Goldenseal (*Hydrastis canadensis*): An Introduction to this North American Medicinal Herb

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INTRODUCTION

Goldenseal (*Hydrastis canadensis* L.) is a highly valued North American medicinal herb belonging to the family Ranunculaceae. It is a small herbaceous perennial found in Northwestern United States and Canada, from Ontario in the North, to North Carolina in the South. Common names include yellow root, orange root, Indian dye, and yellow puccoon. Its main active ingredients are the alkaloids, hydrastine and berberine, and it is used among other things as a muscle stimulant, stomach strengthener, antihaemorrhagic, and laxative. Goldenseal also has some antibacterial activity. Collecting goldenseal from the wild resulted in its near extinction in its native habitat, however, as a result of intensive cultivation it has become more common. In New Zealand goldenseal is currently being evaluated as a new crop (Douglas, 1988).

DESCRIPTION

Goldenseal is a native to the open woodland areas of Northeastern North America. The plant overwinters as a rhizome with leaves emerging early in spring. The stems grow to about 30 cm and generally have two large, slightly hairy leaves. Plants grown at Ruakura in the Waikato flower in mid-spring. A small white flower develops on an extension of the main stem above the oldest leaf. The flower develops into a green berry, which later turns bright red when the seeds are ripe. After the fruit has ripened the leaves start to senesce although they often do not completely die until the first frosts. As the plant develops, the central part of the rhizome eventually dies leaving the remaining parts of the root to grow as independent plants.

HISTORY

The use of goldenseal was widespread amongst the north-eastern American Indians before Europeans arrived. They used formulations of the root to treat local inflammations, debility, dyspepsia, whooping cough, diarrhoea, liver trouble, fever, sour stomach, flatulence, pneumonia, and to improve the appetite (Foster, 1991). Other reports indicate that goldenseal was also used to promote healing of open wounds and, when mixed with bear grease, as an insect repellent (Hobbs, 1990), while Tyler (1993) reports it was used by the Cherokee Indians for treating skin disease and sore eyes. Early pioneers chewed the root to treat a sore mouth and used it as an infusion and treat liver and stomach ailments (Krochmal and Krochmal, 1984). By 1747 goldenseal had become commercialised and in 1860 was entered into the United States Pharmacopoeia (Hardacre, 1974). As a result of low supplies and high prices during the 1903 and 1904 season the first attempts at cultivation were made. Demand until then had been met entirely by harvesting wild populations. The price paid for goldenseal increased gradually until 1933 when an oversupply caused a price collapse. The next high point for goldenseal collectors and growers was the

Second World War with root selling for US$16 kg^{-1}. The high demand for antibiotics at this time resulted in a strong demand for herbal remedies. Returns for roots peaked in 1946 at nearly US$18 kg^{-1} then dropped to a low of US$5 kg^{-1} in 1950. In 1996 the price for dry goldenseal root was US$77 kg^{-1} while dried leaves and petioles sold for US$16.50 kg^{-1} (Louttit, pers. comm.). The revitalized interest in herbal medicine makes it likely that demand for goldenseal root will remain firm. However as a minor crop it is likely that price fluctuations will continue as growers over or under supply in response to changing prices (Foster, 1991).

PHARMACOLOGY

Although all parts of the plant are used for medicinal purposes the rhizome is the most valued component because it contains the highest concentration of active ingredients including 2% to 4% hydrastine and 2% to 3% berberine (Genest and Hughes, 1969). Other active ingredients include hydrastinine and canadine. The pharmacological action of goldenseal is thought to be mainly due to hydrastine and to a lesser extent berberine. Hydrastine is known to constrict blood vessels and lower blood pressure. It has been used in the treatment of gastric inflammation, but higher doses can cause exaggerated reflexes and convulsions. Hydrastinine, on the other hand, causes an increase in blood pressure and stimulates many kinds of involuntary muscles. Berberine acts as a stomach strengthener and anti-haemorrhagic, while canadine has been shown to stimulate the uterus in rabbits and guinea pigs (Genest and Hughes, 1969). Goldenseal is not commonly mentioned in modern pharmacological literature but is still used for its antibacterial properties and its false reputation as a masking agent for drug concentrations in urine (Foster, 1989; Hobbs, 1990; Tyler, 1996).

PROPAGATION

Goldenseal can be propagated by seed, division of the rhizome, or by root cuttings. Division is the most commonly used method (Van Fleet, 1916). Propagation by seed is also popular although the seed reportedly requires 3 months of stratification before it will germinate (Foster, 1984).

At Ruakura whole plants have been lifted throughout the winter when all top growth had died down and the rhizome and roots broken up and lined out into a variety of potting mixes. Although considerable numbers of plants have been produced results have been inconsistent with many of the rhizome segments and root cuttings not producing shoots.

The most successful means of propagation has to date been by collecting suckers from parent plants growing in the field. Suckers are detached from the parent plant in spring when they are about 10 to 15 cm tall and transplanted directly into production beds. By leaving as much soil on the roots as possible and transplanting the plants quickly, transplant shock is kept to a minimum. Overhead watering has not been required provided cuttings are transplanted early enough in the spring to allow roots to develop before the heat of summer. Poor transplanting technique will result in the plants "sulking" until the following spring or plant death. Beds are often mulched with untreated pine (*Pinus radiata*) sawdust for moisture conservation and weed control, soon after planting. Using this method we get a 95% emergence in the spring following transplanting.

Research at Ruakura evaluating strategies for germinating goldenseal seed is

currently underway.

PRODUCTION

Goldenseal prefers a rich, friable, well-drained soil. Foster (1984) reports that adding leaf mould and phosphate promotes growth while Davis (1996) recommends a pH of 5.5 to 6.0 and little or no fertiliser. In New Zealand, excellent growth has been achieved on the free draining sandy loam ash soils found in the Waikato and Rotorua areas. In North America, goldenseal is planted out 20 cm apart in rows spaced 25 to 30 cm in either late autumn after crop harvest or in spring. Goldenseal requires shade to grow well with 75% shade commonly recommended (Sievers, 1948). Shade can be provided by wooden lath, shade cloth, or by growing the crop under a forest canopy. If propagating by division, harvesting should be possible after three or four years while seed-propagated plants may require an extra year. Goldenseal requires similar conditions to ginseng (*Panax quinquefolium*) for good growth (Foster, 1987) with some ginseng growers including goldenseal in their crop rotation after ginseng. After harvesting in late autumn, roots are washed and air-dried until brittle. After five years of growth goldenseal will yield 1 to 2.5 t ha^{-1} dried root. Plants grown for five years in the Waikato yielded on average a dried weight of 29.5 g of rhizome, 28.8 g of root and 31.5 g of leaves and petioles.

PROSPECTS FOR NEW ZEALAND

Goldenseal is reported to be one of the top-selling herbs in the American health food industry (Brevoort, 1995) with a large number of modern day uses (Duke, 1985). It can bring good prices, and if dried properly, has a long shelf life. Our research in the Waikato indicates that it is relatively easy to grow intensively under shade cloth with no major pest or disease problems. Research in the Rotorua area indicates goldenseal will also grow well under New Zealand's large exotic pine (*Pinus radiata*) plantations although growth is slower. Provided the demand and price remain high, early indications are that goldenseal has some potential as an export crop for New Zealand. It will, however, be several years before there is sufficient product available in New Zealand for test marketing to confirm this market potential.

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