Alfalfa
Interseeding in Corn Silage

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Corn silage and alfalfa are often grown in rotation to provide forage for livestock, but low yields of spring-seeded alfalfa reduce profitability

(rotation: corn – corn – spring seeded alfalfa – alfalfa – alfalfa)

Forage dry matter yields
Corn silage: 9 t per acre
Established alfalfa: 5 t per acre
Spring seeded alfalfa: 2.5 t per acre
Excessive corn silage production also causes problems...

- High risk of soil and nutrient loss

- Without crop rotation, corn silage yields decline and input costs for fertilizer and pesticides increase
Goal: Interseed alfalfa into corn to protect soil and jumpstart full alfalfa production the following year

• Alfalfa planted into corn interrows
• Corn silage harvested, alfalfa remains as a cover crop
• Following year(s) alfalfa harvested as a forage crop
Problem: Interseeded alfalfa is prone to stand failure

Three steps to ensure survival of interseeded alfalfa...
Three steps to ensure alfalfa survival

1. Interseed alfalfa soon after corn planting and harvest corn early

Treatments with unlike letters differ at $P = 0.05$
Three steps to ensure alfalfa survival

1. Interseed alfalfa soon after corn planting and harvest corn early
2. Apply “plant protection” products such as prohexadione, fungicide & insecticide to interseeded alfalfa
Control

Prohexadione

Prohexadione + Fungicide + Insecticide

July  August  October
Impact of agrichemical applications and corn population on survival of interseeded alfalfa in 2017 and 1st year yield in 2018
Impact of agrichemical applications and corn population on survival of interseeded alfalfa in 2018

2018 Alfalfa plants per sq ft after corn harvest

- Prohexadione + Fungicide + Insecticide
- Prohexadione
- Control

2019 alfalfa yield data will be summarized soon!
Registration status of prohexadione for use on alfalfa interseeded into silage corn

• Inter-Regional Research Project #4 (IR4) and Fine Americas Inc. submitted a product label to EPA in November 2018 for Kudos 27.5 WDG application on interseeded alfalfa

• Approved product label anticipated for the 2020 growing season
Three steps to ensure alfalfa survival

1. Interseed alfalfa soon after corn planting and harvest corn early
2. Apply “plant protection” products such as prohexadione, fungicide & insecticide to interseeded alfalfa
3. Interseed adapted alfalfa varieties
Successful establishment by interseeding roughly doubles first year alfalfa yields

Treatments differ at $P = 0.05$
Yields of corn silage grown with interseeded alfalfa
Many factors probably influence yields of corn silage grown with interseeded alfalfa

Some examples…
Dry matter content at harvest:
Effects on corn silage yields

200 lbs per acre N applied at Prairie du Sac, Wisconsin 2017

Treatments with unlike letters differ at $P = 0.05$
Timing of corn planting:
Effects on adjusted corn silage yields
Prairie du Sac, Wisconsin 2017

Treatments with unlike letters differ at $P = 0.05$
Response of corn silage yield to nitrogen fertilizer

Arlington, Wisconsin planted May 15, 2017

Dry matter yield (tons per acre)

N fertilizer (pounds per acre)

- **No alfalfa**
- **No alfalfa: adjusted dry matter**
- **Interseeded alfalfa**
- **Interseeded alfalfa: adjusted dry matter**
Is interseeded alfalfa an effective cover crop?
Establishing alfalfa by interseeding rather than conventional spring seeding reduces soil and nutrient loss from cropland

Reductions in runoff due to interseeding alfalfa in corn

<table>
<thead>
<tr>
<th>Timing of runoff study</th>
<th>Soil</th>
<th>N</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early June during corn production</td>
<td>45%</td>
<td>23%</td>
<td>36%</td>
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<tr>
<td>October after silage corn harvest</td>
<td>86%</td>
<td>72%</td>
<td>62%</td>
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<tr>
<td>Following April before alfalfa production</td>
<td>87%</td>
<td>75%</td>
<td>82%</td>
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</tbody>
</table>
Residual soil nitrate after corn silage

