Medicinal Plants with a Potential Niche Market for Propagators

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INTRODUCTION

Herbal medicines and aromatherapy are one of the fastest growing U.S. markets. The companies producing medicinal herb products, such as capsules and tinctures found in health food stores and pharmacies, have traditionally purchased most of their raw herbs from India, China, and the Eastern European countries. A variable demand also exists for wild-collected native North American medicinal plants. In the past, the ultimate destination for many of these native medicinal plants has been Europe and the Orient.

As the medicinal herb industry has matured, the companies buying these plants have instituted new quality control efforts. These include testing for active compounds, purity, and bacterial contamination. Some plants that can be included in this group are purple coneflower (*Echinacea* sp.), ginseng (*Panax quinquefolius*), black cohosh (*Cimicifuga racemosa*), mayapple (*Podophyllum peltatum*), bloodroot (*Sanguinaria canadensis*), helonias (*Chamaelirium luteum*), skullcap (*Scutellaria lateriflora*), and goldenseal (*Hydrastis canadensis*). These plants are usually considered new or specialty crops within traditional agriculture with dependable research information unavailable or only gradually being developed.

GOLDENSEAL

Goldenseal Research. One of the plants in greatest demand is goldenseal, a shade loving herbaceous perennial. It is used for many purposes including as a treatment for AIDS, cancer, and various digestive disorders as well as to boost the immune system. The medicinal properties of goldenseal are attributed to the alkaloids hydrastine and berberine which are usually present in concentrations of 2% to 6%. Unfortunately, native populations have been seriously reduced by over collection and it is now an endangered species in North Carolina so wild collection is illegal. A permit from the North Carolina Department of Agriculture is required to cultivate or propagate goldenseal in North Carolina.

The following has been learned from Dr. J.M. Davis' research during the past 5 years. For grower information summarizing information about goldenseal and other medicinal plants, please check the following websites: www.ces.ncsu.edu/depts/hort/hil/spcrop-index.html or www.herbnet.com.

Propagation. Goldenseal produces a raspberry-like fruit which is full of small, round, black seeds. Seeds should not be allowed to dry out. Propagation by seed is difficult and unpredictable. However, best germination usually occurs when seed is sown immediately after being extracted from the fruit. Studies are currently underway looking at seed extraction, disinfection, and storage. So far, best germination has occurred by holding seeds at 70 F prior to sowing in late August or late October. Seeds will germinate the following spring or the second spring and may

be subject to damping off if conditions are favorable. Good air circulation and lack of excessive irrigation during germination are essential. Seeds should be planted 0.5 inches deep at 3 to 4 seeds per ft in rows 6 inches apart. Harvestable roots can be grown from seed in 5 to 6 years.

Goldenseal spreads via a rhizome that can also be used for propagation. Currently, this is the preferred method of propagation. In fall or spring these rhizomes can be cut into pieces. Include an obvious bud on each propagation piece. Research indicates that it is also very important to have good roots on each piece. Do not cut roots off the rhizome piece! Root cuttings taken in late winter or early spring have also proven successful. Harvestable roots can be grown from rhizome pieces in 3 to 4 years.

Culture. Hardiness is not a problem in much of the United States since the native range is from Georgia to Vermont. Goldenseal should be planted in a rich, well-drained, moist loamy soil where goldenseal has not recently been grown (rotate crops!). Raised beds 2 to 6 inches tall and 3 to 5 ft across have worked well. Research has demonstrated the best emergence and subsequent growth occurred between soil pH 4.8 and 6.7 so beds are usually limed to a pH between 5.5 and 6.5. Supplemental nitrogen and phosphorus reduced emergence the first year but had little affect in subsequent years.

Plants grew best under a natural forest canopy or artifical 75% to 80% shade. While goldenseal can be successfully mulched with shredded leaves, pine needles, bark, sawdust, and chopped straw, our experience has been that straw mulch results in poor growth and severe slug damage. Goldenseal should only need irrigation during drought. If not irrigated during drought, plants will drop their foliage and go dormant earlier than normal.

