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SRWC-PEAM: A Comprehensive Appraisal Tool for Short-Rotation Woody Crops in the Southeast

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Abstract

Short-rotation woody crops (SRWCs) are fast-growing trees grown for energy or paper production. The productivity and economic assessment model for short-rotation woody crops, or SRWC-PEAM, is a web-based tool for evaluating the potential to produce woody feedstock from SRWCs on marginal lands in the southeastern United States. Productivity and economic assessments are based on land history and conditions, species, economic factors and management, and an enterprise budget developed according to recent field research and published data. Extension professionals can use SRWC-PEAM to evaluate stand establishment and management options to find profitable SRWC project scenarios for landowners and improve producers' economic risk management decisions for SRWCs.

Keywords: short-rotation woody crops, energy feedstock, productivity, web tools

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Introduction

Short-rotation woody crops (SRWCs) are fast-growing trees grown for energy or paper production. There is growing need to produce bioenergy feedstock as SRWCs, and because croplands and forestlands are not targeted for that purpose (Ghezehei et al., 2015), evaluating SRWC productivity potential on marginal lands is important. Assessment of productivity potential of lands is necessary as a measure of viability for future sustainable bioenergy feedstock supply (Long et al., 2013) and should address the species that qualify as suitable bioenergy feedstock (Lemus & Lal, 2005). The economic success of SRWC-based feedstock production depends on minimizing establishment and production costs while maximizing returns through enhanced productivity and receipt of adequate feedstock prices.

Because SRWC establishment and management by landowners is not commonly done, Extension professionals have the opportunity to provide technical support and required information to promote adoption by landowners (Grebner et al., 2009; Haider et al., 2015; Townsend et al., 2016) and help ensure economic success. We developed a web-based appraisal tool for SRWC-based feedstock production using an enterprise budget for best stand management on marginal lands. This tool—the productivity and economic assessment model for short-rotation woody crops, or SRWC-PEAM—allows the user to explore the productivity and

economic viability of growing SRWCs based on user inputs. Productivity, project budget, and economic returns are determined on the basis of user-provided scenarios. The tool can be used to determine delivered price or productivity required to achieve a target net present value, such as a break-even point. As current Extension outreach and education programs are improved to better support landowners to produce woody feedstock for energy (Romich, 2015), information generated from SRWC-PEAM supports such outreach efforts by enabling the assessment of economic risks and potential of SRWC production for bioenergy in the Southeast. For SRWC-PEAM to be applicable outside the Southeast, it should be validated for productivity on the basis of biomass data and incorporation of SRWCs suitable for growing in the regions of interest.

How SRWC-PEAM Works

SRWC-PEAM addresses questions regarding productivity and economic viability of woody feedstock based on type of marginal land, management practices, rotation length, and discount rates and feedstock price at delivery. Users provide data by selecting options from drop-down lists for each blank cell or by entering numbers where appropriate. Table 1 identifies data the user must enter. After entering all required inputs, the user selects "Submit (Update)" to view results.

Table 1.

Inputs Into the SRWC-PEAM Tool Used to Create Analyses for Hypothetical Short-Rotation Woody Crop Production Scenarios

General input category	Specific inputs
Site characteristics	Previous land use
	Cultivation history and present cover
	Topographic position
	Microsite
	Depth to water table
	Flooding
	Swampiness/wetness
Soil-related characteristics	Geologic source
	Soil depth and presence of pan
	Root zone soil texture
	Root zone soil color
	Root zone soil structure
	Mottling
	Topsoil depth
	Surface layer compaction
Establishment and management options	Species
	Planting year
	Rotation (years)
	Planting density (trees/acre)
	Initial mortality (%)
	Use of irrigation?

Economic analysis criteria	Delivered price ($/green ton)
	Discount rate (%)

Note. Some inputs are selected from drop-down menus.

SRWC-PEAM has three main components: a site preparation and management component, a land suitability and biomass productivity component, and an economic and enterprise budget component.

- For the site preparation and management component, data from a comprehensive set of establishment and management practices used for SRWC species are used, and the best-case scheme of activities and schedules for establishing and managing a stand is applied (Michler & Rathfon, 2006; Stringer et al., 2010) on the user-selected land type. Examples include use of pre- and postemergent herbicides; soil tillage, including disking and subsoiling; cover crop establishment; planting; use of nutrient and pH amendments; irrigation; weed/grass suppression; harvesting; and hauling.

- For the land suitability and biomass productivity component, biomass yield estimate is based on the suitability of the land for a user-selected hardwood SRWC (Baker & Broadfoot, 1979) and validated with data from many nonirrigated and irrigated poplar (Populus spp.), American sycamore, and sweetgum plantations in the Southeast (Ghezehei et al., 2019).

- The enterprise budget determines the costs of the applicable activities on the basis of up-to-date online prices of items used, published machinery costs (University of Illinois Extension, 2017), and labor costs (U.S. Bureau of Labor Statistics, 2019). Revenues are determined according to predicted yield and expected product value per unit for building a cash flow table for the rotation. The user-provided discount rate is used for calculating estimates of investment quality, including net future value, equivalent annual value, land expectation value, and benefit-to-cost ratio.

Interpreting Output

After running SRWC-PEAM, applying a hypothetical scenario for a particular land, the user can review projected cash flows and investment quality parameters to determine whether that scenario will provide a satisfactory project return. The user can rerun SRWC-PEAM, changing variables such as species and rotation to see how yield and investment quality change. SRWC-PEAM allows the user to select a target net present value (NPV) per acre or to perform a break-even analysis (target NPV of 0). After the user has run SRWC-PEAM, selecting "Green Biomass" displays the green wood biomass (ton/acre) required to achieve the target NPV according to the user-provided delivered price. Selecting "Delivered Price" displays the price ($/green ton) required to achieve the target NPV according to the calculated productivity.

The implications of the target NPV analysis options lie in addressing how higher future prices or higher productivity (growing more productive varieties of the selected species) can enhance returns. Interpretation of the information obtained from SRWC-PEAM should involve taking into account information on disease and pest threats of the selected species at a particular site.

Conclusion

SRWC-PEAM is an open-access web-based tool that provides Extension professionals or others who advise

landowners an opportunity to explore the potential to establish SRWC projects as an investment. Energy policies in the United States continue to establish goals for renewable energy that could generate robust markets for SRWCs. However, SRWC plantations are relatively expensive to establish and manage compared to conventional forest product plantations. That fact and the relative unfamiliarity with SRWCs among landowners will create some reluctance to establish them. Therefore, the information provided by SRWC-PEAM has the potential to improve producers' marketing risk management decisions. Further, the tool is a valuable resource for Extension personnel offering marketing risk management education and outlook programming.

SRWC-PEAM can be accessed in either of two ways:

1. Go directly to the tool at https://projects.ncsu.edu/project/bioenergy/SR_Hardwoods.html.

2. Go to the North Carolina State University Extension Forestry site at https://forestry.ces.ncsu.edu/srwc/, and then select the "Southeast SRWC Feasibility" link.

Author Note

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