New Zealand Institute for Crop & Food Research Ltd
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CROP & FOOD RESEARCH
Mana Kai Rangahau

Valerian
Valeriana officinalis L.

Valerian, a member of the Valerianaceae family, is a perennial herb. The dried rhizome and roots of *V. officinalis* comprise the herbal drug valerian, which has been used for at least 1000 years. Valerian is widely used in Europe as a mild sedative and sleep aid for insomnia, excitability, and exhaustion

Typically, after autumn establishment and winter dormancy, the plant grows from a short rhizome to 2 m high, flowers, and then dies back again in the winter. Valerian has pinnately-divided leaves with six to 10 pairs of lance-shaped leaflets, and bears many small white or pink fragrant flowers in a dense head of several stalked clusters. These heads bear small (5 mm) tapered seeds that are spread by wind. The fresh root has the appearance of a mop - a mass of long, white, relatively unbranched roots, up to 5 mm in diameter and 30 cm long - with a very distinctive and strong penetrating odour.

The Valerianaceae, which has about 200 perennial herb and small shrub species throughout the world, is chiefly found in the temperate and cold regions of the northern hemisphere. *V. officinalis* is indigenous to Eastern and Central Europe, but has become naturalised in Western Europe and parts of North America after early introduction by colonists. The genus also includes species used medicinally in India *(V. wallichii)*, Asia *(V. officinalis var. latifolia* - Kesso root) and the Americas *(V. edulis)*.

Valerian is highly variable. Polyploidy occurs in V. *officinalis* and there are diploid, tetraploid, and octaploid types. English valerian is usually octaploid and Central European usually tetraploid.

Uses

The dried rhizome and roots of *V. officinalis* comprise the herbal drug valerian, which has been used for at least 1000 years. Valerian is widely used in Europe as a mild sedative and sleep aid for insomnia, excitability, and exhaustion. It has depressant activities on the central nervous system, is antispasmodic, and has been described as having equalising effects - acting as a sedative in

agitated states and a stimulant in fatigue. The long standing clinical use of valerian is as a sedative mainly because of the valepotriates present and the volatile oil constituents, notably valerenic acid. One of the most appealing aspects of valerian as a sedative is that it does not interact with alcohol, as do barbiturates, and does not leave the user with a "hangover" in the morning. Studies have concluded that valerian extracts helped to improve significantly sleep quality of people suffering from mild insomnia, with minimal side effects. *V. officinalis* preparations are considered safe despite the known in vitro cytotoxic activity of valepotriates and no acute side effects have been reported.

Valerian oil is obtained from the steam distillation of the dried, ground roots and yield is reported to be between 0.2 and 0.7%. The oil is used in the flavour and pharmaceutical industries, with limited quantities used in the fragrance industry.

Valerian is approved as a GRAS (generally recognised as safe) food ingredient in the USA. Extracts and the essential oil are used in flavouring components in most major food product groups including alcoholic and nonalcoholic beverages, meat and meat products, frozen dairy desserts, sweets and baked goods.

Environment

The major commercial producers are Belgium, France, Holland, Germany, Russia, China, and Eastern European countries. Indian valerian *(V. wallichii)* is grown in India while Kesso root is grown in Japan and China. Valerian can be easily propagated, grown and harvested. It is not particular about soil type, and will grow in many climates-hot or cold, wet or dry - providing that it gets sufficient water and nitrogen. Valerian thrives best in rich, heavy loams with adequate moisture but with free drainage. For ease of postharvest root washing, a relatively loose soil with a low clay content is desirable. In the absence of irrigation, soil will also need to have good water-holding capacity.

Agronomy

Preliminary New Zealand trials indicate that establishing a valerian crop using transplants gives consistently better results than direct-seeded crops. Planting into rows 40-50 cm apart and at 20-30 cm spacing between plants in-row is recommended and mechanical planters can be used. If spring-sown, and growing in favourable conditions, these seedlings will be large enough for harvesting in the following autumn.

