Modern Corn Hybrids' Nutrient Uptake Patterns

Crop Physiology Laboratory
University of Illinois at Urbana-Champaign

Ross R. Bender, Jason W. Haegele, Matias L. Ruffo and Fred E. Below
<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Required to Produce</th>
<th>Removed with Grain</th>
<th>Harvest Index</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>lbs/acre</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>256</td>
<td>148</td>
<td>58</td>
</tr>
<tr>
<td>P&lt;sub&gt;2&lt;/sub&gt;O&lt;sub&gt;5&lt;/sub&gt;</td>
<td>101</td>
<td>80</td>
<td>79</td>
</tr>
<tr>
<td>K&lt;sub&gt;2&lt;/sub&gt;O</td>
<td>180</td>
<td>59</td>
<td>32</td>
</tr>
<tr>
<td>S</td>
<td>23</td>
<td>13</td>
<td>57</td>
</tr>
<tr>
<td>Mg</td>
<td>52</td>
<td>15</td>
<td>29</td>
</tr>
<tr>
<td>Zn (oz)</td>
<td>7.1</td>
<td>4.4</td>
<td>62</td>
</tr>
<tr>
<td>B (oz)</td>
<td>1.2</td>
<td>0.3</td>
<td>23</td>
</tr>
<tr>
<td>Mn (oz)</td>
<td>8.1</td>
<td>1.0</td>
<td>13</td>
</tr>
<tr>
<td>Fe (oz)</td>
<td>18.8</td>
<td>3.5</td>
<td>19</td>
</tr>
<tr>
<td>Cu (oz)</td>
<td>2.0</td>
<td>0.6</td>
<td>29</td>
</tr>
</tbody>
</table>

6 hybrids representing transgenic insect protection grown in Champaign and DeKalb, IL in 2010 with yields of 220-240 bu/ac
Seasonal Dry Matter Partitioning

6 hybrids representing transgenic insect protection grown in Champaign and DeKalb, IL in 2010 with yields of 220-240 bu/ac
Seasonal Nitrogen Uptake

6 hybrids representing transgenic insect protection grown in Champaign and DeKalb, IL in 2010 with yields of 220-240 bu/ac
Seasonal Phosphorus Uptake

6 hybrids representing transgenic insect protection grown in Champaign and DeKalb, IL in 2010 with yields of 220-240 bu/ac
Seasonal Potassium Uptake

6 hybrids representing transgenic insect protection grown in Champaign and DeKalb, IL in 2010 with yields of 220-240 bu/ac
Seasonal Sulfur Uptake

6 hybrids representing transgenic insect protection grown in Champaign and DeKalb, IL in 2010 with yields of 220-240 bu/ac
Seasonal Magnesium Uptake

6 hybrids representing transgenic insect protection grown in Champaign and DeKalb, IL in 2010 with yields of 220-240 bu/ac
Seasonal Zinc Uptake

6 hybrids representing transgenic insect protection grown in Champaign and DeKalb, IL in 2010 with yields of 220-240 bu/ac
Seasonal Boron Uptake

6 hybrids representing transgenic insect protection grown in Champaign and DeKalb, IL in 2010 with yields of 220-240 bu/ac
Seasonal Manganese Uptake

6 hybrids representing transgenic insect protection grown in Champaign and DeKalb, IL in 2010 with yields of 220-240 bu/ac
Seasonal Iron Uptake

Fe Uptake (oz Fe ac$^{-1}$)

GDD$^F$

Percent of Total (%)

- Grain
- Tassel, Cob, Husk Leaves
- Stalk and Leaf Sheaths
- Leaf Blades

Growth Stage

Vegetative
- VE
- V2
- V4
- V6

Tillering
- V8
- V10
- V14
- VT/R1

Early-to-Late-Flowering
- R1
- R2
- R4
- R5
- R6

Seasonal Iron Uptake

6 hybrids representing transgenic insect protection grown in Champaign and DeKalb, IL in 2010 with yields of 220-240 bu/ac
Seasonal Copper Uptake

