AU J.T. 6(2): 95-108 (Oct. 2002)

Production of Herbs in Asia: An Overview

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Abstract

Herbs are leafy or soft flowering parts of plants used to add flavor and/or aroma to food and beverage. In addition to flavoring food and beverages, herbs are also used as medicine, cosmetics, dyes, air fresheners, disinfectants, insect repellants, decorative materials, herbal drinks and teas, and pot pourri.

Herb cultivation in Asia is characterized by subsistence, mixed cropping systems, labor intensive, use of primitive cultivars, and improper post-harvest treatments. Genetic improvement of herbs is accomplished by introduction from other countries, selection from already existing variants, traditional breeding, and biotechnological methods. Factors affecting their productivity are soil structure and fertility, sunlight, temperature, and pest control. Herbs are very delicate, perishable crops which require special post-harvest handling to obtain high quality of fresh herbs.

The present paper describes the cultivation of important herbs of Asia, namely: basil, celery, coriander, curly leaf, dill, holy basil, lemongrass, marjoram, mint, oregano, parsley, rosemary, sage, savory, shallot, tarragon, and thyme.

Keywords: *Herbs, flavor, aroma*, *cultivation, perishable, basil, celery, coriander, curly leaf, dill, holy basil, lemongrass, marjoram, mint, oregano, parsley, rosemary, sage, savory, shallot, tarragon, thyme.*

Introduction

What are Herbs?

Herbs mean different things to different people. To the botanists, they are plants with soft stems (i.e. non-woody) which die down after flowering. To the laymen as well as the herbalists, they are plants that can be used to cure ailments; thus, they are synonymous with medicinal plants.

In this paper, however, herbs are defined as "leafy or soft flowering parts of plants used to add flavor and / or aroma to food and beverage". These are normally known as 'culinary or kitchen herbs', in contrast to other herbs which are used for different purposes, such as medicinal herbs, cosmetic herbs, sweet herbs, salad herbs, etc. (See box on page 96 for description of terms having the word 'herb' as a part). The list of plants used as herbs is given in Appendix 1.

Importance of Herbs

The flavor and the aroma of a given dish, be it a famous French or Italian cuisine, or, for that matter, a less famous oriental dish, depend very much on flavorings and seasonings derived from herbs and spices. Both herbs and spices can give the simplest of foods a variety of flavors such that these foods can be served time and again in so many ways that one never gets tired of them. The story of spices as well as that of related plants, aromatic plants, has already been published (Chomchalow 2001; and Chomchalow 2002). The present publication concentrates on 'herbs' in Asia.

Asian peoples, particularly Southeast and South Asian, are very fond of herbs. The Asian traditions of using herbs are based on centuries of trial and error. The accepted recipes were then passed on from generation to generation, many of which have been modified

and improved by later generations. Unfortunately,

Terms having the word 'herb' as a part of their names

In English literature, there are numerous terms having the word 'herb' as a part. Two groups of terms are used: one ending with 'herb', the other beginning with 'herb'.

1. Terms ending with 'herb': In this group, the term 'herb' is used as a noun, which has the same meaning as used in this publication but is modified by an adjective to signify different type of herbs. Some terms, however, do not bear any meaning of the true herb used in this publication, but represent other plants completely different from the true meaning of herbs. Among the common terms found are:

Cosmetic herbs: Herbs that are used as cosmetics.
Culinary herbs: Herbs that are used in flavoring or seasoning food. (Synonym: kitchen herbs). This is really the true definition of the term 'herbs' used in this paper.
Aromatic herbs: Herbs that are strongly scented due to the presence of high concentration of essential oils. In fact, all herbs are aromatic but many are not strongly scented. Such herbs are employed as material to make *'pot pourri'*, for example.
Dried herbs: Herbs that are dried in order to avoid spoilage during storage.
Fresh herbs: Herbs in fresh stage after harvesting, either to be processed (e.g. drying), or used as such.
Hot herbs: Herbs boiled or roasted for their health-giving properties. They derive from leafy or root vegetables such as sorrel, onions, parsnips, etc.
Medicinal herbs: Herbs used mainly to cure human ailments. (Synonym: *medicinal plants*).
Salad herbs: Herbs served raw as salad seasoning. (Synonym: *sallet herbs*).
Sweet herbs: Herbs used purely to enhance the flavor of a particular dish in the same manner as we use kitchen herbs. The term does not really apply to taste. Some sweet herbs are, in act, very bitter. Examples: sweet marjoram, sweet basil, celery.

2. Terms beginning with 'herb', or its adjectival form, 'herbal': In this group, the term 'herb' is used as an adjective to modify a noun. They still retain the connotation of their original meaning, i.e. of plant giving a flavoring or a seasoning. Among the common terms used are:

Herb bath: Bath with herb-scented water, to soften and soothe, invigorate, relax, cleanse, and relieve sore muscles.
Herb butter: Blend of chopped herb with butter, placed on the dish before serving.
Herb incense: Dried herbs used as incense to add freshness to a room, particularly that of stuffy sickroom and smelly kitchen. It is believed to have an antiseptic or purifying effect.
Herb jellies: Jellies flavored with herbs.
Herb juices: Juices made from herbs (which provide good color) used to flavor and color sauces.
Herb oils: Vegetable oils flavored with herbs, used in salad dressings, marinades, and stir-fries.
Herb preserves: Preserves that are made from herbs.
Herb soups: Soups sprinkled or garnished with chopped herbs.
Herb (or herbal) teas: Teas made from fresh or dried herbs infused in boiling water to allow the flavor to come out. It is believed that herb teas also have medicinal properties, e.g. mint tea, rosemary tea, sage-leaf tea, chamomile tea, thyme tea. *Note that the term 'herb' is replaced by the kind of herb used when referred to a particular herb tea.*
Herb vinegars: Vinegars flavored with herbs to give extra taste to salad dressings and sauces, e.g. basil vinegar, dill vinegar, marjoram vinegar, tarragon vinegar. *Note that the term 'herb' is replaced by the kind of herb used when referred to particular herb vinegar.*
Herbal drinks (or herb drinks): Drinks flavored with herbs made by pounding fresh herbs; other ingredients such as sugar, salt, etc. are often added to give specific taste. *Note that the term 'herbal', an adjective form*

of 'herb', is used instead of 'herb' only in this term.

unlike western peoples who often described the use of herbs in their dishes in written records, very little has been recorded by Asian peoples in spite of the fact that oriental foods, in general, are much more 'spicy' (as the result of added flavors from herbs) than western foods. Among them are Indian, Indonesian and Thai foods, all of which are quite popular, even among European and American, due to the presence of herbs which are added to the dish as a garnish. Herbs have a dual role to play in the kitchen; they are decorative and useful - attractive to look at, and invaluable for flavoring.

In addition to using as flavoring for food and beverages, herbs are also useful to mankind in many other ways, namely:

- ***As medicine:*** Most herbs can be used to cure human ailments. In fact, the term 'herb' is often understood by most laymen as 'medicinal plants', while 'herbalist' is equivalent to traditional doctor who treats his patient with medicinal plants based on various systems of traditional medicine.
- ***As cosmetics***: The use of herbs as beauty aids can be traced back to the earliest civilizations. The ancient Egyptian were coloring their hair with a mixture of henna and indigo, and scenting it with marjoram 5,000 years ago. Oriental peoples also used various kinds of herbs to beautify their bodies from head to toe.
- ***As dyes:*** Both edible and non-edible dyes may be obtained from herbs. These are used in food coloring, hair coloring, and textile coloring.
- ***As air freshener:*** Sweet scented herbs, either grown in the vicinity of the house, or hang up bunches or branches, provide safe, natural air freshener.
- ***As disinfectants:*** Essential oils and some other chemicals present in some herbs have both deodorizing and disinfecting properties.
- ***As insect repellents:*** Many herbs, such as mint, pennyroyal, basil, holy basil, citronella, lemongrass, have insect-repelling properties.
- ***As botanical pesticides:*** These are organic compounds derived from some plants, including herbs such as citronella, holy basil, lemongrass, used in controlling pests of crops, animals, and humans.
- ***As decorative materials:*** Many herbs are decorative in the sense of Tussie-Mussies, an old English tradition of using herbs for decorative purposes, the most traditional and attractive of all herb decorations, adornments, and devices.
- ***As herbal drinks and teas:*** Chrysanthemum, mint, basil, chamomile, etc. are frequently used in herbal drinks and teas. They are not only refreshing, but many also claim to possess therapeutic property; hot basil tea, for example, is helpful in alleviating indigestion and stomach cramp.
- ***As pot pourri:*** Dry herbs such as thyme, sage, rosemary, marjoram, together with dried fragrant flowers (e.g. rose, lavender, jasmine) and spices (e.g. cloves, cinnamon, nutmeg, coriander seeds) are mixed to give sweet scents to the air in a room.

The Impact of Industrialization

One disadvantage of herbs over spices is that the former are derived from leafy parts of plants which, in normal conditions, must be used in a fresh state. Whereas spices are non-leafy parts, easily dried and processed and may be kept for longer period. Thus, herbs need to be cultivated by the users; they are rarely processed and sold in the market. The gradual movement of people from the rural areas to industrialized areas meant a decline in cultivation and fresh harvest of herbs. This has stimulated the need for factory-processed herbs, which, in turn, initiated large-scale cultivation of herbs, accompanied by industrial processing into dried, ground herbs and ready-made herb ingredients for instant cooking. Advance in food technology has made new food products like frozen food, canned food, instant-powdered food, dried-packed food, etc.

quite popular, all of which require flavoring ingredients such as herbs to improve their taste.

Recent Popularity of Herbs

Several factors have contributed to the recent popularity of herbs. These are:

Increasing international travel and immigrants: Convenience and rapid means of transportation have brought tourists as well as immigrants from one land to another. With them, access to different styles of cooking and flavoring offered by these immigrants from one culture, has re-awaken popular interest in herbs. The diversity and increased availability of herbs have encouraged many people to introduce dishes incorporating different flavors into their culinary repertoire.

Back-to-Nature Campaign: The growing dissatisfaction with artificial flavorings, seasonings, and colorings has motivated many people to turn to natural flavors, etc. of herbs.

Health Conscious: The use of certain food ingredients, like salt and sugar, to add taste to food has been known to have certain health hazards. Reduction in the amount of salt and sugar can be achieved through the use of certain herbs.

Herbs in Asia

The Land of Herbs

Asia is a region well known for its rich biological diversity. This includes diversity of plant crops of all kinds, due to the existence of five Centers of Diversity of cultivated plants, namely, (1) the Indo-Malayan Center, (2) the Chinese Center, (3) the Indian Center, (4) the Central Asia Center, and (5) the Afghan Center.

