Mendel BIOTECHNOLOGY

seeding a sustainable future

Miscanthus commercial varieties and their production

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President & CEO

Biomass 2010

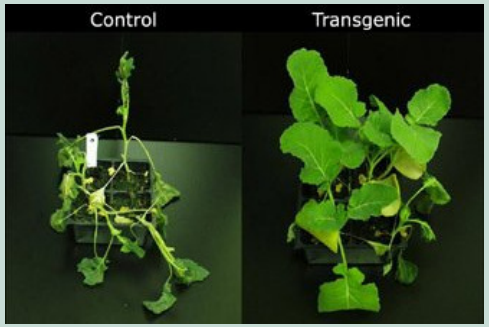
March 30th, 2010

Company Snapshot

Mendel BIOTECHNOLOGY

- **Founded in 1997; Headquarters in Hayward, CA**
  - Additional US operations in Illinois, Indiana, Alabama, Texas
  - Research Operations in China, Germany
  - Well-capitalized (key shareholders: BP, Monsanto, ZAM Ventures)

- **Validated technology platform**
  - Leading trait technology provider to row crop industry
  - Strong intellectual property position in plant gene regulation
  - Blue-chip long-term partners (Monsanto, Bayer)



- **Entered BioEnergy industry 2006**
  - A new generation of Miscanthus products
  - Developing high yield, low input purpose-grown energy crops
    - Sustainable feedstock systems with favorable GHG profiles
  - Differentiated perennial grass varieties
  - Collaborating with BP

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Key issues to be addressed

- *Miscanthus* clonal & seeded products
- Testing of regional adaptation
- A reliable supply chain for production of *Miscanthus*
- Utility of *Miscanthus* biomass in power generation

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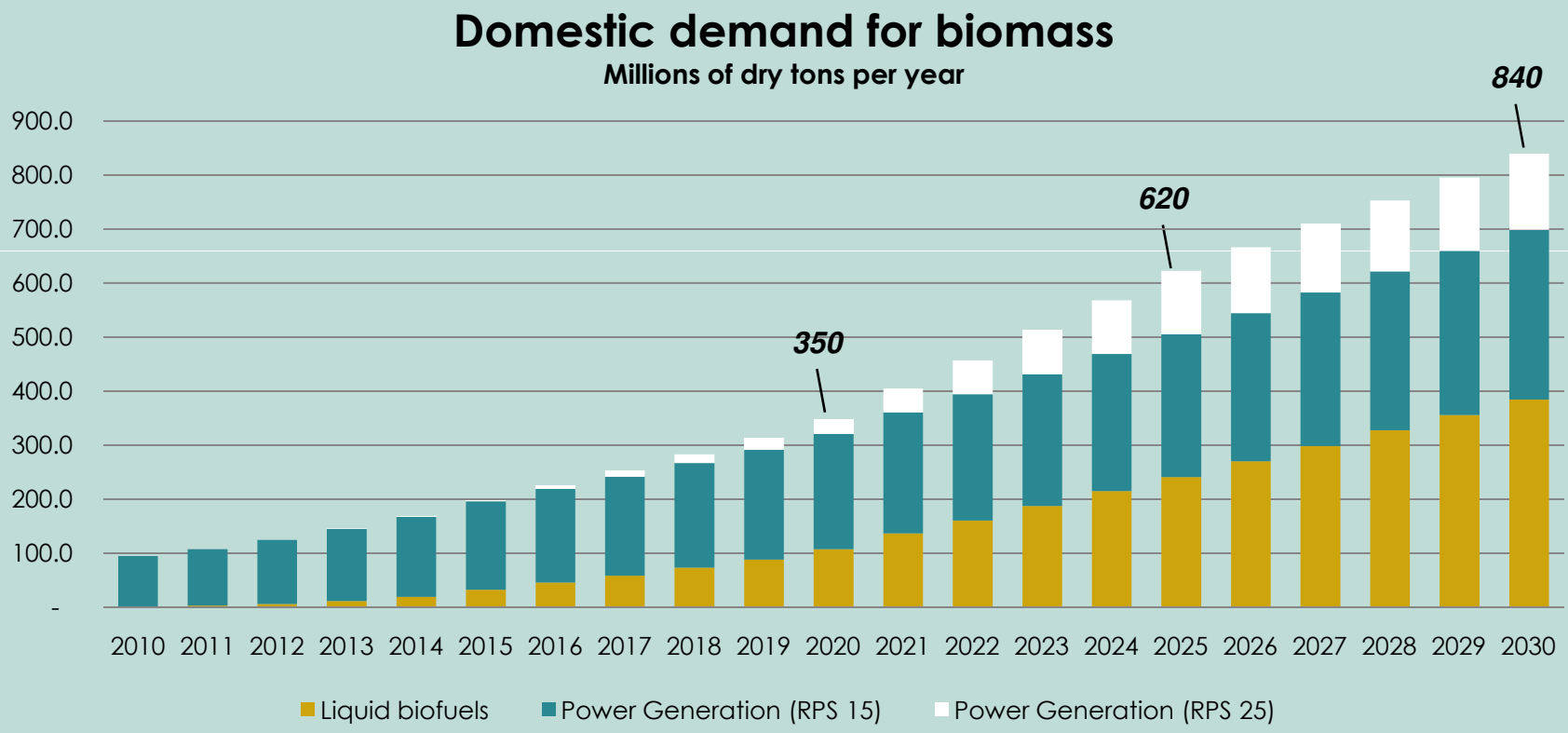
Power generation and liquid biofuels expected to drive biomass demand



