NC STATE UNIVERSITY

Echinacea
(*Echinacea angustifolia*)

MARCH 2012

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Introduction

Botanical Information

Echinacea angustifolia is an herbaceous perennial and a member of the Asteraceae family. Commonly called narrow leaf purple coneflower, it has a natural range in North America that includes most of the mid-western states east of the Rocky Mountains. *E. angustifolia* grows at a rate of six to eight inches per year to a mature height of twelve to twenty-eight inches. The leaves are lanceolate to linear-lanceolate, and the flowers are cone-shaped disks with purple, pale pink, or rarely white spreading ray flowers. The plant has one or more stems that are mostly unbranched, and flowers bloom from June to July. The taproot of cultivated *E. angustifolia* is harvested three-to-four years after planting from seed. The root is most valued for medicinal purposes, although the tops and flowers are also used.

Bioactive Components

The main bioactive components of *E. angustifolia* are flavonoids, such as echinacoside and cynarin, alkylamides such as dodeca-2E, 4E-8Z, tetracetyl isobutylamide, and caffeic acid derivatives. Of the three Echinacea species used for medicinal purposes (*E. purpurea, E. angustifolia, and E. pallida*), *E. angustifolia* is regarded as the most chemically active possessing antibacterial, antiviral, and antifungal properties.

Uses and Treatments

E. angustifolia has a long tradition of use among the native people of North America. It continues to be the most widely used herbal remedy in native cultures. In modern cultures of North America and Europe, *E. angustifolia* is primarily used in medicines believed to stimulate the immune system. It is also used as an antibacterial agent. Traditional and folk uses include treatments for blood poisoning, fever, acne, infections, and sores.

Cultivation Practices

Site Selection

E. angustifolia can be grown almost anywhere within the temperate zones and is quite cold hardy. It prefers a well-drained alkaline soil in a sunny location.

Recommendations for soil pH range from 6.5 to 7.5. *E. angustifolia* can tolerate hot and dry conditions but extensive drought can reduce size and yields. Raised beds are highly recommended, especially for moist or clay soils. Poorly drained soils should be avoided. *E. angustifolia* is known to be more difficult to cultivate and slower growing than *E. purpurea* and *E. pallida*.

Planting

Propagation of *E. angustifolia* can be from seed or transplants. Seed germination is usually slow and poor, often yielding only 50% germination rates. This makes direct seeding in the field inappropriate. Johnny's Selected Seed Co., in Winslow, Maine, recommends the following guidelines for starting seeds indoors to produce transplants: *E. angustifolia* requires light as well as cold stratification (pre-chilling) for seed germination. Using deep flats or pots to allow for good root development, fill with a prepared soil mix, and plant seeds, barely covering with soil. Moisten, cover lightly, and refrigerate at 40-50^{0}F for one month. (*E. angustifolia* requires at least twenty-one days of cold stratification to germinate.) After stratifying, expose flats or pots to warmer temperatures (68^0-77^{0}F) to allow for emergence of the seedlings. Germination generally occurs 10 to 20 days after seeds are exposed to warm temperatures.

When plants are several inches tall (usually eight to twelve weeks after germination), transplant seedlings in well-prepared, permanent planting beds, during late spring or early summer. Space plants eight to 15 inches apart, making rows 18 to 30 inches apart.

Seeds can be sown directly into an outdoor seedbed in fall or early spring, but the soil needs to be well prepared. Plant seeds just under the soil surface spacing them two inches apart. Keep the bed moist and weed-free. When seedlings emerge (at least 21 days), thin to the recommended spacing mentioned above.

The challenge to medicinal herb growers is finding a consistent source of seed true to the particular species, since Echinacea can cross-pollinate easily. Growers should buy from a reliable seed source that specializes in selling seed for the medicinal herb industry.

Weeds, Insects and Diseases

Weed control is very important, especially during the first two years of growth, as Echinacea angustifolia grows very slowly and does not compete well with weeds. Mechanical cultivation is the easiest way to control weeds when the plants are young. This should be taken into account when establishing spacing. Plastic or organic mulches may also be considered. By the second year of growth, periodically attending the field with a hoe, should give adequate control. The best weed control method is to eliminate weeds before the crop is planted. This can be accomplished with tilling and/or planting of cover crops.

Diseases that affect Echinacea include the leaf spots *Cercospora rudbeckii* and *Septoria lepachydis*. A root rot, *Phymatotrichum omnivorum*, has also been identified. Another disease called "aster yellows" is a virus that is transmitted by a leafhopper feeding on Echinacea. Control of aster yellows disease may be attempted by eliminating weeds in the vicinity. Root rots can usually be avoided by planting in a well-drained site. If leaf spots develop, the disease should be identified by submitting

plant samples to a state Plant Disease and Insect Clinic or other appropriate expert. If specific control methods are not provided with the diagnosis, various organic control methods can be attempted. Appropriate Technology Transfer for Rural Areas) (ATTRA) http://www.attra.org has several publications on organic disease control. Other insects that feed on Echinacea include Japanese beetles and thrips. Consult ATTRA for organic methods, such as use of predators, to control thrips. Japanese beetles may be controlled by placing pheromone traps outside the field or planting a trap crop.

