

Department of Agriculture, Trade and Consumer Protection
Division of Agricultural Development
Agricultural Development & Diversification Program (ADD)
Grant Project Final Report

Contract Number: 17093

Grant Project Title: Developing value-added products for the organic medicinal, culinary, aromatherapy and herbal markets.

Amount of Funding Awarded: \$8500

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1) What was the original intent of the grant?

- What did you want to accomplish with the grant?

The objective of the grant was to conduct field trials on five herbs that have high economic value and would grow in Wisconsin. Records were kept on cost of production, cultural and growth requirements, harvest methods, dry weight value and the value added by distilling the essential oils from these herbs.

- How was it expected to benefit Wisconsin Agriculture?

We expected to increase the opportunity for Wisconsin farmers to grow additional acres of non-traditional commodity crops and produce value-added products for the medicinal, culinary, aromatherapy and herbal markets.

- What makes this project work important or significant?

There is very little information available regarding high value alternative crops that could be grown to provide a better income for the Wisconsin Farmer. Income from the traditional row crop commodities is often barely above the cost of production. However, the market for medicinal, culinary, aromatherapy and herbal products are increasing at an annual 15-20% rate and demand for certified organic products are increasing 20-25% annually.

2) What steps did you take to reach your goal?

- What worked?

We had few problems regarding development of cultural methods. Blaine had developed cultural these for other herbs over the years and they worked for growing the five trial herbs.

- What challenges did you face?

The major problems we faced were weather related. Very cold temperatures without snow cover resulted in our having to replant some of the herbs after the first winter. Starting the plants earlier in the fall and heavy mulching would reduce this factor. The first summer after planting was very dry and some of the herbs were a total loss and had to be replanted. Irrigation and mulching would alleviate this problem. The second summer was cold and wet but the herbs produced well and good harvests were obtained.

- What would you do differently?
Start the plants earlier in the fall to get them established before winter and mulch them heavily to reduce winter kill. Mulch the plants again in the spring and plant the herbs in areas where irrigation would be available if needed during dry periods.
- 3) What were you able to accomplish?
 - What are the results from this project?
We were able to produce crops for all the herbs grown in the field trials. Please refer to the grower's guide for details or materials developed through project work. Minority employment was increased in order to care for and harvest the herbs.
 - Include any analysis of data collected or materials developed through project work.
Please refer to the growers guide for this information.
 - 4) What conclusions can you make based on project work and analysis of collected data?
All five herbs; basil, lavender, lemon balm, valerian root and black cohosh are suited for growing in most of Wisconsin. They are highly lucrative crops with potential income for the dry weight products ranging from \$817/acre/year for lemon balm to \$5663/acre/year for valerian root. When distilled, the value will be even higher. These prices are for certified organic products. It should be noted that specialized equipment was needed for producing some of these crops. Several of them also required hand weeding and harvesting.
 - 5) What do you plan to do in the future as a result of this project?
Once the distillation unit is completed and the dried herbs are distilled to extract the essential oils, the next step is to locate potential wholesale markets. After that, I plan to develop my own label for the finished products in order to eliminate the middle man and further increase profits. As market demand expands, I will contract with other growers because I will not be able to grow enough to supply the demand.
 - 6) What information or additional resources are needed to commercially develop this enterprise?
We have all the information we need to grow the herbs. The major need involves marketing to develop the demand for the finished product. We may need to contract with a marketing/advertising/public relations agency for this purpose.
 - 7) How should the agricultural industry use the results from your grant project?
The agricultural industry needs to first be made aware of the results produced by this grant. Growing herbs is best suited for the smaller farmer interested in a niche market. Some of the information is transferable to the growing of other herbs. At some point, it might be possible to form a cooperative with other growers in order to provide them with the use of the distillation unit for adding value to their marketing of these and other herbal products.

Because some of these specialty crops can only be grown in northern states, this will encourage other Wisconsin growers to enter these niche markets. It might also encourage out-of-state growers to invest in agriculture in Wisconsin.

Initially, funds were requested to host a field day to spread the word about the opportunity to grow herbs for the medicinal, culinary, aromatherapy and herbal markets. Due to the grant being downsized, this portion of the grant was eliminated. The information from this grant will now only be available on the Golden Sands Resource Conservation and Development website and through the DATCP reports. However, Bill Ebert plans to put out news release to various agricultural news sources. Blaine Tornow has also spoken in the past about growing herbs for these markets at the Upper Mid-West Organic Farming Conference in LaCrosse and at the SW Badger RC&D spring and fall conferences at Baraboo and he plans to continue his speaking endeavors.

