TRIAL RESULTS

SOYBEAN

SÃO PAULO, BRAZIL (2016)

HIGHLIGHTS

THE POLY4 BLEND OUTPERFORMED THE INDUSTRY STANDARD

ENHANCED MACRO AND MICRO NUTRIENT OFFTAKE

YIELD INCREASED BY 7% COMPARED TO MOP+SSP BLEND

GREATER YIELD ACHIEVED HIGHER MARGIN BY US$53/ha
TRIAL OBJECTIVE

To evaluate POLY4 in a commercial fertilizer programme for soybean in Brazil.

In the World Agricultural Supply and Demand Estimates report (WASDE), the USDA indicate that the 2016/2017 soybean production is currently sitting at an estimated 348 million tonnes. The key drivers in the increasing soybean production are USA, Brazil and Argentina, who collectively contribute 81% to the global market. China, who is also among one of the largest soybean producers, has gained the status of the leading importer of soybeans.

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>SHARE OF GLOBAL PRODUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>33%</td>
</tr>
<tr>
<td>Brazil</td>
<td>31%</td>
</tr>
<tr>
<td>Argentina</td>
<td>17%</td>
</tr>
</tbody>
</table>

OVERVIEW

PARTNER: UNESP
LOCATION: SÃO PAULO, BRAZIL
YEAR: 2016

- Brazil produced 31% of the world’s soybean in 2016/17 and is projected to become the world’s largest soybean producer by 2026.1,2,3
- Soybean production accounts for about 35% of K2O fertilizer use in Brazil.4
- Treatments were a typical commercial blend with equivalent quantities of K compared to MOP+S from SSP.
- The trial was a randomized complete block design with seven replications.

BLEND COMPARISON

POLY4 increases nutrient density of blends, increasing S concentration by three points and adding Mg.

<table>
<thead>
<tr>
<th>TRADITIONAL: INPUTS</th>
<th>POLY4: INPUTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TSP:</strong> 21%</td>
<td><strong>TSP:</strong> 39%</td>
</tr>
<tr>
<td><strong>MOP:</strong> 30%</td>
<td><strong>MOP:</strong> 21%</td>
</tr>
<tr>
<td><strong>SSP:</strong> 49%</td>
<td><strong>POLY4:</strong> 40%</td>
</tr>
</tbody>
</table>

INCREASE IN NUTRIENT CONTENT

Traditional: Inputs
- P: 0
- K: 18
- S: 5
- Ca: 18
- Mg: 2
- CI: 14

POLY4: Inputs
- P: 18
- K: 18
- S: 8
- Ca: 15
- Mg: 2
- CI: 11

+2% increase in nutrient content
PLANT POPULATION\textsuperscript{5,6,7}

- Higher plant population density allows better light interception at early growth phase thus delivering greater growth and yield.
- POLY4 gave higher plant emergence, which subsequently continued to more plants at harvest.

YIELD PERFORMANCE\textsuperscript{5,7}

- There was a significant yield response to the fertilizer blends.
- The POLY4 blend had 7\% greater yield than the industry standard PKS.
- In Brazil, based on average performance of 65 bags of soybean per hectare, 7\% greater yield will deliver 4.5 bags more.

**TREATMENT TABLE**\textsuperscript{5,6}

<table>
<thead>
<tr>
<th>TREATMENTS</th>
<th>NUTRIENTS APPLIED (kg ha(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P(_2)O(_5)</td>
</tr>
<tr>
<td>Control</td>
<td>72</td>
</tr>
<tr>
<td>Standard 0:18:18 blend</td>
<td>72</td>
</tr>
<tr>
<td>POLY4 0:18:18 blend</td>
<td>72</td>
</tr>
</tbody>
</table>

**TREATMENTS AVERAGE NUTRIENTS APPLIED (kg ha\(^{-1}\))**

<table>
<thead>
<tr>
<th>TREATMENTS</th>
<th>P(_2)O(_5)</th>
<th>K(_2)O</th>
<th>CaO</th>
<th>MgO</th>
<th>S</th>
<th>Cl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>72</td>
<td>0</td>
<td>71</td>
<td>0</td>
<td>23</td>
<td>0</td>
</tr>
<tr>
<td>Standard blend</td>
<td>72</td>
<td>72</td>
<td>71</td>
<td>0</td>
<td>23</td>
<td>58</td>
</tr>
<tr>
<td>POLY4 blend</td>
<td>72</td>
<td>72</td>
<td>58</td>
<td>10</td>
<td>31</td>
<td>44</td>
</tr>
</tbody>
</table>
The POLY4 fertilizer blend enhanced macro and micro nutrient offtake by the soybean.

- Improvements in macro-nutrient offtake compared to the standard blend:
  - N: +7%
  - P: +10%
  - K: +7%
  - Ca: +13%
  - Mg: +11%
  - S: +11%

- Improvements in micro-nutrient offtake compared to the standard blend:
  - B: +2%
  - Cu: +9%
  - Fe: +12%
  - Mn: -2%
  - Zn: +24%

PROTEIN YIELD

- Soybean meal is used extensively as a protein source in animal feed.
- The POLY4 blend improved the protein yield by 7% compared to the standard industry blend.

MARGIN

- The POLY4 blend gave the greatest margin over fertilizer costs despite the inclusion of a more expensive P fertilizer.
- The greater margin of US$53/ha was reached due to the greater yield achieved compared to the MOP+SSP blend.

Notes:
1. USDA Oilseeds World Markets and Trade (2017); 2. Agrinews (2014); 3. BrazilGovNews (2017); 4. International Plant Nutrition Institute, IPNI (2014); 5. Standard blend contained muriate of potash (MOP), single super phosphate (SSP) and triple super phosphate (TSP); POLY4 blend contained MOP, TSP and POLY4; 6. Initial soil analysis: pH 4.6; P 15 mg kg\(^{-1}\), K 32 mg kg\(^{-1}\), Ca 160 mg kg\(^{-1}\), Mg 49 mg kg\(^{-1}\), S 10 mg kg\(^{-1}\), organic matter content 2.2%; 7. Results presented are based on data from GENSTAT ANOVA means at K2O rate of 72 kg ha\(^{-1}\); 8. Protein concentration: control (36.7%), standard blend (36.7%), POLY4 blend (36.7%), standard blend (36.7%), POLY4 blend (36.7%); 9. Protein yield (kg ha\(^{-1}\)) and margin (US$/ha) were converted from N content (%) by multiplying by 5.71; 10. Fertilizer prices were obtained from CRU and are 2017 prices for Brazil: MOP (US$262/t), POLY4 (US$200/t), TSP (US$281/t); 11. Costs include fertilizer spreading cost of US$13.07/t; 12. Soybean price was obtained from FAOSTAT (US$344/t); 13. Margin = crop output – (cost of fertilizer material + cost of fertilizer application).