Environment and Natural Resources Trust Fund

2024 Request for Proposal

General Information

Proposal ID: 2024-252

Proposal Title: Green Livestock Foods for Minnesota

Project Manager Information

Name: Pedro Urriola

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

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Project Basic Information

Project Summary: The objective is to conserve and improve soil, water, and climate by providing farmers necessary information to market the use of perennial and winter anual crops in diets for pigs.

Funds Requested: $367,000

Proposed Project Completion: September 30, 2027

LCCMR Funding Category: Methods to Protect, Restore, and Enhance Land, Water, and Habitat (F)

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.

Livestock production is an important economic activity in Minnesota and long-term sustainable production will require agronomic practices that help in soil and water conservation. The greatest portion of the environmental footprint (land use, water, and climate) of livestock production is the production of grains and oilseeds for animal feeding; finding alternative feeds is crucial. Summer-annual crops (e.g., corn and soybeans) leave the soil exposed to erosion and loss of nutrients to ground and surface water. Perennial and winter-annual crops (e.g., winter barley, pennycress, camelina) offer protection to soils. Likewise, seaweeds offer a diverse set of nutrients complementary to conventional feed ingredients. However, many businesses may not move forward planting and harvesting these alternative feeds because the lack of livestock farmers open to use these ingredients in animal feeds. Livestock producers may not use winter-annual crops or their coproducts because there is lack of information on potential impact or benefit to animal health and productivity. Consequently, the aim of this project is to generate and communicate information about the nutritional value of winter-annual crops and seaweed. Pigs will be selected for this project because they are a major activity in the State of Minnesota.

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.

Sustainable production and processing of cover crops and seaweeds require markets, while buyers require reliable and updated information on the nutritional value of the products. The nutritional value of products and coproducts in diets for pigs is measured by the concentration of digestible and metabolizable energy, the concentration of standardized ileal digestible amino acids, and the concentration of standardized total tract digestible phosphorus and calcium. Without this information, pork producers cannot supply pigs with the highly balanced and nutritional diets they require, risking amino acid and mineral deficiency or being forced to use excess nutrients in the diet and while generating excess nutrient losses to the environment. This project will evaluate cover crops and seaweed products and high fiber coproducts in diets for pigs and will provide Minnesota pork producers with information about the concentration of metabolizable energy, digestible amino acids, and digestible phosphorus. The project will leverage existing facilities at the Southern Research and Outreach Center in Waseca, MN. The project will deliver information about these green feeds via distribution channels such as the Minnesota Nutrition Conference, pork and grain farmer oriented magazines, Extension website. The project will train two students as Minnesota's next conservation and production workforce.

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?

The objective is to generate and communicate the necessary information for the development of market for green feeds from products and coproducts of continuous living crops, which preserve soil and water. Specifically, the project will measure digestibility of nutrients and test growth performance of pigs fed the green feeds. This information will be necessary for pig producers to include these green feeds in diets for pigs at a level that supplies required nutrients and avoids excess nitrogen and phosphorus excretion. Two professionals will be trained on cover crop and winter annual crop nutrition as part of the project.

Activities and Milestones

Activity 1: Evaluation of the nutritional value of selected cover-crop products and coproducts

Activity Budget: $129,603

Activity Description:
A gated approach will be used to narrow a list of multiple available cover crops and associated coproducts. The criteria for selection include product availability, likelihood of market development, and predicted nutritional value using literature review and results from preliminary in vitro assays. Five feed ingredients will be selected, purchased, and delivered to the feed mill at the farm. A control and five diets containing the test ingredients will be mixed and fed to 36 pigs in a metabolism experiment. Fecal and urine samples will be quantitatively collected from pigs and stored according to laboratory standard operating procedures. At the end of experiment 1, a subset of 18 pigs will be fitted with a T-cannula in the distal ileum. A control and five diets containing the test ingredients will be fed to pigs, ileal digesta will be collected and stored until analysis. Upon completion of farm work, samples will be analyzed for dry matter, energy, amino acids, crude protein, starch, acid ether extract, total dietary fiber, NDF+ADF, calcium, and phosphorus. The concentration of net energy in test samples will be calculated using corresponding equations. Data will be utilized in developing nutritionally adequate diets for pigs for activity #2.