6 hybrids representing transgenic insect protection grown in Champaign and DeKalb, IL in 2010 with yields of 220-240 bu/ac
<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Required to Produce</th>
<th>Removed with Grain</th>
<th>Harvest Index</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>kg/ha</td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>N</td>
<td>287</td>
<td>166</td>
<td>58</td>
</tr>
<tr>
<td>P\textsubscript{2}O\textsubscript{5}</td>
<td>113</td>
<td>90</td>
<td>79</td>
</tr>
<tr>
<td>K\textsubscript{2}O</td>
<td>202</td>
<td>66</td>
<td>32</td>
</tr>
<tr>
<td>S</td>
<td>26</td>
<td>15</td>
<td>57</td>
</tr>
<tr>
<td>Mg</td>
<td>59</td>
<td>17</td>
<td>29</td>
</tr>
<tr>
<td>Zn (g)</td>
<td>498</td>
<td>309</td>
<td>62</td>
</tr>
<tr>
<td>B (g)</td>
<td>83</td>
<td>19</td>
<td>23</td>
</tr>
<tr>
<td>Mn (g)</td>
<td>567</td>
<td>73</td>
<td>13</td>
</tr>
<tr>
<td>Fe (g)</td>
<td>1318</td>
<td>244</td>
<td>19</td>
</tr>
<tr>
<td>Cu (g)</td>
<td>138</td>
<td>41</td>
<td>29</td>
</tr>
</tbody>
</table>

6 hybrids representing transgenic insect protection grown in Champaign and DeKalb, IL in 2010 with yields of 220-240 bu/ac
Seasonal Dry Matter Partitioning

6 hybrids representing transgenic insect protection grown in Champaign and DeKalb, IL in 2010 with yields of 220-240 bu/ac
Seasonal Nitrogen Uptake

6 hybrids representing transgenic insect protection grown in Champaign and DeKalb, IL in 2010 with yields of 220-240 bu/ac
Seasonal Phosphorus Uptake

6 hybrids representing transgenic insect protection grown in Champaign and DeKalb, IL in 2010 with yields of 220-240 bu/ac
Seasonal Potassium Uptake

K Uptake (kg K₂O ha⁻¹)

- Grain (Dark Blue)
- Tassel, Cob, Husk Leaves (Red)
- Stalk and Leaf Sheaths (Yellow)
- Leaf Blades (Green)

GDDₜ

Percent of Total (%)

0 25 50 75 100

Growth Stage:

- VE
- V2
- V4
- V6
- V10
- V14
- VT/R1
- R2
- R4
- R5
- R6

6 hybrids representing transgenic insect protection grown in Champaign and DeKalb, IL in 2010 with yields of 220-240 bu/ac
Seasonal Sulfur Uptake

6 hybrids representing transgenic insect protection grown in Champaign and DeKalb, IL in 2010 with yields of 220-240 bu/ac
Seasonal Magnesium Uptake

6 hybrids representing transgenic insect protection grown in Champaign and DeKalb, IL in 2010 with yields of 220-240 bu/ac
Seasonal Zinc Uptake

6 hybrids representing transgenic insect protection grown in Champaign and DeKalb, IL in 2010 with yields of 220-240 bu/ac
Seasonal Boron Uptake

B Uptake (g B ha⁻¹)

GDD<sub>C</sub>

Percent of Total (%)

Boron uptake over the course of the growing season for different parts of the maize plant. The graph shows the seasonal boron uptake in grams per hectare for different growth stages and parts of the plant. The x-axis represents the growing degree days (GDD<sub>C</sub>), while the y-axis shows the percent of total boron uptake. The graph includes data for grain, tassel, cob, husk leaves, stalk and leaf sheaths, and leaf blades.

6 hybrids representing transgenic insect protection grown in Champaign and DeKalb, IL in 2010 with yields of 220-240 bu/ac.
Seasonal Manganese Uptake

6 hybrids representing transgenic insect protection grown in Champaign and DeKalb, IL in 2010 with yields of 220-240 bu/acre.
Seasonal Iron Uptake

Fe Uptake (g Fe ha\(^{-1}\))

<table>
<thead>
<tr>
<th>GDD(_C)</th>
<th>0</th>
<th>165</th>
<th>330</th>
<th>495</th>
<th>660</th>
<th>825</th>
<th>990</th>
<th>1155</th>
<th>1320</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent of Total (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grain</td>
<td>Tassel, Cob, Husk Leaves</td>
<td>Stalk and Leaf Sheaths</td>
<td>Leaf Blades</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V6</td>
<td>V10</td>
<td>V14</td>
<td>VT/R1</td>
<td>R2</td>
<td>R4</td>
<td>R5</td>
<td>R6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Growth Stage

6 hybrids representing transgenic insect protection grown in Champaign and DeKalb, IL in 2010 with yields of 220-240 bu/ac
Seasonal Copper Uptake

Cu Uptake (g Cu ha\(^{-1}\))

GDD\(_{C}\) 0 200 400 600 800 1000 1200 1400

Percent of Total (%)

0 25 50 75 100

Grain
Tassel, Cob, Husk Leaves
Stalk and Leaf Sheaths
Leaf Blades

Growth Stage

6 hybrids representing transgenic insect protection grown in Champaign and DeKalb, IL in 2010 with yields of 220-240 bu/ac