1st Brazilian BioEnergy Science & Technology Conference

Eric Mathur, Chief Technologist; August 2011

What We Do

SGB is a bioenergy crop company using molecular breeding and biotechnology to produce elite hybrid seeds of Jatropha.

The Biology of Jatropha Speeds Domestication

Jatropha curcas is an undomesticated crop

- ✓ **Produces oilseeds for > 30 years**
- ✓ 9 month generation time
- ✓ Separate male & female flowers
- ✓ Vegetative propagation
- ✓ Tolerates drought & poor soils

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Jatropha Biodiesel Properties

Jatropha outperforms other biofuel crops:

- ✓ Low cloud point
- ✓ High oxidative stability
- ✓ Does not compete with food security

Feedstock	Cloudpoint	C°	Oxidation Stability	Hrs @ 110°
Jatropha	Low	3°	High	13.1
Palm	High	13°	High	13.37
Soy	Low	0.9°	Low	5.3
Canola	Low	-3.3°	High	14.1

*Source: R. Sarin et al. / Fuel 86 (2007) 1365–1371

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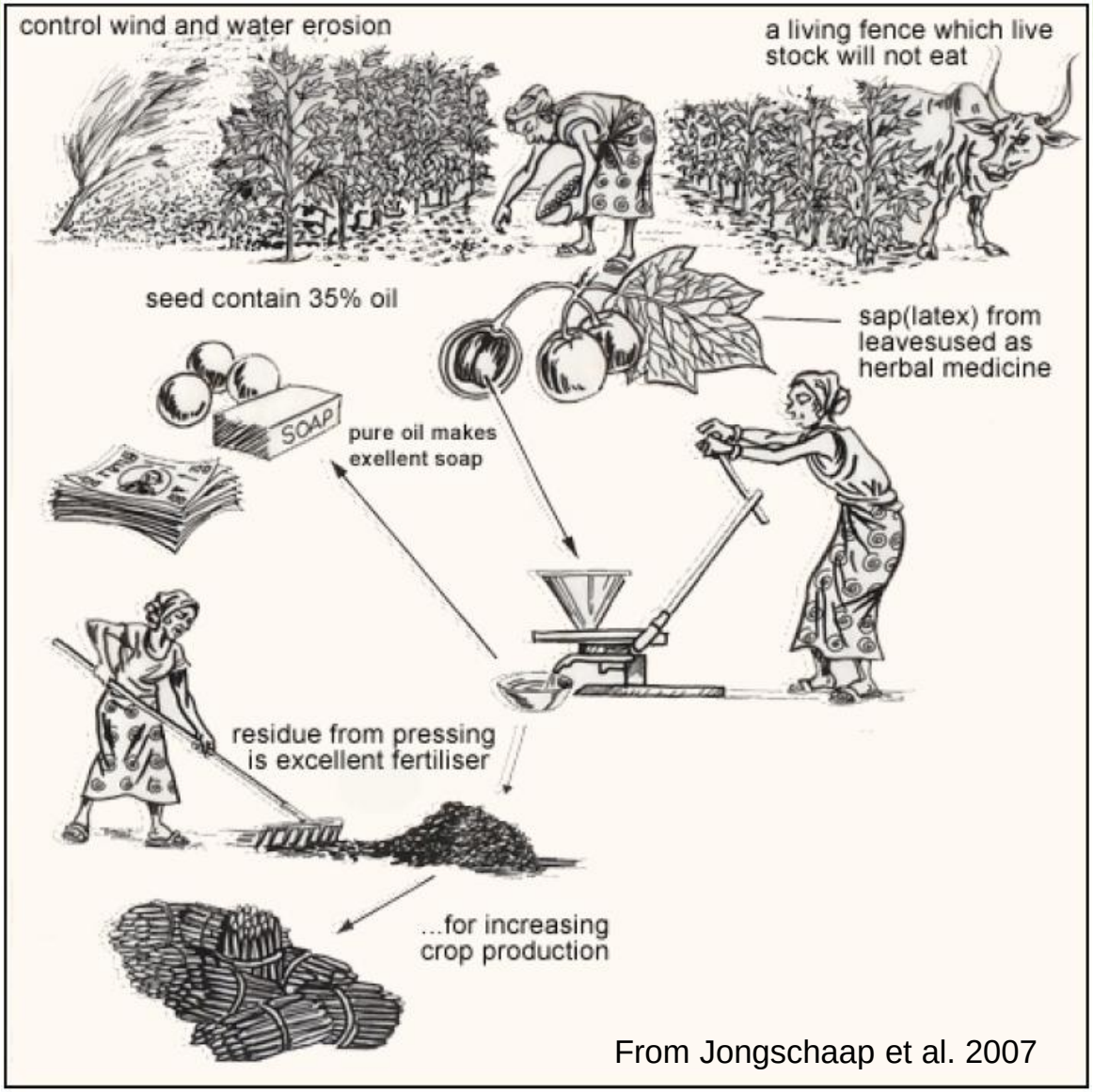
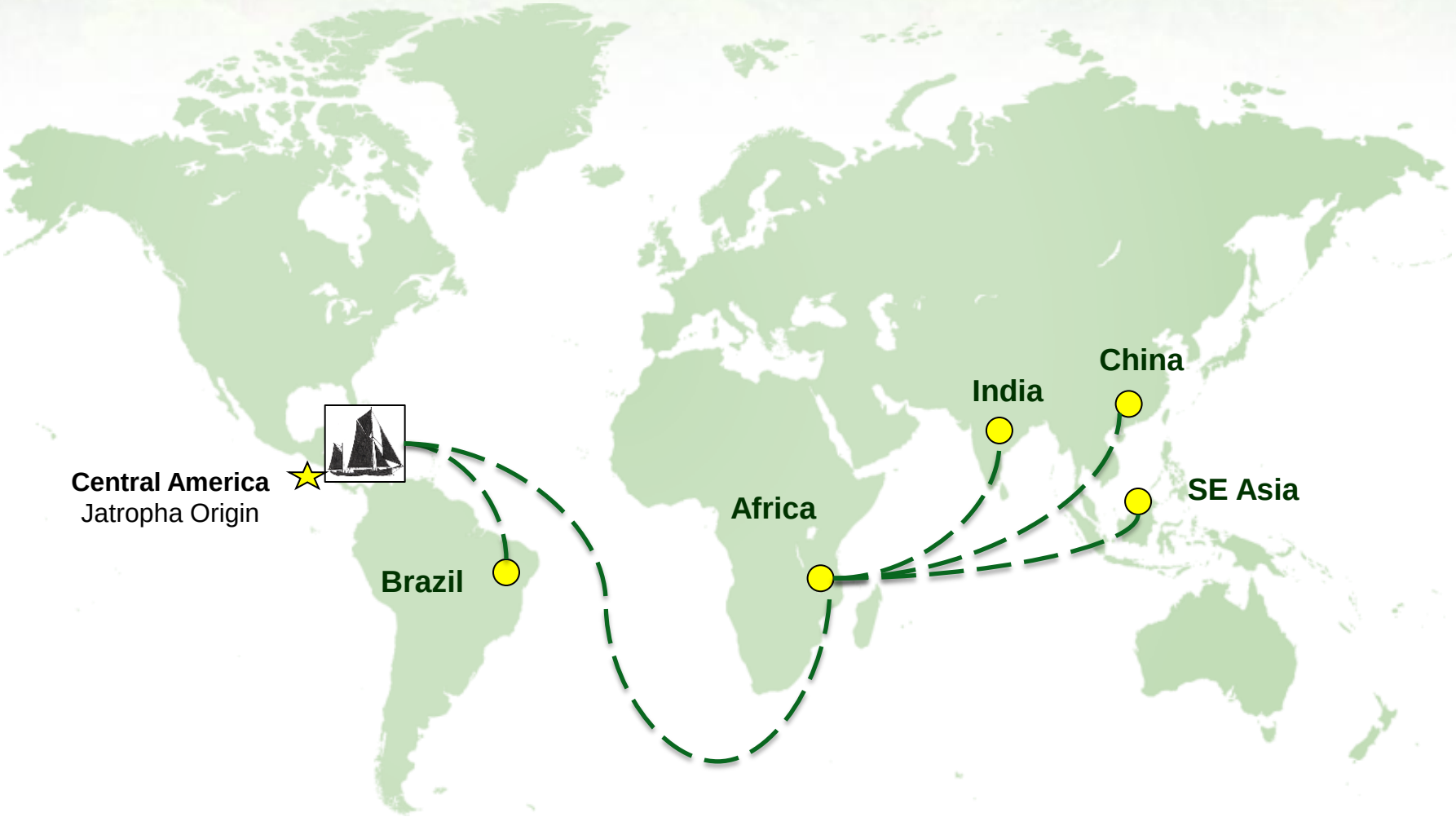
Jatropha curcas has been cultivated for centuries



