

CROP EXCELLENCE[®]

Comparative Technical and Economic Critique: Crystal Green vs. MAP/DAP Coated with Undertow[®]

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OVERVIEW OF PRODUCTS

Crystal Green (28-33-0, 9% Mg): A struvite-based, slow-release phosphorus fertilizer that releases P based on root exudates, marketed for improving phosphorus use efficiency and reducing environmental losses.

MAP/DAP Coated with Undertow[®]: MAP (monoammonium phosphate) is a widely used water-soluble phosphate fertilizer (11-52-0). DAP (diammonium phosphate) is a widely used water-soluble phosphate fertilizer (18-46-0). Undertow[®] is a coating technology designed to reduce phosphorus fixation in challenging soils by preventing P from binding with calcium (in high pH soils) or iron/aluminum (in low pH soils), thereby increasing phosphorus availability.

TECHNICAL COMPARISON

Aspect	Crystal Green (28-33-0)	MAP/DAP + Undertow [®] Coating
Phosphorus Source	Struvite (magnesium ammonium phosphate)	MAP/DAP coated with a fixation inhibitor
Nutrient Release Mechanism	Root-exudate-activated release	Water-soluble with coating to slow fixation
Solubility	Insoluble in water; relies on root exudates for solubility	Highly water-soluble, but coating slows fixation
pH Sensitivity	Stable across a wide pH range	Coating minimizes fixation in acidic or alkaline soils
Early-Season Availability	Slow-release; may not provide sufficient early P availability	Immediate availability with some protection from fixation
Nutrient Composition	28-33-0 with 9% Mg	11-52-0 or 18-46-0 (MAP/DAP)
Application Rate Reduction	Claims up to 25% reduction in fertilizer rate	Claims to improve P efficiency by reducing fixation

TECHNICAL CRITIQUE

Crystal Green

1. Strengths:

- Effective in high pH or acidic soils prone to phosphorus fixation.
- Reduces the risk of leaching losses, particularly in sandy soils.
- Includes magnesium, which may provide additional nutritional value.

2. Weaknesses:

- A slow-release mechanism may limit phosphorus availability during the early stages of crop growth when P demand is high.
- Dependence on root exudates can result in variable performance across different crops and environmental conditions.
- Higher cost per unit of phosphorus compared to MAP/DAP.

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TECHNICAL CRITIQUE (Continued)

MAP/DAP Coated with Undertow®

1. Strengths:

- Provides immediately available phosphorus to support early crop growth.
- The **Undertow®** coating inhibits phosphorus fixation, improving P availability throughout the season.
- Works effectively in soils prone to calcium, iron, or aluminum fixation.
- Lower cost per unit of phosphorus compared to **Crystal Green**.

2. Weaknesses:

- The coating does not fundamentally change the solubility of **MAP/DAP**, so some environmental losses (e.g., leaching, runoff) may still occur in sandy soils or high rainfall areas.
- Coated **MAP/DAP** still requires careful management to prevent overapplication and ensure optimal efficiency.

ECONOMIC COMPARISON

General Aspects

Aspect	Crystal Green (28-33-0)	MAP/DAP + Undertow® Coating
Cost per unit of P	Significantly higher than MAP/DAP	Slightly higher than standard MAP/DAP due to the coating
Application Rate	Claims a 25% reduction	May allow for some reduction in P rates due to reduced fixation
Return on Investment	Highly variable; best in fixation-prone soils	More predictable ROI across a range of soil types
Adoption Considerations	Premium product; niche application in specific conditions	Easier to adopt as it builds on a widely used fertilizer (MAP/DAP)

ECONOMIC MODEL FOR CORN

Below is a detailed cost analysis comparing MAP, DAP, and Crystal Green fertilizers under the following assumptions:

1. Average Corn Production/acre = 200 bushels/acre
2. Corn Price = \$4.00/bushel
3. Acreage = 1000 acres
4. DAP cost = \$2845/ton
5. MAP cost = \$817/ton
6. Crystal Green cost = \$1144/ton

Other assumptions: The farmer needs to apply 30 lbs of phosphorus/acre with the % phosphorus (as P₂O₅) where DAP = 46% phosphorus, MAP = 52% phosphorus, and Crystal Green = 28%.

ECONOMIC MODEL FOR CORN

Aspect	Fertilizer Cost (\$USD)	Total Revenue (\$)	Net Revenue (\$)	Revenue Change (\$/Acre)
DAP	\$24,293.48	\$800,000	\$775,706.52	-\$24.29
MAP	\$23,567.31	\$800,000	\$776,432.69	-\$23.56
Crystal Green	\$61,285.71	\$800,000	\$738,714.29	-\$61.28

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KEY DIFFERENCES IN PERFORMANCE

1. Phosphorus Availability Timing

- **Crystal Green** releases P slowly and may delay early-season availability.
- **MAP/DAP + Undertow®** provides immediate P availability with protection against fixation.

2. Soil Type Suitability

- **Crystal Green** performs well in highly leachable or fixation-prone soils but may underperform in more neutral soils.
- **MAP/DAP + Undertow®** is suitable for a wider range of soils, particularly where P fixation is a concern.

3. Crop Demand Synchronization

- **Crystal Green** relies on root exudates for release, potentially providing a better match to crop demand but with variability in performance.
- **MAP/DAP + Undertow®** provides consistent, immediate availability with reduced fixation risk, offering more predictable results.

WHICH IS BETTER?

Scenario	Recommended Product	Reasoning
High pH soils (calcareous)	MAP/DAP + Undertow®	Reduces phosphorus fixation by calcium
Low pH soils (acidic)	MAP/DAP + Undertow®	Reduces fixation by iron/aluminum
Sandy soils with leaching risk	Crystal Green	Controlled release minimizes leaching losses
Soils with neutral pH and low fixation risk	MAP/DAP + Undertow®	Provides immediate P availability with minimal fixation risk
Early-season phosphorus demand (corn, wheat)	MAP/DAP + Undertow®	Immediate availability is critical for early root development
Perennial crops (e.g., orchards)	Crystal Green	Longer-term availability may reduce the need for frequent applications

OVERALL ASSESSMENT

1. **Crystal Green** is a premium niche product with a specific fit in soils prone to leaching or fixation, but its slower release may limit its broad adoption, especially for annual crops with high early-season phosphorus needs.
2. **MAP/DAP + Undertow®** offers a more practical, cost-effective solution that builds on an already widely adopted fertilizer. The coating enhances phosphorus use efficiency by reducing fixation without compromising early-season availability.

RECOMMENDATIONS

1. For most cropping systems, **MAP/DAP + Undertow®** is a more versatile, economically feasible solution with broader applicability.
2. **Crystal Green** may be justified in specific scenarios where leaching or fixation is a significant concern and where growers are willing to pay a premium for controlled-release phosphorus.

