

TRUTERRA™

A LAND O LAKES INC. Company

Regenerative Farmed Corn
Feedstock for production off
100% bio-based 1,3-propanediol

World Bio Markets
The Hague May 10-11. 2023

Patrick Van Waes
Global Marketing Director PO

CovationBio™ PDO

Primient

COVATIONBIO.
Sorona®

COVATIONBIO|PDO
susterra®

COVATIONBIO|PDO
zemea®

Agenda

The Path of Carbon - Circular

Why Corn?

Responsible – Regenerative Farming

Usage of 1,3-Propanediol



CovationBio™ PDO is a joint venture formed in 2004, originally as DuPont Tate & Lyle Bio Products, for the sole purpose of producing bio-based 1,3-propanediol from the fermentation of glucose.

COVATIONBIO™

CovationBio™ is the innovative biomaterials partner that melds performance and sustainability at scale, for the benefit of all.

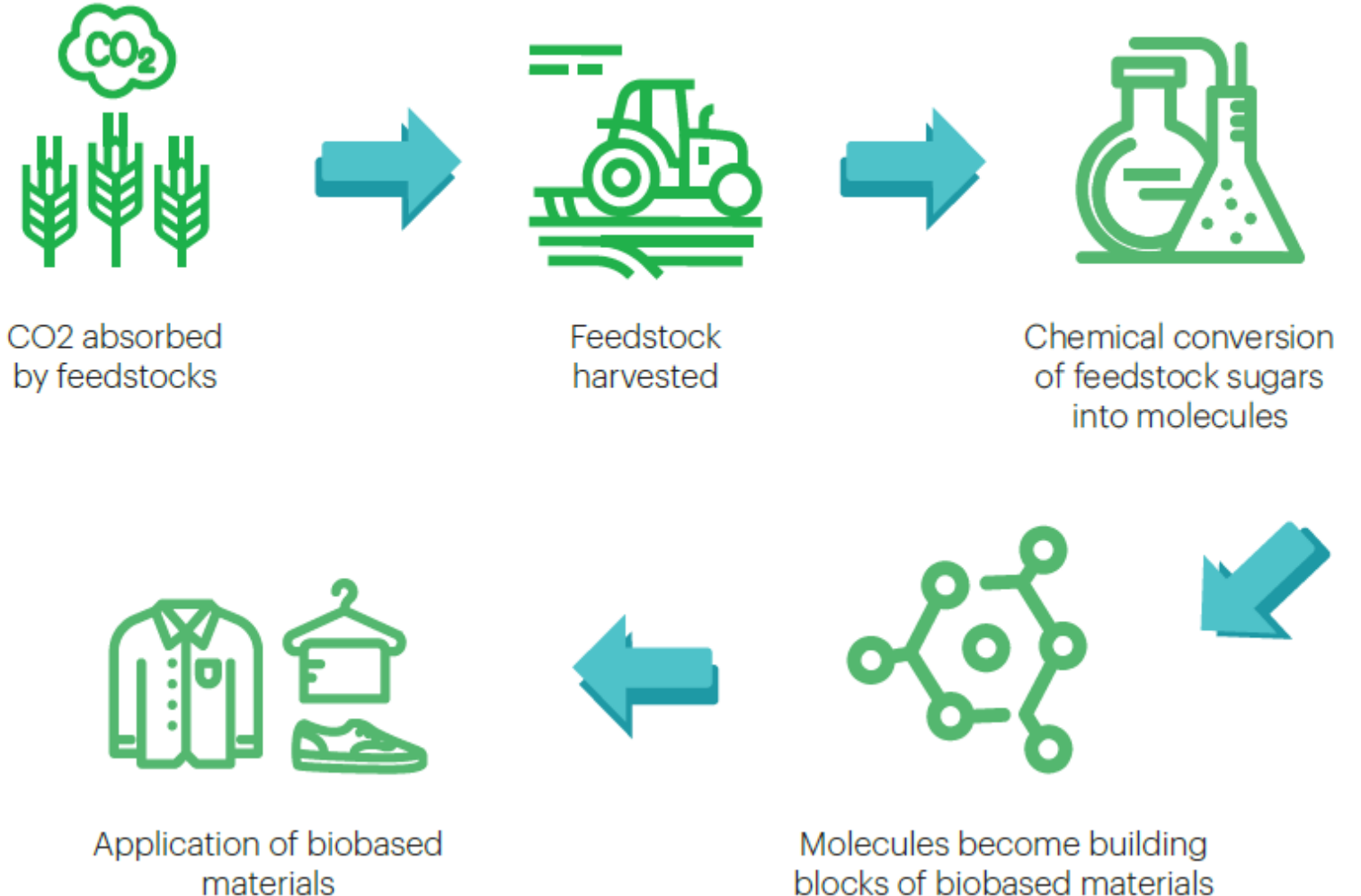
primient

Primient is a leading producer of food and industrial ingredients made from plant-based, renewable sources.

Defossilizing the materials industry towards a more circular economy

THE PATH OF CARBON

- 1,3-Propanediol taps into nature as a source of renewable carbon, transforming plants into the building blocks for the materials that surround our lives.
- The type of crop used as renewable feedstock matters a lot from point of view delivering affordable yields for all stakeholders. This is why we use dent corn.



