

Safeguarding Water Resources Through Nutrient Recovery

TFI - Fertilizer Industry Round Table

November 21, 2013

Fredric "Fritz" Corrigan, Chairman

Ostara Nutrient Recovery Technologies



Ostara Nutrient Recovery Technologies, Inc.

Management



F. Phillip Abrary, CEO

Former CEO RTM; Practice lead PWC

Scott McDonald, EVP & CFO

Former Silicon Valley CEO, COO, CFO

Don Clark, EVP, Technology & Ops

Former COO & CTO, Cargill & Mosaic

Steve Wirtel, SVP, Tech Solutions Sales

Former EVP Sales, US Filter; Partner, Carollo

John Guglielmi, SVP, Fertilizer Sales

Former sales director, The Andersons

Dr. Dan Froehlich, VP, Agronomy

Former head of product innovation, Mosaic





Sustainable Water Stewardship

Innovative and Effective Resource Management



Essential nutrients, vital to the farming community, are discharged from wastewater treatment plants, polluting local waterways.





Recovering One Resource to Protect Another Growing Population = Increased Nutrient Pollution



Three million tons of phosphorus are discharged annually via human waste, worldwide.



Algae blooms, a result of nutrient-rich discharge give rise to oceanic dead zones, mostly found near urban centers. There are over 400 dead zones around the world





Ostara Nutrient Recovery - A Cost-Effective Nutrient Solution



Municipal
Wastewater



Fertilizer
Production



Food +
Beverage



Livestock
Waste



Biofuels



Global opportunity,
multiple applications

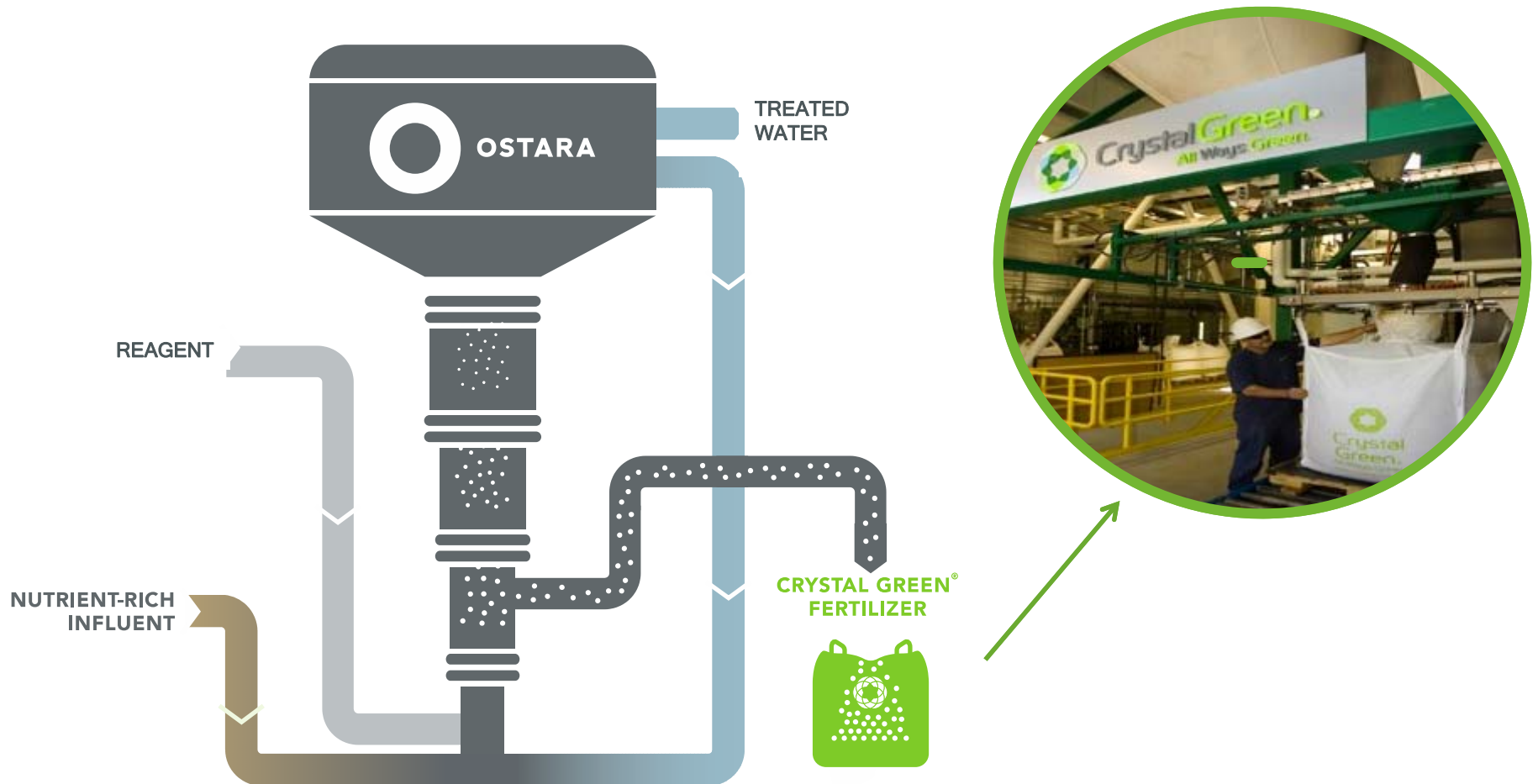
Ostara recovers
phosphorus & nitrogen
from wastewater
streams to produce a
slow-release, enhanced
efficiency fertilizer -
Crystal Green®





