

MAC Integrated Research/Extension Agricultural Projects: 2003–2004

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MAC37: Identification of Optimum Polyacrylamide Application Rate for Erosion Control in Maine's Potato Soils

Principle Investigator(s): Laurie Osher, Chris Reberg-Horton

Background:

Polyacrylamide (PAM) is a soil amendment used in many western states to reduce soil erosion in agricultural fields. PAM reduces erosion by enhancing water infiltration, improving soil aggregate stability, reducing the negative effects of raindrop impact, and decreasing soil crusting. In addition to PAM's benefit in erosion control, PAM has also been found to maximize rainfall penetration and decrease the amount of water needed for maximum yields in some crops. Because of its coagulative properties, additions of PAM in high concentrations can have negative impacts including clogging of agricultural equipment. Adding too little PAM does not effectively reduce erosion or increase water-holding capacity.

1. Complete comprehensive bench scale tests to identify the optimum concentration of PAM to promote aggregation and increase moisture availability in Maine soils.
2. Produce a Maine Agricultural Experiment Station publication containing a literature review and the results of the experiments described in this proposal.
3. Dr. Osher will assist the Maine Potato Board with the preparation of educational materials about the use of PAM on potato fields in Maine.
4. Dr. Osher will publish at least two peer reviewed journal articles. The first, already in preparation with co-author Lauren LeClerc (Junior, honors student) summarizes the results of a comprehensive literature review on the use of PAM in agricultural systems, with special focus on soil properties. The second will be a summary of the experiments described in this proposal.
5. Dr. Reberg-Horton will incorporate the research results into his extension seminars and educational materials. Target audiences for the information will be farmers and agricultural consultants.
6. Dr. Reberg-Horton and Dr. Osher will utilize the results of this research to design field experiments using PAM in a variety of agricultural systems in Maine. They will apply for funding for this future research from the Maine Potato Tax Fund Grant and from the appropriate USDA-CREES Program.

Research Description:

A set of five experiments will be completed on surface horizons from four soils are commonly used to grow potatoes in Maine.

1. Bangor silt loam Exeter
2. Caribou gravelly loam Houlton
3. Plaisted silt loam Newport
4. Plaisted gravelly loam Fort Kent

The experiments will measure soil physical properties related to erosivity:

Soil Property Description of Measurement

- Flocculation; Aggregation of soil particles in solution
- Wet Aggregate Stability; Stability of PAM-treated aggregates in water
- Dry Aggregate Stability; Stability of dry PAM-treated aggregates with shaking
- Surface Strength; Reduction in rupture by drop impact
- Resistance to Erosion; Reduction in sediment yield after PAM treatment

The flocculation experiment (#1) will be completed in the Dr. Osher's laboratory at the University of Maine's, Orono campus. The aggregate stability experiments (#2 & #3) will be completed at the University of Maine Research Farm in Presque Isle. The erosion control and surface strength experiments (#4 & #5) will be completed in the Roger Clapp Greenhouses on the Orono campus.

The equipment to complete experiments #1, #2 and #3 are already owned by the University of Maine's Department of Plant, Soil and Environmental Science. Experiments #4 and #5 will need specialized rainfall and irrigation simulation equipment. To complete these experiments, the system must be constructed using a combination of parts from research suppliers and general equipment available from plumbing supply stores and lumberyards. Some of the parts will need to be fashioned by a machinist.

Three of the four soils were sampled in the summer of 2002 and stored in preparation for these experiments. The Plaisted Gravelly Loam will be collected at the start of the summer field season (mid May). Experiment #1 will be started in late May and completed in mid June by Dr. Laurie Osher and Ms. Lauren LeClerc. Experiments #2 & #3 will be started in mid June by Osher and LeClerc and will be completed during the summer of 2003. The rainfall simulator will be built during the summer of 2003. Once built, it will be tested to ensure uniform raindrop delivery. Experiments #4 & #5 will be started as soon as the equipment is ready, and completed by the end of the summer. Preliminary analysis and replication of experiments (as needed) will be completed in the fall semester of 2003.

Statistical analysis of the results and a preliminary draft of the research reports and manuscripts will be completed by the end of the spring semester of 2004. Reports will be completed by August 2004. Results will be presented at the American Society of Agronomy Meetings in November of 2004.

Industry Support:

The goal of this project is to identify the optimum Polyacrylamide (PAM) application rates on soils commonly used to grow potatoes in Maine. The results of this research will assist the Maine Potato Farms to reduce erosion, improve water utilization, and decrease the need for irrigation.

This research project addresses a Maine Potato Industry Research Priority Area as described in the 1997 Research Visioning Conference Report and updated in 2000: "Item #3a: Soil management practices to enhance water availability through improved soil physical properties" . . . "PAM should be investigated for its impact on soil water availability to potato."

Objectives Met:

Complete comprehensive bench scale tests to identify the optimum concentration of PAM to promote aggregation and increase moisture availability in Maine soils. Completed: Optimum concentration of PAM is 20 Kg/ha.

Dr. Reberg-Horton and Dr. Osher will utilize the results of this research to design field experiments using PAM in a variety of agricultural systems in Maine. They will apply for funding for this future research from the Maine Potato Tax Fund Grant and/or from the appropriate USDA-CREES Program. Completed: Dr. Osher and Dr. Reberg-Horton were among a group of investigators on a proposal to the Maine Potato Tax Fund in 2004. The principal investigators utilized the results of this research and other MAC research to design the proposed study. The project is focused at the field scale research and included the use of PAM to control erosion in potato ecosystems.

Objectives Not Met:

Produce a Maine Agricultural Experiment Station publication containing a literature review and the results of the experiments described in this proposal. Not Completed: A work-merit supported undergraduate student researcher will assist me in getting the information published in this format during the 2004-2005 school year. Her name is Patricia Rouleau.

Dr. Osher will assist the Maine Potato Board with the preparation of educational materials describing the use of PAM on potato fields in Maine. In Progress: Dr. Osher prepared graphics for these publications, however, the Maine Potato Board is waiting for the results of the field scale research prior to preparing the educational material.

Dr. Osher will publish at least two peer reviewed journal articles. The first, already in preparation with co-author Lauren LeClerc (Junior, honors student) summarizes the results of a comprehensive literature review on the use of PAM in agricultural systems, with special focus on soil properties. The second will be a summary of the experiments described in this proposal. In Progress: Two manuscripts are in the final stages of in-house review prior to being

submitted to peer review journals' editors. The titles and authors of these manuscripts are listed in the publications section (below).

Dr. Reberg-Horton will incorporate the research results into his extension seminars and educational materials. Target audiences for the information will be farmers and agricultural consultants. Planned: Dr. Reberg-Horton will incorporate the results into his extension programming. He will give presentations at the Agricultural Trade Show in Augusta and the winter potato growers meetings.

Methods Used to Evaluate Outcomes:

No outcome evaluation method was employed, other than the completion of this termination report, the determination of a grade for John Boucher, and the detailed review and comments on the work of the other students who have assisted me in the completion of in the research.

Integration of Research and Extension Activities:

- Extension agents and members of Soil and Water conservation Districts in potato growing regions of the state assisted in the collection of soil samples used in this research.
- Experiments included the use of the rainfall simulator designed and built by Dr. RoseMary Seymour (UM Agricultural Engineering 1996-2001) and used previously by researchers at the Aroostook Farm.
- Osher has presented the results of this research informally to both extension agents and research scientists.

Outputs:

- Manzo, J. August 2003. "Design and testing of a bench scale device to measure erosion and runoff from Maine's Potato Soils" Presentation at MERITS summer intern program student symposium.
- Osher, L.J. March 2004. "Identification of optimum polyacrylamide application rate for erosion control in Maine's potato soils" Preliminary Report: 2003 Potato Tax Fund Grant, Prepared for the Maine Potato Board Tax Fund Committee.
- Boucher, J. May 2004. "Experiments completed to determine the optimum polyacrylamide application rate for erosion control in Maine's potato soils" Presentation to of independent study research results.
- Osher, L.J., L.G.LeClerc. 200_. Polyacrylamide use for improvement of soil physical properties in agricultural fields. Manuscript in preparation for Soil Science.
- Osher, L.J. and J.R. Boucher. 200_. Identification of optimum polyacrylamide application rate for erosion control in Maine's potato soils. Manuscript in preparation for Soil Science Society of America Journal.

MAC 38: Managing the Invasive European Fire Ant, *Myrmica rubra*

Principle Investigator(s): Eleanor Groden, Lois Berg Stack

Background:

The European fire ant, *Myrmica rubra* has become established in many communities along the coast of Maine. Although we are not certain when this invasive ant was first introduced into these areas, it is clear that the population densities of this ant have increased considerably over the past decade, as have the number of areas in which they infest (Figure 1). European fire ants have colonized disturbed and natural areas around residences, schools, parks, and commercial and municipal buildings where their nest densities have averaged up to 1.4 nests/m² with 1000-2000 foragers per nest. These ants aggressively defend their territory and readily sting humans, pets and livestock that have the misfortune to move slowly or rest within the large areas where they forage (Figures 2&3). Numerous homeowners have reported to us that they are unable to use their yards and gardens because of repeated stings by the ants. Many homeowners, businesses, and public park and resource managers are relying on insecticide treatments for curbing this pest. The efficacy of these treatments is uncertain, and resurgence of local populations suggests that this strategy provides only short-term control. We also have evidence that the invasive populations of this ant are negatively impacting native species.

In addition to the observed increases in numbers of these ants witnessed within many locales in the past decade, the European fire ant also appears to be spreading more rapidly: from 2 locations in Maine in the 1950s to more than 20 locations along Maine's entire coast as of 2002. Unlike the southern imported fire ants, which were imported from South America and are limited to areas in the country with mild winters, the European fire ant thrives in cool temperatures. Given that the geographic distribution of this ant in its native range spans from the United Kingdom to central Asia and from Scandinavia to the Black Sea, it is unlikely that climatic factors alone will limit the spread of this ant in the northeastern U.S.

The biology of *M. rubra* and its pattern of infestation suggest that their primary means of spread is via colony budding which results in expansion from infested areas into adjacent areas. We do, however, have evidence for spread of these fire ants by human activity, particularly with movement of infested potted plants, mulch and fill. We have collected ants from a wholesale greenhouse facility in southern Maine where they were stinging employees when they encountered them in container plants being repotted. We have also confirmed that the first infestation in Maine to become established more than twenty miles from the coast resulted from the planting of shrubs purchased from a nursery in an infested coastal community. (This inland infestation has now persisted through four winters.) It is likely that infested container plants brought to Maine from Europe for planting in gardens of coastal estates are responsible for some of the original infestations in the early half of the 20th century. Subsequent movement of plants, soil, mulch, and fill have spread the fire ant to new areas. For this reason, educating people about this invasive pest is the most important step to take to limit its further spread. The Green industries in New England have been estimated to be valued at .7 billion and growing with much exchange of goods throughout and beyond the region. Restriction of movement of goods due to quarantines or regulations aimed at limiting the spread of this invasive fire ant would be extremely costly. Raising awareness of these ants will aid in reducing the spread of this species in the ME, which will limit both the environmental, regulatory and control costs for this pest.

Because of the proximity of infestations to human activity and many environmentally sensitive areas, it is important to take a "least toxic" approach to developing an IPM program for this pest. Success in managing pestiferous ants has been achieved with "least toxic" control strategies, including baited insect growth regulators and boric acid baits. Researchers in the southern U.S. have found that low concentrations of boric acid (1% and less) in sucrose bait have effectively controlled colonies of pestiferous ants. The low concentration of boric acid is necessary to prevent bait avoidance and provide a slow rate of kill that assures that the foragers distribute the toxin to the remainder of the colony. Our preliminary trials conducted in 2002 (Figure 4) indicate that this may be a promising strategy for European fire ant management. Boric acid has also been shown to enhance the activity of fungal diseases in some insects. In 2002, we found fungal pathogens to be the most common natural enemy of the fire ants on Mt. Desert Island. We hypothesize that exposure to boric acid treatments may encourage increased infection of the ants by natural fungal pathogens, and therefore, increase the efficacy of control.

