

Sorghum: A Commercially Viable Biomass Crop

Customized by Chromatin, Renewable by Nature

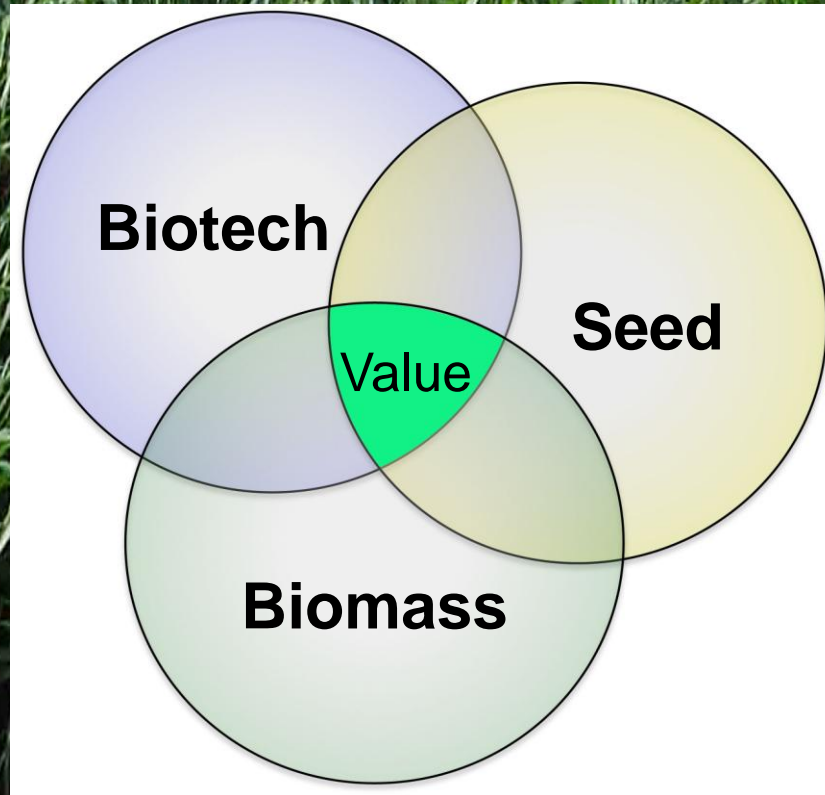


BIO/ Pac Rim Summit: October 11, 2012



Chromatin, Inc.

Chromatin's unique value proposition....



Market position & capabilities

- **Seed products:** Hybrid grain & forage sorghum planting seed with a 45+ year commercial history, brand recognition
- **Production capacity:** 30 million pounds of hybrid seed annually
- **Supply chain:** Export to 20+ countries; products on 3+ million acres per year
- **Relationships:** 300+ growers, dealers, distributors, agents
- **Breeding:** Harnessing natural diversity through molecular breeding
- **Synthetic biology:** Technology to reshape seed quality traits and feedstock composition

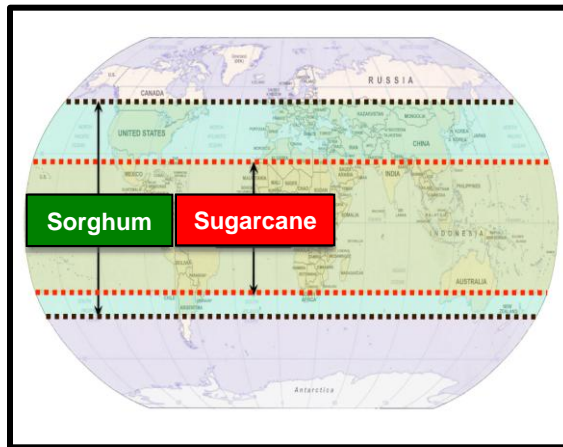


SORGHUM PARTNERS, LLC

a Chromatin company

Why sorghum as a biomass crop?

