Forever Green:
AN AGRICULTURAL LEGACY OF ECONOMIC, ENVIRONMENTAL AND HUMAN HEALTH FOR MINNESOTA

A LEGISLATIVE PROSPECTUS
91st Legislature | Minnesota State Legislature

This Legislative Prospectus portrays an innovative economic development and environmental conservation strategy that will create an agricultural legacy of healthy soil, clean water, and prosperity for Minnesota.

Growing summer annual, winter annual, and perennial crops that are precisely positioned to enhance environmental quality while improving economic outcomes through the use of information technologies is a game-changing strategy for Minnesota’s landscapes and agricultural economy.

Brian Buhr, Dean
College of Food, Agricultural and Natural Resource Sciences
Minnesotans take pride in caring for their land & water

From wilderness to farm field, our state’s conservation goals are designed to support soil, air, and water quality. Protecting these resources ensures the safety of our food and water supply and the health of our soil and people. That translates into a legacy of prosperity, well-being, and resilient landscapes for future generations.

Now, sweeping innovations in agriculture—new crops, new cropping systems, new products and new markets—can make production agriculture an even stronger tool for land and water stewardship, and economic development. Currently, our annual, highly-productive row crops are mostly grown during summertime months, creating opportunities for additional production during the spring and fall seasons while providing additional protection of soil and water resources.

The request for legislative investment, outlined in this prospectus, describes an ambitious initiative that integrates cutting-edge agricultural development with information technologies, supported by a powerful collaboration of major private, public, and non-profit partners.

Creating an Agricultural Legacy:
NEW ENVIRONMENTAL BENEFITS AND ECONOMIC OPPORTUNITIES

NEW CROPS FOR FARMERS
To meet Minnesota’s conservation goals, we must incorporate new crops into agricultural landscapes. To enable this, new winter-annual and perennial crop species have been identified. FGI researchers are using new breeding technologies to rapidly improve these new crop species and at the same time are developing profitable new farming systems that strategically integrate the existing and novel crops.
THE OPPORTUNITY –
Develop crops and cropping systems that provide continuous living cover

The new winter-annual and perennial crops allow year-round continuous living cover, even in Minnesota’s climate. There is room to add these crops to most Minnesota farms, compatibly with current crop production. Adding these crops can improve farmer income, fuel our agricultural economy, and ensure healthy soil and clean water. HERE’S WHY:

- To maintain soil health for the long-term, farmers need to cover land with living plants for as much of the year as possible. This continuous living cover builds healthy, fertile soils, and protects them from erosion.

- Covering farmland with continuous living cover systems also protects lakes and rivers, by limiting water, soil and nutrient runoff that can harm water bodies and cause flooding.

- Most current methods for year-round plant cover on farmland, other than forage systems, require farmers to take land out of crop production, thereby reducing income, and production of food and other products.

- The new Forever Green winter-annual and perennial crops can be added to Minnesota farms, increasing year-round plant cover, income for farmers, food production, environmental protection, and the prosperity of rural communities.

$6 Million per year for New Crops, Smart Decisions, Better Outcomes

Camelina | Winter Barley | Perennial Flax | Grasslands | Hazelnut | Berries | Intermediate Wheatgrass (Kernza®)  
Summer Annual Grains | Pennycress | Silphium | Natural Products | Perennial Sunflower | Cover Crops | Woody Perennials

COMMERCIALIZATION AND SUPPLY CHAIN DEVELOPMENT
To realize the economic potential of these new crops, viable markets for these products must be fostered, and we must build supply chains to move new crops from farms to markets.

AGROINFORMATICS -BIG DATA MANAGEMENT
With supportive information technologies to guide data-driven decision-making for these new farming systems—and for new supply chains and markets—we can maximize environmental and economic benefits from these crops.
A Solution for a Healthy Future:

**SUCCESSES TO DATE**

Forever Green Initiative researchers and public and private-sector partners have made considerable progress in developing new crops, consumer products, and methods to produce them profitably while ensuring environmental benefits. G.E.M.S has developed powerful new data-driven decision-support tools. With significant support from federal and state research grants, legislative appropriations, and from private sector partners, FGI and G.E.M.S have laid a solid foundation for the next stage of this innovative investment in our future.

**HERE’S HOW:**

- Developing and releasing to producers the first named variety of the perennial grain intermediate wheatgrass (Kernza®) in the fall of 2019
- Developing and planning to release to producers the first domesticated food-grade variety of pennycress in the fall of 2021
- Developing early-phase production, supply chains, and markets for intermediate wheatgrass (Kernza®), pennycress, camelina, hazelnut, and alfalfa protein
- Discovered that the perennial grain intermediate wheatgrass (Kernza®) reduces nitrate-N leaching by 95 percent compared to summer-annual row crops
- Discovered that pennycress and camelina grown in relay or double-crop systems with soybean drastically reduced water run-off, soil erosion and nitrate-N-leaching
- Addressed rural drinking water quality by partnering with wellhead protection regions to plant large fields of intermediate wheatgrass (Kernza®)
- Developing a data-streaming platform to make it easier to monitor ecosystem service outcomes while protecting landowner privacy
- Provided decision-support to localize barley breeding efforts to provide consumers with locally-grown beer

Perennial and winter crops offer incredible potential for Minnesota farmers and the food industry. This important innovation at the University of Minnesota will increase farmer profitability and support environmental resilience. We wholeheartedly support this initiative.