Activity Milestones:

Description	Approximate Completion Date
Ingredient sourcing, diet preparation, farm preparation	September 30, 2023
Animal feeding and sample collection	May 31, 2024
Laboratory analysis	May 31, 2025

Activity 2: Feeding green-feeds to nursery pigs

Activity Budget: $140,974

Activity Description:
Newly weaned pigs (720, initial body weight ~12 lb) will be moved to a temperature and humidity-controlled environment at the Southern Research and Outreach Center in Waseca, MN. Pigs will be fed a control corn-soybean meal-based diet and five diets containing the test ingredients. All diets will be mixed with corresponding feed ingredients to meet or exceed the nutrient requirements of pigs for the age and body weight. Pigs will be weight at each time of 3 diet phase change. The zootechnical parameters (average daily gain, average daily feed intake, and feed efficiency) will be estimated at each timepoint. Observations of pig health, fecal consistency, and pig appearance will be recorded. Data will be analyzed according to the appropriate model to account for variation in pen, room, animal origin. Data will be summarized in preparation for a manuscript developed in activity #3.

Activity Milestones:

Description	Approximate Completion Date
Ingredient sourcing, diet preparation, and wean-to-finish barn preparation	September 30, 2025
Feeding pigs and pig weight collection	December 31, 2025
Data summary and preparation of manuscript	June 30, 2026

Activity 3: Regulation and communication of the nutritional value of cover-crops products and coproducts

Activity Budget: $96,423

Activity Description:

The Association of American Feed Control Officials (AAFCO) sets standard for state, federal, and in some cases international animal feeding regulations. The project will communicate with AAFCO investigator to and use the ingredient definition flowchart (https://www.aafco.org/resources/industry/new-ingredient-definitions/) to determine best process for current ingredients. In addition, the nutrient composition of the test ingredients will be shared in a National Nutrition Database (https://animalnutrition.org/). This database is accessible to swine nutritionists in North America. Likewise, the pig zootechnical performance data will be presented at the Allen D. Leman Swine Conference, the Minnesota Nutrition Conference, and American Society for Animal Science (ASAS) Midwest meetings. Information will be also distributed at farmer frequently visited events such as FarmFest and Minnesota State Fair.

Activity Milestones:

Description	Approximate Completion Date
Upload of the data in databases	September 30, 2026
Presentation in conference	September 30, 2026
Manuscript submission for publication	September 30, 2027

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Dr. Hayford Manu	Southern Research and Outreach Center	Dr. Manu is a co-PI and involved in all aspects of project ideation, funding request, implementation, and communication of results. Dr. Manu has a PhD in swine nutrition from the University of Minnesota and works on regular basis implementing research projects.	Yes
Colin Cureton	Forever Green Initiative	Colin will provide input on ingredient selection, environmental impacts, and communication with farmers. This activity is in support of his current role for advancing commercialization of a next generation of perennial and winter annual crops that will improve soil, water, and climate while also offering new economic opportunities for farmers.	No
Mitch Hunter	Associate Director, Forever Green Initiative	Mitch is an agronomist with a policy background, who likes to think about how to design cropping systems for greater diversity, resilience, and sustainability. Mitch will be a Consultant on ingredient selection, environmental impacts, and market development of Forever Green Initiative crops.	No
Alan Doering	Agricultural Utilization Research Institute	Alan is a Sr. Scientist in Coproduct development and he will provide input in all aspects of project development, ingredient selection, and communication. Alan has multiple years of experience in transformation of biobased agriculture coproducts into high value products that synergize with more sustainable and circular economy.	No

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?

Stakeholder engagement since project ideation and subsequent RFP announcement, listserv, gov delivery, and communication in producer-oriented media. The PI and Co-PI have track record of conducting high quality research and publication of this research in high impact peer review journals. The PI and associated network of collaborators actively participate in producer-oriented meetings and solution promotion campaigns such as farm visits, presentations in professional meetings, and participation in agriculture tradeshows. The logo and attribution language will be used according with Environment and Natural Resources Trust Fund (ENRTF) on project print and electronic media, communication and outreach.