The PEARL[®] Process

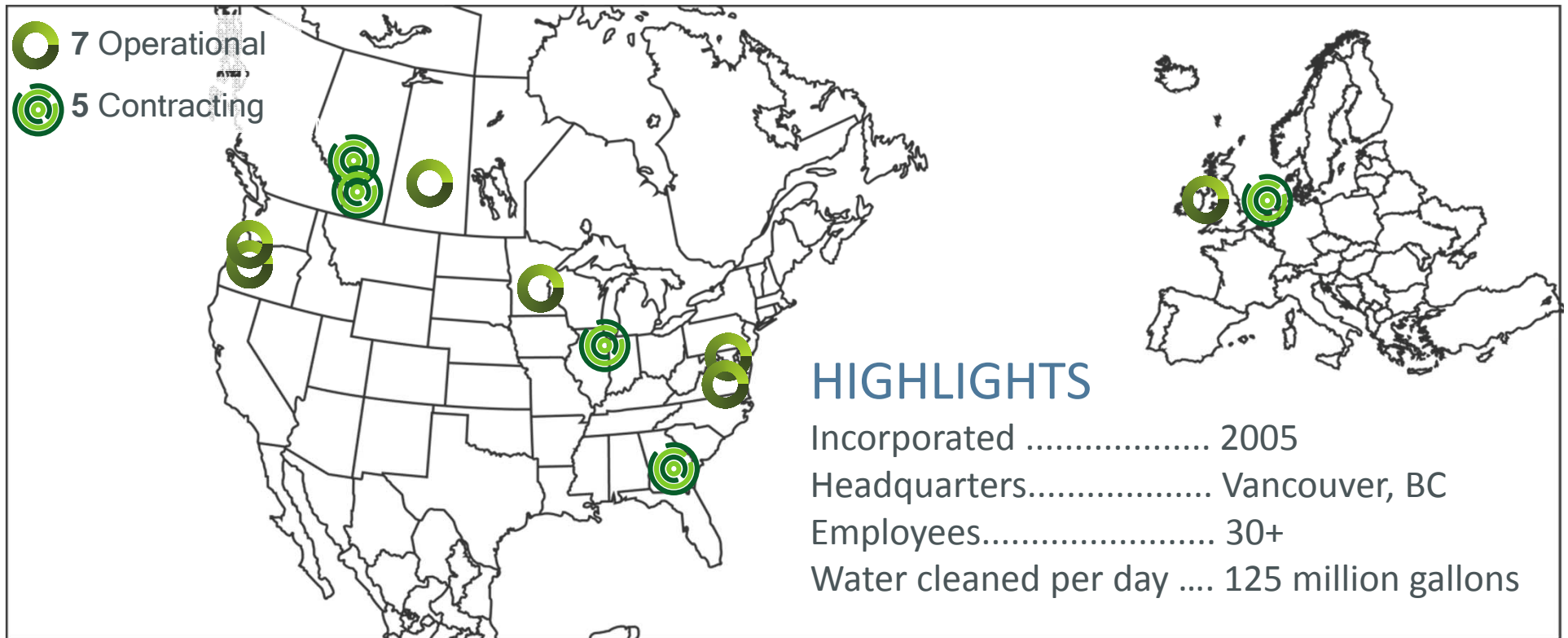
Efficient Nutrient Recovery





Helping Municipalities Solve Nutrient Issues

Cleaning Water + Producing Fertilizer Since 2005





Nutrient Recovery in the Municipal Sector

Chicago - Site of World's Largest Water Treatment Plant Implements Ostara's Pearl® System

- Awarded September 2013;
Start-Up Fall 2015
- Turning 14,000 gallons per minute of wastewater into premium fertilizer
- Recovering 15,000 tons of **Crystal Green®** annually





Mississippi River Watershed Drainage

The World's 3rd Largest Basin





Impact of Municipal Wastewater on the Mississippi River and the Gulf Dead Zone





Water Treatment for the Phosphate Industry



Cost-effective long-term treatment solution for phosphogypsum pond waters; an exciting opportunity to work together

