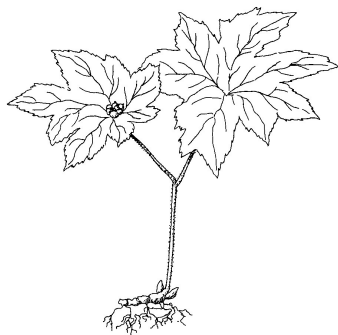


Medicinal Herb Production Guide

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Goldenseal (*Hydrastis canadensis* L.)

Introduction

Botanical Information

Hydrastis canadensis L., member of the Ranunculaceae family, is native to North America with a natural range extending from southern Quebec to northern Georgia, and west to Missouri. Goldenseal is an herbaceous perennial and can be found in rich, densely shaded, deciduous forests. The plant emerges in early spring from buds that overwinter on the perennial rootstock, growing each year to a height of eight to fourteen inches. The leaf is cordate-shaped with a long petiole and can have three to seven lobes. The margins of the leaves are double serrated. Leaves can span three to twelve inches in diameter and three to eight inches long. The single greenish-white flower blooms briefly from late April to May, depending upon location. A berry forms, turning red in July, and contains up to thirty black seeds. The tumeric-colored rhizome and fibrous roots are harvested after the fifth growing season (or later), when the plant is started from seed.

High demand for goldenseal has caused a serious reduction in native populations. Jeanine M. Davis, North Carolina State University, writes, "As early as 1884, dramatic declines in wild populations due to overharvesting and deforestation were documented. In North Carolina, goldenseal is an endangered species, making harvest from public lands illegal. In 1997, goldenseal was listed on Appendix II of the Convention for International Trade on Endangered Species of Wild Fauna and Flora (CITES), an international treaty monitoring trade in threatened and endangered species. This listing imposes controls on goldenseal trade designed to protect the species and to encourage sustainable use. This has not stopped people from collecting it, however, and native populations continue to decrease."

Bioactive Components

The main bioactive components of goldenseal are the isoquinoline alkaloids hydrastine, berberine, and canadine. Berberine has been shown to inhibit the growth of a number of parasites as well as killing tumors. Berberine is also linked to some sedative and antisecretory effects.

Uses and Treatments

Native Americans have used goldenseal in a variety of ways, including as a general antiseptic and a treatment for snakebites. Renewed interest from herbalists in the United States, in the 1990's, sparked new demand for this material in Europe. Modern medicinal uses for goldenseal include the treatment of nasal congestion, digestive disorders, and AIDS. The following table summarizes these and other uses for goldenseal.

Table 1. Modern and traditional uses of goldenseal.

<u>Modern Uses</u>	<u>Traditional/Folk Uses</u>
- AIDS	- Sore throat
- Topical antiseptic	- Mouth sores
- Nasal congestion	- General health tonic
- Eye and ear infections	- Snakebites

Cultivation Practices

Regulations for Growing

Because of goldenseal's endangered status in North Carolina, permits from the North Carolina Department of Agriculture and Consumer Services, Plant Protection Division, Plant Conservation Program, are required to cultivate or propagate goldenseal within the state. Permit applications can be obtained by contacting the NCDA&CS, Plant Industry Division, Plant Conservation Program, P.O. Box 27647, Raleigh, NC 27611, telephone number, 919-733-3610.

Site Selection

The western portion of North Carolina is considered part of goldenseal's prime natural range. Goldenseal grows best in a rich, moist, loamy soil with good air and water drainage and approximately 70-75% shade. Avoid planting in a poorly drained soil. Choose a site with a slight slope to help improve drainage. If an open field is used for production, shade structures will need to be erected. Typically, a wood lath structure or polypropylene shade structure is used. For forest culture, select a site with good air and water drainage in an area shaded by tall, hardwood trees like basswood, hickory, tulip poplar, or white oak. Look for an area where understory woodland plants grow such as black cohosh, bloodroot, ginseng, mayapple, or trillium. If goldenseal is not grown in ideal forest soils, raised beds are recommended, especially for high in clay soils. Make sure sufficient compost or other organic material is added to the planting beds to improve soil tilth and fertility. Soils with a pH range of 5.5-6.5 are ideal for growing goldenseal. Areas where problems have occurred due to soil-borne diseases should be avoided.