Valerian may also be propagated from seed, or from portions of the root stock, and establishment can be undertaken in the autumn or spring. Sowing should be undertaken into a fine, firm, weed-free seedbed, which is rolled after sowing. Seed is sown in rows 40-50 cm apart at a rate of 2-3 kg/ha of seed. The small seed should be sown close to the soil surface and, thus, will require good moisture conditions to aid germination. The seed should emerge within three to four weeks. It should also be noted that the seed loses its viability and care should be taken to obtain fresh seed and have a germination test undertaken. In adverse situations where dry conditions or weed problems are likely, planting from glasshouse-raised seedlings is recommended. Once the crop is established, it requires little management. Any autumn-established crop will flower and removal of flower heads has been promoted as a way to improve root yield. We have no data to support this practice. Valerian can spread by seed and, although palatable to stock, the possibility of its movement from a production area should be recognised. Thus, flower removal in production areas is recommended.

Valerian requires fertile soil, and German production practice is to apply 100-150 kg/ha of nitrogen, in split applications during the growing season, as well as up to 100 kg/ha of phosphorus and 200 kg/ha of potassium fertiliser during soil preparation. There is no New Zealand research information on fertiliser response but trials under New Zealand conditions are being conducted by Crop & Food Research. In general terms, a fertiliser containing NPKS in a ratio of 15:10:10:8 , applied at 500 kg/ha, should provide adequate initial nutrition tied to a follow-up dressing of nitrogen.

Good weed control is essential to achieve acceptable yields of valerian.

Weeds provide competition to the establishing valerian plants and techniques such as presow spraying or planting into a stale seed bed should be undertaken. Once established, valerian provides good competition against weed invasion and, because of its vigorous upright growth and dense foliage, weeds are not a problem. No herbicides are registered for use on valerian in New Zealand. Preliminary trials indicate that, at the transplant stage, valerian shows good tolerance to pendimethalin (Stomp 330E) or oryzalin (Surf lan Flo). Established plants showed a high tolerance to all herbicides tested with best growth and weed control following terbacil (Sinbar) and diuron (Direx or Karmex).

There is a significant trend towards "spray-free" requirements for medicinal herbs in international markets. However, weed control is more time consuming without the use of herbicides. Although non-chemical weed control may be desirable, it may not be feasible to grow valerian on a large scale in New Zealand without herbicide assistance.

In New Zealand, valerian appears to be relatively free from pests and diseases. *Phoma* spp. and *Sclerotinia* spp have been identified in infected plants in New Zealand soils-Phoma in warm moist conditions in spring, *Sclerotinia* in cooler southern sites in autumn. Grass grub can cause substantial damage to roots, and control by cultivation or insecticide should be undertaken before sowing.

Production

Valerian will produce 16-20 t/ha of fresh root, which has a dry matter close to 25%. Dried root yields of 4-5 t/ha are achievable under good conditions. In Crop & Food Research trials conducted at five sites in New Zealand, roots harvested in May, six months after planting, averaged 83 g/plant dry weight. These were well watered and fertilised, and planted in raised beds in rows 60 cm apart with 30 cm between plants, producing an average yield of 4.6 t/ha of dried root.

The challenge for New Zealand growers will be to minimise the labour input involved in the postharvest preparation of root. Most of the problems are associated with the rhizome. It bears the shoot material that must be removed, traps soil at the junction with roots and needs to be chopped to produce uniform drying. Because the rhizome represents only 5-10%, of the weight of underground parts, discarding it may be an option, particularly if it significantly reduces costs and improves product quality.

Harvest

There is still uncertainty about the best time to harvest valerian in New Zealand as it not only depends on the age of the root, but also on the growing environment and seasonal change. In the Northern Hemisphere, an autumn harvest (September) is considered optimal. Crop & Food Research's Plant Extracts Research Unit is developing a quality test for valerian that will enable seasonal changes to be measured and, thus, provide a more definitive harvest time to be recommended.