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Mendel Crop Portfolio to meet market demand

	Sorghum	Miscane	Non-proprietary clone of M x giganteus	Mendel *Miscanthus*-Clonal	Mendel *Miscanthus*-Seeded
Sustainability					
Efficient Photosynthesis	√	√	√	√	√
Low Inputs		√	√	√	√
Adapted to marginal lands	√	√	√	√	√
Soil C sequestration		√	√	√	√
Genetic Diversity	√	√		√	√
Economics					
Yield > 10 dt/ac	√	√	√	√	√
Low establishment cost	√	√			√
First year harvest	√				√
Low production costs		√	√	√	√

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Early commercial *Miscanthus* products will be *M. x giganteus (Mxg)*

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Miscanthus sinensis

"Diploid"

2n=2x=38

+

Miscanthus sacchariflorus

"Tetraploid"

2n=4x=76

=

Miscanthus x giganteus

"Triploid"

2n=3x=57

STERILE

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Weed Risk Assessment

Switchgrass - *Panicum virgatum*

California:

Standard WRA = **Reject**

Sterile = **Accept**

Giant Reed - *Arundo donax*

Florida:

Standard WRA = **Reject**

Miscanthus - *Miscanthus* x *giganteus*

Entire US:

Standard WRA = **Accept**

Barney & DiTomaso 2008 *BioScience*

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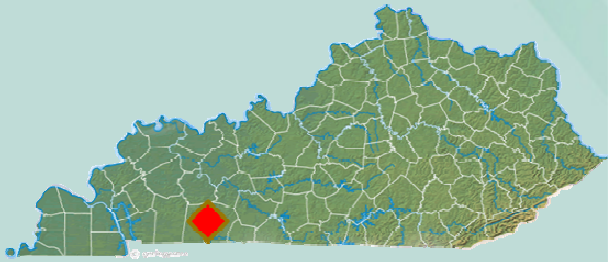
Mendel's first *Mxg* clonal product

M. x gig (MBX-002)

M. x gig (Illinois)



Composition:	MBX-002	II
Glucan	.44	.42
Xylan	.20	.22
Lignin	.22	.20
BTU/#	8,228	8,010
Ash %	1.93	1.66

Mendel Demo Farm – 10/20/2009
Planted – 5/23/2009

Mendel's *M. x giganteus* resulted from a cross between known sinensis & sacchariflorus parents

