

The Economic Potential of Medicinal Plant Production with Particular Reference to Quebec

Ernest Small, Biodiversity, National Program on Environmental Health
Agriculture and Agri-Food Canada, Saunders Building
Central Experimental Farm, Ottawa, Ontario, Canada K1A 0C6

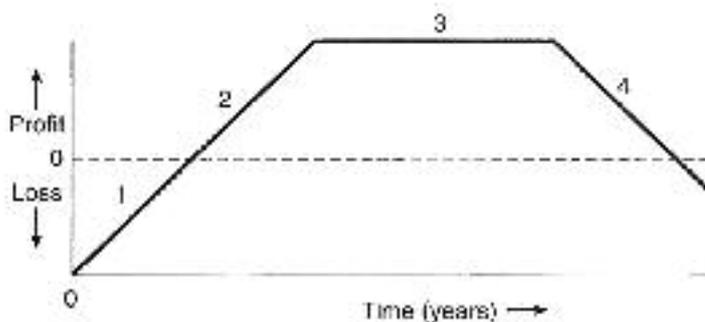
smalle@agr.gc.ca

for distribution at:

QuatriPme colloque de la FiliPre des plantes mdicinales au Quebec (26 mars 2004)

Introduction

Plants are the source of a large proportion of medicines. It has recently been estimated that there are about 400,000 species of higher or vascular plants (Govaerts 2001, Thorne 2002). While not all of these are equally useful, studies suggest that somewhere between a quarter and a third of all species have been used for medicinal purposes by indigenous societies. Deans and Svoboda (1990) suggested that there are over 20,000 medicinal plants; Torkelson (1995) lists over 4,000 scientific names and more than 28,000 common names of medicinal plants; and Duke (2002) provides detailed information on over 800 of the most important medicinal plant species. Despite these large numbers, relatively few species are cultivated commercially on a large scale, as is the case, for example, with ginseng, echinacea, and ginkgo. For medicinal plants, becoming commercially significant is not easy. The odds are about a thousand to one. A species needs to be very special in order to join the relatively elite club of important commercial plants. Fortunately, with common sense and enough background information, the odds of profitably growing medicinal plants that have not previously been raised in a given region are considerably higher than a thousand to one.



While this discussion focusses on the economic wisdom of expanding production of a specific class of crop (medicinal crops) in a specific province of Canada, it is very important to remember that this is an example of a general problem. The phrases "alternative crops," "replacement crops," "substitute crops," and "new crops" all relate to attempts to improve the profitability of farming by growing crops that have not been grown, at least recently, in a give locality. Most such crops are "minor," "specialty," "niche," "non-traditional," or "under exploited," at least initially in the region in question. There have been many analyses of the exercise of new crop introduction (see Small 1999). It is disappointing to learn that no one has yet found a reliable means of choosing new crops that will be successful. Nevertheless, by examining some aspects of new crop introduction, it is at least possible to make more informed choices and to avoid some problems.

Except in cases of monopoly, new offerings in the marketplace strongly tend to follow a characteristic life cycle of profitability, and it is extremely important that those investing in any new crop understand this. The figure provided here illustrates the trend in a hypothetical fashion. Phase 1 is the period of investment in research and development required to bring the new product to the point of profitability; most new products do not survive this period. During phase 2, the market for the product expands to the point of saturation, becoming more profitable. Phase 3 is a stable period of profitability, at the end of which decline occurs (phase 4). The most common cause of the decline in profitability is copy-cat competition, and the more profitable and popular a given product becomes, the faster competition develops. A frequent consequence of such competition is oversaturation of the market, the generation of surpluses, and business failures of those who remained dependent on the sale of the once profitable item. It really doesn't matter how good or important the product is

— even the cereals upon which the world depends have become questionable investments because of surplus production. (The profitability life-cycle diagram is pessimistic in suggesting that every crop will eventually become unprofitable, but there is an escape from this fate: research leading to new cultivars and new uses.)

