Improving crop productivity for higher yields and grower returns

- 9 Billion population by 2050 with expectation of a higher standard of living
- 60% of crop losses due to abiotic (environmental) causes
- Shrinking arable land area, increasing temperature and changing climate
Crop Microclimate Management (CMM)

- Founded 2006
- Active in 42 countries
- Research-based company focused on productivity
- Currently two commercial technologies
- On-going program to develop more effective products
G3 Technology

• based upon dicarboxylic acids
  • Photon® first product
  • proven to increase yield (10-50%) and quality
  • low application rate of 2-40 grams per acre
  • one to seven applications per season depending upon the crop and use
• additional technology offerings in development
• US and international patents pending
Photon®

- works in almost all crops
- commercial (2 years some markets)
- commercially available active ingredients
- approximately 90% GM at $5-10 per acre grower price per application
- low application rate of 20-40 grams per acre
- plateau sales estimated at $200+ million per year
Photon increases crop productivity across diverse environmental conditions.
Field Crop Trial Results

**CORN YIELDS (4 TRIALS)**

- **CORN BU/A**
  - UNTREATED: 150 - 156
  - PHOTON 16 g/A: 153.925
  - PHOTON 16 g/A: 159.325

**Canola Yields, 7 Trials, Photon at Flowering, South Africa**

- **Yield (M/M/A)**
  - Untreated: 0.77
  - Photon 40 g/Ha: 0.86

**Cereal yields, flag leaf, 7 Trials**

- **Yield (bu/A)**
  - UNTREATED: 37.6
  - PHOTON 16 g/A: 43.8

**Soybean Yields (18 trials)**

- **Yield (bu/A)**
  - UNTREATED: 51.4
  - PHOTON 100 g/Ha: 54.6

Additionally, a mention of trials in 2012 and 2013 in NC, IA, AR, NE, OH, IL, AL, with a P<0.027 paired t-test.
G3 mode of action

The scientific literature shows that:

- Dicarboxylic acids exhibit high activity in reversibly inhibiting a key redox enzyme in various organisms
- The state of the reaction product activates/deactivates numerous plant enzymes and systems
- The literature describe over 400 enzymes are impacted by the change in this reaction

CMM position:

- G3 compounds impact a redox signaling compound, stimulating the plant's stress coping mechanisms to prepare for stress
CMM’s first Redox candidates: G3 Technology = Dicarboxylic Acids

Dicarboxylic Acids

Redox Regulatory Protein

Methionine Sulfoxide Reductase

Ca/Calmodulin

MAPK/MEKK Kinases

Stress Response: Salicylate, Jasmonate, Multiple Oxidative Responses

Various cascades multiply low rates to have large protective impacts

Chloroplast Proteins/Enzymes

Mitochondrial Proteins/Enzymes

Cytosolic Proteins/Enzymes

Polymerize to Chaperonin

Stabilize various cellular membranes

Reduced Cellular Damage
CMM future focus

• G3 technology one of several interacting productivity/stress coping pathways
• other chemistry identified that interacts with G3
• investigating the manipulation other of select proteins/enzymes that interact with G3 mode of action
• interactions with other products to induce specific crop responses
Plant productivity/stress solutions market

• nascent market with increasing focus
  • primarily US at present
  • GMO approach in major crops
  • use of pesticides for "Plant Health" dominated by majors
• promotion of non-science based products
• grower unfamiliarity
CMM Partnership interests

• accelerate market penetration:
  • increase awareness of technology
  • improve support - "boots on the ground"
• support research and development program
  • additional G3 products and use patterns
• complimentary biochemical mediators/parallel pathways