Cultivation of American ginseng (*Panax quinquefolius* L.) in the understory of a sugarbush

Foreword

Through a program called "Improvement and Development of Sugarbush Resources", professional foresters and researchers of the Faculty of forestry (*Université de Moncton, Campus d'Edmundston*) have tested different cultivation methods of the American ginseng, a native plant species found in hardwood stands in Eastern North America. Unfortunately, the overharvesting of this plant in the 1700s, due to its worldwide demand almost caused the disappearance of the plant. This technical guide offers an overview of how to cultivate American ginseng in the understory of a sugarbush.

Why cultivate Amercian ginseng?

Medicinal properties of the root:

- Reduction of stress and fatigue;
- Reinforces the immune system;
- Improves short-term memory;
- Regulates arterial tension, cholesterol levels and glycimia.

Salability of the American ginseng:

- An agroforestry product that has an excellent established market. Requires very little marketing effort;
- American ginseng cultivated in a natural environment (understory of a sugarbush) is of higher quality than if produced intensively;
- Can become an attractive income supplement.

Risks associated with cultivation of American ginseng:

- Cultivation is risky and very demanding;
- Success rates are very variable;
- Need to follow instructions carefully, if not there is a high risk of failure;
- North-Western NB is in the northern limit of its range;
- Management of American ginseng crop is very time consuming.

To better understand the American ginseng

Name: Amercian ginseng **Latin name:** *Panax quinquefolius* L.

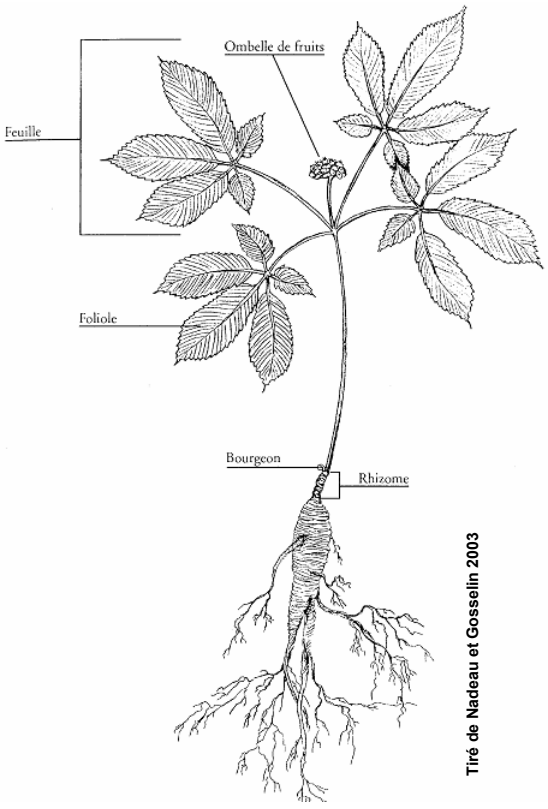
Stem: Height varies with time: 1st year, stem grows to approximately 5 cm; can grow from 20 to 70 cm after several years.

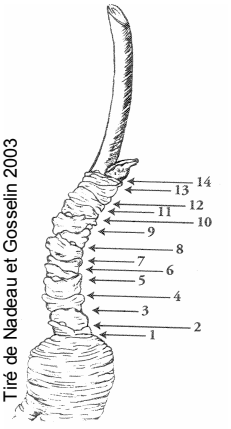
Leaves: Maximum of 4 leaves, each composed of 5 leaflets. All leaves do not appear in the first year. It is acquired over time.

Flowers: 6 to 20 small flowers on an umbel, greenish white in coloration. Flowers appear in spring.

Fruits: 6 to 20 greenish to red berries on an umbel**.**

Roots: The roots grow slowly each year until maturity at around 8 to 10 years in a natural environment. At maturity, the carrot type root is approximately 3 cm in diameter and 5 to 10 cm in length.



