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A private sector Agro-Enterprises advice and assistance service to stimulate the successful development of agro-products, enterprises and export markets in Sri Lanka.

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ROMATIC CROPS DOMESTIC/EXPORT PRODUCTION AND MARKETING WORKSHOP

7TH MARCH 1994, LANKA OBEROI HOTEL

Typical illustrations of Aromatic crops production/marketing publications held in AgEnt's Business Information Center which could be of interest to aromatic growers/processors/ export marketers.

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AROMATIC CROPS DOMESTIC/EXPORT PRODUCTION AND MARKETING WORKSHOP

AGENDA

12:00 noon	:	Arrival of Guests and Registration Snack Lunch
12:30 - 12:40pm	:	Background to AgEnt Project, advice and assistance it can offer - Mr Richard Hurelbrink Chief of Party/AgEnt
12:40 - 1:40pm	:	Aromatic Crops: Some potential opportunities for Sri Lanka - Dr Tom Davies Aromatic Crops Specialist/UK
1:40 - 2:30pm	:	Improved Technology for the Processing of Aromatic Crops in Sri Lanka - Dr R O B Wijesekera Senior Partner, Intecnos Associates
2:30 - 2:45pm	:	Consideration in the Design and Fabrication of Equipment for the Aromatic Plant Industry - Mr C N Ratnatunga Senior Partner Intecnos Associates
2:45 - 3:00pm	:	Tea
3:00 - 3:30pm	:	Strategies for the decade of exports spices, essential oils and medicinal herbs - Mr P N S Wijeratna Asst Director Sri Lanka Export Development Board
3:30 - 4:00pm	:	Open discussion
4:00 - 4:10pm	:	Conclusion

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Spices as flavours

by John Sharp
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1. Summary

The role of spices and flavours in the past has been down graded by poor presentation. The use of spices and their acceptance since their introduction into Europe has been minimal. Spices have tended to be regarded as "Auxiliaries", even by the better authorities. Today this is changing with better presentation, quality control and production techniques.

The various forms of the spice flavours, their advantages and disadvantages are discussed with particular emphasis on spices as natural flavours. Vanilla is highlighted as a typical case of a spice that is extensively used but is rarely identified by its quality in its own right.

Advantages of production of the spice concentrates in their countries of origin are given. Also presented are typical examples of spices supplying the natural note to flavourings, as well as their usage as flavour enhancers.

2. The presentation of spices today

Recently appearing in the national newspapers in the United Kingdom was an advertisement suggesting a unique property of spices. In London there has been much redevelopment of the former docklands. Butlers Wharf, by Jamaica Road, is a stone's throw from Tower Bridge and one part of it, now converted, is the Cardamom Building. This building is a 19th century spice warehouse. The conversion, from the old to the new, is described in detail and concludes with "what remains is a faint spice aroma and 64 stunning apartments".

I felt compelled to investigate this and travelled the 80 km from home. As I approached the building I was convinced I obtained a hint of the spices in the air, but unfortunately inside the overriding odour was that of emulsion paint. The apartments are selling fast, so I may never know if there was a spice odour there or not; and if there was, did it, in these hard days for real estate agents promote the sale of the apartments?

Spices to me mean flavourings and while they do have some other uses, for instance in perfumery and cosmetics, which I will cover later, I believe to a certain extent we take them for granted accepting they are always there, always available in various forms. Our food of today would be very bland without them. Even when there is a hic-cup, like pepper going in short supply, it can always be found being supplied from some part of the world. The price may rise, but will fall as the market position equates itself.

In taking spices for granted we tended to also under rate them. Curry in the European household for years meant left-over meat. Fortunately times are changing on the uses of spices on the domestic front. A walk through your supermarket will reveal the change. Your are confronted with a suppliers stand of "seasonings" containing every herb, spice, condiment and mixture of all three imaginable. You feel you are being offered something new, and you are. They result from the packer being in a position to accept and offer quality, aided by modern analytical procedures. Housewives can now prepare the recipes in the colourful journals calling for various spices. There is a far greater awareness of what the spices are. I had to enter the trade before I first smelt cardamom or understood curry powder was a blend!

Gone are the cardboard pots that would fall apart in the kitchen or splatter the contents everywhere as you attempted to prise off the lid. There are replaced by attractive well labelled jars.

Gone are the brown paper bags of curry powder or peppercorns. The main role of this packaging seemed to let the contents pick up moisture and then go hard.

Gone is the worry of the age of the material. The suppliers representatives will ensure stock rotation.

Gone is the worry of buying too much. The packaging is now more convenient.

Gone is the haphazard self stacking, for the products are now clearly arranged alphabetically, but be prepared to still hunt for pimento under allspice.

3. History through exports

While the history of spices is nearly as complex as history itself, they have made their contribution to it. We do rather overlook their obvious satisfactory use for ages at points of origin, but they did have an interesting history; being exported by camel trains or along the old sea routes. The arrival of nutmegs in

Grenada is an interesting well documented story, a fairly recent one. If the Portuguese and Dutch had not been preoccupied with spices from the Spice Islands I may have been speaking in one of those languages today. Christopher Columbus had been trying to find the Spice Islands so the Americans do owe spices something, but then that was 500 years ago. Glossy recipe books all have some romantic story of the march of spices with the Arabs, with the Romans, etc. yet, it was not until the year 1601 that Clusius, who is known as the father of the flower garden wrote his "Rarorium Plantarium Historia". He gave information on 600 plants not described before and he included clove and nutmeg. He was a Frenchman, whose name was Latinized. He spoke seven languages except English, a language he did not think mattered for botany.

In the United Kingdom this year the 500th anniversary of the birth of King Henry the 8th has been celebrated. Reflecting on this time shows not much has happened to spices since then. The pepper pots found on his raised warship the "Mary Rose" could be in use today. The ladies of his court, particularly his Queen Anne Boleyn, were very fond of a mulled wine flavoured with ginger and cinnamon. It went to her head but did not do her little good as a result. Mulled wine these days in the United Kingdom is only handled during the cold festive seasons. Ginger wine is still a firm favourite; always identified as green ginger wine. Nevertheless with spices there has been little change in their mode of use and presentation until their arrival in the supermarket.

Until recently the use of spices in Europe and North America had been restricted for several factors. The French style herb cooking, based on the delicate herbs like basil, tarragon, parsley, etc. from their own herb gardens has dominated. The Dutch, while having access to the "Spice Islands" and exporting vast quantities of spices did not, in the past, go out of their way to promote spice in foods outside their own empire. Meat dishes flavoured with mace and nutmeg are superb but you have to be in the Low Countries to feast these dishes. The Germans are basically herb people while the Italians and Spaniards have stayed with their own strong tasting aromatic herbs such as thyme, origanium and rosemary. The English have been basically "spiceless" relying mainly on the condiments. A recent report says there are now 6,000 "Curry Houses" in the United Kingdom, while 40 years ago there were seven.

4. What is a spice?

So far we have yet to consider what is a spice, what makes it different from a herb; and in trying to classify them you only produce a giant headache. Botanically the herbs will fall mainly into the Labiatea or Compositae families while the usual spices cover at least six families. It would be much easier to classify spices if they fell into one botanical family like the citrus fruit do.

Various descriptions have been given to distinguish between the herbs and spices. Some based on climatic areas, e.g. spices from hot climates and herbs from temperate regions, but a lot of materials we generally call spices e.g. coriander, cumin seed are to be found in both areas. There are very good examples of herbs, such as basil which can also be found in the tropical zone. A more general description is that herbs owe their flavouring principally to volatile oils (but there are very nice oleoresins produced from some herbs), while spices are said to be classified by volatile oil and non volatile component, such as the high molecular weight constituents that give the pungency to ginger and peppers.

Many materials such as coriander, caraway, fennel and cumin, from the family Umbelliferae appear to be accepted as both herb and spice. I have always regarded celery leaf and its essential oil as belonging to the herbs but the seed and its oil as a spice, perhaps because of most of the seed coming from India. Pimento, pepper, ginger and nutmeg are all from different families; of course they are spices. Perhaps a general rule to follow is herbs from "green leaf" plant material containing volatile oil and from temperate zones, with spices from non herbage material from tropical countries containing both volatile oil and oleoresin. That covers most, apart from vanilla.

5. Vanilla - A special case

Flavours in the name of vanilla are very wide spread, and vanilla flavours under other names, like chocolate, milk flavour, plain ice cream cream soda are equally prevalent. Vanilla flavours can be expensive however, with the availability of chemical produced vanillin and similar compound they can be cheap, but then the quality is apparent. No longer available is vanillin ex clove bud oil, this is further disappointing for the difference between it and the vanillin now available is dramatic. The flavour of natural vanilla, while predominantly characterized by natural vanillin is also enriched by the other compounds present. While the natural vanillin content may be 2%-3%, in taste tests the flavour will appear to be four times this strength. The arguments for "quality and natural" can prevail, for instance for flavouring in baby foods and in quality foods and drinks, such as high grade chocolate and liquors. When food manufacturers are finally required to specify in their labelling "contains natural vanilla" as opposed to "contains vanilla flavouring" consumers will show a market preference. While baby food manufacturers usually use natural oleoresin vanilla for their products their reasoning can be extended to children and adult foods. Few people at the moment are prepared to

accept that the flavour of the chocolate they are eating is basically that of vanilla.

