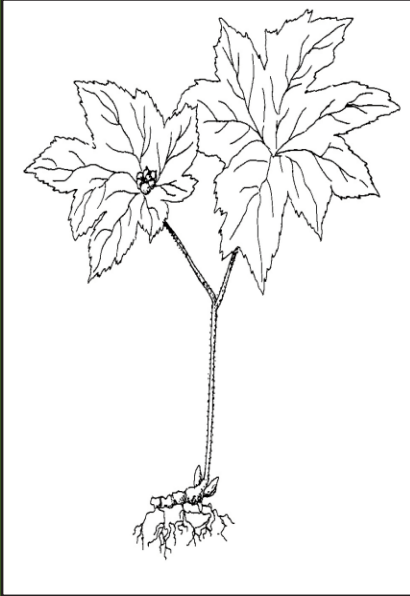


Goldenseal

(*Hydrastis canadensis* L.)



MAY 2013

Jeanine Davis, PhD
Extension Horticulture Specialist;
Alison Dressler- Research Assistant
Department of Horticultural Science
NC State University
Revision of Articles Written by Jackie
Greenfield, Jeanine Davis, and Kari
Brayman

Mountain Horticultural Crops
Research & Extension Center,
455 Research Dr.
Mills River, NC 28759



www.extension.org/forest_farming
<http://ncherb.org>
<http://ncalternativecropsandorganics.blogspot.com>
<http://twitter.com/jeaninencsu>

Introduction

Botanical Information

Hydrastis canadensis L., a member of the Ranunculaceae family, is native to North America with a natural range from southern Quebec to northern Georgia and west to Missouri. Goldenseal is an herbaceous perennial and can be found growing naturally 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 8 to 14 inches. The mature plant has two or more erect stems, usually ending in a fork with two leaves. The dark-green leaf is palmate shaped with a long petiole and can have five to seven lobes. The margins of the leaves are double-serrated. Leaves can span 3 to 12 inches in diameter and 3 to 8 inches in length. A single greenish-white flower blooms briefly from late April to May, depending upon location. A single green berry-like fruit develops, turning red in July and containing up to 30 black seeds. The seeds, which must always remain moist, may take up to three years to germinate. First-year seedlings have two little round leaves and look very different from the mature plants. The turmeric-colored rhizome and fibrous roots spread horizontally in the soil and can form a dense mat. If not harvested, the oldest parts of the rhizome eventually decay and the newer material continues to grow outward. Throughout this article, the term “roots” will refer to roots and rhizomes together, unless indicated otherwise.



Goldenseal berry in fruit
Photo credits: Jeanine Davis' Program

High demand for goldenseal has caused a serious reduction in native populations throughout its native range. Goldenseal is protected on a federal and international level and is listed on Appendix II of the Convention for International Trade in Endangered Species of Wild Fauna and Flora (CITES), an international treaty monitoring trade in threatened and endangered species. This means that a CITES permit is required to sell goldenseal to other

countries. To get such a permit, you need to be able to show that the plants are at least four years old and were obtained legally.

Bioactive Components

The main bioactive components of goldenseal are thought to be hydrastine, berberine, and canadine (all isoquinoline alkaloids). 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 used goldenseal in a variety of ways, including as a general antiseptic and as a treatment for snakebites. Renewed interest from herbalists in the United States in the 1990s sparked new demand for this material in Europe. Modern medicinal uses for goldenseal include the treatment of nasal congestion, digestive disorders, inflammation, and AIDS. Goldenseal is often referred to as a synergistic herb, meaning when taken with other herbs, it increases their efficacy. Goldenseal and echinacea make up a common combination formula.



