

V(A). Planned Program (Summary)

Program # 17

1. Name of the Planned Program

Horticulture

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	5%		5%	
132	Weather and Climate	5%		5%	
201	Plant Genome, Genetics, and Genetic Mechanisms	5%		50%	
204	Plant Product Quality and Utility (Preharvest)	20%		20%	
205	Plant Management Systems	50%		10%	
211	Insects, Mites, and Other Arthropods Affecting Plants	10%		5%	
213	Weeds Affecting Plants	5%		5%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	15.0	0.0	60.0	0.0
Actual Paid Professional	18.4	0.0	66.2	0.0
Actual Volunteer	62.1	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
489501	0	532941	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1576820	0	5845748	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
1014674	0	5865782	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

MAES horticulture research supports a growing and diversified sector of Minnesota agriculture, including fruit and ornamental crops, potatoes, forages and grasses. U of M horticultural research is perhaps best known by its "stars"--the Honeycrisp apple, and the Frontenac, Marquette and La Crescent wine grapes that jumpstarted successful industries. But U of M horticultural research in 2012 delivered progress on a wide range of crops. Some examples:

- Small scale breweries are a new and emerging sector of the agriculture industry in the state, and U of M research is supporting them through new hops research at the Southern Research and Outreach Center. This work complements long running U of M research which has developed some of the most popular malting barley varieties.
- The Minnesota wine industry now has over 1000 acres of cold-hardy grapes in the state, most of which were cultivars developed from the U of M grape breeding program. U of M wine-grape cultivars are at the root of a burgeoning northern wine industry that spans much of the upper Midwest and Canada and has, as one grower put it, "literally moved wine-making 500 miles north."
- The U of M 124-year-old fruit breeding program is one of three left in the country and has released 26 new apple varieties. Laboratory work on the genetic diversity of apples is combined with field testing and in 2012 has identified one form of gene responsible for cell growth in fruit. This basic research is important for understanding, in part, apple crispness, a quality especially prized in new apple varieties.
- Fruit breeders made selections in sweet cherry, blackberry, strawberry and blueberries and grape cultivars in 2012. Further screening will determine which will go forward in nursery and field testing.
- Two new azaleas were approved for release and licensed. A new wisteria cultivar was licensed and available for sale in the summer of 2012.
- Beatrice, the first-ever USDA Zone 4 winter-hardy gladiolus, was released in 2012.
- The genes of a plant virus infecting coneflowers, geraniums and roses were completely sequenced and their genomes characterized, permitting rapid screening of plants for the presence of the viral pathogen genome.
- Studies on elms conducted at the tree nursery at the U of M has greatly influenced the selection and pruning of elms throughout Minnesota.
- Horticultural researchers continue to investigate the potential of hazelnut as a new crop for Minnesota. Performance trials have been established. In 2012 researchers confirmed that field inoculations for screening for resistance to Eastern Filbert Blight were successful, and they completed a second year of scouting for superior wild American hazelnut germplasm.
- Three new potato lines were released in 2012. MN18747, an early maturing French fry processing clone was released in 2012. The 2012 released chip potato line MN99380-1Y was selected for fast-track expansion by the U.S. Potato Board due to its high yield and superior quality, and resistance to cold-

induced sweetening. It will be grown at 11 U.S. locations in 2013. The 2012 released red skin yellow flesh line MN02616R/Y was commercially test marketed with positive results leading to increased mini-tuber production for more rapid commercial expansion.

Extension: The horticulture team organizes, coordinates and participates in events that create and update research-based education for those who grow plants, fruit, vegetables and landscapes in Minnesota. Standout efforts in 2012 included the following: 1) Horticulture educators trained volunteers to deliver education about biochar (a charcoal that can improve soil nutrients) and its use in the garden. Minnesota excelled in the first year of a four-year grant by teaching more contacts in the first year than were expected for the entire four-year grant. 2) In response to the invasion of the Spotted Wing *Drosophila* fruit fly pest of raspberry, blueberry and strawberry, a new web page was developed and Pest Alert articles were published by early September. The primary article was circulated to more than 1,200 growers, and was published in the Minnesota Fruit and Vegetable Growers' Association Newsletter. 3) Those working with professional landscapers presented new information about diagnosing tree diseases to over 200 professional arborists who now report that they use the information in every house call they make to Minnesota's trees.

In addition, the horticulture team continued its strong work in reaching and educating Master Gardeners throughout the state, as described in Outcome Measures. We also share results of a 1.5 year study about the economic impact of cold hardy grapes, a new industry developed in large part through University of Minnesota research.

2. Brief description of the target audience

The audiences are:

1) fresh market producers, including growers of fruits and vegetables for processing, the processing industry, associated agribusiness turf professionals, nurseries and garden centers, and landscape professionals. Several of these groups have high representations of new immigrants.

2) consumers of horticultural information for yards, gardens and landscapes. These include audiences where information is needed in a timely fashion and those who want to build basic knowledge about horticulture and environmental stewardship over time.

Research audiences include all of the above, horticultural researchers, geneticists, producers, distributors, brokers, growers and retailers, plant ecologists, plant physiologists, landscape designers and architects and extension specialists.