This is perhaps the appropriate time to mention biotechnological advances, particularly with reference to vanilla. The one criticism of tissue culture has been about the differences produced giving changes in the end product, but this need not be important. These metabolic changes will result in say some of the 200 compounds in vanilla disappearing but good and consistent product will result. Will the difference be any greater then say vanilla from two of other locations? I think not. Good quality high yielding plant material is still the aim.

6. The spice products available

Spices and the carrier vehicles used for them in the past have always been considered with some suspicion suggesting adulteration. Ash contents were easily "adjusted", cheaper essential oils were added, e.g. clove stem oil into clove bud oil was difficult to detect, ground spices were "stretched" with exhausted material; fortunately with modern analytical techniques the suspicion has mainly gone out of the industry. Gas chromatography made spectacular progress into the quality requirements and now the important HPLC (high performance liquid chromatography) for determining the pungent compounds is another great advance. These services are now readily available to producers and buyers alike and are supportive of routine laboratory work. Air transport gives the producer access to highly sophisticated laboratories for his sample evaluation.

The food processor can now use spices with a fresh confidence; that is once he gets past his buyer who has the fixed idea of the magical TVC of 100,000.

Spices are offered to the food producers of sausage, pickles, chutneys, sauce, soup, etc. in a variety of forms such as the whole spice, the ground spice, both as shipped or as sterilized material, struck on flavours, encapsulated spices, emulsion flavours, the essential oil or the oleoresin and the carbon dioxide extracted material. All have their advantages, and disadvantages. It is regrettable that the producers of a particular type of spice flavour has to promote his own speciality by detracting from the others; they all have their particular usage.

The whole spice, provided it has been picked and shipped correctly has the superior flavour, if you accept the natural variance of flavour and strength. It will sell itself as being pure. Against it is the question of sterilizing, or lack of it, for irradiation is not yet accepted by the market. Also of course, is the question of insoluble specks (they are acceptable in your own pickled onions but not in what you buy), impurities and ingress of vermins; not a real problem in view of packing shed and cleaning technology now available. The greatest problem is the burden of transport. The biggest problem is natural and seasonal variation but this need not be a problem if the processor goes to the trouble of sourcing out good material and shippers, then the laboratory will show how formulae or recipes should be adjusted for this variation, particularly of strength. It is ironic that after much reformulating how the spice can be added by the scoop which can result in up to 50% quantity variation.

The ground spice is open for criticism indicating contamination, burning during grinding and exposing the surface to evaporation, oxidation and moisture. Again good handling and tasting will overcome these problems. One of the biggest problems of natural spices is they always seem to come out of dingy and dilapidated warehouses, in sacks ripped by stevedores' hooks with the contents spilling everywhere. Fortunately modern packaging and containerization has overcome much of this. Cryogenic grinding defeats the burning and caking on the rollers.

The struck-on flavours on salt, starch or dextrose with a trace of anticaking agents are advocated as being of constant uniform strength and quality, sterile, easily handled in sound packaging, delivered readily thus reducing stock holding.

They are formulated from the oleoresin usually fortified with more volatile oil to replace the missing top note. By virtue of them being manufactured they immediately are identified as not being as good as the natural material, although in many cases this is of minor importance. Their biggest advantage is the quality assurance and the biggest problems are the added on value of manufacture and the sales profit necessary for a flavour house, plus of course, the shelf life. The same comments, deleting the worry of shelf life can be applied for the encapsulated flavours. These are ideal for dry mixes, such as packet soups. They will have a greater shelf life than the struck-on flavour, but again by virtue of being processed will lack the organoleptic fullness and be even more expensive.

The emulsion flavours likewise are sterile and for the small batch food manufacture have the convenience of being added by volume. This can be a hazard for emulsion flavours which must be "shaken before use". As a result much over and under dosing can result giving enormous quality variations. I have seen the danger of laboratory glassware taken into the food blending area as it had been the only apparent method of measuring out the emulsion.

The essential oils when pure, and even not so pure had the advantage and disadvantage of concentration. Few foods processors have the ability to control the addition correctly, after all they could suddenly be using a product up to a 100 times as strong as the spice. Many batches of food have been spoilt by overdosing, a bigger fault than under dosing, especially when using "pungent heat" materials. Being a manufactured product, whether by steam distillation or extraction the essential oils immediately lost some of the natural

notes about their quality. Although modern distillation techniques, in good equipment and using such processes as hydrodiffusion and carbon dioxide extraction has improved the quality of oils.

The oleoresins should be treated like essential oils. They certainly are concentrated with respect to pungent matter but they will have lost some of the volatile oil. Some will suggest that the oleoresin helps as a fixative in heated products. Adding back essential oil is not however a great problem.

The biggest problem can be the quality and quantity of the solvents used.

The carbon dioxide extracted oils are interesting products regarding quality. Depending on the conditions used, so varies the components composition. The production plant is expensive and there are very few in existence. These oils have the advantages and disadvantages associated with the essential oils. The use of essential oils and oleoresins should be left to the flavour and perfumery houses for their flavour products.

7. Production of concentrates at origin

What the spice producer has these days is the opportunity to produce essential oils and oleoresins at source. Of course the essential oils have long been produced at origin in a wide variety of equipment and under some extremes of conditions. Now available is good equipment, know how and good analytical techniques for both products.

The producer has a captured source of raw material, here he can utilize the waste. The nicest clove bud oil from Brazil I saw was produced from the sweepings from the packing shed floor; and consequently it was very cheap.

There is a ready labour force that can be utilized when other farm and packing activities are quiet.

The transport costs of the raw material are negligible.

There can be an ample supply of cheap steam by burning residues and waste.

There can be good quality process control.

Local manufacture can be a success. India has proved it. At first it was claimed "for continuity no flavour houses could use any product other than their own in house material". Only then did they have complete control of their own formulations and supply requirements. The first samples of oleoresins I saw coming from India were in lever lid tins that resembled paint tins. The seam of one tin leaked and the spillage ruined all the label identification The lids were difficult to remove and once opened they could not be replaced, they were quite a mess. Perseverance won through and they now enjoy a healthy business. Quality is assured.

8. Spices as auxiliaries

Since their introduction into Europe little attention had been paid to the "compounding" or new ideas regarding spice blends. In the 1920 edition (and it had already been going 50 years) of Mrs Beeton's "Household Management" spices, no herbs were listed under auxiliaries. Amongst her "recipes for auxiliaries" was:

India curry powder

- 4 oz of coriander seeds
- 4 oz of turmeric
- 2 oz of cinnamon seeds
- 1/2 oz of cayenne
- 1 oz of mustard
- 1 oz of ground ginger
- 1/2 oz of allspice
- 2 oz of fenugreek seed

The instructions were "put all the ingredients in a cool oven, where they should remain for one night. Then pound them in a mortor, rub them through a sieve and mix thoroughly together. Keep the powder in a bottle from which the air should be completely excluded".

With instructions like that the curry powder would have to be considered very mild!

Mrs Beeton was a little kinder to an item just referred to as "curry powder":

- 8 oz turmeric
- 6 oz coriander seeds
- 3 oz cardamom
- 3 oz cumin
- 3 oz fenugreek
- 1 oz cloves
- 1 oz white pepper corns
- 1/4 oz cayenne

Thoroughly dry and pound the mixture, first separately then all together. When well mixed pass the whole through a fine sieve, put into dry bottles, cork tightly and store.

Both recipes require some explanation, not given by Mrs Beeton, such as what are cinnamon seeds, how a product from the Caribbean, pimento, found its way into an Indian dish are just some of the questions?

The best curry powder is of course your own, and when prepared fresh. After all it is your recipe. It is

unfortunate that for a while in some Oriental restaurants curry powders were numerically rated to express the heat. The time is now for curry powders to be given descriptions more than "Bombay" or "Madras" curries, with more emphasis on the other notes for flavour variation. Curry should do more than window dress inferior meat or spice up left overs.

9. Spice as flavour enhancers

An interesting aspect of spice usage is where the spice flavour is not readily identified as part of the product composition.

Cola flavours as we have come to know them are basically mixed citrus flavours with the delicate and persistent notes of cinnamon bark and clove bud oils, perhaps some nutmeg. They are not readily obvious as such but provide the character of the flavour. Pimento is an important constituent of many fruit flavours to give a natural note. Its use ranges from plum to raspberry flavours. While the spice products give the "natural" note to the flavours, without them the flavours are very synthetic in taste.