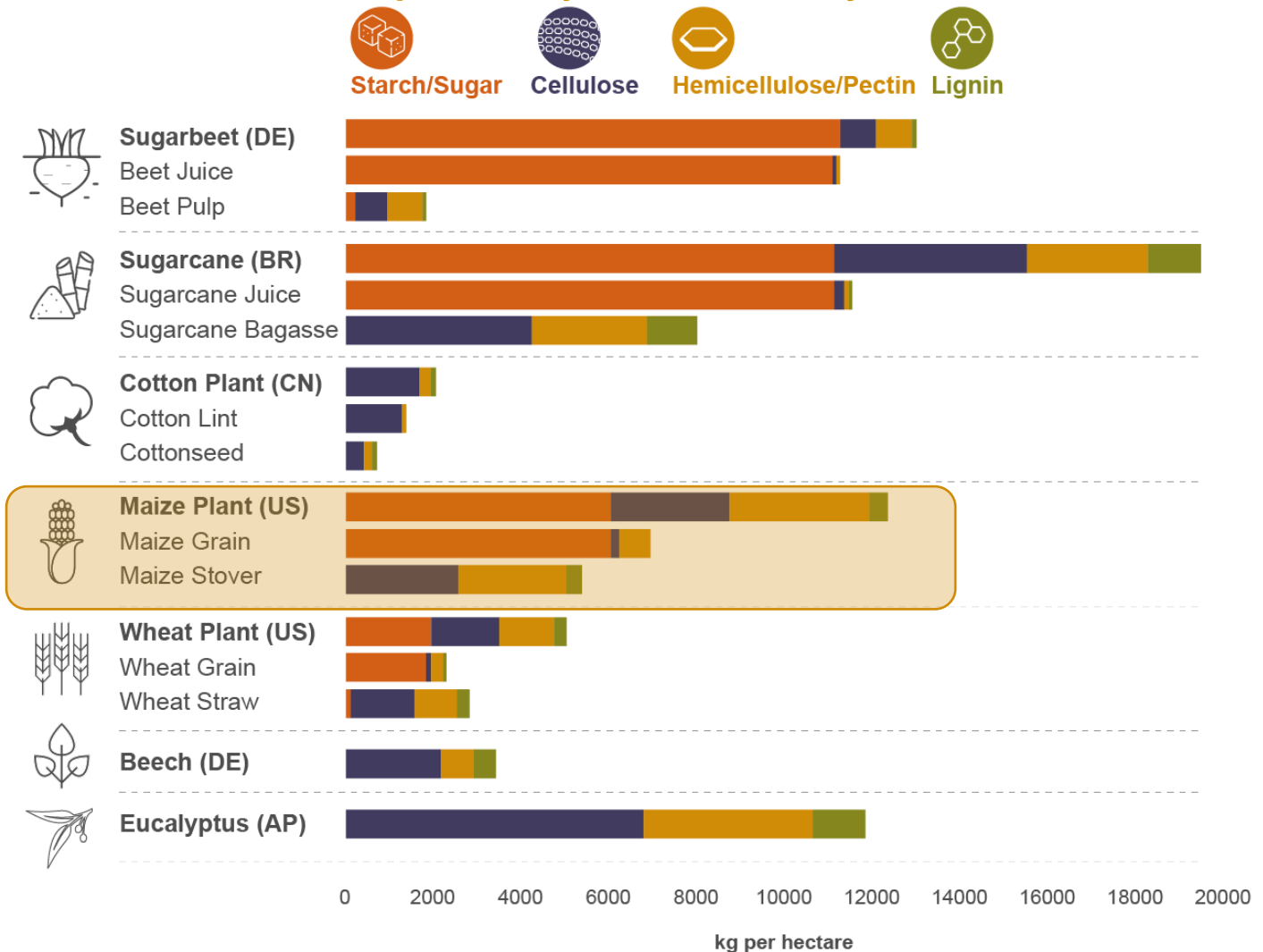
Renewable Feedstocks

1st generation carbohydrate crops are currently the most resource efficient, renewable feedstocks

Biomaterial products require efficient access to sugars for efficient production

- **Hard to Access:** 2nd generation carbohydrate crops do not enable efficient access to the required sugars for biomaterials production.
- **Increased Complexity:** 2nd generation feedstocks require complex innovation to access the required sugars.
- **Lack of Consistency:** 2nd generation feedstocks do not offer a consistent supply of sugars adding in variability to the manufacturing process
- **LCA:** 2nd generation feedstocks do not guarantee a lower environmental impact through the extra processing required to access the sugars
- **Cost:** There are currently no government incentives to offset the additional cost and innovation required of trying to access sugars from 2nd generation feedstocks

Crop Carbohydrate Efficiency



Source: DuPont LCA group;
Sugar as feedstock for the Chemical
Industry, Nova Institute (2019)

Our Process



Harvest

Renewably sourced corn feedstocks are harvested, dried and then wet-milled to create a range of carbohydrate rich feedstocks such as glucose.



Fermentation

Glucose is converted into 1,3 propanediol using a patented microorganism under exact temperatures and conditions in our fermenters.



Refining

The 1,3 propanediol is refined to a final purity of $\geq 99.7\%$ by deactivating and removing the microorganism, water, and other byproducts.

U.S. Industrial Field Corn vs. Sweet Corn



U.S. Industrial Field Corn:

- 90.6 mm planted acres
- 14.2 b bushels produced
- Crop Value: \$51.9 b

U.S. Industrial Field Corn Facts:

- Grown on over 99.7% of U.S. corn field acres
- Produced for ethanol, livestock feed, sweeteners and other manufactured goods
- Considered a grain
- Harvested when kernels are dry and mature
- There are fewer acres of industrial corn planted today than in 1938.