Developing value-added products for the organic medicinal, culinary, aromatherapy and herb markets

Blain Tornow's Grower's Guide

Introduction

Support for this project was provided by a DATCP Agricultural Development & Diversification (ADD) Grant. The Golden Sands Resource Conservation and Development Office provided the administrative oversight for the grant. Principal investigators were Blaine Tornow, certified organic grower and Dr. Lyle Nauman, grant writer.

Project Objectives

Few of the traditional row crop agricultural commodities are consistently profitable for growth by the Wisconsin farmer. This project investigated the development of new sources of income by evaluating five certified organic herbs. There was a lack of reliable farm-level data for growing these herbs in Wisconsin. The specific objectives are:

- Determine the feasibility of growing five medicinal, culinary or aromatherapy herbs that have not been grown in this area before and determine their economic values.
- Investigate the value added marketing of essential oils using steam distillation or solvent extraction of the above herbs.
- Increase minority employment because of the need for hand weeding and harvesting
- Develop a growers guide for these herbs and make it available on the Golden Sands RC&D web site
- Increase the acreage and value of certified organic medicinal, culinary or aromatherapy herbs grown in Wisconsin
- Create opportunities for Wisconsin farmers to grow these crops

Basil

Basil (*Ocimum basilicum*) is an annual that is planted in early June and harvested the same summer in late July. Basil has many uses. As a medicinal it is a restorative, warming aromatic herb that relaxes spasms, lowers fever, improves digestion and is effective against bacterial infections and intestinal diseases. It is used internally for feverish illnesses (especially colds and influenza), for poor digestion, nausea, abdominal cramps, gastroenteritis, migraine, insomnia, snakebites and skin infections. The aromatic oil is used in perfumery and aromatherapy. As a culinary herb, the leaves and stems are used both fresh and dried with tomatoes and tomato-flavored dishes, in pasta sauces, (notably pesto), vegetables (especially beans, peppers, peas and eggplant), soups and stuffing for duck, cheeses, salads, salad dressings, in poultry dishes and in beverages.

The basil plant is erect and branched and reaches two to three feet in height. In the young tissues the stems are herbaceous but become woody as the plant ages. The normally bright green oval-shaped leaves can be red colored and vary in size depending on the form and variety. There are small white to purple flowers arranged in whorls on the raceme. Seeds are a grayish black color, oblong and about 1/16 inch long.

Basil grows best on a well-drained, light loamy soil rich in organic matter with a pH from 6 to 7. The growing site should be warm and sunny. The planting site should be well tilled and smooth. Although basil is cold sensitive (the tissue is injured if near freezing), we seeded the crop directly into the field in June after all danger of frost had passed and night temperatures exceeded 50 °F. It grows readily from seed, germinating within a week of sowing in moist, warm soil.

Basil is sometimes seeded in a greenhouse and transplanted into the field in late spring. For transplanting, sow the seed in peat or paper pots and allow about four weeks for growth before "hardening" and planting in the field. Basil can also be planted in plastic tunnels or covered with a thick loose mulch to protect them in case of a frost.

Because of the small seed and high light requirement for germination, sow seeds only about 1/5th inch deep and cover with a thin layer of sand. Optimum germination temperatures are from 68 to 87 ° F during the day and 59 to 78 °F at night. Seed the plants about seven inches apart with 12 inches between rows although this can be varied to meet the requirements of the machinery used to cultivate the plot. Plant approximately 1600 plants/1000 sq ft.

Basil needs a balanced nutrition program and fields should be fertilized with composted manure for certified organic growing. It grows with a fertilization plan similar to salad greens. Nitrogen at about 8-lbs/1000 sq ft is adequate for the first cutting but additional nitrogen may be needed for a second cutting.

We used both mechanical and “hand pulling” for weed control. Since the plant roots are shallow, considerable care must be taken to avoid injury to them. The plants are sensitive to drought and an irrigation system should be available as needed. Avoid over watering to prevent fungal diseases. Contact of water with the foliage can cause leaf spotting.

Aphids and thrips are common pests and viruses may attack the plants. A *Fusarium* wilt disease can kill the plants and if it contaminates the field, the area will not be able to be used for future basil production.

