Humic Acid: Effects on Nutrient Uptake And Photosynthetic Capacity

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Introduction

Potatoes are an important crop, with about 6,833 acres grown in PA (NASS 2022). Many soil treatment products are marketed towards potato farmers, including those containing humic acids. Humic acid is a mix of large organic molecules that is industrially made from lignite or leonardite brown coal (Mikkelsen 2005). This mixture is soluble and can contain Humic Acid, Fulvic Acid, and trace nutrients (Mikkelsen 2005).

There are several reported benefits to using humic acid during the season: improving nutrient uptake, increasing soil health, growing more vigorous plants, and achieving higher yields. Previous studies have evaluated some of these reports. Hopkins and Stark (2003) found a positive yield increase to using humic acid, whereas Seyedbagheri (2010) found varying outcomes on yield and vigor.

While application time can vary, many of these products can be applied in-furrow on or around the potato seed piece. In 2024, an experiment was conducted to evaluate the effects of humic acid on nutrient uptake and photosynthetic capacity.

Materials and Methods

The variety Lehigh, a popular yellow table variety in Pennsylvania, was chosen for this experiment. The trial was conducted on a Leck Kill soil type under center pivot irrigation. A random complete block design was utilized.

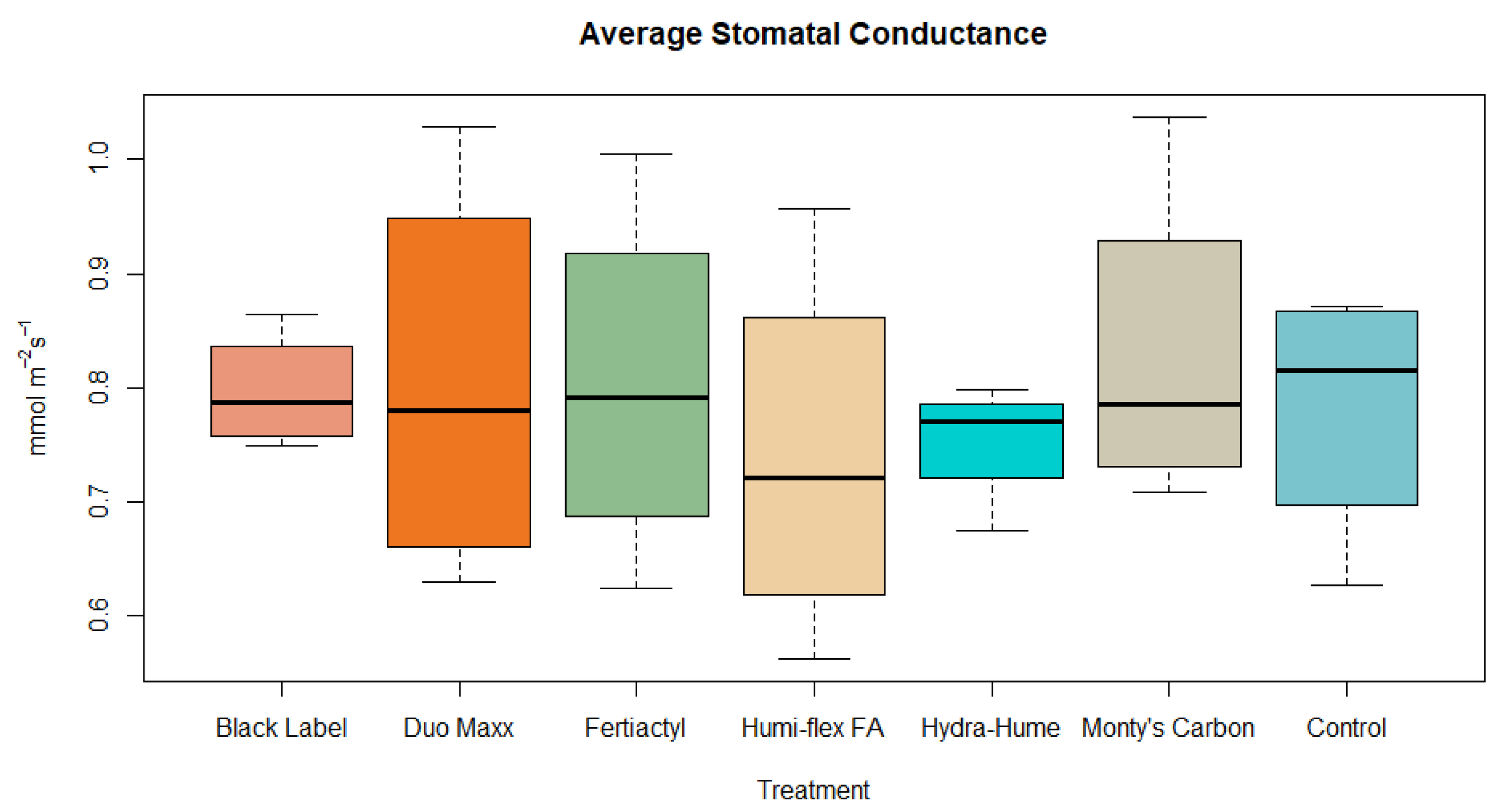
Potato seed was hand cut and planted via a mechanical planter in May 2024; each treatment was applied prior to row closure over the seed piece. The following products were evaluated: Black Label Zn, Duo Maxx, Fertiactyl, Humi-Flex FA, Hydra-Hume, and Monty's Carbon. Treatments were applied at label rates for each product. All other field prep and cultural practices were done according to local practices.