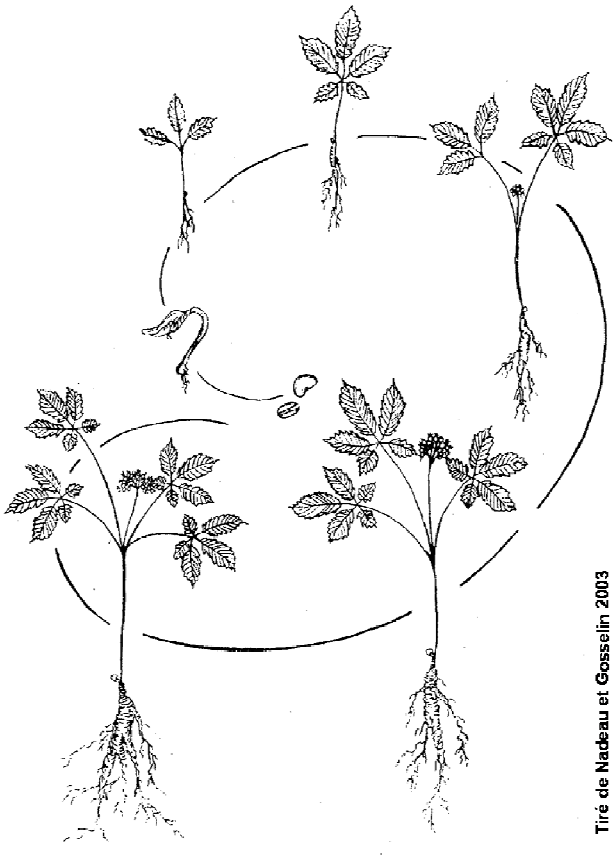


Rhizome: At the base of the stem, there is a section composed scars, which are added each year. The number scars can help estimate the age of the plant.

Habitat preference: Mature maple stand with good crown closure; deep rich soil with lots of organic matter; sandy loam, good drainage, pH at around 5.9. Needs to be an environment that warms up quickly in the spring.

Life expectancy: Can live up to 20 years, deciduous plant, leaves fall after first subzero temperature and emerge at the end of may.

Development cycle: Before maturity, the American ginseng changes appearance at different development stages. The following illustration demonstrates the development cycle of the ginseng. Each phase can last more than one year, depending on the environmental conditions.



Tiré de Nadeau et Gosselin 2003

Did you know?

There are two species of ginseng in Canada. The American ginseng (*Panax quinquefolius*) and the Dwarf ginseng (*P. trifolius*). The Dwarf ginseng does not have economic value since it does not possess any medicinal qualities. Among the other species of ginseng, the *Panax ginseng* is also valuable, but cannot be cultivated in our climates.

How do I cultivate ginseng?

Setting up a ginseng cultivation operation in the understory of a sugarbush

There are 3 ways to cultivate ginseng: 1) field grown; 2) intensive cultivation in a forest undergrowth; 3) wild-simulated woods grown. The first two methods require intensive management, is costly and increase the risk of roots diseases. However, these cultivation methods do produce higher yield in a shorter period of time, but the roots do not have the typical characteristics of the wild grown ginseng valued by the consumers. Therefore, the selling price per unit is much lower.

The wild simulated woods grown method proposed in this technical guide, enables higher quality roots production at lower cost, compared to the other methods. The number of roots produced per surface area is lower which reduces the risk of roots diseases. Time of production is also longer, but the price received for the wild grown roots is ten times higher. We must also keep in mind that the surface area for wild grown ginseng is limited due to their strict environmental requirements and the impracticality of mechanizing the operation because of the constraints created by the forest understory.

Step 1 - Determine one or more sites to establish the ginseng cultivation

The choice of the site is extremely important. This step should be done carefully. It is particularly important to take into account site variability and plant only on micro-sites that meet the environmental requirements of the plant.

It might be interesting to start the cultivation on different carefully chosen sites in the understory of the sugarbush. By doing so, growth rate and success of the cultivation establishment on different sites can be compared and eventually concentrated on the best sites.

When should I choose my site?

- During the summer preceding the plantation.

a) Forest Stand:

- Sugar maple stand composed mostly of sugar maple, which indicate a rich well drained site.
- Crown closure should be almost uniform and produce between 75 and 85% of shaded area - sun exposure for a couple of days can kill the plant.
- Choose a stand with less than 15% of Amercian beech because of the slow rate of decomposition of its leaves.
- Avoid red maple stands, which indicate a poorly drained site.

b) Soil type

- Excellent drainage is key: if roots are submerged in water, it will rot. Although too much water is detrimental, the plant needs approximately 20% of humidity to survive.
    - Avoid sites where water accumulates during snow melts or heavy rains;
    - Avoid basins, low lying areas and bottom of slopes or all other areas where water can accumulate;
    - Choose gentle slopes (5 to 10%) or a medium sized hillock; Avoid north oriented slopes.