Although a second cutting might be possible, we only harvested once and took the entire plant because of the cool wet summer in 2004. In a “normal” summer, the first crop would be taken about 80 days after seeding, just as the first flowers begin opening. Cut about five inches above the ground to ensure enough of the plant will remain to provide a second crop. Harvest the second crop prior to the first fall frost or the cold temperatures will kill the plants.

For our 1.5-acre plot, beds were about 5 foot wide with 6 rows per bed. When harvested, 3 row ft. yielded 1 lb basil wet weight or 3 lb per 15 sq ft (7093 lbs/acre) or ½ lb dry weight per 18 sq ft (1210 lbs/ acre)

Our cost of production was \$1.75/lb dry weight (to wholesale at \$3.00 – 3.50 /lb dry weight (1210 X \$3.00 = \$3630/acre to 1210 X \$3.50 = \$4235/acre. Total cost of production dry weight/acre was about \$2117.50. Potential profit per acre could be \$1512.50 to \$2117/acre.

Lavender

Lavender (*Lavandula angustifolia*) is an aromatic tonic herb with a sweet scent. Medicinally it relaxes spasms, benefits digestion, lowers fevers and stimulates the peripheral circulation and uterus. It has antidepressant effects and is antiseptic. As a medicinal herb it is used internally for indigestion, depression, anxiety, irritability, tension headaches, migraine and for bronchial complaints (including tuberculosis). It is used externally for burns, sunburn, rheumatism, muscular pain, neuralgia, skin complaints, cold sores, insect and snakebites, head lice, halitosis, vaginal discharge and anal fissure. As an aromatic, the dried flowers are used in potpourris. The essential oil of lavender is used in bath soaps and powders, lotions, colognes, high quality perfumes and in aromatherapy. As a culinary herb the fresh flowers are crystallized or added to jams. The plants are used in bouquets and as an ornamental in gardens.

The lavender plant has short, densely branched stems that form a bushy shrub about 30 to 36 inches in diameter. Flowering shoots may grow from 12 to 16 inches long. The leaves are pubescent and grayish-green in color, 1 to 1.5 inches long and ¼ to ½ inch wide. The plant forms a deep, many branched root system. The flowers are violet to blue and the inflorescence is cylindrical in shape. The seeds are a shiny, brownish-black color and approximately 1/10th inch long and ellipsoid in shape.

Lavender is a cold sensitive plant that cannot survive without heavy mulching in areas where the winter temperature goes below 0 °F. Prior to planting in northern areas, the plants are started in the greenhouse for transplanting into the field after the threat of frost has passed. Lavender plants do best in light, well-drained soil with a pH from 6.5 to 7.5 in a very sunny area. The roots can extend up to 10 foot deep once established.

Propagation is by seed or cuttings. Seeding establishment is slow and germinates poorly and unevenly. Therefore, it is best to use cuttings since they root readily if exposed to misting and bottom heat. Tip cuttings are done in late spring before flowering or in late summer and they will root in 4 to 6 weeks and be ready to transplant in about 12 to 16 weeks. In zones 4 and 5, plant seedlings or cuttings in late spring or early summer. Plants should be 24 to 36 inches apart in the row with rows 30 to 36 inches apart.

Lavender is tolerant of poor soils and if a good cover crop is plowed down and some manure added before planting, no additional fertilization will be needed for the life of the plant, which is about 10 years. It requires a high pH, from 6.5 to 8.0, so lime may be required. Lavender requires full sun and very little water. During the first year, weed carefully because the plant is brittle, thereafter, you will probably only have to weed in spring and again in summer. Deer seem to avoid eating it and there are few pests or diseases that effect lavender.

Flowers are harvested starting in the second year when the flowers are in full bloom. The optimal time of harvest is only about 10 days in length. Harvest just under the first pair of leaves. It is dried in about 7 to 14 days and then crushed to separate the stalks from the flowers.

For our 1/5 acre plots, we planted on 6 ft centers with 3 rows/bed. When harvested, 4-row ft yielded 1 pound of lavender or 5 lb per 100 sq ft (2178 lbs wet weight) or ½ lb/ 100 sq ft (218 lbs/acre dry weight).

Total cost of production was \$6.00/lb dry weight (\$1308/acre) that would wholesale at \$10- \$12.00/lb dry weight (\$2180 - \$2616/acre). Potential profit could be \$872 - \$1308/acre.