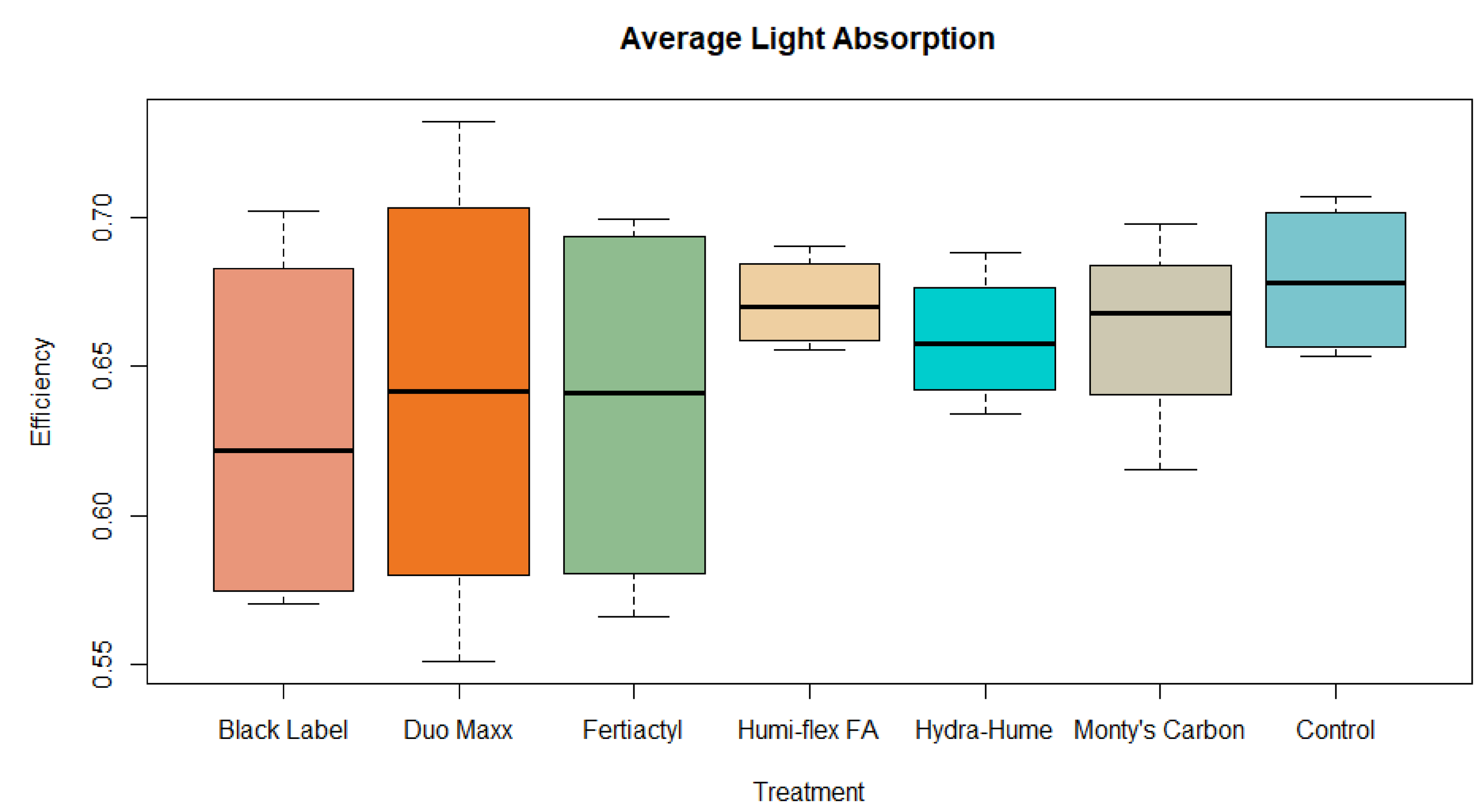
Prior to bloom, plots were sampled for tissue sampling. The 4th most mature petiole and leaves were collected from all plants emerged within a specific plot. Samples were overnighted to Spectrum Analytic Inc, Washington Court House, Ohio, for nutrient analysis. The Licor LI-600 Porometer/Fluorometer was used to sample three random plants per plot for photosynthetic capacity and output. In particular, stomatal conductance, light absorption, and electron transport rate were measured. Data was analyzed using ANOVA in R Studio and statistical significance between treatments was determined using Tukey Comparisons.

Results

Select Petiole Nutrient Results

Treatment	% N	% P	% K
Black Label Average	6.63 a	0.61 b	4.36 c
Duo Maxx Average	6.61 a	0.57 b	4.88 c
Fertiactyl Average	6.46 a	0.55 b	4.55 c
Humi-flex FA Average	6.55 a	0.58 b	4.71 c
Hydra-Hume Average	6.65 a	0.61 b	4.93 c
Monty's Carbon Average	6.6 a	0.56 b	4.72 c
Control Average	6.48 a	0.58 b	4.51 c





Discussion and Next Steps

Preliminary data show no statistically significant difference between any nutrient analyzed for all treatments. This includes Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Sulfur, Boron, Copper, Iron, Manganese, and Zinc. In addition, there was no statistically significant difference observed for average stomatal conductance, light absorption, or electron transport rate.

These preliminary data add to the existing literature on the effects of using humic acid in-furrow. Although this data shows no effect, field site variability may play a key role in realizing benefits of these products. Soil health, organic matter, and parent material differ drastically from Pennsylvania to the Pacific Northwest where experiments on humic acid have historically been conducted. Further research is needed to see if there is a benefit on other soil types in PA and across the United States.

In 2025, a similar experiment will be conducted on two new field sites evaluating the effects of humic acid on yield and tuber quality. This will be the conclusion of a three-year study investigating humic acid applied in-furrow.

References

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