POPULATION GROWING AT 1.1% EACH YEAR

Source: UN Population Division, Monsanto analysis
INCOMES GROWING AT 3.5% PER YEAR...
$5 BILLION PER DAY

Source: IHS Global Insight, Agriculture Division, Monsanto analysis
FOOD DEMAND GROWING AT ~1.75% EACH YEAR

Source: IHS Global Insights, Agriculture Division, Monsanto analysis
WATER DEMAND IS GROWING AT ~2% PER YEAR

Source: McKinsey Resource Revolution 2011, Monsanto Analysis
ENERGY DEMAND IS GROWING AT 2.5% PER YEAR

Source: McKinsey Resource Revolution 2011, Monsanto Analysis
GLOBAL ENERGY DEMAND EXCEEDS GLOBAL FOOD DEMAND

ENERGY Consumption
917.2 quad BTUs / yr
2.3 E 17 kcal / yr

FOOD Consumption
3050 kcal / day
1.0 E 16 kcal / yr

BIOENERGY Will Only Be A Small Part Of The Global Energy Supply

Source: FAO, EIA and Monsanto Estimates
GLOBAL PROTEIN DEMAND IS INCREASING

Source: FAO
POULTRY DOMINATES GLOBAL LIVESTOCK

Global Livestock

Poultry, Meat, Broiler

Source: USDA Estimates

Source: FAO
MANY TOOLS ARE USED TO INCREASE AGRICULTURAL PRODUCTIVITY

**BREEDING**
Highest yielding genetics for the environment: conventional breeding gains and natural disease resistance

**BIOTECHNOLOGY**
Complementary agronomic and yield-enhancing traits

**PRECISION AGRICULTURE**
Optimizing farm management practices, including rotations, soil management, cover crops

**BIOLOGICALS**
Derived from natural materials to support plant health and pest protection

**CROP PROTECTION**
Seed treatments and selective chemistries protect the crop from pests, weeds and diseases
THE FUTURE: CORN FARMERS WILL LEVERAGE TECHNOLOGY AND INFORMATION TO IMPROVE YIELDS

**Software:**
- Agronomy Apps to enable Hybrid Selection & Mapping

**Variable Rate Fertility**
- Variable rate N, P & K “Apps” aligned with yield management zones

**Precision Seeding**
- Planter hardware systems enabling variable rate seeding & row spacing of multiple hybrids in a field by yield management zone

**Fertility & Disease Management**
- “Apps” for in-season custom application of supplemental late Nitrogen and Fungicides

**Yield Monitor**
- High Resolution yield monitoring hardware with auto-calibration, harvest management, and compaction removal

**Breeding**
- Orders of magnitude more data points per year to increase genetic gain
CORN YIELDS, ENABLED IN PART BY INNOVATIONS IN TECHNOLOGY, CONTINUE TO ACCELERATE

Yield, MT/Ha

Source: Crop Science. Vol 46:528-543, USDA
AGRICULTURE’S CHALLENGE
to grow more feed and fuel safely and sustainably.

- Grow more food from less land
- Sustainably reduce water and chemical use
- Maintain and build healthy soil
- Mitigate the impact of drought
- Reduce the amount of energy and emissions per unit produced
ENERGY CROPS PRODUCE OIL AND / OR CARBOHYDRATES

- GJ/ha Lignin
- GJ/ha Cellulosics
- GJ/ha Byproduct (meal, etc)
- GJ/ha Protein
- GJ/ha Oil
- GJ/ha Fermentable Sugar/Starch

Crop types include sugarcane, corn, switchgrass, jatropha, rapeseed, soybeans, camelina, and canola.
THE AMOUNT OF PROTEIN PRODUCED PER UNIT LAND IS CRITICAL TO MEET FEED DEMAND

