements

All priorities should be cognizant and address:

- Gender responsiveness
- User friendliness in sharing knowledge and information
- Sustainable growth
- Capacity building
- Collaboration with public and private partners especially NARS, and regional and international organizations

## **Production**

- Integrated soil and water management in response to climate change
- Integrated pest management
- Cropping systems
- Mechanization to alleviate drudgery

## **Breeding/Genetics**

- Breeding high yielding sorghum cultivars with enhanced ecological adaptation (drought tolerance and *Striga* resistance and diseases and pests) and superior grain quality
- Development, release and distribution of enhanced sorghum germplasm materials with desired end-use quality attributes (malt, biofuel, animal feed, etc.)

## **Markets**

- Promote linkages between value chain actors
- Identify and develop new products for local, regional and other international markets, promote markets for existing products and alternative uses, improve product appeal to consumers and farmers' knowledge on post-harvest operations and capitalize on health benefits of sorghum and millet products over others
- Promote regional integration and exchange of commodities to link deficit and surplus areas/regions, harmonize and domesticate the ratified protocol(s) and use CGIAR as spring to spearhead market changes

## **TOT**

- Research, extension, farmers and users linkage - Linking all stakeholders along the value chain
- Best approaches for technology transfer
- Factors affecting adoption of new sorghum technologies
- Quality seed production and delivery
- Increasing the availability of technologies (seed, fertilizer)
- Information on new technologies available to farmers

## **Processing & Utilization**

- Harvesting & post-harvest management for quality grain
- Public-private partnerships for product and process
- Development and diversification for increased sorghum and millet utilization

## INCREASED PROCESSING AND UTILIZATION OF SORGHUM

**AIM (Broader Object):** Harvesting & postharvest technologies and innovations for quality sorghum grain  
Grain quality issues include, grain cleanliness and moulds (mycotoxin) presence

SITUATION	INPUTS	ACTIVITIES	OUTPUTS	OUTCOMES		
				Knowledge	Behaviour/Practices	Conditions
<p>Current: sorghum grain with mixed varieties which is also dirty &amp; contaminated with soil, stones, &amp; foreign matter.</p> <p>Thus need for harvesting &amp; post-harvest technologies to deliver clean sorghum grain</p>	<p>Funds</p> <p>Human resources expertise</p> <p>Partners (partnerships) – with private sector, NGOs &amp; public sector</p> <p>Physical infrastructure</p> <p>Laboratory and field equipment</p>	<p>Make inventory of sorghum harvesting and post harvest technologies and resources within the ECA region</p> <p>Evaluation of the performance &amp; adaptability of available harvesting &amp; postharvest technologies</p> <p>Selection of best bet technologies</p> <p>Identify develop, adapt/modification &amp; adopt new harvest and postharvest technologies.</p> <p>Promotion and transfer best bet technologies</p> <p>Training in operation, maintenance &amp; repair of users and fabricators/ technical services providers</p> <p>Training of producers and processors in clean grain &amp; mould free quality specifications</p>	<p>Inventory of sorghum harvesting and postharvest technologies in the ECA region</p> <p>Technology evaluation report</p> <p>List of best technologies documented</p> <p>New technologies developed and documented</p> <p>Number of users trained; number of fabricators trained; Number of processors using the promoted technologies</p> <p>Producers and processors trained on clean sorghum grain specifications</p>	<p>Farmers, researchers and processors knowledgeable about the specifications &amp; advantages of clean sorghum grain production</p>	<p>Farmers use improved harvesting &amp; post harvest technologies to produce clean sorghum grain</p> <p>Processors pay a premium for clean sorghum grain</p>	<p>The income to sorghum producers enhanced</p> <p>Improved productivity and returns to sorghum processors</p>

SITUATION	INPUTS	ACTIVITIES	OUTPUTS	OUTCOMES		
				Knowledge	Behaviour/Practices	Conditions
		<p>Operationalize technology business incubators</p> <p>Postgraduate training in sorghum harvest &amp; post harvest techs</p> <p>Advocacy and social marketing of sorghum and sorghum products – trade fairs, exhibitions &amp; promotion, magazines, brochures, fliers</p> <p>Monitoring and evaluation</p> <p>Reporting and report writing</p>	<p>Functional tech. biz. incubators</p> <p>MSc/PhD graduates, theses and publications</p> <p>Trade fairs, exhibitions &amp; promotion attended</p> <p>Magazines, articles, brochures, fliers published</p> <p>M&amp;E Report</p> <p>Report</p>			
<p>Current: mouldy sorghum grain.</p> <p>Thus need for post-harvest technologies to deliver mould free sorghum grain</p>			<p>Producers and processors trained on mould free sorghum grain specifications</p>	<p>Farmers, researchers and processors knowledgeable about the specifications and advantages of mould free sorghum grain production</p>	<p>Farmers use improved harvesting &amp; post harvest technologies to produce mould free sorghum</p> <p>Processors pay a premium for mould free sorghum grain</p>	<p>Health related risks related to mouldy sorghum consumption reduced.</p> <p>Improved productivity and returns for sorghum processors</p>

