

# FOUR SEASONS ORGANIC CONSULTANTS

## ORGANIC HERB AND SPICE GROWING/PROCESSING CROP PRODUCTION GUIDE- TROPICS/SUB-TROPICS

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## GENERAL

### INTRODUCTION

Most culinary herb and spice crops grow well or adequately in the tropics. Some, like sage, moss curled parsley, tarragon, and thyme grow better in temperate climates. Basil, coriander and rosemary can grow at least as well in the tropics under the right (high altitude, cooler) conditions, with adequate irrigation. Lemongrass, ginger and the capsicums are not much grown outside the tropics and sub-tropics.

Questions of maintenance of organic certification- e.g., seed sourcing and derogations, use of implements used on conventional cropping etc is not covered in this guide.

Organic farming in general and herb and spice farming in particular is not yet well supported by research and extension recommendations, in comparison with conventional fields and vegetable crops. Consequently, as much experimentation as possible should be done with various promising treatments, and control areas **always** kept for comparison purposes. Records of trial results should be incorporated into the normal yield records required for organic certification to avoid the results being lost.

## ORGANIC FERTILITY MANAGEMENT

Fertility management is arguably the most difficult element of successful high yield organic farming. Deficiencies cannot be remedied quickly by use of soluble chemical fertilisers, and long term planning is even more necessary than in conventional farming.

As for conventional farming, fertility management should **always** be supported by recent soil analysis results.

Herbs generally grow well with soil pH above 6. A slightly acid soil helps in making rock phosphate available in the soil, particularly the “insoluble” igneous derived types. The general recommendation

Land to be converted to organic status should have high levels of P and K. Our experience suggests that conversion to organic, even with the minimum two year conversion period (during which fertility building legume crops can be grown), is a more economical entry method into organics than certification of virgin or fallow land.

The most expensive, and normally the limiting, nutrient in organic farming is **N**.

A rainfed legume rotation or interplant crop suited to local conditions – sunnhemp, pigeon pea, tephrosia, sesbania, leucena etc. - is usually the cheapest way of supplying N. Legumes should **always** be inoculated with suitable rhizobia cultures unless experience shows that nodulation is prolific and effective without inoculation. Sunnhemp is a promiscuous in its symbiosis with rhizobia, but pigeon pea for example generally needs inoculation unless it has been grown recently on the same lands. Managers should always carry forks to check legume nodulation - pulling the plant from the soil generally removes most nodules.

Other N sources are composted vegetable materials and animal manure (rarely is enough available to supply the general recommendation of 30-50 t/ha compost), oilseed cake, fish meal, blood meal, guano etc.

Animal manures should not be used directly as fertiliser- on seed beds or lands. Weed problems will result, N is normally more leachable from manures than compost, and contamination of crops with splash from manure borne pathogens is likely to be a problem. Bought in manures should be cleared with the certification agency.

Typical analyses for N content in composts average 1%, and oilseed cakes average 5-8%.- as a rule of thumb about 1/6<sup>th</sup> of the protein content. Provision of 50kg N/ha as a top dressing would need about 5 tons of compost or 1 ton of oilseed cake.

With N, the other main limiting nutrient is **P**. Most unimproved tropical soils are low in phosphates. Ideally, organic projects should be started on land with adequate phosphate level prior to conversion. Phosphate rock (PR) dusts are permitted in organic agriculture (superphosphates are not), with some restrictions – check with the certification agency.

Phosphate deposits are widespread in the tropics, but often not exploited and investment in crushing and possibly flotation plant may be needed. A locally available source is a significant economic advantage – transport and other costs especially across borders are high even though PR dusts are generally sold with 30-35% P<sub>2</sub>O<sub>5</sub>. PRs are broadly divided into those of sedimentary origin (“reactive”) and igneous (“unreactive”). The former are often as or more effective in most soils than superphosphates. Igneous origin RPs break down over several years and are more available when used fine ground in moderately acid soils. Availability can be increased *inter alia* by soil activity and acidity from organic matter in the soil, by phosphate solubilising bacterial treatments, by the addition of S, by adding RPs to composts, and by using rotations of suitable legumes and plants with good mycorrhizal activity. Solubilisation of “non-reactive” RPs is easier with adequate moisture to maintain soil biological activity – and availability of supplementary irrigation is of great assistance while phosphate levels are being built up.

Provision of **Mg** and **Ca** is relatively simple dolomitic lime. Sulphur can come from gypsum (also for Ca) or elemental S.

**Potassium** additions from mined rocks permitted under organic regulations are not readily available from regional sources, and the main practical sources are wood ash, compost and oils seed cake. Natural permitted K salts such as Sylvinite could be imported from e.g. UK production. Where possible, however, soils with good K status such as volcanics and some clays should be used and any deficiencies remedied well before conversion is started. For organic farming, the total K content as well as “exchangeable” K is a useful component of soil analysis as farming with high soil activity and improved soil structure encouraged by legume rotations, compost, gypsum etc will make insoluble nutrients available over time.

Where appropriate, inputs should be placed close to the plant rather than broadcast, but even organic fertilisers like oilseed cake may burn the plant if placed too close.

Specialist advice should be taken on the use of available nutrients to ensure mineral salt imbalances are minimised.

Local soil analysts will often have their own index ratings for major nutrients. The classification below is referred to in the production guidelines for individual crops.

#### **CLASSIFICATION OF SOIL ANALYSIS RESULTS (Source UK DEFRA)**

Index	Phosphorus (mg/litre)	Potassium (mg/litre)	Magnesium (mg/litre)
0	0-8	0-60	0-25
1	10-15	61-120	25-50
2	16-25	121-240	61-100
3	26-45	241-400	101-175

## **IRRIGATION**

Irrigation is an economic necessity for herb production in most tropical and sub-tropical climates.