Planting

Goldenseal can be propagated from rhizome pieces, root cuttings, or from seed. To propagate from seed, the berry must be harvested as soon as it is mature, then processed by carefully mashing the fruit to separate out the seeds. This process can take several days, as the seeds and pulp need to ferment in water until they can easily be separated. The seeds must never dry out. When cleaned and rinsed thoroughly, sow the seeds one-quarter to one-half inch deep in a shaded nursery bed, and space the seeds one to two inches apart. Cover with several inches of leaf mulch to prevent the soil from drying out. Germination of goldenseal seed can be slow, erratic, and unpredictable. It is not uncommon for all or part

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of a seed bed to take two seasons before germinating. Richo Cech, author of *Growing At-Risk Medicinal Plants*, recommends waiting to transplant the seedlings into permanent production beds until they are two years old and have formed a rhizome.

The most common and reliable method for propagating goldenseal is from rhizome pieces. Cut rhizomes into one-half inch or larger pieces, keeping the fibrous roots attached, and trying to have at least one big bud present per piece. In a well-prepared bed, plant the rhizome pieces in the ground, right below the soil surface, with the bud pointed upright. Space rhizome pieces six inches apart with rows six to twelve inches apart. Add a thick layer of mulch, using hardwood leaves or shredded hardwood bark. The mulch should be raked back to a depth of one to two inches before the plants emerge in the spring. Tim Blakley, author of *Medicinal Herbs in the Garden, Field, and Marketplace*, writes on another method of propagation from root cuttings, "Buds and plants will form on the fibrous roots that grow away from the main root. These pieces can be planted separately." Not everyone has success with this method. Use the same planting directions as above. Keep all beds free from weeds. Weed control is very important the first few years.

Insects and Diseases

Under natural conditions in the forest, goldenseal has minimal problems with diseases or insects. According to Davis, slugs are often a problem in small plots in the Southeast. They can eat the entire crown of the plant as well as the fruit. If the populations of slugs are intolerable and control measures do not work, it may be necessary to remove the mulch from around the plants. Moles and voles have also been known to damage goldenseal beds. Davis adds that root knot nematodes will severely reduce growth and root yield of goldenseal.

The book, *Index of Plant Diseases in the United States*, lists the following diseases that have been known to affect *Hydrastis canadensis*: leaf blights, *Alternaria* sp. and *Botrytis* sp.; *Fusarium* wilt; root knot nematodes, *Meloidogyne* spp.; root rots, *Phymatotrichum omnivorum* and *Rhizoctonia solani*; and an unidentified mosaic virus.

Harvesting, Cleaning, and Drying

Roots are harvested in the fall after the tops have died down. Harvesting usually begins five to seven years from seeding or four to six years from rhizome transplants. Davis recommends the following harvest, cleaning, and drying techniques, "Dig roots carefully, keeping the fibrous roots intact. Small plots can be dug with a fork, but a larger field requires a mechanical digger like a modified potato, horseradish, or bulb digger. Select large, healthy plants for replanting (in a new area) and have a container available to keep them moist and cool. Carefully wash the remaining roots by spraying with a hose over a large-mesh screen. Remove all dirt, breaking larger roots if necessary, but do not use a brush. Commercial ginseng root washers are available that consist of a drum that turns and tumbles the roots as water is sprayed over them."

Davis continues, "Spread the washed roots on screens, and dry in a well-ventilated area in the shade or in a forced air drier. Simple driers can be constructed from small sheds or rooms in barns. Bulk tobacco barns can also be modified for drying goldenseal roots. Keep

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temperatures low, around 95-100⁰F, (to allow for even and thorough drying) and provide good airflow around the roots. Roots will lose about 70% of their weight during drying. To test for dryness, break a large root. It should snap but not be brittle. Pack dried roots loosely into cardboard cartons or barrels, in clean untreated burlap sacks, or in poly-sacks. Store in a cool, dry, dark area free from insects and rodents.” Yields per acre can vary. Davis reports yields for goldenseal, grown under artificial shade structures, range from 800 to 3,000 pounds of dried root per acre.

