Co-Application of Calcified Algae and MicroEssentials-S10 Affects Phosphorus Availability and Productivity of Maize

Derek S. Lenzen and Frederick E. Below
Crop Physiology Laboratory, Department of Crop Sciences, University of Illinois at Urbana-Champaign

Objective: To evaluate grain yield responses of maize to different combinations and rates of calcified algae and MicroEssentials-S10.

Introduction:
Various seaweed, kelp, algae, and marine derived products have shown promise in increasing stress tolerance, crop health, and yield of maize (Zea mays L.).

A product made from calcified algae (Lithothamnium spp.), Algen (Ocean Minerals, Sao Paulo, Brazil), is a dry granular material containing many organic compounds and is high in calcium carbonate (Figure 1).

These organic compounds may stimulate microbial activity and promote phosphorus mineralization when soil applied. In addition, calcium carbonate raises soil pH which tends to favor microbial activity, but calcium (Ca) has the potential to bind with phosphorus (P) at raised soil pH, making P unavailable for plant uptake.

It was unknown how Algen would affect P availability for maize when applied with an acidifying P fertilizer like MicroEssentials-S10 (12-40-0-10S; MES10), which contains elemental sulfur, and that was the basis of this research.

Results:
In 2020, increasing the MES10 rate slightly increased grain yield over the untreated control (Figure 2). The high rate of Algen with the low (75%) rate of MES10 yielded similarly to the high rate of MES10 alone. However, the high rate of Algen paired with the high rate of MES10 significantly increased yield by 797 kg ha⁻¹ (Figure 2).

In 2021, Algen applied alone nominally decreased grain yield, but there was a synergistic response when increasing amounts of Algen were paired with the low rate of MES10 compared to the low MES10 rate alone (Figure 3). The high rate of MES10 alone increased grain yield by 498 kg ha⁻¹, even though the soil test values (Table 1) were above the threshold predictive of a response to added phosphorus.

When averaged across the 2020 and 2021 growing seasons, the greatest overall yield came from pairing the high rate of Algen with the high rate of MES10 (Table 2). Additionally, the high MES10 and the low MES10 + high Algen treatments increased yield by 420 and 361 kg ha⁻¹, respectively (Table 2).

Grain yield increases were largely driven by modestly increasing kernel number without a compensatory decrease in average kernel weight (Table 2).

Conclusions:
Applications of phosphorus fertilizer (MES10) were critical in setting a higher maize grain yield potential across both years of the study, with the highest grain yields resulting from the high MES10 rate.

Algen (calcified algae) alone had no effect on yield, but pairing Algen with MES10 showed that Algen was able to increase the yield response to phosphorus fertilizer, therefore it was not a replacement for fertility.

On average, the low rate of MES10 paired with the high rate of Algen provided similar grain yields to the high rate of MES10 alone, indicating that Algen may be capable of reducing phosphorus fertilizer needs.

Thanks to Oceana Minerals and The Mosaic Company for supporting this research.