Division of Marketing
Agricultural Development and Diversification (ADD) Program

1998 Grant Final Report

Grant Number 13017

Grant Title Developing Commercial Production of Lingonberries in Wisconsin (Phase 3)

Amount Awarded $15,350.00

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Department of Agriculture, Trade and Consumer Protection
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1999 Grant Project Final Report

Contract Number: 13017

Grant Project Title: Developing Commercial Production of Lingonberries in Wisconsin

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Submitted by: John D. Cuddy Date: 12/30/99

1) Describe the original intent of the grant project.

The intent of the Project was:
a) to evaluate a collection of lingonberry varieties for suitability to commercial culture in Wisconsin.
b) to evaluate different cultural practices for their effectiveness in promoting lingonberry production.
c) to share results and information gathered during the project with interested parties, and;
d) to produce a report.

The project was undertaken to determine if commercial lingonberry culture was practical in the State of Wisconsin. Lingonberries are a high value specialty crop that could add significant income to Wisconsin Agriculture if commercial production practices are developed.

The objectives of the Project were not altered significantly during the duration of the Project.

2) Describe the work conducted on the Project.

Part of the work involved in the Project consisted of caring for, and evaluating an approximately 1/4 acre test plot with a selection of up to 37 different cultivars of lingonberries. Cultivars were evaluated for different growth and fruiting characteristics on a monthly basis during the growing season. An additional 3/4 acre of commercial lingonberry plantings were started to evaluate the effect of different cultural practices on plant development. Much of the work consisted of routine maintenance of the lingonberry beds, preparation of new planting areas, and evaluation of the results of different practices. Interest in the Project was very good and a significant amount of Project time was spent giving tours, responding to inquiries, and producing reports and promotional materials.

The funds supplied by the ADD Grant were instrumental in allowing the us to spend significant amounts of time and energy making the Project work and allowing us to respond rapidly to problems as they arose. Without the financial support of the ADD program I suspect that the project would have been finished in 1997 with the loss of most of the plants and negative results concerning the feasibility of commercial lingonberry production in the State.

Through the support of the ADD program the Project has evaluated 37 varieties of lingonberries and has supplied ranking of these varieties by vigor and productivity in this report. We have evaluated several different planting systems, irrigation regimes, winter protection strategies, fertilization rates, and soil preparation procedures.

Challenges faced during the Project resulted mainly from the lack of available information on lingonberry culture. The amount of published literature is small. The work funded by this project has added a great deal to the total information available about lingonberry culture, and has resulted in requests for information from Sweden, Estonia, Belorussia, Canada, and from many states outside Wisconsin. The collection of lingonberries that the Project has developed is believed to be one of the most complete, and diverse, collections of lingonberry cultivars in the world.

Describe the public outreach efforts of this project.

This research project has resulted in the publication and distribution of a Preliminary Project Report, 1998, and the current Final Project Report, 1999. The Preliminary Project Report has been sent to over 70 individuals interested in lingonberry production. The Final Project Report will be made available to Wisconsin residents at no charge for one year. The Final Project Report will be rewritten and published in book form, under the title "**Growing Lingonberries**". Additionally, the work completed under this project was summarized in an article published in "Metsanduslikud Uurimused XXX" (Forestry Studies XXX), the proceedings of the conference on wild berry culture conducted in Estonia in 1998. Portions of the Report will be available at rushriverproduce.com, a web site currently under construction.

Presentations on the Project have been presented at Wisconsin Farm Progress Days, and will be mentioned in a presentation at "Bringing Profits Back To the Farm" Conference in Eau Claire on Friday, February 11th, 2000. It is expected that interest in the project will continue and we will continue presenting the information developed during this Project at future agriculture conferences. Several field days have been conducted at the Project site, in Sept., 1998, June, 1997, and an additional field day is planned for July, 2000 as part of this project. Several group tours of the Project were conducted for Pierce County Commissioners (1998), UW River Falls Horticulture Classes (1999), and as part of a regional farm diversification conference (1998). We have responded to several hundred inquiries for information over the Internet, by mail, and by phone, and have given tours of the Project to nearly 200 people over the past three years.

Media outreach was accomplished through the mailing of 7 lingonberry specific press releases to 90 to 120 media outlets within our marketing region, including Minneapolis/St. Paul and Rochester, Minnesota, as well as Eau Claire, Wisconsin and several regional publications. Media response was very good with print articles in the Minneapolis Tribune, City Pages (Mpls), St. Paul Pioneer Press, Eau Claire Leader Telegram, Rochester Post Bulletin, and Pierce County Herald newspapers, Wisconsin Trails Magazine, The Country Today, Wisconsin REC News, The Great Lakes Fruit Grower, and several smaller local newspapers and shoppers. Broadcast Media exposure included WCCO Radio and Television (Mpls), Rochester, MN, Television, Wisconsin Public Radio, and Rebecca's Garden (nationally syndicated TV).

Describe the results of this project.

The original expectation of the project were to evaluate a collection of lingonberry varieties for adaptability to commercial planting in Wisconsin, and to develop and evaluate different cultural practices for commercial lingonberry production. The Project succeeded in developing one of the most complete collections of lingonberry cultivars in the world and evaluating them for nine different growth characteristics and, to a more limited degree, for five different fruiting characteristics. A total of 37 lingonberry cultivars were accumulated and compared. The Final Project Report evaluates 25 cultivars, including all commercially available varieties. 12 cultivars were lost to disease or lack of adaptability to the region.

Variations on nine different sets of cultural practices were developed and evaluated. A set of cultural practices have been developed that produce healthy, vigorous lingonberry plants at the Project site. Production of a reliable commercial crop of high quality lingonberries has not yet occurred. It takes lingonberry plants 3 to 6 years to mature and produce a full crop. We expect to sell some lingonberries in the year 2000, with significant crops in the years following.

The full results of the Project are presented in the second half of this report. Briefly we evaluated 37 varieties of lingonberries and five of those varieties proved to be very vigorous and produced significant amounts of quality fruit, another five varieties showed less vigor but also produced quality fruit. We consider these ten varieties to have good potential for commercial production in Wisconsin. The remaining varieties were less vigorous and showed little or no production of fruit. Production methods were evaluated and are presented in the second half of the report.

The impact of the Lingonberry Project on Rush River Produce cannot be overestimated. It has gotten the farm thousands of dollars worth of publicity, it has enhanced our reputation as knowledgeable fruit growers and researchers, and has been a source of continuous challenge and interest for us as horticulture professionals. Economically the grant has provided an on-farm income for us, allowing us to spend much more effort and resources on the Project than we could have without the grant. Additionally we feel very strongly that there is excellent potential for significant income from the lingonberry patch in the next few years.

We conclude that the commercial production of lingonberries can provide significant income potential for small commercial producers and family farmers in the cooler areas of the State of Wisconsin. Lingonberries are a crop for the northern section of Wisconsin and perhaps the cooler lake shore areas along Lake Michigan. Cool summers appear to be the key to growing lingonberries commercially. Additionally, we feel that there is significant income potential in other areas of the State when optimum cultural practices are followed.

Further research that would be beneficial for the development of commercial lingonberry production should include variety testing at a site near Lake Superior and/or in Door County. The commercial production of lingonberries should be best adapted to these areas. Research on the effect of method of propagation on growth habit also needs to be looked into.

Growing Lingonberries in Wisconsin

Final Report

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Overview

This project has been funded by the Wisconsin Department of Agriculture, Department of Agriculture Development and Diversification, since 1996. Their support has allowed the project to develop a great deal of interesting and useful information on lingonberry culture in the upper midwest over the past few years.

