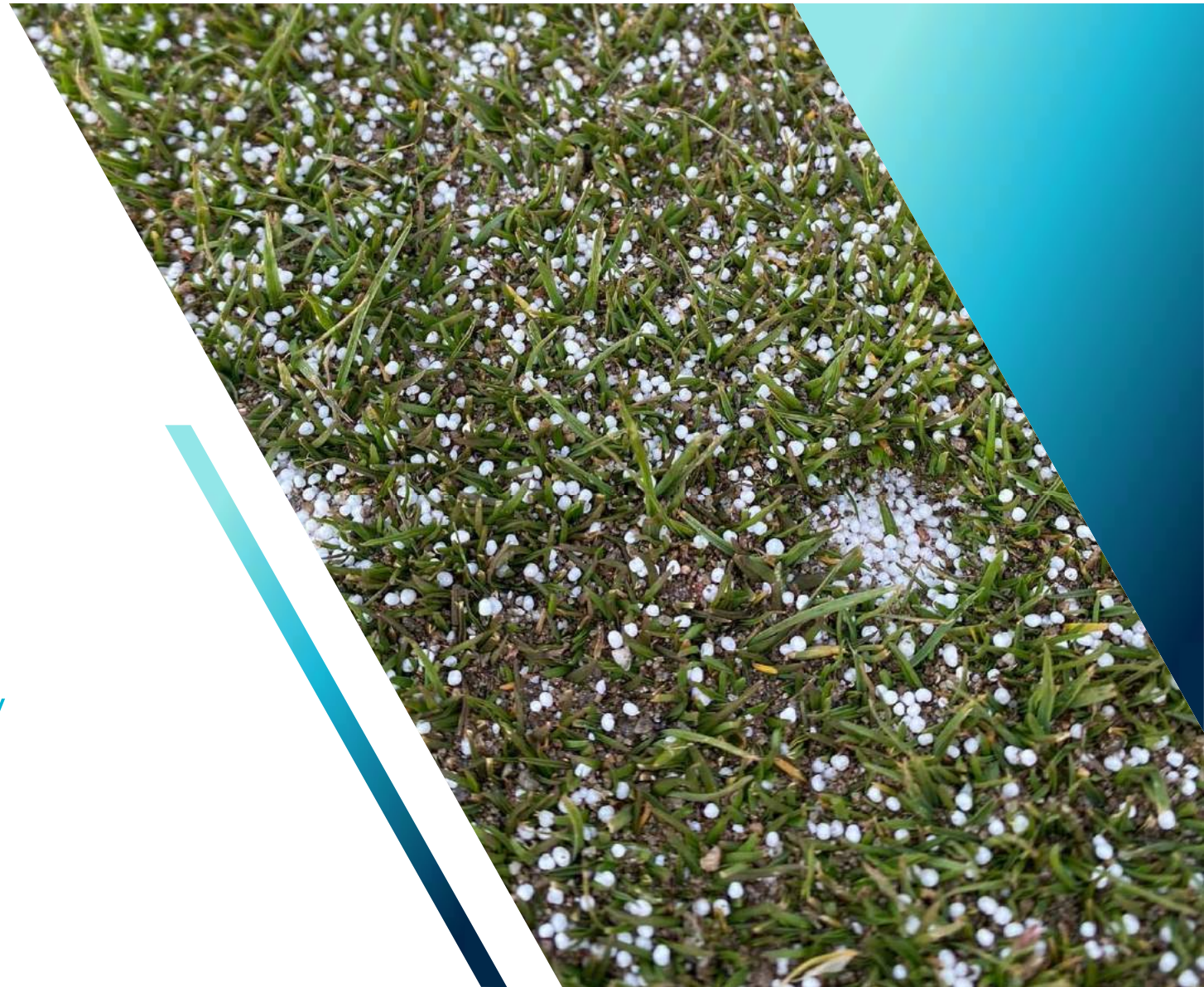




Sierrablen Plus
con Pearl Technology



Introduction – Circular Economy Phosphorous

- New 'mini-range' of four products to add to existing Sierrablen Plus range
- Utilising slow-release phosphorus in a form called Struvite created using a unique process from waste-water treatment sites. Process developed by Ostara.
- Key messages with this brand will be recycled / sustainable N&P, slow-release N&P, and increased rooting from the product.



