Using solid oxygen fertilizers to alleviate flooding problems in vegetable production

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Flooding affects crop production

Vegetable plants uptake oxygen from the soil matrix. Under flooding conditions, plants may not have enough oxygen to survive. Flooding has been a problem in Florida. Agriculture losses from flooding as a result of the hurricane Irene in 1999 and a storm (13.9 in) in 2000 were estimated at $77 and $13 million, respectively, in Miami-Dade County with nearly 19,000 acres of crop damage.

Slow-release oxygen fertilizers

Slow-release oxygen fertilizers are eco-friendly compound fertilizers. They are insoluble and inert if there is no water in the soil. In waterlogged or flooded soils, slow-release oxygen fertilizer will gradually release oxygen for up to 6 months. Meanwhile, they also provide calcium and/or magnesium nutrients.

Application of oxygen fertilizer

Application of slow-release solid oxygen fertilizers (e.g., magnesium peroxide plus additives) can effectively increase oxygen bioavailability in flooded soils, alleviate the problem, and reduce or exclude economic loss in vegetable production suffering from flooding. Application methods include before and after planting or sowing. The method before planting can save labor but the
fertilizers may be wasted if there is no flooding. The other method requires more labor input because manipulation in crop plants is time consuming but this method may save the fertilizers if there is not a flooding problem during the growing season. We recommend applying the fertilizers before planting or sowing for vegetable production.

**Exemplification**

We grew traditional Italian basil (cv. Genovese OG) in 6 inch-pots with ProMix growth medium with (treatment) or without (the control) 1 g slow-release solid oxygen fertilizer incorporated into the growth medium. The plants were not flooded or flooded for five days after they were all 20 cm tall. Their chlorophyll contents were determined using SPAD 502 Chlorophyll Meter (Konica Minolta Holdings, Inc., Ramsey, New Jersey). The biomass was also measured after the five-day flooding. The results showed that the chlorophyll contents and biomass of the flooded plant with oxygen fertilization were both significantly greater than those of the control (Figure 1, 2 and 3).

![Image of basil plants](image)

**Figure 1.** The difference in growth of flooded basil plants with or without oxygen fertilization.
**Figure 2.** The chlorophyll contents of the basil plants without flooding were significantly (p<0.05) greater than those with flooding but without oxygen fertilization. There was, however, no difference in the chlorophyll contents of the plants without flooding and those with flooding but also with oxygen fertilization.

**Figure 3.** Biomass of the basil plants without flooding were significantly (p<0.05) greater than those with flooding but without oxygen fertilization. There was, however, no difference in the biomass of the plants without flooding and those with flooding but also with oxygen fertilization.

**Summary and Conclusions**

Slow release oxygen fertilizers are eco-friendly and affordable. They significantly increased oxygen bioavailability in the flooded soil grown basil. Therefore, they significantly alleviated reduction of chlorophyll contents and biomass of flooded basil plants and hence reduced economic loss caused by flooding. Oxygen fertilization is promising to become a new approach to minimize the negative impact of flooding on vegetable production in Florida.