Land Use	Water Use	Environmental Impact	Energy Use	Climate Change
High yield on marginal land	85% < sugarcane 50% < corn	Herbicide and pesticide use 40-80% < corn	Much less than corn — Less irrigation; fewer chemical inputs	Naturally heat and drought tolerant



Low barriers to adoption

- Globally cultivated crop
- Established infrastructure
- Agronomics well-understood
- 3-in-1: starch/sugar/cellulose
- Durable markets

Chromatin's sorghum breeding pipeline



- Proprietary collection includes 90-95% of global sorghum diversity
- Targets: Increased starch, sugar, cellulose and lignin with improved total yield
- Key traits identified with molecular markers
- Test sites and strip trials span the entire United States and several countries throughout South America, Europe and Asia/Pacific
- 60,000 new hybrids made each year

Drought resistance is a high value target

- 2012: One of ten driest years recorded for KS, NE, IA, MO, and IL and top 20 for surrounding states.
- 2011: One of five driest years recorded for TX and OK and in the top 20 for surrounding states.
- Estimated > \$100MM has been spent to develop drought tolerant corn; however, reports suggest less than 10% improvement over other corn.
- Monsanto's drought tolerant trait: expect \$250-500 M revenue and impact on 45-55 million U.S. acres.
- Pioneer projects that their drought tolerant corn products are suited for 30% to 70% of their acres.
- Sorghum is already drought tolerant. This crop can be marketed to compete with corn in water stressed areas.

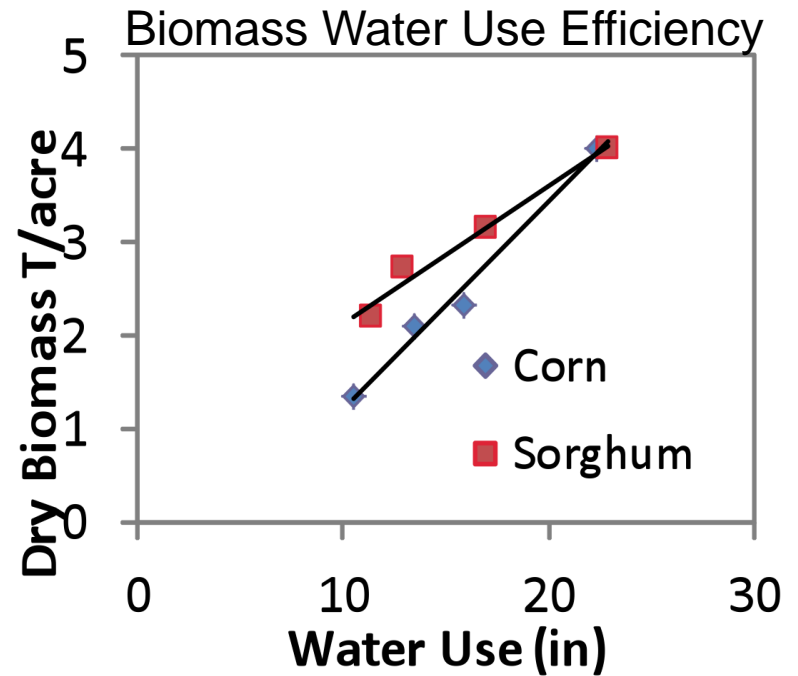
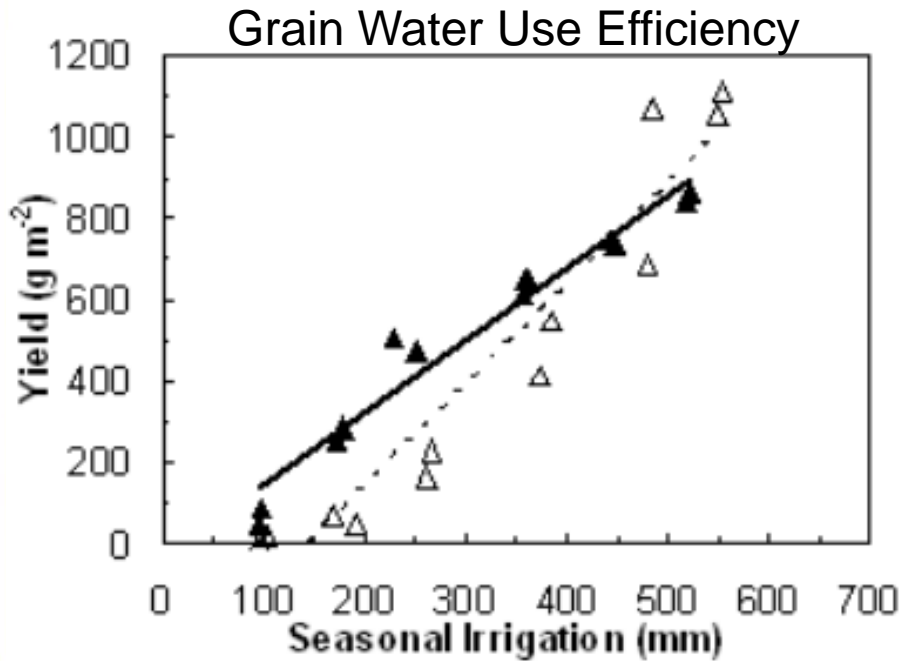
2 years of drought has impacted growers