Ostara's Growing Installation Base

Introducing waste-water management facilities globally.



2005

Year Ostara was founded

17 KMT/YR

current production

14

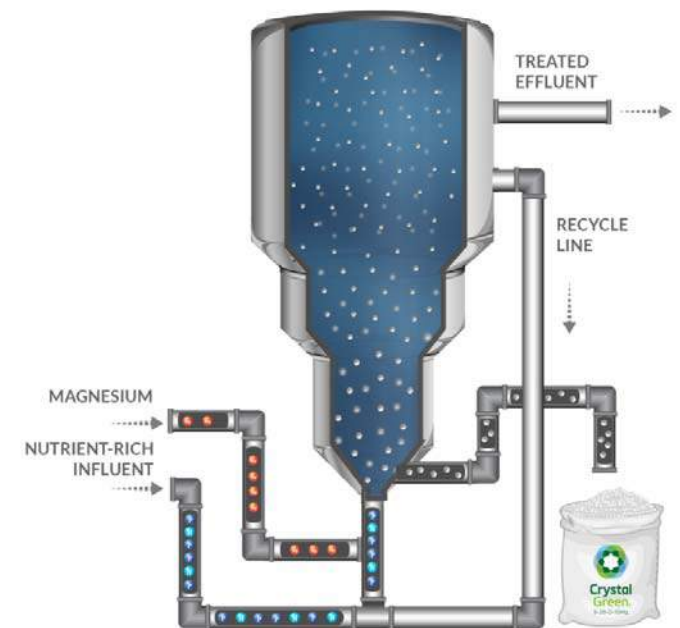
Number of commercial installations worldwide

5

Number of countries with commercial installations

The 'pearl' component (Crystal-Green)

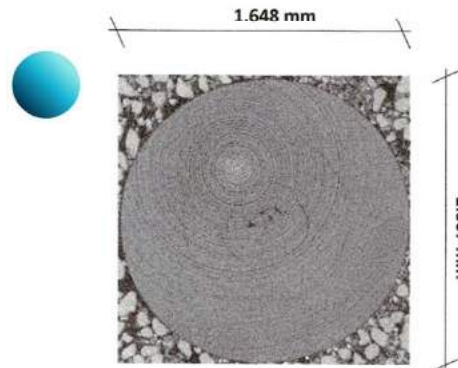
- This Activated Slow Release Fertilizer is made at wastewater treatment plants
- Ostara process based on controlled chemical precipitation in a fluidized bed reactor recovering the material in pure crystalline granules
- The reactor forms 0.9 - 3mm granules, size is controlled based on demand



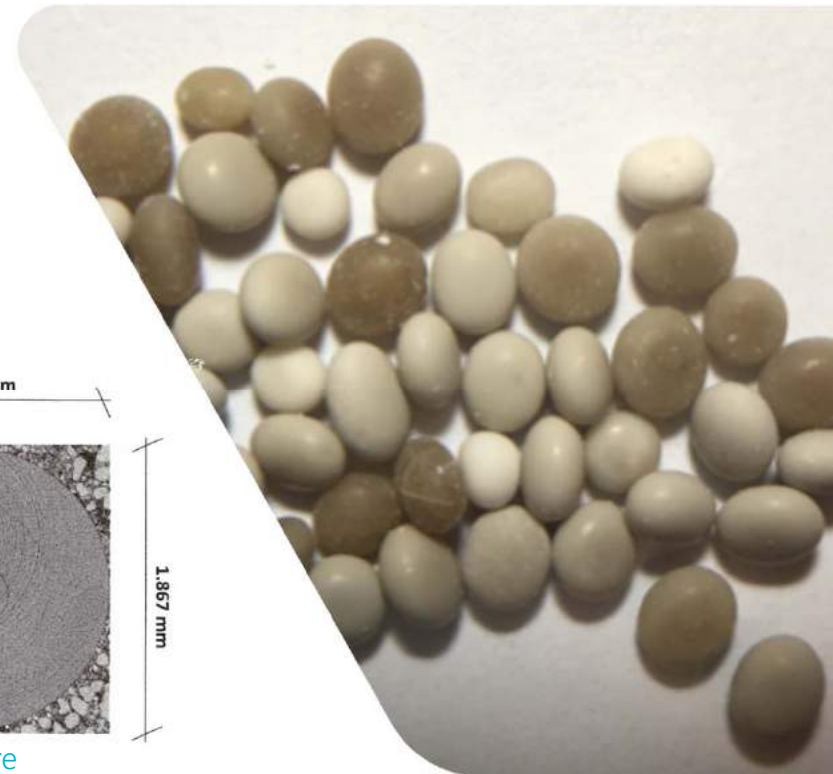
What is Pearl?