Traditional use and local processing of physic nut (Jatropha curcas *L.).*

Jatropha Experienced a Genetic Bottleneck

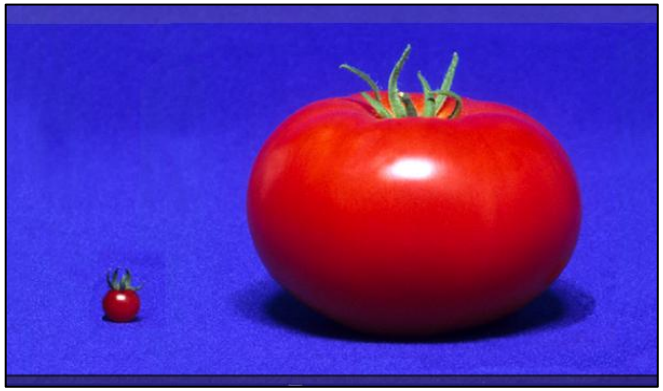


Crop Domestication

✓ All commercial crops are improved versions of their wild relatives

✓Germplasm is the foundation for any successful crop improvement program

- Corn yields improved 25X
- Rubber yields improved 400%



R&D Program Accelerates Commercial Deployment

Key Differentiators

Germplasm: demonstrated genotype diversity

JMax Hybrids: proven heterosis

Genomics: trait & gene discovery

Hybrid Seed Production: large scale low-cost production

Infrastructure

Lab	**Guatemala**	**Greenhouse**
Genotyping pipeline	3 Germplasm Resource Centers	42,000 sq. ft.
Jatropha genomics	12,000 unique genotypes; 600 accession families	Controlled breeding facility; Hybrid Crosses
Marker Accelerated Selection	10-acre seed production site	Genomic studies
Oilseed chemistry	18 Full-time employees	Germplasm showcase

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Phenotypic Diversity: Growth Habit

Extreme branching

Strong apical dominance

Semi-dwarf

Extreme-dwarf

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Phenotypic Diversity: Fruit & Seed Variants

Seed color variation

Non-abscising fruit clusters

Large fruits

Seed size variation

Many fruit per inflorescence

Dehiscent In-dehiscent

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Phenotypic Diversity: Disease & Pest Resistance

Resistant accession families

Anthocyanin accumulation

Fungal infections

Mite resistance

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The Science Behind JMax: Breeding