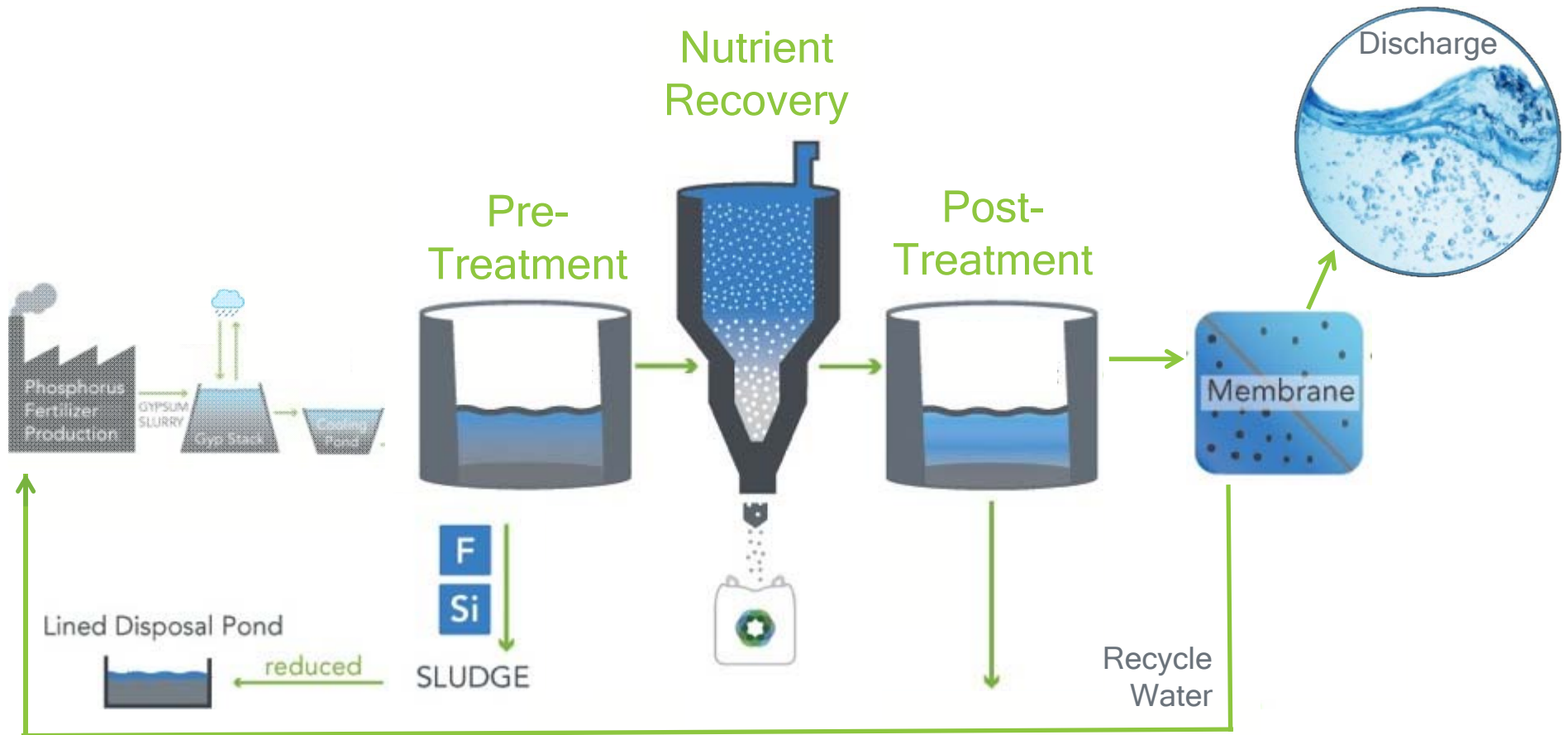


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Water Stewardship

Effective Pond Water Management + Nutrient Recovery





Pond Water Treatment Demo Project

Mosaic's Riverview Facility – March 2012 - August 2013



Sept 2012 discharge water quality targets achieved



March 2013 Crystal Green product quality optimization complete



July 2013 Economic optimization - reduced treatment cost to <\$20/1000 gallons with 15 year amortization



September 2013 System stress test and NNC targets.

Commercial sales strategy now initiated.





Effluent Quality Targets Met

Including new Florida Numerical Nutrient Criteria

- Outperformance of current effluent target criteria
- Requirements met for new NNC for West Central Florida Receiving Waters
 - 0.49 PPM TP, 1.65 PPM TN



	Aug-13	Target Limit	NNC Limit
TP (mg/L)	0.008	10	0.49
N-NH3 (mg/L)	0.48	*	
TN (mg/L)	1.2		1.65
Si (mg/L)	0.01		
F (mg/L)	8.03	10	
pH	6.8	6-8.5	
Conductivity (µS/cm)	58	1275	
Suspended Solids (mg/L)	0	50	





Attractive Economics 500 GPM Pearl Facility

Total Treatment Costs

<\$20 / per 1000 gallons treated

\$10 / 1000 gallons treatment fee

\$10 / 1000 gallons capital cost

@ 15 year amortization

Nominal Capacity	500 GPM
Capital Cost	\$30 M
Estimated Uptime	85-90%
Annual discharge flow	225,000,000 Gal
Amortization	15 Yr
Capital amortization	\$ 9/1000 Gal
Treatment Fee [in-kind]	\$ 10/1000 Gal
Total costs	\$19/1000 Gal

50% reduction in CAPEX, 20% reduction in OPEX*
*from original estimates





CrystalGreen® - 5-28-0 +10%Mg

Enhanced Efficiency from Recovered Nutrients

PHOSPHORUS WHEN CROPS NEED IT. PEACE OF MIND WHEN THEY DON'T.