## INCREASED PROCESSING AND UTILIZATION OF SORGHUM

**AIM (Broader Object):** New product and process development & diversification for increased sorghum utilization through PP partnerships

SITUATION	INPUTS	ACTIVITIES	OUTPUTS	OUTCOMES		
				Knowledge	Behaviour	Conditions
<p>Current: sorghum products few and stigmatized; inadequate knowledge and awareness about sorghum nutritional &amp; health qualities; inadequate processing techs for high quality sorghum products</p> <p>Thus need for new food products and processes development from sorghum; promotion of sorghum products and their respective technologies</p>	<p>Funds</p> <p>Human resources expertise</p> <p>Partners (partnerships) – with private sector, NGOs &amp; public sector</p> <p>Physical infrastructure</p> <p>Laboratory and field equipment</p>	<p>Make inventory of sorghum processing technologies and resources (for food &amp; feed) within the ECA region</p> <p>Improving and transforming indigenous sorghum products and technologies</p> <p>Evaluation of the performance &amp; adaptability of available sorghum processing technologies (for food &amp; feed)</p> <p>Selection of best bet technologies for food &amp; feed</p> <p>Identify develop, adapt/modification &amp; adopt new sorghum technologies (for food &amp; feed). Promotion and transfer best bet technologies thru:</p> <p>Training in new sorghum</p>	<p>Inventory of sorghum processing technologies (for food &amp; feed) in the ECA region</p> <p>Indigenous sorghum processing technologies standardized &amp; industrialized</p> <p>Technology evaluation report</p> <p>List of best technologies (for food &amp; feed) documented</p> <p>New sorghum processing technologies and formulations/products developed (for food &amp; feed) and documented</p> <p>Number of processors</p>	<p>Consumers &amp; processors knowledgeable about nutritional and health benefits of sorghum and sorghum products</p> <p>Processors knowledgeable about technological and business advantages of using sorghum in processing</p>	<p>Positive change in the attitude towards sorghum and sorghum products</p> <p>Increased interest and market for sorghum and sorghum based products</p> <p>Increased industrial/commercial use of sorghum</p>	<p>Improved food and nutrition security of consumers in the ECA countries</p> <p>Improved livelihoods of communities that heavily depend of sorghum in the ECA countries</p> <p>Increased contribution of sorghum to socio-economic development in the ECA countries</p>

SITUATION	INPUTS	ACTIVITIES	OUTPUTS	OUTCOMES		
				Knowledge	Behaviour	Conditions
		<p>processing technologies of processors and farmers</p> <p>Training of producers and processors in clean new sorghum products (food &amp; feed) quality specifications</p> <p>Operationalize technology business incubators</p> <p>Postgraduate training in sorghum processing and value addition (for food &amp; feed)</p> <p>Advocacy and social marketing of sorghum, sorghum products &amp; sorghum processing technologies – trade fairs, exhibitions &amp; promotion, magazines, brochures, fliers</p> <p>Monitoring and evaluation</p> <p>Reporting and report writing</p>	<p>trained sorghum production technologies (for food &amp; feed);</p> <p>Number of processors using the promoted processing technologies (for food &amp; feed)</p> <p>Processors trained on new sorghum product (food &amp; feed) quality specifications</p> <p>Functional tech. biz. incubators</p> <p>MSc/PhD graduates, theses and publications</p> <p>Trade fairs, exhibitions &amp; promotions organized</p> <p>Knowledge Sharing Communication Products (KSCP) Magazines, articles, brochures, fliers published</p>			

