DEVELOPMENT OF COST AND ENERGY EFFICIENT BIOMASS SUPPLY SYSTEMS FOR YOUNG STANDS

Small diameter trees with DBH up to ca 14 cm and height below 12 m represent a significant biomass potential in Sweden and Finland. In order to expand the mobilization of this renewable resource, the cost of harvesting, fractioning and transporting biomasses from harvest of dense and heterogeneous stands should be significantly reduced. Alternative harvesting methods for biomass procurement, rather than removing only delimbed pulpwood in such stands, are currently in use in Fennoscandia, but there is still a lack of information on the effect of implementing new technology and systems to meet the possible requirements of delivered products at biorefinery industry gates.

CURRENT MANAGEMENT SYSTEMS FOR YOUNG STANDS

The conventional harvesting systems are profitable in stands with an average harvested tree sizes above ca 8-9 cm DBH (ca 35 dm^3) (Fig. 1). As the tree sizes increase the higher degree of pulpwood and small timber prior to energy-wood are harvested. Assortments such as delimbed pulpwood, rough delimbed pulpwood, whole tree sections, and integrated harvest of pulpwood and energy wood are cut and hauled to road side. But currently used technology suffers for low productivity if the average tree size harvested falls below 8 cm DBH. In such stands a conventional Pre-Commercial Thinning (PCT) become the most economical alternative. However, such stands could provide the society with significant biomass volumes for the industry e.g. biorefineries. Unfortunately the technology for efficient extraction is lacking.

Figure 1. *Suitability of silvicultural and harvesting operations dependent on the type of stands.*

BOTTLENECKS

In recent studies it has been concluded that new methods and technology for the harvester work are needed in order to reduce systems cost and to utilize the biomass from PCT stands. Currently, the thinning operation is performed by selection from below. This means that too many time consuming crane movements are performed. In addition, un-delimbed small diameter trees are bulky and load-capacities of means for transportation are underutilized, a compaction by compression technologies throughout the supply chain would increase payloads and make the biomass transportation more cost-efficient. However, studies show that such technology must be cost effective, and not slow down other work tasks connected to the operation.

POSSIBLE DEVELOPMENTS – NEW SYSTEMS!

Recent studies show that an implementation of boom-corridor thinning methods in combination with new adapted felling and bunching technology could increase harvester productivity as much as 2-fold, when compared to selective thinning. Studies show also that if the harvester compacts and bundle the biomass already in stand, with high efficiency, the cost for sub-sequent transportations to road side and industry would significantly decrease. Currently, the main products delivered from early thinnings to industry are traditional assortments like delimbed pulpwood, tree sections or chipped whole tree sections. Demands for a greater variety of assortments delivered at industry gates may however increase as the development of supply chains for biorefineries and integrated industries (chemical refineries at pulpmills) accelerate, e.g.: rough delimbed pulpwood, delimbed and debarked pulpwood, stemwood chips with tight particle size specifications, bundled tree sections, chunked whole tree sections etc. For example, in some systems the biomass might require to be transported for long distances and be stored for some time before use, here would high density bundles or chunked wood be suitable alternatives to conventional chips, in others deliveries of delimbed and debarked pulpwood may be required.

COMING SYSTEMS ANALYSIS IN THE PROJECT

In order to conclude which systems are most cost and energy efficient to develop, analyses of current and possible future supply systems are required. Such models/results should then be used for comparison with other supply systems (e.g. stumps and slash).

KEYWORDS

Fuel wood, operational efficiency, small diameter trees, systems analyses

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25.9.2012

European Union
European Regional Development Fund
Botnia-Atlantica
Cross-border cooperation over mountain and sea
REGION VÄSTERBOTTEN
Länsstyrelsen Västernorrland
Österbottens förbund
Pohjanmaan liitto
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