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Seeded *Miscanthus* varieties drive down establishment costs

Breeder trial results support advancement 3Q 2009

- Establishment of Miscanthus plantations from seed rather than rhizomes or transplant plugs facilitates scalability and reduces establishment costs

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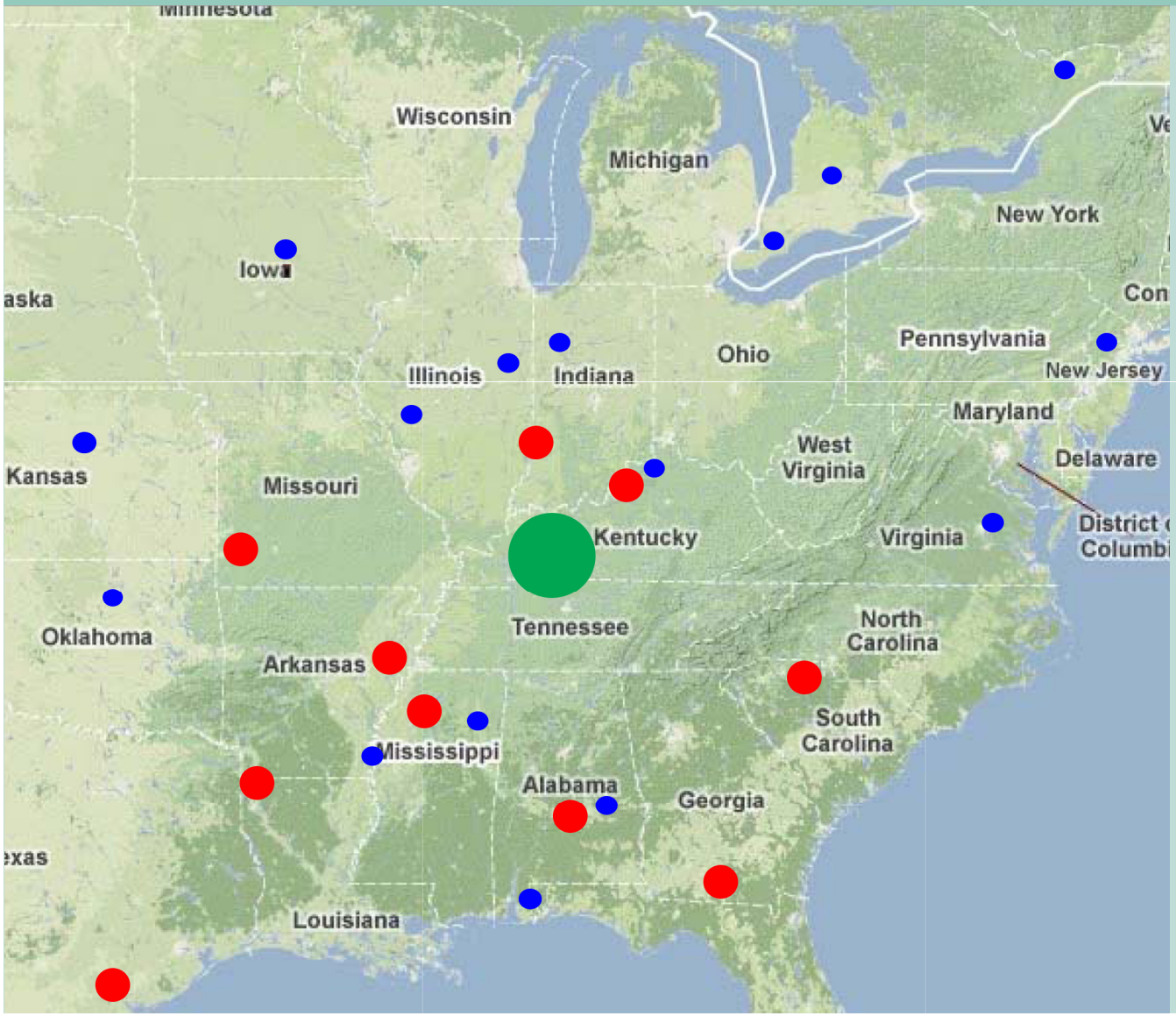
Varieties are being developed and tested in major future production zones