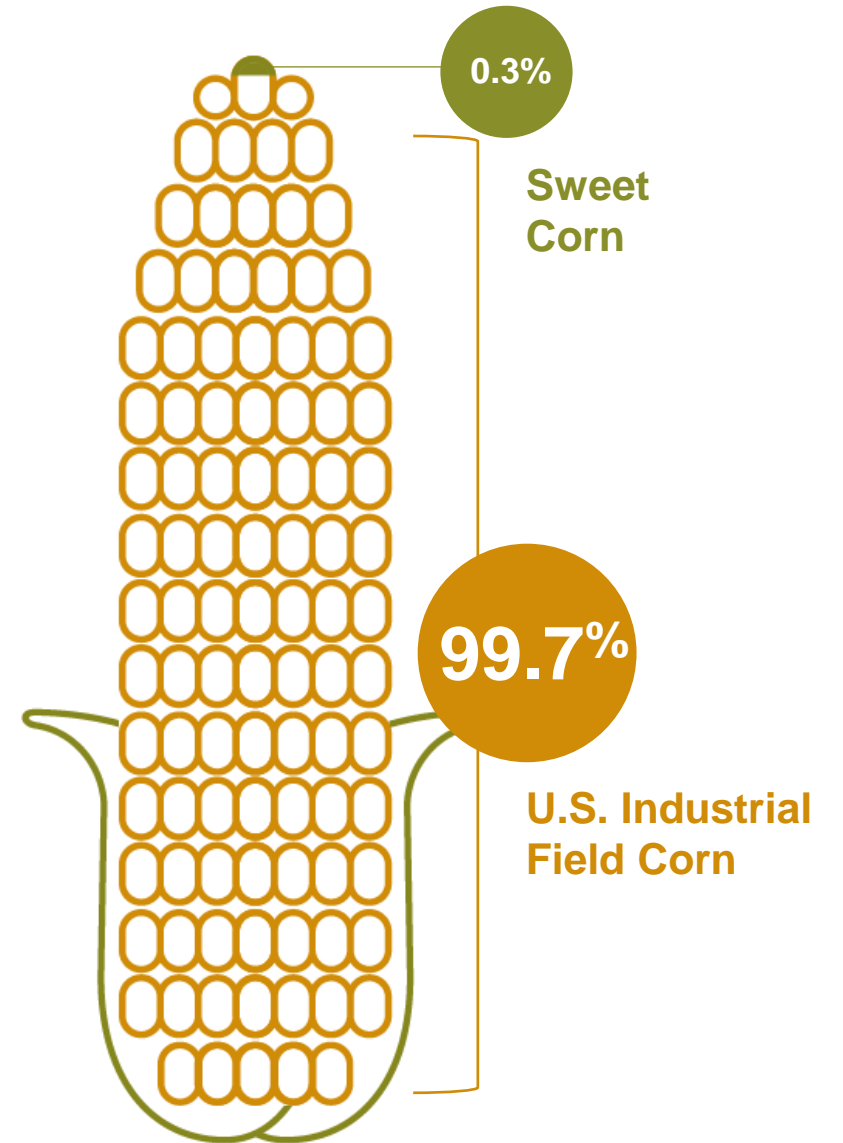


Sweet Corn:

- 242.1k planted acres
- 37.9 mm bushels produced
- Crop Value: \$787.6 mm

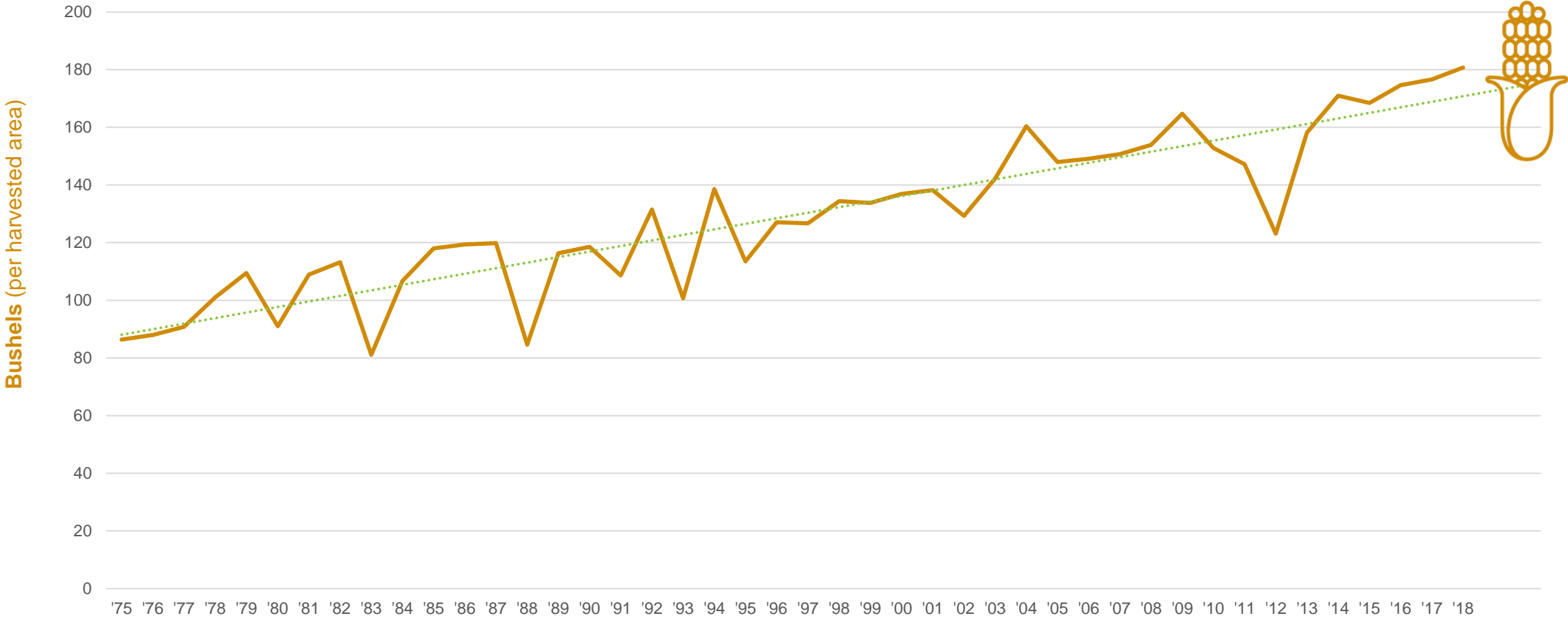
Sweet Corn Facts:

- Grown on less than 0.3% of U.S. corn field acres
- Consumed by humans
- Considered a vegetable
- Harvested when kernels are soft and immature



Crops such as U.S. industrial field corn have seen year-over-year yield improvements, keeping land use stable as production has increased.