Rush River Produce is located in Western Wisconsin near Lake Pepin and Red Wing, MN. The farm produces 8 acres of highbush and half-high blueberries, an acre of summer raspberries, an acre of currants, and an acre of lingonberries. The scenic farm location is a primary tourism destination in the Mississippi River Valley corridor and regularly brings several thousand customers from a 100 mile radius to pick fresh fruit each summer.

Our interest in lingonberry production was started by inquiries from our regular customers looking for a greater variety of berries. Several of our blueberry plant suppliers also started to supply lingonberry plants in the 1990's and provided additional information about lingonberry culture. Dr. Elden Stang, University of Wisconsin - Madison (retired), supplied us with information about lingonberries and a selection of named and numbered cultivars that provided the start of our current research into lingonberry production.

This report is the result of 5 years experience with lingonberries at Rush River Produce. We do not, at this time, presume that we know how lingonberries should be grown in this area. We have learned some things that don't work and some things that do appear to work.

Climate

Lingonberries grow naturally throughout the Northern Hemisphere generally north of the 50th parallel. While the lingonberry plant is widespread throughout the Northern Hemisphere, it is of commercial importance, i.e., highly productive of high quality berries on a regular basis, only in certain areas. These areas include maritime Eastern Canada, the Scandinavian Countries, Northern Russia, and the Baltic States from Estonia south to Northern Germany.

The climactic characteristics of current commercial lingonberry production areas are:
1) short growing season
2) cool summers
3) regular moderate precipitation
4) reliable winter snow cover

The degree to which a location meets these climactic parameters, or that a grower is able to imitate them at a particular site will determine, to a large extent, the productivity of a commercial lingonberry planting.

Here at Rush River Produce in Western Wisconsin our climate is:
1) long growing season
2) warm to hot summers
3) irregular precipitation
4) unreliable snow cover

Given these climactic conditions we are still able to produce healthy lingonberry plants but our experience to this point is that we are not currently able to produce quality lingonberries on a consistent basis. We are not completely sure that this is due to our climate as our planting is young and will not be capable of full production for another few years, but it is likely that our irregular production of fruit is, in part, due to summer temperatures that are too hot, in some years, for proper fruit development.

Soil

For commercial production lingonberries should be grown in an acidic soil with a pH of 4.5 to 5.5. Naturally porous sandy and sandy loam soils are best and should have an organic content of at least 4%. Heavier soils should have a higher content of organic material to allow for easier spread of the lingonberries vigorous rhizome system, and to improve drainage. Heavier soils would probably benefit from trenching or tiling to reduce soil saturation periods and thus reduce pressure from root rot organisms.

The lingonberry plant will grow well in soils that are outside these parameters but review of the literature and our own experience indicate that the best commercials results will be from lingonberry plants grown in these types of soils.

Planting

Lingonberry plants arrive from the nursery in small pots or flats. These should be placed in partial shade and watered regularly and often until planting. Most plants available currently are propagated in a greenhouse and need to be acclimated to field conditions for several weeks prior to planting. This is accomplished by placing the plants in partial shade outside for several days, increasing exposure to direct sun every day. Care must be taken that the soil is kept moist during this period.

We have tried several different planting systems and have found that planting the lingonberry plants at 1 foot in the row, with 5 feet between rows gives good results. We have planted double rows 18 inches apart with plants staggered at 18 inch intervals. This planting will fill in a year or two sooner than a single row planting but the initial cost for plants is about 50% higher.

Under good growing conditions the lingonberry planting will form a matted row about four feet wide after 3 to 5 years as the plants spread. There will be very little spread the first growing season - perhaps 10 to 20% of the plants will throw a few rhizomes. The second year more plants will start to produce off-shoots by rhizomes and the most vigorous will produce new plants up to 2 feet from the mother plant. The third year the bed will start to fill in, and by the fourth or fifth year the rows of plants should be 2 to 4 feet wide with a 1 foot walkway between rows.

Different varieties of lingonberries have different rates of rhizome development with some varieties being much more vigorous at developing rhizomes and consequently able to fill in a planting a year or more sooner than other varieties. Other varieties develop more slowly, at least under growing conditions in Western Wisconsin, with the result of taking longer to develop a mature full bed.

Method of propagation may also have some effect on rhizome production. In Europe many growers propagate plants from cuttings to produce a plant that does not produce rhizomes freely. This is thought to produce a taller lingonberry plant and allow easier harvesting.

The Lingonberry Plant

Lingonberries grow naturally throughout the Northern Hemisphere generally north of the 50th parallel. While the lingonberry plant is widespread throughout the Northern Hemisphere, it is of commercial importance, i.e., highly productive of high quality berries on a regular basis, only in certain areas. These areas include Eastern Canada, the Scandinavian Countries, Northern Russia, and the Baltic States from Estonia south to Northern Germany.

The climactic characteristics of current commercial lingonberry production areas are:
1) short growing season
2) cool summers
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The degree to which a location meets these climactic parameters, or that a grower is able to imitate them at a particular site will determine, to a large extent, the productivity of a lingonberry planting.

Under normal growing conditions the lingonberry plant will begin to flower a few weeks after the snow melts. Flowering continues for several weeks as bees and flies of different species pollinate the flowers and the fruit begins to develop. Fruit development continues through the cool summer with ripening beginning in mid to late August. Several weeks after the first fruit ripens, a majority of the fruit will be ripe enough to allow harvest. Harvest is accomplished with berry rakes. Moderate frosts do not damage the fruit significantly, although frosted fruit may have a shorter shelf life, and picking of fruit can continue until snow covers the plants. The normal shelf life of clean, sound fruit is six to ten weeks in common refrigerated storage. In some areas unpicked fruit will stay on the plant all winter and be edible in the spring when the growing cycle begins again.

In Western Wisconsin, and other areas outside the normal growing range of the lingonberry, the fruiting cycle is altered significantly. Under our conditions the lingonberry plant gets confused and tries to develop two crops, a July crop and an October crop. What appears to be happening is that the lingonberry plant starts out in the spring with a normal response to flower and set fruit in May (it is still carrying flowers and fruit from the previous season at this time due to its confusion). Under the warmer spring and summer temperatures at this site the fruit development and ripening is accelerated and ripe fruit begin to appear in late June with a moderate crop available in early July.

The problems with the July crop are these: (1) at the time this crop is available the air and soil temperatures are usually so high that a significant percentage of the berries "cook" or spoil as they ripen and are unusable; (2) berries that do ripen tend to "shatter" or fall off the plant at the slightest provocation, (3) birds consume a large number of the berries at this time, and, since the plants are confused, (4) the lingonberries are flowering at the same time they are fruiting, and attempts to pick the ripe berries may damage or remove viable flowers and reduce the fall crop.

At this time, when the lingonberry plants would normally be cooling off and beginning to get ready for winter, the short summer nights and continued warm temperatures signal the lingonberry plant that it is still spring and the lingonberries begin to flower for a second time. In our experience they will continue to produce flowers throughout the summer and fall and begin to ripen a second crop of berries in September - if summer temperatures are not too hot. Prolonged temperatures above 75 degrees, day and night, appear to reduce flower and fruit development significantly and, consequently, may significantly reduce the fall berry crop. The summer of 1999 was very warm in Wisconsin with few nighttime temperatures below 75 degrees and many days in the 90's. Second crop flowering was retarded until mid August, when it cooled off, and the fall lingonberry crop was only a fraction of what we had expected.

