

A Traditional Ground-Based System for Woody Biomass Harvesting in Short Rotation Woody Crops (SRWC) Plantations - A Case Study in Michigan

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Reconfigured forage harvesting equipment utilized for plantation biomass harvesting and processing is highly productive but is expensive and not yet widely used in short rotation woody crop (SRWC) production systems. Traditional timber harvesting equipment, on the other hand, has been widely used for decades and can be adapted for use in SRWC plantations. Productivity of these traditional systems is not well understood when they are used in SRWC plantations. Productivity and costs were evaluated for a feller-buncher, skidder, loader, and grinder (the traditional system) in a 7.5 acre small-diameter hybrid poplar plantation in Escanaba, Michigan. Operation cycle time predictive models were developed from a time-motion analysis. Operation productivity and costs were then compared with published data for a reconfigured forage harvesting system. Compared values between the two systems included: machine hourly rate, in dollars per productive machine hour (\$/PMH), the production cost, in dollars per oven dry ton (\$/ODT), and the system production rate, in oven dry tons per productive machine hour (ODT/PMH). The machine hourly rate and production cost of the traditional system were found to be \$349.00/PMH, and \$19.90/ODT, respectively, while the production rate was found to be variably between 11.07-30.31 ODT/PMH. Other analyses performed on the traditional system including: a sensitivity analysis to test the effect of machine utilization on production cost, ANOVA tests to determine the effect of spacing and tree size on felling productivity, and also a net energy analysis to determine the energy ratio between diesel fuel inputs with recoverable energy outputs.

Keywords: Woody biomass, harvesting, processing, supply chain, net energy ratio.

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Biography for Zach Carter

Zach Carter is a master's student of the Biosystems Engineering Department at Michigan State University. He received his bachelor's degree from the same department in 2014, and has nearly completed a bachelor's degree in Fisheries & Wildlife, as well. Previous work has extensively focused on woody biomass storage, short rotation woody crop harvesting, biomass upgrading processes, as well as wildlife management.