SITUATION	INPUTS	ACTIVITIES	OUTPUTS	OUTCOMES		
				Knowledge	Behaviour	Conditions
			M&E Reports Report			
<p>Current: poor quality and high cost animal feed, dominated by maize; high competition for maize as food; but sorghum has comparative adv. over maize since it grows in wider agro-ecological zones</p> <p>Thus need for new animal feed formulations from sorghum grain, forage and stover</p>				Farmers and processors knowledgeable on the advantages of use of sorghum in animal feed	Increased use of sorghum grain, forage and stover in animal feed by farmers in the ECA countries	<p>Increased livestock production in the ECA countries</p> <p>Improved livelihoods of stakeholders in the sorghum value chain in ECA countries</p>

## CAPACITY BUILDING FOR VALUE CHAIN ACTORS FOR IMPROVED SORGHUM MARKET PERFORMANCE

**AIM (Broader Object):** Promote linkages between sorghum value chain actors for improved market performance.

SITUATION	INPUTS	ACTIVITIES	OUTPUTS	OUTCOMES		
				Knowledge	Behaviour/Practices	Conditions
<p>Weak linkages among value chain actors and chain un-competitiveness</p> <p>Need for improved linkages within the sorghum value chain to contribute towards food and nutritional security and economic growth in the changing climate</p> <p>Increased emphasis on value chain approaches for agricultural research and development initiatives</p> <p>Increased number of actors willing to invest in the sorghum value chain (production and value addition)</p>	<p>Collaboration between national and international value chain actors in providing expertise in research, education and extension</p> <p>Institutions provide expertise on group formation and governance</p> <p>Value chain specialists provide training and advisory services</p> <p>Actors', governments' and donors' financial support</p>	<p>Value chain education systems strengthened through value chain actors' interaction platforms (short courses, workshops, exchange visits, graduate training)</p> <p>Formation and strengthening farmers' groups through training and backstopping</p> <p>Conduct value chain studies to map actors and identify challenges and opportunities</p>	<p>Sorghum value chain actors educated on value chain development and improvement</p> <p>Farmers' groups learn on group formation, dynamics and sustainability</p> <p>Institutional capacity (research, training and extension) to participate in strengthening the value chain improved</p> <p>Research finds bottlenecks and solutions for sorghum value chain improvement</p>	<p>Increased knowledge and awareness on sorghum value chain by input suppliers, farmers, traders, processors, consumers and policy makers</p>	<p>Increased participation in value chain activities</p> <p>Increased collaboration among value chain actors</p> <p>Increased adherence to recommended practices along the value chain</p> <p>Increased traders' willingness to pay premium prices for quality sorghum products</p>	<p>Human capacity for improved sorghum value chain performance enhanced</p> <p>Increased volume of sorghum trade</p> <p>Improved quality of sorghum and sorghum products</p> <p>Sorghum value chain competitiveness increased</p>



## IDENTIFICATION AND DEVELOPMENT OF MARKET OPPORTUNITIES FOR SORGHUM PRODUCTS

**AIM (Broader Object):** Identify, develop and promote markets for diversified sorghum products at local, regional and international levels (focus on products, policy harmonization and capacity building).

SITUATION	INPUTS	ACTIVITIES	OUTPUTS	OUTCOMES		
				Knowledge	Behaviour/Practices	Conditions
<p>Limited sorghum products to meet demand at local, regional and international markets.</p> <p>Growing demand for different sorghum products (feed, food, biofuel and brewing)</p> <p>Limited knowledge on quality and safety requirements for different sorghum markets</p> <p>Lack of information on market opportunities for different sorghum products</p>	<p>Collaboration between national regional and international scientists (Food and Social)</p> <p>Experience from value chain actors and expertise from scientists and regulators</p> <p>Expertise, IT infrastructure and market information</p>	<p>Food Scientists develop sorghum products with desired market characteristics. Social Scientists conduct market research to identify and characterize markets opportunities for diversified sorghum products</p> <p>Organize stakeholders' workshop for different value chain actors on quality and safety requirements for different sorghum markets. Involve regulatory bodies to development quality and safety guideline</p> <p>Collaborate with public and private partners to develop, strengthen and disseminate sorghum marketing information system</p> <p>Sensitize and influence public and private sector to invest in market infrastructures improvement/development</p>	<p>Different sorghum products with desired market characteristics developed and improved. Sorghum market identified, characterized or described and publicized to the value chain actors</p> <p>Quality and safety standards reviewed, developed and improved</p> <p>Quality and safety guideline developed. Sorghum market information system developed and strengthened both within the public and private sectors</p> <p>Market infrastructures</p>	<p>Increase understanding of the market opportunities of various sorghum products (feed, fuel, food, beer) among value chain actors- farmers, processors, marketers (retailers, wholesalers), consumers and millers</p>	<p>Farmers aware what the market requirements are in terms of quality, variety, quantity characteristics</p> <p>Processors and buyers willing to buy/source grains from farmers. Scientists apply expertise to develop new sorghum products which are demand driven</p> <p>Processors improve packaging and labeling of sorghum</p>	<p>Diversified/ Greater selection of sorghum products to meet market demand at local regional and international level</p> <p>Higher quality and safety standards of sorghum products is achieved</p> <p>Improved market infrastructure for sorghum products and market information</p>