Echinacea is presently at the end of phase 3, and has entered phase 4. For those who are already growing it, there are still profits to be made, but it is a bad idea for new investors to start growing echinacea. Because of its formidable reputation, however, there are still many who want to jump on the echinacea bandwagon.

For every crop, there is an ideal number of producers. Too little production means that insufficient material can be placed on the market to sustain interest. Too much production means that prices are depressed and profits decrease. In addition to the need for there to be a balance between production and the marketplace, there are also minimum needs for specialties associated with post-production aspects. For many new crops, limitations of processing and/or storage facilities are critical bottlenecks. Often, storage and processing capacity exists, but is remote from the sites of production, so that transportation is the problem. Ideally, there is balance among producers, processors, and marketers, as has generally developed for major, established crops and crop products. Almost inevitably, the development of new crops is accompanied by growing pains, and very often there is a period of several years during which some, who were enthusiastic initially, abandon the enterprise.

Frequently a key to success of a new crop is the backing of an influential manufacturer or retailer, which can result in sufficient market exposure for the merits of the product to become widely appreciated. Certainly supportive producer and marketing organizations are helpful, if not indeed indispensable.

Why New Crops May Not Be Good Investments

Too much optimism is as bad as too much pessimism. In the following, a general case against new crops is made, simply to emphasize the potential hazards. Farmers are conservative, that is, they put great faith in what experience has taught is successful. This is common sense, because changes are normally risky, and so much can go wrong in farming that taking unnecessary risks is foolish. Farmers are comfortable with crops that they have grown for years, are adapted to their soils and machinery, and for which there are established markets. For very similar reasons, processors, marketers and others in the agri-food industry are reluctant to embrace change for change's sake. For example, it is much easier to conduct business when local, national and international markets are well known. New crops or commodities made from them must penetrate the existing marketing or industrial infrastructure, and this is usually beyond the control of farmers contemplating the new crops. There are several key potential negative financial consequences that can result from getting into new crops:

1. The economic gamble may be lost: new crops chosen may turn out to be less profitable than the old crops.
2. Long-term lack of profit: successful new crops often require a lengthy period of development and commercialization before any profit is realized.
3. New crops may simply displace old profitable crops, with no net profit.
4. Copy-cats may adapt the crop to their circumstances and out-compete those who have established it, limiting the period of profitability.

Seeking new crops is simply an economic decision that the risk of continuing to rely exclusively on traditional crops is probably not as wise as trying new ones.

Questions to Ask Regarding Development of a New Crop

1. What demand is being met?
2. Who will grow it?
3. Who will process it?
4. Who will sell it?
5. Who will buy it?
6. Who will consume it?
7. What commodities are being replaced?
8. On whose toes will you be stepping?
9. Who should pay for the development costs?
10. Can intellectual property be protected?

(For a much more sophisticated set of questions to ask in undertaking new crop initiatives, see Fletcher 2002).

Special Investment Problems with Medicinal Plants

Most medicinal species that might seem worth developing as new crops are undomesticated. These often have a

limited yield, mature irregularly, are very variable, aren't suited to current planting and harvesting machinery, or present many other problems. Seeds are often difficult to obtain. Expertise and knowledge is often in very short supply (and often are regarded as trade secrets). Plant breeding may be necessary, management techniques will have to be developed, and markets will have to be located or developed. From time to time, popular medicinal herbs are found to contain toxic constituents, and they lose their popularity, or are even prohibited by government. The cyclical popularity of the herbal market is a major problem, and an investment can be greatly lowered in value in a short period.

For a novice, without farming experience, getting into medicinal plant production is a dangerous decision. For an experienced farmer who has not previously dealt with medicinal plants, it would be wise to not bet the family farm on medicinal plants alone.

In the last 3 years, the medicinal plant over-the-counter industry in North America has experienced reduced sales, particularly because of bad publicity arising from quality issues. The industry is currently attempting to overcome these problems. It might seem that this is not an ideal moment for investment. Conversely, however, just as sophisticated stockbrokers buy when they think the market has bottomed out, this may be exactly the ideal time for investment!