Use of insect growth regulators, including methoprene, has also been successful in controlling invasive ants when added to baits. These materials have been shown to have long-term impacts on colonies. However, because they are relatively slow acting, they may not provide the immediate pest suppression needed. The USDA-ARS Areawide Program for Suppression of Fire Ants in the southeastern U.S. includes treatments with Extinguish®, a baited formulation of methoprene. Seven to 10 days following Extinguish® treatment, after the foraging ants have had sufficient time to incorporate the toxin into the colony's food supply, this treatment is followed by an application of Amdro® (hydamethylnon). Amdro® dramatically decreases the foraging ant population and provides more immediate control of the pestiferous populations. Our preliminary work in 2002 has shown that the European fire ants will readily pick up baited formulations of both Extinguish® and Amdro®. We feel this combination strategy could be useful for heavily infested areas in Maine.

Research Description:

Raise awareness of the biology, ecology, potential spread and methods of managing European fire ants, by developing and distributing user-friendly materials to homeowners and green industry members (nursery, garden center and landscape professionals) in Maine.

1. A fact sheet will be developed on fire ant biology, ecology, potential spread and management .
2. Fire ant information will be incorporated into the University of Maine Cooperative Extension's pest management website (<http://www.umext.maine.edu/topics/pest.htm>).
3. All materials developed will be distributed at multiple venues to both public and industry sectors throughout ME.

Distribution: Fact sheets will be made available to homeowners through the Maine Master Gardener Program, the Bangor Garden Show, the Portland Flower Show, and to walk-in clients at Maine's 16 county extension offices. It will be made available to green industry members at the Maine Landscape and Nursery Association's annual meeting, New England Grows, and at the University of Maine Cooperative Extension's GardenPro. Industry members will be encouraged to pass copies on to their clients. This brochure will also be distributed to nurseries by the Maine Dept. of Agriculture's nursery inspectors (See attached letter from Gibbs). Expected completion April 2004.

Evaluate "least toxic" strategies for homeowners and businesses for management of fire ant using insect growth regulators and boric acid-sucrose bait.

Several homeowner cooperators have been identified on Mt. Desert Island. We will trial the following treatments at 3 sites per treatment for effective short and long-term control of the ants: 1) Amdro®, 2) Extinguish®, 3) Extinguish® followed by Amdro®, 4) baited boric acid, and 5) untreated control. Treatments will be applied in early June. Foraging ants will be sampled on a weekly basis throughout the summer. Samples of ants in the boric acid and control treatments will be collected and assessed for incidence of fungal infection. Results will be incorporated into products developed in the Extension objectives.

Objectives Met:

1. Raise awareness of the biology, ecology, potential spread and methods of managing European fire ants, by developing and distributing user-friendly materials to homeowners and green industry members (nursery, garden center and landscape professionals) in Maine.
 - a. A fact sheet was developed on fire ant biology, ecology, potential spread and management (See attached).
 - b. Fire ant information was incorporated into the University of Maine Cooperative Extension's pest management website and the fact sheet is available on line (<http://pmo.umext.maine.edu/ipddl/insectfs.htm>).
 - c. Fire ant material was distributed at multiple venues to both public and industry sectors throughout ME, including more than 1000 fact sheets distributed to (5 Cooperative Extension County Offices, Maine Organic Farming and Gardening Association, Maine State Department of Agriculture Pest Management Office, Maine State Board of Pesticide Control, Maine Department of Agriculture Nursery Inspectors Program, Pine Tree State Arboretum, Town Offices in Washington County, Southern Maine Community College Horticulture Program, Acadia National Park) Presentations

made and more than 500 fact sheets distributed (Rogers Farm field day, August 21, 2004, New England Greenhouse Conference, October 20, 2004, Pittsfield Garden Club, October 22, 2004, Habitat Stewards Training Session, October 23, 2004, Knox/Lincoln/Waldo Co.'s Master Gardeners training session, November 4, 2004, Greenhouse growers program, 64th Annual Maine Ag Trades Show, January 12, 2005) Interactive display developed and anticipated 1500 fact sheets distributed to landscapers and nursery managers at New England Grows (Boston), February 1-3, 2005.

2. Evaluate "least toxic" strategies for homeowners and businesses for management of fire ant using insect growth regulators and boric acid-sucrose bait. Several homeowner cooperators were identified on Mt. Desert Island and a trial was conducted with the following treatments at 4 sites per treatment for effective short- and long-term control of the ants: 1) Amdro®, 2) Extinguish®, 3) Extinguish® followed by Amdro®, 4) baited boric acid, and 5) untreated control. Treatments were applied in early June 2003. Foraging ants will be sampled on a bi-weekly basis throughout the summer and again at the beginning of Summer 2004. Both Amdro® (2 applications) and the Extinguish® followed by Amdro® (1 application of each) provided the best season long suppression of ant activity. Ant activity in was significantly lower than the other treatments 1 year post treatment. Boric acid baits were not efficacious and did not result in measurably higher levels of natural mortality.

Methods Used to Evaluate Outcomes:

Evaluation of Extension Objectives: (1) The objective of raising awareness among both the public and the green industry was reached by distributing fact sheets to more than 1500 people, and presenting information at meetings and workshops to 400 homeowners and 100 industry members. In addition, this fact sheet will be available at an interactive display at New England Grows in Boston in February 2005, a program that attracts more than 12,000 industry members from throughout New England. (2) Over time, the impact of this process of raising awareness will also be gauged by the number of ants submitted for identification, accompanied by the mailing panel in the fact sheet. The funded research was documented in progress in several newspaper articles that reached thousands of readers. The collaboration of research and extension personnel led to publication of the fact sheet that has been widely distributed, and to the development of the interactive display to be used in February 2005.

Outputs:

- Groden, E. and F. A. Drummond. 2003. An unwanted visitor at Acadia. *Friends of Acadia Journal* 8(2): 10-11.
- Groden, E., F.A. Drummond and L.B. Stack. 2004. European fire ant: a new invasive insect in Maine. *University of Maine Cooperative Extension Bulletin* #2550.
- April 2003. The Ecology and Management of the European Fire Ant*: Groden, E., F.A. Drummond, J. Garnas, and S. Yan. A preliminary report. Bar Harbor Conservation Committee Meeting, Bar Harbor, ME.
- August 21, 2004. Managing invasive plants and insects in Maine. L.B. Stack. A Garden Gathering, Rogers Farm, Stillwater, ME.
- Sept. 2004. Ants! E. Groden and C. Graham. Bugmania, Maine State Museum, Augusta, ME.
- Sept. 2004. The European Fire Ant. E. Groden, F. Drummond, and C. Graham. Common Ground Fair, Unity.
- October 20, 2004. Building an industry: the team approach. L.B. Stack. New England Greenhouse Conference, Worcester, MA.
- October 22, 2004. Managing invasive species in Maine gardens. L.B. Stack. Pittsfield Garden Club, Pittsfield.
- October 23, 2004. Managing invasives in the wildlife garden. L.B. Stack. Habitat Stewards Training Program, Lisbon Falls, ME.
- • November 5, 2004. Managing invasive species in Maine gardens. L.B. Stack. Knox-Lincoln-Waldo Counties' Master Gardener Training Program, Waldoboro, ME.
- January 12, 2005. Pests your spring customers will ask about. Scally, S., R. Folsom and L.B. Stack. Greenhouse growers program, 64th Annual Maine Agricultural Trades Show, Augusta, ME.
- January 12, 2005. European Fire Ant: A Concern for New England's Green Industry. E. Groden. 64th Annual Maine Agricultural Trades Show
- February 1-3, 2005. L.B. Stack and C. Graham. Fight the Invader: European fire ant. New England Grows, Boston, MA.
- Drummond, F.A., J. Garnas, and E. Groden. June 2003. Effect of *Myrmica rubra* invasion on native invertebrate communities. *Acadian Entomol. Soc. Ann. Meeting*, Bar Harbor, ME

- Groden, E., F. A. Drummond, J. Garnas, and S. Yan. June 2003. Seasonal foraging activity of *Myrmica rubra* in Mount Desert Island in Maine. Acadian Entomol. Soc. Ann. Meeting, Bar Harbor, ME
- Garnas, J., E. Groden, and F.A. Drummond. June 2003. Patterns of artificial nest site colonization and colony movement by the invasive European fire ant (*Myrmica rubra*) in Acadia National Park. Acadian Entomol. Soc. Ann. Meeting, Bar Harbor, ME
- Yan, S., E. Groden, and F.A. Drummond. June 2003. Evaluation of local entomopathogenic fungi for potential biocontrol of the European fire ant, *Myrmica rubra* L. Acadian Entomol. Soc. Ann. Meeting, Bar Harbor, ME
- Groden, E., F. Drummond, and S. Yan. 2003. Managing an unwanted visitor at Acadia National Park. Invited speaker. Annual Meeting of the Society of Invertebrate Pathology, July 26-30, 2003, Burlington, VT.
- Groden, E. October 2003. Investigations of Biological Control of an Invasive Ant. Invited speaker. Plant and Invertebrate Ecology Division, Rothampsted Research, Harpenden, Hertfordshire, United Kingdom.
- Groden, E. and F.A. Drummond. October 2003. *Myrmica rubra*: Loved in the U.K., Hated in the U.S. Invited speaker, Centre for Ecology and Hydrology, Winfrith Technology Centre, Dorset, United Kingdom.
- Groden, E. and F.A. Drummond. February 2004. Ecology and Management of the Invasive Ant, *Myrmica rubra*, in the NE U.S. Invited speaker, USDA-ARS CAVE, Gainesville, FL.
- Groden, E., S. Yan, and F. A. Drummond. August 2004. Pathogens associated with the ant, *Myrmica rubra*, in its introduced and native range. 2004 Annual Meeting of the Society of Invertebrate Pathology, Helsinki, Finland populations. Annual Meeting of the Society of Invertebrate Pathology, Helsinki, Finland
- Groden, E. and F. Drummond. October 2004. The Invasive ant, *Myrmica rubra*: Loved in the U.K., Hated in the U.S. Seminar presented in the Dept. of Biol. Sci., UMaine, Orono, ME.
- Groden, E. November 2004. An Unwanted Visitor in Acadia National Park: The Invasive Ant, *Myrmica rubra*. Invited speaker, Dept. of Entomol., Penn, State Univ., State College, PA.

MAC 39: Investigating a Specialty Cut Flower Industry for Rural Maine: Year 2.

Principle Investigator(s): Matthew Williams, Donglin Zhang,, Lois Berg Stack

Background:

Specialty cut flowers (cut flowers other than roses, chrysanthemums and carnations) are a high-value potential crop for rural Maine, due to higher profits and rising sales potential compared to traditional field crops. Most specialty cut flowers are not shipped long distances, and are generally grown within trucking distance of their point of retail sale. Aroostook County, which has an established refrigerated trucking industry, is within driving distance of wholesale and retail florists throughout Maine. The current project will continue investigations into the feasibility of this industry for Aroostook County, as a model for other parts of Maine.

A 2002 MAC grant supported the establishment of specialty cut flowers field trials at Bird Farm, Houlton, Maine. Our findings included the following:

- Cut flowers were successfully grown at Bird Farm. Our initial yield and quality data suggest that this crop has potential. However, some of the crops installed were woody and herbaceous ornamental plants, whose yield will not be able to be determined for 2-3 years.
- Some of the 2002 crop was marketed through a local wholesaler whose interaction with local florists determined that the florists were receptive to purchasing locally grown cut flowers.
- At field days held at Bird Farm, several local growers indicated an interest in transitioning into specialty cut flower production. Some of these growers were interested in participating in year two of the project, to learn production and marketing techniques.