We started lavender in the greenhouse and transplanted it into the plots after all danger of frost was past (early June). Once established, the plant will provide a harvest for up to 10 years. In north central Wisconsin, the beds must be heavily mulched in the winter to prevent winterkill. The above cost would be less in subsequent years unless substantial winterkill would require inter-planting.

Lemon balm

Lemon balm (*Melissa officinalis*) is an aromatic, cooling, sedative herb that lowers fever, improves digestion, relaxes spasms and peripheral blood vessels and inhibits thyroid activity. It has antiviral, antibacterial, and insect repellent effects. As a medicinal herb, it is used internally for nervous disorders, indigestion associated with nervous tension, excitability with digestive upset in children, hyper thyroidism, depression, anxiety, palpitations and tension headaches. Externally, it is used for herpes, sores, gout, insect bites and as an insect repellent. As a culinary herb, the fresh leaves give a lemon flavor to salads, soups, sauces, herb vinegars, game and fish.

Lemon balm is a small shrub that grows up to three foot in height and two foot in diameter. The leaves are ovate and toothed around the edges. The flowers are small to pale yellow and they bloom in the summer.

Propagation is by seed, cuttings or divisions. We planted the seed in late spring and it germinated in 10 to 20days. Thin to 12 to 18 inches in the rows and 24 to 30 inches between rows.

Lemon balm is a perennial that is hardy to Zone 3. It produces best in fertile soil with a pH of 5.0 to 7.0. The entire above ground portion of the plant is harvested when it is starting to bloom in early summer and again in late summer before the first frost. Because the entire above ground portion of the plant is harvested for years, it must be fertilized regularly, especially with nitrogen. It grows best with regular watering once per week. It can be grown in full sun or partial shade and is more succulent when grown in partial shade. It should be cultivated intensely the first year to reduce competition from weeds and to prevent problems separating the weeds from the lemon balm during the harvest. There are few pests or disease problems with lemon balm.

Lemon balm is harvested by hand and should be immediately dried with efforts made to avoid bruising. The leaf dries quickly in 4 to 7 days.

Our 1/5-acre plots were planted on 6 ft centers with three rows/bed. When harvested, 4 row ft yielded 1 lb lemon balm or 15 lb per 100 sq ft (6534 lbs/acre wet weight) or 1.5 lb per 100 sq. ft dry weight (653.4 lbs/acre dry weight).

Total cost of production was \$3.50/lb dry weight (\$2286/acre) which would wholesale at \$6.00/lb dry weight (\$3920/acre dry weight). Potential profit /acre would be \$1633.50 over a two year period or \$816.75/year. This value should increase in subsequent years because the plants will continue to grow for several years.

Valerian Root

Valerian Root (*Valeriana officinalis*) is a bitter, sedative, warming herb with a musty aroma. It calms the nerves, relaxes spasms, improves digestion, relieves pain and lowers blood pressure. As a medicinal herb it is used internally for insomnia, hysteria, anxiety, cramps, migraine, indigestion of nervous origin, hypertension and painful menstruation. An excess caused headaches, palpitations and stupor.

Valerian grows four to eight feet in height with a spread of one to two feet. The leaves are generally deeply divided into seven to ten segments and the stems are hollow. The flowers appear in summer and are white to pink umbel-like clusters. The roots are dark on the outside and white on the inside and form spindle like fibrous bunches.

We planted the valerian seed in the greenhouse for transplanting into the field in about 10 weeks in late spring. Field spacing was 12 to 15 inches in the row with rows spaced 24 inches apart.

Valerian is hardy to Zone 4 and grows best in a rich moist soil. Prepare the fields ahead of time with manure and a good cover crop. Extra nitrogen and phosphorous should be added before preparing the field for planting. Valerian will grow in areas too moist for many other plants and water is essential if the weather is dry. To increase root production, cut the flower stalks before flowering although we did not do this. It will grow in full sun or partial shade and does best with a pH of 6 to 7. Control weeds and cultivate when necessary until harvest in the fall of the second year. We used a root digger and then cleaned the roots well before drying for storage.

We planted on 6 ft centers with 3-rows/ bed. When harvested, 1.5 row ft yielded 1 lb of the root or 30 lb per 100 sq ft (13,068 lbs/acre) or 13 lb per 100 sq ft dry weight (5,663 lbs/acre)

Our cost of production was \$3.00/lb dry weight (\$16,988.40/acre) which would wholesale at \$5.00/lb dry weight (\$28,314/acre). Potential profit/acre could be \$11,325 over a two-year period or \$5663.50/year.