Asia is also a region of ancient civilizations, and people had inhabited this part of the globe for more than five thousand years. They had made use of indigenous plants as food, clothing, shelter and medicine, the four necessities of life, since the dawn of history. Asian foods are spicy because they are flavored with indigenous spices and herbs. Much have been written about spices of Asia, but very little about their sister crops, simply because herbs are special group of plants which must be consumed fresh, thus little known outside the region. In contrast, spices had been brought into Europe and other parts of the world by the Arab traders thousand of years ago (Chomchalow 2001).

It is fair to say that both spices and herbs had made Asian foods spicy. Since most literature do not distinguish spices and herbs, and the only term used has been 'spices', while the term 'herbs' has been hidden and forgotten. In the West, 'herbs' have been well known and recorded in words of written languages, and thus became a separate category of flavoring/ seasoning ingredients of foods.

List of Herbs produced in Asia

Since there are numerous species of herbs used in Asian countries, many of which are unknown to the rest of the world, or even to other countries within Asia, it is impossible to list all of them for lack of references. However, there are some herbs that are well known due to their popularity within the region. The list of major herbs in Asia is given in Table 1. It provides the list according to the common names of herbs arranged alphabetically with accompanying scientific names and the botanical families they belong to.

Cultivation of Herbs in Asia

Characteristics of Herb Cultivation in Asia

Although considered high-value crops, herbs in Asia are not as systematically cultivated as those in other regions. The characteristics of herb cultivation in Asia are as follows:

Subsistence, mixed cropping systems: Most herb crops in Asia are cultivated by small holders who grow several kinds of crops including herbs in a mixed cropping pattern. This is quite adaptive to the existing conditions where a herb industry is not yet established. However, there are also a few large plantations of mono-cropped herbs like lemon grass and basil.

Table 1. Plant species commercially grown as herbs in Asia*

Common name	Scientific name	Family
Basil	*Ocimum basilicum*	Lamiaceae
Celery*	*Apium graveolens*	Apiaceae
Coriander*	*Coriandrum sativum*	Apiaceae
Curly leaf	*Murraya koenigii*	Rutaceae
Dill*	*Anethum graveolens*	Apiaceae
Holy basil	*Ocimum tenuiflorum*	Lamiaceae
Lemongrass	*Cymbopogon citratus*	Poaceae
Marjoram*	*Origanum marjorana*	Lamiaceae
Mint	*Mentha* spp.	Lamiaceae
Oregano	*Origanum vulgare*	Lamiaceae
Parsley	*Petroselinum crispum*	Apiaceae
Rosemary*	*Rosmarinus officinalis*	Lamiaceae
Sage*	*Salvia officinalis*	Lamiaceae
Savory	*Satureja hortensis*	Lamiaceae
Shallot	*Allium ascalonicum*	Liliaceae
Tarragon	*Artemisia dracunculus*	Asteraceae
Thyme	*Thymus vulgaris*	Lamiaceae

** The seeds, fruits or stems of these plants are also used as flavoring materials; thus they also treated as spices*

Labor intensive: Herbs are a special kind of crops which require intensive cultivation, thus very labor-intensive at all stages, starting from land preparation, seeding, transplanting of seedlings, to caring of plants throughout their life cycle. They also require quite heavy fertilizer application to obtain luxuriant growth in order to have a pleasant appearance to the consumers. In the case where synthetic chemicals are not allowed to be applied to the crops, even more intensive care has to be provided. When it comes to harvesting, much more labor is needed than ordinary crops. The same is true for post-harvest operation. Thus, herb cultivation probably is one of the most labor intensive ones. Women have played a major role at all stages of herb cultivation.

Use of primitive cultivars: In most countries in Asia where herbs are grown by small holders, primitive cultivars are used which result in poor yield and quality. In places where large-scale cultivation is taking place, improved cultivars are used.

Improper post-harvest treatments: Small holders naturally do not have knowledge of post-harvest treatments. This results in poor quality produce. The treatment is improved as the cultivation moves to a larger scale.

Genetic Improvement

As a crop, herbs receive little attention from Asian breeders. The only country where genetic improvement is conducted is India.

However, only few varieties of herbs have been released for commercial cultivation in India. As for other countries, practically no varieties have been developed. Varieties of herbs grown in Asia are mostly materials introduced from other countries, the rest is obtained from native materials. Thus, there is a need to start a breeding program for genetic improvement of herbs for commercial cultivation. The following paragraphs summarize the approaches to obtain improved cultivars of herbs:

Introduction from other countries: This has already been practiced in several countries. It is the easiest and least time-and-effort-consuming. The only limitation is adaptability of the introduced varieties to local conditions.

Selection from already existing variants: Variation which occurs spontaneously in any

population of herbs can be selected for future uses, either immediately or after hybridization.

Traditional breeding: Using conventional crossing techniques, breeders can combine desirable characters from the two parents. Objectives of herb breeding are similar to those of other economic crops. However, as quality and quantity of active compounds responsible for flavor and fragrance of a particular herb play the most significant role, the major objective of herb breeding is high quality and quantity of the constituents.