Advice: Take a walk on your woodlot in springtime or after a heavy rain to identify areas that drain quickly.

- Ideal soil type: sandy loam
    - Avoid clay soils and organic soils;
    - Generally, loamy soils are suitable.

How to evaluate your soil

1) Dig a hole and pick up some soil (underneath the humus) in your hand.

2) Moisten the soil in your hand.

3) Roll the soil between your fingers and try to create a "ribbon" of soil :

- If the ribbon is impossible to create the soil is too sandy

- If the ribbon gets from 5 to 7.5 cm in length the soil has too much clay and holds too much water

Ideally, the "soil ribbon" should be approximately 3 cm in length and then break.

- Soil depth should be a minimum of 15 to 30 cm;
- Stoniness: low to medium
    - Too much stoniness creates " L shaped" deformations which is non desirable, devalues the roots and renders harvesting difficult.
    - Too little stoniness creates carrot like roots that is non desirable and decreases the value of the root

How to evaluate the depth and stoniness of the site

When you have identified potential sites, use a round shovel to penetrate the soil in several sites so you can evaluate how deep the shovel penetrates without touching any obstacles. Ideally, gravel of approximately 2 to 7.5 cm in diameter should be found.

Step 2 - Prepare the site

When?

- During the summer preceding the plantation of ginseng

Why prepare the site?

- Increase air circulation in each parcel;
- Decrease risks of disease;
- Create ideal light conditions.

How do I prepare the site?

a) Delimitation and identification of the parcels

In order to ease access to the site:

- **Maximum width =** 2 m
- **Maximum length is variable**

Advice: It is necessary to know the surface area of your parcels to order the seeds and fertilizers. A fixed surface area for each parcel will help you easily calculate the total area of your ginseng plantation easily.

Mark boundaries stakes at each corner so you can identify and locate parcels easily.

b) Brush clearing

The intensity of brush clearing for the purpose of ginseng cultivation is the same as sugurbush brush clearing:

- The goal is to decrease the number of shrubs while maintaining a sufficient quantity to ensure forest regeneration.

c) Cleaning

- Remove all debris on the surface of the soil situated within the parcels.

d) Weeding

- Weeding is only necessary if there is an overabundance of herbaceous plants that could compete with ginseng;
- The goal is to reduce the density of tall ground vegetation;
- It is important to keep some diversity which reduces risks of diseases.

e) Soil analysis

Ginseng has specific needs. It is therefore necessary to carry out a soil analysis during the summer preceding plantation in order to prevent nutrient deficiencies.

When?

- Collect soil samples during the summer preceding the plantation;
- Send the soil samples to a lab for analysis;
- Add an appropriate quantity of fertilizer during the plantation.

** If you wish to have an organic cultivation, choose your fertilizer with that idea in mind.**

How?

It is recommended to gather as much information as possible on the subject of fertilization. The following document: "Nutritional Requirements for Ginseng" found on the British-Columbia website is a good starting point. To access the document, click on the following link:

http://www.agf.gov.bc.ca/speccrop/ginseng/prodguide/05_nutrition_req.pdf

According to Nadeau and Gosselin (2003) minimal nutrient concentration and pH levels for ginseng cultivation are:

Plant nutrients	Needs (kg/ha)
Calcium (Ca)	1000
Phosphore (P)	35-50
Magnesium (Mg)	75-100
Potassium (K)	100-150
Optimal pH = 5.5	

Follow fertilization instructions carefully as it can have an adverse effect on the roots.

Step 3 - Buying seeds:

- It is possible to plant seedlings or to start from seeds ; However, it is recommended to start from seeds.
- Keep your receipts : it is proof that you are growing ginseng.

When?

- In the summer preceding the planting.

Warning :

- Ginseng seeds are sold from producers who harvest seed from their own cultivations;
- Seed quality can vary greatly depending on producers;
- Main risks are:
  - A poor germination rate due to inappropriate storage techniques;
  - Buying seeds that originate from a diseased parent, which increases the probability of introducing diseases into your cultivation.

Some seed producers offer a certificate of inspection issued by a phytopathologiste. This certificate ensures a minimum germination rate and a low risk of disease.

a) Seed stratification

Ginseng seed needs to be stratified for a certain period of time before germination. This means it needs to be exposed to different temperatures in specific conditions that will enable germination. So, if you plant seeds that have already been stratified in fall, the first period of temperature variation has already been completed. During fall and winter, a second phase of temperature variation will occur and seeds will be ready to germinate in spring.

b) Seed storage

This is a critical step that will help conserve the quality of the seeds and ensure a high rate of germination.