Are There Other Classes of Plants that Represent Better Investments than Medicinal Plants?

The answer is "it depends." It depends on such factors as suitability of land and machinery, and background and expertise of the farmer. One investment area that has proven both profitable and long-lived is the production of outdoor ornamentals, including turfgrasses, native shrubs, and planting stock for the home trade. The production of specialty mushrooms is another very promising area in Canada. The greenhouse trade in tomatoes, cucumbers, and some other popular vegetables is very profitable in southern Ontario, but Quebec probably cannot exploit this area to the same extent because of the colder climate. Government-sponsored experimental greenhouse culture of some tropical medicinal plants has occurred recently in Canada, for the purpose of developing a greenhouse medicinal plant industry, but common sense suggests that greenhouse production is just too expensive to be reliably profitable. In various regions of Canada, there is production of specialty vegetables for ethnic populations in nearby cities, and the possibility exists of developing this area, at least for the cosmopolitan city of Montreal. One would have thought that climatic limitations would preclude the development of a wine grape industry in Quebec, but well-motivated growers have already proven otherwise. Still another area that might not spring to mind is marine plant resources. Canada's and indeed Quebec's marine environment is much less polluted than many countries that specialize in algal resources, and there is great potential for utilization of algae and algal products for human, especially medicinal use.

Wildcrafting

Wildcrafting (collection from wild-growing plants) can often be done profitably because of low investment costs. In fact, most of the world's medicinal plants are simply gathered from the wild, and in Canada more than half of medicinal plants are wildcrafted. Indigenous Peoples of Canada have long had a special knowledge of native medicinal plants, and a tradition of wildcrafting. Government funding is sometimes available in support of developmental projects associated with medicinal plants collected by Indigenous Peoples. Plants that become commercially popular tend to be overcollected from the wild, and it is appropriate to then develop a cultivated supply.

Canada Yew: Example of Sustainable Large-scale Wildcrafting in Quebec

In Canada, perhaps the best example of responsible management of a native medicinal species that has become extremely attractive for wild harvest is Canada yew (*Taxus canadensis* L.), also known as ground hemlock and American yew. This evergreen shrub grows from Newfoundland to southeast Manitoba in Canada, extending into Kentucky and West Virginia in the United States. Like its more famous relative Pacific yew (*Taxus brevifolia*), it is a source of the very effective anti-cancer agent taxol. Since the wild supply of Pacific yew is insufficient to meet the demand for taxol, Canada yew has recently become a new, important source. Realizing that overexploitation of the wild supply of Canada yew could occur, analyses were conducted in Canada to establish sustainable harvesting levels. The United States also requires that supplies for pharmaceutical use come from sustainable harvesting operations. In Quebec, the biotechnology firm Bixel Pharma has been granted exclusive harvesting rights to Canada yew on public lands. This example raises the issue of undertaking a deliberate search for other medicinal species of the Quebec flora that could be the basis of similar major industrial initiatives.

Wild Leek (Ail des bois, *Allium tricoccum* Solander): a Quebec Example of Conflict Between

Conservation and Economic Objectives

(based on Small, Cayouette and Catling 1999)