An apple strudel is just another apple slice when the ground cinnamon is not sprinkled on as flavouring, while the careful use of clove flavours in apple pie gives the character the pie needs with few, if any, outside the trade recognizing the link to a dental surgery. Cloves were the breath freshener long before mint.

Egg custard will have the taste of vanilla but is nevertheless dull without the grated nutmeg. The associated mace is still the leading flavour for a superior sausage premix. (The premix contains the preservative, binder, flavour, salt, etc. just add meat and ice for the sausage!)

Vanilla, mentioned before as "the chocolate" flavour needs to be promoted as "the natural flavour of chocolate". Then could a manufacturer of quality chocolate use anything else? One advantage Mrs Beeton did have at the turn of the century is that she insisted her icing sugar was always stored containing a vanilla pod. When this procedure is still followed the taste of the icing is great.

Ginger flavoured products always appear to lack ginger. If the colour looks right, i.e., nice and brown with plenty of caramel and the pungency is added then the ginger notes seem of minor importance. Dry ginger ales appear more of a rose flavour these days, yet on a hot day there is nothing as cooling as a glass of brewed ginger beer. Ginger is the class constituent in chutneys and pickles. It is outstanding as a cake flavour but is only really noticeable in home baked ginger cake where ground ginger is used. Amongst the ingredients listed in a leading United Kingdom brand of "Jamaica ginger cake" is given "ginger flavouring". How much better it would be if the label read "natural ginger extract". There is a need to promote the spice more as "naturals".

The French have obtained wonders using their culinary herbs and yet few diners could distinguish between basil and sweet marjoram, estragon and aniseed, thyme and origanium, rosemary and sage yet they have achieved great flavoured popular dishes. If ordering a steak caribe in two different hotels would two similar dishes be presented? I think not, yet in ordering pizza Napoli, or a French dish from two different locations the end products would be very similar.

For centuries, amongst food manufacturers, in restaurants and in kitchens the published attitude has prevailed that in a spiced food no one spice should be allowed to dominate the flavour and should not be recognized. My only comment to that is... Why not?

Spices in cosmetics and perfumery

by John Sharp
Consultant
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1. Summary

Spices, as essential oils are important components of perfumery formulations, in all types of perfumes, not just to provide spice notes. They can also be a major source of raw material to synthesize some perfumery compounds.

The use of spice oils in aromatherapy is discussed.

There is little use of spices in cosmetics due to the culinary associations and the problem of sensitization.

2. Spices and perfume constituents

In perfumery the spices are used as essential oils or the related concrete, or absolute, in order to have the concentration necessary to produce a satisfactory aroma level. In flavour work, using an essential oil, a dosage of 100 parts per million will usually give a very strong flavour but for perfumery work, say to perfume soap, an application strength 100 times that level would be required.

Most of the men present will have used "Old Spice" at some stage of their lives, and possibly quite a few women as well. I am not here to sell for Shulton, the producers of "Old Spice", but it has to be acknowledged as possibly the first international, and still leading men's brand of fragrance. I referred to women using it for when the brand was first released in the States in 1937 it was as a women is cologne. It was not successful as that so it was relaunched as a men's product. The spice note is basically clove and cinnamon, blended finely so as no one note dominates. Ginger oil, without the heat of course gives freshness and tenacity to any spice perfume.

Old Spice, copied many times is often claimed to be the first men "Stink" that was acceptable to modern men, apart from lavender; but that is not quite true, for much earlier in this century Bay Rum, Carnation, Jockey Club were all masculine odour preparations. In most cases as a hair rub or brilliantine and the three of these were definitely based on spice oils.

Spice descriptions originally given for women's extract perfumes were always to imply a "Hot connection", and the word became "Spicy". Now in the classifications of perfumes published, "Spice" as a group rarely exists. What were once called spicy perfumes by some are usually now found under "Orientals".

It is impossible to give a breakdown of what perfumes contains what, but Vanilla Absolute is a very popular ingredient in the higher priced perfume range. Vanilla gives strength, sweetness and fixative properties, also of course a distinctive vanilla note; but a perfume formulator would not want his perfume described as vanilla-like for fear of the culinary connection.

Pepper oil is extensively used in colognes where it adds tenacity. Celery seed oil, which I regard as a spice oil gives freshness and a very green note. Clove bud, nutmeg, cinnamon bark, pimento berry and other spice oils are used to great effect in quality perfumes, again rarely acknowledged as spices. Small quantities of the absolutes are prepared for some perfumes, but of insufficient quantities for any producer to get excited about. Some concretes and absolutes of tonka beans and cascarilla are used in tabac type perfumes. So much for the expensive end of the market.

The leaf oils, i.e. from clove leaf, pimento leaf, cinnamom leaf are all widely used in the cheaper fragrances for soaps, disinfectants, detergents, room deodorants, etc. where the major constituent, "Eugenol" provides strength to the perfume. These leaf oils are also used as cheaper perfumery substitutes for the more expensive bud, berry and bark oils. They do have the disadvantage of discolouring products, especially soaps. The leaf oils are also a rich source of Eugenol. This compound is used in its own right as a spicy note. Eugenol is used extensively in dental preparations and is used to manufacture Isoeugenol.

The characteristic note of carnation perfumes comes from Eugenol and Isoeugenol. Eugenol was the starting material for the production of vanillin. Caryophyllene is another major constituent of these oils and it is used in artificial oils and in the manufacture of synthetics.

Spices, as the essential oil are important perfumery constituents, and even with the increase of modern perfumes based on synthetics the spice oils will still be a major part of the perfumery industry, for instance there are few good versatile perfumery ingredients as characteristic and as cheap as the leaf oils.

3. Aromatherapy

Aromatherapy by definition is a branch of the perfumery world. What amuses me when reading about aromatherapy in newspapers and magazines; is the sudden revelation that this is something new. I get the impression that the associates of aromatherapy have suddenly gone out into the world and made startling discoveries.

The aromatherapy industry in Europe is reported to be responsible for a 2% increase in consumption of essential oils per year. That figure is encouraging to the essential oil producers but so far the aromatherapists have taken little interest in the spice oils other than pepper and ginger. By one aromatherapist black pepper oil is described as "useful in massage to alleviate muscular tension with a warm stimulating effect on the mind", and for ginger oil "ginger is useful in massage blends for muscular problems. It is a fortifying tonic to calm nervous conditions".

The feeling of "well being" created by smelling essential oils is not new and I for one would be quite happy to smell oils all day, every day; however, some alarming reports came in with the essential oils being used in massage oils. There were some very weird claims for properties of the oils, then there is the problem of some of the oils being sensitizers. Cloves oil, cinnamon bark oil and cassia oil can cause problems on the skin.

Fortunately the aromatherapists, with some pushing by the health authorities, are becoming more reliable and scientific. What did not do the essential oil industry any good was the amount of adulteration of essential oils that took place. Many times I have heard an aromatherapist claim they had a good source of a genuine essential oil only to find they were only paying the listed market price, and it was very difficult to convince them otherwise.

Spice oils can be used successfully to give richness and strength in pot-pourri and similar products.

4. Spices in cosmetics

The use of spices in cosmetics is limited. The problems of spices in perfumery and aromatherapy are the problems of spices in cosmetics. For the producer the suggestion of food is an obvious problem, but the biggest concern is that the oils can cause sensitization of the skin. Cosmetic manufacturers have to be extremely careful in their testing of their products, and they are.

If personal products like soaps and toothpastes are counted as cosmetics then you can consider some very interesting usages. Laundry soaps can be perfumed solely with spice leaf essential oils, some toothpastes have the spice oils compounded in their flavours. Ginger oil and nutmeg oils give interesting notes and clove oils give some warmth to toothpastes. The addition of some pepper oleoresin, again to a toothpaste gives a bite to the product.

In general the addition of spice products to cosmetics has to be avoided, apart from in well tested perfumes and here their use is controlled or limits suggested. Being natural does not always mean safe.

Production and processing of culinary and aromatic herbs

by Nicolas Verlet
Ministry of Agriculture
Nyons, France

1. General characteristics of the production and the consumption of culinary herbs

Known under various names such as: "herbs, aromatic plants" or "culinary herbs", the 14 plants covered by this presentation have specific technical, economic and end-use characteristics which distinguish them from spices and spice seeds.

- Their consumption is mainly concentrated in industrialized countries. They are not traditionally consumed in developing countries, therefore, their large-scale cultivation in developing countries must be based on the existence of potential export markets.
- Their cultivation is well adapted to temperate climates; the major consuming countries (in North America, Eastern and Western Europe) are also the main producers of culinary herbs. Therefore new producers/exporters of these products will face competition [1] from the highly mechanized production of European countries and of a small number of developing countries which have already developed a highly competitive, export-oriented production.