Germplasm → **Selection** → **Elite Cultivars**










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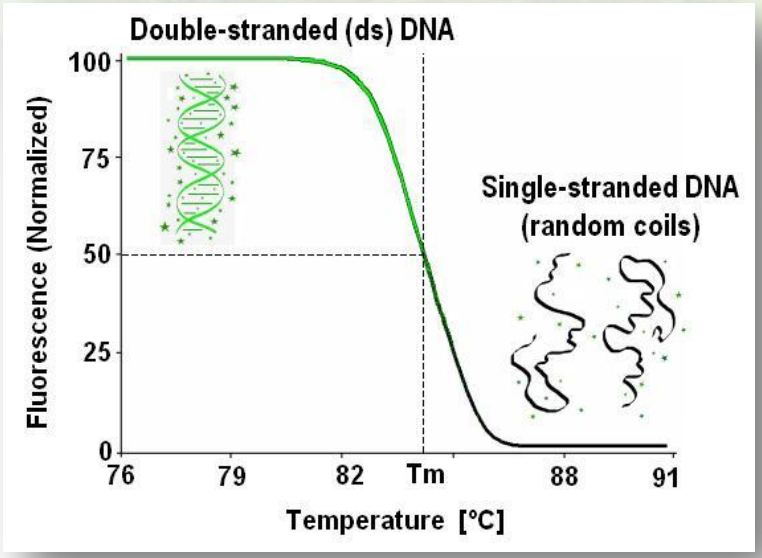
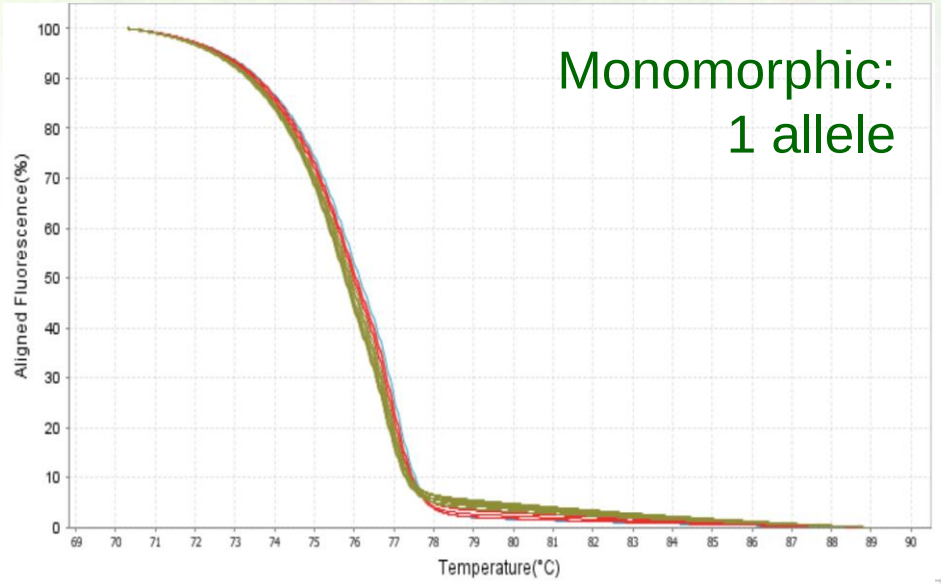
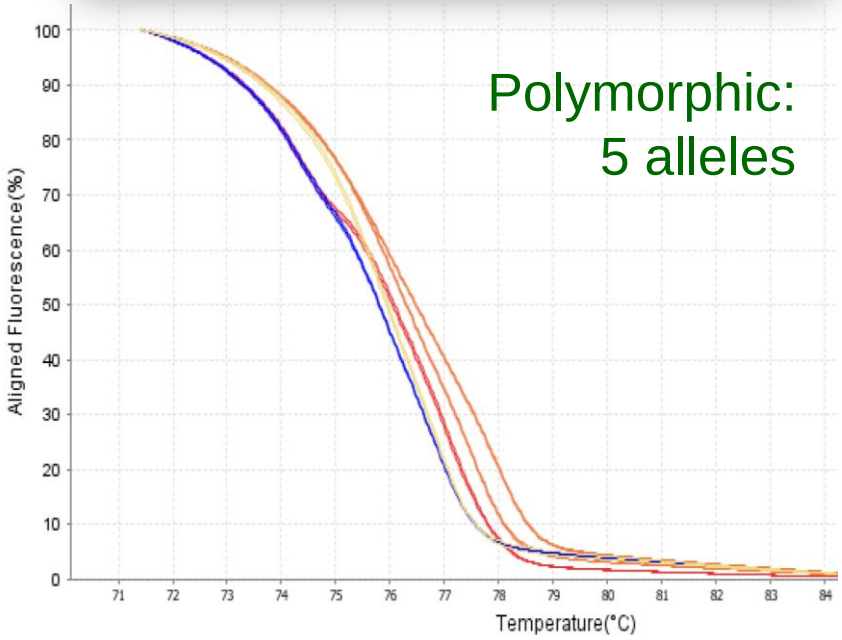
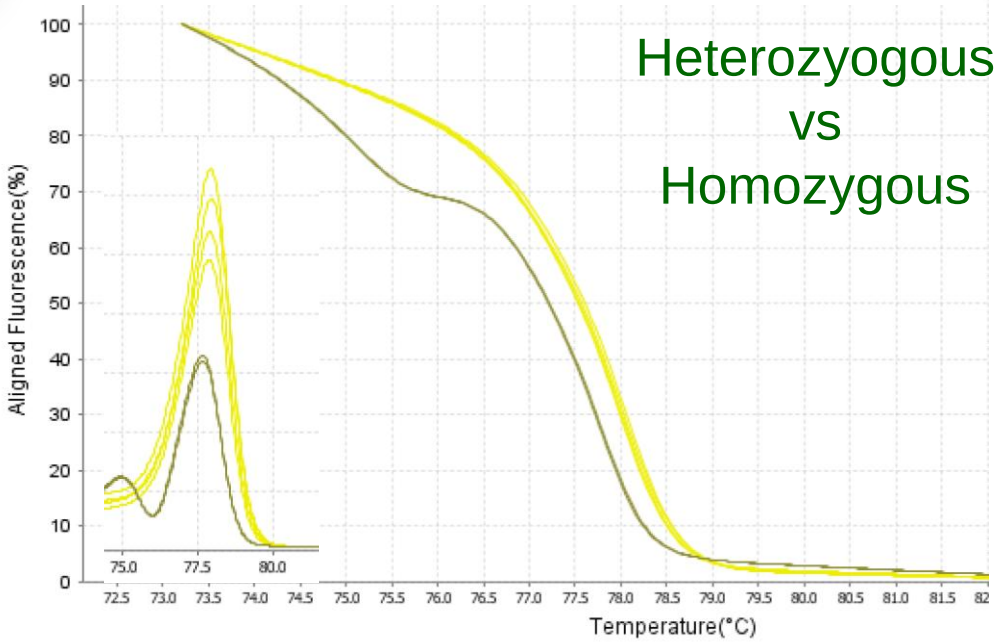
(HRM) High Resolution Melt SSR Genotyping