Harvesting, Cleaning, and Drying

Echinacea root is harvested in the fall after the plant has gone dormant, usually after the second to fourth growing season, depending on which planting method is used - transplanting or direct seeding. A spading fork or other digging tool can be used to harvest very small plantings. Harvesting large plantings will require some mechanized digger to undercut the roots and bring them to the soil surface, such as a modified potato digger. As roots are dug out of the planting beds, be careful to not damage or break the taproot. Shake the roots free of dirt and carefully sort out any roots that are not Echinacea. Keep the roots in the shade until harvesting is complete. Small volumes of roots can be washed with a high-pressure water hose. Larger volumes will require a drum-style root washer. Richo Cech, author of *Growing At-Risk Medicinal Herbs*, recommends processing the Echinacea as soon as possible after washing to minimize oxidation.

To ensure the safety of your herbs for human consumption, follow the recommended Good Agricultural Practices (http://www.ahpa.org/Default.aspx?tabid=69&aId=333) and be sure that your material will meet the federally mandated Good Manufacturing Practices (http://www.fda.gov/Food/DietarySupplementsGuidanceComplianceRegulatoryInformation/RegulationsLaws/ucm110858.htm).

If the roots are not processed fresh, they should be dried immediately. *E. angustifolia* roots need low heat and high airflow to dry properly. Special dryers can be built for drying herbs and roots. Tobacco kilns can easily be modified for that purpose. If a dryer is not available, a greenhouse (with shade) or a room in a shed or house can be modified for drying. The roots should be spread on non-aluminum screens and arranged so that air circulates freely. According to Cech, "Dry for one day at 70^0F, then turn the temperature up to 110^0F, drying the roots until they snap." Cech recommends, "storing the dried root in light-proof sacks or drums and in a cool, dark, and dry location for up to one year." Yield estimates after three growing seasons average 1,125 pounds of dried root per acre.

Marketing and Economics

Annual Consumption and Dollar Value

Both consumption and prices of *E. angustifolia* root have shown a significant decline since the early 2000s. In 2005, about 63,000 pounds of *E. angustifolia* root were sold on world markets, which is almost half of the consumption of 2003. The dollar value of consumption in 2005 was about $630,000. The dollar value in 2003 was almost $2 million, when the price growers and harvesters received was in a higher price range.

In the 1990s the majority of *E. angustifolia* was wild harvested. Beginning in 2001 cultivated sources began to equal or exceed wild harvested material. In 2004, for example, of the almost 100,000 pounds of *E. angustifolia* traded on the market, about 91% came from cultivated sources, with the remaining 9% coming from the wild.

Demand for cultivated *E. angustifolia* will depend on whether it has the same bioactive content as wild harvested material. Improper harvest and storage protocols, particularly in the case of wild harvested material, greatly diminish its bioactive content.

Pricing

Average prices for *E. angustifolia* root have declined over the past 10 years. Currently, cultivated *E. angustifolia* is traded on the wholesale market in the $8-$12 price range. 10 years ago, *E. angustifolia* traded at a price range of $14 - $16. High quality, wild-harvested product will still trade at a higher (around $20) but more erratic price range due to the low volumes of available product and inconsistent harvest cycles. While wholesale prices for *E. angustifolia* root are under $20 per pound, retail prices average around $38.

Many medium-to-large buyers are not interested in paying a premium price for this material as it compares to *E. purpurea*, since many do not differentiate the species from the genus in the advertising of their Echinacea products. However, a few relatively large buyers, are trying to build product differentiation by endorsing *E. angustifolia* as superior to *E. purpurea*. Buyers who are willing to pay a premium price for echinacoside content require levels testing between 1.8% and 2.8% echinacosides.

Distribution Channels

Suppliers of wild harvested material are located throughout the plant's natural range, particularly in the mid-western United States. A small quantity of wild product also emanates from Canada. Cultivation is currently occurring in the United States, Canada, Australia, New Zealand, Chile and Costa Rica. Some growers have become integrated with larger producers, but many small growers and gatherers are still moving material through brokers and specialized sourcing companies.

Commercial Visibility

Echinacea has a worldwide customer base consisting of large, medium, and small processors. Of the top nutraceutical/botanical companies in North America and Europe, 25% offer *E. angustifolia* as a stand-alone product and 51% offer this material as either a stand-alone product or as part of a multi-ingredient supplement.

Conclusion

E. angustifolia will grow under normal row crop procedures provided soil conditions are adequate. However, seed costs are very high in relation to other botanicals. A great deal of skill is required to successfully cultivate *E. angustifolia*, as it is more difficult to grow than the two other Echinacea species also grown as medicinals. If growing conditions are not ideal for the production of high bioactives, the market value of the crop will be adversely affected. Weed control is a major issue when cultivating any strain of Echinacea, but particularly for *E. angustifolia*. Poor weed control will lead to a significant reduction in yields.

Overharvesting in several western states has led to bans and severe restrictions on collection from natural *E. angustifolia* populations.

E. angustifolia continues to gain market share in European and Asian markets as manufacturers add it to their product lines. It trades at a higher price than *E. purpurea* and *E. pallida*, but prices have declined over the years. Customer requirements and expectations for a threshold level of bioactives are vital to this material's viability as a candidate for cultivation.

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

A special thanks to the American Herbal Products Association's contribution to this leaflet with their continuous consultations and their invaluable annual Herbal Tonnage Reports.

Development of the latest version of this leaflet was funded by a grant from the GoldenLEAF Foundation and administered by Advantage West. The project is the WNC Natural Products Project and includes the following partners: AdvantageWest, Bent Creek Germplasm Repository, Bionetwork Biobusiness Center, Blue Ridge Food Ventures, NC State University, and Western Carolina University.