  A low labour cost will not, in this case, represent a considerable advantage or have a strong influence on the production cost, as the large, industrial, or export-oriented cultivations have minimized their costs by high mechanization.
- These plants are cultivated for their leaves and tips. It is possible to mechanize almost wholly of the production process, from cultivation to the delivery of the commercial product. The quality of the final products, defined by commercial standards, is very much dependent on technical aspects of production, such as: selection of planting material, fertilization, weeding (weed-killing), drying, sorting, etc. The quality of the final product and the relationship between quality and techniques of cultivation is crucial for culinary herbs (more than in the case of certain spices), because a product which does not comply to a required quality cannot often be sold, not even at a very low, discounted price.
- Besides the market for dry culinary herbs, there exists a market for the fresh products. The market for fresh products is growing fast, driven by the growing demand for deep-frozen herbs, at the expense of dried products. This trend will continue in the future, especially with the development of new processes for extraction of flavours (including biotechnologies), in order to supply the industry with more sophisticated natural products. Agricultural production of culinary herbs will be influenced by these developments.

2. Cultivation techniques for the production of dry leaves and tips

❑ Relationship between production techniques and the quality of products

As already mentioned, cultivation and production techniques have a direct influence on the quality of the commercial products. Several factors determine the properties of the final products:

- Genetically inherited characteristics of the plants, interesting from the quality point of view, will influence the varietal selection of clones. Clonal reproduction will allow the cultivation of the same chemotype and yield products with homogeneous quality;
- Climatic conditions, i.e., type of soil, altitude, day and night temperatures, rainfall pattern, duration of sunlight, influence the plant characteristics to a certain region;
- Weed-killing will avoid the presence of extraneous plants in the final product; the use of pesticides may, however, leave undesirable pesticide residues in the final product;
- Drying is one of the most difficult and critical operations, influencing directly the colour, the

1 On the contrary, new developing countries, producers/exporters of spices are mainly facing competition from other developing countries, often with similar cultivation and economic conditions.

aroma content and the bacteriological properties of the dry herbs;

- Processing of the final product, i.e., cutting, threshing, sorting, de-dusting, also directly determine the quality of the final products, which is largely influenced by their visual aspect;
- Good storage and transport conditions are essential for the preservation of the properties of dry herbs.

All these production factors do not have the same influence on the quality of dry herbs of different varieties. For parsley, tarragon or chives, for example, the influence of drying is critical, to the extent that all drying methods except dehydration are banned. Meanwhile, all cultural techniques should be optimized in order to obtain plants with bright green leaves and exempt of yellow leaves.

Cultural techniques, on the contrary, have a limited effect only on the quality of rosemary or savoury; the wild herbs hand-picked and dried in the sun will have more or less the same properties as the cultivated, artificially dried herbs.

Herbs can be divided into three categories according to the relationships between the cultivation techniques and their final properties, as follows:

Group I: plants for which the visual quality is determinant (even more important than the aroma content), requesting sophisticated drying techniques, with specific properties in accordance to buyers' requirements and with a relatively high market price.

Group II: plants that can be cultivated and dried using less sophisticated techniques and with qualities that can be improved by processing and varietal selection. Different qualities of these plants are commercialized at various market prices.

Group III: wild plants, most often hand-picked, whose properties can hardly be changed by processing, commercialized at relatively low prices.

In table 1 are summarized the main types of herbs found in each group, their major production problems and the main current producers.

❑ Cultivation techniques

Table 2 summarizes the general soil and climate requirements of culinary herbs. Local experiments and cultivation trials have however to be undertaken in order to adapt the varieties to a given type of climate and soil.

❑ Cultivation sheets

The following cultivation sheets give indications on the average cultivation conditions in temperate zones; yields and cultural practices indicated would have to be adapted to more difficult cultivation conditions. Seedling dates should be modified for tropical climates or for countries with warm winters where catch crops can be cultivated. Indications of chemical weed-killers and their dosages are in accordance with the tests of the Institute of Medicinal and Aromatic Plants and correspond to cultural practices in Europe. They should be adapted to other

Table 1: Main types of culinary herbs, their major cultivation problems and main current producers

Group/plants	Major production problems	Main current producing countries
Group I		
Parsley	Yellow leaves	USA, France, Germany, Netherlands, Mexico
Tarragon	Variety and multiplicaton	France, Iran, Israel, Germany, Netherlands
Chives	Yellowing of apex	USA, Eastern Europe
Chevril	Difficult culture	Netherlands, France
Group II		
Thyme	Variety	Spain, France, Morocco, Albania
Sage	Cleaning	Yugoslavia, Albania, Turkey, USA
Oregano	Variety	Mexico, Turkey, Greece, Israel, Chile, China
Marjoram	Difficult seeding	Egypt, Hungary
Mint		Egypt, China, Morocco, Hungary, France
Basil	Preservation of aroma	Egypt, USA, Albania, Yugoslavia
Dill		India, Egypt, Hungary, Pakistan
Group III		
Bay		Turkey
Savoury		Albania, Egypt, Yugoslavia
Rosemary		Morocco, Tunisia, Spain, Albania, Portugal

Table 2 General soil and climatic requirements of selected culinary herbs

Culinary hers	PH of soil	Water requirements	Requirements of organic matter	Sensitivity to frost	Sensitivity to heat
Bay	ind.	*	*	**	*
Basil	ind.	***	**	***	*
Chive	ind.	***	***	*	**
Chevril	ind.	***	***	**	**
Dill	ind.	***	**	**	*
Marjoram	ind. to calcareous	**	**	**	*
Mint	ind. to calcareous	***	**	**	*
Oregano	ind. to calcareous	*	**	*	*
Parsley	ind.	***	***	***	**
Rosemary	ind. to calcareous	*	*	***	*
Sage	ind. to calcareous	*	*	***	*
Savoury	ind. to calcareous	*	*	*	*
Tarragon	ind.	**	***	**	*
Thyme	ind. to calcareous	*	*	*	*

NB: ind.= indifferent
ind. to calcareous = indifferent to calcareous
* low
** medium
*** high

cultivation conditions and the authorization of their use should be verified for any other countries. In all cases, mechanical or manual harrowing is highly recommended, together with, or instead of, the chemical weeding. For more details please consult the bibliography indicated in the annex.

Plants of Group I

Parsley (*Petroselinum Sativum - Apiaceae*)

Parsley is the most important culinary herb commercialized in tonnage; cultivated varieties have been selected by the producers of vegetable seeds. Two major varieties are cultivated: the flat-leaved parsley, more fragrant, and the "double" or "curly" parsley, less fragrant but more decorative.

- Sowing

Five to eight kg/ha of seeds are broadcast sown in spring. During the long spearing period (4 weeks) the humidity should be maintained constant.

- Fertilizing and irrigation

The high yields in green matter and the numerous cuttings of parsley imply high needs of water and of easily assimilable fertilizers. The addition of organic matter (50 kg of well-decayed manure for example, depending on initial composition of the soil) and of 100 units of P_2O_5 and 200 units of K_2O is recommended before sowing. After each cutting it is recommended to distribute water and spread 100 units of nitrogen.

- Weeding

- Before sowing: 1,200 g/ha Trifluraline.
- Before spearing: 3,500 g/ha Chlorouron, 1,500 g/ha Prometrine, 500 g/ha Linuron.
- After spearing: 4,000 g/ha Monalide, 350-500 g/ha Linuron.

- Diseases and pests

Parsley is not very resistant to diseases and to attacks of insects. Problems are mainly encountered due to Septoriosis (*Septoria petroselini*), the carrot fly and the celery fly. Leaves yellowing is frequent and alter the quality of the product, because it is impossible to separate the yellow leaves. Sometimes the yellowing is caused by parasites, but most often is the result of a combination of several factors such as the suffocation of the radicular system (too compact soil), insufficiency of oligoelements or potassium,

inadequate water feeding, nematodes. Some varieties are less resistant to this phenomenon than others.

- **Harvesting and yields**

Four to six cuttings can be practised according to climatic conditions at 40 days intervals. Average yields amount to 50 tons/ha fresh leaves and stems, but yields exceeding 100 tons/ha have also been obtained. The average production of dry clean leaves (after drying and seeving) amounts to 3 tons per ha.

NB: Cultivation techniques of chevril are very similar to those of parsley, however, chevril yields are inferior.

Chive (*Allium Schoenoprasum L. - Liliaceae*)

Several commercial varieties are available, differentiated by the thickness of the leaves and the intensity of the green colour. The cultivation can be maintained for four years on the average, depending on its sanitary situation and the presence of weeds.

- **Sowing**

Three sowing methods can be used:

- By division of the stool: old bunches are divided and some shoots are picked out in spring or autumn (about 200,000 stools per ha on the average, the density depending on the harvesting and harrowing equipment used).
- By sowing in nursery: sowing of 1.5 to 2 g/m2 of seeds in spring. About 350 g of seeds and 200 m^2 of nursery are needed in order to produce enough plants for planting 1 ha. Young plants are picked out after 45 days of nursery.
- By direct sowing: the technique requires a precision seeder and careful weeding. Four to six kg/ha of seeds are sown in spring or at the end of the summer, depending on climate and irrigation facilities.

