

Producing and Marketing Wild Simulated Ginseng in Forest and Agroforestry Systems

Andy Hankins, *Extension Specialist, Alternative Agriculture; Virginia State University*

Introduction

American ginseng (*Panax quinquefolium*, Araliaceae family) is a familiar plant to many people in the Southern Appalachian region. For several generations, “digging sang” has been an enjoyable and profitable activity for many mountain people. American ginseng is native to many states, east of the Mississippi River, in the United States. It prefers a cool, temperate climate and is only found in the mountainous regions of the Southern states. It also grows naturally in the Eastern provinces of Canada. Ginseng is a tender perennial. The first frosts of fall kill the leafy top, but a new top grows up the following spring, from an underground bud on the perennial root. It takes seven or eight years for American ginseng plants to grow to maturity in a natural woodland habitat.

American ginseng is a complicated opportunity for forest farmers to understand because it can be grown in several different production systems and because there is great variation in market demand and prices paid for the various grades of dried roots. It is a controversial plant. Wild harvest has depleted the natural population to such a degree that it has become threatened with extinction in certain regions (Convention on International Trade in Endangered Species of Wild Fauna and Flora, CITES). Ginseng has a reputation as an aphrodisiac, which has made it a comical rather than a credible plant. It is not easy to grow. A great deal of failure has occurred, in the past, by landowners who casually scatter ginseng seeds in their woods hoping to get rich without doing any work. The ginseng market is disorganized. Certain dealers try to buy ginseng at low prices so they can sell it at high prices. The threat of human theft has made ginseng production impractical in certain regions. There are constant reports about the low prices being paid for cultivated ginseng crops grown in Wisconsin. On the other hand, wild ginseng sells for over \$300 a pound and the market demand in Asia for wild roots is practically unlimited. That market demand and price can not be easily dismissed.

Within this publication, a system of growing ginseng called wild simulated ginseng production will be described. Using this production system, landowners may establish naturalized populations of wild American ginseng on the forest floor in their privately-owned woodlands. If managed correctly, these natural stands of ginseng will be perpetual. A natural stand of undisturbed wild ginseng renews itself by self-seeding. Careful harvest of mature plants can take place, in wild simulated ginseng patches, without taking the site out of production. Young seedling ginseng plants will just grow up to take their place. A carefully managed stand of naturalized American ginseng may produce income for several decades.

Cultivated versus Wild Ginseng

In 1999, wild dried roots of ginseng sold for as much as \$425 per pound. That price has doubled in the last 10 years. In 1999, quite a few pounds of field-cultivated, dried ginseng roots, produced under artificial shade, sold for \$10 per pound. That price has been reduced by 75 percent in the last 10 years. Why should there be such a difference in the prices paid for wild and cultivated ginseng? Most of the ginseng, grown or gathered from the wild in the United States, is exported to Asian countries for sale. Hong Kong has traditionally absorbed the bulk of North American ginseng, accounting for a consistent 80 percent of all purchases of unprocessed root (Bozak and Bailey, 1995). Ginseng growers and gatherers in the United States and Canada produce about four million pounds of dried roots for export to Asia each year. Apparently, the Chinese people prefer wild ginseng over cultivated because it more closely resembles the revered wild Asian ginseng (*Panax ginseng*, C. A. Meyer). This Asian species has been an important component of Chinese folk medicine for over 4000 years (Konsler, 1983). The Chinese believe that the slower growing wild roots, which are harvested at an older age, absorb more curative power from the forest floor (Persons, 1994). Scientific laboratory tests are not used to determine the

www.ext.vt.edu

value of ginseng roots in China. Over the centuries, the Asian buyers have developed quite an elaborate grading system based on the visual appearance of the roots.