Varieties

There are currently 12 commercially available varieties of lingonberries, with two new varieties, Ida and Linnea, are being introduced from the Swedish breeding program in the spring of 2000.

These varietal evaluations are based on monthly evaluations, usually completed in the first week of each month, made in the years 1998 and 1999. The monthly evaluation project has been completed since 1996. Data from the years 1996 and 1997 are excluded from this evaluation because of poor growing practices in the test plot. The resulting information from that earlier period does not accurately represent the potential of these varieties.

Remember that these variety evaluations represent a subjective evaluation of these varieties of lingonberries under a specific set of conditions of climate, soil, and growing practices. Given the state of our knowledge about lingonberry variety performance I would advise anyone planning to put in a large planting of lingonberries to try a test planting of as many varieties as they can get prior to planting a large quantity of any particular variety.

In the monthly evaluation each variety of lingonberry is given a subjective score of 1 to 7 on a number of characteristics and a plant census is taken. Plant height was measured in 1998 and 1999.

Characteristics that we scored were:
(1) Vitality: including winter survival/recovery, new growth, quantity of flowers, color, vigor, rhizome development, and insect damage.
(2) Productivity: including fruit quantity, size, color, and quality.

The varieties were ranked by Productivity and Vitality into three groups.

Group one: most productive and most vigorous

Erntekrone - perhaps our most productive variety. Erntekrone can be a little spotty after planting as it seems to have a greater post-planting mortality than some varieties, but once established the plants are healthy, vigorous, spread rapidly, and produce a very large scarlet lingonberry. Seems to be a decent fall producer, even after a hot summer. 6 to 12 inches tall.

Ammerland - a relatively new introduction. Very vigorous and spreads rapidly. A good summer cropper so far - no crop in the fall of 1999 (due to summer heat?). Transplants well and establishes rapidly. But it is the shortest lingonberry variety we've got - 4 to 8 inches tall.

C-31-2 - a numbered variety from the University of Wisconsin, from Elden Stang's collection. Not available commercially. Very similar to Ammerland. 4 to 8 inches tall.

Regal - One of Elden Stang's UW introductions. It's vigorous and productive. Generally splits the crop between summer and fall. 6 to 10 inches tall.

Koralle - an older variety grown commercially in Europe. Vigorous and productive. It establishes readily, is easy to transplant, and productive summer and fall. It seems to be a little more subject to winter injury. It is a taller variety. 8 to 12 inches tall.

Group two: Productive but less vigorous

Erntedank - commercially grown in Germany, introduced by Wilhelm Dierking. This variety suffered from and didn't recover fully from the root rot discussed elsewhere in this report. Also some heat stress mortality in 1999. Plants that survive are healthy looking, spread moderately, and produce nice large fruit. 6 to 10 inches tall.

Splendor - another of the University of Wisconsin introductions. Not as productive or as vigorous as Regal. Has had problems with winter injury, root rot, and heat stress. A good producer of summer berries. 6 to 10 inches tall.

Sanna - Swedish introduction. Suffers from heat stress, winter injury here. Only moderate vigor. Surviving plants are productive in both seasons. 4 to 8 inches tall.

Scarlet - this variety is moderately vigorous but slow to produce rhizomes. It has had problems with root rot but seems to be recovering well. Moderately productive - it makes a nice large berry. 6 to 10 inches tall.

Red Pearl - We have only had these for two years - but they look promising. They are subject to some winter damage, but seem to recover well. Vigorous and erect plants. Modest production, at two years, of medium-large fruit. 8 to 12 inches tall.

The rest:

Mosovia -A commercial variety from the Poland. It is subject to winter injury, heat stress, and other maladies. It does recover from stress well. The plants that survive are productive in both seasons, of medium sized fruit. 4 to 8 inches tall.

Sussi - A Swedish introduction. It is moderately vigorous and productive here. Subject to winter injury and heat stress. Medium sized berries. 6 to 10 inches tall.

Erntesegen - From Dierking and Northern Germany. It suffered badly from the root rot epidemic in 1997 and has never fully recovered. Remaining plants lack vigor and do not spread. Produced a few nice large berries. 6 to 10 inches tall.

The collection at the test site contains 12 other unnamed cultivars of lingonberries acquired from Elden Stang's collection. Individual descriptions of these varieties is omitted from this report.

Maintaining the Lingonberry Bed

Weeding

Weeding the lingonberry bed is perhaps the biggest operating cost in lingonberry production. At the current time there are no herbicides registered for use in lingonberries. All weeding will need to be done by hand, hoe, and rototiller. For small plot this is not a great issue. For an acre this will mean 150 to 300 hours each year pulling weeds and rototilling.

Lingonberry plants are great weed seed catchers too. There seems to be a special affinity for dandelion seeds, but there will be plenty of other types too. It is important to keep weeds small and pull any well prior to seeding. It is much easier to pull small weeds than big weeds so plan to spend a lot of time weeding in late May, June and July when most weeds germinate, less time will be spent later in the summer. Care must be taken not to disturb the lingonberries shallow wiry root system when pulling weeds that may be growing right in the lingonberry plants.

Diseases/mortality

Lingonberries are subject to Pythium/Phytopthera root rots when grown in soils that remain saturated for any significant period of time. For the years 1996 and 1997 we grew lingonberries on the assumption that they required in excess of one inch of water per week in a soil, a silt loam with organic material added, that holds water very well. The plants lacked vigor and there were unidentified mortality losses on a regular basis. Then, in the month of July, 1997, we received 16+ inches of rain and the soil remained saturated for the whole month. At the end of the month of July a lot of the plants began to loose their color. By the end of the first week in August many of the plants had turned a very dark brown, both leaves and stems, the leaves did not fall for several weeks - 30% of the lingonberry plants were dead.

Rushed consultations over the Internet with several other researchers around the world, diagnosed the problem as Pythium/Phytopthera root rot and advised spraying the plants with Ridomil or Aliette, fungicides that have been used to good effect in other research programs and, reportedly, are used as a cover spray in commercial plantings in Europe. By the end of the second week of August I sprayed the planting with Ridomil. Plants that were only into the early stages of the disease recovered and many of the plants that were not yet affected by the disease began to grow more vigorously and produce flowers at rates we had not seen before in this project. By the end of September the growth rate of

the plants was such that, overall, the lingonberry bed had grown more in 6 weeks than it had grown in the past two years. This increased growth rate was evident the next year and was so pronounced that the scales used to measure growth and vigor in the monthly evaluations had to be expanded from 1 -5 to 1-7 to allow for the increased growth rates.

We believe that for the years 1996 and 1997 we were watering the lingonberry beds too often and too much. Without a chance to dry out for long periods of time the soil became waterlogged and intermittently saturated, introducing the conditions that promote the development of P/P root rot. We had introduced a low-grade chronic level of root rot into the planting by excess irrigation. The monsoon rains of July, 1997, set up the conditions for a severe acute outbreak.

We now spray the plants twice a year with Ridomil or Aliette to prevent the recurrence of the root rot. These chemicals are not currently registered for use on lingonberries. Application has been made to the EPA to extend the label for these chemicals to include their use on lingonberries but as of the date of this report this is not a labeled use of these chemicals. Communications with the appropriate Federal Agencies indicate that the request for a label for Ridomil will be acted on in early 2000. The application for Aliette will not be acted on until later in 2000 or early 2001. We have also reduced the irrigation schedule from 1+ inch per week to about 1/2 inch per 2 weeks in the absence of rain.

