Comparing polyhalite and KCl in alfalfa fertilization

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Introduction

- Balanced nutrients supplying = key factor for alfalfa high quality and yield.
- Potassium fertilization = the most common nutrient input for alfalfa this crop in the high weathered, low-fertile and acidic soils of the tropical region.
- Minerals commonly explored as K sources: sylvite (KCl), sylvinite (KCl + NaCl), and carnallite (K(MgCl₂,Br)₂).
- Potassium chloride potash (58 to 62% of K₂O) = the most potash fertilizer used in Brazil accounting for over 95% of the market.
- However, there are other minerals composed of sulfates = langbeinite, kainite, and polyhalite.

- Polyhalite (K₂MgCa₃(SO₄)₄·2H₂O) is a mineral of natural occurrence with large existing deposits and has potential to be a multi-nutrient (ratio of 11.7%-K, 19%-S, 3.6%-Mg, and 12.1%-Ca) fertilizer for forage crop production.
- Little information is available for the response of alfalfa to polyhalite.
- Polyhalite may provide a slow-release fertilizer source of K, Ca, Mg, and S.

Goal

The aim of this study was to evaluate the effect of doses and sources of application of potassium fertilizer on the alfalfa dry matter yield, quality, and nutritional status.

Material & methods

- Treatments comprised two K sources: polyhalite and KCl (60% K₂O), five ratios (polyhalite:KCl) and four K₂O levels (0, 50, 10 e 200 kg/ha).
  - i) Control (no K, S, Mg or Ca);
  - ii) KCl 100%
  - iii) KCl 87.5% + Polyhalite 12.5%;
  - iv) KCl 50% + Polyhalite 50%;
  - v) KCl 12.5% + Polyhalite 87.5%;
  - vi) Polyhalite 100%;
  - vii) KCl 100% + gypsum (12.5%);
  - viii) KCl 100% + gypsum 50%.
- Measurements: dry matter yield, leaf area, foliar diagnosis (K, S)

Material & methods

- Polyhalite = alternative source of K and S and can meet the nutritional requirements of alfalfa for healthy growth and production.
- Based on K and S uptake, there may be some synergy between the nutrients in polyhalite that enhances alfalfa performance.

<table>
<thead>
<tr>
<th>Doses (K₂O kg/ha)</th>
<th>KCl 100%</th>
<th>KCl 87.5% + Polyh 12.5%</th>
<th>KCl 50% + Polyh 50%</th>
<th>KCl 12.5% + Polyh 87.5%</th>
<th>Polyh 100%</th>
<th>KCl 100% + gypsum 12.5%</th>
<th>KCl 100% + gypsum 50%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter</td>
<td>28.2</td>
<td>28.2</td>
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<td>Yield (g per pot)</td>
<td>52.0</td>
<td>52.0</td>
<td>54.2</td>
<td>57.7</td>
<td>61.1</td>
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<tr>
<td>Leaf area (cm²)</td>
<td>3159.9</td>
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<td>3159.9</td>
<td>3181.3</td>
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<td>Fertilizers</td>
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<tr>
<td>K</td>
<td>4.8</td>
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<tr>
<td>(g/kg)</td>
<td>8.2</td>
<td>8.2</td>
<td>9.9</td>
<td>7.2</td>
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<tr>
<td>S</td>
<td>10.2</td>
<td>10.2</td>
<td>13.4</td>
<td>16.2</td>
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<tr>
<td>(g/kg)</td>
<td>11.5</td>
<td>11.5</td>
<td>13.4</td>
<td>16.2</td>
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<td>Crops</td>
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<tr>
<td>Total</td>
<td>5.366**</td>
<td>5.366**</td>
<td>6.266**</td>
<td>6.266**</td>
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</tr>
</tbody>
</table>

Conclusion

- Alfalfa responded positively to K and S.
- Polyhalite = source of K and S, better than KCl alone or plus gypsum.
- Polyhalite and KCl mixture significantly out produced the control.

Based on K and S uptake, there may be some synergy between the nutrients in polyhalite that enhances alfalfa performance.
- Polyhalite = alternative source of K and S and can meet the nutritional requirements of alfalfa for healthy growth and production.