Higher yields, better crop quality, minimized nutrient loss, through a slow-release phosphorus product

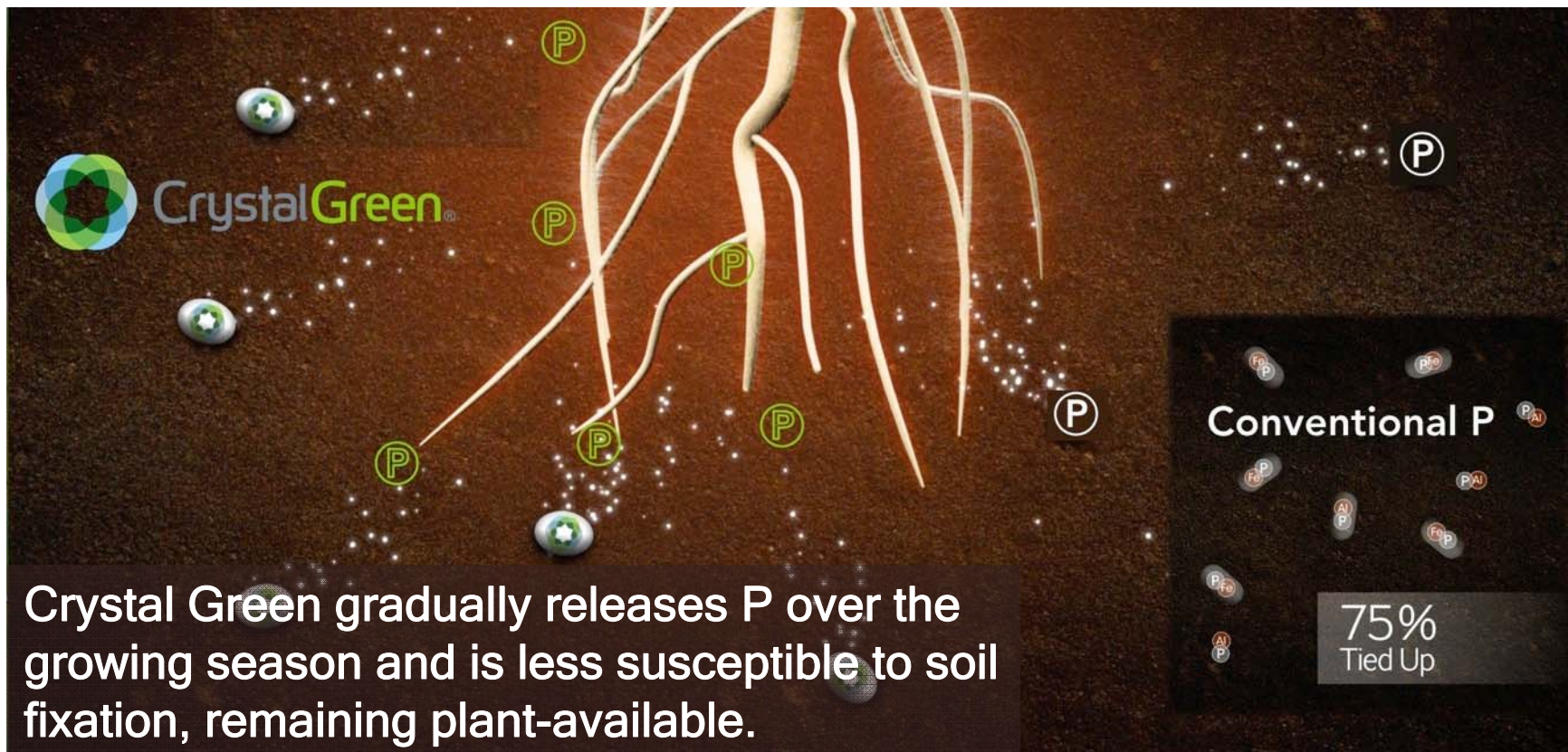


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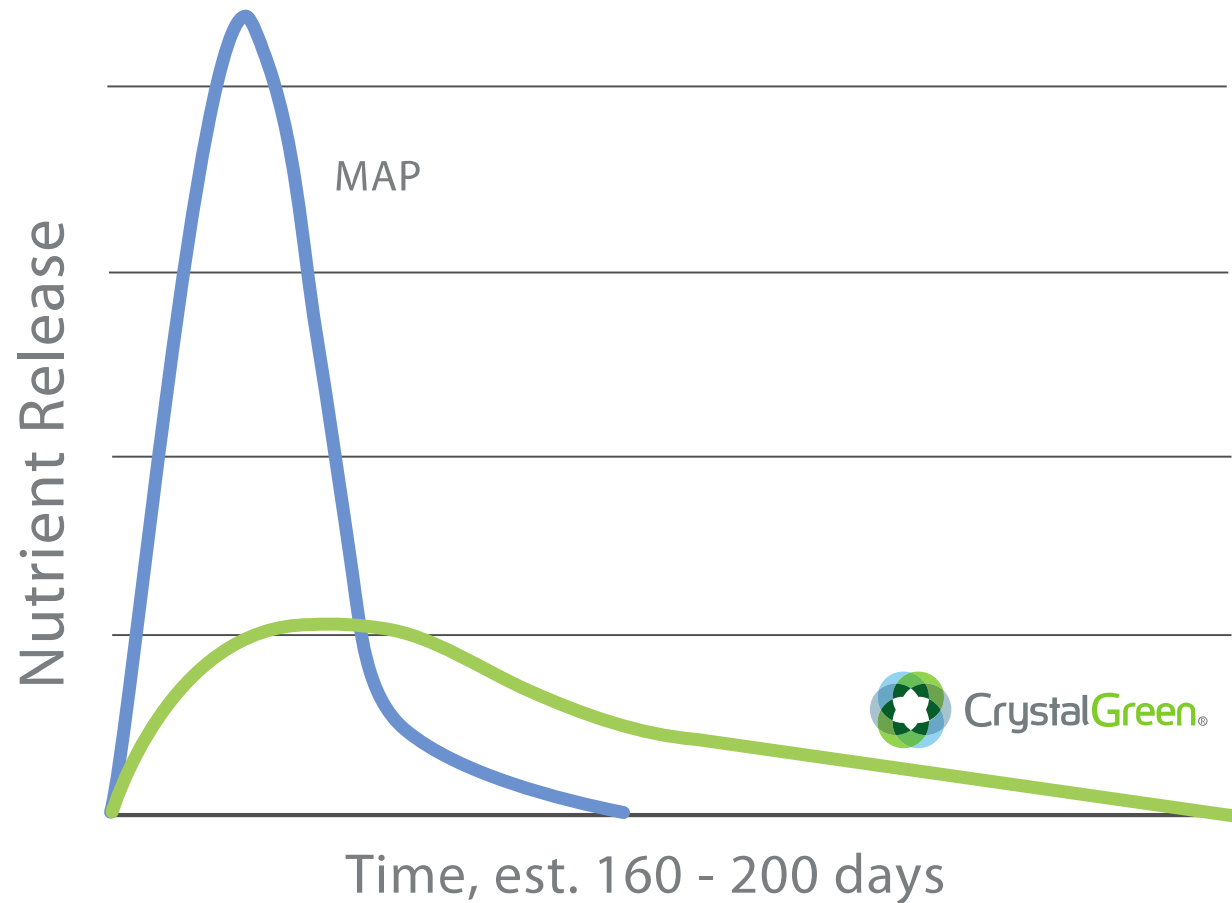
CrystalGreen® - Low-Water Solubility Citrate-Soluble, Plant-Activated Release

- **UNIQUE RELEASE** not dependent on pH, microbes, temperature or coating
- **CITRATE-SOLUBLE** dissolution responds to root growth
- **PLANT-AVAILABLE** remains plant-available up to 200 days





Low-Water Solubility Optimizes Release Season-Long, Plant-Available Release



**Slow-Release =
Less Leaching**

CRF leached over 50%
MORE phosphorus
than Crystal Green
over 4 months.