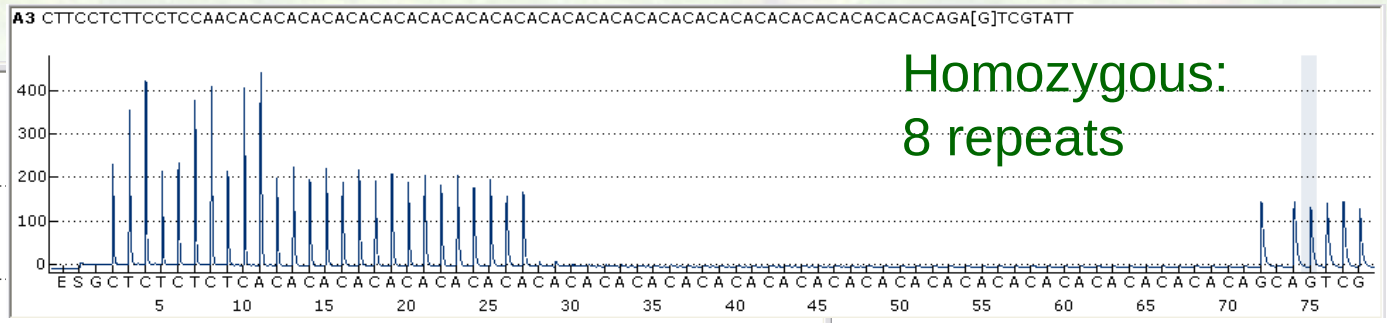


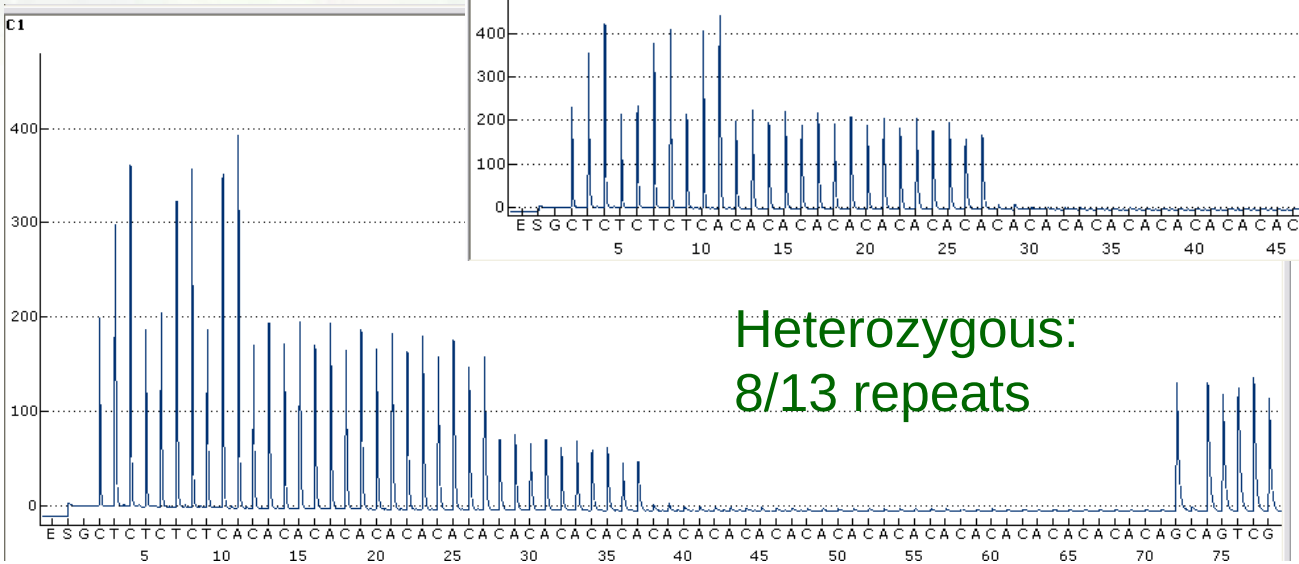


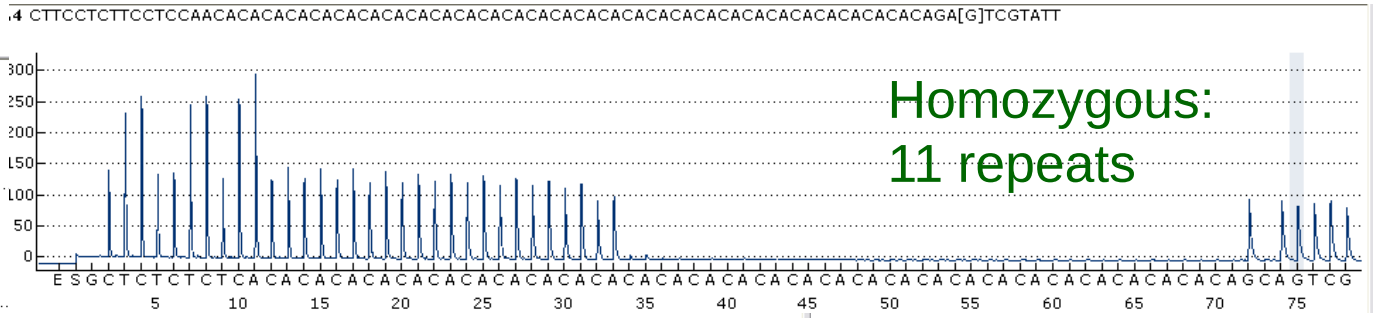


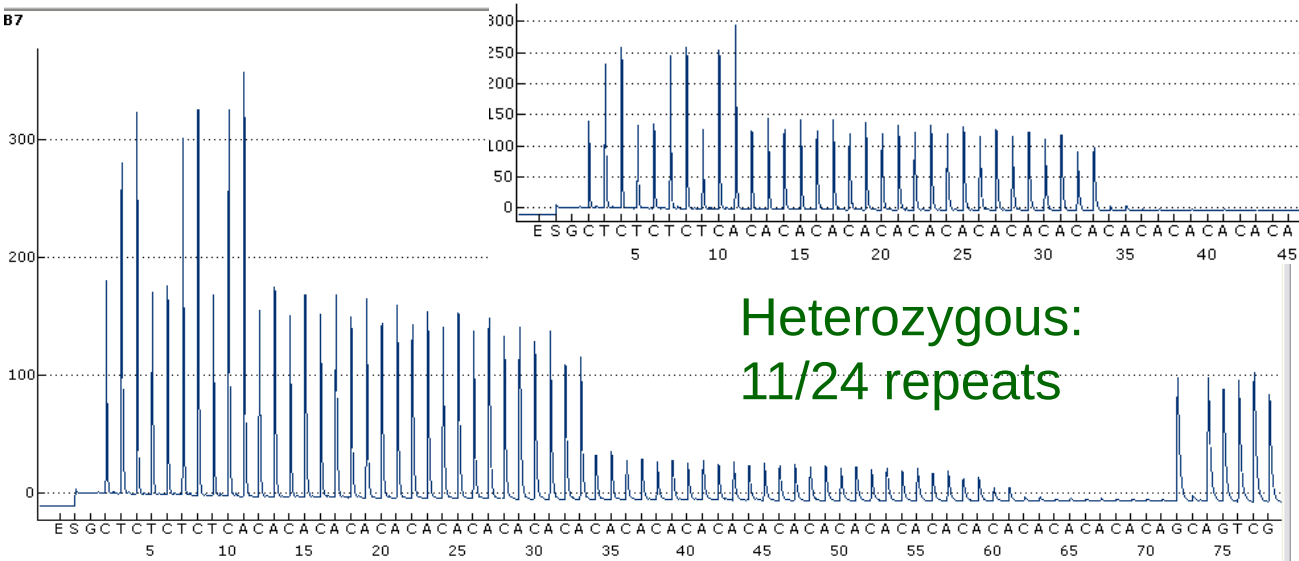


Pyrosequencing of *J. curcas* Microsatellites