In our 2002 project, we supplied specialty cut flowers to a design show sponsored by the Maine State Florists' and Growers' Association, and surveyed the 80 florists who attended. Twenty of the 21 respondents had previously purchased cut flowers from local growers, and all 21 were interested in doing so in the future. They reported that some factors would be "very important" (V) and other factors would be "somewhat important" (S) in their decision to buy Maine-grown cut flowers: quality (21 V, 0 S); direct delivery from farm to shop (18 V, 3 S); availability of unusual flowers (16 V, 2 S); price (15 V, 5 S); and ability to purchase through a wholesale florist (6 V, 11 S). Respondents also listed flowers they would be most interested in purchasing from a local grower. Of the 22 flowers listed, those listed by at least 3 florists were lily (6), garden flowers (6), gladioli (5), snapdragons (4), sunflowers (3), unusual flowers (3), flowers that don't ship well (3), callas (3) and sweet peas (3).

The broad objectives of this 2003 project are to build on the 2002 project, as follows:

- We will assess the woody and herbaceous perennial plants planted at Bird Farm in 2002, for their viability (yield and quality) as fresh cut stems.
- We will increase the diversity of annual cut flowers in the trials, based on recommendations from the commercial florists surveyed as part of the 2002 project. Since this project will not begin until May 1, we will not have time to produce transplants. We will purchase transplants, but cannot project exact cultivars at this time.
- We will begin the transition to local leadership of this project by involving local growers as partners in the production and marketing of specialty cut flowers, based on the interest they expressed in 2002.

Research Description:

We propose the following field work:

- We will assess the winter survival of perennial species planted in 2002, prune them as needed and establish irrigation lines on them for improved production in 2003.
- We will plant new specialty annuals in mulched beds, from either seeds or plugs. Over the course of the summer, we will collect data on yield, quality and market potential of these crops.
- Two crops included in this project offer two possible markets: both dahlias and gladioli are produced vegetatively, and have a high reproduction rate of tuberous roots and corms, respectively. We will investigate

the viability of both of these crops as (1) cut flowers in summer and (2) tuberous roots and corms in fall. Toward this end, we will collect data on yield, quality and storage life.

We propose the following educational activities:

- A major emphasis of this second year is to educate our grower-collaborators, to prepare them to transition to ownership of this project. That education will begin in the field, with hands-on participation to teach the basics of producing field-grown specialty cut flowers.
- Grower-collaborator education will continue with a field trip to small independent cut flower growers in Washington County (peony grower) and Hancock County (sweet pea grower), and York County if funds allow (lily grower).
- The production fields at Bird Farm will be available for tours at summer field days, to encourage additional growers to consider specialty cut flowers as a crop in the future.

Projected Outcomes:

We will collect data on the viability of woody and herbaceous specialty cut flowers, in continuation of work we initiated in 2002. We will share yield and quality data through the field days at Bird Farm, and through an article in the Maine State Florists' and Growers' Association's newsletter.

We anticipate that our grower-collaborators will determine the viability of these crops for their own operations, and either discard the idea at the end of this season, or incorporate production into their farms in 2004.

Industry Support:

The florist design show survey in 2002 demonstrated the enthusiastic reception of florists to locally grown cut flowers. If this project can produce high-quality product and deliver it to those florists, their ongoing support will make this project successful.

New England Grows, a regional trade show, pledged \$00 toward the 2002 project if it was fully funded, to support publication of extension materials. They have shifted that pledge to this second year, as indicated in the budget below.

Three grower-collaborators will contribute labor and time to this project, as indicated in the budget below. In addition, one grower will contribute use of equipment to the project, as indicated below.

Two letters of support have been written by industry members. The first is from one of the grower-collaborators. The second is from a wholesale florist in Houlton, who will participate in the distribution of cut flowers as he did in 2002.

Objectives Met:

Northern Maine's cool night temperatures are well suited for flower production but no market infrastructures exist for export from the area. This project sought to accomplish several broad goals. First to evaluate cut flowers type, but not cultivars evaluation. Second we worked with a local flower distributor to evaluate market acceptability. Third, gladiolas and dahlias were to be evaluated for dual, asexual propagules and cut, potential. Finally to help the local growers who are interested in diversifying their agricultural production.

Methods Used to Evaluate Outcomes:

Marketing infrastructure remains the major impediment to growers. Wholesalers remain primarily importers into the region and have no method for exporting if cuts exceed their internal utilization. Fresh cuts are desirable and preferred by retailers when available which make up the customer base for wholesalers. The only large pooling market in the region remains the Boston Flower Market, but no wholesalers in Maine maintain a continuous supply route with that market that would establish a consistent outlet to small growers exceeding local demand. Dual use with propagules and cuts offer the potential for smaller growers to reach critical marketing mass. Expansion of the propagules needs further evaluation and will continue, woody perennials in the study will be evaluated for expansion in 2005. No further funding need is anticipated at this time with growers becoming self sufficient with existing propagules and revenue from the cuts.

MAC 40: Brassica Green Manures: Biofumigants for Pest Management in Potato

Principle Investigator(s): Eric Gallandt, Erin Haramoto, Chris Reberg-Horton

Background:

Economic, environmental, and biological problems associated with herbicide- and cultivation-based weed control efforts have promoted efforts to develop ecologically-based weed management systems. Although alternative systems may successfully limit crop yield loss, weed control efficacy may be lower and more variable than in conventional systems, resulting in larger annual inputs into the weed "seed bank," i.e., the viable seeds present in the soil and on its surface. Consequently, weed management is the foremost production-related problem faced by growers who do not use herbicides, or those growing crops for which few herbicides are registered, e.g., the Maine Vegetable and Small Fruit Growers Association.

Insecticidal, nematicidal, fungicidal, and phytotoxic properties of members of the Brassicaceae are well-known. Incorporated residues of *B. napus*, for example, reduced weed densities 73-85% in a subsequent potato crop. Because of these pest management benefits, the University of Idaho canola breeder is currently selecting for high-glucosinolate Brassicas to function as "biofumigants" (Jack Brown, personal communication).

Four Brassica varieties from the University of Idaho program have been evaluated at the Rogers Farm since 2000: 'Pacific gold' (*B. juncea*), an oriental mustard; 'Idagold' (*B. hirta*), a yellow condiment mustard; 'Humus' (*B. napus*), a facultative winter canola; and 'Sunrise' (*B. napus*), a low glucosinolate canola. In both early (June) and late (July) plantings the high-glucosinolate 'Idagold' yellow mustard has consistently been superior to the other entries in terms of stand and biomass. Based on the promising agronomic properties of 'Idagold,' research projects were initiated in 2001 and 2002 to characterize the effects of incorporated Brassica green manures on the establishment of weeds and vegetable crops ranging from low to high seed mass, and the effects on the growth and fecundity of species that successfully establish in these residues. This work, being conducted at the UM Rogers Farm, forms the core of Ms. Haramoto's thesis research. The goal of the proposed research is to take the brassica green manures on-farm to evaluate their potential contribution to the management of important pests in early potatoes.

Research Description:

Objective

Determine the effect of preceding Brassica green manures, including 'Idagold' mustard, on subsequent weed establishment, potato yield and quality.

Work Completed

In June of 2002, randomized complete block field experiments consisting of four short-season green manure treatments ('Idagold', 'Dwarf Essex' winter rape; 'Hyola' spring canola; and oat) were established at two experiment stations (UM Aroostook and Rogers Farms) and three on-farm sites (Peacemeal Farm, Dixmont, ME; Goranson Farm, Dresden, ME; New Leaf Farm, Durham, ME). Above ground green manure and weed biomass was harvested in early August immediately prior to mowing, green manure incorporation, and uniform sowing of an oat cover crop. The oat will predictably winter kill and the test crop of "new" potatoes will be planted in the spring of 2003.

Work Proposed

In this experiment we will measure the yield, tuber quality (i.e., size, US#1, disease incidence), weed density and weed biomass in "new" potatoes following the planting of Idagold, Dwarf Essex winter rape; Hyola spring canola; and oat. Red potatoes will be planted at each of our five field sites in the spring of 2003. Weed density, by species, will be measured prior to the first cultivation, and following the final hilling. Weed biomass will be measured in late July. Tuber yield will be measured at a uniform harvest date across locations. These samples will be graded and, with the assistance of Dr. Lambert, Associate Professor of Plant Pathology, they will be evaluated for soil born plant pathogens including *Phytophthora* rots (late blight, pink rot), *Rhizoctonia* black scurf, *Streptomyces* scabies "common scab," and *Colletotrichum coccoides* "black dot."

Projected Outcomes:

Field experiments will conclude in September, 2003. Data analysis and initial drafting of the Brassica Green Manuring Fact Sheet will occur during Oct., Nov. and Dec. of 2003, with a final copy of this publication submitted before the end of the year.

MAC support will permit us to procure and summarize a five site-year data set related to the effects of Brassica green manures on weeds and potato crop yield and quality. These field experiments will be featured during the 2003 Rogers Farm Field Day. Combined with a two-year data set being developed as part of Erin Haramoto's M.S. research, and large-scale on-farm evaluation of Brassica green manures in northern Aroostook County which have been conducted by Tim Griffin, we will have considerable experience and locally relevant data that will be distilled into a UMCE Fact Sheet: "Brassica Green Manures: Short-Season Cover Crops for Pest Management."

"Brassica Green Manures: Short-Season Cover Crops for Pest Management" will be an eight-page, six-color publication with a print run of 1000 copies. This publication will be available through UMCE Publications.

Industry Support:

Collaborating Faculty

- Tim Griffin, David Lambert

Cooperating Growers

- Mark Guzzi, Rob Johansen and Jan Gorenson, Dave and Chris Colson

See attached letter of support from Eric Sideman. The following Maine farmers demonstrate their support for the project through their donation of land, equipment and labor to conduct the on-farm portion of the research: Dave Colson, Mark Guzzi, and Rob Johanson.

Objectives Met:

Determine the effect of preceding Brassica green manures, including 'Idagold' mustard, and conventional short-season green manures on subsequent weed establishment, potato yield and quality.

Methods Used to Evaluate Outcomes:

Rotation crop phase. In June of 2002, randomized complete block field experiments consisting of four short-season green manure treatments ('Idagold' yellow mustard, 'Dwarf Essex' winter rape; 'Hyola' spring canola; and oat) were established at the University of Maine's Rogers Farm experiment station, Peacemeal Farm in Dixmont and the Goronson Farm in Dresden. The cover crops at each site were plowed under in August and oats were then uniformly seeded throughout the plots to provide a winter killed cover crop. Cover crop incorporation was timed carefully so that the brassicas and weeds had not produced viable seeds.

Cash crop phase. Potatoes (var. Red Norland) were planted at each site in the spring of 2003. Weed sampling occurred prior to the first cultivation of the potatoes and at potato harvest. Harvest was timed so that a majority of the tubers were at the grade "b" stage to be sold as "new" or fresh potatoes. Fresh weights of the tubers were taken for yield estimates and a sub-sample was then evaluated for two soil born plant pathogens *Rhizoctonia* "black scurf", and *Streptomyces scabies* "common scab." Potato yield varied among sites ($P < 0.001$), but was unaffected by preceding cover crop ($P = 0.314$; Site x cover crop, $P = 0.997$). Incidence and severity of both powdery scab and *rhizoctonia* were likewise unaffected by cover crop treatment. Incidence was generally greater than 30%, but the severity ratings indicated that, on average, less than 2% of the tuber surface areas were symptomatic. The early harvest of these "new potatoes" may have avoided greater incidence of disease.

Weed density was measured by species at each location, both before the first cultivation, and prior to potato harvest. At each site, sample date, and for each of the predominant weed species, density was similar among the oat and three brassica cover crop treatments. These results are in contrast with our original hypotheses, but are consistent with the recently summarized projects of Haramoto and Gallandt which demonstrated that brassica green manure crops reduced weed establishment to a similar extent as other non-brassica, short-season green manures (Haramoto and Gallandt In press).