Project Manager and Organization Qualifications

Project Manager Name: Pedro Urriola

Job Title: Research Associate Professor

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

Pedro E. Urriola studied the equivalent to Veterinary Medicine at the Universidad Central de Venezuela. He completed a MS at the University of Minnesota and a PhD in Swine Nutrition at the University of Illinois. After that, Pedro worked at Cargill Animal Nutrition. Currently, Pedro is an Associate Professor at the Department of Animal Sciences of the University of Minnesota. Pedro works in transdisciplinary research to find solutions to diverse problems of today's agriculture. Pedro is author or coauthor in more than 70 peer-review publications, two book chapters, and multiple producer oriented articles. Pedro has managed more than 6.5 million dollars in funding as principle investigator or co-investigator. Pedro has experience managing innovation of development projects for global corporations, agriculture commodity groups, and federal institutions.

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

Organization Description:

The PI and Co-PI work at the Department of Animal Science (St. Paul, MN) of the University of Minnesota and the Southern Research and Outreach Center (SROC, Waseca, MN). Both entities are part of the College of Food, Agriculture, and Natural Resource Science (CFANS). The institution is dedicated to training Minnesota's workforce in higher education and discover solutions to the most challenging problems using cutting edge research methods. The CFANS and SROC researchers work in close communication with swine nutritionists, environment conservation non-profit organizations such as the World Wildlife Fund, and American Feed Industry Association in the development of sustainable swine feeding programs.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Research Associate Professor		Dr Urriola will be responsible for all aspects of project ideation, funding application, implementation, and supervisor of animal feeding experiments, supervision of laboratory work, writing and communicating results. Paid calculated at base salary x 10% + 36.8% Fringe.			36.8%	0.3		$44,288
Graduate Research Assistant		The graduate student will be responsible for all aspects of project implementation, animal feeding experiments, laboratory work, and writing and communicating results. Calculated as base salary 50% Research Assistantship, Tuition, and 24.1% fringe benefits.			24.1%	3		$146,656
Undergraduate student		Undergraduate students will be contracted to conduct all farm and laboratory assays in supervision by the project graduate student and PI.			0%	3		$64,291
Civil Service		Dr. Hayford Manu will be responsible for all aspect of farm work at the SROC. Calculated as base salary 15% time x 32% fringe benefits.			32%	0.15		$12,279
							Sub Total	**$267,514**
Contracts and Services								
							Sub Total	**-**
Equipment, Tools, and Supplies								
	Tools and Supplies	Supplies and equipment maintenance for surgeries (2,247 per surgery x 18 pigs). This will allow to purchase anesthesia, medication, sutures, and other suppliers for the care of animals. It will provide funds for purchase of feeds, processing feeds, and consumables for on farm care of pigs.	Activity 1: surgical fit of T-cannula is necessary for collection of intestinal contents for analysis of amino acid digestibility.					$40,451
	Tools and Supplies	Laboratory assays including dry matter, amino acids, minerals, indigestible marker, etc. These	Activity 2: requires the analysis of chemical composition of intestinal					$49,717

		assays cost about $ 1,035.77 per sample x 48 samples.	contents and feces for the calculation of nutrient digestibility.					
							Sub Total	**$90,168**
Capital Expenditures								
							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	Trips from St. Paul to SROC Waseca, estimate 15 trips and 7 nights of lodging.	Activity 1 requires on-farm sample collection and care for animals. Students will stay 7 nights in a hotel during these days.					$3,939
	Miles/ Meals/ Lodging	Travel to two conferences and farm visits for distribution of information.	Activity 3 requires communication of research finding with pork producers and ag. professionals working in Minnesota. Funding to cover presentations in scientific and producer oriented meeting is requested.					$2,379
							Sub Total	**$6,318**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
	Publication	A open access journal manuscript.	Activity 3 requires distribution of research findings. A peer review manuscript will be submitted for publication.					$3,000
							Sub Total	**$3,000**
Other Expenses								

							Sub Total	**-**
							Grand Total	**$367,000**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request

Non ENRTF Funds

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

Attachments

Required Attachments

Visual Component

File: a419fec9-3b3.docx

Alternate Text for Visual Component

Figure describes major issues with current cover crop coproducts in diets for pigs....

Optional Attachments

Support Letter, Photos, Media, Other

Title	File
Urriola Letter Sponsored Projects Admin.	0dbcb640-c65.pdf

Administrative Use

Does your project include restoration or acquisition of land rights?

No

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

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 design, construction, or renovation of a building, trail, campground, or other capital asset costing $10,000 or more?

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?

No