# nexsteppe

DEDICATED TO SUSTAINABILITY

# NexSteppe Vision

Be a leading provider of scalable, reliable and sustainable feedstock solutions for the biofuels, biopower and biobased product industries

# The Big Picture

**Biomass Sorghum**


**Biomass**

**Biopower &**

**Cellulosic Biofuels**

**Sweet Sorghum**


**Fermentable Sugars**

**Biobased Products &**

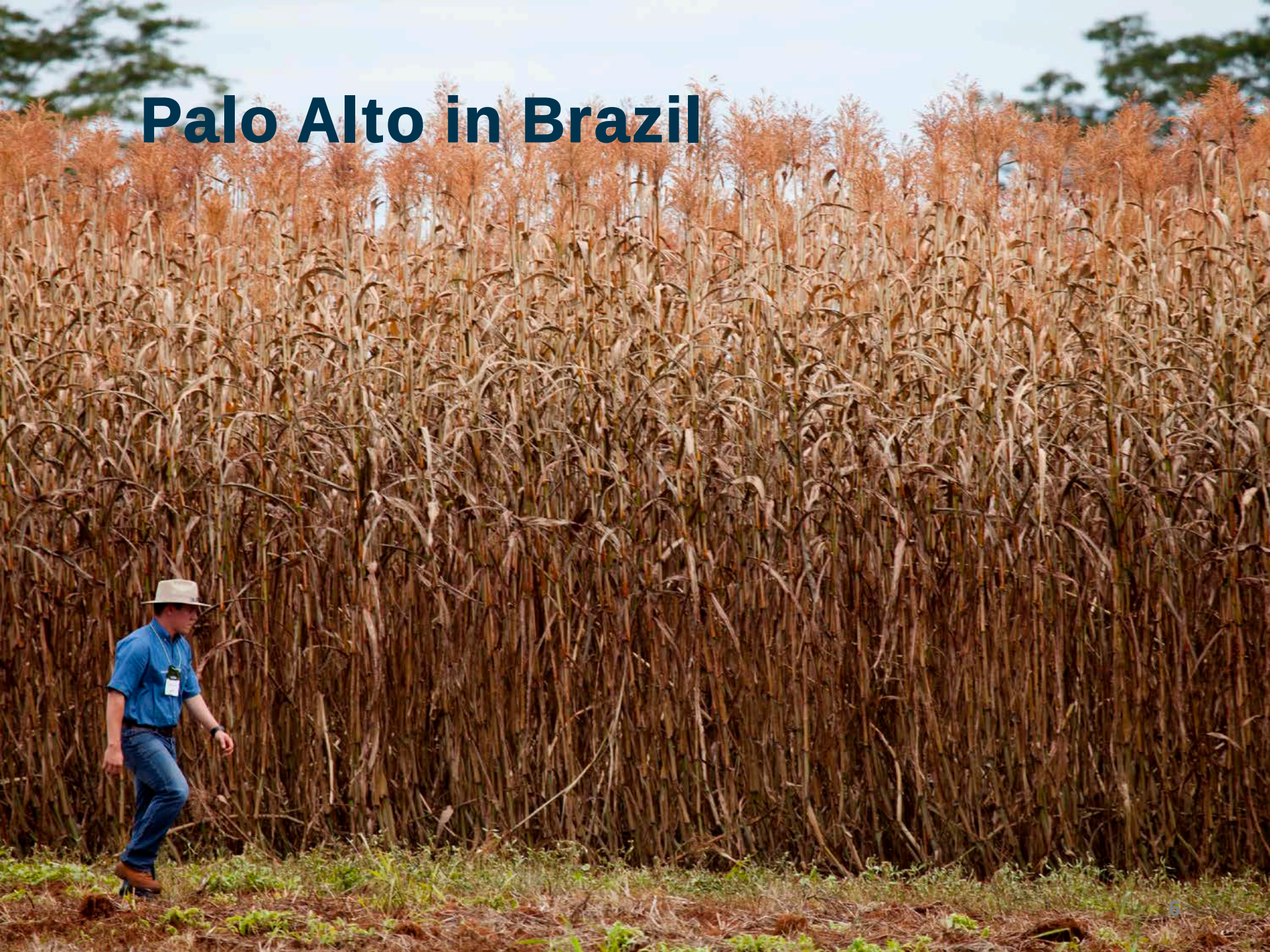
**Advanced Biofuels**

nexsteppe

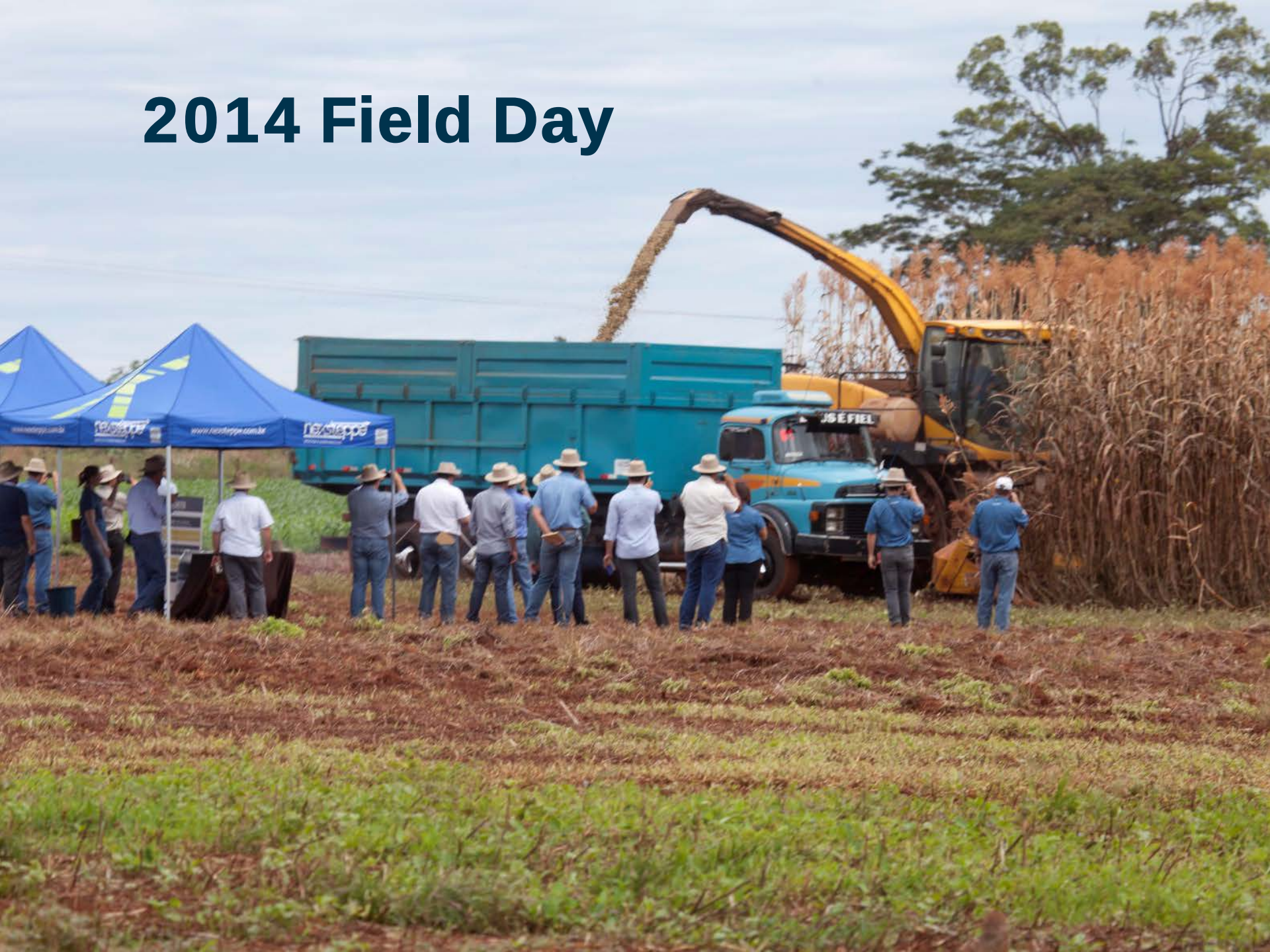
