



2019 Annual Meeting & Exhibits

April 7 – 9, 2019
Amelia Island, FL

Sustainable Approaches to Climate Change

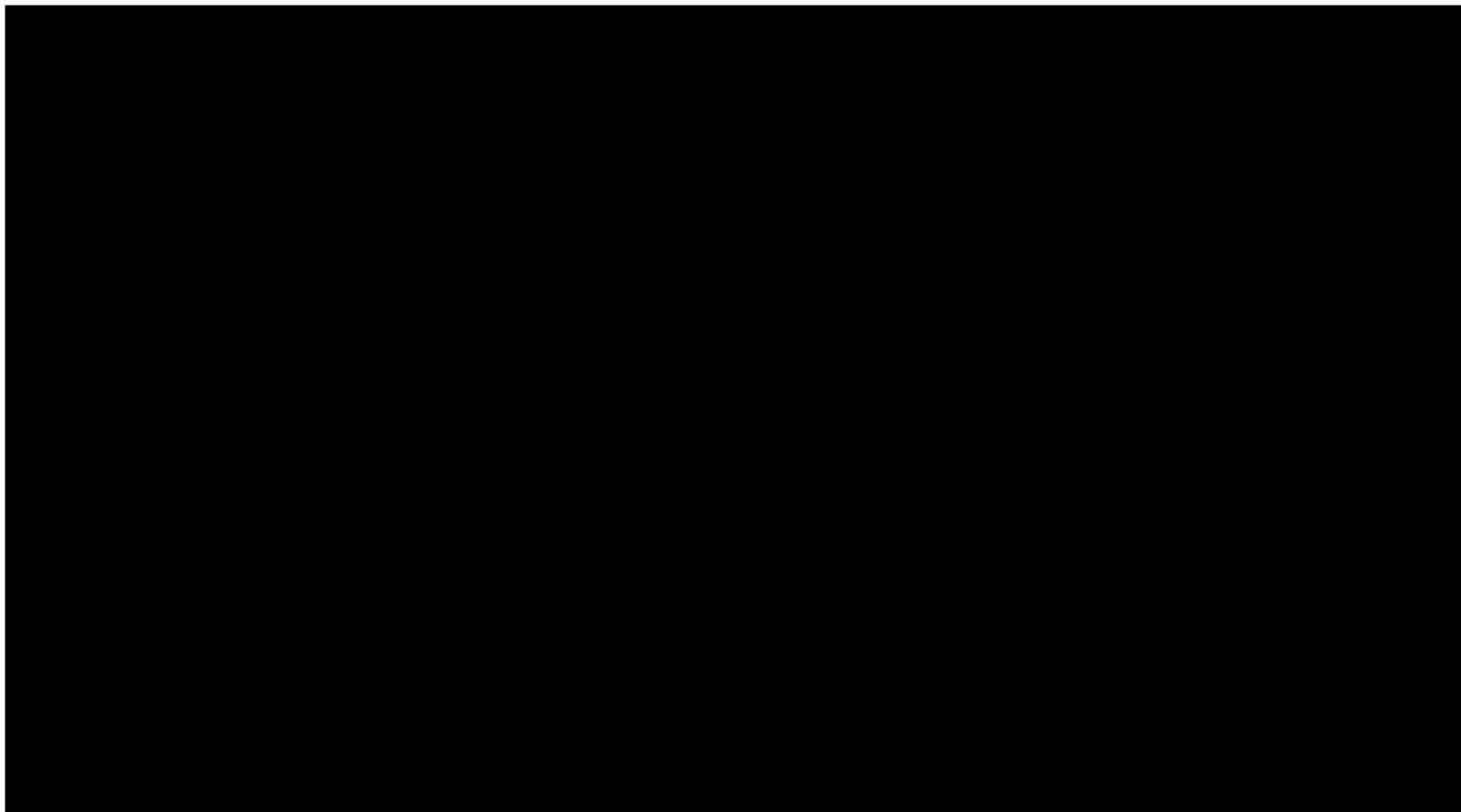
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Agenda