The edible bulbs of wild leek are widely harvested by wildcrafters and there is some commercial trade. Tons of bulbs harvested from the Appalachians are sold in the US Northeast. Medicinally, Indians used the herb in decoctions to treat coughs and colds, and prepared a poultice from the juice of the bulbs to treat the pain and itching of insect bites and stings. The Chippewa employed boiled wild leek to induce vomiting, the Iroquois ate it as a spring tonic and to rid children of intestinal worms, and the Cherokee consumed it as a mild laxative. There have been several recent pharmacological studies of *A. tricoccum* in connection with its potential use as a medicinal herb, particularly with regard to breast cancer. Many southern Appalachian communities have “ramp festivals” from mid-March to mid-April, and it is widely believed that the plants are a spring tonic. Wild Leek undoubtedly possesses many of the medicinal virtues of its cousin, garlic, but is used today exclusively as a culinary herb. In Quebec, millions of newly harvested bulbs were widely available at roadside stands until recently. However, northern populations reproduce slowly (taking an average of 10 years from seed to production of a flower) and depend heavily on clonal reproduction, so that bulb harvest represents a serious threat to survival. In Quebec, it has been estimated that harvesting only 30% annually of the large plants dooms a colony of average size to extinction in 25 years. In 1996 most Quebec populations were already too small to support further harvesting without imminent extinction. Wild Leek is concentrated in heavily populated areas of southern Ontario and Quebec, where habitat destruction has occurred, endangering survival. Further, road building has increased accessibility. Some harvesters have been known to virtually wipe out populations by collecting everything in sight; others doom populations to extinction by harvesting all of the large plants. A fifth of Quebec’s known populations have disappeared in recent times. Thanks to two decades of campaigning and research by Quebec botanists such as Andrée Nault and Daniel Gagnon, Wild Leek became the first species to be designated “Threatened” (=“Vulnerable” in French) in the province, in legislation which forbids any form of trade in the plant, and provides for fines of up to \$40,000.00. However, collection of small quantities in Quebec for personal consumption (no more than 50 plants or bulbs annually) remains possible. The possibility of cultivating wild leek has been explored, especially in Quebec since legislation has forbidden commercial exploitation of the wild source. Cultivation has not been authorized in Quebec because of fear that in the marketplace one could not distinguish legally cultivated from illegally collected wild material. Perhaps a permit system for farmers along with heavy fines for commercial harvesting of wild plants is an appropriate solution. Some wild plants have been saved from extinction by providing a cultivated supply. The potential profitability of cultivation is indicated by some estimates of commercial trade in Quebec of the wild plants exceeding \$500,000 annually in the early 1980s. Wild leek is an extremely attractive culinary novelty that also has medicinal potential, and with such obviously high sales potential and profit margin, it should be developed agriculturally.

Woodland Cultivation

Numerous medicinal species occur in woodlands as slow-growing perennials. Many of these plants have evolved toxic chemicals to defend themselves against insects and other life forms and, as is so often the case, these chemicals have proven to be useful as medicinal agents. Quebec is blessed with abundant woodlands, and there is great potential for cultivation of medicinal plants in woodlands. However, concern has been expressed that woodland cultivation could disrupt and harm natural ecosystems and also affect the survival of rare species (see *Recommandations concernant la culture ex situ d'espèces sauvages menacées et leur réintroduction dans des populations naturelles* at http://cps-skew.ch/francais/recommandations_exsitu_reintroduction.htm; also see Lamoureux and Nantel 1999). This is an excellent area for investment in research. It should be possible to develop sustainable ways of growing medicinal species in at least some classes of woodlands. There are obvious economic advantages, since investment would be much less than in strictly agricultural production systems.

Organic Production

Depending on crop, organic production may add appreciable value to a crop (in North America, organically produced crops often are sold at 15 to 20% higher than the non-organic counterpart). In some cases, organic crops may be demanded by a wholesaler or processor. Certainly organic production offers North Americans a great advantage over much of the Third World medicinal plant supply, whose certification as organic is sometimes not reliable.

Government Support

There are several good reasons why governments should support investment in the medicinal plant industry with particular regard to the establishment of cooperative producer/processor/retailer networks (as discussed below). First, traditional agriculture in Canada is having difficulties, and there is a great need for initiative that involve new crops and new products. Second, medicinal plants are mostly obtained in rural settings—both from

wild plants and from plants cultivated on small farms—and the need is well recognized for governmental initiatives that encourage rural development in a sustainable fashion. Third, the medicinal plant industry is part of an international health industry of huge economic scope, and with the potential for considerable development. Fourth, private sector interest alone is often insufficient to initiate or expand projects such as the medicinal plant initiative suggested, and government funding is needed as a catalyst. And fifth, government backing for tobacco replacement crops is very high, and medicinal plants are extremely good candidates, often making good use of the harvesting, preparation, drying, and storage facilities once used for the tobacco.