Biotechnological methods: Advances in biotechnological research have facilitated *de novo* genetic improvement of herbs through: (a) increasing genetic variability of the germplasm, (b) culturing and selecting desirable genotypes, (c) rescuing embryo of selected genotypes, (d) rapid multiplication of clones of selected genotypes, (e) transferring genes from distant parents, and (f) specific gene transfer.

Factors Affecting Productivity of Herbs

Herbs are special crops that require heightened attention from growers in order to obtain high productivity of quality products. Several factors affect their productivity, namely:

Soil structure and fertility: Herbs require well-drained soils of rather high fertility. Loamy soils with high organic content are ideal for growing herbs.

Sunlight: Although some herb species can survive under partially shaded condition, most herbs prefer full sunlight which is needed not only for maximal photo-synthesis of the crops, but also to synthesize essential oils, the major constituent of herbs which are causal for flavor and fragrance. Both intensity and duration (day length) are of considerable importance for the synthesis of essential oils. Many species require long-day sunshine for optimum production of these constituents.

Temperature: Although many herbs can be grown in cool climates of the temperate zone, the ones that are grown commercially in Asia require warmer climate.

Pest control: While herbs are commonly believed to repel insects and diseases because of specific compounds found naturally in these plants, the accuracy of this belief is not entirely known nor complete. While the essential oils of basil and holy basil, for example, have been reported to have anti-microbial activity under controlled conditions with specific pathogens, many insects and diseases are found on such plants in the field. Hence, they should be checked regularly for insect and disease incidence. Most effective in the control of insects and diseases is the use of resistant varieties and integrated pest management.

Weeds are a serious problem for herb cultivation because they interfere with herbal growth. Moreover, weeds cause great nuisance when it comes to separating them out after harvest. The herbs will be 'off-flavored' due to the presence of weeds, whether consumed no matter fresh or processed. Several brands of weed killers, both pre- and post-emergent, may be used to control weeds. Among the recommended weed killers is terbacil (Sinbar). If properly used, this broad-spectrum chemical gives season-long control of most weed species. However, because of residual effects, terbacil often poses a problem with other crops if used in a rotation program.

Post-harvest Handling

Herbs are very delicate, perishable crops which require special post-harvest handling to obtain high quality of fresh herbs, or even in processing. Even when excellent quality is achieved through proper harvesting and packaging, quality is seldom maintained throughout the marketing process. A number of factors need to be considered in optimizing post-harvest of herbs. They include proper temperature, humidity, handling techniques, atmospheric condition and control of pathogens.

Temperature: Temperature is the single most important factor in maintaining quality of herbs after harvest. A 10^{o}C decrease in product temperature may increase storage life by as much as 3 to 4 times (Joyce and Reid 1986). The quality of most herbs is best maintained at temperatures close to 0^{o}C. For best results,

herbs should be harvested in the early morning to avoid loss of moisture due to field heat, otherwise a pre-cooling operation is needed. This is normally done by forced air-cooling. If herbs are to be stored for a certain period, they should be placed at temperatures above $0^{o}C$ to avoid freezing damage consequent to their high water content.

Humidity: Transpiration of fresh herbs results in early wilting and consequent loss of quality. To avoid transpiration, herbs should be packed in polyethylene bags and placed in cold rooms or air-conditioned transport vehicles where relative humidity is maintained at a high level.

Handling techniques: Most fresh herbs are susceptible to damage during post-harvest handling. Discoloration and physical injuries (e.g. bruise, breaks, etc.) are encountered if they are not handled with care. Microbial infection is likely to follow after bruise or injury.

Atmospheric condition: The occurrence of ethylene released from fresh herbs during storage may have severe effects on some herbs. These include injury symptoms, chlorosis, leaf fall and downward bending of the petioles. However, they will not occur if the room is well ventilated.

Control of pathogens: Herbs packaged in polyethylene bags are likely to be infected with pathogens. Control measures include pre-harvest and handling hygiene and avoidance of injury.

Production of Major Herbs in Asia

The lack of production statistics on herbs in most countries makes it very difficult to determine how large the numbers of herbs grown in Asia. Based on personal judgement and communications with Country Representatives of ANMAP, the author selects 17 species of herbs as major ones commercially grown in Asia. They are listed in Tables 1 and are described below:

Basil (*Ocimum basilicum*)

Basil is one of the most common herbs whose principal use is culinary. It is of Asian origin but also cultivated in southern, central and eastern Europe, North Africa, and also in the USA, particularly California.

The flavor of fresh basil is sweet, fragrant and spicy. It is one herb that cannot be dried successfully since after drying, the taste is quite unlike that of the fresh herb. However, it can be quick-frozen although it loses its color unless blanched first. It is commonly used in several Oriental dishes.

It is an annual bushy plant, 30-60 cm. high with branching stems that bear tender, light green, oval leaves with slightly toothed margin. Clusters of small, white or pale purple, two-lipped flowers appear towards the tops of the stems. It can be grown from seeds or cuttings. It is normally grown in the backyard gardens but commercial production for fresh consumption does occur. Processing of dried leaves is also observed.

The form of basil used to flavor food is different from the one that is used as fragrance that is commonly known as sweet basil. It is also treated as an aromatic plant (Chomchalow 2002)

Celery (*Apium graveolens*)

Celery has a pungent smell and a bitter taste. Both the leaf and the seed are used in flavoring foods. It is a biennial plant with a bulbous fleshy root and coarse, ridged and branched stems, 30-60 cm. The leaves vary in color from yellow green to dark green, and are borne opposite, with dentate margin. Flowers are borne on sparse umbels, greenish-white in color. Seeds are small, oval-shaped.