- Climate change: The Big Picture
- Climate Change Impacts on Spices
- How Spice Producers Can Mitigate the Risks of Climate Change
 - *Crop management strategies*
 - *Processing plants*
- Summary: The Business Case for Spice Producers to Address Climate Change

Welcome to the Anthropocene



Climate change is taking place rapidly, with severe impact on the agriculture industry and developing economies

Climate change could have disastrous effects on the environment, with significant economic implications

Generally, developing economies are more susceptible to climate-related risks



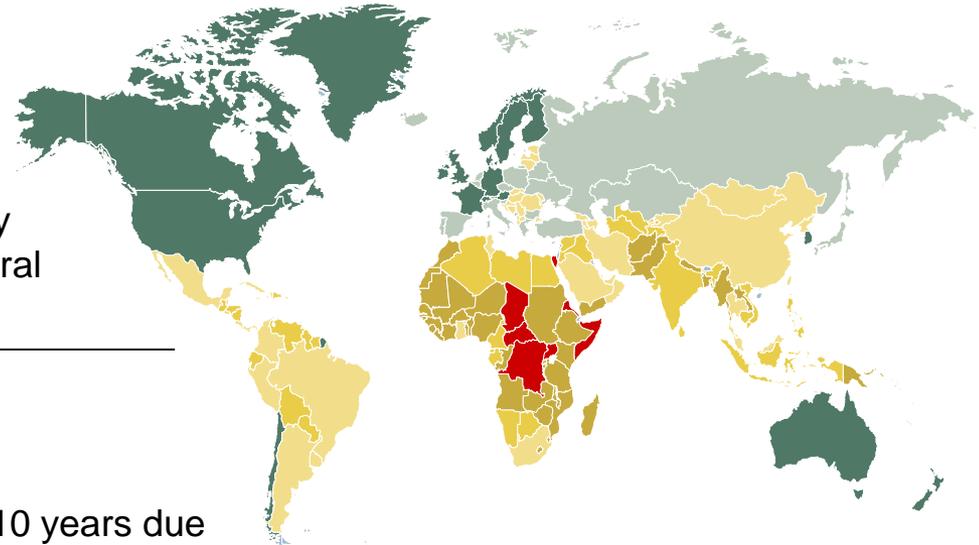
Extreme, erratic weather patterns



Rising sea levels



Increasingly frequent natural disasters



-  Very susceptible
-  Susceptible
-  Intermediate
-  Less susceptible
-  Least susceptible

Significant costs to economies

Over \$240B in the US alone over the last 10 years due to extreme weather events

Slower global GDP growth

Worst case scenario estimated at **~1% lower p.a.**

With severe impact on:

Weather-dependent industries such as **agriculture**
Developing nations and **tropical countries**

Global Extreme Weather Events Are Accelerating

Canada & Great Lakes 2019: Polar vortex hits; temps as low as -40F

Europe 2018: Scandinavia record high temps; wildfires in Sweden

India 2018: heatwaves – temps above 45C, freak duststorms in Rajasthan; extreme rainfall (Kerala State +275% rainfall in 7 days); 14 deadly cyclones

Midwest U.S. 2019:
River flooding inundates the Northern Plains

California 2010-2019:

- 2010-2016 drought
- 2017: 100-year rain
- 2018: 5 largest & deadliest wildfires in history
- 2019: record snowpack

South America 2019: World's driest desert flooded; wettest woodlands burned in Chile; Record high temps in Argentina & Brazil

MENA 2018: Record high temps exceed 51C; 4th hottest year on record all since 2000; Alexandria floods due to rising sea levels

Vietnam 2018: 80% of avg. annual rainfall occurs in just 10 days in Ha Tinh province.