A regular problem with government support is its availability over a sufficient number of years until a new industry initiative has advanced to the point of self-sufficiency. Realistic planning is important in order to not begin projects that do not have a reasonable chance of success because funding will only be available for a limited period. The enthusiasm for crop diversification programs at both the federal and provincial levels in Canada, as well as in the agri-business community, is very strongly determined by the current degree of severity of crop surpluses. That is, when there are unsold surpluses of major crops, governments tend to support the search for alternative or new crops. Of course, when the status quo regarding crops is unsatisfactory, it is especially sensible to search for new crops. However, as a matter of strategic policy, it is extremely important to conduct long-term research to find and develop new crops, since major crops, indeed all crops, inevitably encounter downturns.

Another problem with obtaining governmental support is encountered when a phrase like “traditional medicines” (which is an accurate description of medicinal plants) is employed. This often conjures up a boring image that does not attract the interest of politicians, who want to be seen as supporting new, innovative, exciting research and development. Curiously, the word “medicine” in “medicinal plants” seems to provoke discomfort in some government officials whose task is the evaluation of proposals for assistance. Far better is the phrase “natural health products.” Such simple considerations of language can make the difference between receiving governmental approval, or being denied assistance.

Big Is Not Necessarily Better

Numerous entrepreneurs in Canada operate small businesses of which medicinal plants are a substantial component. These entrepreneurs are often part-time wildcrafters and/or small farmers, who prepare medicinal products (salves, oils, capsules) etc. as a cottage industry. While profits are often limited, job satisfaction is often very substantial, and such individuals often express the viewpoint that they choose not to expand because increasing their work load would detract from their already fulfilling lives. In a world that seems increasingly dedicated to maximizing profits, this old-fashioned view that a relatively simple life is preferable is one that deserves respect. At least some people associated with the medicinal plant industry seem to have found a way of life that doesn't need to be improved or expanded.

Value-addition and Partnerships as Key to Profitability

Producing crops for society is an honorable activity. So is gathering materials from the wild for the use of society, provided that it is done in a sustainable fashion. Nevertheless, the majority of farmers and those involved in collecting plant materials from nature do not receive much money for their efforts. For the small farmer, there is often little money to be made in simply producing crops, and the same is true for those who simply collect materials from wild plants and sell directly to wholesalers. By contrast, profit margins tend to be much larger in processing/value added and retailing aspects of the industry. This is the most important factor when considering future investment in production of medicinal plants. It is not easy for farmers to get involved in the profitable areas of the industry. Farmers are not usually skilled in adding value to a crop and retailing it, and often this requires substantial investment capital. The key to success lies in partnerships. Producer cooperatives and partnerships with processors and retailers are very desirable in order to increase profits. Of course, all business development involves risk, and whether or not a cooperative/partnership venture is justified needs to be evaluated for its investment merits.

Government and university laboratories often provide tissue chemical analyses for a cost, as well as advisory crop services. Access to such services is often cheaper when done on a group basis, and this is an important advantage of cooperative/partnership arrangements.

Production equipment is often expensive, and can be shared in partnership arrangements.

Building a cooperative network among producers, buyers, and researchers may be a key to development of the medicinal plant industry in particular regions.

What Crop Should I Grow?

Except on an experimental basis, planting a crop on speculation that a buyer will be available is a bad idea. The best crop to grow, at least in the short term, is one for which the grower already has a buyer who will purchase that crop at a price that provides a reasonable profit. For long term considerations, it may be advantageous to consider a range of alternative crops, and in some cases these may be medicinal plants. There is no good way of judging how profitable a new medicinal plant species may become, but in the following some desirable characteristics are pointed out.

Who Should I Believe?