This disease affects some varieties of lingonberries much more than others. About 12 of the original numbered varieties in the test plot died out completely during this period. Erntesegen, Masovia, Sanna, and Erntedank are named varieties that suffered very badly from the P/P root rot. Ammerland, Regal, Scarlet and Red Pearl have shown the least effects of the disease.

There are two other causes of mortality that have been significant in the project. Winter injury, due to desiccation of the evergreen leaves and stems of the lingonberry plant, will occur where plants are not protected and winter temperatures get below 10 degrees Fahrenheit. If more than 25% of the plant is affected there is a good chance that the whole plant will die. If only a few stems are affected there is a good chance for recovery. In the lingonberry's native habitat the plants are usually protected by significant snow cover during the coldest part of the year. In this project the plants were protected by freeze cloth, 0.9 oz per square yard polypropylene row cover, with the addition of snow fence around the planting. This has generally provided adequate winter protection. However, in years of less snow fall, when significant parts of the planting were protected only by the freeze cloth there was significantly more winter injury that during deep snow years.

Heat stress can also kill lingonberry plants. This was not a problem at this project until the year 1999 when July and August temperatures were rarely below 75 degrees at night and often above 90 during the day. Many plants just started to fade, with leaves going from dark green to light green, to almost white, then to a medium brown, with the leaves

dropping after about two to three weeks. About 10% of the lingonberry plants showed some effect from heat stress in 1999, with about half of those plants dying.

Fertilization

Most information published about lingonberries indicate little need for any fertilizer. Most of the Vaccinium species are light feeders. However our experience is that, once root diseases are controlled, the lingonberry plants respond very nicely to split Nitrogen applications of 50 to 100 lb actual N per acre per application. N should be applied a few weeks after spring fruit set and again after the summer harvest.

It is important to increase N application further if large amounts of fresh organic matter are applied as mulch or worked into the soil prior to planting. The N demand of the mulch will remove N from the soil and visibly reduce the vigor of the lingonberry plants. We have noted very significant plant stress from lack of N in heavily mulched portions of the planting. 10 to 15 pounds of additional N per inch of mulch per acre should feed the mulch adequately

Irrigation

As stated earlier in this report the years 1996 and 1997 were characterized by over supplying the lingonberry plants with moisture. The frequency and amount of irrigation water supplied exceeded 1 inch of water per week most weeks and was probably in excess of 2 inches of water a significant number of weeks. Our normally brown silty loam soil turned gray/blue and wet at about six inches depth, indicating long periods of saturation. In effect we were setting up perfect conditions for the development of root rot diseases and selecting out those lingonberry varieties that were most susceptible to Pythium/Phytopthera root rot. This was very effective in reducing the number of varieties of lingonberries from 37 varieties at the peak of the study, to the 25 lingonberry varieties currently under test. A few of the remaining varieties have never really totally recovered from the root rot and will likely die out in the next few years.

After our 1997 epidemic the irrigation schedule was reduced to less frequent and less intense applications. At this point we irrigate only every two weeks in the absence of rain, and the only put down about a 1/2 inch of water by drip irrigation. Studies in Sweden indicate that this amount may need to be raised a little during flowering and in the last stages of fruit development to improve production and berry quality.

Winter care

Lingonberries are most reliable and productive of fruit when there is sufficient winter snow cover to insulate the plants from winter cold and wind. The plants are evergreen and subject to leaf and stem desiccation during the winter when exposed. When reliable snow cover is not available the plants may be covered with a polypropylene row cover/freeze cloth and the beds surrounded by snow fence.

Here in Western Wisconsin we have been covering the lingonberries every winter. We use a 0.9 oz per square yard freeze cover put down in November just before the ground freezes. The freeze cloth is weighted around the edges with boards. Then we install snow fence around the north and west ends of the beds. In a high snow year there will be 1 to 3.5 feet of snow covering the bed and we experience only very minor winter injury. (Indeed, it appears that the plants may actually continue to grow through the winter under the cover.) In light snow years winter injury will occur in more plants and if any plants are exposed by a tear in the fabric they are almost sure to freeze out.

Pests

Insect pests have not been a significant problem in this planting of lingonberries during the five years of the Project. There have been several types of caterpillars found feeding on the lingonberry leaves but infestations have been very limited and not of any economic importance.

Vertebrate pests have been more of a nuisance than a real problem.

Birds feeding on the summer crop of lingonberries is probably the most significant pest problem. Lingonberries are prone to shatter, or fall from the bush, during the summer crop. Robin and Cedar Waxwing feeding pressure is strong at this time and berries are lost to the birds both directly through feeding and from being knocked off the plant. The feeding pressure is much reduced during the fall season and does not appear to cause significant losses at this time.

Ground Squirrels have caused some mortality in the lingonberry beds due to tunneling under the plants. The Ground Squirrels apparently like the habitat supplied by the clean cultivation and generous mulch cover in the lingonberry beds. They tend to tunnel under the rows and have trimmed some plants and undermined others. The Ground Squirrels were controlled in the summer of 1999 by the use of rat traps baited with peanuts. This proved to be very effective and two dozen were removed from the lingonberry beds in less than two weeks.

A mystery problem has been encountered with plants, usually young poorly rooted lingonberry transplants, being pulled out of the ground and left lying in the field. This has been noted on an ongoing basis throughout the period of the Project but has only affected a few dozen plants over this period. We believe that deer, or perhaps rabbits, are feeding on the lingonberry leaves and, in the process, are pulling the whole plant out of the soil. Fencing the lingonberry beds would be a solution to the problem but the overall damage is so slight that we felt that this is not worth the effort. We have hung soap around the perimeter of the lingonberry beds to discourage the deer from crossing the area with some success.

Shade Cloth

In 1997 a section of 30% shade cloth was installed over a new planting of lingonberries to determine the effect on the establishment of the lingonberry plants. A search of the literature indicated that the lingonberry plant often grew well in shaded woodland areas but that fruit production was reduced. We thought that some light shade might result in increased vegetative growth in the establishment year, when fruit production was not expected. The results were positive. The lingonberry plants covered by the shade cloth, Scarlet, were somewhat taller and bushier and had a slightly higher post-planting survival rate than plants of the same variety adjacent to the shade cloth protected area.

We had planned, in 1999, to install shade cloth over a part of the planting in June to determine the effect of the shade on soil temperatures and berry quality in the summer crop. We were not able to accomplish this part of the project due to the press of other work on the farm. We still feel that this approach may be the best method of protecting berry quality during the summer production season. We plan to try this in the summer of 2000.

Propagation

Commercial lingonberry propagation can be accomplished in different ways. Currently commercial lingonberry nurseries are propagating by either cuttings or tissue culture. We have used plants of both types with very good results. A researcher from Sweden has told us that the European growers tend to plant material produced from cuttings as this gives a taller lingonberry plant which is easier to harvest cleanly. The down side is that these plants tend to throw fewer rhizomes and thus spread more slowly. Tissue culture propagated plants are reputed to throw more rhizomes and spread faster. We have not noticed a significant difference in the vigor or propagation rate of either type of plant.

We have propagated several varieties of lingonberries by digging "plugs", small lingonberry plants that have developed from rhizomes. The plugs are dug in the spring from rhizomes that developed the past growing season and that have developed significant roots to support the new plant. These rooted rhizome plugs, with the soil attached, are transferred to sections of the bed where other plants have died out, and are watered in. Survival rate has been about 80%. We have tried transplanting unrooted rhizomes with very little success.

