



Perennial Sunflower

# Forever Green Initiative

## Developing New Crops for

- High efficiency agricultural systems
- Improved soil and water quality
- New economic opportunities for farmers, industry, and rural Minnesotans



College of Food, Agricultural  
and Natural Resource Sciences

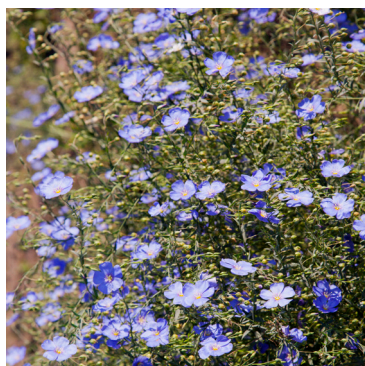
UNIVERSITY OF MINNESOTA

## 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. The Forever Green Initiative is focused on developing new crops to ensure agricultural production to strengthen 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 perennials and short season winter annuals can be used within traditional crop rotations, including corn and soybean rotation, while adding new crop rotation options.



Perennial Flax



Pennycress



Hazelnut



Intermediate Wheatgrass

Forever Green researchers are using new breeding technologies to make rapid improvements in new crop species and are developing new high efficiency production systems. Researchers are utilizing Forever Green 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

Kura 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** Farmers cannot easily increase productivity and profitability and simultaneously enhance water quality and soil health.

**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.

**ECONOMIC INCENTIVES**

Minnesota industry-driven interest in new ingredient sourcing and improved supply chain sustainability metrics. Farmer interest in trialing new cropping systems to diversify economic opportunities. Increasing consumer demand for Minnesota-produced food products with positive environmental, social, and economic impacts.

**SITUATION**

**CURRENT STATUS**

Forever Green crops have been shown to enhance water and soil quality  
 New crop species have been identified but need to be improved  
 Studies are required to integrate Forever Green crops into current cropping systems  
 Farmers need information to produce and market the Forever Green crops  
 New products need to be developed to meet the market demand  
 Forever Green initiative continues to develop scientific talent

**INPUTS**

**WHAT WE INVEST IN**  
 Faculty  
 Staff  
 Postdoctoral associates  
 Graduate students  
 Undergraduate students

Outreach and Communication  
 Volunteers  
 Time  
 Expertise  
 UMN laboratory and field research space

Tools, materials, and equipment  
 Networking with MN industry and small business  
 Space on existing website for hosting educational resources related to the project

**ACTIVITIES**

**WHAT WE DO**

Improve crops using new breeding tools  
 Work closely with farmers to establish Forever Green cropping systems  
 Develop food, feed, energy, and bio-based products

Strategically position Forever Green production systems to enhance soil and water quality  
 Educate students and community

**WE REACH**

Farmers and farming organizations  
 Extension educators  
 Students  
 Research community  
 Minnesotans  
 Supply chain partners

**OUTPUTS**

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

**FOR FARMERS**

Seed for new crop cultivars  
 On-farm field days  
 Agricultural management resources

**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 plant Forever Green crops in buffer and wellhead protection zones  
 Consumers purchase more locally produced 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



# A solution is clear

## In Minnesota, a Forever Green bioeconomy will...

- Build on current agricultural strengths
- Tolerate changing weather patterns and new pest and disease pressures
- Sequester soil carbon
- Improve soil health

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



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

- Support clean water
- Expand pollinator forage and habitat
- Diminish nutrient runoff into ground and surface water



- 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. With this funding for the Forever Green Initiative, perennial grain production in Minnesota alone could exceed 80 million pounds by 2025.
- Can become a permanent part of the path to enhanced water quality, improved natural resources, and high efficiency agricultural production.

### More information:

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