$gJ/ha$ Protein

corn kernel

corn stover total

soybeans

sugarcane cane

Miscanthus

sugarbeet root

wheat grain

canola (seed)

rapeseed Europe seed

rice (hulled grain)
CORN ETHANOL PRODUCTION HELPS TO CONCENTRATE CORN PROTEIN

<table>
<thead>
<tr>
<th></th>
<th>% Crude Protein</th>
<th>Metabolizable Energy, Poultry, kcal/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canola Meal</td>
<td>36.9</td>
<td>1.75</td>
</tr>
<tr>
<td>DDGs</td>
<td>27.1</td>
<td>2.53</td>
</tr>
<tr>
<td>Corn, Grain</td>
<td>9.1</td>
<td>3.31</td>
</tr>
<tr>
<td>Soybean Meal</td>
<td>45.7</td>
<td>2.33</td>
</tr>
</tbody>
</table>
## Distillers Grains Soymeal Displacement Impacts Land Use

### Displacement Ratio, by Species (kg / kg)

<table>
<thead>
<tr>
<th></th>
<th>Dairy</th>
<th>Beef</th>
<th>Swine</th>
<th>Poultry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>0.731</td>
<td>1.196</td>
<td>0.699</td>
<td>0.589</td>
</tr>
<tr>
<td>Soybean meal</td>
<td>0.633</td>
<td></td>
<td>0.295</td>
<td>0.446</td>
</tr>
</tbody>
</table>

### Net acres corn required for ethanol

<table>
<thead>
<tr>
<th></th>
<th>Total Area, M acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total US Corn Production</td>
<td>87.7</td>
</tr>
<tr>
<td>Production for Ethanol</td>
<td>29.26</td>
</tr>
<tr>
<td>Distillers Grain – Corn Area Credit</td>
<td>(8.64)</td>
</tr>
<tr>
<td>Distillers Grain – Soy Area Credit</td>
<td>(7.47)</td>
</tr>
<tr>
<td>Corn “Net Acres”</td>
<td>13.14</td>
</tr>
</tbody>
</table>

Source: Shurson
TREATED CORN STALKS MAKE GREAT CATTLE FEED AND DEVELOP BIOMASS MARKETS

- Increased corn yield increases corn stalk yield
- Corn stalks can be sustainably removed
- Lime treated corn stalks displace a portion of corn in the diet
- Economics work – develops channel today
- Frees up 2.2 B bushels of corn for alternative use

<table>
<thead>
<tr>
<th></th>
<th>Corn Ration</th>
<th>CRF Ration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diet Percentage</td>
<td>3.90%</td>
<td>3.84%</td>
</tr>
<tr>
<td>Return per Steer</td>
<td>$90.54</td>
<td>$118.58</td>
</tr>
</tbody>
</table>

Heifers enjoying CRF 43M tons potential use
TOTAL CORN AND SOY PRODUCTION GROWING AT FASTER RATE THAN CALORIE

### Corn CAGR

<table>
<thead>
<tr>
<th>Metric</th>
<th>CAGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield</td>
<td>1.84%</td>
</tr>
<tr>
<td>Area</td>
<td>1.02%</td>
</tr>
<tr>
<td>Production</td>
<td>2.88%</td>
</tr>
</tbody>
</table>

### Soybean CAGR

<table>
<thead>
<tr>
<th>Metric</th>
<th>CAGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield</td>
<td>1.40%</td>
</tr>
<tr>
<td>Area</td>
<td>2.95%</td>
</tr>
<tr>
<td>Production</td>
<td>4.40%</td>
</tr>
</tbody>
</table>

Agricultural technology will continue to provide farmers with tools to increase yields.
ECONOMICS ARE THE PRIMARY DRIVER FOR BIOENERGY

<table>
<thead>
<tr>
<th></th>
<th>Annual Price Change 1900-2000</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>0.3 %</td>
<td>Discoveries, OPEC</td>
</tr>
<tr>
<td>Food</td>
<td>-0.7 %</td>
<td>Grain yield increase</td>
</tr>
<tr>
<td>Water</td>
<td>0 %</td>
<td>Subsidies</td>
</tr>
</tbody>
</table>

Bioenergy Boom
Innovations in agriculture, and particularly methods to improve yields of concentrated protein for animal feed are required to meet future feed and fuel demands.