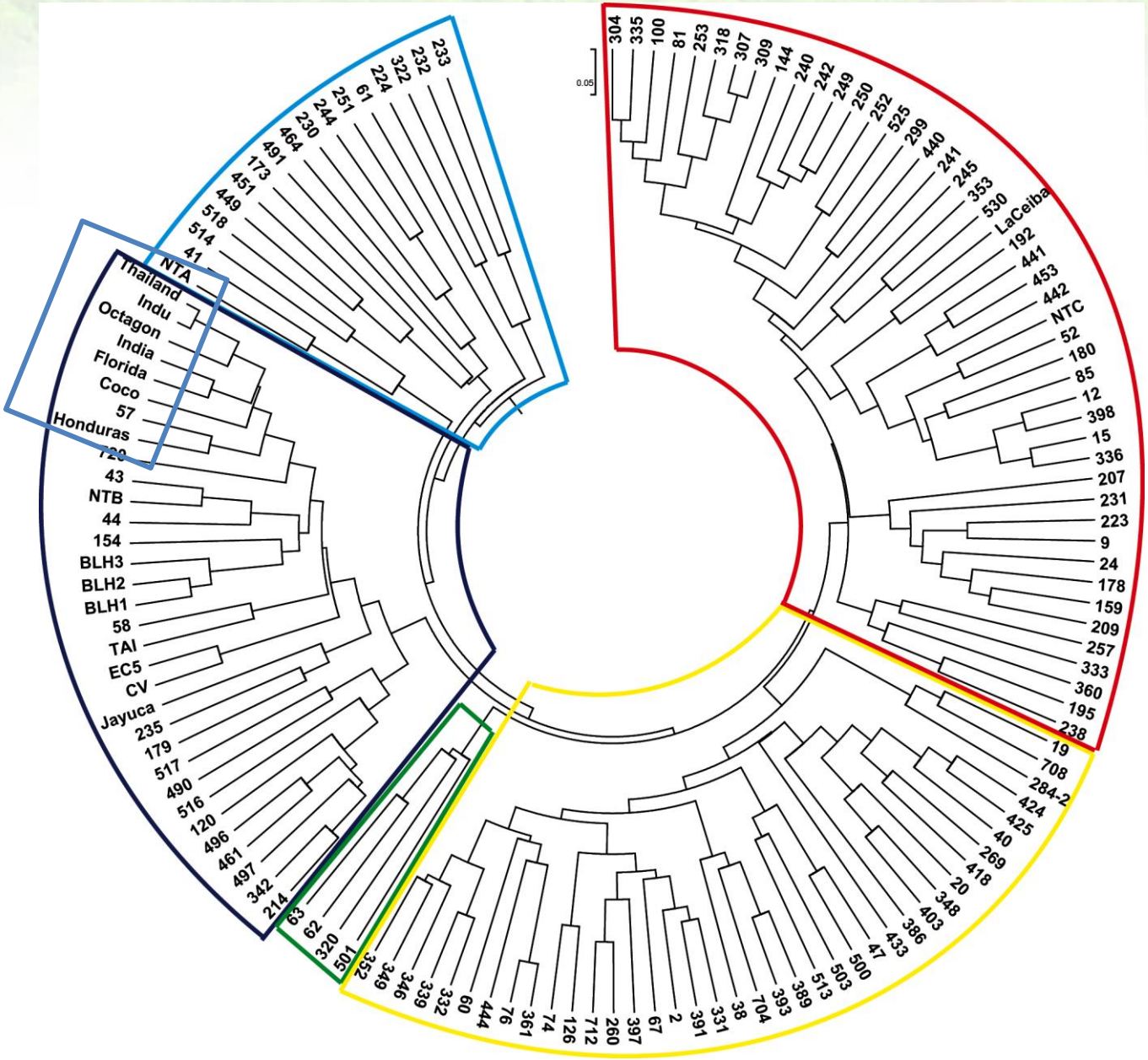




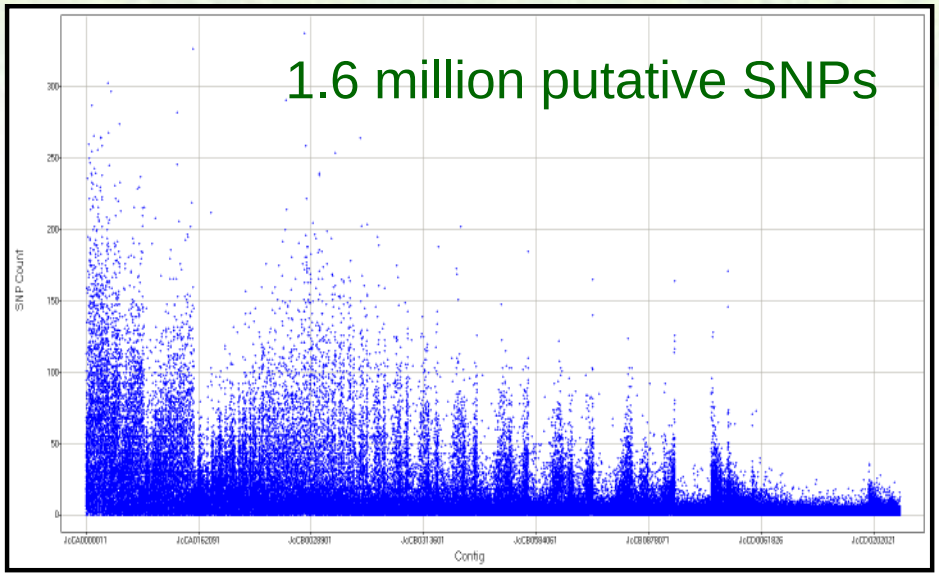


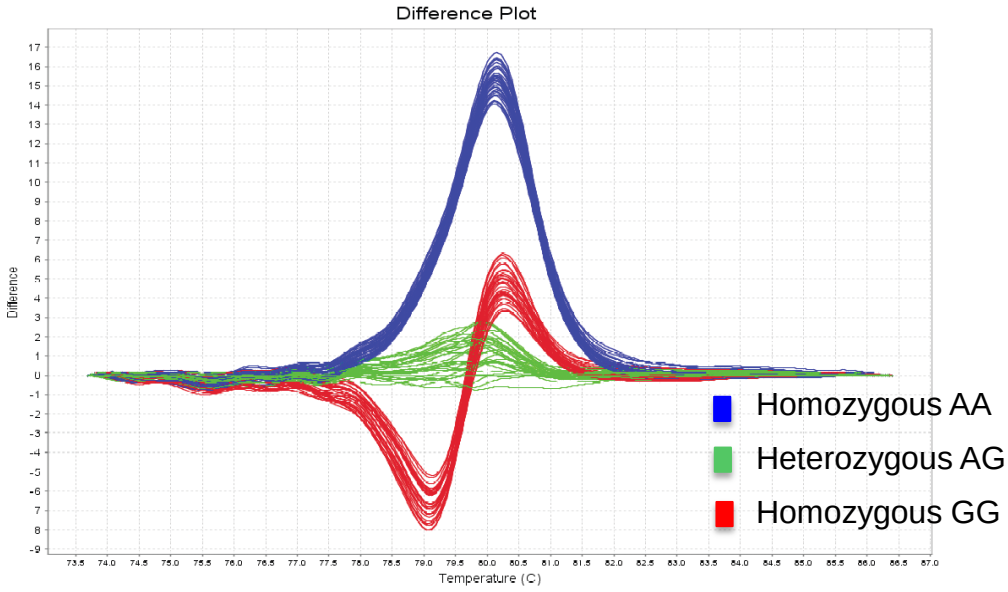


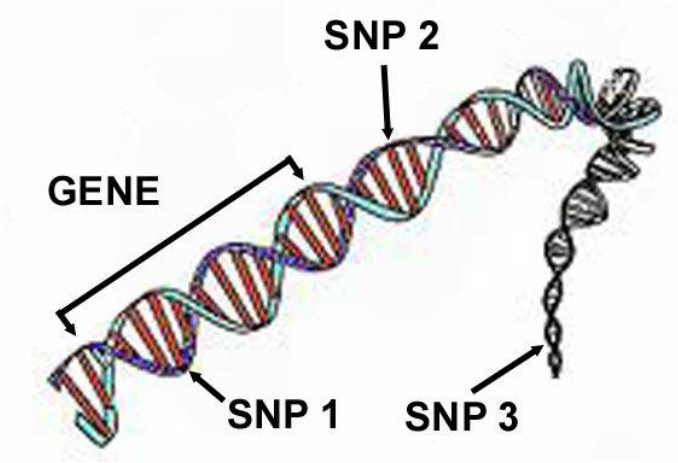
Jatropha Genotyping: SSR Markers



Trait Association Studies







