Can Applied Sugars Influence Maize Growth and Yield?

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**Objective:** To evaluate growth and yield responses of maize to different sources, timing, and placement applications of sugar.

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### Introduction:

Biosimulants have gained a large share of the supplement market in US agriculture as growers look for ways to improve crop health and increase grain yield. With uncertain commodity markets, even small increases in yield can be profitable, creating renewed interest in biosimulant use.

Biosimulants are commonly applied with other products, such as starter fertilizers, herbicides, and fungicides. Two efficient opportunities to apply biosimulants are during planting and the post-emergence application of herbicides.

Although the use of sugars as a foliar biosimulant has been researched in the past, alternative placements and timings of sugar applications are less understood. Some studies examining soil application of sugars suggest they are primarily utilized by soil microbes as an energy and carbon source, thereby acting to enhance soil microbial activity and the availability and use of mineral nutrients to the plant. Additionally, the term “sugar” is general, and different sugar sources vary in their chemical structure and composition, which may impact efficacy. Research regarding the application of sugars (and their multiple sources) to the soil, or to the plant, in maize (Zea mays L.) production systems is lacking.

The objective of this study was to examine the effect of two sugar sources applied in-furrow, either independently or in combination with liquid starter fertilizer, and/or as a foliar application on the growth and yield of maize.

### Research Approach:

Maize was planted following soybean at Champaign, Illinois at a population of 89,000 plants ha⁻¹ using hybrids that we previously identified as responsive to management, DKC63-21RIB in 2019 and DKC62-52RIB in 2020.

Five unique treatment combinations were comprised of an in-furrow (IF) liquid starter, an IF applied sugar, and/or a V5 foliar sugar application and compared to an untreated control (UTC). All treatments were replicated across two sugar sources, dextrose or high fructose corn syrup (HFCS). The IF and V5 foliar applications were chosen to coincide with agronomic practices of planting pass and post-emergence herbicide application.

Liquid starter was applied in the form of APP (ammonium polyphosphate; 10-34-0) at a rate of 37.4 l ha⁻¹ (5.2 kg N ha⁻¹; 17.80 kg P₂O₅ ha⁻¹), sugars were applied at a rate of 4.47 kg ha⁻¹ total monosaccharides.

Plots were four rows wide and planted at 0.76 m row spacing and 12 m in length. Trial design was a split block RCBD with six replications and blocks were split by sugar source. This design allowed for analysis for each sugar independently as well as to compare sugar sources to each other.

### Conclusions:

In-furrow applications of sugars tended to result in visual growth enhancement during early vegetative growth, but this increased growth was not consistently reflected in grain yield. In the higher yielding environment of 2019, sugars applied in-furrow tended to act synergistically with starter fertilizer application to increase grain yields. This finding suggests that sugar sources can stimulate the activity of soil microorganisms, thereby increasing nutrient availability and fertilizer use and improving plant growth and yield.

V5 foliar sugar applications of either sugar source increased grain yield in 2019, but decreased yield in 2020. The sugar–induced yield decrease in 2020 may have been due to the loss in leaf area from hail damage, which resulted in much lower yields than usual for this site. Additional research is needed to determine if the sugar response is associated with the yield level or the degree of crop stress.

The combination of sugar and starter fertilizer in-furrow followed by a V5 foliar sugar application led to the most positive yield trends across both years and sugar sources. This finding suggests multiple independent benefits of sugar applications, that coincide with other important management activities, and that give growers the opportunity to easily and cost effectively increase maize productivity.

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**Table 1.** Treatment summary of starter fertilizer and sugar applications for maize grown at Champaign, IL in 2019 and 2020. Treatments were replicated across two sugar sources, dextrose or high fructose corn syrup (HFCS).

<table>
<thead>
<tr>
<th>Application Placement</th>
<th>Liquid Starter</th>
<th>Sugar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated Control</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>In-Furrow</td>
<td>In-Furrow</td>
<td>In-Furrow</td>
</tr>
<tr>
<td>None</td>
<td>In-Furrow</td>
<td>V5 Foliar</td>
</tr>
<tr>
<td>In-Furrow</td>
<td>In-Furrow + V5 Foliar</td>
<td></td>
</tr>
</tbody>
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