- Ideally, conserve seeds in a cool environment (10 to 15°C). If no such environment exists (cool room or warehouse), use a refrigerator even if it is not ideal because it is too cold, instead of keeping them at ambient air.
- Avoid dehydration, which would kill the seeds. Store them in a breathable bag (such as a cotton bag or a jute bag) and keep the bag moist. Do not submerge the bag in water as it will decay the seeds.
- Aerate the seeds each day. Humid ginseng seeds breath and release carbon dioxide. It is therefore important to aerate the seeds on a daily basis to ensure enough oxygen is available. You can do this by simply transferring the seeds in a bowl a couple of times and replace them in the bag.

Flotation test to determine viability of seeds:

Before planting your seeds, make sure that you are planting viable seeds. Use the flotation test to determine if the seeds are viable or not. Simply put the seeds in a bowl of water. Those that float have to be removed. Those that sink can be used for planting.

Step 4 - Planting

When?

- You should plant as late as possible in fall (just before the soil freezes or the first snow). This reduces the risk seed predation by small rodents.

How?

- Rake the leaf litter and create a pile close by;
- Add fertilizer, if needed;
- Loosen the soil with a rake which helps with mixing the fertilizer and creates a good seedbed;
- Do not loosen the soil too deeply as ginseng roots need to work through obstacles to obtain the desired characteristics;
- Broadcast seeding (method of seeding that involves scattering seeds , by hand or mechanically, over a relatively large area):
    - Suggested density: 22 to 34 kg/ha (20 to 30 lbs/acre). Please note that there is between 15 500 and 17 500 seeds/kg (7 to 8 thousand/lbs); there will be between 35 and 56 seeds per square meter; spacing will vary between 13 and 16 cm square. This is an ideal density in order to reduce the risks of disease.
    - A good germination rate is approximately 65%;
    - Cover the seeds with the raked leaves that were set aside in order to keep good levels of humidity and protect them from rodents.

Step 5 - Maintenance of your cultivation

a) Leaf Mulching

Leaf litter is important for the survival of ginseng. This enables to:

- Keep an appropriate amount of humidity;
- Protect ginseng from extreme variations in temperature: during summer, the leaf litter keeps the ground cool and vice versa in winter.

The natural quantity of leaves (from the litter fall) is sufficient. If the layer is too thick it can hinder the emergence of the plants in spring.

b) Light Weeding (if needed)

- Only if the surrounding vegetation is too dense and only 15 to 25% of the light reaches the forest floor.
- It is, however, necessary to keep a some plants to ensure diversity which reduces problems related to insects, diseases and rodents.

c) Harvesting fruits vs. cutting flowers

If you want to harvest fruits of the ginseng to continue planting in the future, it can be done :

- In June or July;
- 4 to 6 years after the plantation.

However, you can also decide to cut flowers in the beginning of the season which helps the plant to conserve energy and increase root growth.

d) Insects and disease

Generally, insects cause very little damage to ginseng plants. However, there is a very high number of diseases that can attack ginseng roots. On the other hand, wild simulated woods grown cultivation of ginseng reduces somewhat the risk compared to intensive grown ginseng.

Advice:

- **Learn about the symptoms of common diseases such as:** *Botrytis cinerea*, *Alternaria panax*, *Phytophthora cactorum*, *Cylindrocarpon sp*. (or *Ramularia sp.*), *Pythium sp*., *Rhizoctonia solani*, *Fusarium sp*., *Verticillium dahliae*, *Stromatinia panacis* (or *Sclerotinia panacis*). The Ministry of Agriculture of Ontario has published an excellent guide "« Production recommendations for ginseng » (publication 610) which can help you with this topic;
- Monitor the cultivation on a weekly basis so you can identify the problems quickly;
- If you discover a diseased plant, remove it immediately from the site rather than trying to treat it with chemicals. Dispose of the plant by burning it or putting it in the garbage.

e) Slugs

Slugs love ginseng and can cause a lot of damage, even to the root system. There are different ways to control the impact of slugs, such as:

- Beer bottle trap: Completely burry a beer bottle upright half filled with beer so the attracted slugs drown when they fall inside;
- Scatter broken egg shells all around the production zone;
- Scatter ashes from a BBQ or furnace: you need a 1cm thick layer around the production zone for it to work;
- You can also buy anti slug products.

f) Protection (optional):

Certain animals such as rodents love to eat ginseng seed. It is not necessary to put up a physical barrier, but it can be an option for controlling such problems or even to reduce sunlight if luminosity is too high.