Replicated yield trials in 2nd year at 16 locations

Larger scale pilot trials in 1st year at 8 locations

Largest scale demo trial In southwest KY

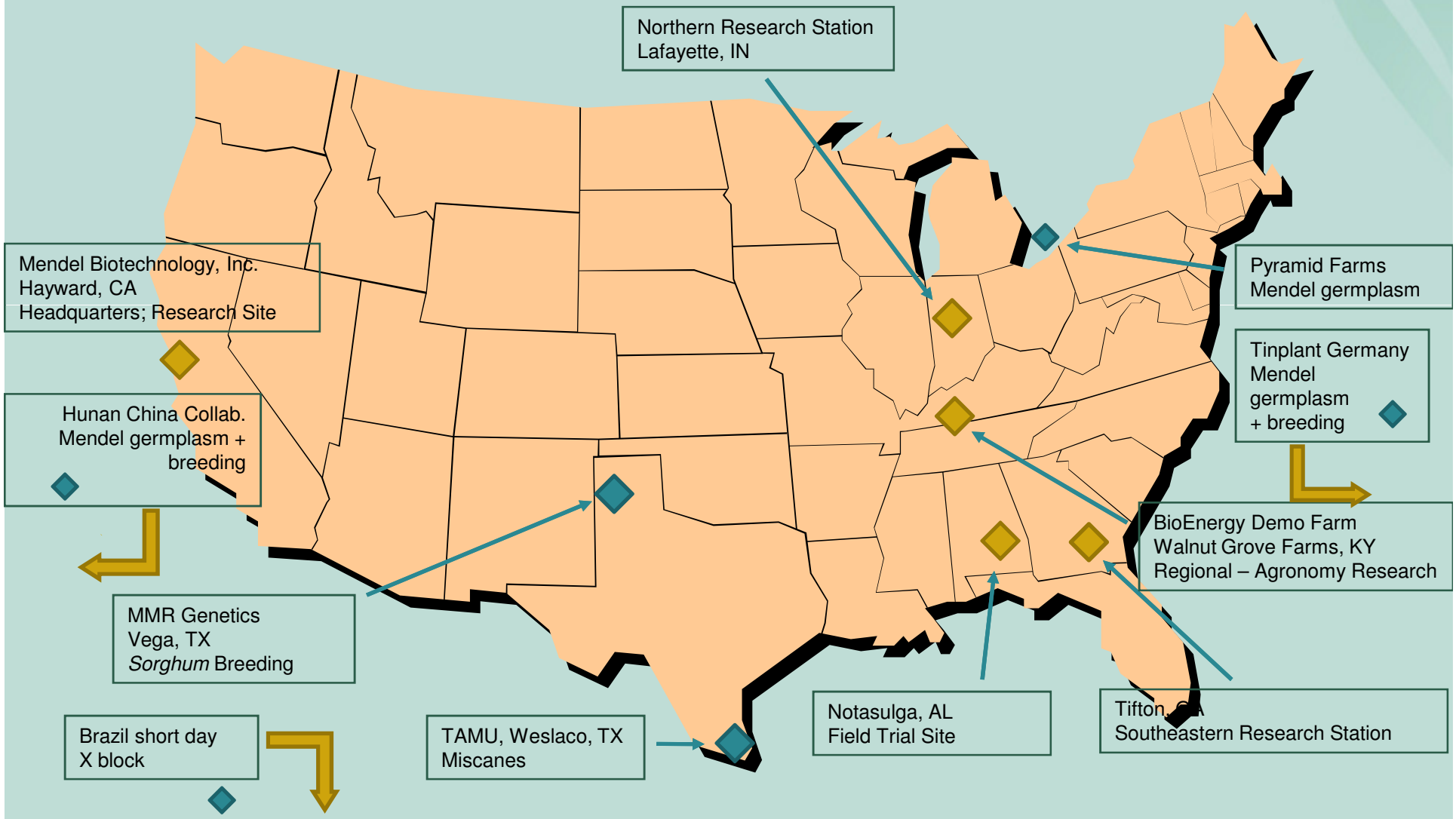
Evaluating both today's products and new lines for seeded products of the future