- **Fertilizing and irrigation**

Sufficient watering is needed after each cutting, in order to limit the yellowing of leaves, which highly depreciates the quality of the product. Ground manure should contain 100 units of P_2O_5, 200 units of K_2O and 100 units of nitrogen at spearing and 60 units of nitrogen after each cutting.

- **Weeding**

- After sowing or plantation: 6,000 - 7,500 g/ha Chlortal, 4,000 g/ha Propachlore.
- After spearing or cutting: 2,400 g/ha Butraline; 500 g/ha Linuron; 240 g/ha Joxynil; 1,000 g/ha Prometryne.

- **Diseases and pests**

Chives are very sensitive to diseases and attacks of fungus, such as the onion mildew (peronospora destructor), the brown rot of the leek (*Puccinia porri*) or the rot of bulbs (*Botrytis allii*). Insects such as the leek moth (*Acrolepiopsis assectella*) can also damage the cultures.

- **Harvesting and yields**

The yield is very low the first year of cultivation. In the following years, five to six cuttings can be done annually, from June to October (about every four weeks). Flowers should be topped before the harvest. Average harvest amounts to 3 tons of fresh plants by cutting and by hectare, equivalent to a total production of about 15 tons/ha of fresh leaves, giving about 3 tons/ha of dried cleaned leaves.

Tarragon (*Aretmisia dracunculus L - Asteracea*)

Two types of tarragon are cultivated:

- the "Russian", "*Redovsky*" variety, very productive but with little flavour;
- the "French", "*Sativa*" variety, sterile under temperate climate, but much more appreciated for its strong flavour and strong green colour.

- **Sowing**

French tarragon should be chosen for intensive cultivation because of its higher value. But its sterility is a barrier to the rapid extension of the culture; the simplest multiplication technique by division of the stool, gives only about 10 rooted fragments that could be replanted from each old stool.

Another more costly propagation system could be used, i.e. by cuttings: young shoots are cut from extremities of branches, planted in a ball of mould and kept under glass until they root. The balls could be replanted into the field after about two months. The density of the plantation varies between 40,000 cuttings and 60,000 cuttings per hectare. Tarragon grows well on acid soils but adapts itself easily to any other type of soil, as long as it is well drained.

- **Fertilizing and irrigation**

This culture which continues for three or five years requires an initial ground manuring and additions of fertilizers containing 80 units of P_2O_5, 120 units of K_2O and 200 units of nitrogen after each cutting. Tarragon is less resistant to drought than parsley; cultivation in dry climates without irrigation will have very low yields, mainly because of the difficulties of re-starting the growth after a cutting in a dry period.

- **Weeding**

- Before sowing: 6,000 g/ha Difenamide; 600 g/ha Linuron.
- After plantation: 500 g/ha Linuron; 1,000 g/ha Promethyne.
- Before spearing (from the second year on): 6,000 g/ha Difenamide; 750 g/ha Linuron; 1,000 g/ha Prometryne.

India

1. Introduction

India is a vast country with appropriate agro-climatic conditions for growing a wide variety of spices. The tradition of cultivating spices goes back many thousands of years. Perhaps India is the largest producer of spices in the world, with an average production of 5.5 million tons per annum. Spices are grown all over India. Important among these are pepper, cardamom, chillies, ginger, turmeric, coriander, cumin, fennel, fenugreek, celery, garlic and herbal spices. India today is probably also the world's largest consumer of spices. It exports only about 5% of the total production of spices. The rest is consumed in the domestic market. This has two advantages:

- The ever increasing domestic demand supports the production, as it assures the Indian farmers of a reasonable price irrespective of international price fluctuations.
- It is comparatively easy to make a target oriented intervention to produce exportable surpluses at the required level and quality.

There is however, the disadvantage of the domestic pull affecting consistency in exports.

The export of spices from India which has been at the level of US$ 145 million during 1980-81 is now averaging US$ 170 million during the last 2-3 years.

Spices grown in India could be categorized into five groups.

- First, spices that are primarily export oriented. This category includes pepper, cardamom and celery seed.
- The second category consists of spices that are primarily consumed in the domestic market. This will include chillies, turmeric, seed spices like coriander, cumin, fennel, etc. and other spices like garlic, tamarind, etc. Small volumes are exported.
- The third category covers value added products, which includes spice oils and oleoresins, ground spices including curry powder, instant curry, consumer packed spices, dehydrated green pepper, pepper in brine and other similar products.
- The fourth category consists of spices which are grown in India but not in adequate quantities such as cloves, nutmeg, cinnamon and cassia. India may be in the export business of these spices in the next 6 to 8 years.
- The fifth category covers spices which are not being grown in India such as vanilla, paprika, oregano, parsley, rosemary, sage, basil, etc. India has a good potential for production of these spices.

2. The Spices Board

The Spices Board is a statutory organization constituted in 1987 under an Act of Parliament, to develop export of spices and coordinate activities of different organizations engaged in the production, processing and export of spices. Fifty two spices come under the purview of the Board for export development. The Board acts as a catalyst for export promotion and as an interface between producers and exporters, exporters and importers and exporters and government agencies. The Board also interacts with international agencies and important government organizations in major countries to enable the Indian exporters to get timely information on various aspects of spice exports. The Board has established a Quality Evaluation and Upgradation Laboratory. The main objectives of this laboratory are to monitor the quality of spices exported and to take up studies on quality at the farmers' and processors' levels and to advise them on cost effective methods of upgrading quality. The laboratory also interacts with major consuming countries and updates its information base on quality parameters in these countries. This updated information is passed on to exporters and farmers.

3. Trends in major spices

❑ Category - I

Pepper

In India, the State of Kerala accounts for about 95% of the pepper production. Pepper is mostly grown by small growers under mixed crop conditions. Pepper production in India has increased over the years. Replanting on a large scale, and adequate care being given to the crop are the factors responsible for the increase in production.

Pepper is the most important spice exported from India accounting for about 36% of the total exports. Export of pepper from India has remained somewhat steady during the last three years. During the current year, it is expected that India will export 36,000 tons. The production of pepper during the current season is expected to be normal and the new crop is expected by January 1992. Agriculture officers are currently in the

field educating growers on scientific post harvest techniques for the new crop.

One of the major areas of concern is the occurrence of quick wilt (Phytophthora) in the pepper growing areas in India. While some prophylactic measures have been found to be successful in certain parts, cost of such measures seems to keep the farmers away from taking adequate care especially in view of the current international prices of pepper. There is also some difficulty at the farmers' level in early detection of the phytophthora disease.

Cardamom

India produces about 4,000 to 4,500 tons of small cardamom (Elettaria cardamomum) per annum. During the current year, production is estimated to be 5,000 tons. Due to global surplus, India has developed her domestic market for cardamom and the shift in demand has considerably reduced the dependence on exports. In spite of good production during 1990-91 and lower exports, prices are being maintained at a reasonable level Export during the current year may not exceed 1,000 tons unless international prices improve.

Celery

India produces about 4,500 tons to celery seed per annum. The State of Punjab accounts for most of the production. The export during the current year is expected to be around 3,000 tons.

❑ Category - II

Chillies

Different varieties of chillies are produced throughout India with an average production of 700,000 tons per annum. Export is only a small fraction of total production and fluctuates widely between 1,200 tons (1985-86) and 21,000 tons (1990-91). The fluctuation in export is mainly due to fluctuation in domestic and international prices.

Efforts are being made to focus attention on cultivation of exportable varieties of chillies.

Ginger

Ginger grown in almost all States in India is traded in the fresh form as vegetable in the domestic market. Dried ginger which is exported is mainly grown in Kerala. India exports about 6,000-7,000 tons of dry ginger per annum. Ginger produced in certain parts of the country is not dried due to lack of adequate sunlight at the time of harvest. The Spices Board collaboration with the Central Food Technological Research Institute, Mysore has developed a technology to manufacture value added ginger products such as ginger candy, ginger in syrup, crystallized ginger and ginger squash. The test marketing of these products have been successful within India. The technology has been transferred to selected entrepreneurs for commercial production of these products to tap the potential within the country and abroad.

Turmeric

Turmeric is cultivated in India in many places. The annual production of turmeric in this country is around 390,000 tons per annum of which around 8,000-20,000 tons are exported annually. The leading importers of Indian turmeric are West Asian countries, the United States and Japan. Efforts are being made to propagate the cultivation of varieties with high curcumin content. Improved post harvesting methods are also being popularized.