- Droughts of 2011 and 2012 have renewed interest in grain sorghum
- 2012 corn forecast at ~120 bu./acre; ~155 bu./acre most years
- Grain sorghum provides a better return for growers when corn yields <100 bu./ acre and sorghum is priced at 87% of corn
- When grain sorghum prices \approx corn prices, it is a better choice when corn yields < 140 bu./ acre



Sorghum water use efficiency

	2011 Yield (bu/ac)	2011 CWUE (bu/in)	2010 Yield (bu/ac)	2010 CWUE (bu/in)	2009 Yield (bu/ac)	2009 CWUE (bu/in)	3-Year Avg. Yield (bu/ac)	3-Year Avg. CWUE (bu/in)
Sorghum	138.9	8.0	118.0	5.5	77.4	5.6	111.4	6.4
Corn	127.2	5.8	101.2	4.3	97.5	6.7	108.6	5.6
Soybeans	61.3	2.9	44.0	2.0	33.4	2.4	46.2	2.4

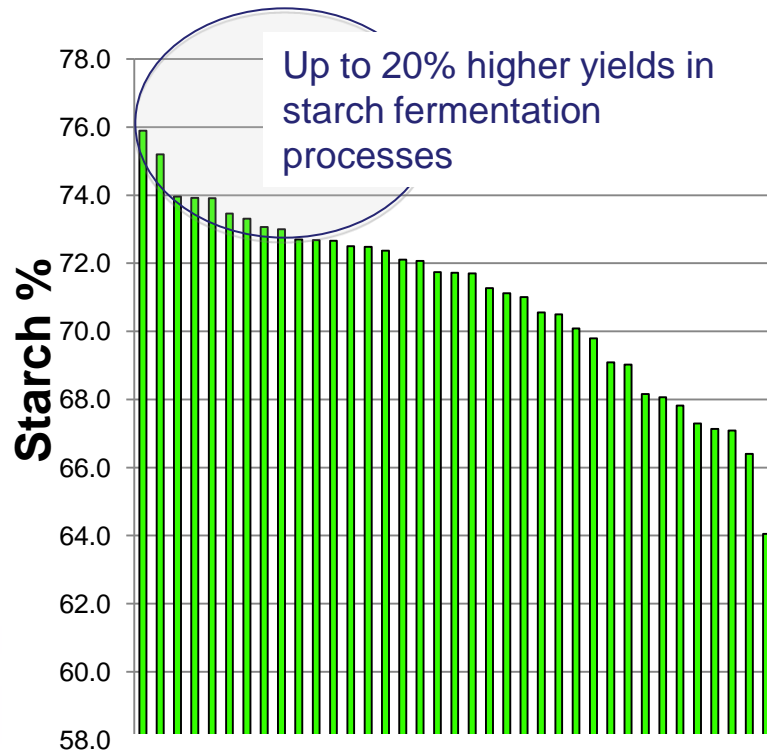


University of Nebraska data

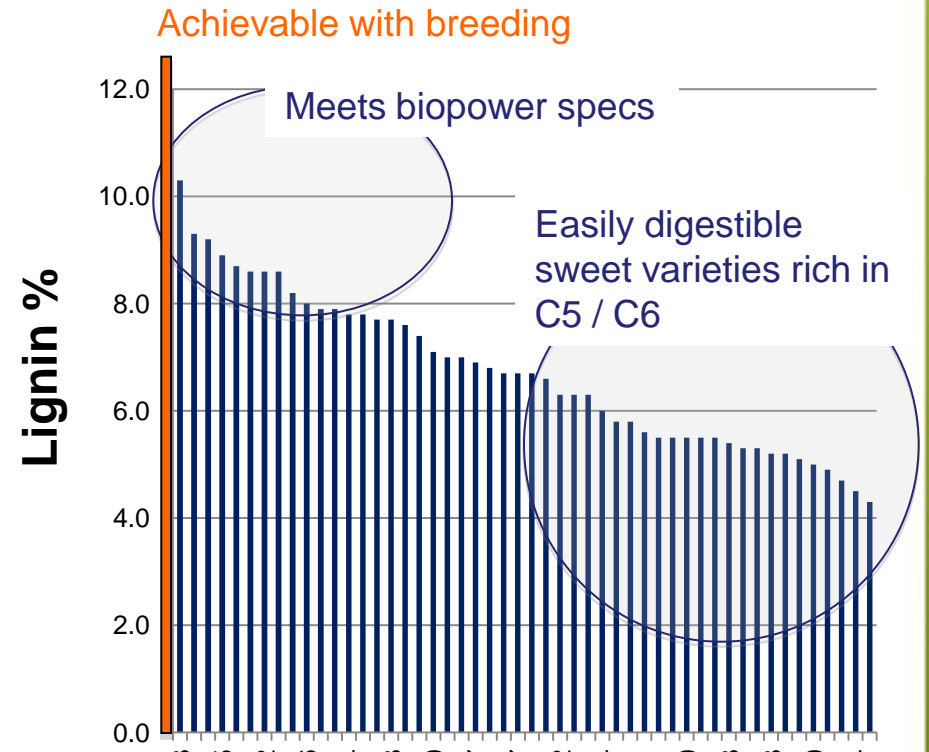


Starch and sugar products available today

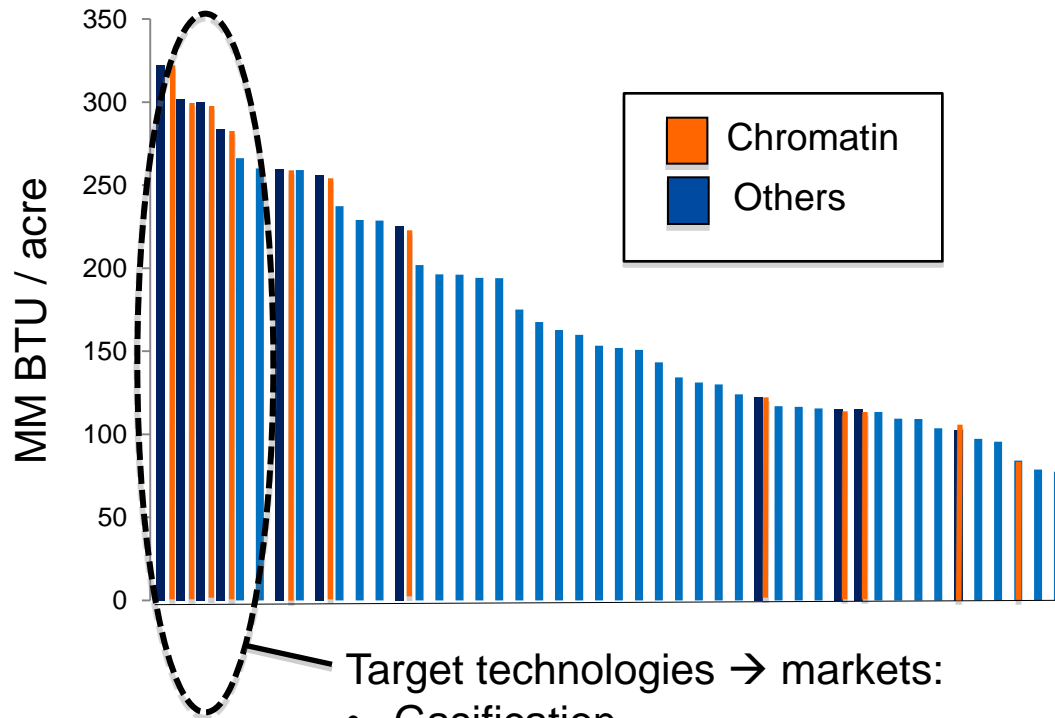
Grain Sorghum



Forage / Sweet Sorghum



High-energy sorghum pipeline...



