



Environment and Natural Resources Trust Fund

2026 Request for Proposal

General Information

Proposal ID: 2026-338

Proposal Title: Evaluating Agrivoltaics on Minnesota's Novel Cold-Hardy Table Grapes

Project Manager Information

Name: Soon Li Teh

Organization: U of MN - College of Food, Agricultural and Natural Resource Sciences

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Project Basic Information

Project Summary: This project assesses the integration of cold-hardy table grape cultivation with solar energy production (agrivoltaics) to optimize land use, improve resource efficiency, and develop guidelines for sustainable agriculture in Minnesota.

ENRTF Funds Requested: \$509,000

Proposed Project Completion: June 30, 2029

LCCMR Funding Category: Energy (E)

Project Location

What is the best scale for describing where your work will take place?

Statewide

What is the best scale to describe the area impacted by your work?

Statewide

When will the work impact occur?

During the Project and In the Future

Narrative

Describe the opportunity or problem your proposal seeks to address. Include any relevant background information.

Minnesota's agricultural sector faces increasing challenges from climate variability, land-use competition, and the need for sustainable energy solutions. Agrivoltaics, or integration of solar panels and agricultural production, offers a promising opportunity to enhance land efficiency while supporting renewable energy goals. However, research on integrating cold-hardy seedless table grapes and solar systems is lacking, particularly in Minnesota's climate. The University of Minnesota recently developed three novel cold-hardy seedless table grapes with the potential to establish a new local industry. This project combines the innovation of a new Minnesota crop with the need for data-driven insights on grapevine performance, resource efficiency, and environmental benefits under agrivoltaic conditions. By evaluating growth, water use, and microclimate effects, we aim to determine the viability of this dual-use approach. Findings will inform growers, policymakers, and energy developers, promoting sustainable agriculture and expanding economic opportunities in the region. Developing guidelines for agrivoltaics adoption in cold climates will position Minnesota as a leader in innovative, climate-resilient agricultural systems.

What is your proposed solution to the problem or opportunity discussed above? Introduce us to the work you are seeking funding to do. You will be asked to expand on this proposed solution in Activities & Milestones.

This project will evaluate the potential of integrating cold-hardy seedless table grape cultivation with solar energy production (agrivoltaics) in Minnesota. Through field trials, we will assess grapevine growth, productivity, and resource efficiency under solar panels compared to conventional vineyard conditions. Data collection will include light availability, vine growth metrics, fruit yield and quality, winter bud damage, water use efficiency, soil temperature, and microclimate modifications.

In collaboration with researchers, viticulturists, and energy developers, we will generate insights on how solar panels influence grapevine performance, water conservation potential, and overall system efficiency. Economic analyses will assess cost-benefit tradeoffs, and environmental impact evaluations will consider soil health, biodiversity, and carbon footprint reductions.

The findings will inform best practices for integrating solar energy with agriculture, providing Minnesota growers with actionable guidelines for agrivoltaic adoption. By bridging renewable energy production with specialty crop innovation, this project supports climate resilience, economic development, and land-use optimization, positioning Minnesota as a leader in agrivoltaic research.

What are the specific project outcomes as they relate to the public purpose of protection, conservation, preservation, and enhancement of the state's natural resources?

This project enhances Minnesota's natural resources by integrating cold-hardy seedless table grape cultivation with solar energy production. Evaluating vine performance under solar panels will improve land-use efficiency and reduce environmental impacts. Key outcomes include reduced water use, increased winter survival, decreased soil erosion, and enhanced biodiversity. Agrivoltaic systems promote climate resilience by moderating soil temperatures and mitigating extreme weather effects. By developing science-based guidelines for agrivoltaic adoption, this project will support sustainable agriculture, renewable energy expansion, and long-term land conservation, equipping Minnesota growers with strategies to enhance productivity while preserving natural resources through climate-smart practices.

Activities and Milestones

Activity 1: Evaluate agrivoltaics system performance

Activity Budget: \$248,000

Activity Description:

This project will leverage the existing solar panel infrastructure at the University of Minnesota West Central Research and Outreach Center in Morris, MN to evaluate the viability of agrivoltaics for cold-hardy seedless table grapes. A replicated field trial will compare grapevines planted under solar panels with those in traditional open-field conditions. Vine performance will be assessed based on growth, winter bud survival, yield, and fruit quality indices. We will also measure key environmental variables, such as light intensity and microclimate temperature, to understand the impact of solar panel shading and energy capture on grapevine performance. Additionally, we will track the performance of the solar panels themselves, including energy generation efficiency, to determine how this dual-use system contributes to renewable energy goals. This activity will provide insights into the feasibility of integrating grape production with solar energy systems in cold climates, helping identify optimal configurations for both agricultural and energy production success.

