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Something About Licorice in New Zealand©

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INTRODUCTION

European licorice (*Glycyrrhiza glabra* L. var. *typica*) is the commonly cultivated member of the genus *Glycyrrhiza*. Other common names include liquorice and sweetwood. A member of the Leguminosae family, European licorice is a perennial deciduous herb, which grows to a height of 1 to 2 m. It produces long thin roots that grow more than 1 m deep, and creeping underground rhizomes that can grow several metres long. Both roots and rhizomes are yellow and juicy inside. The tops are frost tender and die down in the winter, shooting again from the underground crown in the spring. The plant propagates by producing new plants from buds on the rhizomes.

European licorice is native from southern Europe to Pakistan and northern India, and grows in warm temperate to subtropical climates. It can grow on riverbanks and in areas with seasonal rainfall.

Commercial licorice extract is obtained by boiling or diffusing the shredded roots and rhizomes of the licorice plant in water, and then concentrating the extract in evaporators. The root extract contains about 7% of glycyrrhizin (a saponin glycoside about 50 times sweeter than cane sugar), triterpenoid acids, flavonoid glycosides, glucose, sucrose, and starch. This black extract is widely used as flavouring in medicines, confectionery, tobacco products, and in beverages (Tyler, 1993). Licorice also has medicinal properties and is used to treat respiratory tract infections and stomach complaints. These properties have been recognised for thousands of years, and the plant was used in ancient China, India, Egypt, Greece, and Rome. Other economic but less important members of the genus include *G. echinata,* which is found in the Soviet Union and Israel, and *G. uralensis,* which is native to Asia.

CROP PRODUCTION

Site Selection. Licorice appears to grow well in a wide range of environments from subtropical to cool temperate. Reports indicate that the plant does best in warm regions that receive adequate, but not excessive rainfall (Molyneux, 1975, Singh et al., 1984). Soils should be deep, free draining, have high levels of organic matter, and be free of stones, which hinder harvesting of the deep roots. Before planting, the crop production area should be sprayed with a herbicide such as glyphosate to remove all perennial weeds. The ground should then be cultivated, and if a soil pan exists, ripping should be considered. Fertiliser is usually only added if known deficiencies exist. Overseas research indicates that the addition of nitrogen and phosphate fertiliser has no effect on either root yield or glycyrrhizin concentration (Maheshwarp et al., 1984). Many authorities suggest the addition of organic material (Singh et al., 1984) to improve soil nutrient levels especially in sandy soils. Although a legume, licorice grown in New Zealand does not appear to form an association with any rhizobia present in the soil (Martin et al., 1996).

Propagation and Establishment. Typically, licorice is planted in the late winter and early spring and is allowed to grow for 2 to 3 years before the crowns, roots, and rhizomes are harvested. Licorice is a poor seeder (Martin et al., 1996) and is usually established using rhizome segments about 15 cm long with two or three buds present (Singh et al., 1984). The segments are planted 45 to 60 cm apart in rows spaced 70 to 100 cm apart. Licorice can be propagated by seed, which should be collected in mid-summer and sown in seed trays immediately after harvesting. Licorice can also be propagated by tissue culture (Singh et al., 1984).

Management. After establishment, minimal crop management is required until harvesting, although excessive weed competition will reduce yields. Trials in Hawkes Bay indicate that licorice is tolerant of a wide range of herbicides with trifluralin, chlorpropham plus diuron, and cyanazine and metribuzin recommended for pre-emergence application, and bentazone and metribuzin after emergence (Hartley, 1996). Mulching is also recommended for weed control and to help conserve moisture. Irrigation is recommended to help establish a crop especially in dry regions or in sandy soils (Singh et al., 1984), however, it is only rarely required in established crops. Overseas literature suggests that licorice is generally free of pests and diseases (Singh et al., 1984). The only disease problem experienced with licorice grown in the Waikato has been the leaf spot *Phoma medicaginis* that can be controlled with fungicides such as Benlate® (E.I. Du Pont deNemours and Co. Inc., Delaware, USA), Alto® 100SL (Sandoz Ltd., Switzerland), or Octave® 50 W (Hoechst Schering AgrEvo GmbH).