Black Cohosh

Black cohosh (*Cimicfuga racemosa*) is a bitter, tonic herb that soothes aches and pains, controls coughing, lowers fevers and stimulates the uterus. It is used internally for bronchial infections, menstrual and menopausal problems, labor and postpartum pains and for arthritic and rheumatic diseases.

The plant is a deciduous perennial hardy to Zone 3. It grows 12 to 30 inches in height with a 1.5-foot width. Each plant has one bluish green leaf with 2 to 3 leaflets. Leaflets are oval shaped and lobed and the flowers appear in mid to late spring and are star shaped and yellow green in color. They develop into a bluish-black fruit. The rhizome is dark and knobby. Black cohosh grows best in a humus rich, well-drained soil, preferable with shade. It is very slow growing. It is delicate when young and must be hand weeded.

Black cohosh seedlings were hand planted in the fall of 2002 and mulched for the winter. Spacing was on 18 to 24 inch centers with two rows/bed. We harvested at two years of age so it would yield even better if harvested in another year or two.

When harvested it yielded 45 lbs/ 100 sq ft. (19602 lbs/acre wet weight) or 4-½ lb dry wt/100 sq ft (1960.2 lbs/acre)

Our cost of production was \$4.00/lb dry weight (\$7840.80/acre) that would wholesale at \$9.00/lb dry weight (\$17,640.80/acre) Potential profit/acre could be \$9801.00 over a two-year period or \$4900.50/year.

Distillation Unit

This is a downsized custom built unit fabricated similar to a large mint distillation unit. However, it will be mounted on a trailer to allow movement of the unit to the area where the plants are being grown. It will have a 30 hp boiler and a 200 gal distillation vat. Paul Leverage is fabricating the unit. He was a mint grower and has many years of experience with building and operating these units.

Most of the parts have been purchased used and it is estimated that it will cost about \$12,000 for the parts and fabrication of the distillation unit. If built with all new parts, it would cost at least \$24,000.

With the 200 gal vat we will be able to process small to medium batches of different herbs. This will give us the flexibility to process small batches of high value crops efficiently. Processing can be 2-3 vats per day for high volume runs. The amount (dry or wet weight) that can be processed will vary with the herb being processed, the percent moisture in the herb and many other factors. We will have to wait until we have completed some distillation runs before the amount (dry or wet weight) that can be processed per run and the amount that can be processed per day can be provided.

The projected increase in value of the herbs processed through the distillation unit is a closely guarded secret within the industry. However, we believe it should increase the value by 75 to 100% or more. This will vary with the herb being distilled, with the final value of the essential oil, possibly even by each batch, etc. There are too many variables that are unknown at this time to provide any meaningful answers. We look forward to providing some answers after runs are completed this fall.

Summary

The primary purpose of this grant was to determine the feasibility of growing five medicinal, culinary or aromatherapy herbs that had not been grown in the area and determine their economic values. This information is to then be posted on the Golden Sands Resource Conservation and Development web site.

It appears that all five plants: basil, lavender, lemon balm, valerian root and black cohosh are all suited for growing in most of Wisconsin. They are also highly lucrative crops with potential income for the dry weight products ranging from \$817/acre/year for lemon balm to \$5663/acre/year for valerian root. These prices are for certified organic products. It should be noted that specialized equipment was needed for producing some of these products.

The above products have been dried and placed in storage until a distillation unit can be built. The essential oils will then be extracted and a new calculation of the potential profit/acre will be produced. There is a ready market for the end product, either in the dry weight form or as an essential oil. However, it is strongly recommended that a market for the end product be established before initiating the growing of these herbs.

Many other growers should consider the production of certified organic herbs. Although there is some learning involved in producing these products, the economic value is much higher than for more traditional crops. The irrigated Golden Sands area would be ideal for many of these herbs and there would be much less potential for pollution of the ground water if certified organic methods were used. They would be ideal for planting in the rotation between potato crops.

Table 1. Summary of potential economic return for five herbs (based on dry weight) grown under certified organic conditions in north central Wisconsin

<u>Species</u>	<u>Yield (dry weight/acre)</u>	<u>economic value/acre</u>
Basil	1210 lbs	\$1512 to \$2117
Lavender	218 lbs	\$872 to \$1308
Lemon balm	653 lbs	\$816
Valerian root	5663 lbs	\$5663
Black cohosh	1960 lbs	\$4900