Coriander (*Coriandrum sativum*)

Coriander has been used as a flavoring and a medicine for over 3000 years. It has always been a favorite culinary herb in Asia and was introduced to Europe by the Romans. The green leaves have a fragrant, strongly aromatic taste that lends a characteristic flavor to soups, salads, curries and other Oriental dishes. They are extensively used in Southeast Asian and Chinese cooking to flavor vegetable dishes, with fish and meat, and as a garnish. The plant is also harvested for its seeds and

used as a spice. In Thailand, the fleshy roots are also used as herbs in several Thai preparations.

Coriander is a hardy annual plant, 40-60 cm. tall with slender, branched stem bearing flat, parsley-like lower leaves and feathery, thread-like upper ones. The leaves are aromatic when crushed. Flowers are born in flat umbels, white to pale mauve. Seeds are round, and drop as soon as they ripen. Coriander is grown from seed. It needs a dry, light soil and a sunny, sheltered position.

Curry Leaf (*Murraya koenigii*)

The curry plant is a native of South Asia. It is principally grown in southern India for its aromatic leaf which is an essential ingredient and the predominant aroma and flavor in Madras curry powder. Many southern Indian dishes are flavored with its leaves and it is also popular in Southeast Asia and Africa.

It is a small shrub whose leaves resemble those of bay leaves (*Laurus nobilis*), one of the most common herbs used extensively throughout the world to flavor meat and fish dishes. In India, they are generally used fresh. In Europe and the US, dried curry leaves are usually available from shops specializing in Indian and Chinese food. Fresh leaves can be dried in the oven or quick-frozen.

Dill (*Anethum graveolens*)

Dill has a faintly sweet taste. It is normally used in salads, and in particularly associated with fish dishes. It is very common in Vietnamese dishes. It provides flavors to other vegetables like peas and potatoes.

It is an annual plant growing to a height of 50 to 75 cm. and looks much like fennel, particularly its inflorescence, which is an umbel. It is grown from seeds on raised beds at a distance of 15 cm. between plants in a row 30 cm. wide. It requires full sun for optimum growth and flavor leaves are harvested when flowers just start to develop. For spice, its seeds should be left to mature on the plant until dry.

Holy Basil (*Ocimum tenuiflorum*)

A plant closely related to basil, holy basil is used as a herb, and medicinal plant. Except in Thailand where it is commercially cultivated as herb for Thai cooking, holy basil is only grown in home gardens as a medicinal plant. It is considered a sacred plant in India where it is used in religious ceremonies, hence the name 'holy' or 'sacred' basil.

Holy basil is an annual, bushy plant, 30-60 cm high, with branching stems that bear tender leaves with toothed margin. Two main color variations of the leaves are found, light green, and purplish green. The latter has stronger flavor. The inflorescence, which also exhibits the same color variation as the leaves, consists of small, two-lipped flowers, born at the top of the stems. It can be grown from seeds or cutting. Cultivation practices are similar to basil. Its twigs can be harvested only one month after planting, and two weeks after every harvest during the growing season. The whole twigs are best used fresh for cooking or they can be dried and ground for storage.

Lemongrass (*Cymbopogon citratus and C. flexuosus*)

Lemongrass is a perennial herb, densely tufted, with dense clusters of linear leaves. All parts of lemongrass are lemon-flavored and the main ingredient (78%) is citral. The part used in cooking is the basal part of the leaf sheath that is a false stem of the plant. It can be used fresh or dried. The leaves can be used for essential oil extraction by steam distillation.

Lemongrass rarely flowers in cultivation. Propagation is by the use of the lowest part of the false stem (about 2-3 cm) attached to the underground stem. Once the plant is established, tillering will take place within two months, and more tillers will be borne. They are ready to be harvested any time after that.

Marjoram (*Origanum marjorana*)

Marjoram or sweet marjoram is an annual herb of the genus *Origanum,* many of whose species are aromatic plants. Many other species of *Origanum* having aromatic compounds used in flavoring or seasoning are also known as marjoram. These include *O. onites* (pot marjoram), *O. heracleoticum* (winter marjoram), and *O. dictamnus* (Dittany of Crete). Sweet marjoram grows well in a sunny

site. It can be grown from seeds, either through direct seeding or through transplanting seedlings that are grown in the nursery rows or boxes. It grows to a height of 25 cm. The stems are tough and woody. The leaves are oval, dark grayish green. The flowers are very small, borne in clusters around the stem.

Mint (*Mentha* spp.)

Mint is probably the most common aromatic plant since there are at least 40 species of the genus *Mentha*, many of which possess several varieties of different morphology and aroma in their leaves. Species used as herbs include common spearmint (*M. spicata*), apple mint (*M. rotundifolia*), pennyroyal (*M. pulegium*), and more common in Asian countries than in other parts of the world, kitchen mint (*M. cordifolia*). Mint may be used in both sweet and savory dishes. Oriental people have spicy dishes sprinkled with kitchen mint.

Kitchen mint is propagated by cutting, stolon (underground stem) or layering. The latter is a natural phenomenon without human assistance. If the stems are covered with soil, roots will be formed and the rooted stems can be detached for planting. Commercial growing prefers to use stolons since they are hardier in transport and planting.