Pearl = 5-28-0 + 16% MgO (10%Mg)

- Nutrients within granule are truly slow release Activated Slow Release Fertiliser (ASRF), release driven by root acidity (citrate + organic acid soluble)
- Pearl is not water soluble.
- Colour varies between prills 'off-white' depending on raw material (but analysis is consistent). 99.6% pure mineral



Pearl Structure



Pearl's purity

99.6
%
Purity



Root-Activated™ (Citrate Soluble)



Lowest Salt Index of any P source



Hardness similar to MAP or DAP



90, 150, 300 SGN granule size



Lowest Heavy Metals of any P source

Product range

Sierrablen Plus with Pearl Technology

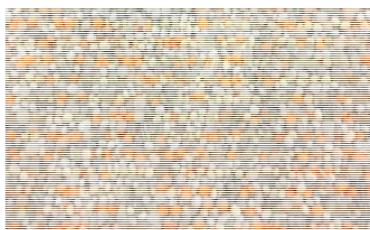


Blends of Pearl with Polyhalite and Poly S
(eqo.s, once fully launched)

Renovator PT

11-11-5+8MgO

Posa zolle



Turf Starter

5-28-0+16,5MgO

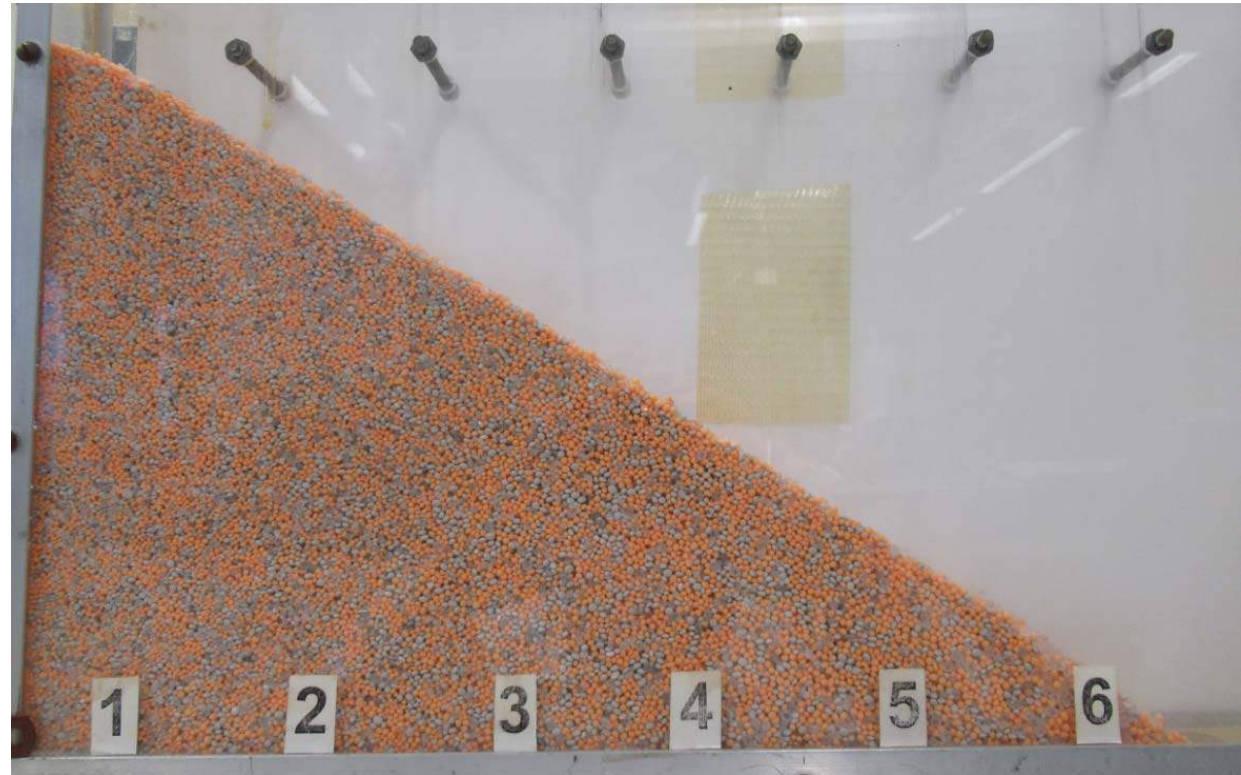
Nuove semine sod



What do we need to know?

Pearl Technology

- Pearl prills are robust
- Pearl prills blend very well – no separation.
- No dust from pearl prills



Unique features

Pearl Technology