Australia 2019: hottest month ever - extreme heat reaches nearly 50C and mean temps exceed 30C

Mozambique 2019: Cyclone Idai is the deadliest storm in Southern Africa in 3 decades; killing 600



Cross-governmental efforts have been established to mitigate the potential damages

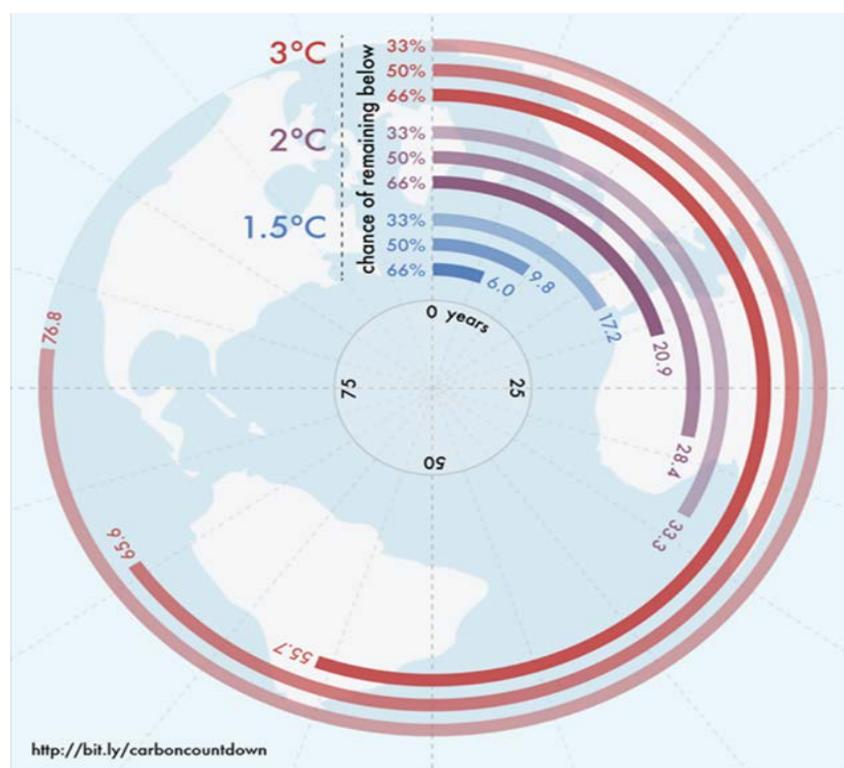
Paris Agreement

- Established in 2015, brought nations together for the first time to **collectively undertake to combat climate changes**
- The main goal was to **keep temperature rise within the 2°C target, and pursue efforts to limit the rise to 1.5°C**
- Many countries were found to have **insufficiently strong pledges**. With current pledges, there will likely be a **minimally 3°C** warming by 2100
- Worse, **countries are not on track** of meeting their pledged targets.

IPCC's special report on Global Warming of 1.5°C

- There will be **significant negative consequences** to critical natural and social systems that humanity relies on in a 2°C scenario.
- We require **radical and urgent transformation** of all systems at an unprecedented scale. In other words, we need much **more than a simple technological fix**.

Chance of global temperature increase remaining below 1.5°C, 2°C and 3°C based on current GHG emissions



The agriculture sector is susceptible to climate change, with lower crop yields and quality, and higher prices

Impact of climate change on agriculture



Lower crop yields

Negative impact on crop yields due to:

- Increased occurrence of pest attacks and diseases
- Weather extremities such as droughts and floods
- Reduced suitable cultivation area

Lower production level is unlikely to meet projected demand for food, resulting in **global food shortages**



Lower crop quality

Key components of agricultural production such as nutrient cycling and waste decomposition will be **undermined or lost through climate change**, resulting in low quality crop yields

For example, growing rice, wheat or barley in high CO₂ concentration results in 10-14% lower protein content



Higher production costs

Higher supply chain costs, particularly refrigeration and transport are expected with rising global temperatures

Labor costs are expected to increase due to lower productivity in higher temperature environments



