A Demonstration of Non-Traditional Crops for the Growing Health Market

(OSCIA Norfolk SCIA Major Grant)

Purpose:

To provide information to farmers on the establishment, management, and marketing of medicinal and culinary herbs for the health market.

1. Collect and share production information for more than 100 medicinal and culinary herbs.
   a) Establishment
   b) Fertility
   c) Pests
   d) Overwintering Potential

2. Identify the relative susceptibility of basil varieties to basil downy mildew, a new disease to Ontario, while at the same time, demonstrating on-farm research on non-traditional crops.

3. Identify and share marketing information for the health market.

Methods:

Herb and Non-Traditional Crop Demonstrations

A plot consisting of 117 non-traditional crops (140 including different varieties of the same herb) for the health market, including culinary herbs, medicinal herbs, and berry crops was established at the Simcoe Research Station in spring and early summer 2010. The 117 crops were:

Allheal
Andrographis
Angelica
Anise
Anise-Hyssop
Arnica
Ashwaghanda
Avens
Bai Zhu
Ban Xia
Basil
Bergamot
Betony
Black Cohosh
Bloodwort
Blue Cohosh
Borage
Burdock
Calendula
Catnip
Celandine
Centaury
Chamomile
Chinese Licorice
Chives
Chokeberry
Cilantro
Cinquefoil
Clary Sage
Cnidium
Codonopsis
Comfrey
Culantro*
Culver's Root
Curled Chervil
Dead Nettle
Dill
Echinacea purpurea
Echinacea angustifolia
Eclipta
Elecampane
Eucalyptus
Evening Primrose
Flowering Spurge
Gansu Rhubarb
Germander
Goji
Golden Alexander
Good King Henry
Gotu Kola
Haskap
Henbane
Hops
Horehound
Hyssop
Japanese Catnip
Joe Pye Weed

Lavender
Lemon Balm
Lemongrass
Lemon Verbena
Licorice
Liverwort
Lovage
Ma Huang
Marjoram
Marshmallow
Milk Thistle
Milkvetch
Moonseed
Motherwort
New Jersey Tea
Nodding Onion
Oregano
Parsley
Pennyroyal
Peppermint
Perilla
Pokeroot
Psyllium
Purple Foxglove
Red Baneberry
Red Sage
Rhodiola
Rosemary
Rue
Sadadhatura
Sage (Garden)
Sage (White)
Salad Burnet
Savory
Sheep Sorrel
Siberian Cocklebur
Skullcap (Baikal)
Skullcap (Virginian)
Solomon's Seal
Spearmint
Speedwell
Spicebush
Spikenard
Stevia
Stinging Nettle
St. John's Wort
Sweet Fennel
Tarragon
Thyme
Turtlehead
Valerian
Vervain
Virginia Mountain Mint
Vitex
Wild Ginger
Wild Yam
Wormwood
Yarrow
Yellow Bedstraw
Za'atar

*This species was planted, but was determined not to be culantro at a later date. It provided a good example of the importance of Good Plant Identification Practices when growing herbs.

The intent of the plot was to raise awareness of these crops and not to demonstrate the ideal agronomic practices of each because it would not be practical logistically. Average requirements for fertility and irrigation were supplied, and crops were monitored to determine which crops did not develop properly at these rates. The perennial herb crops were grown on black woven ground cloth to provide weed control, aeration, and water infiltration. The annual herb crops were grown on black plastic mulch for weed control. Forest herbs were grown under a black polypropylene shade cloth on bare soil covered with straw mulch. The straw mulch was required to provide winter protection to the root systems. The berry crops were grown on bare soil without a weed control barrier. All crops were drip-irrigated as required for average plant requirements. Crops were monitored and observations were recorded weekly for pest development, plant stage, and disorders.

On-Farm Research Demonstration Trials:

Prior to 2010, basil downy mildew, caused by the oomycete *Peronospora belbarhii*, was known to occur in the greenhouse, but not in the field in Ontario. Because this disease had been spreading across North America, a basil variety trial was established both at the Simcoe Research Station and at a grower site near Long Point, Ontario, to track the development of the disease, and to identify varieties that are less susceptible to this disease. The trial was also used to demonstrate how to do a replicated, on-farm research trial. Thirteen varieties were grown at the Simcoe Research Station and five of these varieties were also grown at the grower site. Both trials were arranged in a randomized complete block design with four replications and 5 plants in each replicate. Plants in all treatments were monitored and assessed weekly for damage due to basil

downy mildew. Another recently introduced pest of basil, the Japanese beetle, was also monitored at both sites.