SITUATION	INPUTS	ACTIVITIES	OUTPUTS	OUTCOMES		
				Knowledge	Behaviour/Practices	Conditions
			developed through public and private investment sources			

## Enabling Adoption of Sorghum Technologies for Increasing Production and Profitability

**AIM (Broader Object):** Best bet participatory technology transfer approaches identified and used to disseminate technologies to various stakeholders.

Stakeholder capacity enhanced on the use of participatory approaches for technology transfer.

Adoption and Impact assessment

SITUATION	INPUTS	ACTIVITIES	OUTPUTS	OUTCOMES		
				Knowledge	Behaviour/Practices	Conditions
Low production and productivity Food Insecurity Low income Opportunities Developed technologies  Participatory Approaches available	Collaboration between partners (public, private) along the value chain Linkage between NARS, Universities, Regional and International Institutions Donor support Government support	Seed delivery Identify key actors in the formal and informal seed value chain for production, marketing quality seed of improved varieties Identify sources of various classes of seed of different varieties by end users Link the key actors in the seed sector with sources for production and marketing Package seeds in appropriate quantities to enhance access by different stakeholders Link the key actors to seed sources of production and marketing Integrated Production Packages Identify production packages Validate and select integrated production packages using	Alternative seed delivery models identified and used to deliver quality seed of improved varieties for identified users  Production packages (Integrated crop cultivars, soil fertility and water management) validated and disseminated  Diversified sorghum products (food, feed, beverage) for various market/niches promoted for enhanced utilization  Knowledge on identified needs along the value chain  Knowledge and communication products developed and	Producers acquire knowledge on end users' needs and quantity and quality required  Researchers and extension use appropriate participatory approaches for technology transfer  Consumers have access to information and to a wide range of products  Processors have knowledge on where to source quality grain for their products	Processors developing diversified quality products to expanded market	

SITUATION	INPUTS	ACTIVITIES	OUTPUTS	OUTCOMES		
				Knowledge	Behaviour/Practices	Conditions
		participatory gender oriented approaches Scale up and out the best production packages Sorghum Products Identify new diversified sorghum products for different end users (food/ feed/ beverages) Establish an Innovation platform for the producers and processors to exchange market information Popularize the diverse sorghum products for their health and nutritional benefits Knowledge and communication Identify knowledge and information gaps of the different stakeholders along the value chain Develop a communication strategy to address the identified gaps of the different stakeholders Develop and deliver communication and knowledge sharing products to different stakeholders as per communication strategy Disseminate success stories Capacity for technology	disseminated to stakeholders  Best bet participatory technology transfer approaches identified and used to disseminate technologies to various stakeholders  Stakeholder capacity enhanced on the use of participatory approaches for technology transfer  Adoption and Impact assessment			

SITUATION	INPUTS	ACTIVITIES	OUTPUTS	OUTCOMES		
				Knowledge	Behaviour/Practices	Conditions
		transfer Identify capacity building needs of the different stakeholders Develop training materials and calendar Conduct Training of Trainers (TOT) at grass root levels Support Trainers to conduct more training in the communities to reach more stakeholders				

## Integrated Soil Fertility Management for Increased Sorghum Production

**AIM (Broader Object):** Developing and validating climate change responsive integrated soil and water management technologies for enhancing sorghum production and productivity