MAC 41: Preventing Soft Scald and Maintaining Fruit Quality of 'Honeycrisp' Apple

Principle Investigator(s): Renae E. Moran

Background:

Honeycrisp is a new apple variety in high demand because of its excellent eating quality at harvest and after long-term storage. Unlike many other varieties, Honeycrisp remains crisp and juicy during the storage period and during unrefrigerated conditions that typically occur in marketing. Because of this, it has great appeal to both apple growers and to consumers. It is currently being planted by many Maine apple growers for both a farmstand and wholesale market. However, its susceptibility to soft scald limits wide scale production because it makes fruit unmarketable and can lead to big losses for growers.

Soft scald is a chilling injury that occurs when sensitive varieties are stored at temperatures below 36°F. It is not present at harvest, but shows up in apples stored longer than two months. Symptoms of soft scald are irregularly-shaped large, brown bruises on the surface of the fruit.

Storage temperatures below 36°F lead to the development of soft scald. Apples are normally stored at temperatures near 32°F to maintain peak quality since warmer temperatures lead to softening and greasiness. Holding fruit for a week at temperatures near 50°F prior to placing in cold storage can prevent soft scald, but can also cause other quality problems to develop, such as bitter pit (Bedford, 2001). Preliminary research in Maine has shown that five days at 60°F can prevent soft scald, but leads to quality loss problems such as greasiness. MCP (SmartFresh™) is a growth regulator that inhibits ethylene, the plant hormone that causes apples to ripen. When applied to fruit after harvest, it maintains fruit quality and partially prevents soft scald. MCP may be used in combination with a prestorage treatment of 50°F to prevent quality loss and soft scald, but has not yet been tested.

Controlled atmosphere storage (CA) is the current industry standard for preventing disorders and maintaining quality in apples stored beyond December. In controlled atmosphere storage, the oxygen concentration is reduced to 3% and carbon dioxide is increased to 2-3%. It prevents the occurrence of many disorders, but can lead to increased sensitivity to chilling injury. It may be useful for maintaining quality in late harvested fruit or fruit first held at 50°F prior to cold storage, when apples are less sensitive.

Harvest date determines whether or not apples develop soft scald, but also has a big impact on quality. Growers in Massachusetts, New York and Michigan are encouraged to harvest in early to mid September, when fruit are slightly immature, to prevent soft scald (Weis et al., 2003; Schallier, 2001). To prevent soft scald in Nova Scotia, growers are encouraged to harvest late, when apples are fully mature (Prange, personal communication). These contradictory recommendations between the different regions indicate that weather conditions before harvest may be affecting the development of scald, as it does with other disorders. It appears that regional differences in climate will affect when growers should be harvesting. Preliminary research in Maine indicates that either an early or late harvest can prevent soft scald. Harvest in late September, when apples are at peak quality, will lead to the occurrence of soft scald. However, an early or a late harvest date may not be the best approach to solving the soft scald problem. Early harvested apples are too green and unattractive for consumer appeal, and are more prone to other disorders, such as superficial scald. Late harvested apples develop a greasy film on the surface of the fruit that is unacceptable. Harvest in late September combined with proper storage conditions may allow growers to market excellent quality Honeycrisp with minimal loss due to soft scald.

The Maine Agricultural and Forestry Experiment Station at Highmoor Farm has Honeycrisp apples which are located near the center of Maine's apple production region. This makes it ideally suited for this study since the regional climate appears to determine when to harvest to avoid soft scald. This project will evaluate the effect of harvest date and storage conditions on the occurrence of soft scald and fruit quality of Honeycrisp. Our goal is to find practical harvest and storage practices that growers will implement to prevent losses of Honeycrisp apples.

Research Description:

The following of eight treatments will be applied to Honeycrisp apples:

1. Harvest in mid Sept. (at a starch index of 5.0) and stored at 34EF
2. Harvest in late Sept. (at a starch index of 6.0) and stored at 34EF
3. Harvest in early October (at a starch index of 8.0) and stored at 34EF
4. Harvest in mid Sept. and stored at 37EF
5. Harvest in mid Sept., held at 50-60EF and stored at 37EF in CA
6. Harvest in mid Sept., treated with MCP and stored at 34EF
7. Harvest in mid Sept., held at 50-60EF for five days and stored at 34EF
8. Harvest in mid Sept., treated with MCP, held at 50-60EF for five days and stored at 34EF

Temperature in each cold room will be measured daily. To hold fruit at 50-60EF, fruit will be placed in the hallway outside the cold rooms for five days. Temperature in the hallway will be monitored daily.

For the CA treatment, fruit in bushel boxes will be placed inside a large plastic bag specially designed for CA storage. The bag will be sealed and N₂ added to bring O₂ concentration down to 3%. The concentration of CO₂ will be maintained below 3% with hydrated lime placed inside the plastic bag. The concentration of O₂ and CO₂ will be measured daily and adjusted as needed with N₂ or air.

To apply MCP, fruit will be placed in airtight coolers and exposed to 1 ppm MCP for 20 hours. Half the fruit will be placed in cold storage immediately and the other half at 50-60EF for five days and then into cold storage.

Fruit will be stored until January at which time quality and occurrence of disorders will be measured. Fruit will be held at room temperature for one and seven days after which firmness and ethylene will be measured on ten fruit. Occurrence of disorders will be measured on 50 fruit per plot after seven days at room temperature.

The trees are 'Honeycrisp'/M.26 EMLA planted in 1994 and located at the Highmoor Farm in Monmouth, ME. The study will have a randomized block design with five blocks and four trees within each block. The treatments will be replicated five times.

Projected Outcomes:

This project will identify Honeycrisp harvest and storage protocol for maintaining optimum quality based on conditions in Maine. The results of this project will enable growers to market high quality apples with minimum loss to soft scald. Results will be communicated to growers through an article in Fruit Notes and at the Highmoor Farm Summer Tour. Results will be communicated to other extension specialists and researchers at scientific meetings (American Society for Horticultural Science Annual Conference), and through a peer reviewed article in HortScience.

Methods Used to Evaluate Outcomes:

Flesh firmness after storage was greater with the first harvest than with later harvests, but remained near optimum throughout storage with all harvest dates. Harvest date did not affect the occurrence of bitter pit, soft scald, senescence or decay. Very little soft scald occurred in 2003, so different harvest dates and storage conditions could not be fully evaluated for preventing it. Fruit from the September harvests had better flavor and less greasiness after storage, but by six months, flavor was unacceptably bland with all three harvest dates. Honeycrisp may require the use of 1-MCP or controlled atmosphere storage to preserve flavor and to prevent greasiness in long-term storage. The best harvest dates for long-term storage were mid to late September.

Delayed cooling did not affect firmness or increase occurrence of disorders, but the five-day delay in cooling increased greasiness. Controlled atmosphere storage did not overcome the adverse effects of the five-day delay. Storage at a warmer temperature did not increase incidence of disorders, but substantially increased greasiness and loss of flavor. Decay was not affected by delayed cooling or by storage temperature. With all harvest dates and storage treatments, decay was unacceptably high indicating that a more stringent fungicide program may be needed with this variety.

Growers will be asked in a written survey the number of acres planted to this variety, how it is stored and amount of fruit loss to soft scald or other problems. Current production of this variety in Maine is approximately 100 acres or potentially 40,000 bushels. Since this is only 0.5% of total production, most of it is sold within a few months of harvest. As production increases, the need for long-term storage protocol will increase. This study identified when to

harvest Honeycrisp for long-term storage and a delayed cooling duration that does not impair fruit quality, but can potentially prevent soft scald.

Integration of Research and Extension Activities:

This was an applied research project designed to solve an apple industry problem. Honeycrisp has outstanding eating quality at harvest, but is prone to disorder that lead to losses for growers. Methods need to be developed that prevent disorders if Honeycrisp is to be grown on a large scale. Results were presented to 140 apple growers from Vermont and Maine, in winter 2004.

Outputs:**Publications:**

- Watkins, C.B., M. Erkin, J.F. Nock, K.A. Iungerman, and R.E. Moran. Harvest date effects on maturity, quality and storage disorders of 'Honeycrisp' apples. HortScience (in press).

MAC 42: Beef Backgrounding Trial

Principle Investigator(s): Dee Potter, Mark Hutchinson

Background:

In Maine's beef production system there are two basic enterprises; cow-calf operations and feedlots. In other parts of the country there is an intermediate phase of cattle production known as backgrounding. In a backgrounding operation weaned lightweight cattle (generally less than 500 pounds) are rotationally grazed. It is expected the cattle will gain from 100 to 300 pounds depending on incoming weights, forage quality, length of time on pasture and supplemental feeds. By eating forages the animals experience weight gain as they put on frame and muscle. In essence providing the background or preparation for going into the feedlot where they will be fattened for slaughter.

There are practical reasons why backgrounding operations make sense for Maine. There is a huge grass and forage base here that is vastly underutilized. The gist of a successful backgrounding operation is to put weight on the cattle through forages. The seasonality of backgrounding is also attractive to many farmers who do not want to keep cattle through the winter months. Retired dairy farmers for example have facilities and the land base to raise animals. There is also a short turn around time on the investment in the cattle. Availability of local feedlots adds positive potential for making the system work.

Research Description:

Goal:

- Evaluate the feasibility of beef backgrounding operations in Maine

Objectives:

- Monitor performance and weight gains of backgrounded cattle
- Evaluate the economic variables of a backgrounding operation
- Explore marketing options

Methodology:

The project will be conducted with 10 weaned steers, averaging 425 pounds each. The calves will be purchased in May and placed on pasture where they will be rotationally grazed. The steers will be weighed monthly to track rate of gain. The marketing strategy for the steers is to precondition them according to the Maine Beef Producers Association (MBPA) Feeder Cattle Sale standards and sell them in the fall sale. The following economic information will be recorded for the project; purchase price of steers, grazing fees, preconditioning and marketing costs, sale price received. Sensitivity analysis on the economic components will be conducted to help determine the feasibility of the enterprise.

Project Timeline:

- May 2003 – purchase 10 weaned steers averaging 425 pounds.
- May – October 2003 – rotationally graze cattle.
- October 2003 – market steers via MBPA fall feeder cattle sale.

The potential exists given a positive return on the backgrounding project for the profits to be rolled-over to fund the project for future years.

Project Benefits:

The performance and economic information gathered during this project will serve as a basis for prospective backgrounding operations. As backgrounding is done little in Maine, and to the extent they exist, there is no performance or economic documentation to support the practice this project will provide. There is also benefit to conducting the project on a farm and having the cooperation of a producer.

Projected Outcomes:

The results of the backgrounding project will be presented/ made available at the Annual Maine Beef Conference and Grazing/Pasture programs to be held in the fall of 2003 and spring of 2004. The results will also be submitted to the Journal of Extension for publication.

Industry Support:

Maine Beef Industry Council, Robert L. & Phyllis Johnston (see enclosed letter)

Objectives Met:

Monitor performance and weight gains of backgrounded cattle – Ten steers were weighed every six weeks during the trial which ran from May through October, 2004. The quantitative evaluation of performance is weight gain reported as average daily gain (ADG). For the group ADG was 1.3 pounds with a range of 0.8 pounds to 1.6 pounds. The breakdown of ADG for each weigh period showed the highest weight gains were from May through mid-July (1.96) and lower from mid-July through October (0.85). Qualitative evaluation of performance included health (two steers were treated for respiratory illness), disposition (the cattle required a transition period to acclimate to close human contact) and overall manageability (the cattle were easily trained to rotational grazing and handling).

Evaluate the economic variables of a backgrounding operation – Costs identified are: cattle purchase, trucking, pasture, medication, preconditioning (sale vaccination requirements) and marketing. The largest expense was the purchase of the cattle, followed by trucking and marketing, which primarily was sale commission and yardage. Gross receipts were ,020.84. There was a positive return of ,121.92 for the group with an average of 2.19 per head. The range was -5.57 to 9.26.