- Oregon State University, 2009





Blended Product for Optimal Results

50/50 Crystal Green with MAP & DAP

MAP / DAP / TSP

- Nutrient boost up-front
- Economic value
- Initial P Availability
- Water Solubility



CRYSTAL GREEN

- Season-long nutrient release
- Environmental Benefits
- Extended plant-availability
- Citrate-Solubility



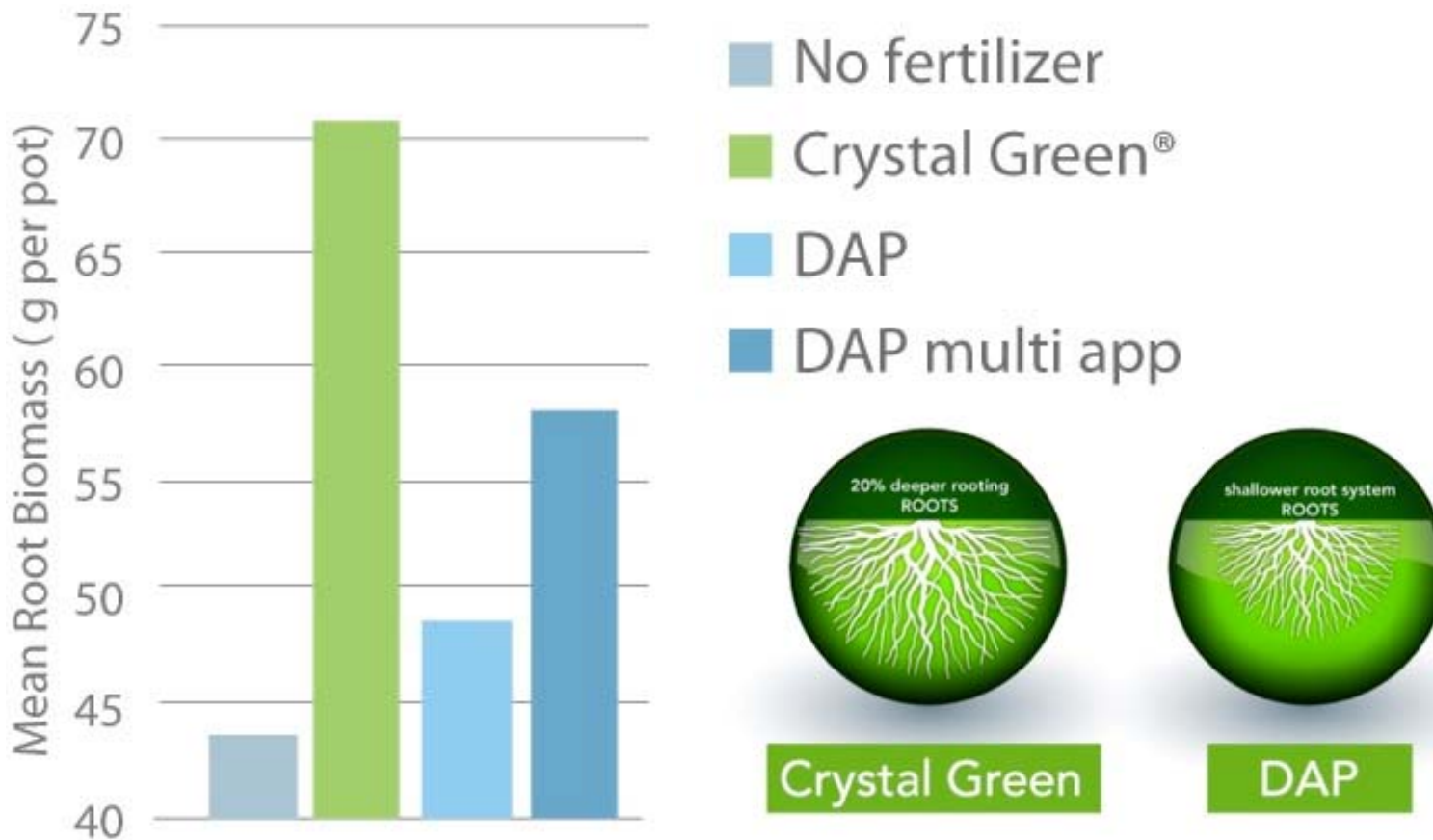
CONSISTANTLY AVAILABLE PHOSPHORUS + N & Mg