Starting lingonberries from seed has, so far, been unsuccessful. We know it must happen in the wild but have not figured it out yet. We have tried to start seeds indoors in pots, and in the field without success.

Economics

The economics of commercial lingonberry production are not fully understood at this time. The cost of production for an acre of lingonberries for this project are roughly:

Establishment year (per acre):

	Sulfur	$600
	Fertilizer	$150
	Mulch	$600
	Plants	$10,000
	Equipment	$1,000
	Labor($10/hr)	$3,500
Total		$15,850

Maintenance (per acre per year):

	Fertilizer	$100
	Winter cover	$150
	Equipment	$500
	Fungicide	$350
	Mulch	$150
	Labor($10/hr)	$2,500
Total		$3,750

Cost of harvest est.: $50.00 per 100 lb.

Discussions with our retail customers indicate that $7.00 per pound is an acceptable price for retail fresh lingonberries. Contacts with wholesalers indicate a wholesale price range of $3.00 to $5.00 per pound for frozen imported lingonberries depending on supplies.

Estimated income:

@2,000 lb. per acre	$14,000 (retail @ $7.00/lb)
	$ 9,000 (wholesale @ $4.50/lb)
@4,000 lb. per acre	$28,000 (retail)
	$18,000 (wholesale)
@6,000 lb. per care	$42,000 (retail)
	$27,000 (wholesale)

The following table uses the numbers for cost of establishment and cost of annual maintenance to project cash flows for a lingonberry planting over 10 years. Actual establishment costs may vary. The income projections in the table presumes a growing site closer to optimum than the current project site. Production (income) is projected to begin at 500 lb. in four years and reach its peak of 5,000 lb. at ten years. For less than optimum sites production will start later and probably never reach the 5,000 lb. per acre.

Year	Operating Cost	Income (Wholesale)	Cumulative Net Cash Flow (Wholesale)	Income (Retail)	Cumulative Net Cash Flow (Retail)
1	$15,850	0	-$15,850	0	- $15,850
2	$3,750	0	-$19,600	0	- $19,600
3	$3,750	0	-$23,350	0	- $23,350
4	$4,000	$2,250	-$25,100	$3,500	- $23,850
5	$4,250	$4,500	-$24,850	$7,000	- $21,100
6	$4,750	$9,000	-$20,600	$14,000	- $11,850
7	$5,250	$13,500	-$12,350	$21,000	+$ 3,900
8	$5,750	$18,000	-$ 100	$28,000	+$26,150
9	$6,250	$22,500	+$16,150	$35,000	+$54,900
10	$6,250	$22,500	+$32,400	$35,000	+$83,650

Conclusions

The results of this Project indicate that Lingonberries, as a commercial crop, have excellent potential in certain geographical portions of Wisconsin. Lake Superior shore areas, and Northern Lake Michigan shore areas, including Door County, show the best potential for commercial lingonberry production. The probability of success with commercial lingonberry plantings decreases as summer temperatures increase to the south and west of the above areas.

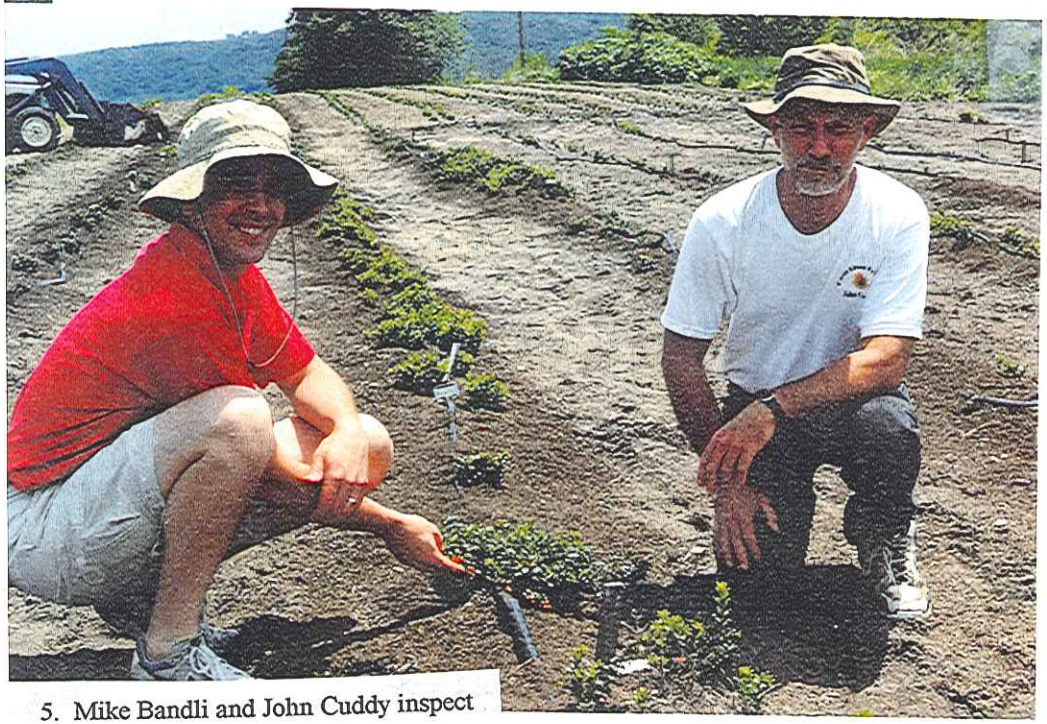
We do feel that lingonberries can be raised profitably in other areas of Wisconsin to the extent that optimum growing conditions, including winter cover and cooler summer temperatures, can be mimicked by the producer. The retail market value of lingonberries is such that less than perfect production and growing conditions may still yield a profitable crop of berries in most years.

1. Masovia in flower

2. Masovia in fruit.

3. Mike Bandli and John Cuddy inspect the lingonberries, 1997. Note shade structure.

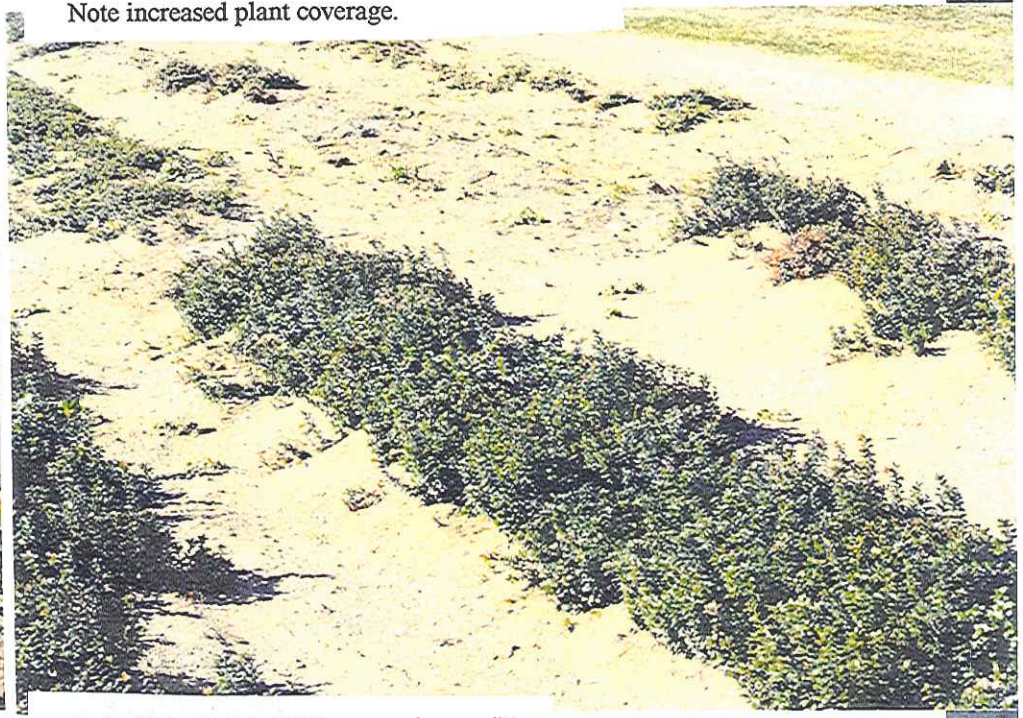
4. UW River Falls horticulture class on tour, 1999.



