

**Author: Francis Chia, Terry Tse**

Date: January 9, 2026

Subject: Application of Struvite Fertilizer in Southeast Asia

---

## 1. Purpose of This Memo

This memo sets out the scientific and commercial basis for adopting struvite (magnesium ammonium phosphate, MAP) as a fertilizer in Southeast Asia, including oil palm and other major crops such as rice, maize, sugarcane, and horticulture.

While local trials may be useful for fine-tuning application rates or placement, the purpose of this memo is to demonstrate that struvite's agronomic function, suitability for tropical conditions, and commercial risk profile are already sufficiently established to support procurement decisions under standard agricultural practice.

## 2. Struvite as a Fertilizer: Established Agronomic Function

Struvite is a chemically defined mineral fertilizer supplying phosphorus (P), magnesium (Mg), and ammonium nitrogen ( $\text{NH}_4^+$ ). Its NPK ratio is 5-28-0 + 10 magnesium (Mg). Its agronomic behavior is governed by intrinsic mineral solubility rather than coatings or proprietary formulations, resulting in a slow-release nutrient profile.

A foundational study by Talboys et al. demonstrated that struvite releases phosphorus gradually in soil, supports plant phosphorus uptake, and performs comparably to conventional soluble phosphate fertilizers while reducing losses<sup>1</sup>.

Recent work by Wang et al. showed that struvite application increased soil available phosphorus, improved nutrient uptake, and supported crop productivity and nutrient-use efficiency in a rice-wheat rotation system<sup>2</sup>. Other studies show similar positive results for field corn<sup>3</sup> and potato crops<sup>4</sup> while reducing environmental costs

A comprehensive review and meta-analysis by Hertzberger et al. evaluated numerous crop studies and concluded that struvite is an effective phosphorus fertilizer across soil types, with particularly strong performance in acidic soils, conditions common throughout Southeast Asia<sup>5</sup>. This is particularly important for Indonesia. Approximately 70% of the total

---

<sup>1</sup> [Struvite: a slow-release fertiliser for sustainable phosphorus management? - PMC](#)

<sup>2</sup> [Struvite as P Fertilizer on Yield, Nutrient Uptake and Soil Nutrient Status in the Rice–Wheat Rotation System: A Two-Year Field Observation](#)

<sup>3</sup> [Struvite application to field corn decreases the risk of environmental phosphorus loss while maintaining crop yield, Vivekananthan Kokulan et al., Agriculture, Ecosystems and Environment 366 \(2024\).](#)

<sup>4</sup> [Economic Assessment of Potato Response to Struvite and Conventional Phosphorus Fertilizer in Eastern Canada, M. Khakbazan et al., American Journal of Potato Research, November 2025.](#)

<sup>5</sup> [A review and meta-analysis of the agricultural potential of struvite as a phosphorus fertilizer - Hertzberger - 2020 - Soil Science Society of America Journal - Wiley Online Library](#)

land in Indonesia is acid soils with a pH less than 5, due to high rainfall and humidity leading to intense leaching (alkaline washing), creating acidic conditions<sup>6</sup>.

### 3. International Precedent: Commercial Use of Struvite

#### 3.1 North America (United States and Canada)

In North America, struvite is widely recovered from municipal wastewater treatment plants and sold as a commercial fertilizer product. The main commercially available product is Crystal Green®<sup>7 8</sup> by Ostara, which has been applied for years in row crops, turf, horticulture, and specialty crops, with performance comparable to conventional phosphate fertilizers and reduced nutrient loss.