The present recommendation is to harvest in autumn with the tops cut to ground level before tile roots are lifted. A root crop lifter that is capable of working to 30 cm depth can be used. The resulting root mass has the appearance of a mop, with white roots (10-30 cm long, 2-5 mm diameter) attached to a short (2-5 cm) rhizome and weighing up to 500 g per plant in the field. Dry soil conditions and mechanical shaking to remove excess soil is desirable before washing. Subsequent washing using a rotary root washer is necessary to remove all soil. Soil is held very tightly in the crown of the plant, and the root mass should be broken into smaller pieces to enable effective washing. Also, the separation of root and chopping the rhizome into smaller pieces is necessary to ensure uniform drying.

Drying method

The best method of drying to prevent enzymatic breakdown of the constituents is to dry the crop as rapidly as possible without overheating. Overseas study provides some direction. One study found the maximum preservation of the valepotriates when drying without forced air flow was about 35EC while with forced air at 0.05m^3/min. the best preservation was at 60EC. If essential oil retention is the target, a temperature of 40EC with an air flow of 0.05 kg/m^2 was best. It was concluded that to retain both active fractions the best overall method was drying at 40EC with an air flow rate of 0.25 kg/m^2. New Zealand studies are underway to verify these recommendations.

Quality

Gross tests of quality listed in most European pharmacopeia include a minimum of 25% extract, 10% total ash, and less than 15% moisture. Up to 5% of other parts of valerian are also permitted in the dried root. There appear to be no general chemical tests for quality although essential oil or valepotriate content have been used as measures of quality. Individual companies use their own in-house standards to assess quality, based on experience and basic chemical tests. As noted, Crop & Food Research is developing a comparative test based on valepotriates and valerenic acid and this will allow quality comparisons and local standards to be set.

There is also potential to use organic production systems and there is often a premium price for such a product.

Markets

The largest market for herbal medicines using valerian is Europe, where phytomedicine counter sales in 1990 were $US 2.4 billion, and 65% of this total was in Germany.

The volume of valerian root traded is unknown, but traded values suggest that it is hundreds rather than thousands of tonnes annually. The prices depend on quality and degree of processing and are in the range $2, to 20/kg, with a typical price around $5/kg. Although attempts to produce uniform phytomedicine standards for Europe have begun, it is likely to be some time before they are established. Because most phytomedicine markets in European countries are dominated by local brands, with very few products crossing national boundaries, suppliers to these markets must pay particular attention to the specific requirements of the individual market for which the product is destined.

Supply contracts should be sought, and trial shipments made to the target market.

Seed sources

The species *V. officinalis* has a considerable morphological range and there are selections in Europe that have high valepotriates. Crop & Food Research has recognised differences in seed lines but, to date, without a qualitative test to measure those differences, no comparative study has been pursued.

Directories of seed suppliers include:

Anon, 1992: The New Zealand nursery register 1992/93. Reference Publishing Co., Auckland, New Zealand.

Philip, C. (ed. Lord, T.) 1991: The plant finder 1991/92 Edition. Headmain Ltd. UK.

Issacson, R.T. 1989: Andersen Horticultural Library's source list of plants and seeds. Andersen Horticultural Library, University of Minnesota, USA.

The thousand seed weight for *V. officinalis* is about 0.75 g. The price for seed depends on the source and it retails between NZ$500 and $1000/kg.

Future prospects

As a priority, Crop & Food Research is setting up an analytical test of valerian quality to enable comparative crop be undertaken. Important crop and processing tests to be undertaken. Important questions relating to cultivar selection, harvesting technology and postharvest processing have not been addressed. Perhaps as important is work to identify the requirements of the quality standards and processing requirements of the major traders in the crop. There is now a need to get commercial volume onto the world markets to assess fully the crop's potential.

Further reading

Foster, S. 1990: Valerian. American Botanical Council. Botanical Series No. 312.

Hobbs, C. 1989: Valerian: a literature review. Herbalgram 21 (Fall): 19-34.

Parmenter, G. et al. 1992: Production of the medicinal crops *Valerian* and *Echinacea* in New Zealand. *Proceedings of the New Zealand Agronomy Society 22.*

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