Drip irrigation tends to produce the highest yields at the lowest energy cost, and reduces problems with soil splash on leaves, and fungal diseases.

Perennial crops like rosemary originate in climates with a long dry season, and will survive with limited moisture for a period if it is necessary to economise on water while the crop is not being reaped for fresh leaf- but irrigation is needed to generate new growth.

Overall, total water input in the growing season of 20 mm per week net on herb crops in general is a reasonable compromise between yield and water use/cost. Specific crop requirements are dealt with in the individual crop sections- e.g. mint where the crop can benefit from double this amount of water, with soil kept constantly close to field capacity.

## **CROP ESTABLISHMENT**

Care and detailed supervision is needed to establish a good initial stand. Infilling a poor stand subsequently is difficult, and expensive in irrigation and labour.

Transplanted crops generally take more easily when planted out in cooler weather with cloud cover, and if they can be rain planted the initial heavy demand on irrigation is reduced. Most herbs take better when transplanted from seedbeds as rooted cuttings. Only a small amount of leaf should be left above the ground for most herbs, on about 50mm of stem- this reduces desiccation through transpiration.

Transplanting into a hole filled with at least a litre of compost or compost soil mix will increase the moisture retention ability of the soil and make a good stand much more likely. A hole for transplanting into the compost can be made by a pointed stick or dibber, and care taken to ensure roots on cuttings are not compacted in the planting hole. Close supervision of transplanting is a good investment.

Direct sown crops like coriander and parsley (both tap rooted *umbelliferae*) should be sown if possible in cooler weather to reduce weed competition problems during and after germination. Flame weeding of beds where broadleaf weeds have been germinated (stale seedbed technique) can be used before drilling the crop. A precision planter- preferably tractor drawn to allow straight rows to be drilled to allow subsequent mechanical cultivation, is very useful. We use a Stanhay with seed placement by pierced belts.

## **VARIETY SELECTION**

Selection of seed or planting material should always be done in co-operation with buyers in the target markets. Obtaining the assistance of buyers to develop a new source of

supply that they may not believe they need or which may not eventuate is not always easy- but it can be done.

New seed and planting materials need approval from the certification agency- derogation from the EU rules requires specific authority. Planting material must normally undergo a transition period unless from an approved certified organic source.

Once the initial sourcing work has been done, seed and planting material should come from the organic crops – a few beds of seeding herbs should be kept for future sowings.

Four Seasons can provide contract growers with organic certified seed and planting material for all the crops mentioned, or put growers in touch with sources.

In the initial stages when imports of seeds and planting material are generally necessary, good relations with the local plant protection department are needed to avoid loss of material in quarantine or by delays in clearance on arrival.

## **ORGANIC WEED CONTROL**

This (along with N management) is the main problem for organic farming, and especially so for herb and spice production- where crops generally do not canopy heavily and so do not shade out weeds. Managers should aim for **zero tolerance of weeds** at all times. The sayings “one year’s seeds means seven years weeds” and “a stitch in time saves nine” need to be emphasised continually to supervisors and staff.

If land has been farmed conventionally prior to conversion to organic, weed control before and during conversion should be meticulous, and care taken to ensure the land is **free** of perennial weeds using either cultivation or herbicides or both. Mechanical cultivation and hand weeding should be continued through the conversion period with zero tolerance for seeding or perennial weeds. If fallow land goes directly into organic status, perennial weed roots should be desiccated by ploughing and fallowing in a dry period- hand weeding of perennial weeds once they are established is difficult and expensive.

Perennial weeds are particularly problematic in herb crops like mint and oregano where the crop covers the soil surface (a “meadow crop”), and inter-row cultivation is not possible.

Particular attention should be paid to elimination of perennial grasses in roadways and paths as these often encroach into crop areas.

Legumes in the fertility building rotations should be drilled or planted in rows so clean cultivation can be practiced.

Hand weeding should be carefully supervised to avoid damage to crops and a resultant requirement for subsequent infilling. Flowering and perennial weeds should be removed

from the land on the day of cultivation. Perennial weeds should be lifted with forks, rather than hoed.

Compost should have been properly heated to destroy weed seeds, and manures should **not** be used uncomposted for weed control as well as disease prevention reasons.

Mechanical cultivation is possible in the early stages of growth following establishment, and row spacing should be determined to fit in with settings of cultivation equipment.

Flame weeding may be found useful in establishing seedbeds – by allowing annual weeds to germinate and killed without disturbing the soil. Weeds are touched by a gas flame rather than incinerated. A flame weeder is simple to make, or one can be adapted from designs sold in garden centres in the EU. A harness is made for a 5 kg gas cylinder, or a tractor mount made with multiple burners and a larger cylinder.

Mulching with black plastic may allow germination of weeds in seedbeds but prevent growth leading to weed destruction, and in lands will help prevent soil splash on leaf. Mulches made from natural fibre such as sisal or coconut matting are available but expensive. Mulch from locally available material should be weed free- ideally composted- veld grass needs careful harvesting to avoid seeds. Use of lower C/N ratio mulching materials like legume leaf will reduce the risk of surface lock up of N. As suggested earlier- uncomposted manure or animal bedding should never be used as mulch- there is a risk of pathogen transfer to the crop, and manure will generally carry weed seeds.

Work is being done on some herbicides which are permitted under some certification regulations, such as pine oil and fatty acid derivatives.