Struvite is considered an ideal product for the golf course and turf markets and widely applied in North America because it provides a slow-release source of nitrogen, phosphorus, and magnesium. Primary advantages include faster recovery time, improved stand, and intensified natural color. Because the fertilizer contains 10% magnesium, it supports photosynthesis and creates more vibrant, greener grass. Unique root-activated solubility of struvite allows it to build denser root mass, which is critical for turf that must withstand high wear and environmental stress. Unlike conventional fertilizers that are water-soluble and prone to runoff, struvite granules only release nutrients when triggered by organic acids exuded by growing roots. This nutrition-on-demand mechanism ensures the fertilizer remains plant-available all season while significantly reducing the risk of nutrient runoff and leaching into local waterways, which is particularly important in high rainfall seasons.<sup>9</sup>

Operational benefits for golf course managers include:

- Ease of Application: Struvite only needs to be applied twice per year, ideally during aerification, where it can be used straight or mixed with sand.
- Predictability: Struvite crystalline structure makes it more predictable than other slow-release products as it is not affected by excessive moisture, bacteria, or temperature changes
- Reduced Mower Pick-up: Struvite granules are designed to penetrate the canopy efficiently, resulting in minimal pick-up by mowing equipment
- Seed Safety: Struvite low salt index makes it incredibly safe for new seeds and helps promote uniform emergence

<sup>6</sup> [Forage Crops in Acid Soils in Indonesia, Ade Sumiahadi, Ramazan Acar, International Symposium for Environmental Science and Engineering Research, May 2019, Konya, Turkey](#)

<sup>7</sup> This is an almost identical product to Phostone® that is produced by our competitor.

<sup>8</sup> [Crystal Green | Ostara](#)

<sup>9</sup> <https://www.ostara.com/benefits/turf-ornamental-applications/>

### 3.2 Europe

Europe is currently the largest region for struvite deployment, driven by phosphorus scarcity and circular-economy policy. Under the EU Fertilising Products Regulation (EU 2019/1009), struvite and other precipitated phosphate salts<sup>10</sup> are formally recognized as fertilizer materials, enabling their sale and use across EU agricultural markets.

European studies evaluating commercially produced struvite have shown that struvite consistently meets fertilizer quality standards. A systematic comparison of struvite products from multiple European installations found that phosphorus released from struvite was available for plant uptake in soil-maize tests, with no significant reduction in plant biomass, supporting its suitability for agricultural use<sup>11</sup>. Currently, the dominant commercial product in Europe is also Crystal Green®.

### 3.3 Japan

Japan represents one of the earliest and most consistent examples of real-world struvite application, through full-scale recovery, sale, and agricultural use. Recovered struvite has been sold to fertilizer companies and applied to paddy rice, vegetables, flowers, and landscaping.

A widely cited account documents three years of operating and selling recovered struvite from a full-scale wastewater treatment plant, confirming stable operation and agricultural distribution<sup>12</sup>.

### 3.4 What This Global Adoption Means for Southeast Asian Buyers

The international use of struvite shows a clear pattern:

- Struvite is already commercialized, not experimental.
- It is used in high-regulation, high-performance agricultural markets.
- Adoption has occurred without country-by-country crop trials as a prerequisite.
- Buyers rely on chemistry, nutrient release behavior, and precedent, not on repeated local validation.

### 3.5. Strategic Implication for ASEAN Buyers

When struvite is viewed in its global context, it becomes clear that requiring a local trial before purchase is not consistent with how struvite is adopted elsewhere. International buyers adopt struvite based on:

<sup>10</sup> [European Sustainable Phosphorus Platform - Struvite precipitation](#)

<sup>11</sup> [A systematic comparison of commercially produced struvite: Quantities, qualities and soil-maize phosphorus availability - ScienceDirect](#)

<sup>12</sup> [Three Years Experience of Operating and Selling Recovered Struvite from Full-Scale Plant](#)

- known nutrient chemistry,
- and proven use at commercial scale.

For Southeast Asia, where phosphorus losses, magnesium deficiency, and environmental pressure are significant, this global adoption strongly supports direct procurement and deployment of struvite, using local experience only to optimize application, not to justify initial adoption.