Explore marketing options – The steers were marketed through the Maine Beef Producers Association fall feeder cattle sale. This is a cooperative marketing event. The choice to market the cattle through the sale was based on the close proximity of the farm to the sale location. Also, given the small number of animals, selling power was increased by taking advantage of the cooperative marketing opportunity. A larger group of animals would have made exploring other marketing avenues more practical and applicable.

All of the objectives were met for the trial. The on-farm based trial ran from May 21 through October 13, 2004. The ten steers were purchased from a larger group which was brought in to southern Maine from Virginia several weeks earlier. The steers were weighed four times at six week intervals and were rotationally grazed over a 3.5 acre area. The economic data collected was from the figures provided by the cooperating producer. Issues and practical considerations for backgrounding were also identified and have been reported in presentations and publications on the trial.

In recent years there have been a number of inquiries on ways to either diversify farming operations or utilize exiting resources such as pasture ground and facilities. Backgrounding is one segment of the cattle industry that has potential but is rarely seen in the northeast. Before a new enterprise can be promoted, trials need to be conducted to help identify its feasibility, economics and challenges. The target audience for the trial is producers in Maine who are considering a backgrounding enterprise. While the group of animals in the trial was small, there was a range of both performance and economic outcomes which would be expected with larger numbers of animals. The intention is to continue monitoring backgrounding operations and collect data. The results of this trial along with others will be the basis for a fact sheet and enterprise budgets for beef backgrounding in the region.

Outputs:**Presentations:**

- First Annual Maine Grass Farmers Network Grazing Conference
- October 27, 2004 New Gloucester, Maine
- 64th Annual Agricultural Trades Show – Maine Beef Producers Annual Meeting
- January 12, 2005 Augusta, Maine
- Scheduled: March 8, 2005 Houlton Agricultural Series
- March 14, 2005 Winter School Series, Frenchville, ME

Publications:

- Spudlines December 2004

MAC 43: Initial Evaluation of A Hybrid – Mulch System for Tomato Production

Principle Investigator(s): Mark G. Hutton, Eric Gallandt, Chris Reberg-Horton

Background:

It is critical that we reconsider the intensive tillage used in our current cropping systems. In addition to a high level of fuel consumption, tillage encourages oxidation of soil organic matter and overall deterioration of soil quality. Ironically, as farmers work to reduce their reliance on herbicides, the frequency and intensity of tillage often increases. No-till has proven benefits in the capacity to improve soil quality, and reduce soil erosion while generally improving the economic efficiency of the producer. In agronomic zones with relatively few growing degree-days, however, the surface residues in no-till systems result in cool spring soil, poor emergence, and generally unacceptable yields. The "hybrid-mulch" system described by Louis Lego (NE SARE Farmer Grant FNE 00-309; Louis Lego, Elderberry Pond Country Foods) offers a solution to the soil temperature problem by exploiting the thermal properties of black plastic-covered beds. Although tillage is not eliminated in this system, it is less frequent occurring perhaps only in one of three-four years. Furthermore, the living mulch between the rows of plastic reduces weed growth, adds organic matter, and generally improves soil health.

Research Description:

Two production systems will be compared in this experiment: hybrid-mulched annual beds and conventional spring-made beds. The hybrid mulch beds are raised plastic mulched beds that were formed in the fall of 2002; a cover crop of winter rye was established between the beds. The cover crop will be managed by mowing and thereby, manage weed competition, prolong the life of the plastic mulch by partially covering the plastic with plant residue. The conventional spring made beds will be made in late May of 2003. In early June of 2003, tomato transplants will be set into all of the raised beds at 18" row spacing. The tomatoes will be trellised using the basket weave system and grown using recommended cultural practices. The center plants from each plot will be harvest bi-weekly as fruit mature. Fruit number, weight and quality will be evaluated.

Projected Outcomes:

Results of these vegetable variety trials will be analyzed and summarized for presentation to growers at meeting such as the Maine Vegetable and Small Fruit Growers Association Meeting and the New England Vegetable and Berry Growers Winter Meeting. The results will also be presented in the statewide Extension Vegetable Newsletter and posted on the UMCE Pest Management web site. Growers and Master Gardeners will have the opportunity to view the experiments first-hand and discuss the varieties during the summer field day.

Methods Used to Evaluate Outcomes:

This project produced several important findings and a data set that made it possible to secure additional funding from Northeast SARE to look at this production practice in more detail. Our initial findings indicated that the herbicide applied to control the inter-row cover crop had a greater effect in suppressing weed competition. This in large part was believed to be the result of the fact that the cover crop was very tall (> 1 m) at the time of herbicide application and when it died it remained standing and densely shaded the ground controlling weed germination and growth. Additionally, the mowed cover crop was not growing as thickly as hoped and when mowed did not provide sufficient straw to create a thick organic mulch between the beds.

Tomato yields between the three treatments were not statistically different though the conventional spring made beds had the greatest and earliest yield. The yield from the herbicide treated plots was the lowest of the three treatments and the latest to mature. The delay in maturity and low yields are thought to be the result of the standing inter-row cover crop residue shading the tomatoes and plastic mulch slowing early season growth. However, fruit quality from the herbicide treated plots was superior to the conventional spring made plots and the mowed inter-row mulch. This is believed to also be a result of the standing cover crop residue.

The results of this initial experiment were promising and lead to several refinements in the experimental design. A SARE Research and Education grant was applied for and obtained (LNE 04-203, 131,302 dollars) based on this MAC project.

MAC 44: Evaluation of White Inter-row Mulch for Increasing Yields of Bell Pepper

Principle Investigator(s): Mark G. Hutton, David T. Handley, James F. Dill,

Background:

Peppers are a high value vegetable crop for Maine farmers, but are difficult to grow under our growing conditions. Techniques are needed to enhance pepper maturity and yield to make this a more viable and profitable crop for Maine growers. Maine vegetable growers face several difficult challenges to economically viable pepper production, not least of which, is Maine's short growing season. The use of black plastic mulch and raised beds is a common practice utilized to increase earliness and yield of many vegetable crops. Plastic mulch has the additional benefits of reducing weed competition, reducing irrigation frequency, and decreasing fertilizer leaching and runoff. Recent studies, at the University of New Hampshire (Ouellette and Loy, 2000), have shown that white plastic mulch placed between black plastic covered raised beds of tomatoes increase yields 28 to 36%. Research at the Pennsylvania State University (Orzolek, personal communication) has shown increased yields of bell pepper when grown on raised beds covered with reflective silver mulch. Reflective mulches, including silver mulch, reflect sunlight back into the plant canopy increasing the potential amount of photosynthesis. However, reflective mulches also reduce soil temperature. This is an undesirable side effect of covering planting beds in Maine's already cool soils. We propose to test the effect of white inter-row mulch on the yield and earliness of bell pepper

Research Description:

Earliness, fruit quality and total yield of transplanted bell pepper (cv. Aristotle) will be compared between high-density plots and standard density plots with and without white inter-row mulch. The experiment will be conducted in a split-plot design with inter-row mulch as the main treatment and plant density as the sub-treatment. All plants will be grown in double rows on raised black plastic covered beds. Plots receiving the inter-row mulch treatment will have the alley between planting beds covered with white plastic mulch. In the check plots the alleys will remain bare soil. Standard density plots (= 9,680 plants/acre) will be achieved by planting at the recommended in-row spacing of 18". High-density plantings (14,520 plants/acre) will be at 12" within row spacing. The center plants from each plot will be harvested bi-weekly as fruit mature. Fruit number, weight and quality will be evaluated. Plant growth rate and health will be monitored through the growing season.

Projected Outcomes:

Results of these vegetable variety trials will be statistically analyzed and summarized for presentation to growers at meetings such as the Maine Vegetable and Small Fruit Growers Association Meeting and the New England Vegetable and Berry Growers Winter Meeting. The results will also be presented in the statewide Extension Vegetable Newsletter and posted on the UMCE Pest Management web site. Growers and Master Gardeners will have the opportunity to view the experiments first-hand and discuss the varieties during the summer field day.

Methods Used to Evaluate Outcomes:

Plant growth was very good during the 2003, growing season. However, there were large variations in temperature and rainfall during the summer that drastically affected pepper yields. There were only three harvests made during the 2003, growing season: August 26, September 10, and September 25.

The peppers grown on black plastic without inter-row mulch produced the lowest total number of fruit averaging just over one marketable fruit per plant and lowest average weight of fruit per plot (Table 1.). The white inter-row mulch treatment increased the average yield of peppers by 32% over peppers grown on black plastic alone. This increase in yield was equivalent to the yield increase of high-density tomatoes (12" spacing) grown with white inter-row mulch over tomatoes at conventional spacing (18") grown on black plastic mulch (Ouellette and Loy, 2000). The pepper plots grown on the reflective mulch produced the greatest number of fruit per plot. The total yields of peppers harvested from the reflective mulch treated plots was significantly greater than the yield of peppers from the black plastic mulched check treatment. The reflective mulch treatment increased pepper yields by 97% over black plastic mulch alone, and 49% over black plastic with white inter-row mulch treatment.

MAC 45: Evaluating the Amino Sugar N Test for Preventing Overfertilization

Principle Investigator(s): Chris Reberg-Horton, Rick Kersbergen, Mark Hutton, Bruce Hoskins

Background:

Nitrogen overfertilization continues to be a problem for the dairy industry in Maine and for all farmers utilizing organic nitrogen sources. Presidedress soil nitrate testing (PSNT) is the recommended practice to prevent N overfertilization in many states and is listed as an encouraged practice in nutrient management plans for Maine dairy and livestock farmers. Unfortunately, most farmers have not adopted the test. The main reason for low adoption is the inconvenience of having to sample during the middle of the growing season. PSNT testing has not proven as reliable as hoped for either. The test is extremely sensitive to rainfall events, sampling depth, and crop developmental stage. What is needed is a more convenient soil N test that is a better predictor of N availability from organic amendments.

A new soil nitrogen test has been developed at the University of Illinois that could dramatically reduce nitrogen overfertilization (Khan et al. 2001; Mulvaney et al. 2001). The amino sugar N test is based on a new method for fractionating the soil organic nitrogen pool. Finding the fraction of this pool that can be expected to become plant available in the near future has long been a goal of soil scientists. Quantifying amino sugars appears to be the key and may revolutionize how nitrogen recommendations are made. The amino sugar pool was found to be a better predictor of crop responsiveness to N fertilization than total hydrolyzable N, $\text{NH}_4\text{-N}$, amino acid N, preplant nitrate testing (PPNT), or presidedress soil N (PSNT) (Mulvaney et al. 2001). Soils with an amino sugar N concentration over 230 mg N kg⁻¹ did not need to receive additional nitrogen inputs.

Research Description:

- Evaluate the amino sugar nitrogen test to assess its suitability to Maine by comparing it to the PSNT as a management tool for separating N-responsive from non-responsive sites.
- Recalibrate current nitrogen recommendations, based on the amino-sugar N test.
- To have 40 Maine farms utilize this test in determining N and manure applications for their crops in 2004.

Project Description

This project seeks to evaluate the amino sugar N test for Maine's soil types and growing conditions. On-farm trials of the test will be conducted on silage corn fields that regularly receive manure. A total of 30 sites will be selected with about half being predicted to be nonresponsive to N fertilization and half responsive. Sites which have a history of heavy manuring or compost additions are often nonresponsive to additional nitrogen. Soil samples will be taken before corn planting to run the amino sugar test. Two treatments will then be applied, with 3 replicates at each site. Treatments will consist of an application of manure or compost at planting versus no additional input. Soil sampling for the PSNT test will be taken at the normally recommended time, when corn reaches 8 to 12 inches in height.