- Activated Slow Release Fertilizer to be used as a recycled nutrient source proven to be more effective than usual P applications (thus lowering P application)
 - Greater rooting density
 - Less P lost from system
 - More P efficiency
 - Faster sod production – to lifting time.



Sod production

Pearl Technology

- Manage sod area renovation as usual
- Adjust Phosphate availability.
 - 50% P as MAP blend with K & S top-dress pre-drilling.
 - Place Crystal Green on surface with seed & roll in (50% of P).
- Weed control post establishment.
- Flat roll.
- Mowing regime from six weeks onward.
- Example -> 100 kg DAP + 200 kg Sierrablen Plus urf Starter



Ostara own research

Pearl Technology

- Crystal Green incorporated at drilling reduced lifting by a significant proportion
- Normal cycle turf lifted 15-18months.
- → Crystal Green addition at drilling reducing lifting to 10months.
- Less weed ingress.
- Less maintenance costs.



Studies show better rooting

Pearl Technology

Cornell University

A. Martin Petrovic & Jeff Barlow

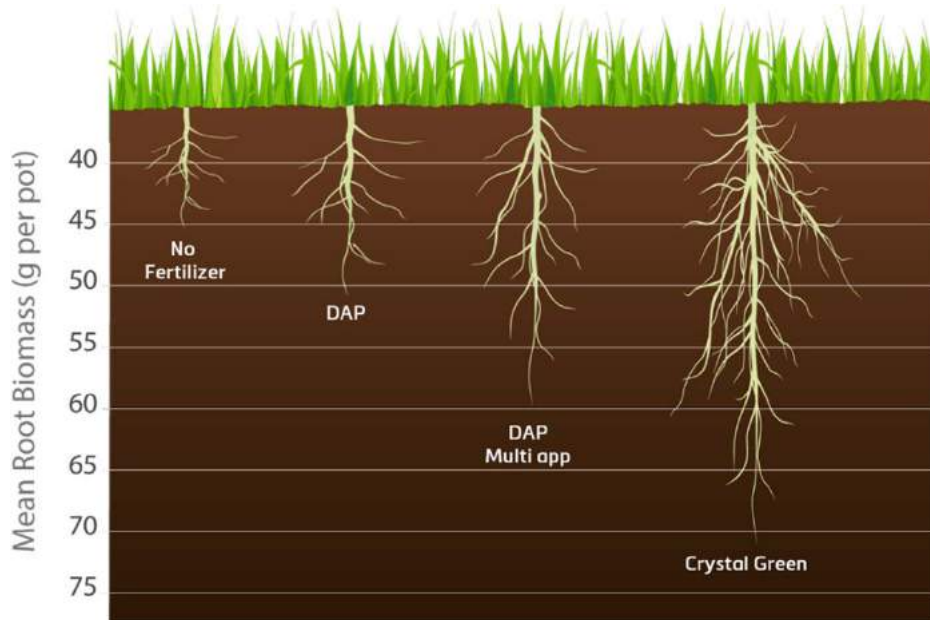
Comparison of diammonium phosphate (DAP) to Crystal Green (CG) as a Phosphorus Source: turf response and phosphate fate