# Commercial Seed Shipping to Customers

# Palo Alto in Texas

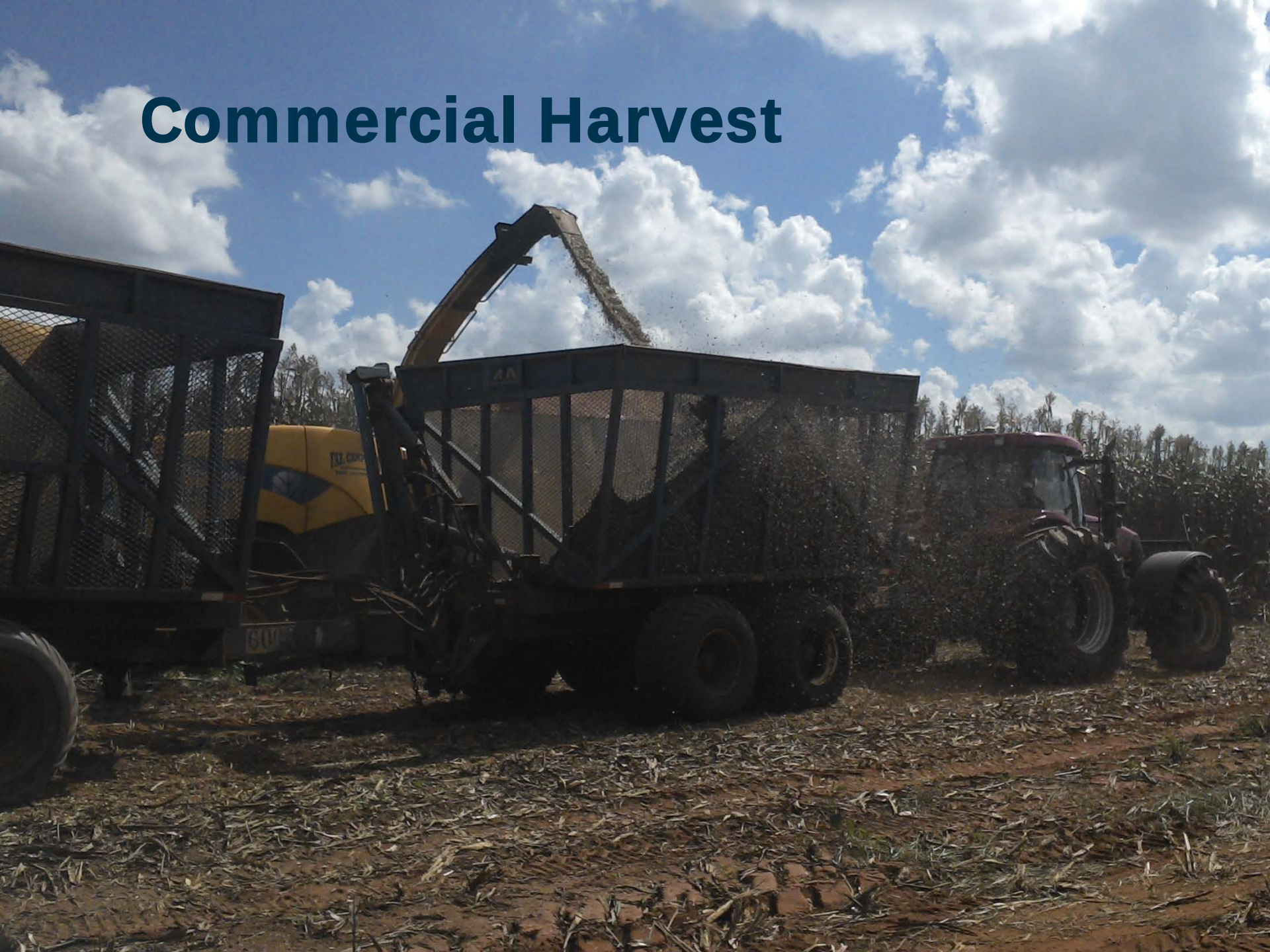
# Palo Alto in Brazil



# 2014 Field Day