Suggestion: A wooden cage can be erected around the cultivation. A mosquito mesh can be used to reduce luminosity if it is too bright.

Step 6 - Harvesting the roots:

When?

- Generally 8 to 10 years after germination;
- In autumn: when leaves start changing color, but before they fall so you can easily find the roots.
  - Before deciding to harvest, ensure that the plants are mature. They are mature if they have 4 leaves;
  - The older the root, the higher its value. However, the older it is, the higher the risk of disease or damage. Check the markets to aid in your decision to harvest or not;
  - There is the option to harvest all of the roots or just a portion of the crop.

How?

- **With gardening tools, such as a spading fork, carefully dig out the root**.
- Do not damage the root or the rhizome (which indicates the age of the root). Damaged roots have a lower value.
- Be very meticulous!
- If root dehydration is not done immediately, they can be warehoused for a maximum of 6 weeks in a cool environment of 1 to 5 °C at 80% relative humidity. If these conditions are not respected, quality of the roots will diminish.

Step 7 - Washing and drying roots:

- Wash the roots immediately before dehydrating them:
  - Coarse wash the roots to remove the excess dirt;
  - Do not rub the roots. It is normal and even desired to have traces of dirt in the pits of the root.
  - You can use a spray of water to clean the roots. Make sure there is not too much pressure.
- Dehydrate the roots before selling them. Quality of the roots can be adversely affected by a flawed drying technique. Get information on the best practices for drying and make sure that your oven is suitable for drying ginseng roots.
  - Ideal temperature: 38°C but can vary between 32 et 38°C;
  - Good air circulation is key during the process, it reduces the humidity and speeds up the process;
  - Stop the process when roots are at 8 to 10% humidity.

Marketing and Economic potential for ginseng roots

Marketing

Regulations

There are many laws and regulations for the management of natural (wild) populations of American ginseng, an endangered species. In Canada, it is against the law to harvest wild populations of American ginseng.

This law does impact producers since they need to acquire a permit to export cultivated ginseng roots. Since the roots of the cultivated variety is identical to the wild variety, producers need to be able to prove that the roots come from a cultivation and not from a wild population.

- Keep your receipts to prove that the ginseng roots are cultivated;
- The fact that the roots that you are selling are all the same age is another proof of a cultivation.

Appearance of the roots

The quality of the ginseng root is determined by its appearance. Specific criteria already exists. Here are a few characteristics that consumers look for when buying ginseng roots and that increase there value.

- Need to look like a wild root (old, stalky, lots of branches and wrinkles);
- No flaws;
- No diseases;
- Firm after dehydration;

Commercilization

Ginseng roots are presently commercialized in different forms: dryed root, capsule, infusions, tea, energy drinks, candy, etc.

Even though a well established market exist for ginseng, it is important for producer to verify market accessibility before starting the production. To get such information, you can contact “Ginseng Boréal” or other producers of ginseng.

All in all, simulated woods grown ginseng requires little investment in capital but lots of time compared to the other type of ginseng cultivation. People who whish to try their hand at ginseng cultivation need to be very rigorous in their approach at every step. This is especially true for Northern New Brunswick since it is at the limit northern of ginseng distribution. However, if the producer is ready to invest time and effort, ginseng cultivation can be relatively lucrative and an interesting way to diversify revenue of his woodlot.

Did you know?

Canada is the 3rd largest producer of ginseng after China and South Corea. Ontario is the largest canadian producer. Most of the world production comes from intensive agricultural production.

Economic potential

Costs associated with simulated woods grown ginseng are due to the purchase of seeds, the establishment of the production and the labour required to maintain the site for 9 years or so. Revenues are potentially very interesting, but the risk is high since ginseng cultivation in the understory of a sugarbush can have a very poor success rate. The success is most often linked to time invested in the operation. Gather as much information as you can and start small to perfect your cultivation technique.

The following cost and revenues table is for information purposes only. The estimated salary for labour is 25$/h with expenses, including travel. This cost does not apply when the woodlot owner does the work.