U.S. Industrial Field Corn Yield: 1975-2018



Source: ProExporter Network

Sustainability Starts With Responsible Farming: Truterra Partnership Program

Delivering insights integrated with 26 USDA conservation practices:

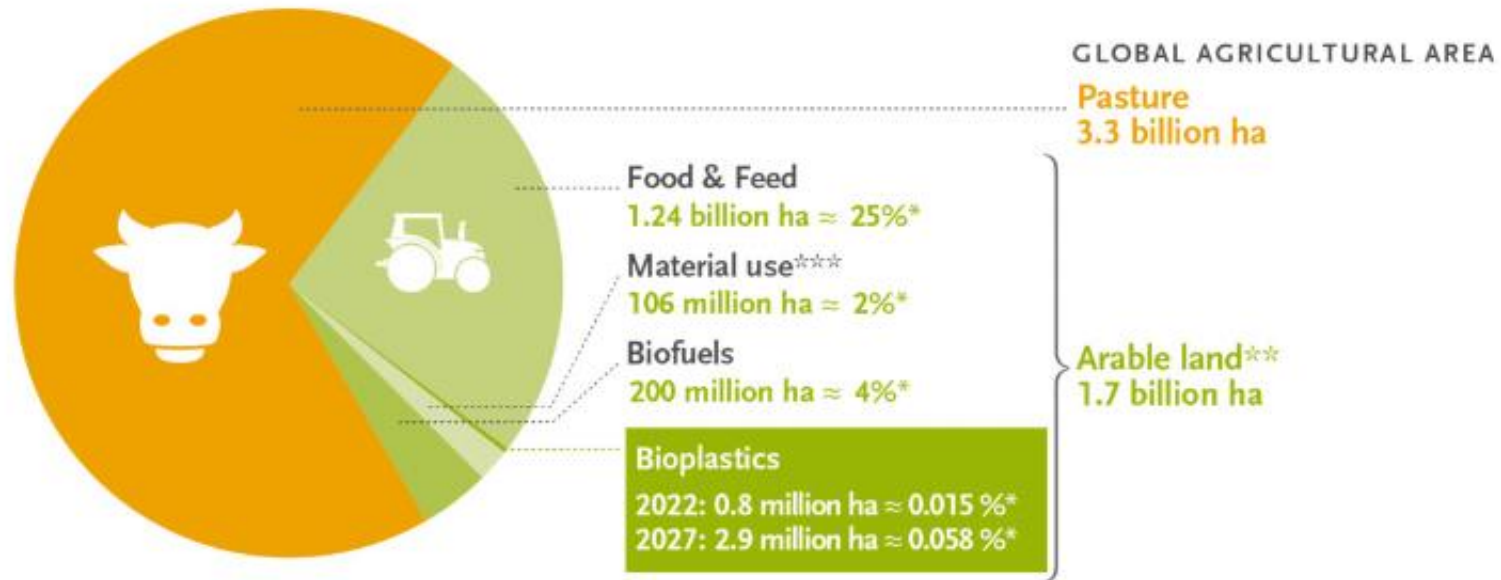
- No-till farming
- Crop rotation
- Cover crops
- Optimized fertilizer and pesticide use
- Contour conservation management