# Commercial Harvest



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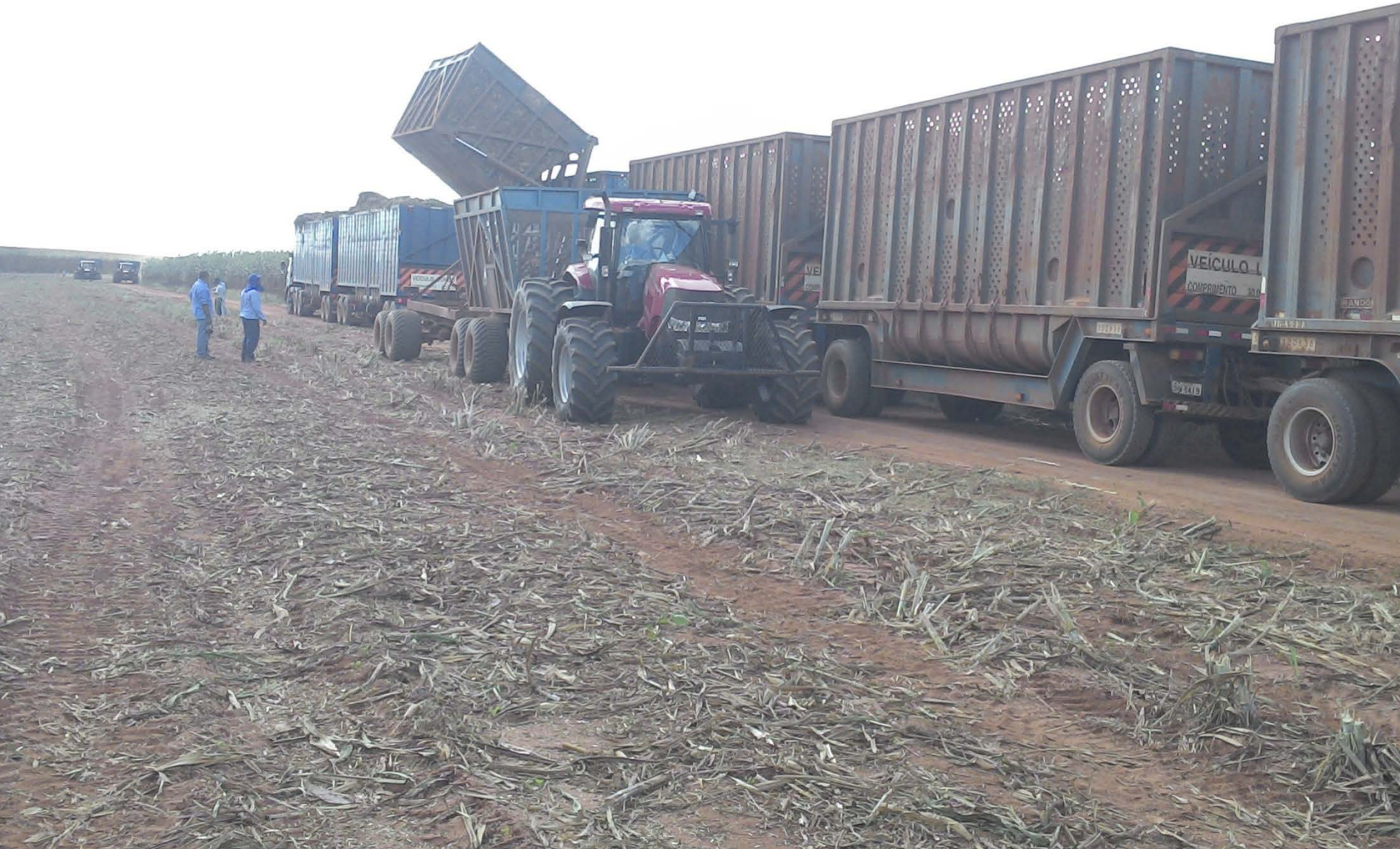
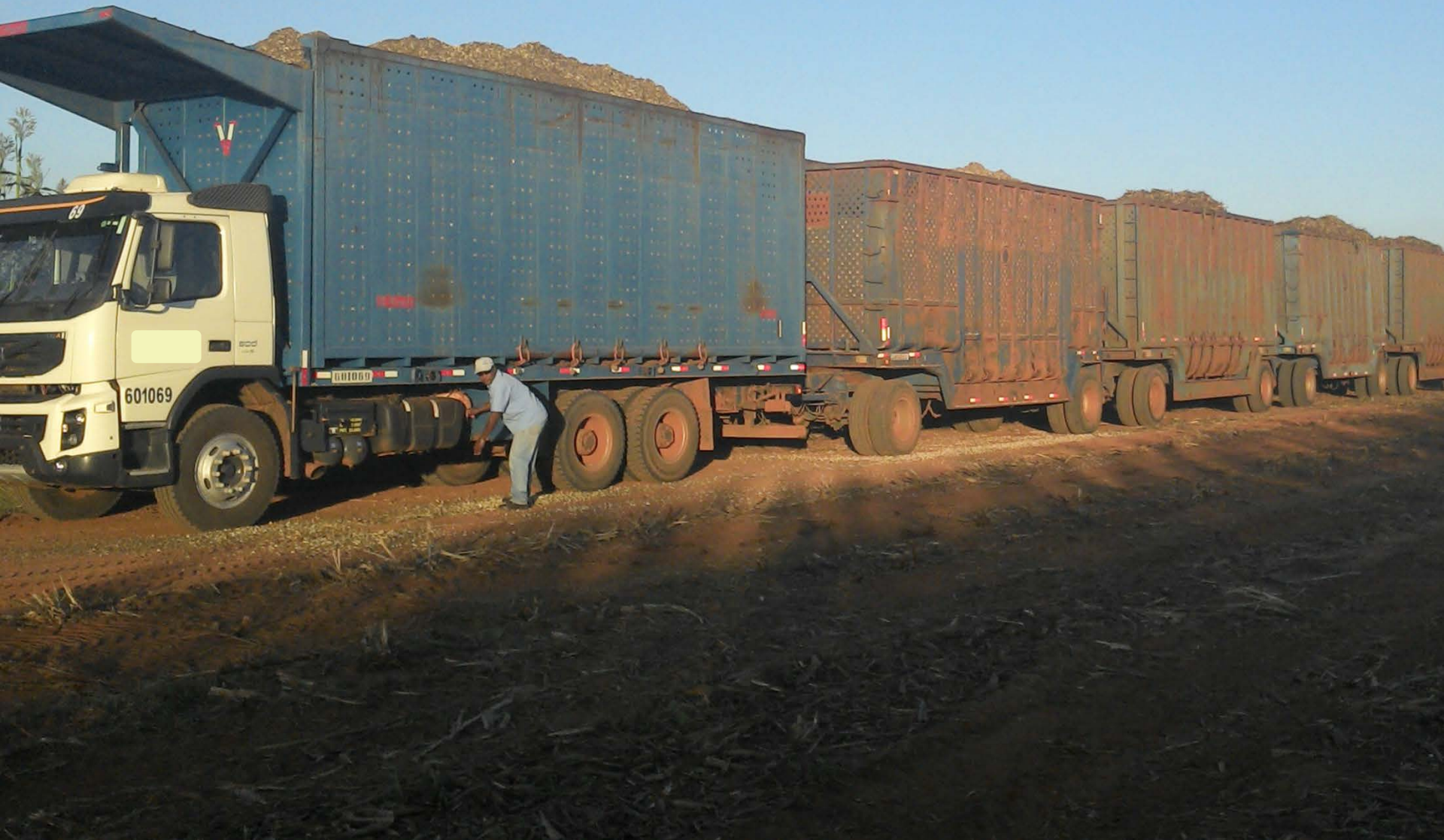