When you know very little about a crop, it is easy to be convinced that it is a good investment possibility. It would seem that experts would provide the best advice, but when it comes to new crops, this is often not the case. Those who have specialized in research on a given plant, particularly government and university researchers, tend to develop an exaggerated opinion on the potential value of the crop. The very best way to search for new medicinal crops is to network with people and organizations that are concerned with these, and evaluate a range of opinions regarding the merits of particular potential new crops. Attending meetings of societies with interests in the subject, and keeping up to date on the relevant literature, are key to learning information that will be helpful to making decisions.

Ginseng

American ginseng (*Panax quinquefolius*) is the most important medicinal crop in Canada, and indeed no other medicinal plant approaches its value. However, most of the crop is exported to China, and now that China has learned to grow American ginseng, Canada's ginseng export market could be facing a major problem. Investing in the production of more North American ginseng may therefore not be a good idea at this time. It is advisable to develop the North American ginseng products market using Canadian ginseng, since most ginseng products consumed in North America are made with Asian ginseng. This may be a key to the future of the ginseng industry in Canada.

Some Chinese Medicinal Plants Have Become Popular. Should I grow Them?

Generally not. The only meaningful advantages of growing most Asian medicinal plants as crops in Canada are to ensure organic production and quality control. Asian plants are already grown so cheaply and efficiently in Asia that a long-term investment in them in Canada is unlikely to be repaid.

Curiously, Ginkgo (*Ginkgo biloba*), a native of China, has been very successfully developed as a plantation medicinal crop outside of China (Small and Catling 2002). With the rise of medicinal usage of ginkgo leaf extracts in western culture, trees began to be cultivated in orchards for harvest of leaves in Europe (starting in 1982 in Bordeaux, France), and in the United States in the 1990s. The world's largest plantation, occupying 4856 ha (12,000 acres), is in Sumpter, South Carolina, and is owned by a German company. The South Carolina plants are cultivated in extremely high density (40 cm or 1.3 feet apart), and kept very short to make mechanical harvesting of the leaves easy. Most of the ginkgo leaf used to manufacture ginkgo medicinal preparations comes from the South Carolina farm. The extracts are prepared in Germany, and are the main source of ginkgo medicinal preparations in North America. The reasons why ginkgo has been successfully developed as a medicinal crop outside of China despite competition from the Chinese (who also supply some of the ginkgo in international trade) are not evident.

Avoiding Crops That Easily Produce Large Amounts of Product

Alfalfa illustrates the point of this section. Alfalfa is one of the top-ten medicinal herbs in sales in the United States. But it is so easily grown, and harvested in such massive amounts, that it would be foolish to try to make a living just by growing alfalfa for the medicinal market. By contrast, ginseng is so successful in part because it takes a tremendous investment in time, money, and resources in order to generate a relatively small amount of product. Wasabi (Japanese horseradish, *Wasabia japonica*) is an interesting spice/medicinal crop that has only recently begun to be grown in Canada. It requires very special hydroponic and temperature regulation, and like ginseng, needs great investment in time, money, and resources in order to generate a small amount of very expensive product (for which there is fortunately a very large potential market). Essential oil crops (a well-developed industry in Quebec) tend to be good investments for the same reason.

Adaptogens: a Desirable Area of Medicinal Plant Investment

A mystique often is important to the commercial success of medicinal plants, regardless of whether or not modern science has demonstrated that a medicinal plant is actually effective. In this regard, "adaptogens" offer relatively good long-term investment opportunities. The term adaptogen was used by Russian pharmacologists, starting with N.V. Lazarev about 1947, and popularized by his student, I.I. Brekhman. Adaptogenic