100%

Of our dent corn substrate footprint covered by the Truterra program

- 50,000 acres
- 243 fields
- 175 growers

Land Use Estimation For Bioplastics 2022 and 2027

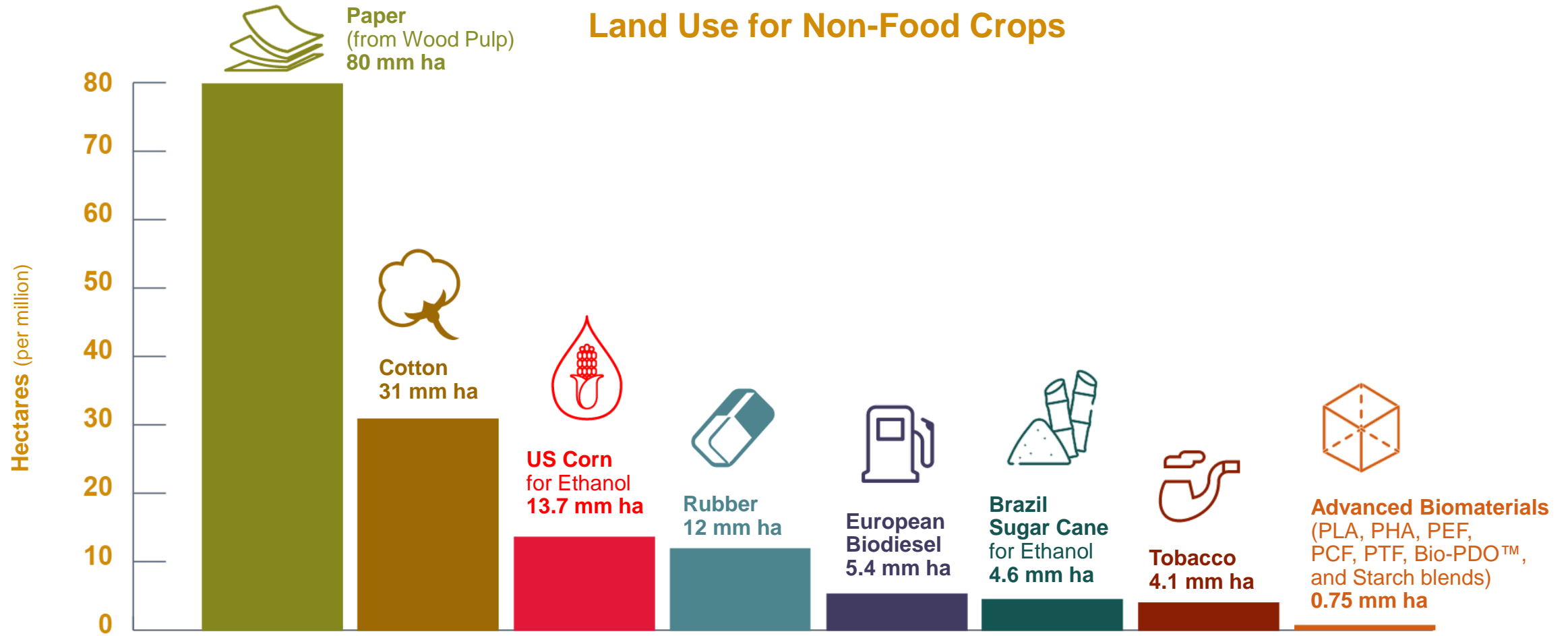


Source: European Bioplastics (2022), FAO Stats (2020), nova-Institute (2022), and Institute for Bioplastics and Biocomposites (2019), University of Virginia (2016). Info: www.european-bioplastics.org

*In relation to global agricultural area, ** including approx. 1% fallow land, *** Land-use for bioplastics is part of the 2% material use

*Source: World plastics production 2021, Plastics Europe, 2022.

For Centuries, We've Used Land to Grow Non-Food Crops for Everyday Products



Source: IfBB 2016 Bioplastics facts and statistics; FAO 2012, Land use per m³ wood perecoinvent; FAO, 2009-2013; US DOE AFDC, USDA 2015; www.sugarcane.org; OECD/FAO Agricultural Outlook 2015

Sustainability Starts With Responsible Farming: Truterra Partnership Program

Susterra® sustainability metrics

Susterra® PDO is made from **100% renewably and responsibly-sourced** plant based ingredients

Susterra® PDO

100%

Renewable content by weight

Petroleum based BDO

0%

Renewable content by weight

Manufacture of Susterra® PDO uses **46% less non-renewable** energy vs equal amount of petroleum-based BDO.

56

MJ/kg nonrenewable energy consumption

104

MJ/kg nonrenewable energy consumption

Manufacture of Susterra® releases **48% less GHG** emissions vs. petroleum-based BDO.

2.5

Kg CO₂ equivalents/kg

4.8

Kg CO₂ equivalents/kg

Sustainability Starts With Responsible Farming: Truterra Partnership Program

Susterra® sustainability metrics

Susterra® PDO is made from **100% renewably and responsibly-sourced** plant-based ingredients

Susterra® PDO

100%

Renewable content by weight

Petroleum-based propylene glycol

0%

Renewable content by weight

Manufacture of Susterra® PDO uses **41% less non-renewable** energy vs equal amount of petroleum-based propylene glycol.

56

MJ/kg non-renewable energy consumption

95

MJ/kg non-renewable energy consumption

Manufacture of Susterra® releases **42% less GHG** emissions vs. petroleum-based propylene glycol.