SITUATION	INPUTS	ACTIVITIES	OUTPUTS	OUTCOMES		
				Knowledge	Behaviour/Practices	Conditions
<p>Need for much increased sorghum production and productivity in sub-Saharan Africa</p> <p>Increased adaptation to climate change</p> <p>Need for improved soil fertility and ecosystem health</p> <p>Enhance human resource capacity</p> <p>Information and knowledge base</p>	<p>Collaboration/ partnership between Sub-Saharan Africa national (NARS), regional (e.g., ASARECA, SADAC) and international (e.g., ICRISAT , CIMMYT) research institutes, universities, public and private extension organization, public and private partnerships (PPPs)</p> <p>Research institutes, universities, postgraduate students</p> <p>GO &amp; NGOs, farmer , private sector, organization, Donor support</p>	<p>Identifying and documenting ISFM technologies adapting to climate change</p> <p>Conduct research to generate technologies on identified gaps</p> <p>Evaluating and validation</p> <p>Training (informal and formal) of stake holders in ISFM</p> <p>Knowledge and information on ISFM technologies up scaled</p>	<p>Available technologies identified, gaps identified and documented</p> <p>ISFM technologies adapted to climate change generated</p> <p>The available technologies evaluated and validated</p> <p>Stake holders trained and capacity strengthened</p> <p>ISFM technologies up scaled</p> <p>ISFM web site established</p>	<p>Increased understanding ISFM and climate change impacts by diverse stake holders including farmers, extension agents &amp; NGO, private sector</p> <p>Improved skills and utilization on ISFM technologies and adaptation to climate change among stake holders</p>	<p>Stakeholders apply ISFM technologies to enhance sorghum production and productivity and adapt to climate change</p> <p>ISFM technologies adopted and diffused by/within community</p>	<p>Human capacity to improved ISFM enhanced</p> <p>Food security increased,</p> <p>Profit and sustainability at farm and community level,</p> <p>Long term adaptation to climate change</p>

## Enhanced Resilience of Sorghum to Drought in the ECA Region

### AIM (Broader Object):

SITUATION	INPUTS	ACTIVITIES	OUTPUTS	OUTCOMES		
				Knowledge	Behaviour/Practices	Conditions
<p>Need for much increased agricultural production in Ethiopia to meet basic needs and for economic growth</p> <p>Rapid development of irrigation for smallholder IEFS in Ethiopia</p> <p>Available expertise in IEFS over-taxed.</p> <p>Much capacity with UNL and IWMI for enhancement of human resources and information base for IEFS</p> <p>Low sorghum yields due to climate change induced drought stress</p>	<p>Collaboration between Ethiopian and international partners UNL &amp; IWMI provide expertise in res., education, and ext.</p> <p>Private sector partnerships, e.g. Valmont, drip irrigation?</p> <p>University faculty and pre- and post-graduate students</p> <p>Donor support</p> <p>Advisory board with UNL, IWMI, OWERB, HU, DOA-Oromia represented</p> <p>Early maturing drought tolerant sorghum germplasm: Drought tolerant local accessions</p> <p>INTSORMIL PI institutions provide expertise and training</p> <p>Infrastructural capacity (field and laboratory facilities)</p>	<p>Extension, research and education strengthened through short courses of <math>\geq 2</math> month giving much conceptual and hands-on training and through on-going technical support from IWMI &amp; UNL</p> <p>Conduct research on alternative crops and varieties, irrigation, soil management and other aspects of IEFS</p> <p>Extension trains/ advises farmers in IEFS, e.g., through farmer field schools and other means</p> <p>Extension strengthens community management capacity for support to IEFS</p>	<p>Diverse stakeholders trained and/or advised in development and improvement of IEFS. Communities learn skill and develop management plans for large scale smallholder irrigation schemes</p> <p>University curricula and resources enhanced for undergraduate and graduate education in IEFS</p> <p>Extension capacity and methodology improved for training and advising farmers in IEFS</p> <p>Research finds solutions for improving IEFS</p> <p>IEFS web site established</p> <p>Irrigation engineering capacity strengthened with input from UNL</p>	<p>Increased interest in and understanding of IEFS by diverse stakeholders including farmers, faculty, students, irrigation engineers, extension research and policy makers</p> <p>Communities have skills for enabling IEFS</p> <p>Research and extension trained for the challenges and opportunities of IEFS</p> <p>Producers and others more knowledgeable of BMPs for IEFS.</p> <p>Varietal preferences and selection criteria of researchers well known</p>	<p>Scientists apply expertise to address IEFS</p> <p>Extension and TOT partners assist farmers in IEFS</p> <p>Farmers diversify and improve irrigated CS for increased efficiency, production, profit, and sustainability and make other FS improvements</p> <p>IEFS activities facilitated by the community</p> <p>University graduates apply their expertise to smallholder IEFS</p> <p>Farmers perception of drought tolerant sorghum varieties improved</p> <p>Scientists apply the knowledge and skills for selecting drought tolerant sorghum varieties</p>	<p>Human capacity to improve IEFS enhanced.</p> <p>Farmers use water, N and other resources efficiently in IEFS for increased production, food security, profit, and sustainability at farm and community levels</p> <p>Improved sorghum productivity</p> <p>Increased food security</p> <p>Increased incomes</p>