Freshly dug and washed goldenseal roots
Photo credits: Jeanine Davis' Program

Cultivation Practices

Site Selection

Goldenseal grows best in a rich, moist, loamy soil with a soil pH of 5.5 to 6.5, good water drainage, and approximately 70 to 75 percent shade. Avoid planting in a poorly drained soil as goldenseal does not tolerate "wet feet." Many growers will select growing sites with a slight slope to help improve water 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, the site should be shaded by tall hardwood trees like basswood, hickory, tulip poplar, or white oak. Look for an area where similar understory plants are growing, e.g., black cohosh, bloodroot, ginseng, mayapple, or trillium. Building raised beds is recommended, especially for soils high in clay. Also, make sure sufficient compost or other organic material is added to the planting beds to improve soil tilth and fertility. If soil pH is less than 5.5, lime can be added to increase growth. If the soil is low in available phosphorus, use a slow-release natural product such as rock phosphate. Nitrogen derived from compost or other organic materials should be adequate. Areas where problems have occurred due to soilborne diseases should be avoided.

Planting

Goldenseal can be propagated from rhizome pieces, root cuttings, or seed. To propagate from seed, the fruit 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



Wild-simulated Goldenseal bed.
Photo credits: Jeanine Davis' Program

pulp need to ferment in water until they can easily be separated. The seeds must never be allowed to 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 1 to 2 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 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.



Goldenseal plant with ripening fruit
Photo credits: Jeanine Davis' Program

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 6 inches apart with rows 6 to 12 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 1 to 2 inches before the plants emerge in the spring. Lee Sturdivant and Tim Blakley, authors of “Medicinal Herbs in the Garden, Field, and Marketplace,” suggest 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.

GOLDENSEAL (*Hydrastis canadensis* L.)

Regardless of the planting method used, keep all beds free from weeds. Weed control is very important during the first few years as the goldenseal plants become established.

Insects and Diseases

Under natural conditions in the forest, goldenseal has minimal problems with diseases or insects. Slugs may be a problem; they can eat the entire crown of the plant as well as the fruit. If the populations of slugs are intolerable and the usual control measures (e.g., lime and wood ash, beer traps, copper strips, and bait) 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. Root knot nematodes will also severely reduce growth and root yield of goldenseal but can usually be avoided by testing the soil for their presence before planting. 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.



Goldenseal in flower. Shortly after the flowers, the fruit will develop. From the fruit, seeds can be harvested.
Photo credits: Jeanine Davis' Program

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 planting rhizome pieces. 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. If enough fibrous roots are left behind, the bed will often reestablish itself, making replanting in that area unnecessary. 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. Commercial root washers are available that consist of a drum that turns and tumbles the roots as water is sprayed over them. Remove all dirt, breaking larger roots if necessary, but do not use a brush. Spread the washed roots on screens, and dry in a well-ventilated area in the shade or in a forced air dryer. Simple dryers can be constructed from small sheds or rooms in barns. Bulk tobacco barns can also be modified for drying goldenseal roots. Keep temperatures in the dryer low, around 95° to 100°F, and provide good airflow around the roots. Roots will lose about 70 percent 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, clean untreated burlap sacks, or poly-sacks. Store in a cool, dry, dark area free from insects and rodents. Yields per acre can vary drastically depending on production method and location, but generally range from 800 to 3,000 pounds of dried root per acre.



Goldenseal plant with ripening fruit
Photo credits: Jeanine Davis' Program

Marketing and Economics**Regulations for Selling**

Because goldenseal is listed as an Appendix II plant with CITES, a permit or certificate must be obtained before exporting cultivated or wild-harvested roots, root pieces, or powder. Finished products, e.g., extracts or capsules, are not regulated. To obtain the required permits or certificates to export cultivated material, proof that the roots, rhizomes, or seeds came from legally acquired parental stock is required, as well as verification that plants were cultivated for at least four years. For permit applications and more information, contact the Division of Management Authority, US Fish and Wildlife Service, 4401 N. Fairfax Drive, Room 212, Arlington, VA 22203. The telephone number is 800-358-2104, and the website address is international.fws.gov.

Annual Consumption and Dollar Value

In 2005, approximately 84,000 pounds of goldenseal root were traded on world markets, almost a 50 percent increase from 2003, but close to a 60 percent decline from consumption levels in 2001. In 2005, the dollar value of consumption was around \$2 million.