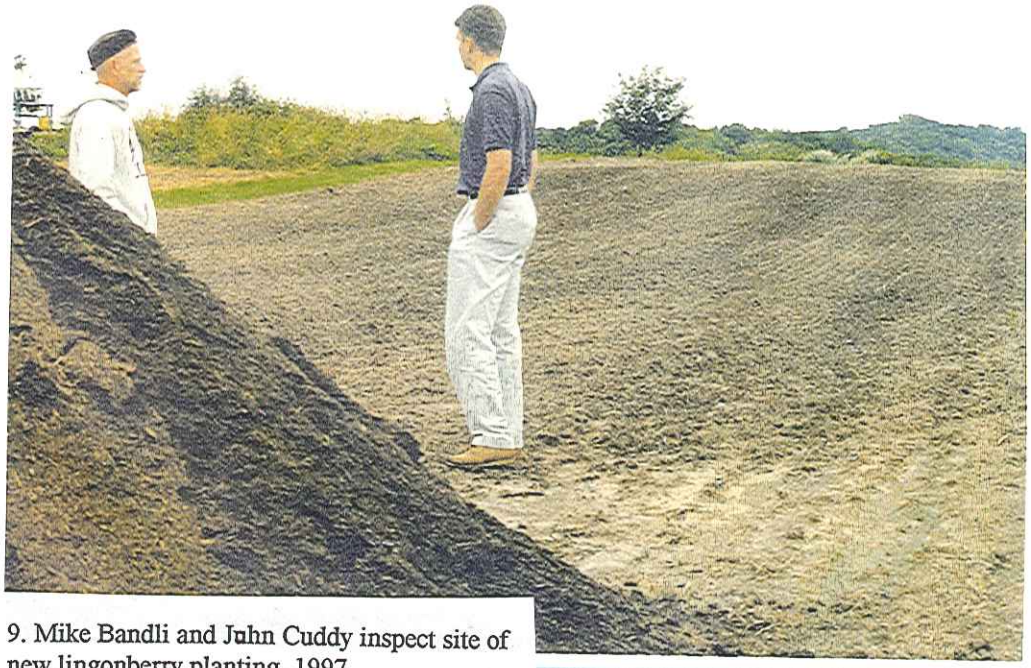
5. Mike Bandli and John Cuddy inspect test plot, 1998.

6. Test plot, 1999. Same view as last picture. Note increased plant coverage.

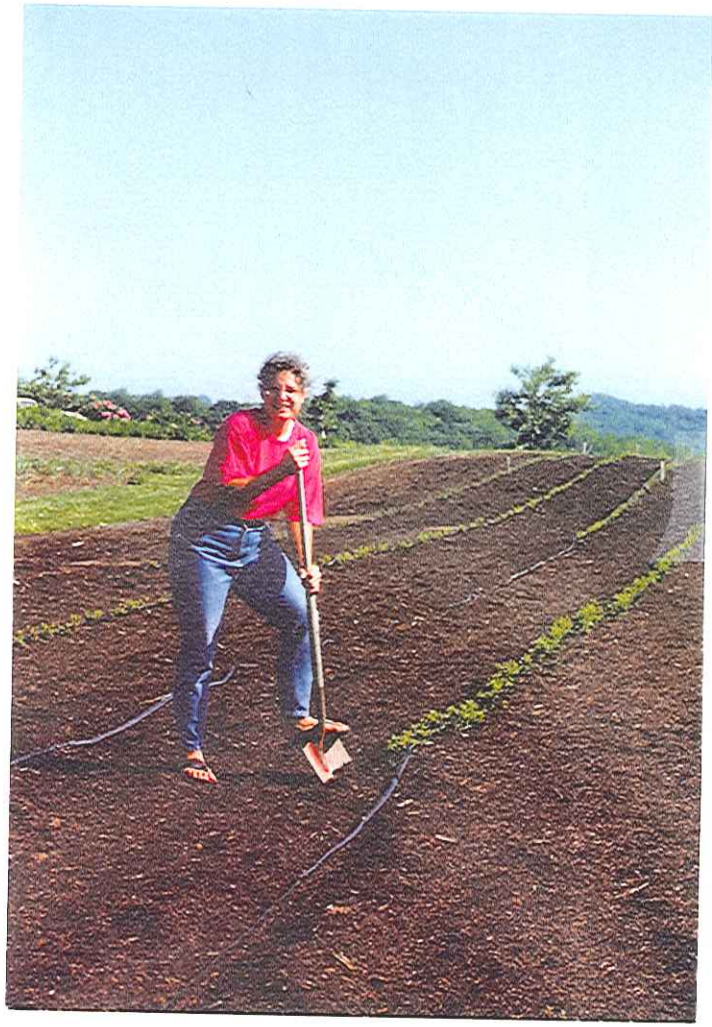
7. Red Pearl plot, 1998, after one year growth.



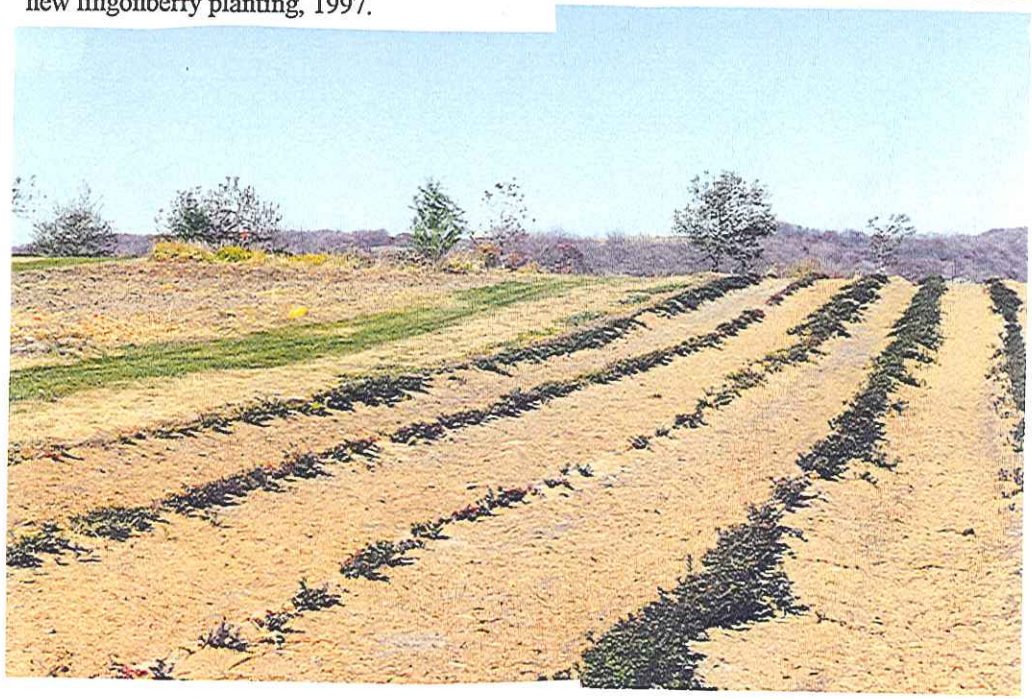
8. Red Pearl plot, 1999, same view as #7. Note plant growth.