Arlington, Wisconsin

Treatments with unlike letters differ at $P = 0.05$
But will interseeding of alfalfa be profitable?
Average net return ($ per acre) of a CS1-CS2-CS3/A1-A2-A3-A4 rotation as influenced by interseeding success rate and corn silage yield drag

<table>
<thead>
<tr>
<th>Success of alfalfa establishment by interseeding (%)</th>
<th>100</th>
<th>95</th>
<th>90</th>
<th>85</th>
<th>80</th>
<th>75</th>
<th>70</th>
<th>65</th>
<th>60</th>
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<tbody>
<tr>
<td>Corn 0</td>
<td>159</td>
<td>157</td>
<td>155</td>
<td>152</td>
<td>150</td>
<td>147</td>
<td>145</td>
<td>143</td>
<td>140</td>
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<tr>
<td>silage 5</td>
<td>153</td>
<td>151</td>
<td>149</td>
<td>146</td>
<td>144</td>
<td>142</td>
<td>139</td>
<td>137</td>
<td>135</td>
</tr>
<tr>
<td>yield 10</td>
<td>147</td>
<td>144</td>
<td>142</td>
<td>140</td>
<td>138</td>
<td>136</td>
<td>134</td>
<td>131</td>
<td>129</td>
</tr>
<tr>
<td>loss 15 (%)</td>
<td>141</td>
<td>138</td>
<td>136</td>
<td>134</td>
<td>132</td>
<td>130</td>
<td>127</td>
<td>125</td>
<td>123</td>
</tr>
<tr>
<td>(relation 20%)</td>
<td>134</td>
<td>132</td>
<td>130</td>
<td>128</td>
<td>126</td>
<td>124</td>
<td>122</td>
<td>119</td>
<td>117</td>
</tr>
<tr>
<td>(relation 25%)</td>
<td>128</td>
<td>126</td>
<td>124</td>
<td>122</td>
<td>120</td>
<td>118</td>
<td>116</td>
<td>114</td>
<td>112</td>
</tr>
</tbody>
</table>

Net return of rotation with spring seeded alfalfa = $130 per acre per year
Potential problems with interseeding
Wheel traffic damage of interseeded alfalfa

Wet soil conditions at corn silage harvest in early September

Stand recovery by mid October

Photos by Brad Holtz
Ongoing work

- Best rates and timing for prohexadione, fungicides, insecticides, and herbicide application
- Optimal planting and harvest management
- Long-term survival and yield of interseeded alfalfa
- Corn hybrid selection
- Fertilizer and manure management
- Breeding alfalfa for improved interseeding survival
- Evaluate success of the interseeding system in different states
- Promote alfalfa interseeding to producers, industry, NRCS, crop insurance…
USDA-NIFA grant project in 2018 and 2019 will be “Identifying Factors to Optimize Establishment of Alfalfa Interseeded in Corn”

- Investigators: Mark Renz and Will Osterholz (Univ. of Wisconsin), John Grabber and Dave Bjorneberg (USDA-ARS in Wisconsin & Idaho), Kim Cassida and Erin Burns (Michigan State Univ.), and Jessica Williamson (Penn State Univ.)

- Some key findings thus far....
  - Seedbed must be suitable for alfalfa establishment
  - Weed control best with Roundup-ready production system
  - Agrichemicals (prohexadione etc) improved alfalfa establishment more in WI than in other states
NAFA-Alfalfa checkoff grant project in 2020 and 2021: “Forage Production of Alfalfa Established in Silage Corn vs. Conventional Production Systems”

- Investigators: John Grabber (Wisconsin) and Dave Bjorneberg (Idaho)

- Objectives:
  - Evaluate the timing of corn planting, alfalfa interseeding, and corn harvest on corn silage yield and 1st year alfalfa forage yield and quality
  - Compare yield and quality of interseeded alfalfa systems to several conventional alfalfa production systems used in Wisconsin and Idaho
QUESTIONS?

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