Seed spices

Seed spices consist of coriander, cumin, fennel, and fenugreek. These spices are grown mostly in the States of Gujarat and Rajasthan. India is also the largest consumer of seed spices. Export of these seed spices constitutes about 9% of the total production. Exports during the current year are expected to be around 17,000 tons.

❑ Category - III

Value added products

Spice oils and oleoresins, consumer packed spices, spice blends, curry powder, green pepper products, ginger products and cardamom based products are the value added segments in Indian spice exports. While the Indian spice oil and oleoresin industry has registered a healthy growth and has been able to absorb frontier technologies to cater to the world market, the other segments are still in a preliminary stage of growth in terms of volume of export. While these segments have excellent potential in the world market, much more needs to be done in terms of packaging, marketing and advertising. It has been our experience that it is extremely difficult to penetrate established markets with new brand names.

❑ Category - IV

Tree spices

Tree spices like cloves, nutmeg, mace and cassia are not adequately produced in India at present. It is estimated that around 1,500 tons of cloves and 5,000 tons of nutmeg and mace and are produced in India against the domestic demand of 3,500 tons and 5,200 tons respectively. Adequate efforts are being made to increase production of these items through increasing the area under cultivation to attain self-sufficiency during the next five year period.

❑ Category - V

The spices identified in this category are vanilla, paprika and herbal spices. While it has been established that India has the necessary agro-climatic

conditions for growing most of these spices, the shortage of seeds and planting material has been a constraint. The other constraint likely to come up is the technology for dehydration for some of the herbal spices. However, it has been found that there are farmers in India who grow these grades mainly for domestic use. Plans are being finalized to expand steadily from this production base to produce exportable surpluses within the next 3 to 5 years.

4. Recent developments

❑ Quality upgradation

The quality of spices and spice products exported from India are being upgraded right from producers to processors and exporters levels by consciously avoiding certain traditional practices and adopting scientific methods. This is being achieved through:

- A series of quality education and awareness programmes for growers, intermediate traders and exporters of spices jointly by the Spices Board, inspection agencies and the Agriculture Department.
- Encouraging the setting up of processing and cleaning units in major spice growing regions and trading centres.
- Establishing a well equipped evaluation and upgradation laboratory and encouraging exporters to set up their own laboratories.

For quality assurance, the exporters are instructed to clean and grade the product according to importers' specifications. We also have government agencies specialized in export inspection of spices.

❑ Market driven production to ensure consistency

To meet the challenges of a dynamic spice industry, India plans to change the present system of production and marketing. Possible strategies are under discussion to ensure that India remains a consistent exporter of quality spices. India would like to export 120,000 tons of spices every year.

❑ Better packaging

Packaging plays an important role in exports. Apart from retaining the properties of the spices and increasing the shelf- life, the package should also be appealing to the consumer. The Indian Institute of Packaging (IIP) undertakes specific studies for developing packages suitable for the product. Workshops/seminars on export packaging with leading materials and machinery suppliers were organized by the IIP in major export leading materials and machinery suppliers were organized by the IIP in major export centres. The Institute also works closely with agencies like PIRA in the United Kingdom for technology upgradation.

❑ Research and development of new end products

Spices markets are changing rapidly due to increasing popularity of convenience foods, changing food habits and increase in the use of processed and semi-processed "ready to eat" food. In order to tap the potential for a changing market, it is necessary to develop new end-products which have high consumer preference, like ready-to-use spice blends and extracts. Research agencies like Central Food Technological Research Institute, Mysore; the National Institute of Nutrition, Hyderabad; the Regional Research Laboratory, Trivandrum, and the Government Ayurveda College, Trivandrum are regularly working on development of new end-products using spices.

❑ New policy initiatives

The Government of India has recently announced a bold and pragmatic economic policy. This has been followed up with innovative changes in the trade and industrial policy.

The major objectives of the new industrial policy package will be to build on the gains already made, correct the distortions or weaknesses that may have crept in and maintain a sustained growth in productivity and gainful employment and attain international competitiveness.

In pursuit of the objectives, the Government has decided to take a series of initiatives in respect of the policies relating to the following areas:

Industrial licensing

Industrial licensing is abolished for all industries, except those specified irrespective of levels of investment.

Foreign investment

In order to invite foreign investment in high priority industries, requiring large investment and advanced technology, it has been decided to provide approval for direct foreign investment up to 51% foreign equity in such industries. Food processing (including spices) is one of them.

Foreign technology agreements

With a view to injecting the desired level of technological dynamism in Indian industry, the Government will provide automatic approval for technology agreements related to high priority industries within specified parameters.

❑ World Spice Congress

India organized the first World Spice Congress in 1990. The Congress was sponsored jointly by the

Spices Board and the All India Spices Exporters' Forum, Cochin. A total of 78 overseas delegates from 22 countries along with international organizations like ITC in Geneva, UNDP and IPC in Jakarta attended the Congress. The main objective of the Congress was to bring together the world's leading importers and Indian exporters for a healthy exchange of ideas and information. The Congress was undoubtedly of considerable use to all those involved in the spice trade. The Spices Board has already initiated action to implement the recommendations of the Congress in the areas of production, planning quality assurance and marketing strategy to increase exports.

As recommended by the Congress, the next World Spice Congress will be held in November 1992.

Sri Lanka

1. Introduction

Sri Lanka, formerly Ceylon, situated in the Indian Ocean, is located 5°-10° north of the equator and enjoys uniformly high temperatures throughout the year. The country is endowed with fertile land, and agriculture has been the mainstay of Sri Lanka's economy for many years.

Sri Lanka has been famous for her range of spices for centuries. Spices was the magnet that drew foreigners to Sri Lanka - first the Arabs, then the Portuguese, the Dutch and finally the British.

In the course of time other products such as tea have overtaken Sri Lanka's spices, in terms of value and volume but her traditional position as a supplier of quality spices stands unassailed.

Sri Lanka produces a large number of spices, the major ones being cinnamon, pepper, cardamom, cloves, nutmeg and mace; over 90% of which is exported.

In 1990 exports of spices from Sri Lanka were valued at SL Rs 1,519 million (US$ 38 million) and accounted for 46% of other agricultural exports from Sri Lanka. In terms of total foreign exchange earnings to the country, spice exports account only for about 2% but it is significant that it is an integral part of the country's rural economy and contributes much to rural incomes.

2. Production

According to current estimates, the acreage under spice crops is approximately 50,000 hectares (annex 1). About 40% of this is accounted for by pepper and 30% by cinnamon.

The production of spice crops continues to be largely confined to mixed home gardens particularly in the case of pepper, cloves and nutmeg. Approximately 70% of the cinnamon is grown as a pure crop by small holders while much of the cardamom, about 80%, is grown under estate conditions.

Poor prices fetched by most spices during the last year or two have been a disincentive to spice producers, except in the case of cinnamon, where high prices have stimulated new cultivations.

The main constraint affecting spice exports in Sri Lanka continues to be its supply base. As such the thrust of the development programmes in the sector have been to develop and promote commercial cultivation. In view of the limited availability of suitable land, the Government has adopted several measures to promote commercial cultivation of spices, especially pepper, as an intercrop on coconut land.

However, the typical mixed home garden unit of spice production cannot be overlooked since the bulk of export earnings from spices continues to come from this segment. Hence, while striving to promote commercial cultivation, programmes are being implemented to assist smallholders to increase productivity through proper agricultural practices.

3. Spice crop assistance scheme

In order to assist growers of spices, the Department of Export Agriculture (DEA), formerly the Department of Minor Export Crops, continues to operate a subsidy scheme for cultivating a range of export crops. This scheme provides plant material, cash grants and technical advice.

Extension activities for educating farmers on proper agricultural practices and post harvest handling are also provided through regular training programmes of the DEA. The Sri Lanka Export Development Board (SLEDB), the Sri Lanka Standards Institution (SLSI) and representatives of the Spices & Allied Products Traders Association (SAPTA) have participated in programmes carried out in various districts in the country.

In addition, assistance is offered through the Perennial Crop Development Project (PECRODEP) which is being implemented in Sri Lanka with assistance from the Asian Development Bank (ADB). Through this scheme, subsidies are available for cultivation of crops prescribed under the government subsidy scheme and low interest credit facilities are available for crop production and farm improvement. PECRODEP also operates farm planning and advisory services. Currently this scheme is restricted to five districts in Sri Lanka.

4. Marketing

The internal market for spices takes up only a small fraction of production. Over 90% of the spices produced in Sri Lanka are exported, except pepper, where more of the production is consumed locally.

The internal marketing of spices is done through collectors and dealers who are the link between the

grower and exporter. However, in the case of cardamom, practically the entire production is sent by the producers direct to the weekly spice auctions held under the auspices of the SAPTA.

In order to strengthen the knowledge of market prices at producer level the SLEDB and the SAPTA publish wholesale market prices weekly through the news media.

5. Exports

Sri Lanka's exports of spices for the period 1987 to 1990 is given in annex II.