9. Mike Bandli and John Cuddy inspect site of new lingonberry planting, 1997.



10. Terry Cuddy digging to add a few new plants to new lingionberry planting, summer 1998.



11. New lingonberry planting, fall 1999. Same view as #10. Note increased plant coverage.

12. Lingonberry bed tucked away for winter.
Covered with freeze cloth with snow fence to trap snow.

ASI POSTEN
The American Swedish Institute July/August 1999 Volume 18, Number 7

Swedish-American Bulletin Board

compiled by Jan McElfish

- Gammelgården Museum will host the annual Scandia Spelmansstämma on August 21 in Scandia, Minn. Music begins at 1 p.m. with a parade and concert until 2 p.m. The ASI Spelmanslag and various other groups will perform. The museum buildings will be open and arts and crafts vendors will have displays. A smörgåsbord with two settings will be offered at 11 a.m. and 3 p.m. (Make reservations in advance.) A dance will be held at the Community Center from 7-10 p.m. Call Lynn Moratzka at 651-433-3430 or 651-641-3419, or Nancy Dahlin, 612-722-0547.
- With assistance from the Agriculture Diversification and Development Program of the Wisconsin Department of Agriculture, and five years of research into varieties, growing practices, and soil requirements, Rush River Produce will offer its first crop of lingonberries for sale this summer. Lingonberries produce two crops each year: the first in early July and a fall crop in late September. Rush River Produce is located near Maiden Rock, Wis. (a one-hour drive from the Twin Cities). Call 715-594-3648 for availability, picking information, and directions.

ASI Traveler

When planning a trip to Sweden, many people are uncertain about accommodations. While some have a chance to stay with relatives, most people will stay in hotels, which comprises much of the travel budget.

On average, hotel rooms in Sweden cost more than U.S. rooms. However, the overnight cost includes the room, a buffet breakfast (a $12-18 value per person), and the VAT tax (23-25%). Although most hotel rooms are smaller than Americans are used to, larger "family" rooms are often available for three or more people. All hotels have special prices for children staying in their parents' room. Bed and breakfasts are available, but in most cases must be arranged through local tourist offices once you arrive in Sweden.

Hotel discount programs can

Rush River funded to develop nation's newest fruit crop

MAIDEN ROCK--A half-acre of lingonberries in Pierce County could be the start of a whole new crop in America, seeded with funds from the Marketing Division of the Wisconsin Department of Agriculture, Trade and Consumer Protection.

Rush River Produce, owned and operated by John and Terry Cuddy, Maiden Rock, is home to a 50-by-400-foot plot of the small tart berries that the Cuddys plan to harvest commercially in 1998. The couple received two Agricultural Development and Diversification (ADDS) grants totaling $26,000 from the department to develop commercial lingonberry production in Wisconsin.

"Specialty crops create new profit centers for farmers," said Mark Liedl, marketing division administrator. "In the case of lingonberries, the potential for profits is even greater because they're consumed as juices, sauces, jams and jellies, rather than fresh. That gives farmers the opportunity to add value.

"We believe lingonberries offer strong potential for export, particularly to Asia," Liedl said. "Lingonberries are delicacies in the Scandinavian nations and among people of Scandinavian descent here in the U.S. But we have to import all of our lingonberries into the United States, because there is no domestic production.

"Even in Scandinavian and the subarctic regions where the berries are native, they are harvested in the wild," he said. "At most, there are 50 known acres of cultivated lingonberries in the entire world."

Lingonberries are smaller than their cranberry cousins, but taste a lot like cranberries. They grow on low evergreen bushes, 12 to 18 inches high, that reproduce by rhizomes or "runners," favor loose acidic soil and need plenty of snowcover for protection from harsh winter winds. Lingonberries are mostly used in sauces, jams, and jellies, or in baking. Sold frozen, they command six to eight dollars a pound.

The Cuddys have tested 40 varieties of lingonberries, many of them obtained when a UW researcher was discarding his research collection. They have found a dozen that show good commercial potential, and another dozen that promise to do well with enough attention to good cultural practices.

Hand weeding and mulching are essential for lingonberries to thrive. The Cuddys are experimenting with shade cloths that encourage the plants to produce more foliage than fruit. They hope that a couple of years of shade will develop sturdier, more hardy plants that will then yield more fruit.

The Cuddys plan to produce a handbook for small commercial lingonberry growers. More than half of the 18 tours they've led on their lingonberry plot have been groups of Wisconsin residents interested in small commercial operations.

For information about the project, call John and Terry Cuddy, 715-594-3648. For information about ADD grants, call Mike Bandli, 608-224-5136.

Great American Smokeout to be observed Thursday

The Pierce County Public Health Department will observe the Great American Smokeout this Thursday.

The department encourages all smokers to refrain from smoking for 24 hours and challenges all teenage smokers to participate in the Smokeout. Thirty-seven percent of Pierce County's teenagers (ages 14-17) and 20 percent of the county's adults are smokers. In an average year, 2.5 million packs of cigarettes are sold to county residents alone and, statewide, minors illegally purchase 5.4 million packs of cigarettes each year.

The use of tobacco is the single most important preventable cause of disease and premature death. In the county, the estimated annual burden of tobacco is $6.2 million spent on the direct health care costs of smoking.

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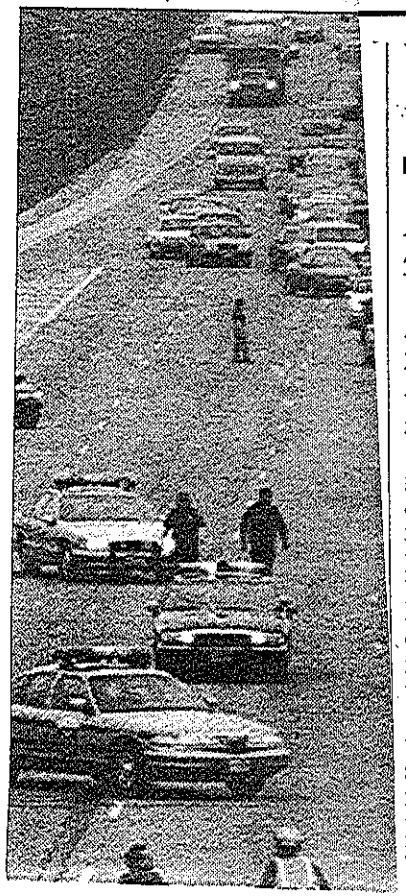
WISCONSIN



Farmers hope berry venture goes wild

■ Couple hope lingonberries are viable commercial crop

ASSOCIATED PRESS

MAIDEN ROCK, WIS.

John and Terry Cuddy are adding 500 lingonberry plants to the crop line at their Rush River Produce farm and hope to sell the berries commercially in about five years.