Herb Open House

An Open House was held at the Simcoe Research Station in the afternoon of September 10, 2010 to introduce growers to the wide range of herbs that can be grown in Ontario and answer grower questions about the production of herbs. The Open House was advertised in OMAFRA newsletters and crop reports and through the OSCIA. Attendees were given a map of the demonstration plot along with a handout that provided some information on each herb such as traditional uses, origin, and harvest details. OMAFRA staff were on hand to answer any questions about herb production.

Results:

Herb and Non-traditional Crop Demonstrations:

Pests were the biggest production challenge in the herb plots, with 71 of 116 monitored crops having some form of insect or disease damage. Approximately 17 insect and 42 disease pests were observed, many of which attacked multiple crops. Thirty five of these pests (15 diseases and 10 insects) significantly impacted the quality or yield of at least one variety. The most serious pests were Japanese beetles, mites and sucking insects. Japanese beetles were observed in the plot from early July through mid September, where they fed on at least 14 different culinary and medicinal herbs, resulting in significant defoliation on basil, evening primrose, perilla and bloodwort. Sucking insects (specifically garden fleahopper, leafhoppers and aphids) and mites also had an extremely wide host range, affecting 29 and 15 different species of herb, respectively. Mites had a much more significant impact on the crop however, with 11 herbs suffering moderate to severe damage from mite feeding, compared to only 5 herbs suffering significant impacts from the sucking insects. The most important diseases included powdery mildew, Alternaria and downy mildew. A number of herbs were affected by a variety of fungal or bacterial stem or leaf blights which could not be identified. However in most cases these unknown diseases had only minor impacts on plant quality.

Main lessons learned from these demonstration plots:

1. While pests are often not a major issue for new crops, pests can be severe even in the first year of production and the crop should be continually monitored.
2. It is commonly assumed that herb crops, particularly medicinal herbs, do not have pest problems and in fact are often recommended to repel certain pests. In contrast, the herb demonstration plot has shown that pests can attack many herbs and can sometimes affect quality and yield.
3. Many tropical and subtropical crops could be grown as annuals in Ontario, especially in an extended growing season as occurred in 2010. It is not yet known whether this would be economically viable and would probably depend on having a market for locally produced product. Examples of tropical and sub-tropical herbs that grew well in the plot include: eucalyptus, lemon grass, perilla, sadadhatura, and lemon verbena.
4. Not all crops can be grown in Ontario. For example, rhodiola is multi-use herb that has become increasingly popular in recent years. It is adapted to sub-

5. While many of the herb crops performed well under the conditions provided, a number of herbs were not ideally suited to these conditions. Growers of new herb crops should experiment with different planting systems before growing them on a large scale.

The information gathered from observations of these demonstration plots are being compiled into crop profiles that will eventually be posted on the OMAFRA website in an interactive specialty crop module that will help Ontario specialty crop growers identify new opportunities. It is hoped that many of these profiles will be posted by summer 2012 once another year of observations have been collected. The demonstration plots will be in place until 2012 to track winter survival of the perennial herbs and record observations on plant growth and pest pressures under a wide range of weather conditions.

On-Farm Research Demonstration Trials:
Basil Downy Mildew Variety Trial

The results of the basil downy mildew variety trials are presented in Table 1. Basil downy mildew was first identified at the grower site on August 27 and at the Simcoe Research Station site on September 13. As a result of appearing 17 days earlier than the Simcoe site, disease severity was much higher at the grower site by the end of the growing season, causing nearly complete canopy destruction. Downy mildew developed around a few initial infection sites, resulting in high variability in both plots. Bush basil had higher disease severity than all other varieties due to a dense leaf canopy that limited airflow. It is likely that the high disease pressures at the grower site overcame any differences in susceptibility among the varieties. Overall, all Italian varieties (Sweet, Genovese, Bush and Purple) appear to be susceptible to the disease. Spice and Indian basil did not develop downy mildew at the Simcoe site. The Thai basil in the nearby herb demonstration trial also did not develop any symptoms of downy mildew. It is likely that the Asian and Spice basils are resistant to the disease. However, these are often not suitable replacements for the highly susceptible Italian varieties.