Pests. Fortunately, goldenseal suffers few attacks from diseases or insects because labelled pesticides are not available. Slugs will eat the entire plant crown and fruit. Keeping mulch away from the crown of the plant and other common slug remedies seem to provide some control. Moles may damage beds and can be controlled by trapping or by bordering beds with wire mesh set 8 to 12 inches deep into soil. Rootknot nematodes are harmful to goldenseal. *Phytophthora cactorum*, a problem with ginseng, does not appear to harm goldenseal so crop rotation with ginseng is possible since both plants grow well under similar cultural conditions. In recent years, new plantings of goldenseal have been established in which plants are grown intensively and "pushed hard". In these plantings, some fungal diseases caused by *Fusarium* and *Alternaria* species are being found.

Harvest. When plants have fully occupied land either harvest the roots or divide plants. If you do not, the plants will start to crowd themselves out.

Dig roots in the fall after tops have died down. Remove all soil, breaking larger roots if necessary, but do not use a brush. Spread clean roots on screens and dry in a shaded, well-ventilated area or in a forced-air drier. Roots will lose about 70% of their weight during drying and should snap cleanly when at the proper moisture level. Dried roots should be packed loosely and stored in a cool, dry area secure from rodents. If a market exists for leaves and stems, harvest must be earlier such as in early September while foliage is still green. Dig carefully, keeping the many fibrous roots intact if harvesting leaves and stems for transplanting.

DISCUSSION

There is much remaining to be learned about goldenseal. However, the amount of scientific information that has been gained in the past few years demonstrates that commercial propagation and production of many medicinal herbs provides an opportunity for enterprising nurserymen. As selection is made for plants with higher concentrations of essential ingredients, clones will develop. Asexual propagation techniques have the potential to rapidly increase the production efficiency of the medicinal herb industry.

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We shall be discussing the genus *Taxus* as one of many plant genera that produce anticancer compounds. Literature tells us that *T. baccata* produces a medicinal compound Docetaxel trademarked as Taxotere® by Rhone-Poulenc Rorer as an investigational drug. This evening our discussion will be relevant to Paclitaxel, which is sold as Taxol® by Bristol-Myers Squibb. Early on, in the mid 1980s, sadly the FDA only designated *T. brevifolia* our Pacific yew, as the only approved source of Taxol®. This dastardly act meant ripping the bark from 100-year plus trees thus killing the trees. Thankfully, this no longer is the case, since *T. brevifolia* is currently a threatened species. Today the only *Taxus* biomass source is from the nursery community. This biomass, which must be extracted and purified to obtain medical compounds, could be whole plants, roots (only), branches (only), or needles from current year's growth. We will briefly discuss the nursery role in each of the above and offer some suggestions to avoid pitfalls should you sign a contract with a pharmaceutical company.

I wish to caution all my nursery community friends that transactions with biotechnology companies are far different than dealing "with our own". Over the years, I have learned first hand that most of these people have never seen a nursery, never seen a taxus plant, generally have no agricultural knowledge, no knowledge of plant propagation, and the list goes on! If you are approached, ask many questions as to what type of biomass they are requiring, including cultivar (which is very, very important) as well as biomass condition (green or dry), and then have them submit a contract as to conditions. After you review the contract, have your attorney review same prior to signing. Sadly, a simple purchase order, which we deal with daily, will not suffice. My friends, I can't stress that point enough, it is extremely important! Do not sign a contract which only pays you on Taxol® percent of concentration, since this varies dependent upon time of year, nitrogen uptake levels, and cultivar, etc. Today, the cultivar of choice for Taxol® is *T.* ×*media* 'Hicksii', however, I am sure that not all *T.* ×*media* cultivars have been studied.

The various options we have as growers include the following:

- Entire plant (roots/tops) — contract, prior to planting, to grow close-spaced for 3 to 5 years, clean harvest, generally not dried but shipped as green biomass.