Jerry Lynch, Chief Sustainability Officer, General Mills, Inc.
What's Needed:

GENOMICS TO FUEL PLANT BREEDING
Modern plant breeding is fueled by the expanding library of genetic information provided by non-GMO genomic science. Each of the new crops need continued genomics research to discover new genes and associated traits in the crops that can enhance the commercial and environmental value of these crops.

EFFECTIVE PLANT BREEDING PIPELINES
Advances in plant breeding are often described as finding “the needle in the haystack”—i.e., rare naturally occurring variation that enables development of valuable new crop traits. To be successful, plant breeders must have robust ‘pipelines’ with useful and novel plant germplasm combined with the facilities and capacities to continue to develop and refine the new crops for commercialization over many years.

CROPPING SYSTEMS THAT DELIVER ECONOMIC AND ENVIRONMENTAL BENEFITS
New perennial and winter-annual crops must be combined with current crops to create new research-based cropping systems that enhance natural resources and the farm economy.

NEW HIGH-VALUE PRODUCTS FOR CONSUMERS
Products from these crops give consumers something they’re hungry for: a way to support local economies and the environment by choosing products from cropping systems that deliver these benefits. Continued innovation in such products is a top Forever Green Initiative priority.

INFORMATION TECHNOLOGY FOR PRECISE DECISION MAKING
Data-driven decision making—agroinformatics—can now support development of the new crops, and new farming systems, supply chains, and markets that maximize their economic and environmental potential. Agroinformatics research must refine and extend these decision-making tools to make them useful for farmers and land-managers.

DEVELOPING SUPPLY CHAINS FOR NEW CROPS
New crops require new supply chains: the facilities and capacities to bring them to market. Research and development are needed to support private and public investment in the activities, information, and resources involved in moving these new crops from farm production, to processors, and finally to consumers.
What the Legislation Includes:

The legislation includes $6 million per year in long-term base funding to accelerate deployment of an innovative economic development and environmental conservation strategy based on development of new profitable, resource-conserving crops and intergrating them into our existing farming systems. The new funding will build on early successes to deliver widespread benefits for people and the environment across Minnesota, creating an agricultural legacy of healthy soil, clean water, and prosperity. We expect this funding investment to provide excellent returns. It will leverage substantial private-sector and non-profit investments and advance the public-private partnership that is already driving this strategy to scale. Specifically, this base funding will support the following efforts:

- Genomic, plant breeding, agronomic, and food-science research to develop new winter-annual and perennial crops for commercialization
- Assessment of beneficial effects of winter-annual and perennial crops on soil health; carbon storage in soil; and air and water quality
- Commercialization of new crops through development of supply chains that support rural economic development across Minnesota
- Agroinformatics technologies to maximize environmental and economic benefits through data-driven decision support
- Strategic coordination of Forever Green’s new crop development research, commercialization, supply-chain development, and agroinformatics decision support

Robust crop rotations are an integral part of profitable agricultural production. Integrating perennial and winter-annual crops into existing farming systems provides growers with new revenue streams and improves soil health.

Carmen Feynholtz, Farmer, Minnesota

We are an environmentally-conscious business with a focus on producing high-quality, organically-produced products at our brewery in Saint Paul. Our goal for Bang Brewing is to have the biggest impact with the smallest footprint. We have been working with the Forever Green Team for the past two years, making beer with new crops, hosting field days about our collective work, and interacting with Minnesota State Fair attendees at the CFANS display at the Fair. We are strong supporters of this comprehensive effort.

Sandy and Jay Ross, Owners, Bang Brewing

The Minnesota Barley Growers Association has long benefited from University of Minnesota plant breeding research. High yielding, high quality barley varieties have kept Minnesota producers in the malting business for 75 years. This research proposal that includes winter barley will benefit the producers and the environment for many years to come.

Mary Zutz, Executive Director, Minnesota Barley Growers Association
For nearly 70 years, Northern Minnesota has benefited from the University of Minnesota’s development of perennial grass seed crops. New, perennial seed crops have stabilized farm income, lessened erosion, and enabled growers to profitably raise crops in all types of weather. Adding these perennial crops to our rotations has made us resistant to commodity cycles affecting two-crop rotation farmers. We strongly support a permanent state investment for this work.

Richard Magnusson, Farmer and President, Turf Seed Council, Roseau

The Birchwood Café’s blueberry Kernza® éclair was a Star Tribune-recognized new food at the 2017 Minnesota State Fair. Our restaurant believes in the power of winter-hardy and perennial crops as a creative food source for our customers, who learn about agriculture and the importance of crops that grow economies and safeguard the environment when they eat these foods. We believe in supporting Minnesota’s farmers and encourage the Legislature to make this strategic investment in our economic, environmental, and culinary future.

Tracy Singleton, Owner, Birchwood Café
"It is obvious that we need to reduce the environmental impact of agriculture while we continue to increase production of nutritious food. It’s not so obvious how to do it. The Forever Green Initiative is the most comprehensive and forward-thinking scientific endeavor to introduce new crops in agriculture to rapidly lessen the environmental impact of whole rotational systems centered around major staple crops. The scientific rigor and the thought-leadership brought by this program are inspirational and reassuring that agriculture and farmers can and will be part of the solution in improving the environment, rather than part of the problem.

Gabe Gusmini, R&D Director – Crop Improvement PepsiCo, Personal Statement"

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