Chromatin sorghum

Today:

7900 BTU / lb

> \$1000 / acre advantage

If 20 M acres, \$20 B

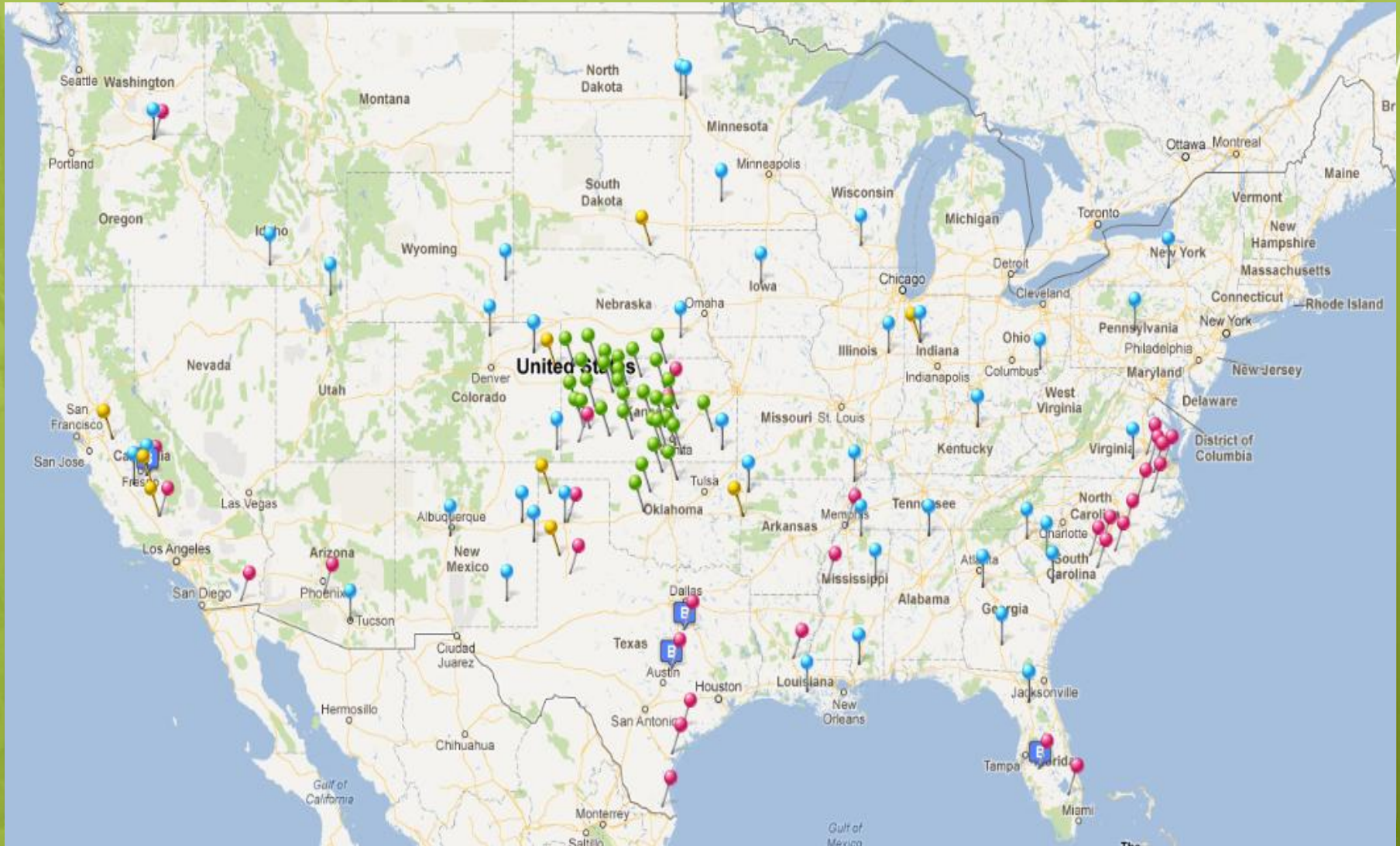
Pipeline:



8500 BTU / lb (breeding)

>9000 (synthetic biology)

\$10B (on 20 M acres)

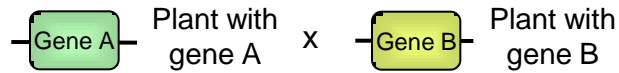
U. S. test plots and strip trials...