Two methods for assessing whether a plot was overfertilized will be used. Measuring yield on fertilized and unfertilized experimental plots is the accepted method for determining whether the fertilizer was needed. Another method is to conduct a nitrogen test on the cornstalks at the end of the season (stalk nitrate test). Nitrogen values above 2000 ppm indicate overfertilization occurred (Varvel et al. 1997). While this approach is less accurate, it is more practical for farmers wanting to evaluate their practices on a routine basis. Both measures will be employed to judge how predictive the amino sugar and PSNT tests are. Potato farms that utilize manure in rotations will also participate to validate the accuracy of the amino sugar test for potatoes. If the amino sugar test proves as reliable as it has in other states, the Maine Soil Testing Laboratory can routinely offer and interpret this test for growers. A recommendation of no additional N will be made for soils testing higher than the threshold we establish.

Projected Outcomes:

Outreach to farmers will be based on fully integrating growers into the trials so that they participate in executing the research and interpreting its results. Not only will this give them a deeper understanding of the implications of the research, it will make them excellent spokespersons on behalf of the project. A tour of several participating farms will be organized as part of the Maine Sustainable Agriculture Society's annual tour and as part of the soil health

workshops being organized by Cooperative Extension and NRCS in July 2003. Results will also be disseminated during grower meetings this winter by the four extension faculty cooperating on the project. The following meetings will be utilized: Maine Agricultural Trade Show 2004, Maine Farm days 2003-2004, Maine Dairy Seminar 2004, and the Regional CCA recertification meetings 2004. Fact sheets will be developed for producers to learn how to utilize this test. A report will be produced for MAC distribution.

Industry Support:

Evidence of support from the agricultural industry can be seen by the number of growers who have already signed up to participate if we receive funding. Farmers participating so far include: Jim Hilton, Glenn Dickey, John Dorman, Piper Farm, Richard Varnum, Carl Smith, Adrian Wadsworth, Steve Morrison, Terry Thomas, Walter Fletcher, Richard Perkins, and Jeff & Penny Stevens.

- Mulvaney, R.L., S.A. Khan, R.G. Hoef, and H.M. Brown. 2001. A soil organic nitrogen fraction that reduces the need for nitrogen fertilization. *Soil Sci. Soc. Am. J.* 65: 1164-1172.
- Khan, S. A., R.L. Mulvaney, and R.G. Hoef. 2001. A simple soil test for detecting sites that are nonresponsive to nitrogen fertilization. *Soil Sci. Soc. Am. J.* 65: 1751-1760.
- Varvel, G. E., Schepers, J. S., and Francis, D. D. 1997. Chlorophyll meter readings and stalk nitrate as complementary nitrogen indices for residual nitrogen. *Journal of Production Agriculture*. 10:147-151.

Objectives Met:

1. Evaluate the amino sugar nitrogen test to assess its suitability to Maine by comparing it to the PSNT as a management tool for separating N-responsive from non-responsive sites.

Despite the hype by other researchers, the amino sugar tests did not work on Maine's soils. Maine soils had extremely high levels of amino sugar N, higher than any other state tested so far. Most of our samples were above the 250 mg kg⁻¹ cutoff which should indicate no additional nitrogen is needed for silage corn. Many of these sites, however, did respond to nitrogen. The graph below demonstrates what little correlation we saw between the test and yield responses to N. Our results concur with tests performed in Connecticut and Pennsylvania. Further research is needed to determine why the test is ineffective in the Northeast and whether adjustments can be made to adapt the test to our soils.

Objectives Not Met:

2. Recalibrate current nitrogen recommendations, based on the amino-sugar N test.
3. To have 40 Maine farms utilize this test in determining N and manure applications for their crops in 2004.

While these objectives were not met due to the ineffectiveness of the test, extension around the project was highly successful at educating farmers about the difficulties of making nitrogen recommendations. The project also highlighted how presidedress nitrate testing (PSNT) can be used effectively if careful consideration of the weather is made. At several lectures on nutrient management, participants in the project discussed the transitory nature of nitrogen and how the amino sugar test, the presidedress nitrate, the preplant nitrate, and total nitrogen measured different aspects of the nitrogen cycle. By discussing the differences between the tests, we were also able to highlight key times in the cropping cycle when nitrogen contamination of water sources were most likely to occur. Lectures about the amino sugar test and the multiple methods of nitrogen testing were made at:

- "Nitrogen Management and Nitrogen Testing for Organic Farmers" Farmer to Farmer conference, Bar Harbor, November 1st, 2003.
- "Comparison of Nitrogen Testing Methods and the Impact of Weather" Agricultural Trade Show January 13 & 14th 2004. Two sessions were offered for farmers and consultants certified to write nutrient management plans.
- "The Amino Sugar N Test—An Alternative to N Crediting Systems?" Nutrient Management Training workshop organized by the Natural Resource Conservation Service, Orono, March 4, 2004

MAC 46: Improving Winter Survival of Blackberries in Maine with Trellis Systems.

Principle Investigator(s): David Handley, James F. Dill, Fumiomi Takeda

Background:

Blackberries and related hybrids (Boysenberries, Loganberries, etc.) are not commercially grown in Maine due primarily to poor winter survival and the short growing season. However, the demand for specialty fruit such as these is very high and could command profitable prices at Maine's farm markets for both fresh and processed products. Hence, interest in growing blackberries is high among small and part-time farmers looking for crops with a market niche and the potential for high returns on investment. It may be possible to overcome the lack of hardiness in some blackberry varieties with relatively minimal winter protection, but as yet no economically viable methods have been developed. Recent research in trellis technology at the USDA-ARS in West Virginia may provide a practical technique for growing and protecting blackberries through severe winter conditions. A "swing" trellis originally designed to ease mechanical harvest of blackberries may have application for providing winter protection as well. The trellis is designed such that the plants can be grown in an upright position during the vegetative phase of their growth. During the fruiting phase, the arms of the trellis can be rotated or swung to angle the canes into a position that makes the fruit easily accessible for harvesting. The ability to reposition the canes with relatively little effort could also be used to lower the canes in the fall so that exposure to winter conditions would be reduced, and much of the planting would be protected by snow. Repositioning the canes would also make applying a protective cover over the plants much more practical as their height would be reduced from about eight feet to about two feet. This technology is relatively simple to construct and operate. Although somewhat more costly than conventional trellis, it may provide a practical, economical means to grow blackberries and other winter-tender cane and vine crops under Maine growing conditions and thus open new markets for these high value fruit.

Research Description:

Four varieties of blackberries will be planted under two trellis systems, a conventional "I" trellis, and the swing-arm trellis at Highmoor Farm, the Maine Agricultural Experiment Station in Monmouth, at Highmoor Farm, the Maine Agricultural Experiment Station in Monmouth. Part of the planting will be covered with protective fabric during the winter for additional protection and part will be left uncovered. Plants will be evaluated for establishment, vigor, winter survival, yield, and fruit quality over four seasons. Plots will be harvested from the 2004 through the 2006 seasons.

Projected Outcomes:

Results of this study will be presented to growers through presentations at meetings, including the Maine Vegetable and Small Fruit Growers Annual Meeting, the New England Vegetable & Berry Growers Winter Meetings and the North American Bramble Growers Association Meeting. The results will also be presented in the statewide Extension Vegetable & Berry Newsletter, and other New England Extension newsletters. The results will also be posted on the UMCE Pest Management web site. Growers and Master Gardeners will have an opportunity to view the experiment first-hand and discuss the treatments during field days to be held at Highmoor Farm during the 2004 through 2006 at Highmoor Farm, the Maine Agricultural Experiment Station in Monmouth, growing seasons. Results will be presented to agricultural research and extension staff at scientific meetings including the American Society for Horticultural Science.

Methods Used to Evaluate Outcomes:

Four varieties of blackberries were planted at Highmoor Farm, the Maine Agricultural Experiment Station in Monmouth, in June 2003. These plants were started from tissue-cultured plants grown in pots during the 2002 season. Plants were spaced six feet apart in rows 12 feet apart. Each plot consisted of four plants. Plants were fertilized according to regional recommendations and allowed to grow along the ground. In November all plants were covered with straw mulch for winter protection. Trellis parts were obtained to establish the trellising treatments in the spring of 2004.

The winter of 2003-2004 was exceptional hard on many perennial plants in Maine. Extended periods of extreme cold and wind, combined with very little snow cover resulted in significant injury and death of many of the plants included

in this study. When growth started in the spring of 2004, it was estimated that more than 60% of the plants were either dead or had significant winter injury. Therefore it was determined that the trial should be re-planted in 2005 to eliminate the confounding aftereffects this injury would place upon the study. The site has been planted to cover crops, and new plants will soon be ordered to re-establish this trial.

In addition to funding from the Maine Agricultural Center, the Maine Vegetable and Small Fruit Growers Association and the New England Vegetable and Berry Growers association contributed funding to support this research in 2003 and 2004.

MAC 47: Determining Consumer Preferences for Sweet Corn Phenotypes to Enhance Marketability in Maine

Principle Investigator(s): David Handley, Mark Hutton

Background:

Sweet corn is among the most important commercial fresh vegetable crops grown in Maine. However, it is a challenge for most farmers to market this crop profitably. While its popularity makes it a nearly essential item in the farm market, its high requirements for acreage, nutrients and pesticides create a significant drain on farm resources that is difficult to recover under current competitive pricing. Testing consumer preferences regarding the many types of sweet corn that are presently available can better focus marketing of this crop and may point out presently under exploited market niches. This, in turn, could allow farmers to raise prices to a more profitable and sustainable level while increasing both their corn market and sales of other crops often tied to fresh sweet corn sales. Among the most obvious differences to consumers regarding sweet corn varieties is color. Most fresh sweet corn currently sold in Maine is the bicolor (yellow and white) type. This is based on a consumer preference that developed for a variety ("Butter & Sugar") that has not been widely grown for over 20 years. Prior to that development, yellow corn was generally preferred in most of the state, along with white corn in the southern part of the state. The latter was based on the variety "Silver Queen" that requires too long a growing season to be used in much of Maine. Adding to the spectrum in recent years is the introduction of several varieties of red-colored sweet corn. Color plays a very important role in consumer acceptance of product, and modifying product color is often used to enhance sales. Sensory analysis of the different corn color types now available and adapted to Maine growing conditions could point to under-exploited consumer interest in the variety of corn available and open new market niches for this crop.

Research Description:

Two varieties of each of four color phenotypes (yellow, white, bicolor, red), all homozygous sugar-enhanced, will be planted at Highmoor Farm, the Maine Agricultural Experiment Station in Monmouth, and grown according to regional recommendations. At the appropriate stage of maturity, samples of each color type will be harvested and immediately transported to the Food Science Center on the University of Maine campus for sensory analysis. Each color type will be tested for consumer preferences in both visual and "blind" tests to determine how great the role of color is in developing a preference. Data from the tests will be used to suggest test markets for preferred color types to growers to develop or expand marketing niches. Growers will be able to observe and test their own preferences for the color types at a field day planned at Highmoor Farm, where samples will be available and information on sensory analysis and consumer acceptance testing. Sensory analysis data from the trial will be statistically analyzed and summarized for publication.

Projected Outcomes:

Results of this study will be presented to growers through presentations at meetings, including the Maine Vegetable and Small Fruit Growers Annual Meeting and the New England Vegetable & Berry Growers Winter Meetings. The results will also be presented in the statewide Extension vegetable newsletter, and other New England Extension newsletters. The results will also be posted on the UMCE Pest Management web site. Growers and Master Gardeners will have an opportunity to view the experiment first-hand and discuss the treatments during one of the two field day to be held at Highmoor Farm during the 2003 growing season. Results will be presented to agricultural research and extension staff at scientific meetings including the American Society for Horticultural Science.

