



Forever Green

Expanding Agricultural Productivity and Sustainability

- Increase yields
- Decrease environmental impact
- Improve soil and water
- Provide economic opportunities



College of Food, Agricultural
and Natural Resource Sciences

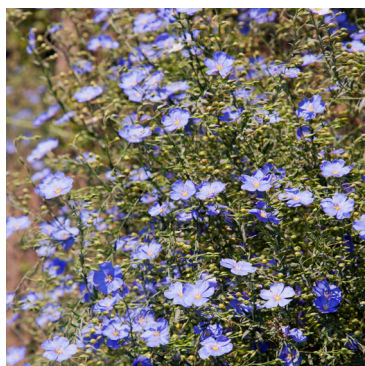
UNIVERSITY OF MINNESOTA

The challenge is clear:

For the state of Minnesota, to meet proposed water quality goals, we must incorporate winter annual and perennial crops into agricultural landscapes. The Forever Green Initiative at the University of Minnesota is positioned to realize this goal and more. Forever Green is focused on ensuring agricultural production that strengthens economies while protecting water and other natural resources.

By coupling innovations in crop breeding, agricultural production methods, food science, and utilization technologies, we can add to the productivity and profitability of current agricultural systems and enable major improvements in water quality.

Forever Green innovations are based on perennial and winter-tolerant crops that will create new economic opportunities and environmental benefits for crop production in northern climates. The array of small grain perennials and short season winter annuals can be used within a traditional corn and soybean rotation practice and applied to emerging crop options.



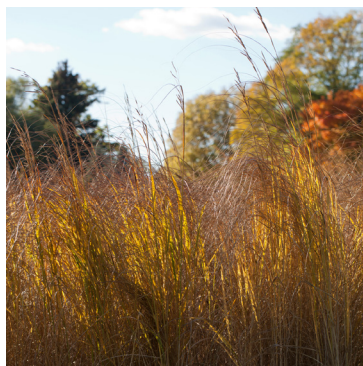
Perennial Flax



Pennycress



Hazelnut



Intermediate Wheatgrass

New Forever Green breeding technologies are being applied to make rapid improvements in species, along with new methods for designing sustainable production systems, utilizing the crops as feedstocks for new products, and minimizing risk for potential investments in these crops and technologies for entrepreneurs and investors.

PERENNIAL CROPS

Intermediate wheatgrass—wheat-like grain, forage, biomass

Perennial sunflower—edible seeds, oil

Native polyculture grassland mixtures—biomass, forage, natural products

Perennial flax—edible oil

clover—nitrogen-fixing cover crop

Silphium—edible oil

WINTER ANNUAL CROPS

Pennycress—oil, biofuel, cover crop

Camelina—edible oil, biofuel, cover crop

Winter barley—food, malting barley

Hairy vetch—cover crop, nitrogen-fixation

NATIVE WOODY CROPS

Hazelnut—nuts, edible oil

Shrub willow—biomass

Berries—antioxidant-rich fruit

Agroforestry—woody and herbaceous crop mixtures for feed, food and fuel

PROBLEM Many land-use practices lead to economic losses and ecosystem degradation.

GOAL Develop and enhance agricultural systems to improve natural resources and provide economic opportunities.

ASSUMPTIONS

Farmers want to diversify their cropping systems. Farmers want to improve water and soil quality. Forever Green crops can be profitable for MN farmers. There is market demand for Forever Green products. Forever Green seeds and plants will be available in quantities needed.

EXTERNAL FACTORS

Weather conditions may affect aspects of field trials. Insect pests, animal herbivory, and disease outbreaks may reduce yields of Forever Green crops. Farmers may not be willing to trial or adopt new cropping systems. Products developed may not fill a consumer niche.

SITUATION

CURRENT STATUS

Forever Green crops can contribute ecosystem services
Mandatory crop buffer land can be planted with profitable crops
Farmers need information on the feasibility of new crops and systems
Forever Green crop production needs to co-exist within other cropping systems
Minnesotans are aware of the need for agricultural practices that maintain water quality
Minnesota needs to continue to develop scientific talent

INPUTS

WHAT WE INVEST IN

Faculty	Volunteers	Tools, materials, and equipment
Staff	Time	Space on existing website for hosting educational resources related to the project
Postdoctoral associates	Expertise	
Graduate students	UMN laboratory and field research space	
Undergraduate students		

ACTIVITIES

WHAT WE DO

Establish research plantings
Work closely with farmers to establish observation trials on their farms
Communicate regularly with our community of interest about Forever Green
Educate students

WE REACH

Farmers
Farming organizations
Extension educators
Students
Research community
Minnesotans

OUTPUTS

Products, services, and events intended to lead to the project's outcomes:

FOR FARMERS

On-farm field days
Online resources
Presentations at farmer conferences

FOR THE RESEARCH COMMUNITY

Scholarly research publications

FOR MINNESOTANS

Information on Forever Green via TV, radio, newspaper, blogs

OUTCOMES

CHANGES IN KNOWLEDGE

Increased awareness and use of UMN educational resources
Increased knowledge about contribution of Forever Green crops to ecosystem services
Increased farmer knowledge of Forever Green crop production systems and economic potential
Increased public awareness of locally produced crops and products

CHANGES IN BEHAVIOR

Farmers use UMN educational resources to learn how to produce Forever Green crops
Farmers value ecosystem services provided by Forever Green crops
Farmers establish plantings of Forever Green crops on their farms
Consumers purchase more locally made Forever Green products

IMPROVED SOCIETAL CONDITIONS

Water and soil quality are enhanced
Diversity of crops grown in Minnesota increases
Farmer profits increase by growing higher-value crops
Availability of locally-produced Forever Green products increases
High-quality scientific talent is attracted to UMN to meet future MN workforce needs

LOGIC MODEL Forever Green



In Minnesota, a Forever Green bioeconomy...

- Builds on current agricultural strengths
- Tolerates climate viability and new pest and disease pressures
- Increases soil carbon
- Improves soil health

- Provides sources for a wide range of new food, energy, and bio-based products
- Attracts high quality talent to the University of Minnesota to meet the future workforce needs



- Supports clean water
- Expands pollinator forage and habitat
- Diminishes nutrient runoff into ground and surface water



- Creates new businesses and employment opportunities for rural communities including food, health, fuels, and other industries



- Has the potential to create some 12,000 permanent jobs in rural Minnesota. Market opportunities currently exist with General Mills, Patagonia Provisions, PepsiCo, Aveda/Estee Lauder, and many local and grower-owned businesses.
- Could become a permanent part of the path to enhanced water quality, improved natural resources, and sustainable agricultural production. With funding for this development, small grain perennial production in the U.S. alone could exceed 80 million pounds by 2025.

More information:

Don Wyse: wysex001@umn.edu • 651.470.9878

Greg Cuomo: cuomogj@umn.edu • 612.625.1158

www.forevergreen.umn.edu



College of Food, Agricultural
and Natural Resource Sciences
UNIVERSITY OF MINNESOTA