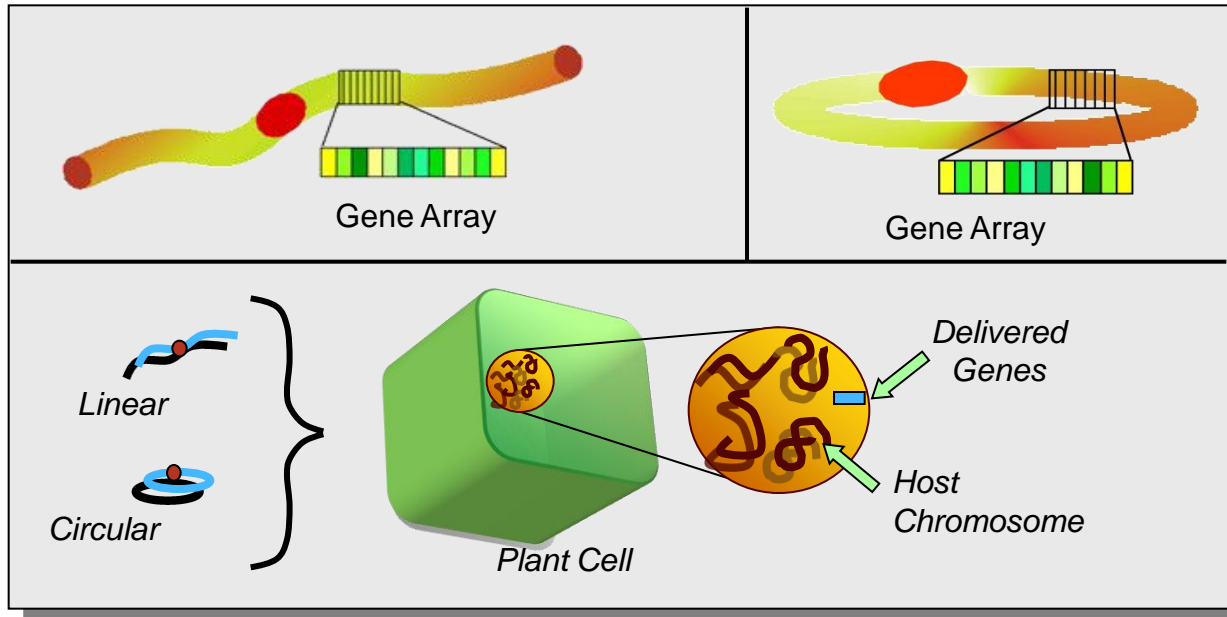
-  State Trials
-  Dealer Plots
-  Land O' Lakes Answer Plots
-  Internal Protocols
-  Breeding Sites

Chromatin's Gene Stacking Technology

Traditional Gene Delivery



Mini-Chromosome Technology



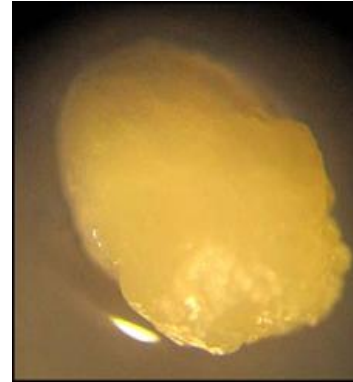
Making Mini-C Containing Plants



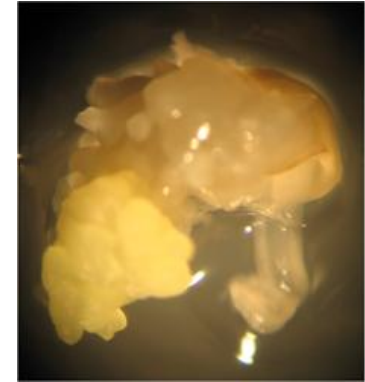
Immature embryos



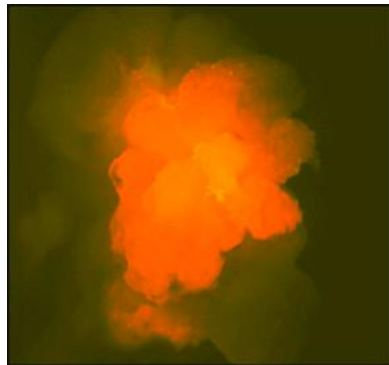
Gene Gun



Regenerating embryo



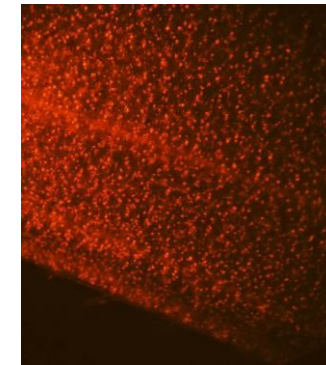
Callus growth on selective media



Callus expressing marker protein (DsRed)



