Determining the Effects of Felling Method and Season of Year on Coppice Regeneration

2015 FORMEC Annual Meeting
Linz, Austria, October 4 – 8, 2015

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The objective of the study is to determine the potential effects of the felling equipment and the harvest’s season of year in the regeneration of coppice in short rotation woody plantations in the Southeastern United States.

Specific Objectives:

- Compare the effects caused on short rotation woody crops’ ability to coppice when harvesting with a shear head and a chainsaw.
- Determine if the short rotation woody crops’ coppicing ability may be affected by the season of year (winter and summer) in which the harvest is performed.
Materials and Methods

- Sites:
  - Little Rock, AR
  - Lake Placid and Venus, FL
  - Fort Pierce, FL
  - Stoneville, MS

Southeast United States
Materials and Methods

- Two seasons of year compared (winter and summer)
- Two harvesting methods compared (shear and saw)
- Clonal Eucalypt, Cottonwood and Black Willow plantations
- Plantations between 2 and 6 years
- Plots’ size: ~0.5 ha (0.25 ha summer and 0.25 ha winter)
Felling Equipment

- Fecon shear head:
  - Bunching arm
  - Accumulator arm
  - Moving knife
Bark Damage Classification

- Bark damage may have effect on coppice regeneration
- Done after harvest and skidding
- 5 damage classes specified:
  - 0 (0% damage)
  - 1 (1 – 25% damage)
  - 2 (26 – 50% damage)
  - 3 (51 – 75% damage)
  - 4 (>75% damage)

Damage Class 0
Damage Class 4
Analysis

- Sites individually analyzed

- Dependent variables:
  - Coppicing ability
  - Number of New Sprouts

- Independent variables:
  - Felling equipment
  - Season of year
  - Diameter of stump at ground level (DGL)
  - Bark damage
  - Harvest damage
  - Skidder damage (when present)
Results

Winter harvest Coppice

Summer harvest Coppice
### Effect of Harvest Season

- **Effect on coppicing ability:**

<table>
<thead>
<tr>
<th>Site</th>
<th>Specie</th>
<th>Winter Harvest Survival (%)</th>
<th>Summer Harvest Survival (%)</th>
<th>Significance (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evans</td>
<td>Eucalypt</td>
<td>96</td>
<td>79</td>
<td>0.00398**</td>
</tr>
<tr>
<td>Bates</td>
<td>Eucalypt</td>
<td>29</td>
<td>28</td>
<td>N/A</td>
</tr>
<tr>
<td>Lykes</td>
<td>Eucalypt</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Estes</td>
<td>Cottonwood</td>
<td>98</td>
<td>49</td>
<td>0.000365***</td>
</tr>
<tr>
<td>Admire</td>
<td>Cottonwood</td>
<td>99</td>
<td>92</td>
<td>0.01482*</td>
</tr>
<tr>
<td>Admire</td>
<td>Black willow</td>
<td>95</td>
<td>97</td>
<td>0.8403</td>
</tr>
</tbody>
</table>
## Effect of Felling Method

- **Effect on coppicing ability:**

<table>
<thead>
<tr>
<th>Site</th>
<th>Specie</th>
<th>Saw Stumps Survival (%)</th>
<th>Shear Stumps Survival (%)</th>
<th>Significance (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evans</td>
<td>Eucalypt</td>
<td>88</td>
<td>87</td>
<td>0.16513</td>
</tr>
<tr>
<td>Bates</td>
<td>Eucalypt</td>
<td>39</td>
<td>20</td>
<td>N/A</td>
</tr>
<tr>
<td>Lykes</td>
<td>Eucalypt</td>
<td>93</td>
<td>85</td>
<td>0.9629</td>
</tr>
<tr>
<td>Estes</td>
<td>Cottonwood</td>
<td>83</td>
<td>61</td>
<td>0.080209</td>
</tr>
<tr>
<td>Admire</td>
<td>Cottonwood</td>
<td>95</td>
<td>96</td>
<td>0.27268</td>
</tr>
<tr>
<td>Admire</td>
<td>Black willow</td>
<td>96</td>
<td>96</td>
<td>0.7799</td>
</tr>
</tbody>
</table>
Effect on Number of New Sprouts Regenerated

- Effect of harvest season and felling equipment:

<table>
<thead>
<tr>
<th>Site</th>
<th>Specie</th>
<th>Felling Method</th>
<th>Harvest Season</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Chainsaw</td>
<td>Winter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Shear head</td>
<td></td>
</tr>
<tr>
<td>Evans</td>
<td>Eucalypt</td>
<td>4.1</td>
<td>4.1</td>
</tr>
<tr>
<td>Bates</td>
<td>Eucalypt</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Lykes</td>
<td>Eucalypt</td>
<td>11.0</td>
<td>N/A</td>
</tr>
<tr>
<td>Estes</td>
<td>Cottonwood</td>
<td>2.2*</td>
<td>2.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.8*</td>
<td></td>
</tr>
<tr>
<td>Admire</td>
<td>Cottonwood</td>
<td>4.5*</td>
<td>4.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.5*</td>
<td></td>
</tr>
<tr>
<td>Admire</td>
<td>Black willow</td>
<td>5.1</td>
<td>4.4*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.3</td>
<td></td>
</tr>
</tbody>
</table>

* Statistically different
## Other Factors Affecting Coppice Regeneration

<table>
<thead>
<tr>
<th>Site</th>
<th>Specie</th>
<th>DGL on Coppicing ability</th>
<th>DGL on Number of Sprouts</th>
<th>Damage on Coppicing</th>
<th>Damage on Number of Sprouts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evans</td>
<td>Eucalypt</td>
<td>0.77830</td>
<td>7.48E-09***</td>
<td>0.00391**</td>
<td>0.00507**</td>
</tr>
<tr>
<td>Bates</td>
<td>Eucalypt</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Lykes</td>
<td>Eucalypt</td>
<td>0.0819</td>
<td>1.01E-13***</td>
<td>0.6886</td>
<td>0.283</td>
</tr>
<tr>
<td>Estes</td>
<td>Cottonwood</td>
<td>0.345785</td>
<td>&lt;2E-16***</td>
<td>0.184227</td>
<td>0.415602</td>
</tr>
<tr>
<td>Admire</td>
<td>Cottonwood</td>
<td>0.00339**</td>
<td>&lt;2E-16***</td>
<td>0.90886</td>
<td>0.97056</td>
</tr>
<tr>
<td>Admire</td>
<td>Black willow</td>
<td>0.0115*</td>
<td>&lt;2E-16***</td>
<td>0.0524</td>
<td>0.0498*</td>
</tr>
</tbody>
</table>
Conclusions

• **Effect of Harvest Season on Coppice Regeneration:**
  
  • Winter harvest ensures higher survival rates of eucalypt and cottonwood stumps. No difference was observed on black willow.
  
  • Black willow stumps regenerated more sprouts when cut during summer. No difference observed on cottonwood and eucalypt stumps.

• **Effect of Felling Equipment on Coppice Regeneration:**
  
  • No difference on stump survival was found on harvesting eucalypt, cottonwood and black willow with the chainsaw or the shear head.
  
  • Cottonwood stumps cut with shear head generated more sprouts in Admire site, while in Estes site stumps cut with chainsaw generated more sprouts. No difference observed on eucalypt and black willow.
Conclusions

• **Other Factors Affecting Coppice Regeneration:**
  
  • Diameter of stumps:
    
    • Positive linear relation between DGL and stump survival observed in both species at Admire.
    
    • In all sites, and species, a positive linear relation was observed between the DGL and the number of sprouts regenerated.

  • Bark Damage:
    
    • In eucalypt, a negative linear relation was observed between bark damage and stump survival.
    
    • A negative linear relation was observed between the bark damage and the number of new sprouts regenerated per stump in eucalypt and black willow.
Recommendation for Future Research

• Determine the effects of felling method on coppice growth and yield: no effect observed on coppice regeneration, however an effect can be observed in yield.

• Further research in the importance of number of new sprouts per stump: one single stem per stump may be more desired than 5 stems per stump.

• Evaluate the potential of the shear felling method used in this study as a SRWC harvest system.

• Deepen the study of the effect of harvest season on coppice regeneration: year round harvest may be necessary for feasibility of system.
Acknowledgements

• Integrated Biomass Supply System (IBSS)

• Auburn University School of Forestry and Wildlife Sciences

• United States Forest Service

• ArborGen

• Evans Properties

• SFWS Graduate students and USFS interns
Thank you... Questions?