

# Ginseng Cultural Management and Research Update in Atlantic Canada

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## ABSTRACT

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The Canadian production of American ginseng (*Panax quinquefolius* L.) occurs mainly in Ontario, British Columbia and the Atlantic provinces. Although ginseng is a profitable crop, its successful production is dependent on careful consideration of cultural management factors which include site selection, site preparation, seed selection and handling, shading and mulching, pest and nutritional management, and handling of harvested crops.

Diseases of particular concern in Atlantic Canada are root rots caused by *Phytophthora cactorum*, *Cylindrocarpon destructans* and *Fusarium* sp. Recently two systemic fungicides (metalaxyl and fosetylal) were registered; however, growers in Atlantic Canada have experienced metalaxyl resistance resulting from the reliance on this single compound for the control of *Phytophthora* spp. Current research being conducted on alternative control of these diseases will be discussed.

In weed control research, 2,4-D, MCPA, clopyralid have continued to show promise for weed control at low rates. In trials to evaluate non-selective herbicides as post-senescence or pre-emergence in ginseng, glyphosate (Round-up) provided control of perennials as well as willowherb and lamb-quarters. In phytotoxicity trials, ginseng significantly tolerated grass herbicides, including clethodim, rimsulfuron, tralkoxydim, nicosulfuron and fenoxypop. For broadleaf herbicides, significant tolerance was shown for bromoxynil, thifensulfuron methyl, flumetulam/clopyralid, thifensulfuron/tribenuron. Disease and weed management of ginseng in Atlantic Canada will be discussed.

## Introduction

American ginseng (*Panax quinquefolius*), native to the hardwood forests of northeastern North America, is cultivated in all provinces of Canada except Manitoba (Table 1). More than 97% of the area cultivated to ginseng in Canada is in the provinces of Ontario and British Columbia. The third province, Nova Scotia, has less than 1% of the area in Canada cultivated to ginseng. Nova Scotia grows about two-thirds of the Atlantic Canadian ginseng crop.

In 1987, there was about 0.5 ha planted to ginseng in Atlantic Canada. This has increased to about 51 ha, distributed among 43 farms in Atlantic Canada in 1998. In the western provinces of Saskatchewan and Alberta, which were introduced to ginseng later than Atlantic Canada, there are

140 growers cultivating ginseng on a total of 44 ha.

In Atlantic Canada, most of the ginseng is grown under shade structures, with a few growers producing crops under the natural shade of hardwood forests. The cost of production is estimated to be lower in woods-grown ginseng because no shade structure need be constructed. Although official figures on areas planted to woods-grown ginseng are not available, it is estimated that between 400 and 800 ha of woods-grown ginseng is presently under cultivation in Ontario. Robitaille (1998) speculates that the production of woods-grown ginseng in the Province of Quebec will increase because ginseng can be intercropped with sugar maple on maple plantations. In 1997, Ontario produced 1.2 million kg of dried ginseng root and British Columbia produced one half million kg.

In Atlantic Canada, some growers have decided to stop growing ginseng because of problems with production, and because the market price has dropped, perhaps because of the financial situation in Asia, which is the principal market for Canadian-grown American ginseng.

The Canadian government supports research on ginseng production but most of the research is done in Ontario and British Columbia where ginseng production is concentrated. The climate and soils of Atlantic Canada are different enough from those of Ontario and British Columbia that research is required in the Atlantic provinces, especially in the area of plant nutrition, disease management and weed control.

**Table 1.** Ginseng Production Situation in Canada

Province	Number of Growers	ha
British Columbia	150	1619
Alberta	40	20
Saskatchewan	100	24
Ontario	450	2024
Quebec	3	4
Atlantic Canada		
New Brunswick	5	8
Nova Scotia	20	32
Prince Edward Island	12	9
Newfoundland	6	2
Total	786	3742

Figures are estimated for 1998, in consultation with Mr. Allen Smith, President, Associated Ginseng Growers of British Columbia.

### Ginseng Nutrient Requirements

Few studies have been done on the nutrient requirements of ginseng in soils in Atlantic Canada. Fertilizer recommendations (Table 2) are extrapolated from research done in other parts of North America. In our trials in Nova Scotia, no differences in germination or root growth over two years

could be attributed to levels of nitrogen (0, 33, 66, 100 kg/ha) or potassium (0, 50, 100, 150 kg/ha).

## Disease Management

Plant diseases constitute one of the major constraints to ginseng production in Atlantic Canada. Site selection is considered to be an important factor in disease management. In this wet climate, good drainage and slope, as well as adequate air circulation under the shade structure are important to reduce both root and foliar disease. Soil fumigation prior to establishment of the field is recommended, but with the withdrawal of methyl bromide from the market, some growers have ceased this practice

**Table 2.** Nutrient Levels for American Ginseng in Atlantic Canada

Nutrient	Recommended Range (kg/ha)
N	40, 50, 80, 100*
P <sub>2</sub> O <sub>5</sub>	200-250
K <sub>2</sub> O	300-350
Ca	1500-2000
Mg	250-300

\*Nitrogen level for 1, 2, 3 and 4-year-old field respectively. This recommendation will be reevaluated before use by the N.S. Plant Industry Soil Laboratory.

The fungicides registered for use on ginseng are listed in Table 3. Except for perhaps pentachloronitrobenzene, none of these fungicides has an adequate effect on damping off and root diseases caused by the fungi *Rhizoctonia*, *Pythium*, or *Cylindrocarpon*.