Final Report, November 30, 2011

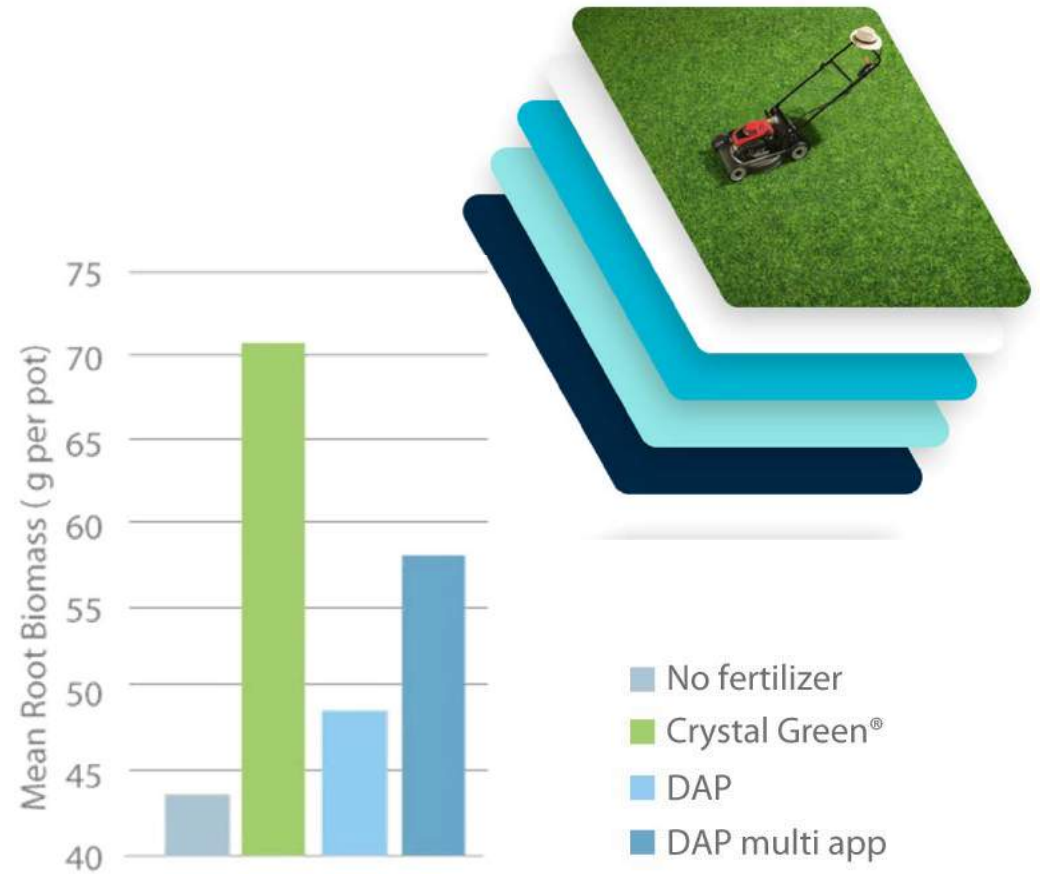


Results

Pearl Technology

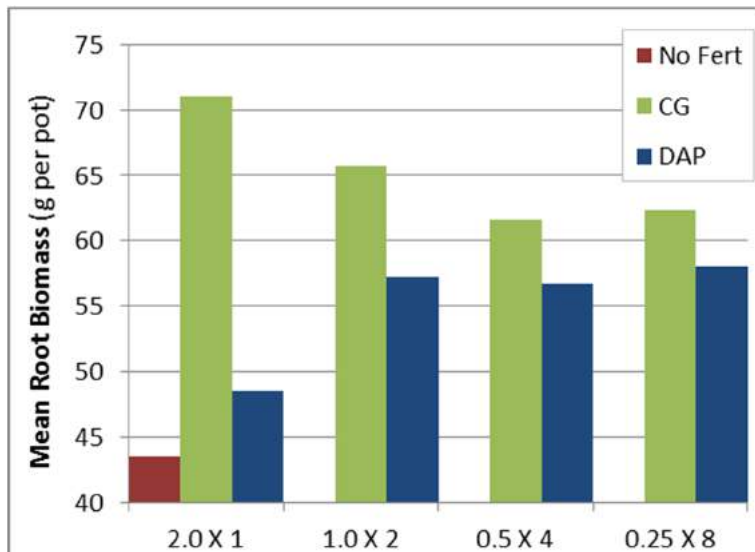


Source: Cornell University, 2010-11



Newly Seeded Study – Root Biomass

Pearl Technology