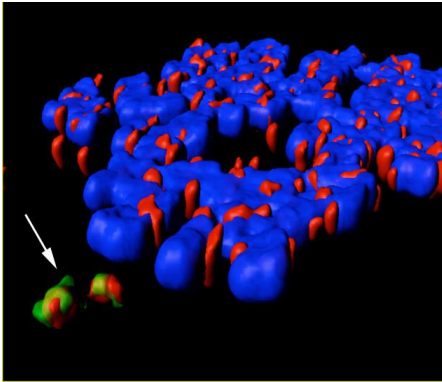
T0 Plants expressing marker protein (DsRed)



Chromatin technology

Synthetic biology adds gene stacks to crops

Mini-chromosome



“And by the end of the decade, I see mini-chromosome technology as the primary trait transfer technology used in corn,” – Roger Kemble, Syngenta Biotechnology (Farm Industry News, 3/9/11).

High energy & high sugar sorghum

Energy



- Extractable fuel
- Increased BTU

Sugar



- Increase sugar content
- Improve sugar extraction / degradation

Licensed for use in specific crops:

Corn, soybean, cotton, canola, sugarcane



Bayer CropScience



Dow AgroSciences

syngenta

Biotechnology

MONSANTO

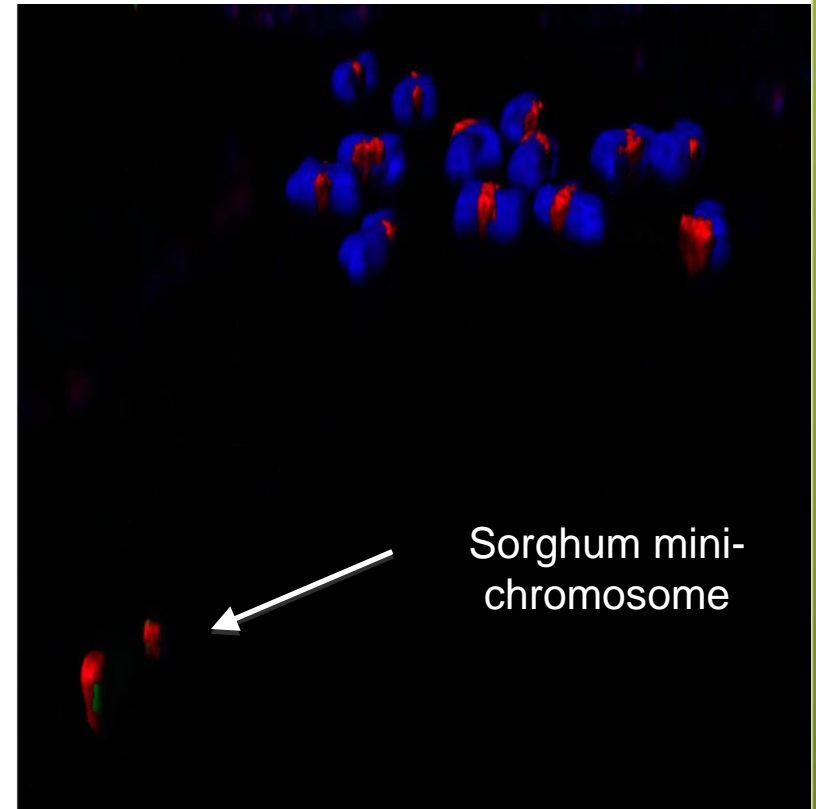


Chromatin, Inc.

Plants Engineered to Replace Oil (PETRO)

ARPA-E, Advanced Research Projects Agency – Energy

- Chromatin-led project selected for \$5.8 million DOE funding
- Engineering the terpenoid metabolic pathway in sorghum to produce farnesene
- Sorghum mini-chromosome to deliver up to 12 genes to sweet sorghum
- Final production costs ~ \$1.60 / gal
- 11,000 BTU feedstock