Experienced buyers of ginseng can easily tell the difference between wild and cultivated roots. The wild roots are dark tan in color, gnarled in appearance and show many concentric growth rings. They are often forked. Some of them resemble the body of a man. Wild roots are generally small in size and light in weight. One distinctive characteristic of a wild root is a long neck. The cultivated roots are cream colored, smooth and fat and exhibit few concentric growth rings. Cultivated roots are often large and heavy. They are most often shaped like a carrot. Ginseng grown from cultivated seed will typically have a short neck.



American ginseng roots are offered for sale in shops and stores throughout China. The Chinese believe that ginseng is a panacea for their health.

Approximately two million pounds of ginseng were grown in intensive cultivation under artificial shade in Wisconsin in 1994. Ginseng cultivation has been practiced there since 1900. In 1994, production in Ontario, Canada, exceeded one and one-half million pounds. In 1994, production in British Columbia exceeded one-half million pounds (Bozak and Bailey). In 1994, artificial shade grown roots were selling for \$30 to \$40 per pound. In 1995, artificial shade grown roots sold for \$18 to \$30 per pound. In 1996, artificial shade grown roots sold for \$10 to \$22 per pound. In 1997, artificial shade grown roots sold for \$6 to \$18 per pound (Persons, 1998). Current prices are below the costs of production. The artificial shade cultivated ginseng industry in North America is collapsing.

One of the primary reasons for declining prices of cultivated American ginseng is increased production in China. The author traveled to the famous ginseng production regions of Northeast China in 1996 with two West Virginia Extension Agents, David Cooke and John Scott. They saw hundreds of acres of American ginseng being grown under artificial shade in Liaoning, Jilin and Heilongjiang Provinces. The Chinese ginseng experts

told them that they have been buying American ginseng seed from Canada for the past 20 years. The Chinese have become very adept at growing excellent quality cultivated American ginseng roots. Officials from the People's Republic of China - Ministry of Agriculture told the American visitors that China will be self sufficient in American ginseng by the year 2000 (Hankins, 1997). They were referring to cultivated American ginseng. China will not be self sufficient in wild American ginseng. All of the ginseng Cooke, Hankins and Scott saw in China was growing under artificial shade. During hard times in the past, the Chinese cut down most of their forests to heat their homes and for cooking. The forested lands that are so abundant in the United States do not exist to any large degree in China. Without access to hardwood forests, they do not have the capability to establish naturalized populations of American ginseng.



American ginseng growing under artificial shade in Jilin Province, People's Republic of China.

When ginseng is grown in an open field under artificial shade, the stressful conditions which wild ginseng plants must face are eliminated. Cultivated ginseng does not have to compete with woodland plants for nutrients or water. Under intense cultivation, the roots quickly grow to a size suitable for harvest. Four-year old roots are very commonly harvested. Yields as high as 2,500 pounds of dried root per acre have been reported. Establishment costs for one acre of ginseng beds, under wood lath shade or under polypropylene shade cloth, varies from \$20,000 to \$40,000 depending upon the current prices of materials needed.

The greatest problem associated with intensely cultivated ginseng is disease control. *Alternaria* blight is the most widespread fungus disease. Damping off is a common disease of seedlings. In soils that do not have adequate drainage, actual root rotting can be caused by *Phytophthora cactorum* and other fungal organisms. Any disease outbreaks severely threaten ginseng under intense cultivation because the plants are so close together that the disease can quickly spread through the entire bed. This intense fungus disease pressure forces artificial

shade growers to use a vigorous spray schedule to prevent losses. Many ginseng consumers worldwide have become concerned about these fungicide applications. Ginseng is a medicinal herb taken to improve a person's health. The presence of pesticide residues on the roots or within the roots, in the case of systemic fungicides, is a severe drawback. This concern is certainly a factor in the price decline for cultivated roots.

Production Of Wild Simulated Ginseng

A method called wild simulated cultivation can be used to grow ginseng without fungicide sprays and expensive establishment costs. The prices paid for ginseng grown under wild simulated cultivation are normally the same as prices paid for wild ginseng roots. Ginseng production is very risky. The chosen site may not be suitable for good growth. The crop may be stolen. Rodents may destroy the roots. The market price may fall. Plant diseases will almost certainly occur. On the other hand, if the right conditions can be found, wild simulated ginseng production can provide income for those who have patience, perseverance and discretion. It is also a very enjoyable project.