Supply and Demand

Demand continues to exceed supply for high-quality, cultivated goldenseal. Wild-harvested product is meeting the demand requirements of buyers more concerned with the name recognition than bioactive components. Cultivated material represented about 40 percent of the overall supply in 2005. Restrictions on wild harvesting in many areas and the desire for higher



Freshly dug and washed goldenseal roots
Photo credits: Jeanine Davis' Program

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. The publication of positive research reports on the efficacy of goldenseal should continue to drive demand. Over the next three to five years, the market for all goldenseal is expected to grow at a rate of 5 to 10 percent annually. The market demand for high-quality, cultivated material is expected to grow at a faster rate, approaching 10 to 15 percent annually.

Pricing

Prices for wild-harvested goldenseal root fluctuate significantly from harvest season to harvest season. The price of cultivated product changes less but trades in a higher price range. In 2012, collectors were selling wild-harvested material to dealers for \$20 to \$25 per pound of dried root, while growers were selling cultivated material to the same buyers for about \$30 to \$35 per pound of dried root. Wholesalers were selling goldenseal for about \$67 per dried pound, and the retail price was averaging about \$115 per dried pound.

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 are 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 (mostly European) processors.

Commercial Viability

Goldenseal has a long, established 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 percent hydrastine and 6 percent total alkaloids is considered acceptable for most buyers. Because of its multifaceted effect on the body, goldenseal is often included in combination formulas, particularly with echinacea. Interest in the European market continues to steadily increase as this material has been combined with better-established herbs such as echinacea(s) and black cohosh. Of the top nutraceutical/botanical companies, 29 percent offer this material as a standalone product and 51 percent offer this material as either a standalone product or as part of a multi-constituent supplement.

Conclusion

The high demand for goldenseal has put native populations in serious decline throughout its range. A CITES permit is required to export goldenseal. Commercial interest in this product has been high and is expected to remain so. Goldenseal trades at a higher price bracket than most plants. In recent years, more efforts have been made to encourage farmers to cultivate this high-value crop. With more cultivation efforts occurring, supply will slowly increase but not at a rate consistent with demand, which should keep prices in a relatively high bracket.



Goldenseal tinctures from Herb Pharm (right) and Gaia Herbs (left). It is common for goldenseal extracts to be combined with other plant extracts, such as Echinacea. Photo Credit: Company websites

Resources

Cech, R. 2002. "Growing At-Risk Medicinal Herbs." Horizon Herbs. Williams, OR. 314 pp.

Persons, W.S. and J.M. Davis. 2007. "Growing Ginseng, Goldenseal, and Other Woodland Medicinals." Bright Mountain Books, Fairview, NC. 466 pp.

Fernald, M.L. 1970. "Gray's Manual of Botany." D. Van Nostrand Company, New York, NY. 1632 pp.

Radford, A.E., H.E. Ahles, and C.R. Bell. 1968. "Manual of the Vascular Flora of the Carolinas." University of North Carolina Press, Chapel Hill, NC. 1183 pp.

Strategic Reports. 2002. Analysis of the economic viability of cultivating selected botanicals in North Carolina. A report commissioned for the North Carolina Consortium on Natural Medicinal Products by North Carolina State University, Raleigh, NC. 244 pp.

Sturdivant, L. and T. Blakley. 1999. "Medicinal Herbs in Garden, Field, and Marketplace." San Juan Naturals, Friday Harbor, WA. 323 pp.

USDA, Crops Research Division, ARS. 1960. Index of Plant Diseases in the U.S., Agricultural Handbook No. 165., Washington, DC., 531 pp.

This article is a revision of the manuscript published in 2004 for the North Carolina Consortium on Natural Medicines, a Golden LEAF Foundation-funded project of the University of North Carolina-Chapel Hill and North Carolina State University. The original article was authored by Jackie Greenfield and Jeanine Davis and can be found at naturalmedicinesofnc.org.