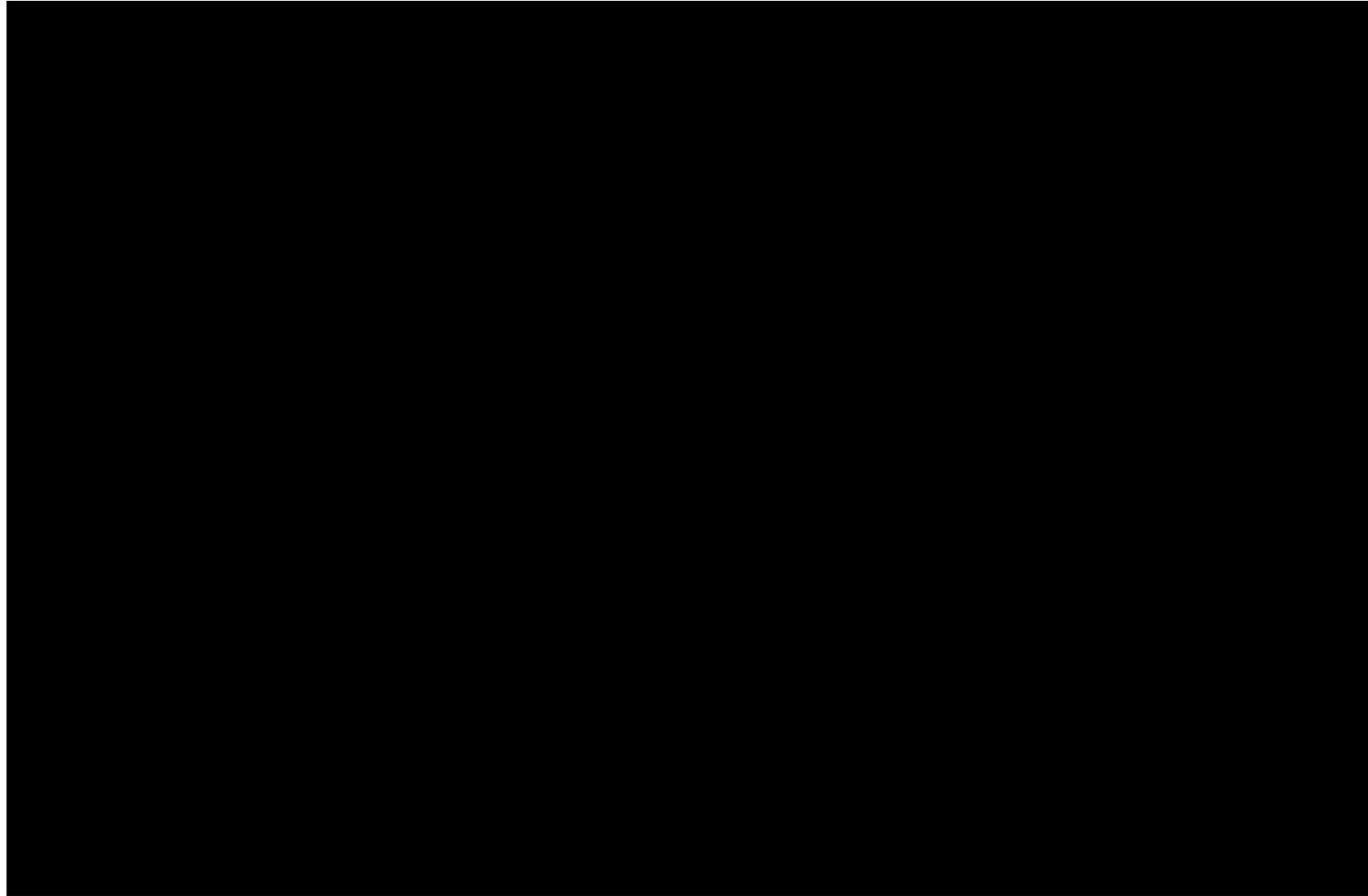
Higher prices

Price rises are expected across crops driven by food shortage, resulting in an imbalance between food supply and demand