"There are no commercial lingonberry growers in the country at this time," John Cuddy, 49, said as he cleared hay from some of the small berry bushes now planted in a temporary nursery area at the farm high in the hills overlooking Lake Pepin. "They mostly grow wild all over in the higher latitudes. In fact, this is pretty much the southern limit for them."

Terry Cuddy, 39, said the berries — which are related to cranberries and sometimes are called mountain cranberries, foxberries or partridgeberries — primarily are used as an ingredient or flavoring rather than as an eating berry.

"Lingonberries are really popular in Norway and Sweden for jellies, syrups, sauces, things like that," she said. "There's a Scandinavian Christmas rice pudding that's usually made only with lingonberries. It's like cranberries and turkey for us."

The smallish, tart, red berry is only available frozen in the United States. Most are imported from Europe.

"The Norwegians and Swedes are paying eight bucks a pound for them frozen over in the (Twin) Cities right now," John Cuddy said. "If I can sell them for six bucks a pound fresh, I'll be a happy farmer."

The lingonberry plant is a low evergreen that spreads by putting out suckers. The Cuddys have 34 varieties they will transplant, after which they will determine which varieties to use in their commercial plantings.

They received the plants from Eldon Stang, a former University of Wisconsin-Madison scientist who had collected samples during trips to Europe.

"He'd just wander through the woods, see a plant and say, 'Well, this one looks large and healthy, and it has a good berry, and it tastes good. I'll take some of this,' " John Cuddy said. "He said at one point he had 11,000 different plants from different sources. This selection of 34 varieties was from the best of those."

The Cuddys saved the lingonberry collection from the compost pile when Stang left the university to take a job with cranberry growers in Chile.

The plants also grow wild throughout Canada and are especially popular in Eastern Canada.

Adding an unusual berry to their produce line isn't unusual for the Cuddys. Their farm, which is a summer and fall pick-your-own destination for popular blueberries and raspberries, also sports more exotic offerings, including apricot trees; black, red and white currants; gooseberries; garlic; and perennial flowers.

"We'll sell cut flowers, and sometimes if somebody sees a plant they like, I'll go get a pot and dig it out for them," Terry Cuddy said.

...criteria regarding construction, equipment and sanitation. It must be easy to clean and sanitize, well lit and well ventilated. Water used in processing must be annually tested for bacterial contamination. The facility and equipment used in

If you are planning to process a canned product, the written recipe needs to be submitted to the DFS for review. The DFS doesn't actually "approve" the recipe but it does evaluate it to make sure it

Paul Dietmann is the Sauk County Extension agriculture agent. He may be contacted at Sauk County UW-Extension, 505 Broadway, Baraboo, WI 53913, (608) 355-3250, or e-mail paul.dietmann@ces.uwex.edu.

Lingonberries offer new option

MAIDEN ROCK — A relative of Wisconsin's most abundantly produced fruit could have a bright future as a commercial crop for some state farmers.

The lingonberry, a small, tart cousin of the cranberry, may provide some Wisconsin farmers with an alternative commercial crop and second profit center. Found wild in northern forests around the globe, lingonberry is known as the dry ground cranberry and is closely related to the marsh-grown cranberry.

As part of a state agricultural grant project, John and Theresa Cuddy of Rush River Produce identified several key climate characteristics of current lingonberry production areas. Lingonberries, thrive in areas with a short growing season, cool summers, regular and moderate precipitation and reliable winter snow cover.

"We believe that lingonberries, as a commercial crop, have an excellent potential in certain regions of Wisconsin," Mr. Cuddy said. "The Lake Superior shore areas, northern Lake Michigan and Door County probably offer the greatest potential for lingonberry production in the state. However, we feel that lingonberries could be raised profitably in other areas of Wisconsin to the extent that optimum growing conditions, including winter cover and cooler summers, can be mimicked by the producer."

The Cuddys' findings resulted from a $15,350 Agricultural Development and Diversification grant in 1998 from the Wisconsin Department of Agriculture, Trade and Consumer Protection. Their project studied the suitability of commercial lingonberry production in Wisconsin.

"The lack of available information on lingonberry production methods was one of the biggest challenges we faced," Mr. Cuddy said. "Most lingonberries are harvested wild, and the amount of published literature is small. The work funded by this project has added a great deal to the total information available about lingonberry culture, and we've had requests for information from Sweden, Estonia, Belorussia, Canada and many states outside Wisconsin. There is still much more we need to learn before this industry takes off."

The Cuddys evaluated 37 lingonberry varieties, including all of the commercial ones. They found five varieties that proved to be very vigorous and produced significant amounts of quality fruit, and another five that were less vigorous but produced quality fruit.

"We consider these 10 varieties to have good potential for commercial production in Wisconsin," Mr. Cuddy said. "Cool summers appear to be the key to growing lingonberries commercially."

"This project has provided the state with a solid foundation for the lingonberry industry to develop in Wisconsin," said Stan Shaw, administrator of the DATCP Marketing Division.

More information about the lingonberry project is available by calling the Cuddys at Rush River Produce, (715) 594-3648 or e-mailing cuddy@win.bright.net. More information about ADD grants is available by calling (608) 224-5136.

Wisconsin Department of Agriculture, Trade and Consumer Protection

Dairy 2020 gra

MADISON — Five Wisconsin farm operations and a rural business will receive a total of $16,375 in Dairy 2020 Program and Rural Economic Development Program grants for business development initiatives.

"These grants will help businesses expand and modernize their operations, which will greatly contribute toward healthy and vibrant communities all across Wisconsin. And this year's businesses are very deserving of this investment from the state," Gov. Tommy Thompson said Jan. 31.

The successful proposals are summarized below:

• Andrew Peterson and Rick Seefeldt, Eland, Marathon County, $2,500 Dairy 2020 grant.

Mr. Peterson and Mr. Seefeldt

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Lingonberry: Commercial Crop Option

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The lingonberry, a small, tart cousin of the cranberry, may provide some Wisconsin farmers with an alternative commercial crop and second profit center. Found wild in northern forests around the globe, lingonberry is known as the dry ground cranberry and is closely related to the marsh-grown cranberry.

As part of a state agricultural grant project, John and Theresa Cuddy of Rush River Produce identified several key climate characteristics of current lingonberry production areas. Lingonberries, which are a high-value specialty crop that could add significant income to Wisconsin agriculture, thrive in areas with a short growing season, cool summers, regular and moderate precipitation, and reliable winter snow cover.

"We believe lingonberries, as a commercial crop, have an excellent potential in certain regions of Wisconsin," John Cuddy said. "The Lake Superior shore areas, northern Lake Michigan and Door County probably offer the greatest potential for lingonberry production in the state. However, we feel lingonberries could be raised profitably in other areas of Wisconsin to the extent optimum growing conditions, including winter cover and cooler summers, can be mimicked by the producer."

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"This project has provided the state with a solid foundation for the lingonberry industry to develop in Wisconsin," said Stan Shaw, administrator of the DATCP marketing division. "Not only could lingonberries be a second profit center for some Wisconsin farmers, they also have a strong potential for export and value-added processing. As domestic production develops, Wisconsin could be positioned to take advantage of these market opportunities."

More information about the lingonberry project is available by calling the Cuddys at Rush River Produce at 715-594-3648 or e-mailing them at cuddy@win.bright.net. More information about ADD grants is available by calling 608-224-5136.

The ADD program is directed by the DATCP marketing division. Established in 1989, the program provides grants for new and innovative approaches to increase agricultural productivity and profits. The program has awarded $2.91 million for 157 projects and has generated about $60 million in economic growth for Wisconsin agriculture.