EFFECT OF DIFFERENT BLEND RATIOS OF POLY4 WITH MOP ON THE YIELD AND NUTRIENT UPTAKE OF RICE IN SICHUAN, CHINA

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Enhancing productivity in a changing climate
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A single source of bulk nutrients as foundation for effective, efficient, flexible and sustainable fertilization.

**Characteristics**

- Improves yield and quality
- Straight or as part of a fertilizer blend
- Efficient nutrient release profile
- pH neutral

Notes: 1) Based on 90% polyhalite grade. Macro nutrients based on w/w % and micro nutrients based on mg/kg; micro nutrients’ content: B 1.69, Zn 1.9, Mn 3.1, Mo 0.3, Se 0.5, Fe >0.5, Cu 1.1, Sr 1414. 2) POLY4 is the trademark name for polyhalite products from the Sirius Minerals polyhalite project in North Yorkshire, *48% SO₃, B – boron, Cu – copper, Se – selenium, Zn – zinc, Fe – iron, Sr – strontium, Mo – molybdenum, Mn – manganese.*
CONTEXT

• China is the largest rice producer in the world, and accounts for as much as 29% of total world rice production. China produced 209.5 million metric tonnes of rice from 30.2 million ha of land in 2016 (FAO, 2016)

• Rice is a significant crop in Sichuan province in China

• The rice cultivated area in Sichuan province was 1.99 million hectares

• Large amounts of potassium are required for rice growing
CHINESE RICE FARMERS COMMONLY USE MOP AS A POTASSIUM FERTILIZER
TRIAL OBJECTIVE

• To assess the effects of different blend ratios of POLY4 with MOP on the yield and nutrient uptake of rice in Sichuan, China

Source: 19000-SAAS-19017-17.
## SOIL ANALYSIS

- Site location: Maosheng village, Lu County, Sichuan province, China
- The basic properties of the experimental soil

<table>
<thead>
<tr>
<th>pH</th>
<th>OM (%)</th>
<th>Available P (mg kg(^{-1}))</th>
<th>Available K (mg kg(^{-1}))</th>
<th>Exchangeable Ca (mg kg(^{-1}))</th>
<th>Exchangeable Mg (mg kg(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.3</td>
<td>3.9</td>
<td>7.5</td>
<td>136</td>
<td>3400</td>
<td>600</td>
</tr>
</tbody>
</table>

Notes: 1) All treatments received 150 kg N ha\(^{-1}\) 75 kg P\(_2\)O\(_5\) ha\(^{-1}\).  
Source: 19000-SAAS-19017-17.
## TREATMENTS
The application rates of nutrients from POLY4 in rice (kg ha\(^{-1}\))

<table>
<thead>
<tr>
<th>Treatment(^1)</th>
<th>K(_2)O (fertilizer)</th>
<th>POLY4 proportion (%)</th>
<th>CaO</th>
<th>MgO</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>MOP 100</td>
<td>135</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>MOP 20 + POLY4 80</td>
<td>135</td>
<td>80</td>
<td>129</td>
<td>46</td>
<td>147</td>
</tr>
<tr>
<td>MOP 30 + POLY4 70</td>
<td>135</td>
<td>70</td>
<td>113</td>
<td>40</td>
<td>129</td>
</tr>
<tr>
<td>MOP 50 + POLY4 50</td>
<td>135</td>
<td>50</td>
<td>80</td>
<td>29</td>
<td>92</td>
</tr>
<tr>
<td>MOP 70 + POLY4 30</td>
<td>135</td>
<td>30</td>
<td>48</td>
<td>17</td>
<td>55</td>
</tr>
<tr>
<td>POLY4 100</td>
<td>135</td>
<td>100</td>
<td>161</td>
<td>58</td>
<td>184</td>
</tr>
</tbody>
</table>

Notes: 1) All treatments received 150 kg N ha\(^{-1}\) 75 kg P\(_2\)O\(_5\) ha\(^{-1}\).
Source: 19000-SAAS-19017-17.
MATERIAL AND METHODS (1)

• The nitrogen and phosphorus fertilizer sources were urea and mono-ammonium phosphate respectively

• All P and K fertilizers were applied as base fertilizer

• N fertilizer was applied as split in the experiment: 60% nitrogen as base fertilizer and the rest as dressing fertilizer at tillering stage