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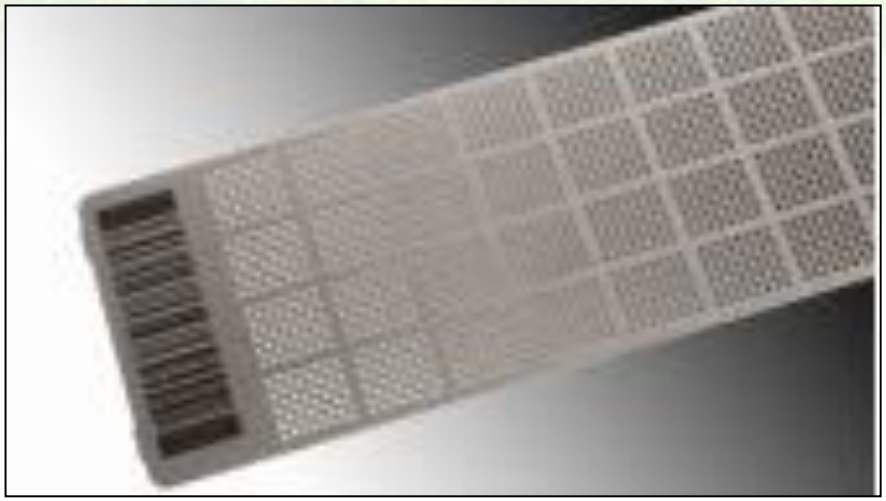
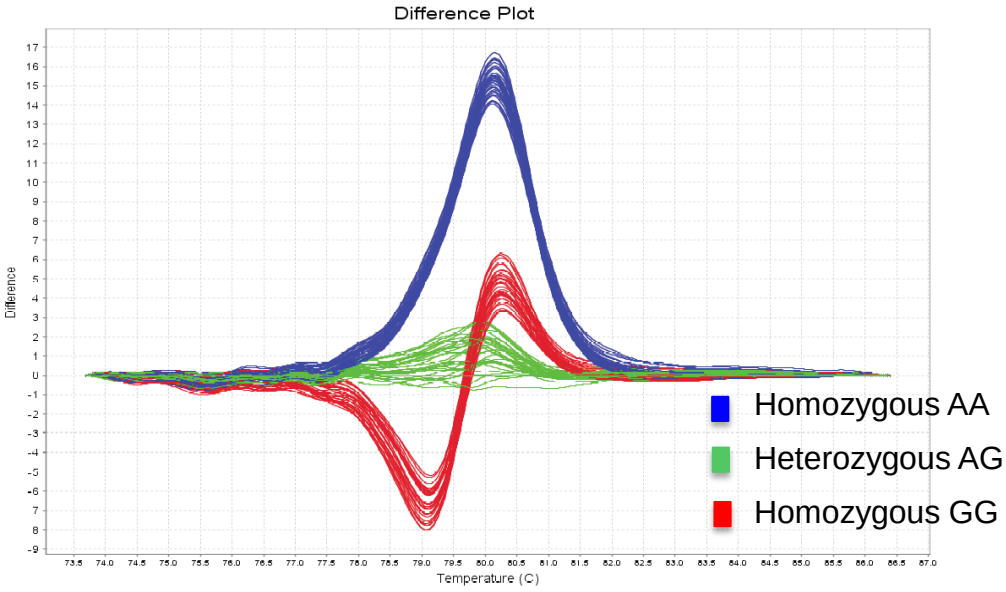
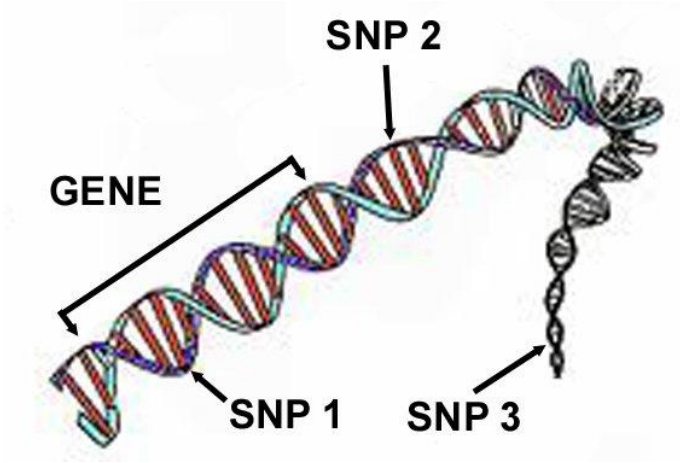
Marker Accelerated Selection (MAS)