Japanese beetles caused considerable damage to many basil varieties at both sites. At the Simcoe site the highest damage occurred in the Nufar F1, Sweet Salad, Napoletano, and Superbo varieties. No damage occurred to Bush, Spice or Indian basil. At the grower site, Napoletano and Genovese had the highest damage. Based on these results, Italian varieties of basil are generally more susceptible to Japanese beetles than the other types, with Napoletano consistently having the highest damage. Among the Italian varieties the Japanese beetles appeared to have a distinct preference for certain varieties. However, it is unclear whether that preference is affected by the neighbouring varieties. For example, a Napoletano plant surrounded by Indian and Spice plants may be damaged more than the same plant surrounded by other Italian varieties. Japanese beetles also appear to prefer the highest branches in a given area, resulting in more damage to tall varieties when there is a mix of varieties.

These trials and the information gathered from them received much media attention in summer 2010. Articles about basil downy mildew that mentioned the research plots appeared in both the Toronto Star and Cottage Life Magazine. Results of this trial will be presented in both a HortMatters article about basil pests, and a poster presented at the Ontario Fruit and Vegetable Convention on basil downy mildew.

Table 1. Basil downy mildew and Japanese beetle damage ratings of 13 basil varieties grown at two sites in southern Ontario.

Variety	Basil Downy Mildew Percent of Canopy Damaged		Japanese Beetle Mean Damage Rating Over Season[z]	
	Simcoe Station	Grower Site	Simcoe Station	Grower Site
Sweet Group				
Sweet	1.1 a[y]	74.8 a	0.55 b-d	0.59 a
Napoletano	2.1 a	80.2 a	0.92 de	2.47 b
Medinette	2.2 a	74.8 a	0.03 ab	0.13 a
Sweet Salad	2.1 a	--	0.93 de	--
Nufar F1	0.2 a	--	1.32 e	--
Genovese Group				
Genovese	0.5 a	78.5 a	0.43 a-d	2.82 b
Martina	0.8 a	--	0.77 cd	--
Superbo	0.0 a	55.5 a	0.93 de	0.56 a
Bush Group				
Bush	18.6 b	--	0.00 a	--
Pistou	0.4 a	--	0.03 ab	--
Purple Group				
Rubin	2.4 a	--	0.37 a-c	--
Other Basils				
Spice	0.0 a	--	0.00 a	--
Indian	0.0 a	--	0.00 a	--

[z] Based on the mean ratings over the period that Japanese beetles affected the crop. Visual ratings based on estimated percent of canopy affected (0 = no damage, 1 = 1-20% of leaves damaged, 2 = 21-40% of leaves damaged, 3 = 41-60% of leaves damaged, 4 = 61-80% of leaves damaged, 5 = 81-100% of leaves damaged)

[y] Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test.

Herb and Non-traditional Crop Open House

In addition to the Open House held in September, 2010, the plot was open year round for guided tours. Over 100 people toured the plot during the Open House and over the summer including growers, natural health practitioners, OMAFRA specialists, staff from the Pest Management Regulatory Agency, and OSCIA members. An evaluation form was given to each participant in the Open House. Of the evaluations that were returned all of the participants were either satisfied or somewhat satisfied with the Open House

and most indicated that they were very likely to use the information provided at the Open House in the next few years. A much larger Herb and Non-traditional Crops for the Health Market Demonstration Day/Workshop is being planned for August 2011. Participants provided feedback and suggestions to help us plan the event.

Overall the comments submitted were very positive and helpful for the organizing committee.

Summary:

This project successfully met its objectives of educating growers on various aspects of herb crop production and on-farm research trials. The project also highlighted the challenges of growing these crops. In addition, the crop profiles being developed over the next few years will be a valuable resource for farmers in Ontario. Finally, this project laid the groundwork for future workshop and demonstrations on growing and marketing non-traditional crops for the health market.

Next Steps:

This project established herb demonstration plots that will be in the ground for the next few years. We will continue to monitor the crops for winter survival, pest pressures and crop growth under a wide range of weather conditions. Herb crop profiles will be developed for many of the herbs over the next two years. Funding has already been received to develop these profiles, along with crop profiles on non-traditional crops from the 2009 demonstration plots, into an interactive online module to help growers identify new specialty crop opportunities.

An herb and non-traditional crops for the health market demonstration day/workshop will be held in August 2011 with the herb demonstration plot as a centrepiece. The day will include a speaker program, industry networking event, and plot tours.

This project has provided valuable information to specialty crop growers on an area that has received minimal attention in recent years. The natural health product industry has expanded rapidly over the past few years, while the herb production industry has remained relatively stagnant. It is hoped this project, along with other demonstrations of non-traditional crops, will diversify agriculture in Ontario and help growers remain profitable and sustainable.

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