Site Selection

To grow wild simulated ginseng, the first step is site selection. The most favorable temperature and soil moisture conditions generally are associated with north or east facing slopes with at least a 75 percent shade canopy. That is dense shade. The best shade is provided by deep rooted, deciduous trees such as Yellow poplars and oaks. Ginseng grows best in a moist, well drained soil. That is almost a contradiction of terms but these soils do exist. Successful growth of ginseng most often occurs in sites where other herbaceous woodland plants are growing. Plants that indicate a good place to grow ginseng include Jack-in-the-pulpit, bloodroot, Solomon's seal, jewel weed, galax, trillium, wild yam, hepatica, Black cohosh, wild ginger and ferns. In certain soils ginseng even grows well in association with poison ivy. Excellent soil drainage is essential. A swampy soil or a heavy clay soil must be avoided.

Soil Management For Wild Simulated Ginseng Crops

Once a potential site has been identified, a soil test should be taken. Dig up soil from at least six spots on the slope, mix it together in a plastic bucket and take the soil to your local Extension office so it can be mailed to the state soil test laboratory for analysis. When the soil test results come back, the most important numbers to look at for ginseng are the soil pH, available calcium (Ca) and available phosphorus (P). A typical pH from a soil

sample taken from the forest floor from a north facing hillside in Virginia is 4.5. In the past, growers have been told to treat soil, with a pH that low, with lime to try to bring the soil pH up to 5.5 to 6.0 for ginseng production. Recent research by Bob Beyfuss in Greene County in the state of New York calls this practice into question. Mr. Beyfuss is an Extension Agent with Cornell Cooperative Extension who has a very strong interest in ginseng. In 1996, he recruited a team of ginseng hunters to assist him in a soil research program with wild ginseng. He asked these wild ginseng diggers to take soil tests wherever they found patches of wild ginseng growing well out in the woods. He got back 70 soil samples from them.

Beyfuss was surprised at the soil test results that came from this study. He said in his report, "*The most interesting and puzzling result of the analysis was the positive correlation of very low pH and very high levels of calcium. This is the exact opposite of what would be expected in mineral soils. The average pH for these samples was 5.0 + or - 0.7. Soils that are strongly acid such as this usually have calcium levels in the range of 1000 to 2000 pounds per acre or less. The average calcium levels in these samples (where ginseng was growing well) was 4014 + or - 1679. It is my suspicion that this abnormality may, in fact, be the key to the limited range of healthy populations of wild ginseng. Duplicating this soil condition may be the key to successfully cultivating American ginseng in a forested environment.*" (Beyfuss, 1997)

At the same time that Bob Beyfuss was testing the soils under wild ginseng stands in New York, Jim Corbin, a Plant Pest Specialist with North Carolina's Department of Agriculture, was conducting similar research in the Great Smoky Mountains National Park in western North Carolina and East Tennessee. He conducted soil analysis from several wild ginseng stands and reported that, "*In ginseng, calcium deficiencies can be seen in stunted plants that lack general vigor. Growth buds are smaller and more fragile. In good ginseng stands, calcium on a per acre basis is consistently higher than in the other stand categories, and within these stands there was better plant diversity, less disease and a larger stem height in mature plants.*" (Corbin, 1997)

These two reports have caused controversy among ginseng growers and researchers. The new idea is to apply gypsum (Calcium sulphate) to soils for ginseng rather than lime (Calcium carbonate) which has been used in the past. The reasoning behind this is that the gypsum will add calcium but will not raise the soil pH. Rates as high as 5 pounds of gypsum per 100 square feet of growing bed have been recommended to bring the calcium levels up to 4000 pounds per acre. There are strong suspicions among several ginseng experts that ginseng diseases, like Phytophthora root rot, may

be suppressed by acid soil conditions. There are strong suspicions among the same group that applications of lime to bring the soil pH up may lead to increased disease problems. Unfortunately, these suspicions have not been tested by replicated research studies. A few concerns about heavy applications of gypsum have been voiced by soil scientists. They are worried that growers may throw the soil fertility out of balance if they apply too much gypsum. Clearly, controlled research studies need to be conducted as soon as possible.