Denser Root Mass

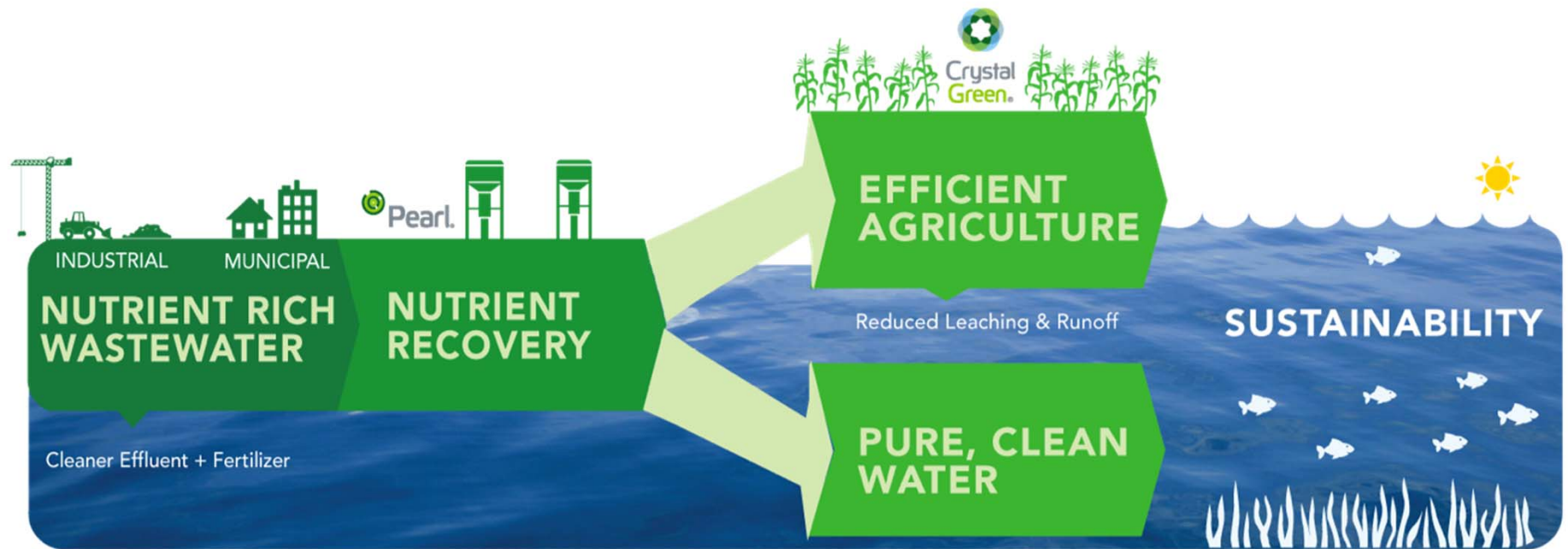
For Improved Recovery & Optimized Uptake





Minimizing Environmental Impact

The New Phosphorus Cycle



THANK
YOU

Fredric "Fritz" Corrigan

Ostara Board Chair

Ostara Nutrient Recovery Technologies

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