# Transportation



# NexSteppe Works Closely With Many of the Leading Companies in the Biobased Economy

## Investors

DUPONT

TOTAL

BRAEMAR ENERGY VENTURES

## Customers

raízen

ODEBRECHT Agroindustrial

CMAA

Granol

umoe bioenergy

BUNGE

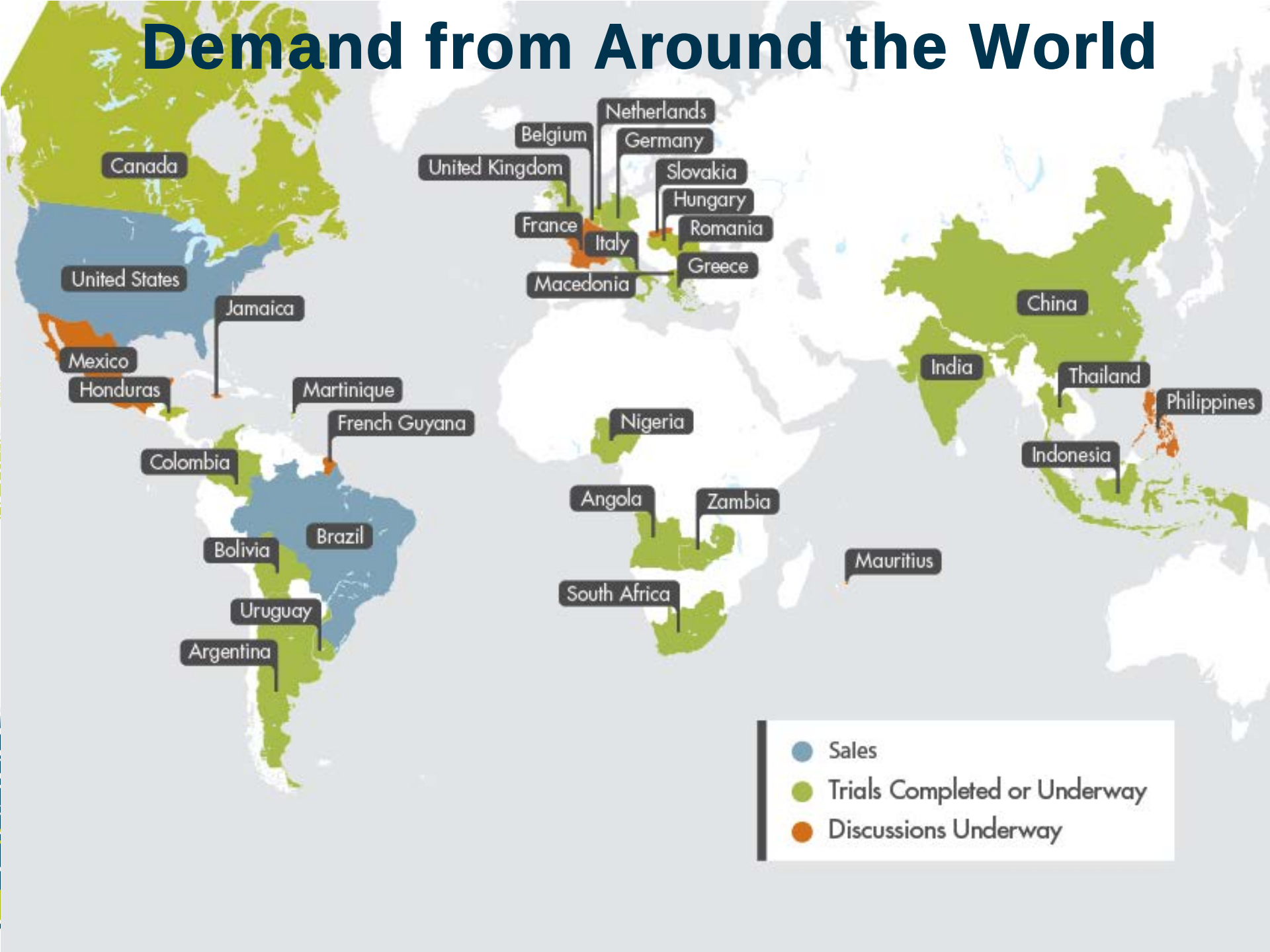
RHODIA SOLVAY GROUP

noble agri

USINA SÃO FERNANDO AÇÚCAR E ALCOOL

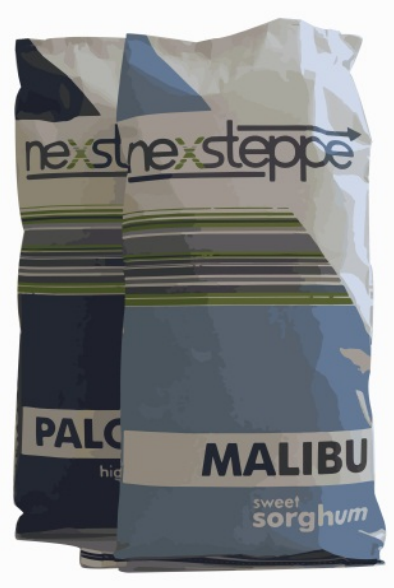
CARAMURU

# Demand from Around the World



# Why Sorghum?

- For the grower...
  - High-yielding