Treatments labels: P Rate X # of applications.
Mean root biomass at end of trial (g per pot)

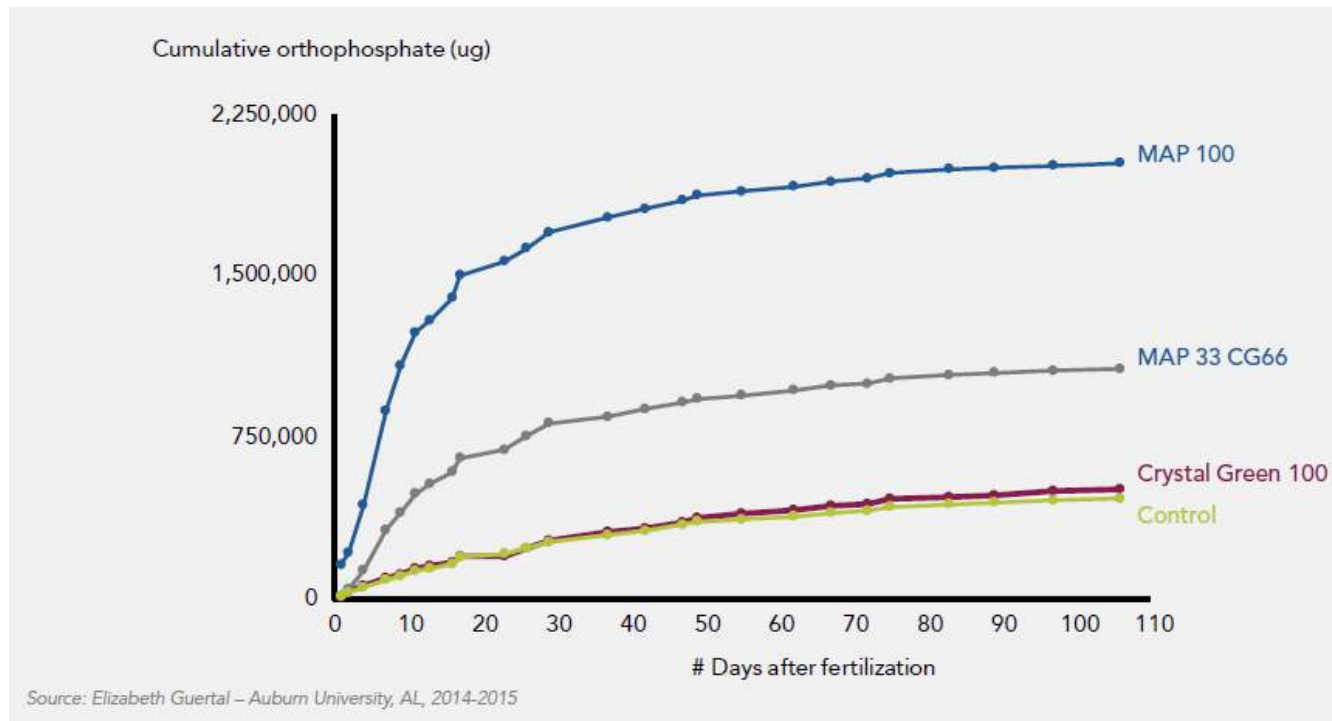
“Crystal Green treatments... produce more root growth than the similar DAP applications...”

