International Sorghum for Biofuels Conference

Workshop # 1

Conversion

Challenges / Knowledge Gaps Assessment

Challenges / Knowledge Gaps	Impact				Implementation		
	Productivity	People	Countries / Geography	Overall Impact	Difficulty	For top 5 in column E, capture reason for why difficult to address	Cooperation Needed
1. Handling & Processing, transportation, storage	35	24	34	33	29	Stability of juices. Economics. Lack of equipment. Extending life of stored product. Transportation infrastructure.	30
2. Better fermentation agents (microbes & enzymes)	31	5	13	30	34	C5 vs C6. GMO. Cost. Diversity of enzymes. Specific inhibitors.	31
3. Size for small and large scale (distributed versus centralized) (and where is the process done – on farm or at the factory, or both).	18	31	31	29	18	Simpler, less costly on farm. Design for small scale fermentation systems, better distribution for this technology/info. Environmental impacts on farm (waste, etc.) Political pressures (food vs fuel). Local licensing issues. Scaling down at an economically sustainable level is needed. Standardization of quality (sugar quantity and quality). Identification of products for small scale.	23

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4. Solid versus liquid fermentation needs at the factory.	19	11	12	16	9	Scale (solid is more difficult on large scale). Hard to develop process for small scale. Scaling up.	19
5. Products and byproducts other than, beyond, or in addition to, ethanol (including catalysts)	28	25	29	28	29	Optimizing the mix of products at the biorefinery. Catalysts (stability, pathways, etc). Markets for the products. Addressing best market for farmer. Size and scale that are economically sustainable. Quality consistency.	27

Key Messages

- Researchers need to consider economic analysis up front – will this be viable for the farmer and the processing plant?
- Regional approaches are very important, possibly more important than national in some cases.
- Environmental concerns should be considered up front as research develops new technologies/systems, etc.

Challenge / Knowledge Gap	Possible Strategies	
	Solutions / Approaches	**Time Frame: S= (<3); M=(3-5); L = 5+**
1. **Handling & Processing, transportation, storage**	**a. Low cost, stable liquid production**	**S**
	b. Dehydrating technologies to avoid inhibitors (stalks & reducing water)	**S-M**
	c. Efficient harvesters/crushers (80% extraction of available juice)	**M**
	d. Stable low-cost storage/in silage stalks	**M**
	e. Seed & leaf disposition (advice to farmers on handling)	**S-M**
2. **Better fermentation agents (microbes & enzymes)**	**a. Robust microbes for high product concentration, tolerant of product inhibition, temperature and contaminants**	**L**
	b. Overcoming recalcitrance of cellulose through better enzymes (deconstruction)	**M**
	c. Microbes that handle a broader array of fermentable sugars (C5 vs C6 enzymes and fermentation agents)	**M-L**
	d. Risk assessment research to address GMO concerns/safety	**S**

3. **Size for farm and large scale (distributed versus centralized) (and where is the process done – on farm or at the factory, or both).**	**a. See number 1.**	# 2 Conversion
	b. Optimal farm-scale size for sustainable production	**M**
	c. Sweet sorghum: feasible dewatering system; low-tech affordable systems to harvest/extract and enter market on small scale	**S-M**
	d. Regional scale low-cost integrated systems	**M**
	e. Public-private-producer partnership to address these needs.	**M**
4. **Solid (dry) versus liquid fermentation needs at the factory.**	**a. Low-cost process to increase product concentration in the solid state fermenter.**	**M**
	b. Scaling up and making economically viable and continuous the process of producing biofuels, such as ethanol, butanol, and hydrocarbons	**M-L**
	c. Cost analysis for solid versus liquid; cheaper technologies	**Varies**
	d. Strategy to identify whether solid or liquid fermentation is better	**S-M**
5. **Products and coproducts (including biocrude, hydrocarbons, bioproducts)**	**a. Flexibility in products (Knowing what has the highest value or what will have the highest value) Varies**	
	b. Better catalysts, particularly those that function in a liquid phase	**L**
	c. Products from solid wastes of initial process; conversion technologies to convert byproducts into feedstocks	**s-M**
	d. Standardization of quality for byproducts; evaluation of uses; maintain actual product quality and consistency in the long term.	**M**
	e. Rational, affordable management of liquid wastes; factoring in local regulations for recycling	**S-m**
	f. Minimizing/optimizing water usage	**S-M**

Collaboration

Benefits

- Industry, government and farmers – faster progress in processing and production
- Public and private institutions – R&D
- Public and private institutions – industry has access to important enzymes
- Collaboration between disciplines very important (communication
- Rural economic development – rural sector is a consumer and producer of energy
- National security and economic well being
- Part of national policy
- International collaborations important to making biofuels available worldwide and helping to mitigate oil demand.
- Can improve potential for funding support; leverages available resources
- Can increase energy availability in most countries.

Barriers

- IP – major barrier. Government is too slow.
- Mobilization of capital – can be too slow.
- Getting agriculture involved – gap between technology development and stakeholder involvement.
- Inadequate resources for research
- Lack of adequate crop insurance
- Message of importance is diluted among many other voices (lobbyists)
- Outside economic influences (tariffs & trade barriers, competing industries)
- Special interests of other industries, other interests groups (e.g., certain environmental groups)

Potential Next Steps

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