Methods Used to Evaluate Outcomes:

Four varieties of sweet corn, all homozygous sugar-enhanced, representing four color types now available (yellow, white, bicolor, red), were planted at Highmoor Farm, the Maine Agricultural Experiment Station in Monmouth, on 11 June, 2003 and grown according to regional recommendations. Samples of each variety/phenotype were harvested on 5 September and immediately transported to the Food Science Center on the University of Maine in Orono for sensory analysis. Each color type was tested to determine how color might influence consumer preference.

Forty-two subjects aged 18 years or older who purchase and consume corn on the cob from local farm stands were recruited from the University of Maine community via flyers and First class notices. Subjects were asked to read an

informed consent form before evaluating samples. Participation in the test was assumed to provide consent, and subjects who had allergies to corn were not allowed to participate in the study.

Corn ears were microwaved in batches then husked to provide freshly-cooked corn. Each ear was cut into 2-inch wide sections, and ends of ears were discarded. Cut corn was held in covered pans in a warm oven to maintain temperature. Each panelist received one piece of each type of corn. Each type was labeled with a 3-digit code and all four types were served at the same time with a glass of spring water for palate cleansing. The Food Neophobia Scale (Pliner & Hobden, 1992) was used to determine whether persons with low food neophobia scores are more likely to find red corn acceptable. Data from the surveys were analyzed by analysis of variance and Fisher's LSD test, with a significance level of 0.05.

It should be noted that during the cooking process the red corn loses much of its color, fading to a purpler tint with a yellow background. Microwave cooking affected color less than steaming or boiling, and was thus the method chosen for all varieties in this test. Most of the 42 persons who participated in the test were female, with ages ranging from 20-59 years. Sixteen persons said that they eat corn purchased from farm stands six or more times per year. Eight persons, generally younger ones, ate farm stand corn one or less times per year. Only two persons had Food Neophobia Scale (FNS) scores that would classify them as food neophobic (>40). Twenty-five persons had low scores indicating that they liked to try new foods. This finding is not unexpected since we recruited people willing to try new types of corn.

The bicolor corn received the highest ratings in all categories except texture. All corn types received mean scores of 7 (like moderately) or higher, but the white corn was liked significantly less than the yellow and bicolor corn (Table 1). The white corn color was liked least overall, and the red corn color was liked less than that of the bicolor. Sweetness acceptability was similar among types except that red sweetness was liked less than that for bicolor. Responses to the question "Now, please compare this sample to the corn that you typically purchase at farm stands. Is this corn: Less Sweet, As Sweet or Sweeter?" varied (Table 2). Red corn was the only type to have a large number of "less sweet" ratings. Texture acceptability ranged 6.7-7.4 and no statistical differences were observed.

Since only two persons had FNS scores over 40, we grouped those individuals together with persons having average scores. When we compared the hedonic scores based on FNS classification, persons with food neophilic scores gave significantly higher rating to the red corn for overall, color, sweetness and texture acceptability, but no differences were found for the other types of corn.

These results suggest that there is an opportunity for marketing new colors of sweet corn, such as the red varieties now available, to persons who like to try new foods. While white corn looked less promising in this study, color did influence consumers enough to positively influence their preferences. This may indicate that providing new colors of corn could increase demand at local markets, and/or command higher prices than standard varieties.

Outputs:

Results of this study will be presented to growers through presentations at meetings, including the Maine Vegetable and Small Fruit Growers Annual Meeting and the New England Vegetable & Berry Growers Winter Meetings (2004-2005). The results will also be presented in the statewide Extension vegetable newsletter, and other New England Extension newsletters. Growers and Master Gardeners were able to view the experiment first-hand and discuss the treatments during two field days held at Highmoor Farm during the 2003 growing season. Results will also be presented to agricultural research and extension staff at the American Society for Horticultural Science in 2005. In addition to support for the Maine Agricultural Center, the Maine Vegetable and Small Fruit Growers Association and the New England Vegetable and Berry Growers association contributed funding to support this research.

MAC 48: Women's Agricultural Network (WAgN) -- Our Stories

Principle Investigator(s): Vivianne Holmes

Background:

As the number of women and other underserved farmers in Maine continues to increase, these farmers need access to the necessary tools and knowledge to make effective business decisions and develop successful agricultural enterprises. WAgN is a well-developed, innovative educational network connecting underserved farmers with resources to meet their educational needs. Its mission statement is: The Maine Women's Agricultural Network enables women and other underserved people to successfully own, operate and support agricultural-related enterprises.

Over the past five years, the Maine Women's Agricultural Network (WAgN) has served to connect over 700 farmers all over the state -- primarily women who are either potential or active farmers. Its basis has been informal with no conventional "organization" that would require officers or other volunteer roles.

This fall and winter, a Strategy Advisory Group, including women farmers and representatives from supporting agricultural agencies and UMCE, explored ideas that take into consideration geographical and financial challenges, as well as WAgN's mission. They determined that it is time to create a new generation of the organization that maintains the philosophy that all members are equally responsible for its success. In keeping with this philosophy, they offered WAgN's friends and members a proposal for consideration and comment—a proposal that they accept, affirm, and are committed to support.

Affirmed was the WAgN Mission Statement. Also, the proposed actions for financial sustainability were supported, such as, membership dues, annual giving, corporate sponsors, service fees, and applications to new grant sources.

One of the challenges the Network faces in upholding its mission is Maine's size and unique geography. In trying to address this issue, yearly multi-day farm tours have been held in different parts of the state, allowing for greater accessibility. On-farm network meetings have also been held in different areas of the state in an effort to accommodate as many people as possible (there are nearly 1000 people on WAgN's mailing list). However, these measures haven't always been enough to include everyone in attending and truly feeling a part of WAgN. It has been difficult, if not impossible, for any given member to attend meetings regularly.

Therefore, a structural change will be implemented. To expand the model of a decentralized structure, WAgN will develop regional and affinity groups around the state with a Leadership Council acting as a hub for these groups. By restructuring in this way, meetings are more accessible to more members, it boosts participation and outreach, and WAgN can better utilize USDA Agricultural Service Centers and University of Maine Cooperative Extension's offices infrastructures.

WAgN will develop 5 regional groups determined by geographic and demographic areas. As part of, or in lieu of, a regional group, members may wish to form an affinity group relating to their special interests. Presently, Aroostook County has a regional group and there is one affinity group in western Maine.

Not only does the organizational change proposed above address the survival and functions of the Network, but it also addresses other issues impacting all women in farming in Maine. Although all farmers face similar obstacles, women face additional barriers because they are generally considered atypical in the farming industry. In general, women farmers:

- Engage in more non-traditional agricultural endeavors
- Do not participate in the traditional educational opportunities
- Feel isolated and do not have the necessary networks in place to ask for help
- Seem to be invisible to funders, bankers, policy makers and politicians, and the general public
- Are not aware of available agricultural programs and/or not have access to them
- Have a greater need for small-scale loans which traditional lending sources are not currently equipped to provide

- Are left out of information loops that lead to federal, state, and local assistance
- Have very limited involvement in agricultural policy-setting organizations
- Have a limited understanding of agricultural policy.

Women are a minority occupying various roles and running diverse and innovative enterprises in agriculture today. They range from full-time farmers to passionate gardeners to girls and young women dreaming of owning their own farm. They are single, married, divorced, or lesbian. Each woman has her own fascinating, unique story of how she became involved in agriculture and what she is currently doing in the field.

These stories need to be told—often and everywhere! Women in farming should be visible, honored, and acknowledged . . . and telling their stories will help breakdown the barriers.

Research Description:

- Form a trained leadership and interview team to document the women in farming across the state.
- Create a profile portfolio of 'Our Stories' of women in farming and archive with Maine Folklife Center at the University of Maine.
- Inform, educate and share 'Our Stories' and the data with policy makers, the general public, other farmers, agency personnel and politicians.
- Strengthen the Women's Agricultural Network in Maine by providing accessible on-farm network meeting opportunities and increase the number of women attending.
- Collect and collate census-type data that corroborates and identifies the growing number of women in farming in Maine. The Our Stories Project will benefit underserved, non-traditional farmers by providing networking opportunities, educational and leadership training. It will benefit the organizations, agencies, and policy makers who serve this clientele to make more informed and supportive decisions of women farmers, as well as provide appropriate educational opportunities. The project will employ: a qualitative research study to capture the stories of women in farming; the WAgN educational model of an on-farm network meeting that brings women in farming together to share their stories, network, and learn from each other; and an outreach and sharing of the stories and data with educational partners, sponsors, policy makers, researchers and the women farmers themselves.

The importance of telling our stories and documenting women's lives and work provides value for:

- Individuals— by validating, sharing, and promoting their lives and work
- Partners— by creating educational opportunities
- Sponsors— by documenting examples and models for evaluation and celebrating successes
- Policy makers —by providing visual, audio, and printed testimonies to inform future policy-making
- Researchers— by adding qualitative documentation to quantitative evidence
- WAgN— by validating the power of networking

Understanding how essential reflective storytelling is to a learning process, the project enhances learning through the use of on-farm network meetings. The format of these meetings begins with a sharing circle incorporating introductions and brief farming backgrounds, the host farmer sharing her story in more detail, networking continues over lunch, and then the host farmer conducts a farm tour and/or an educational workshop takes place.

A core group of leadership women (temporary employees) will be mentored and trained in the formation and support of 5 regional or affinity groups. These groups will be strategically located throughout Maine. Training and hands-on experiences will familiarize the Leaders with the on-farm network meeting format. Training may include: pre-meeting organization, media coverage of meetings and news release creation, program coordination, meeting facilitation, etc. Leaders will conduct at least 3 network on-farm meetings during the year of the grant. Expectation is that Leaders continue to voluntarily lead meetings for at least one year after project completion, or they train another person (volunteer) to do so.

A Coordinator will help train, support, and supervise the Leaders and have the same responsibilities as above. The Coordinator will have a mentored on-farm network meeting with the Principal Investigator (PI). The Coordinator will then conduct one mentored on-farm network meeting with each Leader in their region. These mentored meetings

will allow the Coordinator and Leaders to practice their skills while having an experienced WAgN member present for their first meeting. The Coordinator will work closely with the PI in designing trainings and supporting the Leaders. The PI will supervise and train the Coordinator.

The PI will convene a research advisory team to design methodology, protocol, and participant selection criteria. Pauleena MacDougall, Associate Director, Maine Folklife Center at the University of Maine, will provide training on how to interview and capture the stories and will archive the project's findings. Judy Graham, Human Development Specialist, UMCE, will provide technical expertise in qualitative research. The portfolio may consist of census-type data and the visual and audio stories that are collected. Leaders and the Coordinator will be trained and then conduct a phone survey of members in their region to gather census-type data. They will audio tape and take photographs to document each event held. They will suggest to the PI which women should be profiled in depth.

Projected Outcomes:

- Expanded knowledge of women in farming by sharing model and project findings with the small farm educators, researchers, and service providers
- Increased accessibility to meetings and in an individual's ability to attend more than one meeting
- Trained leadership core is created that works to perpetuate itself
- Policy makers, the general public, other farmers, agency personnel, politicians, etc. are better informed about women in farming in Maine resulting in more effective programs and policies in support of women in agriculture
- WAgN program gains allies, collaborators, and additional resources that support its mission

Method of Sharing Outcomes

The portfolio may include written media releases, reproducible images (digital, photo and slide) and visual and/or audio stories. The PI will have final responsibility in compiling and disseminating census-type data, the stories and the impacts. Results of the research will be shared with MAC, as well as submitted to the Journal of Extension and other appropriate parties. The Maine Folklife Center at the University of Maine will archive the stories in the Northeast Archives of Folklore and Oral History.

Industry Support:

See attached letters of support

Objectives Met:

1. Form a trained leadership and interview team to document the women in farming across the state.
2. Create a profile portfolio of 'Our Stories' of women in farming and archive with Maine Folklife Center at the University of Maine.
3. Inform, educate and share 'Our Stories' and the data with policy makers, the general public, other farmers, agency personnel and politicians.
4. Strengthen the Women's Agricultural Network in Maine by providing accessible on-farm network meeting opportunities and increase the number of women attending.
5. Collect and collate census-type data that corroborates and identifies the growing number of women farming in Maine.

