Investigating Dual-Use Solar in Wild Blueberry

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OBJECTIVES

- Connect with regional leaders on the topic of agrivoltaics
- Document the costs of managing wild blueberry under solar panels

LOCATION: Rockport, ME

PROJECT TIMEFRAME: 2020 – 2024

INTRODUCTION

In 2021 and 2022 we collected plant and environmental data to understand the impact of installing a solar array on wild blueberry land. We concluded that installation did not significantly reduce wild blueberry cover. This array was not built as a true dual-use array because it has spacing very similar to a standard array with eight-foot rows and panels eight feet off the ground. Shading exceeded 90% reduction in sunlight, thereby reducing wild blueberry yield dramatically, as expected. In 2023 we did not collect further plant or environmental data but focused on bringing experts from the New England region together for knowledge sharing on dual-use agriculture and began understanding more about the costs associated with managing wild blueberries under a solar array.

Dual-use solar is the installation of solar panels in such a way that agricultural activities such as crop production and animal grazing can still occur profitably. Such arrays include higher panel heights and increased row spacing to allow enough sunlight to reach the crop underneath and for equipment and workers to maneuver.

METHODS

Agrivoltaics Knowledge Sharing

On November 14, 2023 we convened a group of major players in the Northeast dual-use agriculture sphere for a knowledge sharing session. Participants included those from UMaine Extension, UMass Extension, State of Maine Department of Agriculture, Conservation, and Forestry (DACF), State of Massachusetts Department of Agricultural Resources (MDAR), Maine Governor's Energy Office (GOE), Maine Farmland Trust, American Farmland Trust, ReVision Energy, and BlueWave Solar. A summary of relevant information that we learned can be found in the Results section.

Cost Comparison

The Rockport array was installed in 2021, making the 2022 crop year in this field still a recovery season and therefore the crop was not harvested. The revenue made from the solar panels is not yet available. This field will be harvested in 2024 which will allow us to complete our budget analysis. A cost comparison before and after solar was begun given the limited data available thus far. A one-on-one interview with the farmer who manages the Rockport solar-blueberry site was completed by going through costs with the farmer. We used a calculator made in Microsoft Excel to determine annual return, revenue per acre, and total cost per acre.

RESULTS

Agrivoltaics Knowledge Sharing

From the UMaine Extension organized knowledge sharing meeting held on November 14, 2023, we learned from the States of Maine and Massachusetts. The State of Massachusetts MDAR receives applications for dual-use solar projects and approves them through a six-step process. UMass Clean Energy Extension receives dual-use project proposals and provides a Pre-Determination of the project based on their agronomic and energy expertise with suggestions for a successful project. There have been 35 dual-use solar projects on 435 acres approved by MDAR on commercial cranberry, mixed vegetable, hay, and livestock farms since 2018. In Massachusetts, developers must use a Shading Analysis Tool to ensure that the maximum reduction in sunlight due to shading from panels on any square foot of land does not exceed 50% during the growing season (Clean Energy Extension, 2022). This tool was created by the Solar Massachusetts Renewable Target (SMART) program, the Massachusetts Department of Energy and Resources (DOER) and BlueWave Solar for Massachusetts at their longitude and latitude and is therefore not entirely transferrable to Maine sites. The user can input solar panel dimensions, number of rows, the tilt of panels, region in the state, and the output generates a sun or shade map of the area and design. The University of Massachusetts Amherst uses this for research and education while solar developers use it to evaluate potential sites. A webinar on the Shading Analysis Tool can be found on the BlueWave Solar website. Challenges to the Massachusetts dual-use project approval process are that it takes longer to get a project approved, more research is needed, and it is hard to optimize both the crop and energy.

Dual-use arrays with commercial crops below are possible with solar companies that are learning how to work with farmers to address their needs with modified spacing and panels such as elevated single-axis tracking panels. Research is underway in Massachusetts in a collaboration between UMass and American Farmland Trust to explore broccoli, squash, lettuce, and hay production in a dual-use solar array with 28ft wide rows. As of 2018, the State of Massachusetts has had an incentive program for dual-use solar. Rate payers (residents receiving energy from the grid) pay $0.06 cents per kW/h to solar developers for dual-use solar projects.