Research field trials

Pilot field trials

Energy farm

We have operations in key regions



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We're learning how to produce *Miscanthus* field-ready plugs

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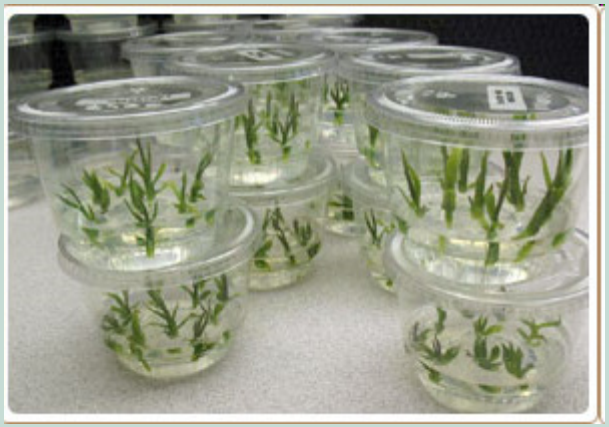
- Initial portfolio of Miscanthus products (clonal)
  - ~ All *M. x giganteus* types
  - ~ Product offering includes proprietary and non-proprietary clones
  - ~ Delivered as plugs



- Production methods being developed with partners

SPEEDLING
A Wearnes Company

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We're learning how to plant them

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We're learning to harvest the resulting biomass

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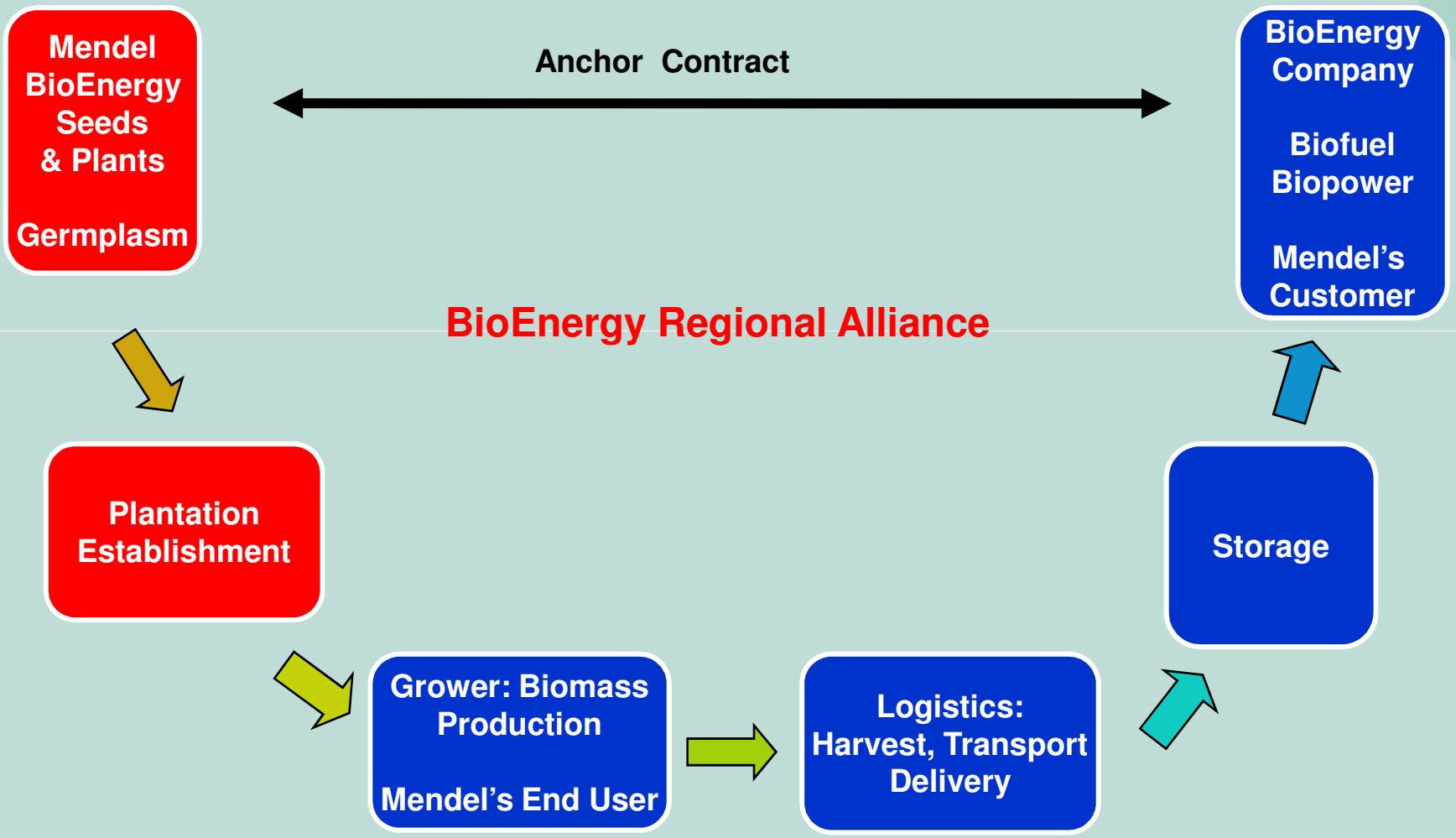
We're working with partners to develop feedstock supply chains