The other soil nutrient that ginseng growers should monitor is phosphorus. In 1978, Dr. Tom Konsler initiated a four-year study to measure ginseng root growth response to P additions to the low P soils found at the Mountain Horticultural Crops Research Station in Fletcher, N. C. Dr. Konsler found positive correlation of root weight with phosphorus additions. He also found that ginseng plants took up calcium more readily in soils that had available phosphorus so the interrelationship is important (Konsler, 1990). Growers should amend their low P soils so that at least 95 pounds per acre of actual phosphorus is available (Persons, 1994).

In the wild-simulated method, there is no tillage of the soil. Many persons recommend planting "woods grown" ginseng in tilled up, raised beds in the woods, under a natural canopy of shade. That method certainly can be used for production of ginseng but growers should not expect to receive high prices for roots produced in tilled beds. Ginseng roots harvested from tilled beds look like cultivated roots rather than wild roots. Prices paid for this kind of ginseng range from \$30 to \$100 per pound of dried roots. Since there is no tillage of the soil with wild simulated ginseng crops, all fertilizers are applied on the soil surface. Applications of gypsum and/or rock phosphate may have to be made every two or three years. Soil testing should be done every year to monitor available soil nutrients.

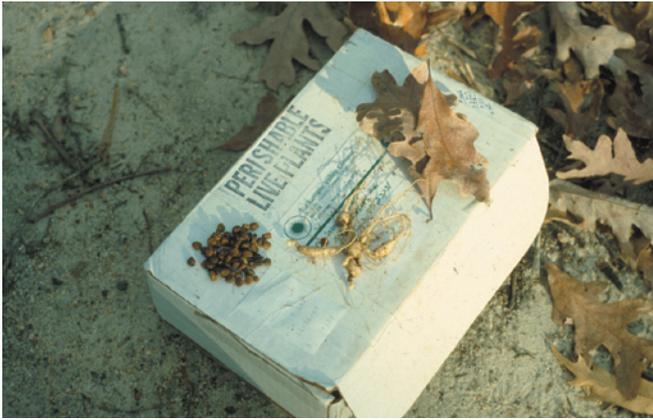
Planting

In the wild simulated method, stratified ginseng seed is planted in the fall after the trees lose their leaves. The best month for planting in Virginia is November. Ginseng cannot be planted in the spring. The stratification requirements for ginseng force everyone to plant in the fall. That seed needs to come out of the stratification box and into the soil after 12 months. If the seeds are left in stratification for a longer time to accommodate spring planting, the seeds will sprout inside of the stratification box and will be useless. Some growers make the mistake of planting ginseng seeds in September and in October before the trees lose their leaves. The problem with this practice is that the falling leaves form a mulch on the forest floor that may be too deep for the germinating ginseng seedlings to grow through. Fall planted seeds lie

in the soil until the following April. When they germinate, they can grow up through an inch or two of leaves but they cannot grow up through four or five inches of leaf mulch, which may accumulate in many sites from natural leaf fall.