Activity Milestones:

Description	Approximate Completion Date
Plant grapes under solar and conventional systems	June 30, 2027
Install trellis systems and energy meters	June 30, 2027
Evaluate vine performance under solar and conventional systems	October 31, 2028
Investigate energy capture and generation	December 31, 2028

Activity 2: Analyze resource efficiency and environmental impacts

Activity Budget: \$235,000

Activity Description:

Our project will analyze the resource efficiency and environmental impacts of agrivoltaic systems by assessing water use, soil health, and overall sustainability. We will evaluate water efficiency by monitoring soil moisture and vine water status, comparing irrigation needs under solar panels versus open-field conditions. Soil health indicators, including organic matter content and microbial activity, will be measured to assess long-term impacts on soil quality. Additionally, we will examine agrivoltaics' potential to conserve soil, mitigate extreme temperatures, and enhance biodiversity. Environmental benefits, such as reduced irrigation needs and improved climate resilience, will also be analyzed. By comparing these factors between grapevines grown under solar panels and those in traditional open-field conditions, we aim to quantify the sustainability benefits of this dual-use system. The results will provide critical data on agrivoltaics' role in water conservation, temperature moderation, and soil health maintenance, informing best practices for sustainable vineyard management in Minnesota's climate.

Activity Milestones:

Description	Approximate Completion Date
Assess water use efficiency under agrivoltaic systems	September 30, 2028
Monitor soil health indicators	September 30, 2028
Evaluate temperature mitigation under agrivoltaic systems	April 30, 2029

Activity 3: Develop guidelines and recommendations for agrivoltaics in Minnesota

Activity Budget: \$26,000

Activity Description:

This activity will focus on developing science-based guidelines and recommendations for the adoption of agrivoltaic systems in Minnesota. We will synthesize the data collected from evaluating grapevine performance, resource efficiency, and environmental impacts to create comprehensive best practices for integrating solar panels with cold-hardy grape production. The guidelines will address key factors such as panel spacing, vine management, irrigation strategies, and microclimate management to maximize both agricultural and energy production outcomes. Additionally, the recommendations will include strategies for mitigating potential challenges, such as shading effects and winter survival, specific to Minnesota's cold climate. The UMN Grape Breeding Program collaborates closely with the Minnesota Grape Growers Association (MGGA), ensuring that the guidelines and recommendations will be effectively disseminated to the target audience. These deliverables will provide actionable insights for grape growers, policymakers, and energy developers, positioning Minnesota as a leader in sustainable, climate-resilient agricultural practices.

Activity Milestones:

Description	Approximate Completion Date
Present results at statewide and regional conferences	June 30, 2029
Host a site demonstration during Midwest Farm Energy Conference	June 30, 2029
Develop a guidebook on grape agrivoltaic systems	June 30, 2029
Submit semi-annual reports and a comprehensive final report	June 30, 2029

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Bradley Heins	University of Minnesota WCROC	Provides executive assistance and expertise on agrivoltaics logistics, execution, and data collection	Yes
Erin Treiber	University of Minnesota	Conducts system testing, project management, data collection, and result dissemination	Yes
Graduate Student Research Assistantship	University of Minnesota	Assists with all aspects of project execution, monitoring, evaluation, data collection, and analysis	Yes
Colin Zumwalde	University of Minnesota	A viticulturist with over 10 years of grape production experience, Colin will assist in all grape-related activities (planting, trellising, evaluating vine performance, etc.), and educational outreach.	Yes

Long-Term Implementation and Funding

Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If additional work is needed, how will this work be funded?

Findings will be shared through field days, workshops, and publications in collaboration with the Minnesota Grape Growers Association, ensuring direct outreach to growers. Research results and best practices will be made publicly available through University of Minnesota Extension, as well as statewide and regional conferences. Ongoing efforts will seek additional funding from state and federal programs, such as the USDA Sustainable Agriculture Research and Education (SARE) program, to expand trials and refine agrivoltaic recommendations. Partnerships with solar developers and agricultural stakeholders will support long-term implementation, fostering continued research and adoption of agrivoltaics in Minnesota's cold climate.

Project Manager and Organization Qualifications

Project Manager Name: Soon Li Teh

Job Title: Assistant Professor

Provide description of the project manager's qualifications to manage the proposed project.

Dr. Teh is an Assistant Professor and Director of the Grape Breeding Program at the University of Minnesota. With over seven years of experience in grape research, his program is nationally recognized for developing cold-hardy wine and table grape cultivars. As an Extension Specialist, he collaborates closely with the Minnesota Grape Growers Association to host workshops, outreach events, and regional conferences.

The project team also includes two viticulturists and Dr. Heins, a faculty member at the UMN West Central Research and Outreach Center, where the agrivoltaics trial will be conducted. Dr. Heins has extensive experience evaluating agrivoltaic systems and energy use on dairy farms, providing valuable expertise for this project. His knowledge will help adapt agrivoltaic strategies for grape production in Minnesota's cold climate.