Products for the emerging biomass market

Forage Sorghum



- 10 commercial products
- Leading position in US hybrid seed market

Grain Sorghum



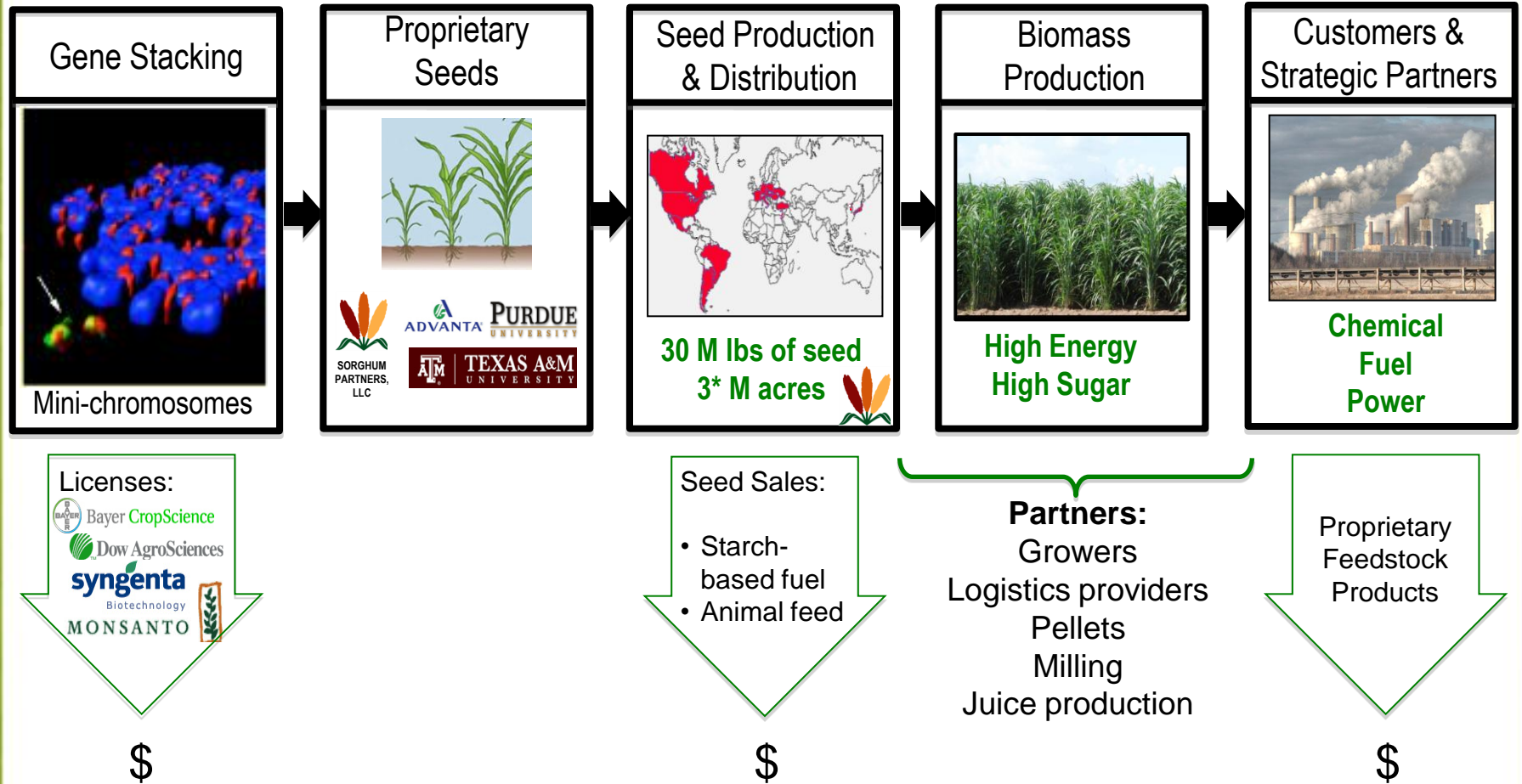
- 17 commercial products
- Rapid expansion into growth markets

Sweet Sorghum



- Enabling commercial and scalable production for large emerging global markets

Vertical integration in sorghum feedstock



Investors and operations

Chicago



Champaign-Urbana

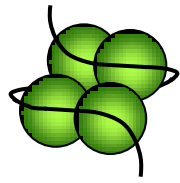


Texas



Investors

- Leading venture capital firms
- Leading strategic investors



Chromatin, Inc.

Customized by Chromatin, Renewable by Nature

- ***Commercial-stage and scalable technology & products today***
- ***Creating value via sales of grain, forage and sweet sorghum planting seed***
- ***Creating value by designing customized biomass feedstock***