Some crops such as white mustard (*Sinapis alba*) seem to have a particular effect on specific weeds- Nutgrass (*Cyperus spp*). A dusting of lime is effective on oxalis sp. *Tagetes minuta* also seems to help suppress weeds, and any crop which canopies well if sown in rows and kept weed free can serve as a cleaning crop.

## **PEST AND DISEASE CONTROL**

### **1. General**

Under competent organic management, pests are, suprisingly perhaps, much less of a problem than under traditional conventional farming. The presence of compost with its complex array of characteristics, and the absence of soluble N with the resultant increase in general plant health and reduction of sappy forced growth – are factors.

Cutworm can be a serious problem- e.g. on capsicums. Keep the land clean for a period prior to sowing or planting. Sprays of pyrethrum or BT may be effective once damage has been observed. Spray only if unavoidable.

Once established, herbs are not generally subject to major insect pest problems. Insect pests are not usually a problem if habitats for predators are maintained, and the temptation to spray against outbreaks of pests is resisted. Organic permitted sprays are non-specific, and so tend to reduce predator populations which have to build after pest numbers have been re-established. Predators will generally keep problem pests such as spider mite and whitefly under control if they are allowed to. These two were serious pests when we farmed herbs conventionally and sprayed routinely, but since conversion to organic they have been virtually absent.

Plant diseases are a problem on lemongrass and mint- both of which can suffer attacks of rust, but after reaping, new growth is usually acceptably clean. Anti-fungal sprays permitted under organic certification rules, such as sulphur, and copper salts, are broad spectrum and can interfere with beneficial fungi.

Thrips can be a problem on *Allium* spp. Mulching is effective against thrips, by helping prevent insect entry into soil which is part of the breeding cycle of most thrips.

## 2. Organic Sprays

Spraying should be **avoided if at all possible**. To make this possible, some re-indoctrination of staff may be necessary if they are trained to spray prophylactically or at the first sign of pest presence. Most organic permitted sprays are broad spectrum and will damage predator populations.

For insect pest control, pyrethrum and rotenone sprays are easily made or purchased, and are effective between them against most insect pests. *Bacillus thuringiensis* (BT) and Nuclear Polyhedrosis virus (NPV) sprays are effective against caterpillars- though moth/caterpillar problems are rare with herbs.

Natural pyrethrum breaks down quickly in sunlight, and if used should be sprayed in late afternoon or early evening. An effective spray can be made by water extraction of pyrethrum flowers with a soft soap mix as a sticker/spreader.

In the absence of derris, the best source of rotenone compounds is *Tephrosia vogelii* leaf, and the plant is a useful legume crop as the pods are not subject to theft. An extract can be made from the leaf in a similar manner to pyrethrum flower extract. *Tephrosia* is possibly less damaging to useful predators than pyrethrum.

Garlic spray is effective against thrips, even on garlic itself.

Spray production recipes are available as a separate Four Seasons leaflet if required and if management consent to spraying is obtained.

### **3. Compost**

The beneficial effects of compost on plant nutrition and disease resistance are well known- and there is never enough compost.

Material that can be brought in for composting- distillation residues, pack house waste, manure from local livestock enterprises- whatever is available should be secured and the certifier's permission obtained. Oilseed cake from non edible crops such as castor and jatropha are the most economical bought in NPK as there is no competition from the stockfeed industry.

Detailed information on composting is not included here. A C/N ratio of the material blend of around 30 is normally recommended but most materials will eventually be composted successfully - if the heap is at least 1.5 m high and the same across the base, it is watered and turned regularly when the centre has cooled- and preferably the heap should be shaded.

### **4. Organic Nematode Control**

Few herb crops are very susceptible to nematode attack. Some *umbelliferae* such as angelica and lovage can show extensive galling.

The best defence is high organic matter and the resultant soil borne predator populations. *Pasteuria penetrans* became evident on our soils once conversion to organic status had shifted our emphasis from NPK figures to achievement of higher soil organic matter content.

### **5. Beneficial Insects and Bug Banks**

Establish rows a metre or so wide at convenient intervals- at land boundaries or on contour ridges- of suitable predator host plants, preferably perennials for ease of management. Fennel, pigeon pea, citronella are all useful. Avoid killing predators by accepting some crop damage and resisting the impulse to spray outbreaks- when possible. There is usually enough for everyone, and in the long term spraying is likely to be counterproductive.

### **6. Beneficial Fungi**

In much the same way as broad spectrum insecticides like pyrethrum and rotenone damage control through killing predators, the main fungicides allowed in organic systems- sulphur and copper salts- can kill beneficial fungi.

*Trichoderma harzianum* TH (and other T varieties) are widely used in seedbeds to control soil borne fungal diseases (e.g. in tobacco seedbeds). Selected strains are effective against a wide range of plant pathogenic fungi including *Pythium* spp., *Rhizoctonia solani*, *Fusarium* spp., *Botrytis cinerea*, *Sclerotium rolfsii*, and *Sclerotinia homoeocarpa*, and *Gliocladium virens*. Root zone protection from fungal pathogens is taken from seedbed soil with transplants. The root structure of treated plants is generally better developed, and yields higher. **All** seedbeds should be treated with TH following manufacturer's recommendations, and **all** direct sown seeds should be treated with TH-including rotation legumes such as sunnhemp.

## **HARVESTING**

For distillation and drying, reaping on a larger scale is done with a side bar mower or forage harvester. For fresh produce and smaller scale dry and distillation production, sharp sickles or knives are used.

Field hygiene such as hand and implement washing, avoidance of contact of crop with soil, and storage protected from contamination by rodent and avian droppings etc., is important.