By 2050, price of the following crops are expected to rise:

- Rice by 37%
- Maize by 55%
- Wheat by 11%

Climate Change Impacts on Spice Crops



Climate Change Impacts on Spice Crops

- Temperature, sunshine hours, and photoperiods impact growth stages including: flowering, fruit setting and fruit development, seed setting, and final reproductive and vegetative yields
- Timing of rainfall and humidity increases prevalence of weeds, pests, and diseases which decreases yields, increases costs, and reduces storage life
- Prolonged drought and arid conditions affect availability of water and water quality including prevalence of salts that drives down yields in most crops
- Extreme and violent conditions such as high winds, hail, frost, snow, and landslides can completely destroy entire crops
- Increased competition for land, increased prices for water and energy

Tip Burn



Wind Erosion



Seeders & Weeds



Climate Change Impacts on Spice Crops



Black Pepper: high temperatures cause spike shedding



Garlic: requires certain chill hours for seed setting and rain at the wrong time of year causes garlic to shatter, lose root plate, and an increase in mold



Cardamom: prolonged drought causes abortion of flowers



Seed spices such as coriander, fenugreek, cumin affected by powdery mildew



Onions: sudden temperature drops results in bolting

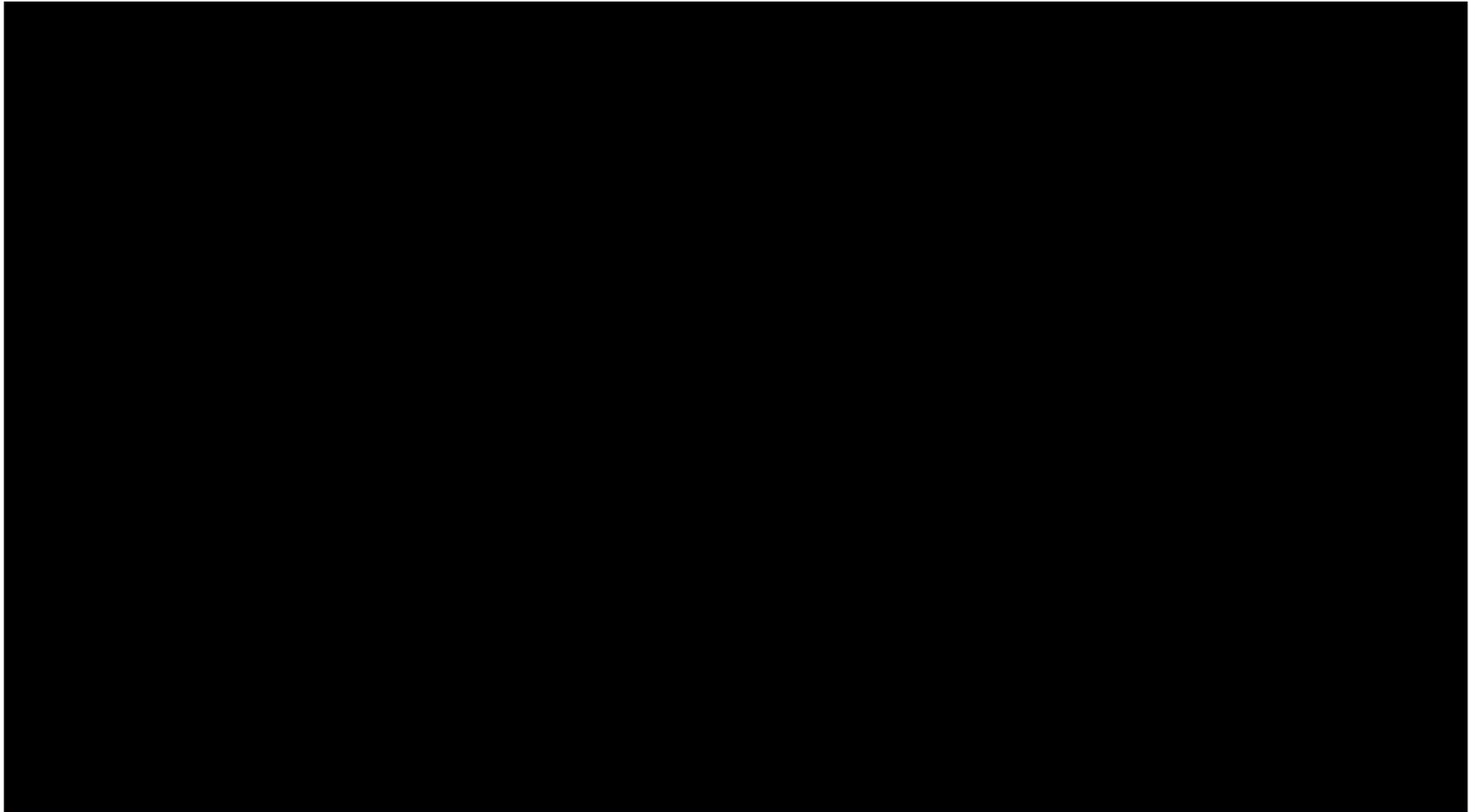
Climate Change Impacts on Spice Crops



Prolonged drought caused heat, wind, salt, and disease damage in U.S. chilies in West Texas and New Mexico



Mitigating Climate Change Impacts: Effective Crop Management



Mitigating Climate Change Impacts: Effective Crop Management

- Evolving and adapting crop types, shifting growing regions and long-range planning
- Shade trees and reforestation initiatives
- Water Stewardship
 - *Establish reservoirs and above ground storage*
 - *Drip irrigation conversion and automated systems*
 - *Groundwater re-charge*
- Integration and training on Good Agricultural Practices (GAP)
 - *Integrated Pest Management (IPM)*
 - *Soil Management – mulching, composting and green manuring, cover crops, incorporation of crop residues, minimal and zero-till practices,*
- Climate Smart Agriculture
 - *Technology: geospatial and thermal imagery and hyper-spectral cameras; dendrometers, weather stations, etc.*