Marketing and Economics

Regulations for Selling

A CITES permit or certificate must be obtained before exporting cultivated or wild-collected goldenseal roots. Proof that roots, rhizomes, or seeds came from legally acquired parental stock will be required, as well as verification that plants were cultivated for at least four years. For permit applications and more information, contact the Office of Management Authority, 4401 N. Fairfax Drive, Room 700, Arlington, VA 22203. Telephone number is 1-800-358-2104, and website address is: <http://international.fws.gov>.

Annual Consumption and Dollar Value

In 2001, approximately 265,000 pounds of goldenseal were sold on world markets. This represents a 27% increase from the year 2000. The dollar value of consumption, in 2001, was roughly \$7.5 million, making it 6% higher than in year 2000. In 1997, the dollar value of consumption was about \$6.3 million.

Supply and Demand

Demand currently exceeds supply for high-quality cultivated goldenseal. Wild harvested product is currently meeting the demand requirements of buyers more concerned with the name recognition than bioactive components. Cultivated material represented about 25% of the overall supply in 2001.

Restrictions on wild harvesting and the desire for higher concentrations of bioactive components continue to drive demand higher for high-quality cultivated material. Many manufacturers are incorporating goldenseal into other herbal products in the belief that it enhances the potency of other herbs. A positive monograph from European health organizations, such as Germany's *Commission E.*, would greatly enhance the marketability of this product in the European community.

Over the next three-to-five years, the market for this material will grow at a rate of five-to-ten percent annually. The market demand for high-quality, cultivated material will grow at a faster rate, approaching 10% to 15% annually.

Pricing

Price for wild harvested goldenseal fluctuates significantly from harvest season to harvest season. The price of cultivated product changes less, but in a higher price range. In 2001, wild harvested material traded in a range of \$28-\$30 per pound of dried root, while, high-quality, cultivated material traded in a range of \$32-\$38 per pound of dried root. Current prices paid for high-quality, cultivated material range from \$35-\$45 per pound of dried root.

Distribution Channels

Customer concentration in this market is highly fragmented. Small-scale collectors, mostly in the southern regions of the Appalachian range and Missouri, supply almost all of the wild harvested material. Cultivated sources are located mainly on small acreage plots in Canada, Wisconsin, and the Pacific Northwest. Many growers of goldenseal are members of co-ops or vertically integrated into large processors.

Distribution channels are specialized and rely on experienced goldenseal brokers and professionals to bring small growers, collectors, and buyers together. Wild harvested material is handled through established general brokers that warehouse goldenseal and send it to large European processors.

Commercial Visibility

Goldenseal has established a long track record of medicinal use in North America. High levels of total alkaloids in this material are of extreme importance to buyers in the North American market. Bioactive content of 3% hydrastine and 6% total alkaloids is considered acceptable for most buyers.

Within the last ten years, interest in the European market has been steadily increasing as this material has been combined with better-established herbs such as Echinacea(s) and black cohosh. Of the top nutraceutical/botanical companies, 29% offer this material as a stand-alone product and 51% offer this material as either a stand-alone product or as part of a multi-constituent supplement.

Conclusion

Initial start-up costs per acre are high for field cultivation of goldenseal. Woods grown methods are still practiced among small growers. Most cultivation currently is by ginseng growers rotating out of ginseng production and into goldenseal production. In general, growing and harvesting techniques used for field-cultivated ginseng can be directly applied to goldenseal production, reducing the initial start-up costs for this material.

Goldenseal has been the focus of a great deal of research regarding its effectiveness as an immune system stimulant. Restrictions on wild harvesting and the desire for higher concentrations of bioactives continue to drive demand for a high-quality cultivated material. Overharvesting of naturally occurring populations has landed goldenseal on the CITES list

(Appendix 2). Canada and several U.S. states, including North Carolina, have placed severe restrictions on the harvest of wild populations.

This Medicinal Herb Production Guide includes excerpts from, Analysis of the economic viability of cultivating selected botanicals in North Carolina. Strategic Reports. 2002.

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