

# Introduction to growing herbs for essential oils, medicinal and culinary purposes

Research is currently being carried out by Crop & Food Research to assess the potential for commercial herb production in New Zealand. The research involves assessing agronomic factors, economics of production and market prospects.

## Introduction

The herb industry can be separated into three main categories:

1. essential oils,
2. medicinal crops, and
3. culinary herbs.

Establishment of a herb production venture involves relatively high capital investment, particularly for plant material, irrigation, machinery and distillation or drying equipment. In addition, there is only limited information available on production practices, especially for New Zealand conditions, product quality and market commitment. Therefore, there is a high level of risk involved in setting up a venture based on herb production. The level of risk declines as the industry develops, production technology increases, markets are defined and an industry infrastructure is established. Potential 'natural product' markets are strong and growing.

This broadsheet aims to provide a brief overview of the factors that need to be considered before growing herbs on a commercial scale.

## Essential oils

Essential oils are natural mixtures of aromatic compounds in plants that are extracted by steam or solvent distillation. These compounds are used by the flavour and fragrance industry, natural product industries, aromatherapists and cottage craft outlets.

Plants yield between 0.01 and 2.0% essential oil (calculated on the weight of fresh herb distilled). A large area of crop is required (more than 20 ha) to obtain reasonable quantities of oil.

The main requirements to produce essential oils are the correct plant material, good horticultural/arable soils, irrigation, good shelter, harvest equipment and distillation equipment.

## Medicinal herbs

Medicinal herbs are widely used as diet supplements and in the treatment of illness. For example, valerian root, echinacea root, ginseng, peppermint, feverfew. Generally production is intensive and requires small areas of land (1-20 ha).

The main requirements to produce medicinal herbs are the correct plant material, good horticultural/arable soils, irrigation, good shelter, harvesting equipment, a drier and drying shed, secondary sorting and processing equipment. For root crops, a washing facility will be necessary.

Crops are also grown for standardised plant extracts used in pharmaceutical products, mostly grown under contract to a pharmaceutical company and not grown on speculation. Evening primrose is a crop grown in New Zealand for the extraction of gamma linolenic acid (GLA) from its seed.

## Culinary herbs

Culinary herbs include herbs used for flavours, preservatives and colour enhancers in food preparation and food products, for example, thyme, sage, parsley, rosemary, chives.

Generally production is intensive and requires small areas of land (1-20 ha).

The main requirements to produce culinary herbs are the correct plant material, good horticultural/arable soils, irrigation, good shelter, harvest equipment, a drier and drying shed, secondary sorting and processing equipment or a cool store if supplying the fresh market.

## Production requirements

The following aspects need to be taken into consideration when producing essential oils, medicinal or culinary herbs.

### 1. Choice of crop

- Choice will be influenced by factors such as location, climate, soils, grower experience and preferences, finance, markets and market trends, and specialisation such as organically produced crops.

The crop must meet the specifications of the destined market (International Standard specifications or individual company 'in-house' specifications). These specifications are generally determined by chemical analysis and physical assessment, olfactory evaluation and appearance. It is important to understand that the chemical composition of a crop can be affected by such things as plant cultivar, environment, time of harvest and post-harvest handling. Experimental plantings should be established to determine how quality can be optimised before growing a block on a commercial scale.

A local library, news articles and an accumulation of ideas from various people provide a useful base to work from. Crop & Food Research has published a series of broadsheets that gives a good introduction to a range of new crops, their cultural and processing requirements and market prospects.

### 2. Market research

- Undertake an analysis of the market place: identify crops or products that the market wants, timing of supply, volumes required and prices. Commercial test samples to assess market acceptability will be required.

### 3. Site selection

- Size of land area.
- Location - distance to market or processing facilities.
- Climate - suitability for a particular crop, for example, basil requires a frost-free site.
- Topography - suitable terrain for machinery.
- Soils and drainage - good quality horticultural or arable cropping soils with good drainage are necessary for most crops. For instance, stone-free soils are needed for root crops such as dandelion or burdock. Detailed soil maps and bulletins are available for most parts of New Zealand, for example, the four Landuser Guides by P.D. McIntosh that detail soils with horticultural potential in Otago and Southland (see recommended reading list).
- Shelter - is a requirement for all crops. Exposure to hot, dry winds over the harvest period can severely reduce yields of essential oil crops. Tall-growing crops such as valerian can suffer extensive damage if

sufficient wind shelter is not provided.