Establishment of an American Ginseng cultivation of one hectare in the undergrowth of a Sugarbush

Establishment cost

Site identification		
100 $ / ha * 1 ha (work completed by a professional)		100.00 $
Site preperation and cultivation establishment		
Labour (2 people @ 25$/h[1])	240 h	6 000.00 $
Equipment[2]		
Shovel, rake, stone hammer, drill, industrial stapler, knife		- $
Fertilizer and lime (if needed)		
Fertilizer	approx. 1.10$/kg	
Lime	approx. 85$/ton	
Seeding[3]		
35 to 56 seeds /m^2		
7000 to 8000 seeds / lbs	approx. 96$/lbs	5 760.00 $
	Sub Total	11 860.00 $

Maintenance costs (for 9 years)

Maintenance		
Weeding (9 summers x 1person @ 25$/h)	300h	7 500.00 $
Inspection (1 h/week x 12 weeks/summer x 9 summers @ 25$/h)	700h	17 500.00 $
	Sub Total	25 000.00 $

Cost for harvesting and dehydration

Harvesting		
2 people @ 25$/h	160 h	4 000.00 $
Washing and drying		
According to Persons (1999) - renovations to accomodate storage		400.00 $
Energy cost for drying		240.00 $
	Sub Total	4 640.00 $
	Total costs	**41 500.00 $**

Production

1 kg of seeds = between 0 and 20 kg of dryed roots

Average = 8kg of dryed roots for every kg of seeds

60 lbs of planted seeds = 480 lbs[4]

Revenues[5]

Depends on market price at time		
440 to 660 $/kg or 200 to 300$/lbs	480lbs =	120 000.00 $
	Total revenues	**120 000.00 $**

[1] 25$/h inculdes all costs, including travel.

[2] Generally a woodlot owner has this material.

[3] By planting 45 seeds/m2 and considering there is 7500 seeds/lbs = 60 lbs of seeds.

[4] Ratio = 8:1.

[5] Used a revenue of 250$/lbs.

Available resources

Before starting your ginseng production, it is important that you inform yourself as much as possible. Talk to other ginseng producers, they might be able to give you sound advice. The following are groups or people that might be able to help you:

Jeff Levesque Chargé de projet
Forêt expérimentale
Faculté de foresterie (UMCE)
165, boulevard Hébert
Edmundston (N.-B.) E3V 2S8
Tel : (506) 737-5050 pst. 5236
E-mail : **JELEVESQ@UMCE.CA**

Isabelle Nadeau et Lucie Gosselin
Ginseng Boréal
2685, rue Saint-Calixte Est
Plessisville (Québec) G6L 1S6
Tel : (819) 621-0002
E-mail: ginsengboreal@hotmail.com