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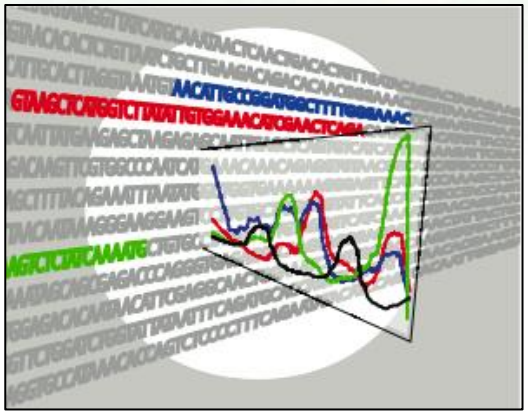
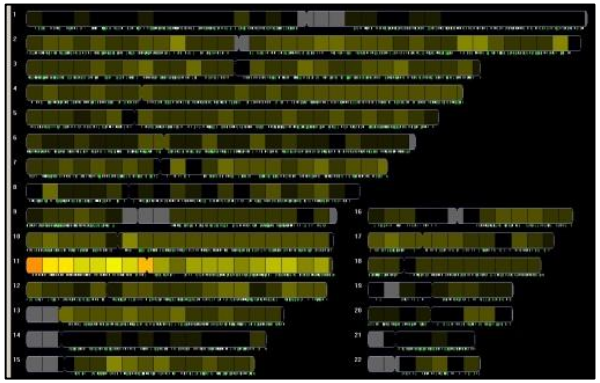
Value of Genomics in Plant Biotechnology

- ✓ Molecular markers accelerate breeding
- ✓ Enables early selection of progeny
- ✓ Facilitates transgenic trait development
- ✓ Jatropha functional genomics
- ✓ Strain fingerprinting for IP protection





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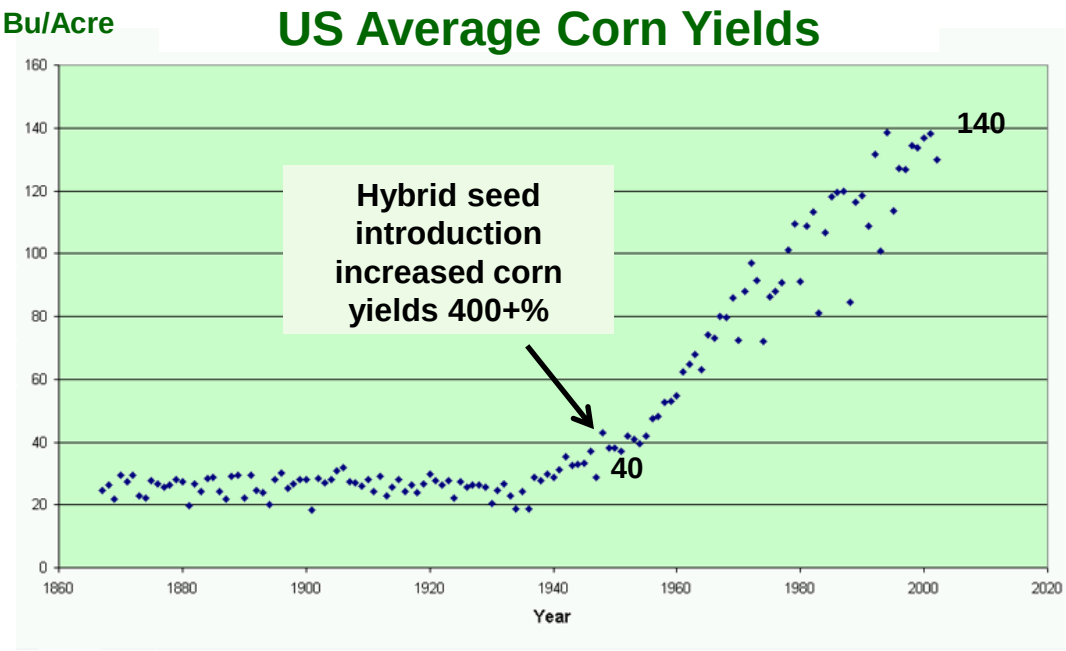
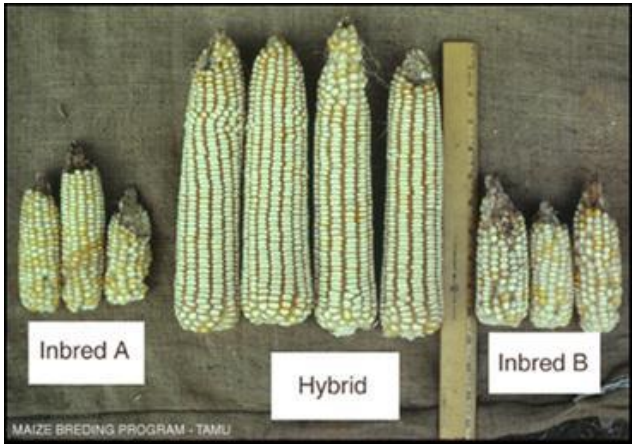
Hybrid Seed Technology Revolutionizes Jatropha Industry