3. How was eXtension used?

A wealth of information regarding apple varieties and rootstocks has been amassed by researchers across the U.S., Canada and Mexico over the past 30 years. An eXtension Community of Practice titled eApples is providing region-specific apple rootstock descriptions and recommendations to commercial producers, nursery professionals, Extension educators, Master Gardeners, home gardeners and consumers. Diverse educational tools such as data bases and articles are housed at eXtension.org, creating a commons of information critical to the apple industry. This developing web site will help to increase adoption of new and existing apple rootstocks ideal to particular regions. With access to information, crop characteristics will greatly improve and the incidence and impact of pest and disease problems will be reduced. Producers will have information that contributes to the sustainability of their operation and information for home gardeners and consumers on the significance of regional apple production will bolster the industry.

Minnesota researchers and Extension educators serve on this community of practice with

collaborators across the country and Canada.

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	173152	1246712	52600	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2012

Actual: 8

Patents listed

Beatrice, first-ever USDA Z4 winter-hardy gladiolus

Summer Waltz, shrub rose

Summer Cascade, Kentucky wisteria

Two new Deciduous azalea selections licensed by Bailey Nurseries.

MN99380-1Y, MN18747, MN02616R/Y--three new potato lines

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	3	40	43

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Workshops, classes and seminars will provide information to professionals in the commercial horticulture industry. (Target expressed as number of events.)

Year	Actual
2012	5697

Output #2

Output Measure

- Master Gardeners, trained by Extension, will deliver hours of educational service to the residents of Minnesota. (Target expressed as the number of volunteer hours committed by Master Gardeners in a year.)

Year	Actual
2012	129222

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Participants of Horticulture program events will achieve significant learning gains regarding horticulture. (Target expressed as the percentage of participants who achieved learning gains.)
2	Participants of Horticulture program events intended to improve participant horticulture practices will improve practices as a result of attending events. (Target expressed as a percentage of participants that changed one or more horticulture practice.)
3	The Master Gardener program in Minnesota mobilized almost 130,000 hours of volunteer time to create and maintain green space in Minnesota. (Quantitative outcome is the Independent Sector value of that service.)
4	Cold-hardy wine grapes, developed by MAES research, have grown a new economic industry in northern states. (Outcome represents the economic impact of vineyards and wineries in nine states and regions.)
5	Research and Extension will improve the management practices and health of bee pollinators.
6	Research will support a potential agronomic niche horticultural crop.

Outcome #1

1. Outcome Measures

Participants of Horticulture program events will achieve significant learning gains regarding horticulture. (Target expressed as the percentage of participants who achieved learning gains.)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	95

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Research-based information about horticulture in Minnesota's cold environment helps to create more beautiful and profitable spaces where Minnesotans work, live and play.

What has been done

Educational courses are offered for and by volunteers in community and online settings.

Results

In an examination of horticulture workshops, 95 percent of participants reported learning gains.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
132	Weather and Climate
201	Plant Genome, Genetics, and Genetic Mechanisms
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
213	Weeds Affecting Plants

Outcome #2

1. Outcome Measures

Participants of Horticulture program events intended to improve participant horticulture practices will improve practices as a result of attending events. (Target expressed as a percentage of participants that changed one or more horticulture practice.)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	68

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The quantitative outcome represents evaluation results from across the state. For example, Master Gardener trainings were evaluated for their effectiveness in changing participant practices. In urban settings, lawns and gardens improve the quality of life and aesthetics of communities. However, when gardeners are not conscientious, they pose a risk to the environment due to overuse of chemicals, overuse of watering, waste of water and water runoff, and control of invasive or noxious plants.

What has been done

Trained Master Gardeners learn, change practices themselves, and train others in a myriad of community settings including festivals and events, public gardens, public housing, youth programs and more.

Results

In an evaluation of Master Gardeners who had been with the program for a while, an assessment of changed gardening practices was made. Top responses included: 1) improved care for trees; 2) splitting and disseminating house plants; 3) adopting chemical free options for lawn and plant care; 4) reducing overhead watering, switching watering times, and reducing frequency of watering; 5) planting more plants for consumption; and more.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
132	Weather and Climate

201	Plant Genome, Genetics, and Genetic Mechanisms
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
213	Weeds Affecting Plants

Outcome #3

1. Outcome Measures

The Master Gardener program in Minnesota mobilized almost 130,000 hours of volunteer time to create and maintain green space in Minnesota. (Quantitative outcome is the Independent Sector value of that service.)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	2793780

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The creation, care and maintenance of green space in communities stimulates public value in a number of ways. Gardens and property improvement support the property values of homes and neighborhoods. Some plant choices serve as a barrier to water runoff or soil erosion. They generate local food choices, and strengthen social capital within communities as people work together to create gardens. Information delivered to and through Master Gardeners help communities enjoy and enhance the benefits of horticulture in communities.

What has been done

In 2012, Extension educators and specialists reached over 2,000 Master Gardeners, providing them with classes and events to deepen their knowledge of plants and green environmental concerns.