2.5

Kg CO₂ equivalents/kg

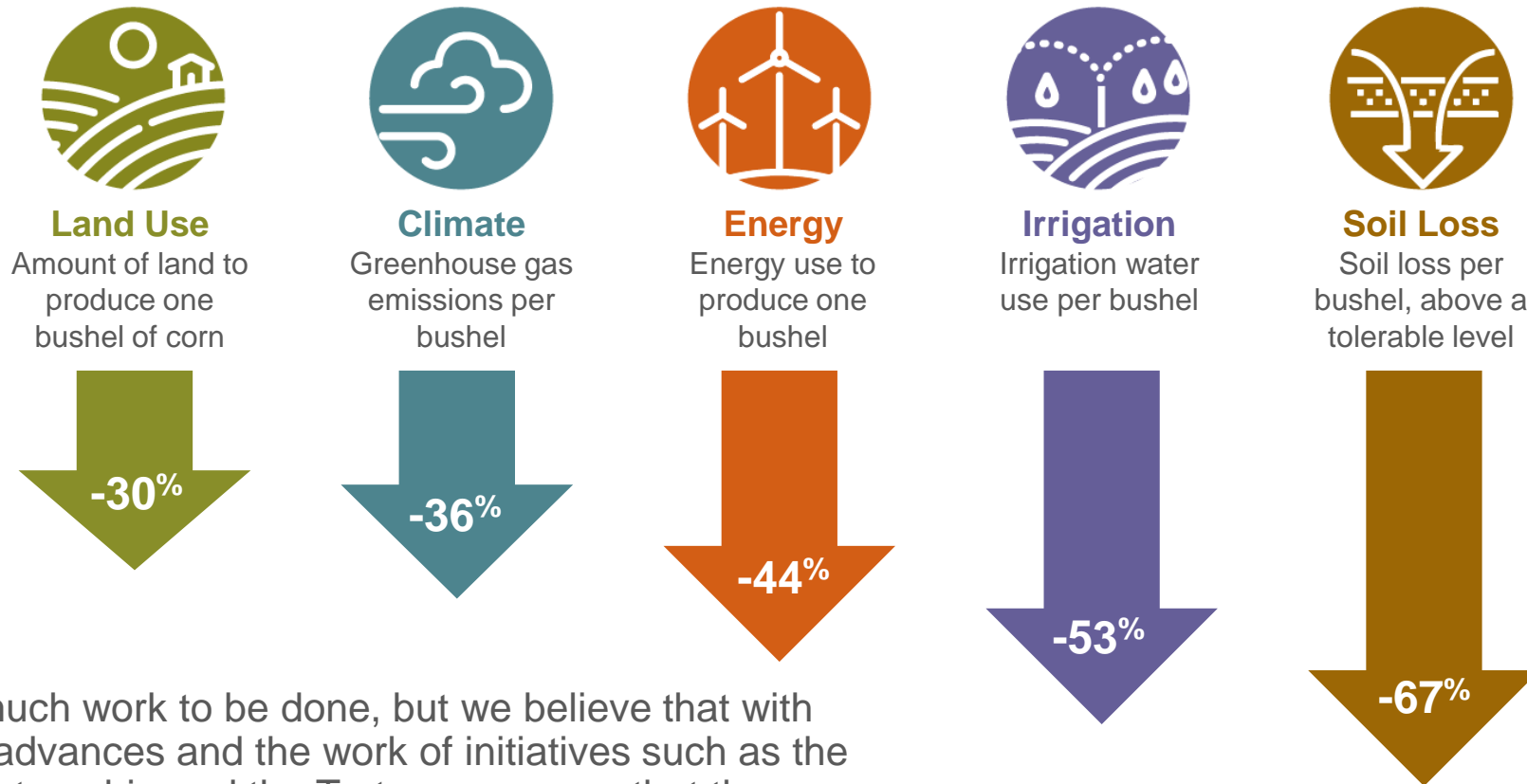
4.3

Kg CO₂ equivalents/kg

As Corn Production Has Become More Efficient, Environmental Impacts Have Significantly Declined

Advances in high-yield agriculture have increased resource efficiency (per bushel) across all key environmental impact measures with decreases in per bushel.

U.S. Industrial Field Corn's Impacts: 1980-2011



There is still much work to be done, but we believe that with technological advances and the work of initiatives such as the Soil Health Partnership and the Truterra program that these numbers will continue to fall over time.

Source: National Corn Growers Association; Field to Market

When Performance and Sustainability Matters, Choose Susterra® Propanediol



Performance Polymers

Susterra® propanediol is a road-ready ingredient in footwear, outdoor apparel, performance gear, and more, combining flexibility, durability, and sustainability across a range of TPU, PU, and other synthetic materials.



Functional Fluids

A wide range of fluid applications – from heat-transfer fluids to engine coolants – can benefit from the favorable viscosity and thermal stability of Susterra® propanediol.



Coatings, Inks, & More

Combining exceptional cohesion properties and recyclability, Susterra® propanediol brings sustainable performance to coil coatings, polyurethanes, inks, wood coatings, metal coatings, adhesives, elastomers, and more.

Why using 100% bio-based Susterra and Zemea 1,3-Propanediol?

- **Renewable**
- **Lower Footprint**
- **Scalable to mainstream today already**
- **Range of Applications**
- **Safe & USDA certified**

Questions?

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BRAND PORTFOLIO

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