There are presently about 20 commercial sources of American ginseng seed. Most seed is sold by experienced ginseng growers, who have developed large-scale ginseng farms. Beginning growers should be cautious in buying ginseng seed. Most experienced growers have bought seed at one time or another that failed to germinate in the spring after fall planting. Growers are advised not to buy cheap seed. It is rarely a good deal. A great deal of meticulous care is required to successfully produce viable, stratified ginseng seed. Seed producers, who do the job the right way, are not likely to sell their seed at cheap prices. Most seed producers do like to sell their stratified seed in advance. To be assured of the best seed, growers should order and pay for ginseng seed in July or August. Once the seed is paid for, delivery can be postponed until the middle of October. Growers who wait until the middle of October to buy ginseng seed are likely to receive poor quality seed from the "bottom of the barrel." When purchased ginseng seed is received, it should be stored in the refrigerator. It usually comes in zip lock plastic bags. The seed in the bags should be misted with water, once a week, until planted. A pound of ginseng seed contains about 6500 seeds. If the seed ever dries out it will die. A good way to check the viability of any ginseng seed is to dump it in a bucket of water. All of the good, viable seed will quickly sink to the bottom. Any seeds that float on the surface are probably dead and are worthless for planting.

It is a good idea to plant ginseng seed in defined beds that are 5 feet wide and 50 feet long. The beds should be separated by 3-foot wide walkways. The beds should run up and down the slope, rather than across the slope, for better air drainage around the plants. It is not necessary or desirable to clear undergrowth away from the planting beds. It is perfectly natural for there to be trees, shrubs and herbaceous weeds growing in the beds that will be planted in ginseng. Wild ginseng grows in close association with other plants. Plant diversity decreases fungus disease pressure. This is an extensive planting method. If dense patches of weeds exist on the site, simply avoid them and plant in other areas. It is desirable to disturb the site as little as possible to reduce spread of fungus diseases. Growers are advised not to plant ginseng in close proximity to patches of ferns. The roots of ferns secrete allelopathic chemicals which deter other plants from growing next to them. Ginseng grows well on many hillsides where ferns grow, but not right up next to them.



It takes 10 pounds of stratified ginseng seed to plant one-half acre of wild simulated ginseng.

One management practice that may increase yields of ginseng is treating seed before planting. Nearly all of the stratified seeds purchased from commercial sources will be contaminated with spores of *Alternaria*, *Rhizoctonia*, *Fusarium* and *Phytophthora* fungi. These diseases may spread from contaminated seed. If stratified seed is soaked in a 10 percent bleach solution for two minutes, these fungal spores will be reduced. One cup of Clorox to nine cups of cold water will effectively control spores located on the surface of the seed. The bleach solution should be rinsed off of the seeds after two minutes. This control is not completely effective. The diseases may be present inside the seed. Careful selection of seed sources is recommended.

The only tools needed to plant wild simulated ginseng are a rake and a garden hoe. Rake the leaves on the forest floor away from the 5 foot wide bed right down to the topsoil. Using one corner of the hoe, make three narrow furrows 18 inches apart, all the way down the length of the bed. The furrows should be one inch deep and three inches wide. Plant ginseng seeds, by hand, 3 inches apart in each furrow. About one ounce of seed will be needed to plant three furrows, at this spacing, in a bed that is 5 feet wide and 50 feet long. Cover the seeds with 3/4 inch of soil. After planting, carefully step down each row to firm the soil around the seeds. Once the seeds are in the ground, gypsum or rock phosphate may be applied over the surface of the bed as needed. To finish the planting, rake one inch of leaves back over the bed as a mulch. After a couple of rain storms, no one will be able to detect that any planting has occurred. The site will look completely natural.

The stratified seed will germinate the next spring. The plants will look like three small strawberry leaves on a stem about one inch tall. Some of the seed will not germinate and some will be eaten by rodents. Over the next seven years, the plant population in each bed will be reduced every year by natural forces. The final stand will be a thin, healthy population of wild ginseng plants. In the wild simulated method, after planting, no more work is required until the ginseng roots are dug six to 10 years later. The ginseng plants are left to the vagaries of nature. Weeds on the forest floor will

compete with the plants for water and nutrients. Insects and rodents will attack certain plants. Fungus diseases may defoliate the ginseng plants. Severe weather may reduce plant growth. All of these stressful conditions result in a wild appearance of the roots that are eventually harvested. When the ginseng plants become four or five years old, they will begin producing red berries that contain ginseng seeds. The plants will self-seed and begin new populations of ginseng on the ground underneath the parent plants. This self-generation is fine but growers should not count on it for reliable future crops. Growers who want to have ginseng roots to sell every year should plant a couple pounds of seeds in new beds, every fall, for future harvests. This should not be a one-time activity.