- Root mass for each treatment is statistically different from all others.
- Applying CG in 1 or 2 applications was better than applying DAP 8X.



Studies show reduced P leaching.

Pearl Technology



ICL independent trial

Pearl Technology



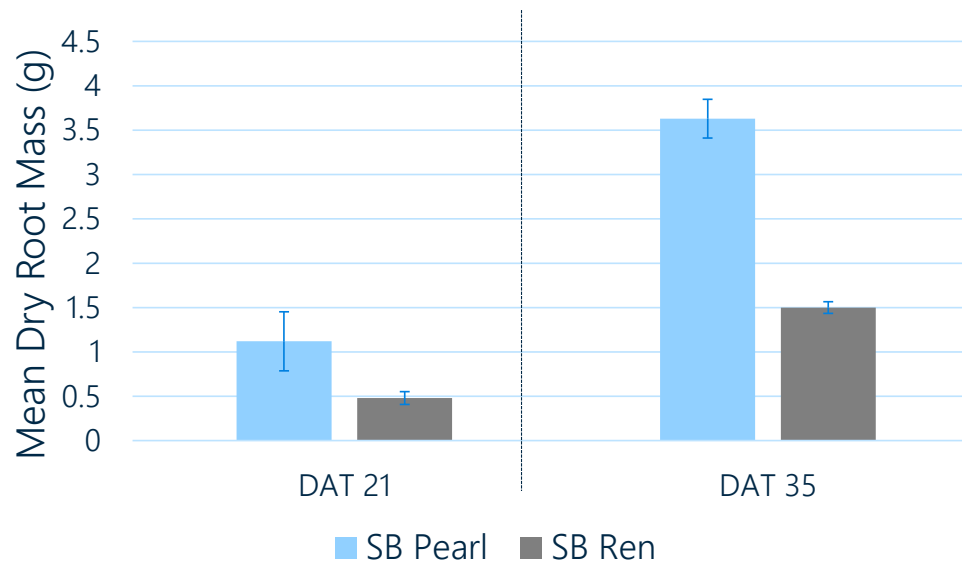
Carried out at i2L Research Laboratories - Summer / Autumn 2018
Perennial Ryegrass seed



Sierrablen Pearl Renovator 11-11-5+4CaO+8MgO
VS
Sierrablen Plus Renovator 20-20-8



Turfing trial rooting (day 35)



Trial C -Roots
Significantly better rooting when applied under turfing situations.

ICL independent trial - summary

Pearl Technology



Turfing trial rooting (day 35)



- Significantly improved rooting in comparison with Sierrablen plus renovator when used before turfing.
- Significantly improved rooting in comparison with Sierrablen plus renovator when incorporated into top 50mm rootzone before seeding.
- As a water insoluble granule it will need to 'get into' the rootzone prior to N & P release. So time period of trial is important.

ICL ind. trial – Summary thoughts

Pearl Technology



Turfing trial rooting (day 35)



- Slow release NP granule. Root-activated nutrients.
- Supported by good independent data.
- Improves rooting (our trials show this as well)
- Reduces P movement outside the rootzone.
- Sustainable / recycled nutrient / circular economy nutrient
- Potential:
 - Turfing / sodding market (both at seeding and at laying)
 - Pitch / green renovations (incorporated into rootzone is best)
 - High / Low pH environments (where P is fixed quickly)