## **MANAGEMENT OF STORED ORGANIC CROPS**

Management of fresh herb storage is covered separately, as are the procedures for CO<sub>2</sub> and freezing treatments of dried produce, and N<sub>2</sub> flushing of essential oils in storage. Good hygiene – processing as soon as possible after reaping, and avoidance of all unprotected material, rodent and avian entry into stores, and rigorous enforcement of cleaning procedures on machinery after use – will avoid most infestation problems.

# Herb Production Guide

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## BASIL

### Introduction

To be read in conjunction with the general section on growing herbs.

*Ocimum basilicum* – Sweet Basil- is widely used in Italian and other continental cooking, and is one of the higher volume selling herbs in the EU and US. Linalol type is used, and not the high methyl chavicol type grown for essential oil the Indian Ocean islands.

Thai Basil *O. basilicum* 'Thyrsiflora' Basil. One popular variety is Siam Queen. Narrower leaf than sweet basil, without the characteristic crinkling of that variety. A niche market herb in the UK, but growing in popularity.

The crop is an annual, sown from seed and generally transplanted rather than direct sown. Basil is cold sensitive, and temperatures under 10-12 deg C will damage leaf (see FS Fresh Herb processing guide).

### Soil and Fertility

Subject to local advice, initial soil status should be brought where possible to DEFRA level 3 or above (see general guidelines) using permitted soil amendments and maintenance dressings for subsequent years would be:

NPK INDEX	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	Mg
0	75	100	100
1-2	50	50	50
3	25	25	Nil
Over 3	Nil	Nil	Nil

50-75 kg/ha N should be applied as compost, blood meal, oilseed cake etc., at the start of the growing season, and after each completed reaping. The side dressing promotes the growth of young shoots, without which there is a preponderance of old woody stems which tend to drop leaves easily.

Avoid excessive N leading to sappy growth and possible lack of flavour

### Variety Selection

Seed from reputable seed houses should be acceptable to buyers of Sweet Basil- but advice should be taken and a trial crop grown to check acceptability when possible if

buyers cannot recommend a variety. Selection of Thai Basil seed should be made in close consultation with buyers.

### **Sowing/Planting**

Approx 6 kg seed per ha for direct sowing, less for transplants. Field spacing 20x50 or 50,000 per ha. Transplants are the norm.

In cooler areas, sow seedbeds when danger of cold weather passed, or under plastic cover.

### **Weed Control**

Mechanical cultivation is possible in the early stages of the crop.

### **Pests and Diseases.**

None noted to date on our crops.

Basil wilt disease caused by a soil borne pathogenic fungus, *Fusarium oxysporum f. sp. basilicum*, has been reported in the US and elsewhere. Plants grow normally and then wilt. Initial symptoms usually include brown streaks on the stems, discoloration of the stem, and leaf drop. Transmission can be by seed. The recommendations in the General section to use *Trichoderma* in seedbeds should reduce the possibility of infection.

### **Harvesting and Yields**

Very generally- 1-2 tons dried - or 3 tons export marketable fresh, and 1 ton dried.

### **Fresh Produce.**

Flowering may be reduced by pinching off flowering shoots for small scale production.

The optimum storage temperature is 12 deg C. Lower temperatures may cause leaf discoloration.

## **FOUR SEASONS CROP PRODUCTION NOTES**

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### **CROP: CHIVES**

#### **Introduction**

To be read in conjunction with the general section on growing herbs.

*Allium schoenoprasum* is propagated from bulb division, and is a short lived perennial. Initially may be started from seed.

#### **Soil and Fertility**

See general section,

#### **Variety Selection**

Suitable vegetative material will need to be sourced.

#### **Sowing/Planting**

Seeds 900/gm. Plant out from division 10cm x 30cm.

#### **Pests and Diseases**

Thrips can be a minor problem. Mulching and garlic sprays are useful. See general section.

#### **Weed Control**

See general section.

#### **Irrigation**

See general section.

#### **Harvesting and Yields**

3 t/ha is the planning yield for fresh shoots. Chives do not dry well except under freeze drying as the hollow stem collapses and the result resembles poor quality hay.

## **FOUR SEASONS CROP PRODUCTION NOTES**

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M Jack

### **CROP: CORIANDER**

#### **Introduction**

To be read in conjunction with the general section on growing herbs.

*Coriandrum sativum* is grown by direct sowing of seeds and used for seed, leaf (fresh or dried) and herb and seed oils.

#### **.Soil and Fertility**

Grows well on heavier soils, and usually does well on residual fertility.

#### **Variety Selection**

A small seeded higher oil content variety is suited for seed distillation, and a larger seed variety is used for seed spice production.

Varieties bred for leaf production allow longer growth before secondary leaf and flower growth is initiated.

#### **Sowing/Planting**

Direct drilled in rows 30-50 cm apart, with inter row spacing 2-4 cm. 10- 15 kg seed per ha..

Succession sowings are required for fresh leaf production, where possible in cooler weather in the tropics.

#### **Pests and Diseases**

None seen.

#### **Weed Control**

The seed can be slow in germination, and the seedbed should be as free of weed seeds as possible – use of the stale seedbed system is useful.

Mechanical cultivation is possible before the canopy develops, and one or two hand cultivations after should be sufficient to keep the land weed free.

#### **Harvesting and Yields**

For seed crops, reap when some seeds are still just green or the riper seeds will shatter. Stooking on to matting leads to less loss through shattering. Reaping should be done early in the morning, and great care taken not to reap plant roots with soil- heavier soil particles are similar in density to the seed and can be impossible to winnow out. Seed has been properly dried when it is possible to put a hand to the bottom of a 20 kg sack without great effort.