One-year old plants of American ginseng.



A perpetual stand of ginseng may be maintained by allowing mature plants to self-seed.

Economic considerations

The costs involved in growing half an acre of wild simulated ginseng, planted in the method described above, are as follows:

10 lbs. of ginseng seeds	\$800.00
planting labor (160 hrs. at \$6.00/hr.)	\$960.00
harvest labor (270 hrs. at \$6.00/hr.)	\$1620.00
drying labor (16 hrs. at \$6.00/hr.)	\$96.00
gypsum (16 - 50 lb. bags at \$4.00/bag)	\$64.00
rock phosphate (16 - 50 lb. bags at \$8.00/bag)	\$128.00
miscellaneous - tools, clorox, heat, phone, etc.	\$100.00
total	\$3768.00

The income involved in growing half an acre of wild simulated ginseng depends upon the yield and future price. If a low price of \$260 per pound of dried roots is used, income will be:

Root yield	50 lbs.	Gross income - \$13,000	Net income - \$9,232
Root yield	75 lbs.	Gross income - \$19,500	Net income - \$15,732
Root yield	100 lbs.	Gross income - \$26,000	Net income - \$22,232

Security measures

The greatest threat to a crop of wild simulated ginseng is human theft. This problem is most common in regions where many people go out in the woods searching for wild ginseng. This activity, which is called “hunting sang,” is part of the culture of the Southern Appalachian region. Ginseng hunters comb the mountains of Virginia, West Virginia, Kentucky, Tennessee and North Carolina in late summer looking for ginseng. Most of these ginseng hunters are honest people who do not steal and who do not trespass on private land. A small percentage of the ginseng hunters are, however, lowlife rogues who will certainly be very excited if they come across a dense population of plants. These criminals think nothing of property boundaries or “No Trespassing” signs. They know that they are likely to find more ginseng on someone’s privately-owned land than they will find in the National Forest where the legal gatherers search. They are likely to cross private property at times when they know the landowners will be gone. They will steal as much ginseng from a wild simulated stand as they can dig.

The good news about this theft problem is that one man with a shovel cannot dig very much wild simulated ginseng in any short period of time. It takes nearly three hours to dig up three pounds of fresh roots that shrink to one pound of dried ginseng. Most thieves are not likely to stay at a growing site any longer than that. A thief could steal all of the roots in a small patch in one morning but no one could possibly steal half an acre of wild simulated ginseng in just a few hours. Quite a few growers have grown wild simulated ginseng until they first see evidence of theft. At that point, growers accept the inevitable and go ahead and harvest their ginseng roots. Usually theft problems do not begin until the ginseng is somewhat mature, so there will probably be no real financial loss.

It is quite possible to grow American ginseng without experiencing any theft problems. It is highly recommended that anyone attempting to grow ginseng this way keep quiet about the enterprise. There are approximately 300 landowners in Virginia growing ginseng today and they all prefer to remain anonymous. The wild simulated method of growing ginseng is best practiced on lands that are controlled. There are many areas, within the native range of ginseng, in which traffic over private land by hikers is restricted. The crop should not be planted within view

of any public road or trail. A few loud dogs that sense the presence of strangers can be an excellent deterrent to trespassers. An isolated patch of woods, fenced off from the cattle, in the middle of a large pasture might be a good site to grow ginseng. This might be an especially safe location if a couple of those cattle are bulls. American ginseng has even been grown in wood lots, located in suburban neighborhoods, without any threat of theft.

Growers are warned not to become too aggressive in protecting ginseng crops from thieves. Shooting a gun in the air to scare trespassers away from the woods is all right, but shooting the trespassers even if they are actively digging the ginseng is not all right. Ginseng growers who do this will be subject to imprisonment. It is against the law to shoot people trespassing on private property unless they break into the home. Growers are also advised not to keep a vicious dog. If the dog injures the ginseng thief, the owner of the dog is liable. If the dog injures an innocent person, the owner of the dog is liable.