❑ Cinnamon

Sri Lanka continues to dominate the world trade in true cinnamon. Over the last 5 years or so exports have remained static at around 6,000 metric tons *per annum*. In value terms however, there has been a definite upward trend with foreign exchange earnings, increasing from SL Rs 396 million (US$ 13 million) in 1987 to SL Rs 1,135 million (US$ 28 million)

The bulk of Sri Lanka's cinnamon exports continue to be destined to Mexico. Other important buyers are Latin America and the United States. It has been observed that cut cinnamon has been making an impact in the Latin American markets in recent times. Sri Lankan cinnamon fetches premium prices in these markets. However Sri Lanka has lost out in the European market where there is competition from the cheaper cassia.

❑ Pepper

Pepper exports in 1990 amounted to 1,305 metric tons valued at around SL Rs 117 million (US$ 3 million). Depressed prices in the world market for pepper resulted in a drop in exports during the period 1988-1990.

Sri Lankan pepper is exported to several markets of which the more important ones are India, the United Kingdom, the United States, and the Middle East. Currently exports are limited to black pepper in bulk. Due to the high extraction value characteristic of Sri Lankan pepper, it is preferred in certain segments of the industry and fetches a premium price.

❑ Cloves

Sri Lanka's exports of cloves have had mixed fortunes. In 1988, a record harvest enabled the country to export a little less than 2,000 metric tons but as a result of a poor crop in 1989, exports dropped to a mere 87 metric tons in that year. In 1990 exports picked up again and were in the region of 2,300 metric tons valued at around SL Rs 234 million (US$ 5.6 million). Over 90% of Sri Lanka's clove exports have traditionally been destined to India owing to the preferential tariff enjoyed on imports to India under the Bangkok Agreement. However, changes in the import policy of the Government of India have drastically affected exports to that market and by 1990 exports dropped to 0.9% of total clove exports. Currently the bulk of exports are destined to the Middle East and Singapore.

❑ Cardamom

Cardamom exports in 1990 were 34 metric tons valued at SL Rs 10 million (US$ 0.2 million). Exports have declined over the last few years and current exports amount to only one fifth of exports in 1987. The bulk of the production comes from estates owned and managed by the State sector although there are a few private estates. The Sri Lankan product is generally of the green variety but improper processing has resulted in lower grade cardamom of a poor colour.

The markets for cardamom include Singapore, Maldives and Bangladesh.

❑ Nutmeg and mace

Export of nutmeg in 1990 was 268 metric tons valued at SL Rs 22 million (US$ 0.6 million). Production has been largely static at around 300-400 metric tons per year. The bulk of the nutmeg is exported in shelled form to markets such as the United Arab Emirates, India and Kuwait. In the case of mace, exports were only 2 metric tons in 1990 valued at SL Rs 0.5 million (US$ 0.01 million)

6. Processed products

❑ Spice oil and oleoresins

Sri Lanka exports a range of spice oils of which the more important ones are cinnamon bark oil and nutmeg oil. In addition, small quantities of pepper oil, ginger oil and cardamom oil have also been exported in the recent past. Total exports of spice oils in 1990 were valued at SL Rs 95 million (US$ 2.4 million)

Sri Lanka is the world's largest producer of cinnamon bark oil and exported 0.7 metric tons valued at SL Rs 7.4 million (US$ 0.2 million) in 1990. Small quantities are produced in Europe and the United States from cinnamon bark imported from Sri Lanka. Although cheaper synthetic substitutes have been developed certain perfumerists and flavourists continue to prefer the genuine cinnamon bark oil.

Owing to the specific quality characteristics, Sri Lankan products have successfully established their own niche in the world market. It is noted that most flavour and fragrance companies prefer to continue imports through traditional suppliers in France and the

United States. A recent study carried out in Japan has established that there are subtle differences in quality between the genuine Sri Lankan products and those imported into Japan through other centres. Compounding houses in Japan appear to be somewhat reluctant to break away from traditional links and make direct purchases from source of origin.

In the area of oleoresins Sri Lanka has only a limited capacity despite producing certain spices, particularly pepper, ideally suited for this industry. The Government is encouraging the establishment of such ventures with a view to adding value to spices produced in the country and would welcome joint venture proposals in this field.

❑ Ground spices

Although the bulk of Sri Lanka's spice exports is in unprocessed form, over the last few years, some headway has been made in direct exports to consumer markets. A range of spice packs have been developed in which spices are packed, whole or ground. Ground spice mixes have been developed for a variety of culinary requirements.

The ground spices and spice mixes are generally packed in triple laminated aluminum foil sachets or packed in a variety of attractive terra cotta and ceramic containers and are now being exported to several important market centres. However, in terms of volume and value, this constitutes only a very small fraction of exports of spices from Sri Lanka.

7. Institutional arrangements

There are several institutions that assist in the development and promotion of the production and export of spices from Sri Lanka.

❑ The Department of Export Agriculture (DEA)

The task of this Department which functions under the Ministry of Agricultural Development and Research is to implement the subsidy schemes of the Government and to provide extension services to the growers. The Department also engages in research activities related to plant breeding and agronomy and in identifying high yielding, pest and disease resistant planting material. Officers of the Department also advise growers on proper agri-horticultural practices.

❑ The Sri Lanka Standards Institution (SLSI)

SLSI sets export standards for spices and implements the quality control scheme. No exports of spices (except cinnamon) can be made unless samples drawn from the actual shipments, satisfy the standards laid down. Cinnamon has not yet been brought under this quality inspection scheme as the quill form in which this sample is exported makes sampling rather difficult.

❑ The Ceylon Institute of Scientific & Industrial Research (CISIR)

The CISIR has well equipped laboratories and skilled technical personnel for carrying out analyses on spice products. The Institute is also involved in developing techniques of spice processing. This organization has been closely involved in designing and developing equipment for the essential oil industry.

❑ Spices and Allied Products Traders Association (SAPTA)

The SAPTA is an association of exporters, producers, dealers and brokers and is affiliated to the Ceylon Chamber of Commerce, the largest and the oldest Chamber in the country. It is under the by-laws of the SAPTA that weekly auctions of spices and allied products are held.

❑ The Sri Lanka Export Development Board (SLEDB)

The SLEDB is the focal point for exports from Sri Lanka and has identified spices as a priority sector for development and promotion.

The EDB has conducted several market studies which include a survey of West European markets for spices in general, and recently for cinnamon specifically. Programmes have also been carried out in Japan for developing Sri Lanka's exports of essential oils to that market. The EDB has also been involved in programmes for upgrading knowledge and skills of the spice farmers and has sponsored two programmes to study spice cultivation in Kerala, India which were carried out with the assistance of the Indian Spices Board.

Following deliberations at the 2nd Meeting of the Spice Group where attention of producing countries was drawn to the growing consumer awareness in developed countries on hazards associated with contaminated food, the EDB commissioned the CISIR to carry out a study on export shipments of selected spices and beverages crops. This study is aimed at assessing pesticide residues and microbial contamination in products shipped regularly to Europe and North America.

8. Future programmes

Pepper and cinnamon have been identified by the Government of Sri Lanka for promotion and

development over the next few years. However price stability in these commodities is of vital importance to ensure the success of these programmes. Fluctuating prices experienced in the past have been a deterrent to general expansion in production. Although some thought has been given to the establishment of a common fund for commodities to assist farmers during lean periods, no programmes as such have been formulated. Sri Lanka looks to the Group for any ideas and suggestions in formulating a workable solution.

The bulk of spice exports from producing countries including Sri Lanka continue to be in unprocessed form. Although several attempts have been made to penetrate the market for consumer packed spices, not much headway has been made mainly due to the very closed nature of the processed spice market. However, other than the main market which is controlled by the multinational companies, there is a demand for spices in exclusive outlets such as health food shops, specialty restaurants and gourmet shops. A generic product promotion campaign by the Group in these speciality areas would enable countries like Sri Lanka to reach this segment of the consumer market directly.

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Market Intelligence

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Market Factors

A number of factors are currently impacting the market for herbs and spices, including greater adventurism on the part of consumers manifested in a greater willingness to experiment with a wider range of recipes and flavours, and the move towards eating in the home. On the negative side, development of culinary aids and convenience foods which already contain herbs and spices, and health concerns, are acting to limit demand for herbs and spices and salt respectively.

The **recessionary squeeze on PDI** has entailed a general move towards eating in the home, with fewer meals taken outside. This has led to growth in added-value products including fresh herbs, mixes, pastes and sauces as well as an increasingly sophisticated array of premium quality herbs and spices. For example, using Provençale herbs in place of mixed herbs, has acted to boost market value at a time when volumes have fallen back.