Oregano (*Origanum vulgare*)

A very close relative of marjoram, oregano is a hardy annual that grows to a height of about 20cm, with woody stems and dark green leaves, 2 cm long. The flowers are small and white in color. They are borne on long spikes.

Oregano thrives well on a well-drained soil in full sun but can also be grown indoors provided it is placed on the windowsill. Propagation is by seeds.

The fresh leaves are used as salads and in various dishes. Dried leaves are also used.

Parsley (*Petroselinum crispum*)

Parsley is probably the best known herb because it is so widely used as a garnish (which is often thrown away by people who think that it is used only for decorating the dishes!), since it has beautiful, yellowish green, curled leaves. It has a unique flavor and can be used as a condiment or a persillade.

Parsley is a hardy biennial that flowers the year after it is sown. Seeds quickly lose their viability and should be sown as soon as possible after their harvest. Germination unusually takes a long period, to appear up to 8 weeks, but do much more quickly if the soil is warm.

Rosemary (*Rosmarinus officinalis*)

A native of the Mediterranean and widely cultivated in temperate climates as a garden plant, rosemary is a very aromatic evergreen shrub whose height may reach 1.5 m. Branches are covered with soft hairs when young and later become woody with grayish-brown scale bark. Leaves are long and narrow with a dark green upper surface and a pale gray, hairy underside. When rubbed, a strong camphor-like aroma is released. Flowers are pale blue in color, with two lips, borne in clusters on upper leaf axils of the branch.

Rosemary is propagated from seeds, but commercial varieties are normally propagated from cuttings. It prefers a sunny position in well-drained soil. It is a popular kitchen herb. It has strong pungent flavor.

Sage (*Salvia officinalis*)

Sage is an evergreen shrub, 50-90 cm tall. The young stems are covered with white hairs but become woody at the base with age. The leaves are thick, grayish green, oblong with round apex. Inflorescence is borne at tip of branches, consisting of tubular, two-lipped, violet-blue flowers. It is most adaptive plant in terms of soil condition. With the exception of very acid soil, it can grow in almost any type of garden soil. It is normally used as stuffing or forcemeat. It can be used on grilled pork chops.

Several varieties have been developed. Propagation can be made by seeds, cuttings or by layering. Sage prefers a well-drained soil and a sunny position. Being a perennial crop, sage can survive year after year by developing woody stems at base.

Sage is strongly aromatic and has a powerful flavor, especially when dried. It is one of the commonest kitchen herbs in European cooking.

Savory (*Satureja hortensis*)

There are two kinds of savory, summer (*Satureja hortensis*), and winter (*S. montana*). The first, which can be grown in Asia, is an annual herb that is self-sown. It has a strong, hot and slightly bitter flavor.

Summer savoy is propagated by seeds. Seedlings should be thinned to about 15 cm apart. It needs strong sunlight and good drainage. It grows to a height of 45 cm. The leaves are dark green, long and narrow (like soft pine needles). The flowers are small, pale mauve.

Shallot (*Allium ascalonicum*)

Shallot is closely related to onion (*Allium cepa*) and garlic (*Allium sativum*). It is one of the most common herbs used throughout the world. Most Oriental dishes are flavored with its leaves that give a fine tang to flavors, nuttier than an onion and distinct from garlic.

Shallot is very easy to grow; propagating by the use of small bulbs (also incorrectly called 'seeds') taken from the cluster of mature bulks (which are also used as spice). They are normally grown on raised beds, several clusters of young bulbs producing clusters of tube-long leaves that should be harvested when still green. Harvesting is done by pulling the whole plants including their young bulbs.

As propagating material, wait until the leaves fade completely, then pull the whole plants up and leave them to dry in the air until quite dry, then store the bulbs in cool dry place.

Tarragon (*Artemesia dracunculus*)

Native to southern Europe, tarragon is now cultivated commercially in Europe, Asia and the USA. It is a bushy, aromatic perennial, 60-90 cm high. The slender stems bear smooth, dark, shinny leaves; linear in shape, and widely spaced along the stem. Flowers are globular, grayish-green or greenish white, and woolly. Propagation is by seeds or cuttings.

Thyme (*Thymus vulgaris*)

Thyme is one of the most important herbs, used as a real all-rounder, in stuffing for meats and fish, in stews, casseroles, poultry, forcemeats, marinades and soups. It is particularly good on certain vegetables, onions, etc. Other species of *Thymus* are also used as herbs, such as lemon thyme (*Thymus citriodorus*).

Thyme is grown from seed on raised beds. It can also be propagated by means of layer. This is done by spreading the branches out from the center and covering their stems with soil, leaving just the leaf tips exposed. Roots will be formed within ten days and the rooted branches can be detached for transplanting.

Form of Herbs

The flavor and aroma of herbs are due to the presence of essential oils that are complex organic compounds produced by the plants in their glands located in their leaves and flowers. They are volatile compounds evaporating with heat. They also evaporate during storage, although quite slowly, especially if kept in cool place. Different kinds of herbs behave differently in their full release of flavors and aromas, depending on their condition and inherent characteristics. This difference is referred to as the aggregate form of herb that can be divided as follows:

Fresh Herbs

These are herbs that are best used in their fresh state since their flavors are easily lost soon after picking from plants. It is best to pick these herbs when they are needed for use. If bought herbs are used, they should be kept as fresh as possible. The best method is to store them in the refrigerator in sealed plastic bags or a box so that the leaves or young flowers do not dry out.