The 'Our Stories' project has benefited over a 1000 underserved, non-traditional farmers by providing networking opportunities, educational and leadership training. It has benefited the organizations, agencies, and policy makers who serve this clientele so that they can make more informed and supportive decisions with women farmers and provide appropriate educational opportunities. The project employed the WAgN educational model of on-farm network meetings that brings women in farming together to share their stories, network, and learn from each other, and, an outreach and sharing of the stories and data with educational partners, sponsors, policy makers, researchers and the women farmers themselves.

We have accomplished the following with the support of the grant either directly or indirectly. One of the main impacts of this project was the multiplier effect of the hiring the consultants. We reached more people statewide and

nationwide and have been more creative and effective with outreach and education. Also, by having enthusiastic and energetic consultants meant we could do more in-depth outreach than would have happened with only one person holding the program together. Here are examples of the many things we accomplished in the last 1½ years with the 5000 dollars from the MAC grant:

1. Hired 4 consultants, trained and supervised - 3 women to organize network meetings across the state and 1 woman to create a Membership Directory.
2. Produced a Member-to-Member Directory. 80 women wanted to be listed.
3. Conducted 10 network meetings. Over 150 people attended.
4. Had an additional 12 meetings and staffed informational displays at both MOFGA Fair and AG Trade Show in 2004 and 2005. These events are key to our outreach and membership drive activities. Over 180 people attended.
5. Presentations on WAgN and/or WAW were made for University of Maine Page Museum (with TV coverage) and UMaine's Women in Curriculum Lunch Talks (with UM taping). Over 50 people attended.
6. Major press coverage, local, state and national.
7. Maine WAgN/Vivianne Holmes is on planning committee for Women in Sustainable Agriculture National Conference in Burlington, VT for 2005.
8. WAgN sponsored a Farmland Protection workshop. 13 people attended.
9. Collaboration with Time & Tide RC&D for transition of WAgN's operational home continues to grow.
10. Conducted a 3-day, experiential on-farm weekend for women for beginner and established farmers. Over 50 people attended.
11. WAgN is a member of AgCOM (Agricultural Council of Maine) and a WAgN representative has attended meetings to share who are, what we do and be a voice for women farmers.
12. Created an effective and updated website. We have increased our hits from 200 to over 1700/month.
13. Published 12 newsletters. Circulation 1200.
14. Supported the revival of Monmouth Grows, a grassroots farmer community action group.
15. Attended numerous events and shared information about WAgN, such as, Soul of Agriculture, the Blaine House Conference and a small business development group in the L/A area. Numerous contacts.
16. Maine and Vermont WAgN directors met with interested women in Pennsylvania and helped them start their own PA WAgN, now successfully established.
17. WAgN member and myself attended and shared our stories of Maine WAgN at a Risk Management National Women in Agriculture Conference in Kansas that was for extension staff.
18. WAgN establish memorandum of agreement with Maine Centers for Women, Work and Community (UMA) for them to provide WAgN outreach in Aroostook County.
19. We have begun collecting 'Our Stories', creating a relationship with UM Folklife Center staff and are exploring a relationship with a UM grad student to do interviews with women farmers at the 2005 MOFGA Fair.
20. Maine Forest Service, recognizing the uniqueness and strength of WAgN's educational model, contracted with WAgN/UMCE for ,000 to deliver their Women and the Woods Program. This program is a natural expansion to WAgN's educational activities as most farmers also manage woodland.

Objectives Not Met:

1. Re-hire or hire more consultants to cover the state for another year;
2. Continue to capture, share and archive our stories of being women in farming;
3. Continue and finish the work we have started.

Integration of Research and Extension Activities:

- Presentations and/or collaborations with the UM Folklife center, UM Women In Curriculum, UM Page Museum, the Risk Management Women in Agricultural National Conference, PA WAgN, etc.
- I received two awards that recognized my work with WAgN and both events allowed me to highlight women farmers' stories to audiences we normally do not reach. The Maine Women's Fund award was 0, which I donated to WAgN and I spoke to over 700 people. The University of Maine Women in Curriculum event gave me the ear of the UM President and a number of UM Deans and the Governor of the state, as well as, 100 other people.

MAC 49: Evaluation of heat synchronization protocols for timed artificial insemination breeding for Maine Beef Producers

Principle Investigator(s): Kenneth M. Andries, Gary Anderson, Dave Marcinkowski

Background:

The use of Artificial Insemination (AI) in beef cattle allows beef producers to utilize higher quality sires and reduce the number of bulls that are needed for the breeding season. The result is a higher quality, more desirable calf crop and a decrease in the costs of production making the farm more financially sustainable.

The major limiting factor in implementation of AI in beef herds is estrus detection. One method to reduce the problems with this is to utilize estrus synchronization. This is a procedure that will allow the producer to shorten the time he or she will need to observe estrus and can even result in a timed breeding of animals. The primary benefits of an estrus synchronization program are easier AI breeding, shorter calving seasons, and more uniform calves.

There are several synchronization products available commercially but many do not have good conception rates with timed breeding in beef cattle. A new product called a "Eazi-Breed CIDR", a controlled intravaginal progesterone-releasing product, was approved for use in the U.S. this past summer. This product promises a better conception rate on timed breeding than other methods currently available.

There is a new heat detection aid available this breeding season available from Genex inc. We will evaluate this new product with a similar existing product for effectiveness and its ability to stay on the animal. Both products are back patches. The new product has a scratch off area that reveals a bright color when the cow is ridden during estrus. The existing product is a dye pack that breaks when the cow is ridden during estrus turning red.

The project we are proposing will compare the new CIDR protocol to a commonly used protocol utilized in dairy and beef herds along with the use of two different estrus detection aids. This study will allow for more information to be provided to the beef producers in Maine related to the effectiveness of these protocols and how they can be applied to their breeding programs.

Research Description:

- The objectives of this project will be to evaluate the effectiveness of two commercially available estrus synchronization protocols and estrus detection aids for use with timed breeding of beef cattle.
- Determine the effectiveness of the CIDR synchronization protocol for timed breeding
- Determine the effects of synchronization on total conception rate in beef herds.
- Compare two estrus detection aids for beef cattle.

Project Description

This project will be conducted at the Witter Teaching and Research Farm at the University of Maine Campus. The beef cows will be randomly assigned to one of two synchronization protocols within breed. The protocols being used are a two-injection prostaglandin or CIDR. Each product will be used according to label directions.

Cows will be randomly assigned to one of two estrus detection aids within breed and synchronization protocol. Each cow will have the proper estrus detection aid placed on her tail-head according to manufactures directions. Each product will be evaluated on ease of application, how well it stays in place, ease of reading, and effectiveness in estrus detection.

Cows will be bred AI on detected estrus or timed breeding according to recommended protocols. Breeding dates will be recorded for all cows. The condition of the estrus detection aid will also be recorded at breeding. Cows will be exposed to natural service sires no shorter than 10 days after the last AI breeding. Ultrasound techniques will be used to determine pregnancy and stage of gestation. This will allow us to determine date of breeding and AI conception rate without reducing overall conception rate of the herd.

Projected Outcomes:

Cattle will be pregnancy checked in October 2003. Results will be analyzed and final project outcome will be known by December 2003.

A news article for beef producers related to the effectiveness of estrus synchronization and a recommended protocol for producers to follow to increase the effectiveness of AI in beef herds. There will also be an extension "Fact Sheet" written related to estrus synchronization and heat detection for beef cattle.

Presentations at producer meetings in January and April of 2004 will also be given related to the results of this project.

Industry Support:

The Maine Beef Producers Association has provided a letter of support for this research project. We have also received donations of semen from producers that will be used as part of this research program.

Abstract:

Beef producers in Maine need to increase the utilization of improved genetics to increase the value and profitability of their herds. The most economical method to achieve this is through the use of artificial insemination. The major limiting factor in artificial insemination is estrus or heat detection in the cow herd. By utilizing heat synchronization, producers are able to schedule artificial insemination to and plan for resources to increase efficiency of these programs. The availability and utilization of estrus detection aids can also help producers determine breeding and decrease the amount of time required to have a successful breeding program. There are several types of heat synchronization protocols available today. The introduction of a new product known as the EZ Breed CIDR has shown promise for increased conception rates at timed breeding. This reduces the amount of time the producer needs to spend on heat detection. Because most of our beef producers have jobs off farm, it is important for them to be able to follow programs that will fit into their schedules.

Objectives Met:

Evaluate the effectiveness of two commercially available estrus synchronization protocols with timed breeding of beef cattle. We compared the new CIDR protocol to a well established, two shot hormone treatment for synchronization. We initially observed good responses to both treatments according to ultrasound images taken during the synchronization procedure and expected a good response and high conception rates in the project. However, we had poor synchronization at the expected time of breeding. Only 13 of the 38 cows were showing signs of estrus by the time of breeding and only 10 became pregnant on timed breeding according to ultrasound pregnancy evaluation. There was also no spike in number of heats detected after breeding to indicate that the timing of the breeding was not correct with only 6 new animals showing signs of heat within 24 hours of breeding. Research with heat synchronizations has indicated that you can expect cows 50 to 60 percent conception rates from timed breeding with these protocols. Because of this and the early ultrasound data we expected a greater response and increased conception rate from this program. We are not sure what may have caused the poor response in this study.

There was not a significant difference between breeds for observed heat or conception on timed breeding. Thirty-nine percent (9 of the 23) of Angus cows and 27% (4 of 15) of Belted Galloway showed signs of heat at the time of breeding. At our first pregnancy check, 7 Angus and 3 Belted Galloway cows were pregnant. Due to reported difficulty in observing heat in the Belted Galloway by breeders, we had hoped to have a larger number conceive than showed signs of estrus.

Determine the effects of synchronization on total conception rate in beef herds. After the timed breeding we marked the dates of observed estrus and started breeding on observed estrus after a 10 days, allowing birth date to be the final determination of conception date. Because the estrus cycle in cattle is a 21-day cycle, we concentrated on the animals that were expected to be in estrus. Resulting in a 50 percent conception rate on observed estrus post synchronization. This indicated that there is not reduction in conception rate due to the use of synchronization protocols if you breed on observed estrus.

Compare two estrus detection aids for beef cattle. To help producers in determining which cows are in heat, companies have produced estrus detection aids. We compared two types of estrus detection aids in this study to determine their reliability and ease of reading for use in beef cattle. The first type of estrus detection patch was a dye filled tube that is attached to the back of the cow and turns red when activated. A newer device works similar to a scratch off ticket in that it has a coating that is rubbed off to be activated. The dye tube was much easier to read from a distance and had a better retention rate. The scratch off type patch was self-sticking and we had problems with these not staying on the cows when they were on pastures. They were also more difficult to read requiring you to get closer to the cows to evaluate. There were also problems with cows activating these patches on trees and other scratching post in the pasture making it difficult to interpret the results of the observation.

Methods Used to Evaluate Outcomes:

The results of this project differed from the expected in that we did not have as strong a response to the synchronization as indicated in previous research. Because of the overall response to both protocols we are working to repeat the synchronization part of this project in 2004. All the beef cows in 2003 were in heavy condition (condition scores 6 to 8). The hormones used to synchronize estrus are fat-soluble molecules. We believe that this may have played a role in the response we had to the protocols.

The results of the estrus detection aids indicate that for beef cattle, the dye tube type of aid worked well. This type of device has been available for years to producers and has still proven reliable. The scratch off type device appears more suited to dairy cattle where closer observation is a standard practice.

After the data from 2004 is collected we will re-evaluate the results of this study. A flyer and experiment station publication will be generated with the two years worth of data for distribution to producers in Maine.