**Introduction**

- Lower yields from old alfalfa (*Medicago sativa* L.) stands are sometimes due to inefficient production practices (Canevari and Putnam, 2007)
- Appropriate management practices can improve productivity of old alfalfa stands
  - Nutrient management is crucial to a productive alfalfa
  - Potassium (K) requirement in alfalfa is high
  - For optimum yield response
  - Integrating K with other agronomic factors such as harvest time:
    - Could improve physiology, growth, and development of aging stands of alfalfa
  - For satisfactory forage production
  - Information on the interaction effect of K and harvest time on older stands of alfalfa is unavailable.

**Objective**

- Determine the effect of K and harvest time interaction on forage yield of old alfalfa stands.

**Materials and Methods**

- The study was performed at the University of Wyoming James C. Hageman Sustainable Agriculture Research and Extension Center, Lingle, WY during 2019-2020
- Treatments included:
  - 6 K rates: 0, 56, 112, 168, 224, and 280 kg K₂O ha⁻¹
  - 2 Harvest times: early harvest (late bud to early [10%] bloom); late harvest (7 days after early harvest)
- Experimental design
  - Randomized complete block design
  - 4 replications
- Potassium (K₂O) was applied to a 13 years old stand of alfalfa (VNS) (Figure 1)
- Fertilization date: October 26, 2019
- Individual plot size: 2 m x 6 m
- 4 harvests were made under each harvest time in 2020
  - Forage yield was measured at each harvest
  - Relative water content was also determined at each harvest
- Data were analyzed using SAS 9.4

**Results and Discussion**

- Growth of old alfalfa stands after K fertilization was observed (Figures 2 and 3)
- Forage yield was measured at each harvest
- For optimum yield response, high and moderate level of K is required by older stands of alfalfa when harvested early or late, respectively
- Different K rates required by the plants at both early and late harvest could be attributed to maturity stages of the plant when frequently harvested early or late.

**Results**

<table>
<thead>
<tr>
<th>Potassium (K₂O)</th>
<th>Early Harvest</th>
<th>Late Harvest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>0</td>
<td>1650b</td>
<td>1600b</td>
</tr>
<tr>
<td>56</td>
<td>1705b</td>
<td>2390a</td>
</tr>
<tr>
<td>112</td>
<td>1855ab</td>
<td>1915b</td>
</tr>
<tr>
<td>168</td>
<td>2225a</td>
<td>1710b</td>
</tr>
<tr>
<td>224</td>
<td>1740b</td>
<td>2380a</td>
</tr>
<tr>
<td>280</td>
<td>1620b</td>
<td>2785a</td>
</tr>
</tbody>
</table>

Average: 1806, 2133, 1312, 1688, 6938

**Discussion**

- Forage yield was significantly (*P < 0.001*) affected by interaction between K and harvest time and harvest frequency
- At early harvest, highest total forage yield (7990 kg ha⁻¹) was produced under 224 kg K₂O ha⁻¹ application rate
- At late harvest, 168 kg K₂O ha⁻¹ gave the highest total forage yield (8640 kg ha⁻¹) (Table 1)
- This suggests that for optimum yield response, high and moderate level of K is required by older stands of alfalfa when harvested early or late, respectively

**Acknowledgment**

We thank the University of Wyoming Forage Agronomy lab team and SAREC crew for assistance in the study.

**Table 1.** Forage yield of old alfalfa stand affected by potassium and harvest time at different harvest frequencies at the University of Wyoming James C. Hageman Sustainable Agriculture Research and Extension Center in 2020.

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Average: 1806, 2133, 1312, 1688, 6938

**Figure 2.** Growth of old alfalfa stand after K application (April 2020) at the University of Wyoming James C. Hageman Sustainable Agriculture Research and Extension Center.

**Figure 3.** Growth of old alfalfa stand at first harvest (early harvest; June 10, 2020) at the University of Wyoming James C. Hageman Sustainable Agriculture Research and Extension Center in 2020.

**Figure 4.** Relationship between forage yield and relative water content of old alfalfa stand over four harvest periods (under early and late harvests) at the University of Wyoming James C. Hageman Sustainable Agriculture Research and Extension Center in 2020.

**Summary and Conclusion**

- Potassium and harvest time interaction affected forage production of aging alfalfa
  - Highest annual total forage yield was observed for:
    - 224 kg K₂O ha⁻¹ application rate at early harvest
    - 168 kg K₂O ha⁻¹ application rate at late harvest
- Moisture content of older alfalfa stand plays a significant role in the improvement of alfalfa production.

**Reference**


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- This suggests that for optimum yield response, high and moderate level of K is required by older stands of alfalfa when harvested early or late, respectively

- Different K rates required by the plants at both early and late harvest could be attributed to maturity stages of the plant when frequently harvested early or late.

- On average, total forage yield produced under early harvest (6938 kg ha⁻¹) and late harvest (6730 kg ha⁻¹) were comparable (Table 1).
- There was a quadratic response between forage yield and relative water content of alfalfa (Figure 4)
- This is an indication that the moisture content of older alfalfa stands has a direct influence on its forage production potential.