Dried Herbs

Herbs dried before use are most suitable for industrial processing and use, especially in food industry. They have a more pronounced flavor than in the fresh state. However, not all herbs can be dried; some are simply unsuitable for drying. Examples of such herbs are dill,

parley, chives, fennel. The flavor of certain herbs, notably basil, is much impaired by the drying process. Some dried herbs also lose both scent and taste, becoming hay-like when kept for longer than 3-6 months.

Commercially available dried herbs are either ground (powder) or chopped into small pieces. They are packed into small bottles equipped with numerous holes for sprinkling.

Freeze-dried Herbs

There are herbs that can be freeze-dried. Although considerably more expensive than conventionally dried herbs, they retain both flavor and color much better, and resemble fresh herbs since they have absorbed some of the cooking liquid.

Herb Products

Unlike spices, which, by their inherent characteristics, favor processing resulting in numerous types of products, herbs are normally consumed fresh. However, a few herb products are available in the markets, mostly derived from dried herbs. These products include:

Ground Herbs

Once the herbs are dried, they can be ground into various-sized products, from coarse to fine and powder forms depending on the nature of herbs and the purpose. They are then packed in a small bottle, whose inner cap is perforated by holes that allow the ground spices to come through by shaking.

Herb Teas

Herbs are processed into a product ready to be used to make tea. There are two methods to make herb teas:

Tea Bag: This is made by packing small amount of ground herbs in special paper bags. Most is made of only one kind of herb although some may be blended. These bags can be made into a drink by infusion, i.e. by placing the bag in hot water, or by decoction, i.e. by boiling the bag in water.

Spray Drying: This is done through the use of modern equipment, the same method used in making spray-dried coffee. The herbs are boiled and concentrated, and finally placed in the spray-dry apparatus. The product is in a powder, easily dissolved in hot water.

Discussion

Herbs have different meanings to different people. To most laymen, herbs are synonymous with medicinal plants, while in this publication they are treated as culinary herbs, i.e. plants whose leafy and soft flowering parts are used as flavoring or seasoning materials. They are closely related to spices, which are non-leafy parts used for the same purpose as herbs. Both herbs and spices have been utilized by the Asian and other peoples throughout the world from time immemorial.

The recent impacts of urbanization, industrialization, and a 'back-to-nature' movement have led to increase use of herbs during the past decades. Never before have laymen expressed so much interest in using herbs, both as flavoring/seasoning materials, and for other purposes. This has stimulated cultivation of herbs for fresh consumption and for industrial processing. Before attempting to cultivate herbs, farmers should realize that herbs are special crops used on special occasions. Thus, there are both advantages and disadvantages in herb cultivation.

Advantages of Herb Cultivation

The following advantages of herb cultivation are recognized:

Increasing demand: Industrialization and the resulting urbanization make it impossible for urban people to grow their own herbs while demand is increasing due to rises in living standard and increases in population.

Suitability of cultivation: Herbs can be cultivated in small areas for fresh-herb markets in the cities, or in large areas for industrial processing.

Ease in cultivation: Herbs are easy to grow from seeds, cutting or layering. Few pests and diseases are observed attacking herbs hence they rarely require pesticides.

Profitability: Herbs are high-value crops as compared to other commercial crops. They take less time (especially if they are annuals) and space than most other crops. They are easily marketed, either in the fresh or the dry stage. They can be sold retail or wholesale to local restaurants, at roadside stands, in market places or supermarkets, and to food processors or flavoring houses. Herbs can be processed and developed into more finished sale products such as herbal teas/drinks, herb vinegar, herb honey, herb jellies, etc. Proper packaging and labeling can enhance market opportunities.

Disadvantages of Herb Cultivation

Herbs have also some disadvantages which farmers should know before cultivating them. They are:

Lack of information: Very little is known about herbs. Although numerous books are available, they either concentrate on medicinal rather than culinary herbs, or describe herbs of the temperate zones, many of which are not known in Asia.

Lack of improved cultivars: Except India where a number of improved herb varieties is available, most countries depend on primitive cultivars or introduced varieties that may not be productive.

Lack of agro-technology: Cultivation of herbs needs skill and experience that are not readily available to new growers.

Lack of reliable supply of seeds: Unlike other commercial crops where reliable supply of seeds is readily available, herbs, in most Asian countries, suffer from lack of such a service. Even if available, the service is of low quality standard.

Lack of registered pesticides: Since most herbs are produced for fresh consumption, the use of pesticides must be restricted to those that do not leave residues at the time of harvest. At present, pesticides specifically developed for herbs are not available.

Lack of reliable market: Markets for either fresh or processed herbs are either not available or not reliable.

References and Selected Bibliography

Callery, E. (Ed.). 1994. The Complete Book of Herbs: A Practical Guide to Cultivating, Drying and Enjoying More than 50 Herbs. New Burlington Books, London, UK.

Chomchalow, N. 2000. Production of medicinal and aromatic plants in Southeast Asia. AU J.T. 4(2): 84-94.

Chomchalow, N. 2001. Spice production in Asia: An overview. AU J.T. 5(2): 92-104.

Chomchalow, N. 2002. Aromatic plant production in Thailand: An overview. AU J.T. 6(1): 43-53.

