Tracking short rotation woody crop (SRWC) planting operations in northern New York

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Introduction

- In 2012 USDA supported the establishment of a Biomass Crop Assistance Program (BCAP) project for willow biomass crops in northern NY.
- Celtic Energy Farm and one other landowner signed contracts for 480 ha (1,188 acres) of willow biomass crops in this project area.
- ReEnergy Holdings committed to purchasing all the willow biomass produced in this project area and using it for power and heat production.
- BCAP provides an opportunity for commercial scale willow planting operations to be observed for the first time in the United States.
- Establishment costs are one of the main factors that contribute to landowner’s hesitance to enter the market (Lowthe-Thomas and Slater 2010, Buchholz and Volk, 2012).

Objectives

- Calculate planting rates for willow biomass crops at a commercial scale.
- Determine the amount of planter down-time and identify components of planting operations and site conditions that contribute to down-time.
- Establish estimates of plant densities for recently planted fields in northern New York.

Methods

- Four sites in Northern New York were examined during this study with over 240 ha (600 acres) planted in spring of 2013.
- Time Motion Analysis: We recorded planter movements at 1-second intervals using GPS devices, while making note of events occurring throughout the operation.
- Top and bottom diameter of stems were measured on a sample (n = 990) of willow stems used for planting.
- A random sampling protocol was developed and used to inventory recently planted fields and record the number of living plants and cuttings lying on the ground in a subsample of plots.

Results

- The planting rate (effective field capacity (EFC)), excluding time turning around at the ends of fields and reloading the planter, was greater than the Egedal (1.1 ha hr⁻¹) (Table 1).
- Median EFC excluding turn around time at the ends of fields and reloading the planter, were 1.4 ha hr⁻¹ for the Step planter and 1.3 ha hr⁻¹ for the Egedal planter (Table 1).

Table 1. Average and median EFC, excluding turn around at the ends of fields and reloading the planter, during planting operations.

<table>
<thead>
<tr>
<th>Planter</th>
<th>Number of legs (n)</th>
<th>Total area (ha)</th>
<th>Mean EFC (ha hr⁻¹)</th>
<th>EFC Std. Error</th>
<th>Mean EFC (ha hr⁻¹)</th>
<th>EFC Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combined</td>
<td>291</td>
<td>44.9</td>
<td>1.34</td>
<td>0.03</td>
<td>1.38</td>
<td>0.13</td>
</tr>
<tr>
<td>Step</td>
<td>209</td>
<td>38.3</td>
<td>1.43</td>
<td>0.04</td>
<td>1.41</td>
<td>0.12</td>
</tr>
<tr>
<td>Egedal</td>
<td>82</td>
<td>6.6</td>
<td>1.12</td>
<td>0.07</td>
<td>1.30</td>
<td>0.12</td>
</tr>
</tbody>
</table>

- The median length of non-planting periods (npp) was 29s for the Step planter and 18s for the Egedal planter. For both planters, discrete npp’s were mainly below four minutes (Fig. 3).
- Non-planning periods accounted for 47% of the total observed planting time, with 18% in-field and 75% in the headland.
- 51% of the combined delays were 30s or less and can be attributed to planter material jams, cleaning debris from packing wheels and navigating areas unfit for planting (physical obstructions, drainage).

Figure 3. Frequency distribution of non-planning periods (npp) for both planters, in field and headland, as 30 second intervals.

Conclusions

- Site factors, mechanical conditions of the planters, and quality of the planting material all contributed to reducing the effective field capacity (EFC) of willow planting operations.
- Wet ground conditions in June extended the planting season into mid-July, but also slowed down planting operations because packing wheels were commonly clogged with soil and debris, requiring constant attention.
- Changes in topography and wet spots caused the tractor to deviate from the planting row, forcing the tractor to realign itself with the row.
- Mechanical breakdown of the Step planter stopped planting or reduce the planting progress by removing one of the two planters from the production system (Fig. 3).
- The lack of spare parts for planters and local manufacturers of spare parts was an issue that often delayed planting for long periods.
- The recommended minimum diameter for willow planting stock is 9.5 mm. 94.5% of the stem tops and 17.7% of stem bottoms were below this threshold (Fig. 4).

References


Figure 4. Stem diameters of planting material used during the 2013 planting season. Top figure is diameter at the top of the stem and bottom figure are diameters at the bottom of the stem. The dashed line indicates the minimum recommended diameter for planting stock.