SITUATION	INPUTS	ACTIVITIES	OUTPUTS	OUTCOMES		
				Knowledge	Behaviour/Practices	Conditions
Limited skill and number of scientific personnel in sorghum research	Regional collaboration between scientists/institutions Increased involvement of private and public seed companies/enterprises	Haramaya Univ. strengthens curricula and resources for IEFS with input from UNL and IWMI  Key Ethiopian personnel and selected students study irrigated agriculture at UNL or IWMI  Assemble and characterize drought tolerant germplasm materials available in/outside the ECA region  Development and evaluation of new breeding populations involving selected drought tolerant sources and adapted materials  Participatory evaluation of drought tolerant candidate sorghum varieties and hybrids for yield potential and resistance to pests	and IMWI  Drought tolerant germplasm/parental lines identified  High yielding drought tolerant families identified High yielding disease and pest resistant drought tolerant varieties and hybrids identified Varieties carrying known drought tolerance QTLs selected Quality characteristics of candidate varieties and hybrids determined Drought resilient germplasm made available			



SITUATION	INPUTS	ACTIVITIES	OUTPUTS	OUTCOMES		
				Knowledge	Behaviour/Practices	Conditions
		<p>and diseases</p> <p>Marker assisted introgression of known drought tolerance QTLs into elite sorghum varieties</p> <p>Evaluation of grain, nutritional and processing quality of candidate varieties/hybrids</p> <p>Release and deployment of new drought tolerant cultivars in the ECA region (linkage with seed companies, demonstrations with farmers and seed companies)</p> <p>Enhance scientific capacity to tackle drought</p>				

## Enhancement and Improvement of Access of Sorghum Germplasm with Drought Tolerance in ECA Region

### AIM (Broader Object):

SITUATION	INPUTS	ACTIVITIES	OUTPUTS	OUTCOMES		
				Knowledge	Behaviour/Practices	Conditions
Food insecurity accelerated by climate change scenarios	Collaboration between breeders, extension agents, and farmers	Participatory collection of local accessions	Indigenous sorghum landraces assembled	Breeders learn and use advanced breeding techniques and tools	Breeders collaboration within the region Policy makers would be supportive to breeding programs in the region	Sorghum resilient to climate variability Food security and rural income would be enhanced
Availability of large pool of un utilized local sorghum accessions in the breeding program	Equipment and materials Genotyping services(Markers, software, labs)	Genetic and phenotypic characterization for drought tolerance. Data base creation and knowledge sharing	Genetic diversity of indigenous sorghum landraces identified	Understanding the physiologic and genetic basis of drought tolerance in sorghum	Breeders develop and apply skills and expertise Participation of the farmers in breeding programs	Breeding programs would have enhanced capacity to deal with climate change
Limited knowledge in improved sorghum improvement techniques in the ECA	Phenotyping facilities IT equipments and expertise Expertise, molecular markers & well equipped labs	Multiplication and maintenance of identified draught tolerant genotype.	Drought tolerance Resistant sorghum genotypes accessed	Increased awareness and commitment of policy makers on sorghum importance in addressing food insecurity	Universities curriculum mentoring and training sandwich programs	
Low institutional capacity to implement sustainable sorghum improvement program in ECA	Seed store, cold rooms, breeding cages. Seed of selected drought tolerant materials	Exchange of drought tolerant genotypes among NARS Introgression of DT traits into improved varieties		Indigenous knowledge would be utilized by breeders and farmers gain skills of sorghum production		
Limited appreciation of sorghum in addressing food insecurity and poverty	INSORMIL/ ICRISAT/Universities expertise in research & extension Public relations expertise in advocacy	Participatory variety selection of drought tolerant varsities Lobbying and advocacy on importance of sorghum as FS crop				
Limited knowledge						

SITUATION	INPUTS	ACTIVITIES	OUTPUTS	OUTCOMES		
				Knowledge	Behaviour/Practices	Conditions
<p>on sorghum utilization and product diversification</p> <p>Lack of strong coordination of sorghum improvement effort in ECA</p>	<p>Expertise, tools &amp; software</p> <p>Funding</p>	<p>and coping strategies to climate change</p> <p>In service and postgraduate training for scientists and students on advanced breeding techniques.</p> <p>Data management and networking</p> <p>Use of spatial techniques and GIS for germplasm</p>				

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