Chomchalow, N.; and Henle, H.V. (Eds.). 1993. Medicinal and Aromatic Plants in Asia. Proc. Regional Expert Consultation on Breeding and Improvement of Medicinal and Aromatic Plants in Asia. RAPA Publ. 1993/19, FAO/RAPA, Bangkok, Thailand.

Joyce, D.; and Reid, M. 1986. Postharvest handling of fresh culinary herbs. The Herb, Spice and Medicinal Plant Digest. 4(2): 1-2, 5-7.

Kowalchik, C.; and Hylton,W.H. (Eds.). 1987. Rodale's Illustrated Encyclopedia of Herbs. Rodale Press, Emmaus, PA, USA.

Kruger, A. 1993. An Illustrated Guide to Herbs: Their Medicine and Magic. Dragon's World Ltd., Limpsfield, UK.

Ortiz, E. L. 1992. The Encyclopedia of Herbs, Spices & Flavoring. Dorling Kindersley, New York, NY, USA.

Rees, Y.; Tilterington, R.; and Sutherland, N. 1994. A Creative Step-by-Step Guide to Growing Herbs: How to grow and enjoy these useful and versatile Plants. CLB Publ. Godalnning, Surrey, UK.

Stevenson, V. (Ed.). 1974. A Modern Herbal: How to Grow, Cook and Use Herbs. Tressure Press, London, UK.

Trewby, M. 1984. A Gourmet's Guide to Herbs and Spices. HP Book, New York, NY, USA.

Appendix 1. Species of plants used as herbs

Scientific name	Common name	Family
Allium ascalonicum	Shallot	Alliaceae
Allium odorum	Chinese leek	Alliaceae
Allium schoenoprasum	Chives	Alliaceae
Aloysia triphylla	Lemon verbena	Verbenaceae
Anethum graveolens	Dill	Apiaceae
Angelica archangelica	Angelica	Apiaceae
Anthriscus cerefolium	Chervil	Apiaceae
*Apium graveolens**	Celery	Apiaceae
Artemesia abrotanum	Southern wood	Asteraceae
Artemesia absinthium	Wormwood	Asteraceae
Artemesia dracunculus	Tarragon	Asteraceae
Artemesia vulgaris	Mugwort	Asteraceae
Borago officinalis	Borage	Boraginaceae
Calendula officinalis	Pot marigold, calendula	Asteraceae
*Carum carvi**	Caraway	Apiaceae
*Chenopodium ambrosioides**	Ambrosia	Chenopodiaceae
Chrysanthemum vulgare	Tansy	Asteraceae
*Coriander sativum**	Coriander	Apiaceae
*Cuminum cyminum**	Cumin	Apiaceae
Cymbopogon citratus	Lemongrass	Poaceae
*Foeniculum vulgare**	Fennel	Apiaceae
Hyssopus officinalis	Hyssop	Apiaceae
Juniperus communis	Juniper berries	Cupressaceae
Laurus nobilis	Bay	Lauraceae
Lavandula angustifolia	Lavender	Lamiaceae
Lavandula officinalis	English lavender	Lamiaceae
Levisticum officinale	Lovage	Apiaceae
Lippia citriodora	Lemon verbena	Lamiaceae
Melissa officinalis	Lemon balm	Lamiaceae
Scientific name		

* Also used as spice due to the presence of non-leafy part (normally seed) used in flavoring and seasoning.

	Common name	Family
Mentha citrata	Bergamot mint	Lamiaceae
Mentha cordifolia	Kitchen mint	Lamiaceae
Mentha pulegium	Pennyroyal	Lamiaceae
Mentha rotundifolia	Apple mint	Lamiaceae
Mentha spicata	Spearmint	Lamiaceae
Monarda didyma	Bergamot	Lamiaceae
Murrya koenigii	Curly leaf	Rutaceae
Myrrhis odorata	Sweet cicely	Apiaceae
Ocimum americanum	Hairy basil	Lamiaceae
Ocimum basilicum	Basil	Lamiaceae
Ocimum citriodorum	Lemon basil	Lamiaceae
Ocimum gratissimum	-	Lamiaceae
Ocimum minimum	Bush basil	Lamiaceae
Ocimum tenuiflorum	Holy basil	Lamiaceae
Origanum marjorana	Marjoram	Lamiaceae
Origanum onites	Pot marjoram	Lamiaceae
Origanum vulgare	Oregano	Lamiaceae
Pelargonium capitatum	Rose geranium	Geraniaceae
Pelargonium crispum minor	Scented-leaf geranium	Geraniaceae
Pelargonium monium	Lemon-scented geranium	Geraniaceae
Petroselinum crispum	Parsley	Apiaceae
Peucedanum graveolens	Dill	Apiaceae
Pimpinella anisum	Anise	Apiaceae
Rosmarinus officinalis	Rosemary	Lamiaceae
Ruta graveolens	Rue	Rutaceae
Salvia officinalis	Sage	Lamiaceae
Salvia sclarea	Clary	Lamiaceae
Satureja hortensis	Savoy (summer)	Lamiaceae
Satureja montana	Savoy (winter)	Lamiaceae
Symphytum officinale	Comfrey	Boraginaceae
Thymus vulgaris	Thyme	Lamiaceae
Tropaeolum majus	Nasturtium	Tropaeolaceae
Urtica dioica	Nettle	Uticaceae
Verbena officinalis	Vervain	Verbenaceae