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We're working with partners to develop feedstock supply chains

News Media Contact(s):
(202) 586-4940 **For Immediate Release**
August 31, 2009 **DOE Selects Biofuels Projects to Receive up to $21 Million in Funding**

FDC Enterprises Inc. of Columbus, Ohio (up to $4.9 million) will primarily target Abengoa Bioenergy's cellulosic biorefinery, which is currently under development in Hugoton, Kansas. FDC Enterprises Inc.'s project plans to complete design, fabrication, and demonstration of three types of innovative new harvest and biomass handling machines, including a single-pass mowing and baling operation, a Bale Picking Truck, and a Self Loading Trailer. Annual demonstration harvests will be performed on large-acre tracts of biomass feedstocks. Available plots of high yielding energy crops, including **miscanthus** and biosorghum, will also be harvested.

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Miscanthus composition compares favorably with other feedstocks

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Biomass feedstock	Glucan %	Xylan %	Estimated BTU/lb*
Corn stover	36.1	21.4	7,800
Switchgrass	35.0	21.8	7,500
Sugarcane bagasse	38.6	20.4	6,200
Poplar	43.8	14.9	8,500
Aspen wood	44.8	14.9	8,500
Miscanthus	46.0	19.8	8,000

* Average value of multiple samples tested

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Comparative Biomass Fuel Profiles

Fuel Properties	Miscanthus Clonal	Miscanthus Seeded	Switchgrass	Woody	Ag Residues
Energy Density	=	=	=	+/-	+/-
Moisture	+	+	+	-	+/-
Ash	=	=	=	+	+/-
Pre-processing costs	+	+	+	-	+/-
Grind-ability	+	+	-	+	+/-

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Summary

- We have a unique product offering today of genetically diverse, clonal *Miscanthus* products
- We have the leading germplasm collection for *Miscanthus* improvement
  - ~ Including the development of seeded *Miscanthus* varieties
- We are collaborating across the supply chain to provide simple solutions for bioenergy producers

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Questions?