• Randomized complete block design with three replications

Notes: 1) All treatments received 150 kg N ha⁻¹ 75 kg P₂O₅ ha⁻¹.
Source: 19000-SAAS-19017-17.
MATERIAL AND METHODS (2)

- To determine the effectiveness of POLY4 as a nutrient source for rice production
  - Yield
  - Tissue nutrient concentrations
  - Change in soil nutrients

Notes: 1) All treatments received 150 kg N ha\(^{-1}\) 75 kg P\(_2\)O\(_5\) ha\(^{-1}\).
Source: 19000-SAAS-19017-17.
APPLYING POLY4 COMPARED WITH CONTROL

无肥
Control

POLY 100%
Sustaining the future.

SEVEN TREATMENTS IN THE FIELD
YIELD RESULTS (1)
Response of rice grain yields to POLY4 proportion in the same K rate (135 kg K₂O ha⁻¹) applied

There was a polynomial equation between rice yield and applied S amount associated with POLY4 (Y= -0.0512x² + 10.273x + 8206.2, R² = 0.5976, Y = rice yield, x = S input).

Notes: 1) All treatments received 150 kg N ha⁻¹ 75 kg P₂O₅ ha⁻¹.
Source: 19000-SAAS-19017-17.
YIELD RESULTS (2)

Rice grain yields for different K source

Notes: 1) All treatments received 150 kg N ha$^{-1}$ 75 kg P$_2$O$_5$ ha$^{-1}$.
Source: 19000-SAAS-19017-17
K ACCUMULATION
Response of total K accumulation (straw + grain) to S rate from POLY4 applied

\[ y = -0.0009x^2 + 0.2885x + 212.93 \]

\[ R^2 = 0.5746 \]

Source: 19000-SAAS-19017-17
P ACCUMULATION
Response of total P accumulation (straw + grain) to S rate from POLY4 applied

\[ y = -0.0003x^2 + 0.0827x + 30.863 \]

\[ R^2 = 0.874 \]

Source: 19000-SAAS-19017-17
S ACCUMULATION
Response of total S accumulation (straw + grain) to S rate from POLY4 applied

\[ y = 5\times10^{-5}x^2 - 0.0025x + 14.361 \]
\[ R^2 = 0.6293 \]

Source: 19000-SAAS-19017-17
A SIGNIFICANTLY POSITIVE CORRELATION BETWEEN RATE OF INPUT S AND P CONTENT IN RICE GRAIN, Mn CONTENT IN STRAW, POST-HARVEST SOIL-AVAILABLE S CONTENT

<table>
<thead>
<tr>
<th>S rate from POLY4</th>
<th>P content in grain (g kg(^{-1}))</th>
<th>Mn content in straw (mg kg(^{-1}))</th>
<th>Post-harvest soil-available S content (mg kg(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(r = 0.524, \ p &lt; 0.05)</td>
<td>(r = 0.462, \ p &lt; 0.05)</td>
<td>(r = 0.585, \ p &lt; 0.05)</td>
</tr>
</tbody>
</table>
# POST-HARVEST SOIL AVAILABLE K AND S CONTENT

<table>
<thead>
<tr>
<th></th>
<th>Post-trial available K content (mg kg(^{-1}))</th>
<th>Post-trial available S content (mg kg(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Control</strong></td>
<td>121.5 \text{a}</td>
<td>152.6 \text{a}</td>
</tr>
<tr>
<td><strong>MOP</strong></td>
<td>133.6 \text{b}</td>
<td>186.8 \text{b}</td>
</tr>
<tr>
<td><strong>POLY4</strong></td>
<td>146.4 \text{c}</td>
<td>232.6 \text{c}</td>
</tr>
</tbody>
</table>

Source: 19000-SAAS-19017-17
CONCLUSIONS

• Applying POLY4 combined with MOP gave a better rice yield response than applying MOP or POLY4 alone; and rice grain yield varied with different blend ratios of POLY4 with MOP.

• Rice grain yield, total K and P accumulation (straw + grain) improved with increasing S supply from POLY4 at low S input rate and decreased at high S input rate.

• A significantly positive correlation between rate of input S and P content in rice grain, Mn content in straw, post-harvest soil available S content.

• POLY4 (100%) significantly increased post-trial soil available K content over MOP (100%).

Source: 19000-SAAS-19017-17
THANK YOU

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