Results

Master Gardeners committed 129,222 hours of service to Minnesota communities in 2012. This is valued by Independent Sector at \$2,793,780. Among the outcomes of this service, we can count dozens of community gardens, the daily diagnosis of plants and plant problems, community projects that improved the environment of public housing and Habitat for Humanity projects, and conversations at Farmers' Markets, community fairs and festivals and other public venues where

people come to learn and ask questions.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
213	Weeds Affecting Plants

Outcome #4

1. Outcome Measures

Cold-hardy wine grapes, developed by MAES research, have grown a new economic industry in northern states. (Outcome represents the economic impact of vineyards and wineries in nine states and regions.)

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	228000000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Real economic impact is best achieved through the development of new industries, rather than competition for existing industry. New industries are critical to developing a healthy economy.

What has been done

Cold hardy wine grape varieties, including Frontenac and Marquette grapes developed by the U of M Agricultural Experiment Station (MAES), are high-quality and disease-resistant grape cultivars that can thrive in harsh climates. U of M Extension has supported the industry in several ways -- through the increased development of farmers' markets, and through the development of cooperative marketing ventures such as wine trails in southwest Minnesota. U of M varieties are the most popular varieties in the nine states, representing 55 percent of the total cold hardy production.

Results

In 2012, Extension Community Economics faculty completed a study of the economic impact of this new industry in nine northern states and regions. The economic impact of cold hardy grapes vineyards and wineries in the nine states is \$228,000,000. A conservative estimate of the impact of related tourism is an additional \$113,000,000. In Minnesota, wines and wineries had an economic impact of \$26.5 million and an estimated \$43.8 million in tourism. The industry created 1,463 jobs in Minnesota.

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate
201	Plant Genome, Genetics, and Genetic Mechanisms
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems

Outcome #5

1. Outcome Measures

Research and Extension will improve the management practices and health of bee pollinators.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	2012

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Diseases, pests and the mysterious phenomenon of colony collapse disorder pose a dire threat to the U.S. beekeeping industry, and, in turn, to the \$20-billion-a-year crop industry that relies on insect pollination. Because of these increasing pressures, the ranks of managed bee colonies have plummeted in recent years. On average, beekeepers are losing 30 percent of their colonies every growing season.

What has been done

U of M bee specialists have found ways for bees to keep themselves healthy, using their own natural defenses so beekeepers can avoid chemical inputs, by breeding disease-resistant bees. Most recently, after helping three commercial-scale beekeepers in Minnesota establish hygienic disease resistance in their colonies, the research and outreach team is now working closely with some of the country's largest bee breeders to adopt sustainable pest management strategies. Much of the research to date has focused on the European-imported honey bee -- the primary victim of colony collapse disorder -- but they have also turned their attention to the wide range of native bee species that are also embattled, yet serve an important role in crop pollination.

Results

Extension efforts have created the Bee Squad, a program to assist urban, backyard beekeepers to help provide habitat for managed and wild bee pollinators. Extension has also created a rapidly-expanding national program, called Bee Tech Transfer Teams to assist commercial beekeepers transport their bees to monitor disease and parasite loads in colonies, and help bee breeders select for disease resistance. Reports from beekeepers are extremely positive, as indicated by increased demand for more teams in other parts of the U.S.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants

Outcome #6

1. Outcome Measures

Research will support a potential agronomic niche horticultural crop.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	2012

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Craft beer production grew by 13 percent in 2011, which for the first time surpassed 5 percent of the U.S. beer market in volume. Retail sales were nearly 15 percent of the \$95 billion U.S. beer market. But the amount of Minnesota grown hops that go into that beer is virtually zero. But U of

M research may do for hop farming and the craft beer brewing industry what it has done for cold-hardy grapes and winemaking in Minnesota.

What has been done

Hops are now being grown at two locations at Research and Outreach Centers in Minnesota. They are experimenting with novel trellis technology, which would simplify trellis installation and maintenance, scouting and pest/disease control and harvesting.

Results

This new research program is an example of how research responds to local needs, in this case expressed interest from both home brewers and the craft beer industry, and the increasing interest in locally produced foods. It's an emerging industry and part of the agricultural landscape in Minnesota and U of M is helping to develop.

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Competing Programmatic Challenges

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

A targeted evaluation in 2012 considered whether educational offerings online could produce learning outcomes. Surveys were distributed at the end of workshops to gather evaluation data. Pre-post questions were used to determine the magnitude of learning gains, and participants were also asked to indicate the likelihood that they would change their behavior. Online surveys were used to assess the virtual field days the turfgrass team executed. Eighty percent of respondents replied that they preferred the virtual format over the in-person format. One commented, "I think that the virtual format is a great way to display and promote the research being conducted at the U of M. I hope that it will continue in the future." Lastly, near the end of the year, a needs assessment was also developed, and results will be used to better understand target audiences and to influence the delivery method and content targeted in future programming.

Key Items of Evaluation

Ongoing evaluation of the both the process and the product help program planners assess and change programming to meet needs. Evaluation has demonstrated that even

program methods as sacrosanct as "field days" can be modernized successfully. Over 5,000 viewers attended an online field days event for horticultural research in 2012, with strong participant involvement and satisfaction.