- Weeds - identify weeds present and assess possible control strategies available.
  - Water availability - irrigation is necessary for all crops in most environments, particularly during crop establishment. Therefore, an irrigation system should be installed as a primary investment.
  - Specialist buildings or crop structures - drying plant, pack house or distillation unit to meet Departments of Health and Labour regulations. Some crops need shade houses or tunnel houses, for example, ginseng must be grown under heavily shaded conditions.
- ### 4. Crop establishment and management
- Source of seed or plant material of some species is limited. Vegetative propagation or special seed treatments will be required for some species.
  - Pre-plant requirements - a soil test should be taken to determine soil acidity (pH) and nutrient levels. Appropriate applications of fertiliser and lime can then be recommended. The site should be free of weeds and well cultivated to give an even seed bed for direct seeding or transplanting of crops.
  - Planting - transplanter or seed drill. The method of establishment used depends on the crop grown. Further information for specific crops can be found in the broadsheet series.
  - Weed control - perennial weeds such as couch and yarrow should be eliminated before establishing the crop. Annual weeds can be controlled using appropriate selective herbicides or mechanical methods. Effective weed control is vital to achieve acceptable crop yields and avoid contamination of the end product.
  - Pest and disease control - it is essential to be aware of the potential problems and remedy the situation early, for example seed-borne disease or virus is minimised by using clean seed. Specialist advice will be needed to identify pests and diseases affecting a crop.
  - It should be noted that very few agricultural chemicals are registered for use on herb crops in New Zealand and therefore no recommendations for chemical control of weeds or pests and diseases can be made.
  - Irrigation - application rates and timing may require specialist advice.
- ### 5. Harvest
- Time of harvest - often requires extractions and chemical analysis to define the best time to harvest, particularly for essential oils and medicinal herbs.
  - Harvest method - to be cost effective, mechanical harvesting is usually required, particularly as the area of crop grown increases. Purpose-built or specially modified machinery may be needed for some crops.

- Yields - crop yields vary considerably depending on grower experience, the cultivar grown, environmental conditions and processing methods, and will, to a large extent, determine the economic viability of a herb production venture.

## 6. Processing

- The product - be aware of market requirements. Some crops can be sold fresh, but most are processed in some way.

### - Distillation equipment

Essential oils are commonly extracted by steam distillation. The basic still design is shown in Figure 1. Steam is piped from a boiler into the bottom of the still vessel which contains the plant material. The volatile oils in the plant material are released and carried upwards with the steam and pass from the top of the still vessel through a condenser. Cold water flows continuously through a system of internal tubing in the condenser, cooling the steam/oil mix to a liquid. The water and oil flow into a separator (florentine flask) where the oil, generally having a specific gravity less than water, floats to the surface and is collected.

The still design, capacity, water purity levels and flow rates, operating temperatures and length of distillation are important aspects that can affect the composition and quality of the oil. Technical assistance to optimise extraction efficiency is necessary.

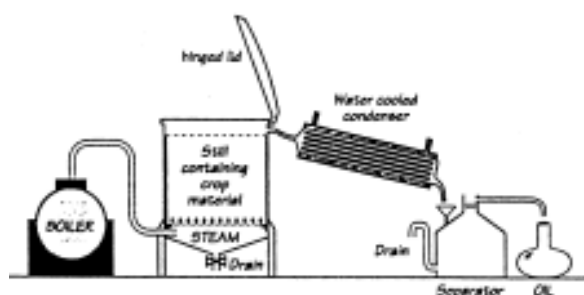


Figure 1: Basic still design for steam distillation.

Other products used in the flavour and fragrance industry can be extracted from plants using a solvent extraction system. A high degree of technical expertise and significant capital investment are needed to set up such a system.

### - Drying

To dry large quantities of crop effectively, a drying shed equipped with a forced-air drier or a freeze drier will be

necessary. Volumes, drying temperature, length of drying and drying technique play an important role in the quality of the end product. Specialist advice will be required to recommend appropriate equipment and methods, to optimise drying efficiency and minimise loss of critical plant components.

- Packaging - the type of packaging and how to meet consumer demand and market specifications requires excellent communication with the market. Specialist advice may be necessary.

- Storage - generally herb products and essential oils should be stored in a cool, dry place away from sunlight and protected from insect infestation. Essential oils should be bottled in glass or non-reactive metal containers. A cool store or freezer may be necessary to store plant material before processing.

- Processing and storage facilities and methods need to satisfy the requirements of the Resource Management Act and local authority by-laws and Departments of Health and Labour criteria. Detailed requirements should be obtained from the relevant authorities before setting up facilities.

## 7. Market

- Begin by targeting specific smaller markets interested in the likely quantity of product you are able to supply. Supply will be a major problem if large markets are sought initially with the strong likelihood of losing the contract if the product cannot be supplied in full.

- Personal contact with potential buyers is important. Samples that are representative of the quality of the product that you can produce, and an indication of quantities able to be supplied over an appropriate time frame will be required.

## 8. Financial analysis

- Capital requirements - plant material, irrigation, harvesting and processing equipment.

- Development and running costs - expert advice, travel costs and direct expenses involved with growing and processing the crop need to be estimated.

- Expected yields - obtained from trial plots or estimated from reported data.

- Awareness of market trends and prices.

Once all possible financial data have been compiled, gross margins and other financial indicators can be developed with the help of specialist advisers to indicate the potential profitability of an enterprise.

## Recommended reading

Chiej, R. 1984: The Macdonald encyclopedia of medicinal plants. Macdonald and Co., London, UK.

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