The challenge with establishing dual-use projects that work in Maine is that our power grid infrastructure is outdated. Three phase power is required at the road to install a solar array. Until our grid has been updated companies like BlueWave that have worked with farmers to design innovative dual-use projects will not be able to do so. In 2022, with the passing of LD 1881, the state of Maine DACF requires a compensation fee to be paid if solar is sited on prime agricultural soils. This fee can be waived if an equivalent square foot area of land is put into conservation. The Department is currently developing definitions of “prime agricultural soils” and “dual-use solar” which aim to protect the environment and Maine’s farmland. They are hiring someone to manage a new permitting scheme. Before agreeing to any contracts with solar companies, land owners need to contact their municipal assessor to investigate what types of tax consequences will be put in place with the addition of solar if their land is considered “high value farmland” (LD 1881). The U.S. Department of Energy Technologies Office (SETO) is researching agricultural benefits and setbacks to agrivoltaics that are added to farm operations (DOE, n.d.).

Cost Comparison

The Rockport dual-use wild blueberry site is a leased field managed by an IQF processor grower. We interviewed the farm manager about their crop management costs before and after this particular solar array was installed in 2021. The costs from the 2019 crop year in Table 1 are from the same area that solar now stands. The solar array was built in 2021 (crop year) and was held over for a crop year again in 2022 to get all sections of the field into the same cycle. The grower did not harvest when the solar array was built in 2021 due to construction. In 2022, the grower estimated the cost of harvest was not

worth the return from the low yield while the field was still recovering. Weed management was done using herbicide wiping and spot mowing, along with some disease control to prepare the crop for 2024. There were no fertilizer applications, insect management, pollinating costs, or harvest costs in 2023 (Table 1).

Table 1. Itemized revenue comparison of before and after building a solar array in wild blueberry located in Rockland, ME. Costs are from 2019 before the array, and 2022 after construction in 2021 Parentheses represent a loss. The field has not yet been commercially harvested after construction.

Category	Description	Before Array	After Array
Pruning	Bush hog mowing	$ 400.00	$ 367.50
	Mowing	$ 560.00	$ 630.00
Weed Control	Application of Callisto	$ 160.00	$ -
	24 oz of Callisto	$ 100.08	$ -
	LI700 Surfactant	$ 9.12	$ 7.85
	Choice water conditioner	$ 7.22	$ -
	Application of Poast	$ -	$ 100.08
	Poast	$ -	$ 225.20
	Brush wiping	$ -	$ 1,500.00
Disease Control	Application Fitness and Radiate	$ 96.00	$ -
	Fitness	$ 96.00	$ -
	Fitness	$ 28.20	$ -
	Radiate	$ 38.40	$ 48.40
Pollination	Bee hives (12)	$ 1,184.16	$ -
Insect Control	Application of Imidan	$ 96.00	$ -
	10 lbs of Imidan	$ 112.80	$ -
	LI700 Surfactant	$ 7.49	$ -
Harvest	Cost of harvest (approximate)	$ 3,259.64	$ -
Yield	Blueberry yield ($0.40 per lb)	$ 6,862.40	$ -
Tax	Blueberry tax ($0.0075 per lb)	$ 128.67	$ -
Pounds Harvested	Total Yield (lbs)	17,156.00	0.00
	Total Costs and Revenues		
	Total fixed costs	$ 16.08	$ -
	Total variable costs	$ 769.39	$ 372.96
	Total costs ($ per acre)	$ 785.47	$ 372.96
	Returns ($ per acre)	$ 72.33	$ (372.96)
	Average total annual return to management	$ 578.62	$(2,983.70)
	Yield (lb per acre)	$ 857.80	$ -

DISCUSSION

Our biggest take-home message for landowners considering a solar array is to determine whether the project is primarily for energy production or crop production and to determine if you have three-phase power at the road or not. Finally, make sure you have excellent communication between yourself, the solar developer, and the construction company.

In 2024, we plan on building mock solar panels and spacing them 28ft apart and 10-15ft high to evaluate shading over wild blueberry. In Rockport, we will also evaluate wild blueberry plant density and yield again to conclude the project. We will then finalize the cost of wild blueberry management under the Rockport solar array.

CURRENT RECOMMENDATIONS

- When considering a solar array, decide if it the main goal is crop or energy production.
- Ensure excellent communication between you, the solar developer, and the construction company.

ACKNOWLEDGEMENTS

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