  - Harvest in 3-4 months
  - Can be rotated with other crops
  - Established agronomic systems
- For the processor/project developer...
  - Drop-in
  - Broad geographic adaptation
  - Heat and drought tolerant
- For the seed company...
  - Huge genetic diversity
  - Rapid breeding and product development cycle
  - Fast scale-up
  - Established hybrid systems
  - Seed propagated



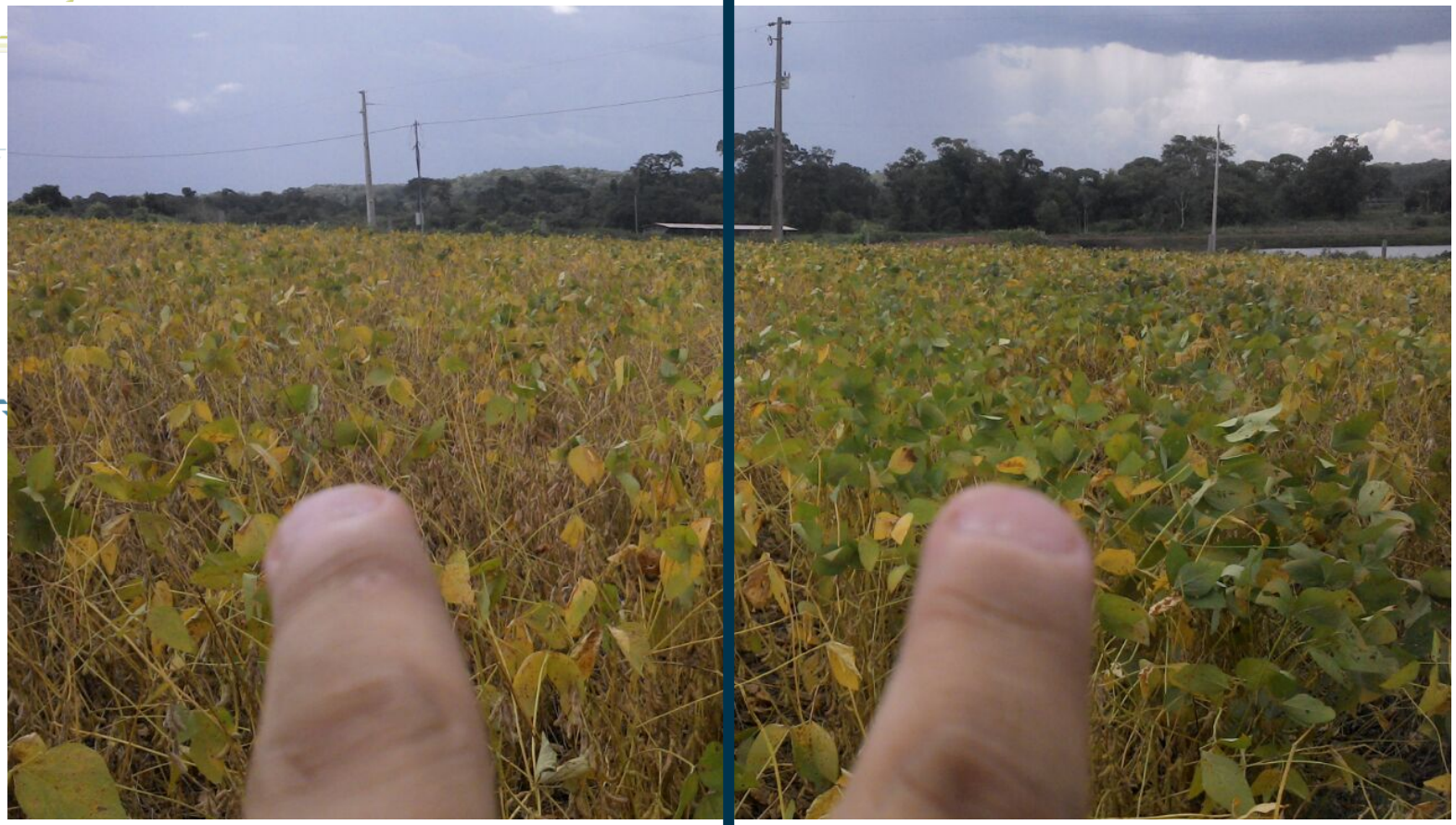
# Key Attributes of Biomass Sorghum Equate to Lower GHG emissions