Marketing Wild Simulated Ginseng

Small farmers who try to grow and sell fruit and vegetables for profit generally have to give a great deal of time and attention to marketing. With those crops, it is extremely important to have a buyer lined up before even planting the crop. Seasonal price fluctuations can mean the difference between profit and loss. In some years markets become totally flooded with certain kinds of produce and growers can barely give it away. Vegetable growers often spend long hours at tailgate farmer’s markets trying to sell their produce directly to the public. Various kinds of cooperatives and grower associations have been organized to assist vegetable growers with the difficult job of marketing.

In selling dried roots of wild simulated ginseng, the situation is totally different. It is hard to find any product that is easier to sell. In Virginia, there are 45 certified ginseng buyers spread out across the state. These buyers are regulated by the Virginia Department of Agriculture and Consumer Services - Office of Plant Protection. A list of the certified buyers can be obtained from that office (See literature review). All that a grower has to do is drive to the buyer’s house or store or service station, carry the roots in, watch as they are weighed and accept payment if he agrees with the price that is offered. If the grower does not like the price that is offered, he can take his roots to the next buyer down the road. A grower who has a large volume of roots to sell often will allow buyers to make bids on his roots to get the highest price. Some growers sell directly to large herb companies who buy ginseng for export to Asia. In a few states, ginseng auctions have been organized to help both the buyers and the sellers.

Current price information is easy to obtain from several sources. Marketing wild simulated American ginseng roots is easy because market demand is very strong for this scarce commodity. The only thing a first time seller has to watch out for is country dealers who might try to buy valuable ginseng at a low price. Many of these country dealers also buy and sell guns, hunting dogs, furs, used car batteries, etc. They practice the art of trading. If they make a low offer and the grower accepts it, it is his own fault.



Freshly dug ginseng roots have three times more weight than dried ginseng roots.

Literature Reviewed

Beyfuss, R. L. 1997. Ginseng Soil Characterization and Ecology Study. Cornell Cooperative Extension of Greene County, HCR 3, Box 906, Cairo, New York 12413.

Beyfuss, R. L. 1998. Growing Ginseng and Goldenseal in Your Forest. Cornell Cooperative Extension of Greene County, HCR 3, Box 906, Cairo, New York 12413.

Bozak, G. and Bailey, W. G. 1995. Ginseng Production In North America. Presented at the International Conference of Ginseng and Allied Plants, Harbin, People's Republic of China.

CITES regulations. U. S. Fish and Wildlife Service, Office of Management Authority, 4401 North Fairfax Drive, Arlington, VA 22703. 1-800-358-2104

Corbin, J. 1997. A Study of American Ginseng in Western North Carolina and East Tennessee. North Carolina Department of Agriculture report.

Hankins, A. 1997. The Chinese Ginseng Industry. *The Business of Herbs*. Vol. 25. Jemez Springs, New Mexico.

Konsler, T. 1983. Ginseng: A Production Guide for North Carolina. The North Carolina Agricultural Extension Service Pub. AG-323. Raleigh, N. C.

Konsler, T. 1990. Lime and Phosphorus Effects on American Ginseng: 1. Growth, Soil Fertility, and Root Tissue Nutrient Status Response. *Journal of American Society for Horticultural Science*. Alexandria, VA.

Persons, S. 1994. American Ginseng: GREEN GOLD. Bright Mountain Books Inc. Asheville, North Carolina.

Persons, S. 1998. Tuckasegee Valley Ginseng Newsletter, P. O. Box 236, Tuckasegee, North Carolina 28783. 828-293-5189

Virginia Department of Agriculture and Consumer Services. Virginia Ginseng Management Program. Office of Plant Protection, Endangered Species Coordinator, P. O. Box 1163, Richmond, VA 23209 804-786-3515