 - *Lower carbon footprint: proximity to processing plants, low carbon fuels in farm machinery, on-farm renewable energy sources such as solar*
- Post Harvest Management
 - *hermetically sealed bags*
 - *cold storage*
 - *investment in rural infrastructure*
- Genetics – research and breeding of crops that can adapt to climate change through disease resistance and drought tolerance

Reducing Emissions and Other Risks Through Efficient Processing

There are many opportunities to reduce the impacts of climate change in processing operations

- Install energy-efficient lighting throughout factories and warehouses
- Implement metering systems on wells and driers to measure water and energy usage
- Reduce transport to processing plants and review fleet fuel requirements; identifying opportunities to improve fuel-economy
- Establish an energy and/or sustainability champion at each plant who is responsible for identifying practical measures to conserve resources
- Develop a strategic energy management plan develops a roadmap of actions that can be taken and will prioritize projects based on cost and impact
- Convert to renewable energy sources such as solar
- Join the Carbon Disclosure Project (CDP) and begin disclosing
- Consider a Scope 1, 2, or 3 GHG emissions assessment to understand your footprint
- Consider Alliance for Water Stewardship Certification



ALLIANCE FOR
WATER STEWARDSHIP





The Business Case for Addressing Climate Change

Spice Producers can't afford **NOT** to understand and invest in climate change mitigation strategies

- Climate change drives up production costs
 - *Increased costs of farm inputs*
 - *Lower yields and quality*
 - *Higher energy costs*
- Investors are looking to invest in companies that can mitigate risks; often offering incentives for companies with effective climate change strategies
- Government grants are available to incentivize and offset costs
- Reputational risks for poor practices may be difficult to quantify but are real and can lead to long-term brand damage
- Leading companies enjoy a more engaged workforce
- Sustainability is a differentiator in the marketplace
- Understanding climate change and its effects on food trends (e.g. rise of plant-based diets) opens up new product and market opportunities for spice producers