- High yields with short growth cycle, opportunities for inter-cropping and ability to grow on more marginal land lead to low, no or even positive indirect land use change
- Lower agricultural input requirements than for most traditional row crops and other dedicated energy crops
- Below-ground sequestration by extensive root systems provide rapid carbon sink
- Lower transportation inputs due to lower moisture at harvest and higher yields enabling smaller collection radius
- Optimized composition (through genetics and management practices) improving process yields for conversion technologies

# Low, No or Even Positive Indirect Land Use Change

- Short cycle times allow biomass sorghum to be grown in rotation with food crops
  - Producing biofuel feedstocks through increased intensity of agricultural land utilization, using systems like crop rotation, significantly reduces actual indirect land use change
  - Crop rotation can lead to zero or even positive land use change as food crop yields are increased through the benefits of crop rotation
- Lower water needs and industrial end-use make biomass sorghum a compelling choice for marginal, degraded or contaminated land
  - Use of land that is uneconomic or unsafe to grow forage or food crops reduces or eliminates food crop displacement
  - Biomass sorghum used for biopower being considered for remediation of cropland with heavy metal contamination
- High yields mean biomass sorghum yields require less land to produce the same amount of end product
  - US EPA estimates that biomass sorghum will yield approximately 30 dry tons/hectare by 2022 compared to 16 dry tons/hectare for switchgrass
  - Compared to ~4500 liters per hectare of ethanol produced per year by corn, biomass sorghum can produce >6,000 per cycle, even at today's field and process yields, with the potential for multiple cycles per year in many locations

# Demonstrated Benefits to Food Crop Yields from Rotation with Sorghum



Without rotation

After Palo Alto
(15% yield increase)

# Lower Agricultural Inputs and Water Requirements

- Biomass sorghum has low fertilizer requirements compared to other feed crops and dedicated energy crops
  - US EPA estimates that biomass sorghum requires only 30% of the fertilizer of switchgrass
- Biomass sorghum has low water requirements and is resilient even during periods of drought. It...
  - Requires only 2/3 of the total water of maize, 1/2 that of sugarcane
  - Is less sensitive to the timing of water availability
  - Depletes soil water profiles less than many other row crops

# Below-Ground Carbon Sequestration

- High biomass sorghum has a substantially larger root system than, e.g., corn, making it better at scavenging for water and preventing leaching of nutrients
- The annual nature of sorghum combined with appropriate management practices allows compounding accumulation of this root biomass
- Sorghum crops, both in continuous growth and in crop rotation patterns, significantly increase soil organic carbon

# Reduced Fuel Use in Transport

- High yields significantly reduce collection radius required for a given facility
  - Yields per hectare of nearly 12X wastes and residues reduces collection area from 80,000 Ha to 20,000 Ha for a 300MGY 2G ethanol plant
- Low moisture of Palo Alto biomass sorghum at harvest reduces hauled weights lowering fuel requirements
  - Palo Alto biomass sorghums are typically 55-60% moisture at harvest as compared to 75-85% for traditional forage or silage crops

# Improved Product Yields per Ton

- Increased levels of accessible cellulosic sugars in 2G ethanol feedstocks
  - Increases processing efficiency
  - Reduces capital costs (due to smaller front-end for same output)
  - Reduces gross feedstock requirements, and
  - Reduces the necessary footprint of the feedstock supply area
- NexSteppe Palo Alto biomass sorghum hybrids have been identified by the US EPA as having higher cellulosic content than other tested sorghums
- Reducing moisture at harvest from 80% to 55% results in a corresponding gain in energy content of approximately 125% (LHV of 8.07 MJ/Kg compared to 3.59 MJ/Kg).
  - Avoiding use of winrowing to dry sorghum also dramatically reduces deleterious components of ash picked up with soil (e.g. silica)