Herb oil crops are reaped when seeds have formed but not ripened. The oil will need the unripe “stink bug” smell of the leaf and flower, and not the warmer and more orangey smell of the ripe seed.

Leaf needs to be without secondary leaf or flowering tops

Yield 2-3 tons of fresh leaf, and 1 ton of leaf- or 1-2 tons of seed.

## **FOUR SEASONS CROP PRODUCTION NOTES**

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### **CROP: DILL**

#### **Introduction**

To be read in conjunction with the general section on growing herbs.

*Anethum graveolens* is an annual crop in the tropics. Fresh Dill herb is a popular flavouring and decorative herb for fish.

#### **Soil and Fertility**

Subject to local advice, initial soil status should be brought where possible to DEFRA level 3 or above (see general guidelines) using permitted soil amendments and maintenance dressings for subsequent years would be:

NPK INDEX	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	Mg
0	75	100	100
1-2	50	50	50
3	25	25	Nil
Over 3	Nil	Nil	Nil

50 kg/ha N should be applied as compost, blood meal, oilseed cake etc., at the start of the growing season, and after each completed reaping

#### **Variety Selection**

#### **Sowing/Planting**

Direct sowing with good irrigation management is preferable to transplanting this tap rooted umbeliferous crop. Drill 30-50cm rows, 5cm in row final stand, about 10kg seed/ha.

#### **Pests and Diseases**

The flowering plant attracts aphids. A trap crop such as fennel nearby is useful.

No diseases seen but soil borne diseases such as rhizoctonia has been a problem elsewhere.

#### **Weed Control**

See general section

## **Irrigation**

See general section

## **Harvesting and Yields**

For fresh market production, harvest with minimal flowering. A seed, dried herb or dill herb distillation (last reaping, at the later flowering/early seed set stage) crop can be taken.

2-3 tons fresh and 800 kg dried herb would be average yields.

## **FOUR SEASONS CROP PRODUCTION NOTES**

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### **CROP: GINGER**

#### **Introduction**

These notes should be read in conjunction with the general herb and spice guidelines.

A spice crop used for flavouring. Propagated only by rootstock. Tropical to sub tropical, sea level to 1500 m. In subtropical climates, the best areas are low altitude sites, with supplementary irrigation

Subtropical sites at higher altitudes are not generally hot enough for the highest yields. The crop is subject to sun scorch midday to mid afternoon in the hotter 3 or 4 months if humidity and cloud cover is low.

#### **Soil and Fertility**

Ginger will grow in most soils, but is intolerant of water-logging. Partial shade is helpful in avoiding sun scorch and providing local humidity. Requires a minimum of 1500 mm of rain/irrigation and minimum average temperatures of 30 deg C.

Fertilise against soil sample results. Ginger is a heavy feeder if a high yield is achieved.

The crop is susceptible to nematode attack, and heavier soils with higher organic matter will be more likely to have predator populations able to reduce the chances of problem levels of nematodes.

A leguminous green manure crop as a recent part of the rotation is recommended to increase N and organic matter levels.

#### **Planting**

Selection of planting material is important. Higher yielding selections are grown in countries such as China, Australia, India, Jamaica and South Africa. For the fresh market, use of a low fibre selection is important, and this material is on sale in the importing countries and thus easily sourced. Currently the main suppliers of ginger for the fresh and processing market are Brazil, Costa Rica, Thailand and China.

Fingers of fresh ginger with at least one and preferably 2 or 3 viable buds, 25-40g pieces planted about 5cm deep, spacing approx 50x20 cm, 500 x 2000/ha= 100,000 planting stations/ha, seed requirement 100,000 x 30g or 3 t/ha. Seed pieces are planted A high plant population with planting material with several growing points is needed for an acceptable yield. It is a false economy to plant with reduced seed amounts, and better to plant a smaller area if seed is in short supply.

If the soil to be used is loose, planting can be on the flat- otherwise plant on beds. In the higher areas plant in early spring and lift in late autumn when the leaves have dried off.

### **Irrigation**

Given the long growing period required for maximum yields, irrigation is usually necessary.

Low precipitation irrigation can be used to reduce sun scorch. A low output sprinkler system- 3-4 mm per hour per sprinkler is effective. Sunburn is likely to occur with young shoots when shade temperatures reach 31-32 C. These conditions are most likely to occur between 10am and 3pm in mid summer. Commence irrigation when the temperature reaches 31° C and wet the top 2 cm or so of soil. Check moisture daily and watch carefully on still days or when dry winds are blowing.

Ginger can also be grown as an inter row crop between lines (2-3 m apart) of legumes such as pigeon pea which will provide some shade and a more humid microclimate. This method fits well into an organic regime.

### **Weed Control**

Shading out of weeds only occurs after 2-3 months in a well grown crop. Mechanical cultivation can be done inter-row until a canopy develops. Hand weeding is necessary, and thick mulching with seed free low C/N ratio material – composted if available- is helpful for both weed control and N top dressing.

### **Harvesting and Yields**

On a larger scale, harvesting is assisted by mechanical lifting as for other root crops such as potatoes. Use of a horizontal bar fixed to tines and drawn under the crop will loosen roots and make lifting easier.

For fresh ginger the crop is harvested earlier when the rhizomes have a lower fibre content- 6-7 months after planting. For drying, ginger is harvested after 7-10 months.

Rhizomes are washed after lifting, and may be sliced or crushed to permit more rapid drying- sun drying where possible is more economical, but care must be taken to avoid rodent, avian and mould infestations. Artificial drying temperatures in the rhizomes should not exceed 35 deg C to avoid excessive loss of volatile oils.