plant-derived, legal, drug preparations have been credited with improving the performance of elite Russian sports figures and cosmonauts. An adaptogen has been defined as a substance that is “innocuous, causing minimal physiological disorder; non-specific in action, increasing resistance to the adverse influences of a wide range of physical, chemical and biological factors; and capable of a normalizing action irrespective of the direction of the pathological change.” The validity of the concept of an adaptogen has been debated, and much of the supportive research to date does not provide unbiased and unequivocal evaluation. Nevertheless, adaptogenic plants are increasingly being used medicinally in response to stress-generated maladies that are becoming more common in western society. The world’s best known adaptogens are ginseng (certain *Panax* species) and Russian ginseng (*Eleutherococcus senticosus*); other highly touted adaptogenic plants include roseroot (*Rhodiola rosea*), schizandra (*Schizandra chinensis*), and the mushroom reishi (*Ganoderma lucidum*). Devil’s club (*Oplopanax horridus*), native to Canada, is another example (see Small & Catling 2000). Whether “immune-boosters” such as echinacea fall into the category of adaptogens is open to interpretation.

Annuals vs. Herbaceous Perennials vs. Woody Perennials

This is not a major issue, but deserves mention, because there are marketing implications. Annual plants must be sold in the season they are grown, and normally should not be sown unless they have been pre-purchased. Perennial plants can be sold over a longer period, so there is more possibility of selling when market prices are higher. Shrubs (such as Russian ginseng and sea buckthorn) produce over a very long period, which is desirable, but they represent a more permanent investment, and if the market drops disastrously for a prolonged period, the land occupied represents a large loss of investment opportunity.

Root Harvest vs. Stem Harvest

This is also not a major issue, but relates to the efficiency of a farming operation. As a rule, it is wise to grow a number of medicinal species, since the success of most of these often varies. If all are root crops, then equipment that harvests roots can be used for all of them, and vice-versa.

Hedging Bets: Investing in Medicinal Plants That Are Also Used for Other Purposes

A crop that produces products with a range of applications can offer better long-term market potential than a crop that is useful for only one application. Sea buckthorn (*Hippophae rhamnoides*), a crop currently under development in Canada, is an excellent example (Li 2003). The main medicinal sea buckthorn product is oil for medical and cosmetic purposes, which has been incorporated into commercial ointments for treating a wide variety of types of skin damage, including burns, bedsores, eczema and radiation injury. (The presence of essential fatty acids, which are important for the maintenance of healthy skin, likely accounts for some of the value of the oil as a skin conditioner, and provides a rationale for use of the oil in sun care cosmetics.) In addition, sea buckthorn berries make very tasty juice (used alone or in blends), jellies, marmalades, sauces, and liqueurs, and so a second area of potential profitability is available. It should be emphasized that there are numerous species of shrubs that produce berries (e.g. aronia, elderberry, rose) which also have potential for dual usage for food and nutraceutical purposes, and that many of these are adapted to the climate of Quebec.

Demographic Trends

The population is generally getting older in Western countries, including Canada and the United States, increasing the potential market for medicinals that treat conditions associated with aging. Medicinal plants with products related to aging women would seem to be particularly good investments (women are more inclined to become knowledgeable about, and use herbal products). Black cohosh, *Cimicifuga racemosa*, for example, is used for “women’s complaints,” particularly as a replacement for estrogen replacement. Similarly medicinally-cosmetic plants are also promising (for example gamma-linolenic-acid seed-oil sources, such as evening primrose, borage, and hemp; GLA is known to improve skin conditions). It has been argued that the hectic pace of modern society increases the attractiveness of herbs used as calmatives (nervines).

Medicinal Plants for Livestock and Pets

Of course, humans are animals, so it should not be surprising that veterinarians have been prescribing plant drugs for livestock at least as long as doctors have been doing the same thing for people. Nevertheless, it does seem somewhat surprising that a popular movement has arisen for pet usage of plant medicines, just as for humans. There are now books on how to treat one’s pets with over-the-counter herbals, and lectures by people specializing in this area are well-attended. Those dealing with the medicinal plant industry, therefore, would be wise to keep this special market in mind. At present, medicinal use of herbs for animals is governed by Health Canada, and these regulations need to be kept in mind.