Organization: U of MN - College of Food, Agricultural and Natural Resource Sciences

Organization Description:

The University of Minnesota is the primary organization, with its nationally recognized grape breeding program based at the Horticultural Research Center (Chaska) and the agrivoltaics field trial planned at the West Central Research and Outreach Center (WCROC) in Morris. Since 1878, the UMN grape breeding program has released 13 grape varieties, driving the development of cold-climate grape and wine industries in Minnesota, the Dakotas, Wyoming, Montana, and

Vermont. The WCROC, a 1,100-acre agricultural experiment station, specializes in applied research and hosts a robust renewable energy program, including 600 kW of solar photovoltaic systems.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Lead investigator		Oversees the project, submit semi-annual reports, a final comprehensive report			37%	0.18		\$32,706
Co-investigator		Provides executive assistance on agrivoltaics			37%	0.12		\$27,972
Researcher 6		Conducts system testing, project management, data collection, and result dissemination			37%	0.75		\$95,938
Graduate student research assistantship		Assists in all aspects of project execution and data collection			23%	3		\$182,665
Research Professional 1		Viticulturist to help with grape planting, production, and trellis setup			32%	0.99		\$80,884
							Sub Total	\$420,165
Contracts and Services								
Solar maintenance	Service Contract	Maintenance of solar and agrivoltaic component system				0.09		\$10,000
Soil sampling and analysis	Service Contract	Soil health indicators of agrivoltaic vs conventional systems				0.18		\$20,000
UMN WCROC Horticulture	Internal services or fees (uncommon)	Support for grape testing under agrivoltaic and conventional systems. Services include planting, routine plot management, and regular monitoring. This is internal to the UMN WCROC.				0.45		\$20,000
UMN Horticultural Research Center	Internal services or fees (uncommon)	Greenhouse space for grape seedlings. Services include space use, monitoring and watering.				0.1		\$3,000
							Sub Total	\$53,000
Equipment, Tools, and Supplies								
	Tools and Supplies	Energy meters (10)	To monitor agrivoltaic voltage systems					\$5,000

	Tools and Supplies	Tensiometer (1)	Soil moisture monitoring and water use efficiency					\$5,000
	Tools and Supplies	Field supplies	General field supplies include pots, trellis wires, posts, bamboos, plot markers, sampling bags, and others					\$9,835
							Sub Total	\$19,835
Capital Expenditures								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Conference Registration Miles/ Meals/ Lodging	3 trips per year for one presenting person (investigator or graduate student), 50 miles per trip	Travel, lodging, and meals necessary for formal presentations at statewide and regional conferences within Minnesota	X				\$5,000
							Sub Total	\$5,000
Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
	Printing	Extension Supplies and Printing	Printing for Extension workshops, field days, and conference presentations					\$5,000
	Publication	Peer Reviewed Publications (2)	Research publication in open access journals					\$6,000
							Sub Total	\$11,000
Other Expenses								
							Sub Total	-

							Grand Total	\$509,000
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Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Travel In Minnesota	Conference Registration Miles/Meals/Lodging	3 trips per year for one presenting person (investigator or graduate student), 50 miles per trip	These expenses will be used by either the Project Investigator or the presenting graduate student to disseminate project findings at state conferences, workshops, and seminars, which are necessary for public outreach and broader education in Minnesota.

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
			State Sub Total	-
Non-State				
			Non State Sub Total	-
			Funds Total	-

Total Project Cost: \$509,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: [ae98a3c2-132.pdf](#)

Alternate Text for Visual Component

The picture depicts a dual-use farming system that integrates a novel Minnesota crop (cold-hardy seedless table grapes) with agrivoltaics (solar systems for energy capture, resource efficiency, and crop protection)....

Supplemental Attachments

Capital Project Questionnaire, Budget Supplements, Support Letter, Photos, Media, Other

Title	File
University of Minnesota letter	830ceb77-78b.pdf

Administrative Use

Does your project include restoration or acquisition of land rights?

No

Do you understand that travel expenses are only approved if they follow the "Commissioner's Plan" promulgated by the Commissioner of Management of Budget or, for University of Minnesota projects, the University of Minnesota plan?

Yes, I understand the UMN Policy on travel applies.

Does your project have potential for royalties, copyrights, patents, sale of products and assets, or revenue generation?

No

Do you understand and acknowledge IP and revenue-return and sharing requirements in 116P.10?

N/A

Do you wish to request reinvestment of any revenues into your project instead of returning revenue to the ENRTF?

N/A

Does your project include original, hypothesis-driven research?

Yes

Does the organization have a fiscal agent for this project?

No

Does your project include the pre-design, design, construction, or renovation of a building, trail, campground, or other fixed capital asset costing \$10,000 or more or large-scale stream or wetland restoration?

No

Do you propose using an appropriation from the Environment and Natural Resources Trust Fund to conduct a project that provides children's services (as defined in Minnesota Statutes section 299C.61 Subd.7 as "the provision of care, treatment, education, training, instruction, or recreation to children")?

No

Provide the name(s) and organization(s) of additional individuals assisting in the completion of this proposal:

Dave La Fave at the University of Minnesota

Do you understand that a named service contract does not constitute a funder-designated subrecipient or approval of a sole-source contract? In other words, a service contract entity is only approved if it has been selected according to the contracting rules identified in state law and policy for organizations that receive ENRTF funds through direct appropriations, or in the DNR's reimbursement manual for non-state organizations. These rules may include competitive bidding and prevailing wage requirements

Yes, I understand