Yields vary greatly- depending on quality of management, soils, irrigation, climate, reaping stage etc. 7 -75 tons fresh material, 15- 20% % dry matter recovery, 1 to 15 tons dried.

## **Drying**

For export quality the rhizomes are boiled for about an hour and dried, and then rubbed mechanically or manually to remove the skin.

For local quality the skin can be left on, as long as the rhizomes are washed to avoid grit. They can be cut manually or in e.g. a forage chopper and dried. Sun drying is acceptable if climatic conditions permit, but artificial or solar assisted drying will result in lower mould and bacterial counts.

## **Diseases and insect pests**

Root knot nematodes can be a problem in lighter soils. Maintenance of a high level of soil organic matter will help control nematode- and most fungal disease - problems. Information on heat treatment and other control methods can be found at the reference below.

References:

### **Ginger in Queensland**

<http://www.dpi.qld.gov.au/horticulture/4748.html>

**(Rodger Broadley, Department of Primary Industries and Fisheries, Queensland Govt, Australia)**

**Tropical Agriculture Series. Spices. Purseglove et al. Vol 2**

## **FOUR SEASONS CROP PRODUCTION NOTES**

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### **CROP: LEMONGRASS**

#### **Introduction**

To be read in conjunction with the general section on growing herbs.

The leaves of *Cymbopogon citratus* are used in teas and sometimes for flavouring. The stems, whole (removed like bay leaves from foods before serving) or chopped, are used in Asian cooking.

#### **Soil and Fertility**

Subject to local advice, initial soil status should be brought where possible to DEFRA level 3 or above (see general guidelines) using permitted soil amendments and maintenance dressings for subsequent years would be:

NPK INDEX	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	Mg
0	75	100	100
1-2	50	50	50
3	25	25	Nil
Over 3	Nil	Nil	Nil

75 kg/ha N should be applied as compost, blood meal, oilseed cake etc., at the start of the growing season, and after each completed reaping.

#### **Variety Selection**

All citratus varieties seem to be similar, but as usual samples should be sent to potential buyers to make sure the variety to be used is acceptable.

#### **Sowing/Planting**

One mature plant can provide 50 planting pieces- stems with a few roots of 10 cm which are planted about 5cm deep and in rows 50cm to 1m wide and 30-50 cm in row spacing.

The crop lasts for many years if well managed. If stems are reaped, the life of the crop is shortened.

#### **Pests and Diseases**

Rust is a problem, but new leaves are generally unaffected, as are the stems. Rusted leaf can be distilled or dried- if the colour is still a reasonably light yellow- for lemongrass powder and tea bag fines.

Termites can be a problem, and a mulch should be laid of uncomposted dry matter (with no seeds) to act as an alternative food source- 10-15 cm from the base of the plants.

### **Weed Control**

Lemongrass provides a full canopy and shades out weeds to some extent when ready for harvest, but after harvesting handweeding is needed.

### **Irrigation**

See general section

### **Harvesting and Yields**

Lemongrass can be reaped after a year- earlier if well managed.

Reaping of stems should be carefully supervised to avoid damaging the clump. Re-ridging or earthing up of reaped clumps is sometimes needed to avoid having the main root exposed above the soil.

## FOUR SEASONS CROP PRODUCTION NOTES

Revised Oct 05

M Jack

### CROP: GARDEN MINT/SPEARMINT

#### Introduction

*Mentha spicata* – Spearmint or Garden mint- grows in most climates. Rust and weed control are the main problem areas. A variety which is shown to have some tolerance to rust under the local conditions should be selected.

The life of a mint crop depends on a number of factors- weed control to avoid grass infestations, maintenance of fertility and avoidance of compaction are some. Generally 3-5 years is optimal, but light cultivation with spring tines can extend this period

#### Soil and Fertility

Good drainage is preferable for best growth. Mint subject to severe waterlogging will be adversely affected and will even die out in places.

Mint will do well in wide range of soil. The ideal situation is a soil light enough to allow cultivation for weed control in most conditions, but still with sufficient ability to retain moisture. Mint has a high water requirement. Volcanic red and alluvial loam soils are examples of suitable soils.

Subject to local advice, initial soil status should be brought where possible to DEFRA level 3 or above (see general guidelines) using permitted soil amendments and maintenance dressings for subsequent years would be:

NPK INDEX	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	Mg
0	100	150	100
1-2	75	100	50
3	25	50	Nil
Over 3	Nil	Nil	Nil

75 kg/ha N should be applied as compost, blood meal, oilseed cake etc., at the start of the growing season, and after each completed harvest.

#### Varieties

Mint varieties vary in their susceptibility to rust. The problem is to select a variety that is acceptable to the potential buyer, which grows well in the environment selected. This may more of a problem for fresh produce than dried, where the appearance of the plant and leaf is not apparent.

## **Sowing/Planting**

Mint is planted from runners and not seed. Wider row spacing allows more mechanical inter row cultivation during establishment, but rows 30- 50 cm apart to suit other crop spacings and settings on cultivation equipment is probably best. Runners can be placed 15 cm apart- but if enough planting material is available, runners placed continuously in row will allow quicker establishment.

## **Irrigation**

Mint is a notoriously heavy water user, and as a rule of thumb will grow optimally with twice the irrigation required by most other herb crops.

## **Weed Control**

As one of the plants that forms a complete soil cover where inter row cultivation is not possible, weed control must be especially well managed, and pre-planting, elimination of annual grasses is particularly important.