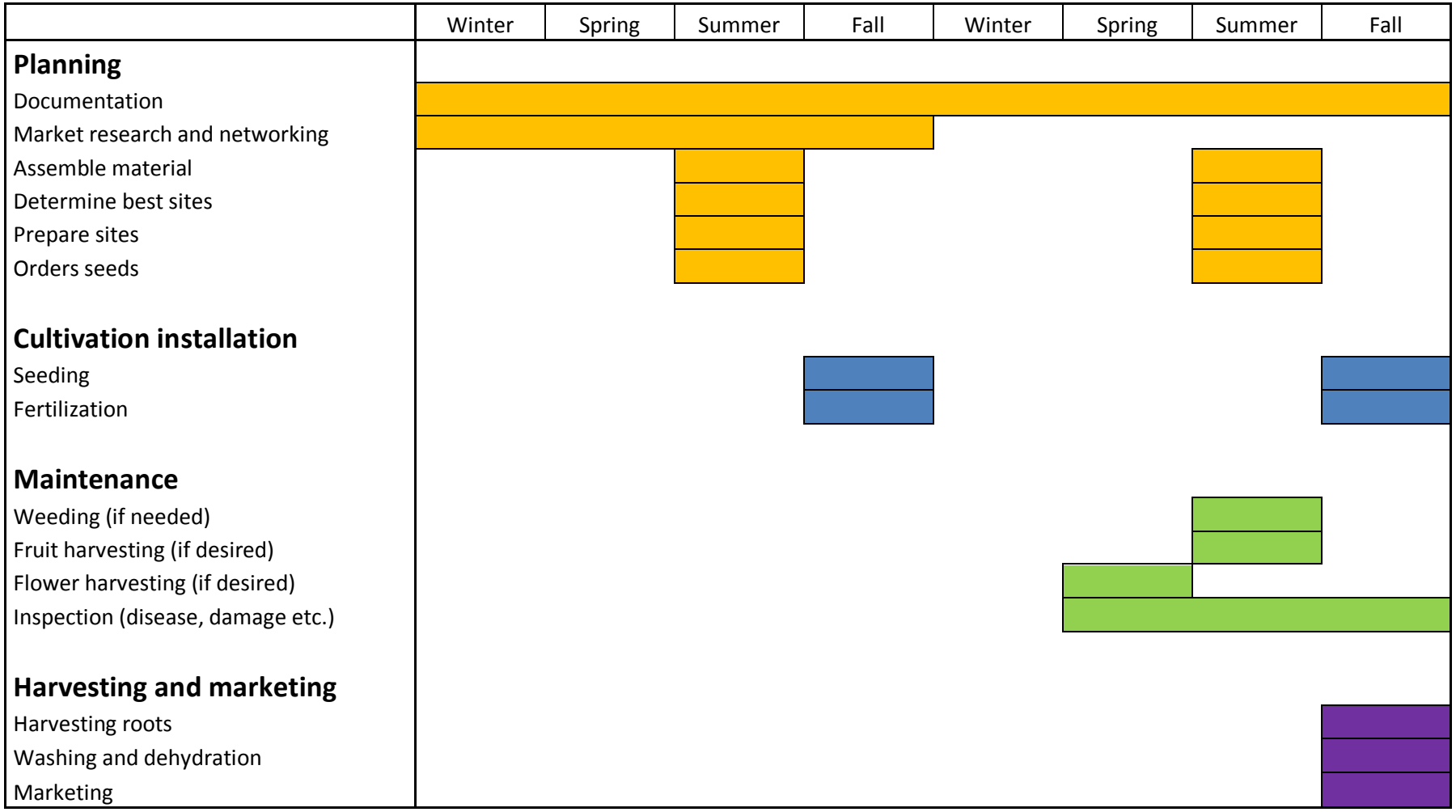
Services offered by "Ginseng Boréal" are the following: sales of quality seeds (seeds must be ordered between mid-July and end of August), private consultation such as site evaluation, advice on techniques from seeding to harvest, presentations, workshops and more.

Guy Langlais
ITA de La Pocatière
Tel : (418) 856-1110 poste 389
E-mail :guy.langlais@agr.gouv.qc.ca

Mr. Langlais is conducting tests on Amercian ginseng cultivation in sugar maple stands in the Bas-Saint-Laurent and Gaspésie regions. These zones are at the upper limite of the Amarican ginseng distribution. His results will surely be interesting.

Mycoflor Inc.
Richard O'Breham, propriétaire
7850, chemin Stage
Stanstead (Qc) J0B 3E0
Tel: (819) 876-5972
E-mail : mycoflor@sympatico.ca
Site web : http://www.mycoflor.ca/index.html

The following is an example of the establishment and harvesting of a Ginseng production in the undergrowth of a sugarbush. It can be used as a guide, but is for information purposes only



Additional information

This technical guide is presented by the *Faculty of forestry of "l'Université de Moncton - Campus d'Edmundston"* within the context of the "Improvement and Development of Sugarbush Resources Program". The main objective of the program is to optimize the economic model of Sugarbushes in New Brunswick by investing in development, research and technology transfer. More precisely, the program aims to meet the following objectives:

- Diversify production and find innovative new products for commercialization;
- Technology and knowledge transfer;
- Training and professionalization of the workforce.

Do not hesitate to communicate with experienced professionals and to share your experiences with us.

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email : **jeff.levesques@umce.ca**

Conferences and workshops are available at the « Montagne Verte » Sugar Bush. Moreover, other forestry extension material in other aspects of the program are available for interested people. Other technical guides that are available discuss topics such as multi-resource inventory, beaked hazel, wild indian cucumber, mushrooms and organic fertilization in maple stands. Contact Jeff Levesques for more information.

You can also visit our web site at www.umce.ca/foresterie /érablière for more information.

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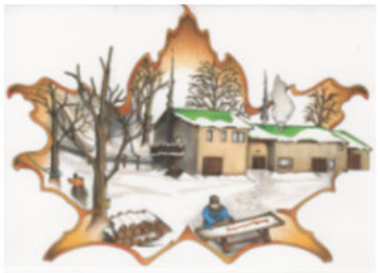

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