Hybrid Effect

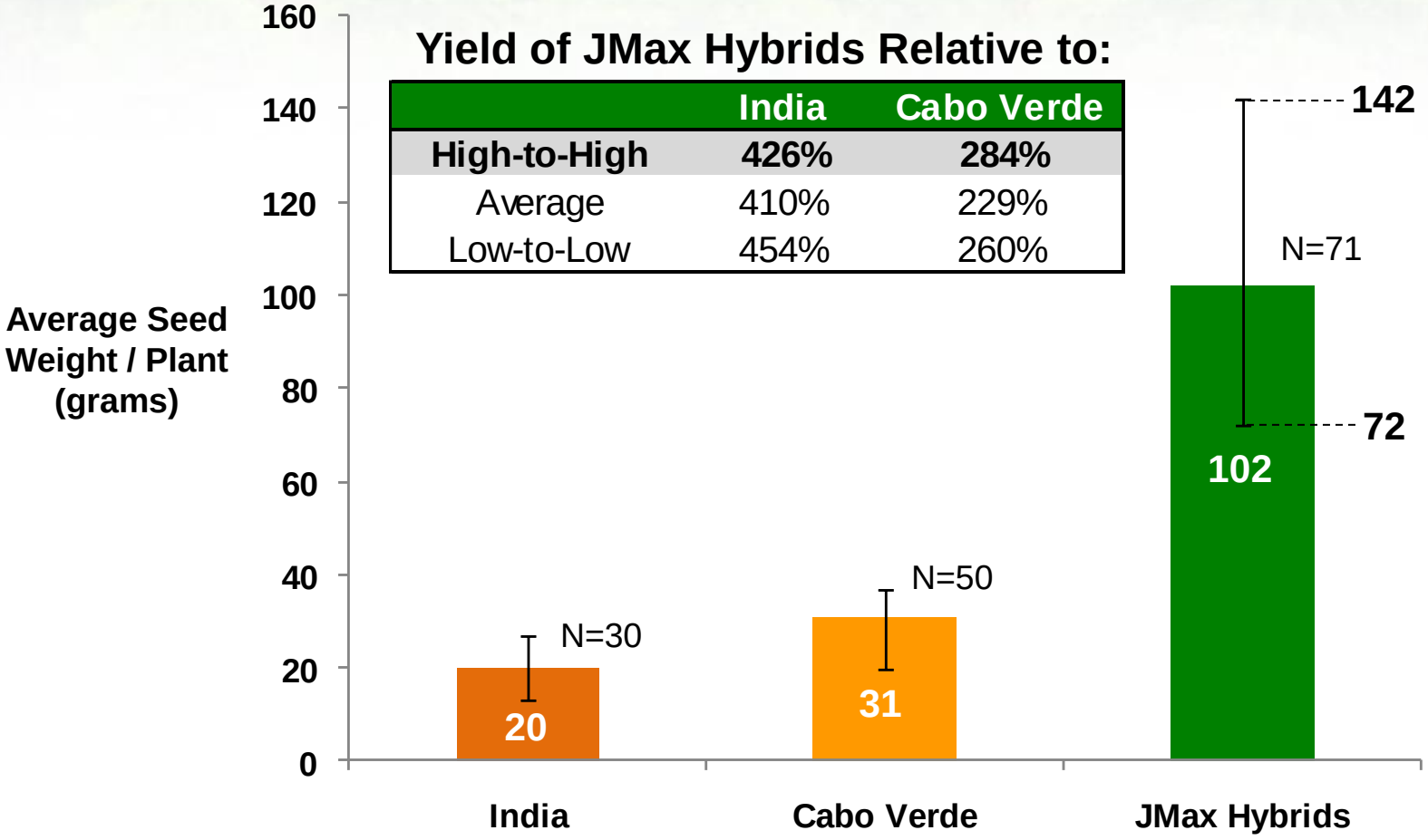


Higher yielding, stronger plants

SGB Hybrid Program

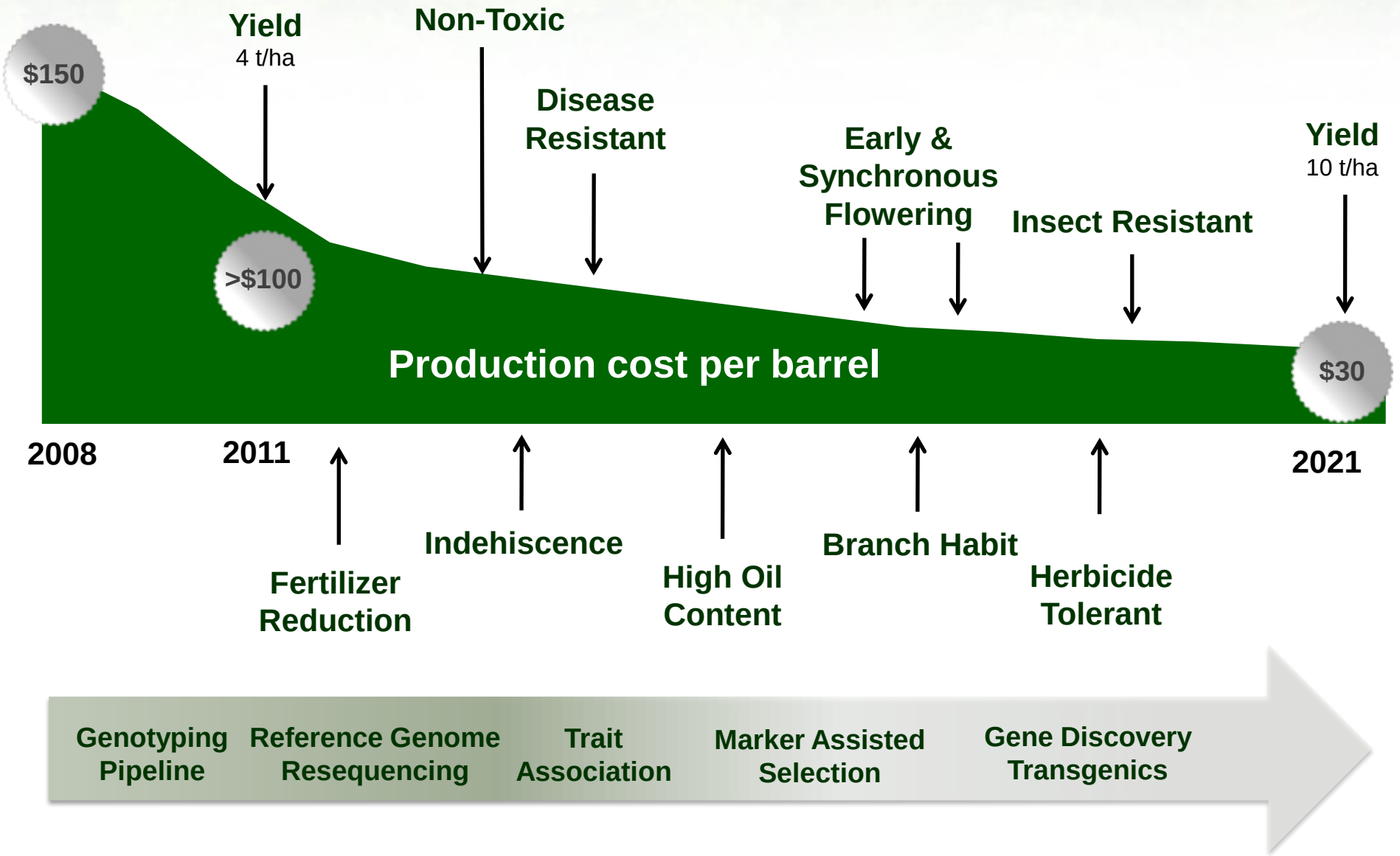
1,400 hybrid crosses	Converted provisional patent
1M hybrid seeds in Q4-2011	F2/F3 inbred parental lines
15,000 plant hybrid production site	Introduction of key traits

JMax Hybrids Significantly Outperform Best Commercial Varieties



	India	Cabo Verde	JMax Hybrids
Avg. Seeds / Plant:	26	47	139
Avg. Seed Weight(gr):	0.76	0.65	0.75
Average Oil Content	35%	35%	36.7%

Trait Pipeline Increases Competitive Advantage & Crop Economics



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