## **Pests and Diseases**

### **Mint Rust**

*Puccinia menthae* is a fungus that forms rust – coloured colonies on the underside of the leaves of the Mint. Rust spores collect on the soil and lower leaf surfaces, and can re-infect new growth. With the right selection of mint variety and growing conditions, rust is not always a serious problem. New growth after harvesting provides the cleanest material. Vigorously growing plants seem to be less susceptible and they reach the harvesting stage earlier giving the rust less time to develop. This is done by giving the Mint optimum conditions for growth, in particular, plenty of compost and irrigation when needed. Harvesting the crop earlier can limit the development of the disease.

### **Harvesting and Yields**

A yield of 30 t/ha gross fresh weight is achievable under good management using organic methods. The proportion marketable as export quality fresh produce depends on factors such as the incidence of rust.

### **Drying and Processing**

Mint presents no particular problem in drying or cleaning.

In low latitudes the oil content is generally low due to limited flowering and distillation is unlikely to be viable.

## **FOUR SEASONS CROP PRODUCTION NOTES**

Revised Oct 05

### **CROP: OREGANO**

#### **Introduction**

To be read in conjunction with the general section on growing herbs.

*Origanum vulgare* is a perennial widely used in Mediterranean cooking, and is one of the higher volume selling herbs, both as fresh and dried herbs.

#### **Soil and Fertility**

Subject to local advice, initial soil status should be brought where possible to DEFRA level 3 or above (see general guidelines) using permitted soil amendments and maintenance dressings for subsequent years would be:

NPK INDEX	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	Mg
0	75	100	100
1-2	50	50	50
3	25	25	Nil
Over 3	Nil	Nil	Nil

100 kg/ha N should be applied as compost, blood meal, oilseed cake etc., at the start of the growing season, and after each completed reaping

#### **Variety Selection**

There are many varieties, and particular care should be taken to source material acceptable in target markets.

#### **Sowing/Planting**

Once established, the crop will form a mat. To allow quick cover, rooted cuttings should be placed as close as feasible, but 50x25cm or 80,000/ha is a normal compromise. Seeds are small- generally 50g sown under good management in a seedbed will provide planting material for 1 ha.

#### **Pests and Diseases**

None encountered

#### **Weed Control**

Good control of weed in preceding crops and the absence of perennial weeds is vital in this full ground cover crop, where inter crop cultivation is difficult..

**Irrigation**

Needed for production of marketable fresh shoots out of the rains. Drought tolerant otherwise and when no reaping is taking place maintenance of the stand can be done with 25 mm net each 2-3 weeks.

**Harvesting and Yields**

Under good organic management 2-3 tons fresh shoots and 2-3 tons dried cleaned leaf, is aimed at from about 15 tons/ha plus of fresh material.

## **FOUR SEASONS PRODUCTION NOTES**

Revised Oct 05

### **CROP: PARSLEY**

#### **Introduction**

To be read in conjunction with the general section on growing herbs.

*Petroselinum crispum* is grown in two main forms- flat leafed and moss curled. The former has been found to be the higher yielding, and is more economical for flavouring end uses- in fresh or dried form. Moss curled is preferred in the UK for garnishing, but increasingly flat leafed parsley is used there for garnish as well. We do not recommend growing moss curled for export unless there is a specific demand for it.

In temperate climates parsley is grown as an annual for a single summer season as it flowers in the second season. In tropical climates the plant can yield for 12 months or more without flowering.

The crop is best direct drilled in cool weather, but can be transplanted successfully, particularly if grown in plugs so the tap root does not have to be broken on transplant.

Parsley is widely cultivated in the target export markets, and local supplies are available from April to October or later.

#### **Soil and Fertility**

Subject to local advice, initial soil status should be brought where possible to DEFRA level 3 or above (see general guidelines) using permitted soil amendments and maintenance dressings for subsequent years would be:

NPK INDEX	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	Mg
0	75	100	100
1-2	50	50	50
3	25	25	Nil
Over 3	Nil	Nil	Nil

50 kg/ha N should be applied as compost, blood meal, oilseed cake etc., at the start of the growing season, and after each completed reaping.

#### **Variety Selection**

We have found no market acceptability problems with seed supplied by major suppliers, but the general advice to seek assistance from potential customers applies.

#### **Sowing/Planting**

Final stands should be 50cm rows by 10-15 cm in row. Direct drilled crops use about 6 kg per ha, and transplants 3 kg. Direct sowing is assisted by use of flame weeding on stale seedbeds- see General section.

### **Pests and Diseases**

*Septoria petroselini* has been reported, and is seed borne. In Europe the carrot fly can be a problem. We have seen no significant pest or disease incidents to date

### **Weed Control**

Stale seedbeds for direct sown crops. Mechanical cultivation for the first month or two post emergency is usually possible.

### **Irrigation**

Normal herb requirements.

### **Harvesting and Yields**

3 tonnes fresh and 1 tonne dried are reasonable target combination yields.

## **FOUR SEASONS CROP PRODUCTION NOTES**

Revised Oct 05

### **CROP: ROSEMARY**

#### **Introduction**

To be read in conjunction with the general section on growing herbs.

*Rosmarinus officinalis* is a long lived perennial, generally propagated from cuttings. Woody shoots not suitable for fresh markets can be distilled and the shoots have around 1% oil.

#### **Soil and Fertility**

Subject to local advice, initial soil status should be brought where possible to DEFRA level 3 or above (see general guidelines) using permitted soil amendments and maintenance dressings for subsequent years would be:

NPK INDEX	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	Mg
0	100	150	100
1-2	75	100	50
3	25	50	Nil
Over 3	Nil	Nil	Nil

75 kg/ha N should be applied as compost, blood meal, oilseed cake etc., at the start of the growing season, and after each completed reaping

#### **Variety Selection**

There are several main types and a variety should be selected which produces well for the specific market envisaged. For fresh produce long shoots with white stems are needed-woody stems are not marketable.