## 4. Demonstrated Application in Southeast Asia

### 4.1 Field-Level Application under Southeast Asian Conditions (Vietnam)

A field trial conducted in Vietnam evaluated magnesium ammonium phosphate (MAP/struvite) recovered from swine wastewater as a fertilizer in maize production (Trung et al., 2022). The study compared struvite-based treatments with conventional fertilization regimes under real field conditions and reported clear positive plant growth responses, demonstrating that recovered struvite can function effectively as a phosphorus fertilizer in Southeast Asian agricultural systems<sup>13</sup>. This study is significant because it confirms that struvite functions agronomically in Southeast Asian soils, climates, and management systems.

### 4.2 Palm Oil Sector Relevance (Malaysia)

Several studies link struvite directly to the palm oil industry. Agudosi et al. characterized struvite crystallized from palm oil mill effluent (POME), confirming high phosphorus and magnesium content and physical properties suitable for fertilizer use<sup>14</sup>.

Tadza et al. recovered struvite from raw POME and conducted controlled plant growth tests comparing the struvite product with a commercial fertilizer, reporting stronger plant growth in the struvite treatment during the test period<sup>15</sup>.

While these were not oil-palm field yield trials, they provide direct evidence that struvite derived from palm oil wastewater behaves as a functional fertilizer, reinforcing its relevance to plantation nutrient systems and circular nutrient strategies.

## 5. Why a Local Trial Is Not a Prerequisite for Purchase

Local trials are useful for optimizing application rates and placement, but they are not required to validate struvite's fundamental agronomic function. The nutrient chemistry, release behaviour, and regional applicability of struvite are already supported by peer-reviewed research and Southeast Asian application experience.

<sup>13</sup>[Influence of MAP Recovered from Swine Wastewater as a Fertilizer Source on the Growth and Nutrition of Maize Plant | Science & Technology Asia](#)

<sup>14</sup>[Characterization of crystallized struvite on wastewater treatment equipment:](#)

<sup>15</sup>[Characteristics of Struvite Precipitate from Palm Oil Mill Effluent](#)

In commercial agriculture, fertilizers such as triple superphosphate, DAP, kieserite, and controlled-release products are routinely adopted without estate-specific trials, based on known chemistry and performance in comparable environments. Struvite meets these same criteria and carries a lower environmental and agronomic risk than highly soluble phosphate fertilizers. Fewer applications also imply lower overall labor costs.

## 6. Relevance to Oil Palm and Major Southeast Asian Crops

Oil palm yield formation spans 18–24 months, making short-term yield trials biologically unsuitable for any fertilizer. As a result, oil palm fertilizer decisions are routinely based on nutrient form, availability, and efficiency, not short-term fruit yield data.

Struvite aligns well with oil palm nutrition needs:

- phosphorus supports root development and reproductive processes,
- magnesium supports chlorophyll formation and sustained photosynthesis,
- slow release reduces losses in acidic, high-rainfall plantation soils.

Struvite aligns well with oil palm nutrition requirements: phosphorus supports root and reproductive development, magnesium supports photosynthesis, and slow release reduces losses in acidic, high-rainfall soils.

The same agronomic logic applies to other major Southeast Asian crops. Rice benefits from ammonium-based nutrition and reduced phosphorus loss under flooded conditions. Maize responds strongly to improved phosphorus availability, already demonstrated in Southeast Asian field conditions. Sugarcane has high magnesium demand and long crop cycles that favor slow-release nutrient sources. Horticultural crops benefit from controlled nutrient availability and reduced environmental losses.

## 7. Conclusion

Struvite is a commercially credible fertilizer option for Southeast Asia, supported by:

- established agronomic research,
- documented application and testing within the region, and
- extensive commercial use in multiple global markets.

Local trials may refine best practices, but they are not required to justify procurement. Buyers can proceed with confidence, treating struvite as a standard mineral fertilizer suitable for Southeast Asian agriculture.

*The authors would like to thank Professor Qing Chen and his team of the College of Resources and Environmental Sciences at China Agricultural University for their assistance in the preparation of this memo.*