Prior to the recent registration of metalaxyl and fosetylal, *Phytophthora cactorum* was considered by many growers to be the most threatening disease to ginseng in Atlantic Canada. In addition to reducing the marketability of infected roots, the disease reduced the persistence of the ginseng crop, often forcing harvest after only three years of growth. Adequate control is now available using a programme that rotates the fungicides metalaxyl and fosetylal, but requiring up to three applications per year of the first, and five applications per year of the second year-old crop.

Disappearing root rot (*Cylindrocarpon destructans*) is now the most threatening disease of ginseng in Atlantic ginseng gardens. Although the disease does not become obvious until the third year of production, it may be present earlier on because we have isolated it from seed. Research in our lab is aimed at identifying the sources of inoculum of *Cylindrocarpon destructans*, determining the role of seed stratification in seed infection, and developing a method of biological control that can be applied, perhaps during the stratification process.

Several pathogens are associated with improperly stratified seed or infected seed during the seed stratification process. A survey of microorganisms in stratified and non-stratified seed from various

locations in Atlantic Canada has been conducted. *Fusarium* spp. was the fungus most frequently isolated from the stratified ginseng seed but not from the green seed (Table 4).

The fungus was found more in endosperm and embryo than in seed coat, suggesting that the fun-

**Table 3.** List of Fungicides and Their Control

Fungicide	Active Ingredient	Control
Dithane M-45	mancozeb	Alternaria Leaf Blight
Rovral	iprodione	Alternaria Leaf Blight
Dyrene	analizine	Alternaria Leaf Blight
Bravo 500F	chlorothalonil	Alternaria Leaf Blight Botrytis Gray Mold
Quntozine	PCNB	Rhizoctonia Crown Rot and Damping-Off
Ridomil 2G	metalaxyl	Phytophthora Root Rot
Aliette	fosetyl-al	Phytophthora Root Rot

**Table 4.** Frequency (%) of Isolation on Four Fungi from Various Parts of the Ginseng Seed

Fungi	Green Seed	Whole Seed (stratified seed)	Seed Coat (stratified seed)	Endosperm/embryo (stratified seed)
<i>Fusarium</i>	4	44	13.6	34
<i>Trichoderma</i>	0	54	10.8	12
<i>Botrytis</i>	24	-	-	-
<i>Monilinia</i>	2	2	-	-

gus may be seed-borne. *Botrytis* was isolated frequently from unstratified seed, but not from stratified seed. This fungus is known to cause a crown rot and a leaf blight of ginseng. It seems that it may be removed from the seed during the stratification process. *Trichoderma* species were also highly isolated from the stratified seeds. From the seed that *Trichoderma* was isolated, no *Fusarium*, even other fungi, was observed. *Trichoderma* seems to grow fast on acidified PDA and suppress the growth of other fungi. *Trichoderma* may be a useful agent to suppress the seed-borne diseases in ginseng seed. Our research laboratory is hoping to develop a biocontrol method for *Cylindrocarpon destructans*. The disease appears mostly in third and fourth year-old ginseng fields and there is no chemical control for this pathogen.

Four of twenty isolates of the fungus *Trichoderma* that were derived from ginseng seed inhibited the growth of *Cylindrocarpon* on potato dextrose agar. We plan to use these four isolates in greenhouse and field trials to see if they protect ginseng roots from *Cylindrocarpon destructans*. Experiments will also be done to see if they protect seed from infection by *Fusarium* or *Cylindrocarpon* when applied before seed stratification.

## Weed Management

Four herbicide screening trials, evaluating a number of herbicides were conducted in 1997. The products 2,4-D, MCPA, clopyralid, showed promise for weed control at the lower rates and should be evaluated further. In addition, early spring or fall applications of glyphosate also are promising. There was good broadleaf control but not for the grasses.

In trials to evaluate non-selective herbicides as post-senescence or pre-emergence in ginseng, glyphosate (Round-up) provided control of perennials as well as willowherb and lambsquarters. The Round-up formulation performed better than the Touchdown formulation. The herbicide glufosinate (Ignite) provided marginally better control of lambsquarters and willowherb but control was still not as good as seen with either glyphosate formulation.

In a trial to evaluate phytotoxicity of various herbicides to ginseng, ginseng showed good tolerance to all grass herbicides evaluated, including clethodim, rimsulfuron, trakloxydim, nicosulfuron and fenoxypop. For broadleaf herbicides, good tolerance was shown for bromoxynil, thifensulfuron methyl, flumetulam/clopyralid, thifensulfuron/tribenuron. There was some injury from the bromoxynil, but the effect was not significant. One problem in this trial was that the population of ginseng was low, so these products should be evaluated further from crop tolerance as well as weed control.

## Conclusion

American ginseng production is expected to be sustained in Atlantic Canada despite the current poor ginseng market situation.

In Atlantic Canada, certain diseases such as *Fusarium*, *Phytophthora* and *Cylindrocarpon* diseases are more prevalent due to moist and cool environmental conditions. Therefore, site selection and field preparation with proper fumigation application prior to planting seem very important.

Biocontrol approach to control diseases could be of great benefit in ginseng disease management but requires continuous research. Weed control with herbicides will be ideal for broadleaf and grass weeds. Further research is required to select suitable products. Integrated pest management research will provide a more efficient ginseng production at reduced costs.

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