#### **Sowing/Planting**

Seedbed sowing rate 200g/Ha. Seeds 1000 per gm. Spacing 1m x 50 cm. Cuttings 15 cm long with leaves removed from all but 5 cm, and planted 10cm deep.

#### **Pests and Diseases**

None observed

#### **Weed Control**

Rosemary provides a good canopy and weed control is not difficult once the crop is established.

**Irrigation**

See general section

**Harvesting and Yields**

Up to 5 tons fresh shoots, and 100kg/Ha oil

## **FOUR SEASONS CROP PRODUCTION NOTES**

Revised Oct 05

### **CROP: SAGE**

#### **Introduction**

To be read in conjunction with the general section on growing herbs.

*Salvia officinalis* is grown from seed or rooted cuttings, and transplanted.

Considerable areas are cultivated in the EU in summer. Limited demand for the fresh herb.

The main problem with the crop is intermittent “die back” which is probably due to drainage problems, and is associated with termite infestation- probably of the root area once roots start rotting. We have found no disease organisms that can be shown to cause the condition.

#### **Soil and Fertility**

The crop needs good drainage. We find the crop grows better with less die back under organic than it did under conventional management, and it appears to be sensitive to high nitrate availability from soluble N fertilisers. It is probably more suited to lighter soils

Subject to local advice, initial soil status should be brought where possible to DEFRA level 3 or above (see general guidelines) using permitted soil amendments and maintenance dressings for subsequent years would be:

NPK INDEX	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	Mg
0	200	250	100
1-2	125	150	50
3	50	75	Nil
Over 3	Nil	Nil	Nil

50 kg/ha N should be applied as compost, blood meal, oilseed cake etc., at the start of the growing season, and after each completed harvest.

#### **Variety Selection**

The commonly available variety is narrow leaf sage, which sets seed. Some fresh produce markets prefer a broader leaf sage, which is grown from cuttings. Check with the buyer before purchasing the initial seed or obtaining cuttings.

Seed can be saved from the narrow leaf crop, and cuttings taken for seedbeds.

**Sowing/Planting**

5 kg/Ha seeded into seedbeds, and planted out 50x25cm. 100-150 seeds/gm.

**Pests and Diseases**

Die back as mentioned above

**Weed Control**

See general section

**Irrigation**

See general section

**Harvesting and Yields**

25 tons fresh leaf per ha is possible, but a combination of 3 tons fresh leaf and 500kg dried is used for budgeting purposes.

## **FOUR SEASONS CROP PRODUCTION NOTES**

Revised Oct 05

### **CROP: TARRAGON (French)**

#### **Introduction**

To be read in conjunction with the general section on growing herbs.

*Artemisia dracunculus* is propagated from root cuttings and not seed. Suitable material should be sourced. True French tarragon has a taste reminiscent of aniseed, and does not set seed. It is a difficult crop in the tropics, and should be grown only on a trial basis. Demand is limited for the fresh or dried material, but prices are generally good and the herb can yield well.

#### **Soil and Fertility**

See general section

#### **Variety Selection**

Suitable material needs to be sourced.

#### **Sowing/Planting**

Plant out 5-10 cm rooted rhizomes 30x30cm on beds. Mulch heavily with and cover runners with compost to encourage rooting.

#### **Pests and Diseases**

Our material on initial plantings suffered from a fungal disease we were unable to identify, but the plant now seems to have evolved a defence, and no disease is evident.

A rust, *Puccinia dracunculina*, has been identified elsewhere, as has damage from soil borne fungi such as *rhizoctonia*, which should be controlled by the general recommendation for seedbed treatment with *Trichoderma*.

#### **Weed Control**

See general section.

#### **Irrigation**

See general section

#### **Harvesting and Yields**

7 ton yields of fresh material are claimed but our planning yield is 3 tons/ha fresh material.

## **FOUR SEASONS CROP PRODUCTION NOTES**

Revised Oct 05

### **CROP: THYME**

#### **Introduction**

To be read in conjunction with the general section on growing herbs.

*Thymus vulgaris* is widely grown in target markets. It does not do particularly well in tropical conditions and production should be on a small scale to test growing conditions before large scale production takes place.

The crop is a perennial propagated from seed or cuttings. Seeds are very small and seedlings difficult to identify to start with, and seeds should be sown into a seedbed where weeds have been eliminated as far as possible by plastic mulches or stale seedbed techniques.

#### **Soil and Fertility**

Subject to local advice, initial soil status should be brought where possible to DEFRA level 3 or above (see general guidelines) using permitted soil amendments and maintenance dressings for subsequent years would be:

NPK INDEX	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	Mg
0	75	100	100
1-2	50	50	50
3	25	25	Nil
Over 3	Nil	Nil	Nil

50 kg/ha N should be applied as compost, blood meal, oilseed cake etc., at the start of the growing season, and after each completed reaping. The side dressing promotes the growth of young shoots, without which there is a preponderance of old woody stems which tend to drop leaves easily.

#### **Variety Selection**

See general section

#### **Sowing/Planting**

Plant out from transplants 50cmx 30 cm. 500g per ha. 5000 seeds/gm

#### **Pests and Diseases**

Some root rot damage has been observed with secondary termite attack.

**Weed Control**

See general section

**Irrigation**

See general section

**Harvesting and Yields**

3 tons fresh and 500 kg dried/Ha is the estimated yield under average management.