The Advance of Science and the Implications for the Medicinal Plant Industry

The discussion to this point has addressed only medicinal plants that are grown or collected from the wild for conventional herbal preparations or extracts. Genetic engineering is in the process of altering conventional crops so that they can be used as chemical factories for the production of desired medicinals. In the short term, hostility to genetic engineering is likely to delay these developments to some extent, but in the long term, it is inevitable that the medicinal plant industry will be affected. Even without genetic engineering, advances in vat culture have made the collection of some medicinal plants obsolete. Progress in tissue culture techniques also may be expected to lessen the value of some medicinal plant species. Even more significant is the continuing trend for synthetic pharmaceuticals to replace medicines based exclusively or partly on natural plants. A decade ago, there was a great resurgence of interest in natural medicines because of failures of conventional pharmacology to provide cures at reasonable prices. “Nutraceuticals” or nutritionally-desirable food extracts are now competing in the marketplace for those interested in relatively cheap “natural” health care products. It is by no means certain that, in the long term, traditional plant medicines will continue to attract a substantial proportion of the public, as is the present case.

Conclusions

1. There is potential for increasing the size and profitability of the medicinal plant industry in Quebec.
2. Investing in the medicinal plant industry is relatively risky by comparison with investing in some other crop development ventures. Experience in the industry is desirable, and thoughtful, long-term planning is necessary.
3. Governmental support for the medicinal plant industry in Quebec is strongly justified and may indeed be essential for continued development and expansion.
4. As with other business ventures, careful planning is essential to increase the probability of success of an expansion of the medicinal plant industry in Quebec.
5. Key to the profitable future of the medicinal plant industry in Quebec is emphasis on the development of producer-researcher-processor-retailer cooperatives and networks.

Literature cited

- Deans, S.G., and Svoboda, K.P. 1990. Biotechnology and bioactivity of culinary and medicinal plants. *AgBiotech News Info.* 2: 211–216.
- Duke, J.A. 2002. Handbook of medicinal herbs. 2nd edition. CRC Press, Boca Raton, FL, USA. 936 pp.
- Fletcher, R.J. 2002. International new crop development incentives, barriers, processes and progress: An Australian perspective. Pages 40–64 in *Trends in new crops and new uses*. Edited by J. Janick and A. Whipkey. Ash Press, Alexandria, VA.
- Govaerts, R. 2001. How many species of seed plants are there? *Taxon* 50: 1085–1090.
- Lamoureux, G. and P. Nantel. 1999. *Cultiver les plantes sauvages sans leur nuire*. Fleurbec éditeur, Saint-Henri-de-Lévis, Québec. 80 pp.
- Li, T.S.C. and T. Beveridge. 2003. Sea buckthorn (*Hippophae rhamnoides* L.), production and utilization. NRC Press, Ottawa. 133 pp.
- Small, E. 1999. New crops for Canadian agriculture. Pages 15-52 in *Perspectives on new crops and new uses*. Edited by J. Janick. ASHS Press, Alexandria, VA. Available on Web:
 Part 1: <http://www.hort.purdue.edu/newcrop/proceedings1999/v4-015a.html#canola>
 Part 2: <http://www.hort.purdue.edu/newcrop/proceedings1999/v4-015b.html#grasspea>
- Small, E. et P.M. Catling. 2000. Les cultures médicinales canadiennes. CNRC-NRC, Ottawa. 281 p.
- Small, E. and P.M. Catling. 2002. Blossoming treasures of biodiversity: 7. *Ginkgo biloba* - brain food from a living fossil. *Biodiversity* 4(1): 29-31.
- Small, E., J. Cayouette, and P.M. Catling. 1999. Poorly known economic plants of Canada - 22. Wild leek, *Allium tricoccum* Solander var. *tricoccum* and var. *burdickii* Hanes. *Bull. Can. Bot. Assoc.* 32: 39- 42.
- Thorne, R.F. 2002. How many species of seed plants are there? *Taxon* 51: 511–512.
- Torkelson, A.R. 1995. The cross name index to medicinal plants. CRC Press, Inc., Boca Raton, FL, USA. 3 vols.