Harvesting. Harvesting is usually carried out in winter after the tops have died down when the crop is 3 to 4 years old (Singh et al., 1984) although our work in the Waikato suggests that crops could be harvested after 2 years. The crop is harvested by turning the soil with a plough to a depth of up to 90 to 120 cm then gathering the root by hand. Research in New Zealand shows that over 75% of the root and rhizome material are in the top 30 cm. After harvesting, the roots are trimmed, washed, cut into small pieces, and air dried for up to 6 months until the moisture content has been reduced to less than 10%. After harvesting the crop usually re-establishes from the roots that remain in the soil. Overseas results indicate commercial roots and rhizome yields of

10 to 20 t ha^{-1}, with exhaustive harvesting yielding up to 50 t ha^{-1} (Singh et al., 1984). New Zealand trials have yields up to 25 t ha^{-1} after 2 years, and up to 34 t ha^{-1}, if the crop is grown for 4 years and harvested down to 90 cm. Licorice roots and rhizomes are marketed as natural root, sold whole or peeled for processing, or as licorice sticks obtained from green roots and sold in confectionery stores.

Processing. The licorice root, which can be green or dried, is converted into 3 mm chips and extracted at 75 to 85°C in single column diffusion towers in a continuous extraction process. The licorice extract then passes through several evaporators before being machine moulded (Molyneux, 1975). The extracted licorice is marketed either as a solid licorice extract, in powder form, mixed with other flavouring agents as pressed licorice, or mixed with wheat flour as extruded licorice or licorice paste.

QUALITY

Licorice root is not normally graded but product should be clean with less than 3% foreign matter and a moisture content of less than 10% (Singh et al., 1984). The major active substance in licorice is glycyrrhizin, a triterpenoid saponin (Gibson, 1978, Fenwick et al., 1990). The concentration of glycyrrhizin varies depending on cultivar, growing conditions, time of harvest, and root age or size. Triterpenoid saponin concentrations vary from 2% to 15% and include glycyrrhizin, which is made up of ammonium and calcium salts of glycyrrhizinic acid, and 24-hydroxyglycyrrhizin. In addition there are many other triterpenoid saponins and more than 30 flavonoids and isoflavonoids present in the root (Bisset, 1994). In New Zealand trials, glycyrrhizin concentrations in dried roots and rhizomes have varied from 2% to 6%. Liquid licorice extract should contain 4.5% to 6% glycyrrhizin and solid licorice extract should contain not less than 6%. For medicinal use the licorice must meet the standards of the appropriate pharmacopoeia.

USES

The British Herbal Medical Association (1983) recommends licorice mainly as an anti-inflammatory and expectorant agent. It is also used as a demulcent, spasmolytic, and adrenal agent (Bisset, 1994), and as a mild laxative. Licorice is often included in throat lozenges and is a common flavouring agent in medicines. It is not recommended for people suffering from high blood pressure or heart problems.

Licorice is widely used in food, both for its sweetness and aniseed like flavour. It is also popular in confectionery, especially in Europe. Licorice is used in the production of beers and spirits, for flavouring, and for improving foam stabilisation or head forming characteristics. However, most licorice is used in the tobacco industry with about 90% of the world's licorice supply used to flavour tobacco products such as cigarettes, pipe tobaccos and, ironically, antismoking preparations. The licorice flavour in some confectionery is derived from the herb anise (*Pimpinella anisum*) rather than licorice. Once the licorice extract has been removed from the root the by-product is sometimes used to make insulation board, or for mushroom culture (Molyneux, 1975). As licorice can grow on sand dunes (Mohammad and Rehman, 1985) and river-banks (Singh et al., 1984) it could potentially be used for erosion control.

PROSPECTS

The crop is mainly grown in Mediterranean and Middle Eastern countries, and in China. World production of roots is about 30 to 40000 t annum^{-1}. There is considerable trade in licorice. Current United Kingdom usage is estimated to be 16200 t annum^{-1}. In New Zealand, licorice is purchased by the confectionery trade as a spray-dried powder with a minimum of 21% glycyrrhizin. The present price of the powder varies between NZ$8 and NZ$11 kg^{-1}, but is higher for pharmaceutical grades (Martin et al., 1996).

It is unlikely that New Zealand growers would be able to match the prices of overseas licorice producers. The most likely market for New Zealand-grown licorice is in the production of a high quality extract for supply to the local food industry, with emphasis on the assured supply of a quality uncontaminated product. Licorice could also find some use in erosion control or as a novelty plant in the home garden.

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