Home cooking has acted as a stimulus to the herbs and spices market by encouraging usage of a wider range of products in a variety of recipes. Both magazines and television programmes which feature recipes are an important influence on the market, with recommendations for usage of Continental and ethnic products to reproduce authentic tastes. Current vogues in home cooking include a prevalence of Mediterranean dishes which require herbs such as oregano and basil, and seasonings such as freshly ground black pepper. Likewise, Thai, Indonesian, Cajun and Chinese herbs and spices are currently gaining from the popularity of these cuisines, while growth in home barbecues has resulted in greater usage of ready made barbecue seasonings.

As **consumers are becoming increasingly adventurous** in terms of the range and variety of cuisine prepared in the home, basic herbs and spices are often eschewed in favour of more convenient, ready made culinary aids such as pastes, mixes and cooking sauces for various recipes. Sectors such as curry paste, tomato purée with added herbs for use as a base for a pasta sauce, butters flavoured with garlic and herbs and ready made stir fry sauces are currently expanding. As such, while the range of meals and styles of food cooked in the home continues to widen, dried herb and spice market development remains restricted by growth in culinary aids, which acts to limit demand for products used to make meals from scratch.

A further related factor for restraining herbs and spices market development is **the growth of convenience foods** such as ready meals and cooked flavoured chicken. Ethnic meals are one of the few ready meal sectors maintaining sales in a recession-hit sector, and already contain the herbs and spices which would be used in their creation in the home. Similarly, ready cooked tandoori chicken products cut into demand for tandoori seasonings.

Increased foreign travel and a large indigenous ethnic population have both acted as important influences on the herbs and spices markets in providing consumers with a less ethnocentric outlook on diet and encouraging usage of a wider range of products in order to obtain the same tastes of foods sampled on holiday or in a restaurant. A high prevalence of Indian and Chinese restaurants in the high street continues to assure these cuisines a more mainstream role in the British diet, with continued ethnic food development along the lines of Thai, Malay, Cajun, Creole and Mexican foods encouraged both by increased holiday travel and the popularity of restaurants and fast food chains serving these types of meals.

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Concern over health and diet has had both positive and negative influences on the herbs and spices market. Growing awareness among consumers of the broadly healthy nature of the Mediterranean diet has entailed increased usage of products associated with these recipes such as oregano and basil, along with ready-mixed Italian and Provençale seasonings. Likewise, recognition of the links between salt and hypertension or high blood pressure has caused consumers to attempt to cut down on intake of salt, both while cooking and seasoning foods, and in the supermarket through purchasing low salt content alternatives.

The market for **fresh pre-packed herbs** and herbs in grow pots has developed in recent years, although is not perceived as a profound threat to the industry. Fresh herbs remains a small, own label led business, with purchase mainly for use in a special recipe for a particular occasion rather than for everyday usage. Freeze dried herbs have not lived up to initial expectations.

Seasonality is a factor in this market, particularly with regard to salt sales. During periods of particularly cold weather and heavy snow, sales of salt for use in clearing snowfalls soar. Likewise, protracted periods of hot weather can act to boost sales of products such as barbecue seasonings, while consumption of herbs and spices peaks traditionally in the colder months of the year when more hot food is consumed. This perhaps, suggests a need to mount a campaign extolling the benefits of using herbs and spices in salads and cold food which might stimulate growth.

Market Size and Trends

Sales of herbs, spices and seasonings and salt have declined in real terms over the 1987-91 period. The former sector has suffered as a result of the development of more convenient culinary aids such as sauces and pastes for use in cooking which has acted to stifle demand for herbs, spices and seasonings. Salt consumption has fallen through concern over possible links with high blood pressure and increased consumption of convenience foods which already contain salt and require little or no seasoning. Nevertheless, some segments of both markets are displaying growth.

Figure 1 The market for herbs, spices, seasonings and salt, by value, 1987-91

	1987		1989		1991		% change
	£m rsp	%	£m rsp	%	£m rsp	%	1987-91
Herbs, spices, seasonings*	49	70	53	71	58	73	+18
Salt	21	30	21	29	21	27	-
Total	**70**	**100**	**74**	**100**	**79**	**100**	**+13**

* includes whole black pepper, whole other pepper, ground white pepper, ground black pepper and curry powder

Source: Mintel

Herbs, spices and seasonings

Volume sales of herbs, spices and seasonings have tailed off slightly over the course of the late 1980s, with the market contracting by some 3% over the 1987-91 period to 90.9 million units. Value sales of £58 million in 1991 amount to a decline of 4% in real terms over the same period, reflecting a slightly lower average unit price in the market caused by the development of own label and economy lines. At the same time, product diversification and premium sector development within the market have acted to minimise falls in average prices.

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The Consumer

In order to assess buying behaviour for herbs and spices, Mintel commissioned BMRB to interview a nationally representative sample of housewives, during February 1992, when 956 respondents were asked the following question:

"Which of these types of seasoning, dried herbs and spices have you bought in the last six months?"

Figure 14 Herbs and spices bought in the last six months, February 1992

Base: 956 housewives

	%
Ground white/black pepper	66
Mixed herbs	49
Curry powder	44
Mixed spices	37
Whole black pepper	34
Parsley	33
Chilli powder	30
Sea/rock salt	29
Oregano	25
Paprika	23
Other herbs	33
Other spices	32
None	5
Never buy	3
Don't know	*

* low response

Source: BMRB/Mintel

Purchase of different types of herbs and spices closely reflects overall segmentation within the market with ground pepper, mixed herbs and curry powder featuring as the most widely purchased products in the market. A relatively high response for whole black pepper reflects the recent upsurge in sales. Only 3% of respondents never buy herbs and spices, reflecting the near universatility of these products.

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Part I

General market considerations

Some developing countries view the cultivation of culinary herbs for export to industrialized markets as an opportunity for diversifying agricultural production. However, while they may have the right climatic conditions for cultivating these herbs, they can initiate export-oriented production only on the basis of an assessment of the market situation in consuming countries. To assist these countries in making such an assessment, the International Trade Centre UNCTAD/GATT (ITC) has carried out a survey of the markets for the 12 most traded culinary herbs in France, Germany,[1] the Netherlands and the United Kingdom within its programme of technical co-operation. The results of its investigations are presented below.

A. Product definition

No standard definition exists for herbs, and the distinction between herbs and spices is often imprecise. For the American Spice Trade Association (ASTA), the term "spices" also covers herbs and aromatic seeds. In traditional Western usage, the term "herbs" denotes plants grown mainly in temperate and Mediterranean climates, whose leaves, stems and flowering tops are used fresh or dried, chiefly for food seasoning.

This survey covers the 12 best known and most widely traded herbs employed mainly for culinary purposes, namely: parsley, mint, sage, thyme, bay, marjoram, rosemary, basil, oregano, dill, savory and tarragon. They are classified under the following headings of the Standard International Trade Classification, Revision 3 (SITC), and the Harmonized Commodity Description and Coding System or Harmonized System (HS):

SITC, Rev. 3	HS or CCCN[2]	Heading
054.59	0709.90	Other vegetables, fresh or chilled. (Covers, among many other items, parsley, chervil, tarragon, savory, dill and sweet marjoram (*Majorana hortensis* or *Origanum majorana*).)

1 Excludes the former German Democratic Republic, which was a separate country at the time of the investigations for this study.

2 Customs Co-operation Council Nomenclature.

056.19	0712.90	Other vegetables and mixtures of vegetables, whole, cut, sliced, broken or in powder, but not further prepared. (Among others, covers parsley and chervil.)
075.28		Thyme, saffron and bay leaves
	0910.40	Thyme; bay leaves[3]
292.49	1211.90	Other plants and part of plants (including seeds and fruits), of a kind used primarily in perfumery, in pharmacy or for insecticidal, fungicidal or similar purposes, fresh or dried, whether or not cut, crushed or powdered. (Covers, among other items, leaves and flowers of basil (*Ocimum basilicum*), wild marjoram (*Origanum vulgare*), mint (all species); herbs, flowers and leaves of rosemary (*Rosmarinus officinalis*), and leaves and flowers of sage (*Salvia officinalis*).)

B. Product forms and major end-uses

1. Product forms

Culinary herbs are traded internationally largely as **dried** herbs. Both the wild and cultivated varieties are traded mostly in the "crude", "unmanufactured" or "not ground" forms, which means that they have been cleaned but not further processed.

Further processing beyond the drying stage is most often undertaken in the consuming country. This involves grinding, chopping or crushing, or further cleaning and packaging of whole leaves, stems or flower-heads.

All major spice/flavour companies market various mixtures or combinations of herbs, mainly for the retail or household market. An example is the "bouquet garni", which consists of small amounts of thyme, rosemary and bay leaves - either blended and packed in a muslin bag or tied in a bunch which can be removed after cooking. "Fine herbs" are usually a combination of tarragon, chervil, parsley and chives which are mixed and/or cooked with food and are eaten. "Mixed herbs" are generally made up of marjoram, thyme, parsley and sage.

The international trade in intensively cultivated herbs, dehydrated with the aid of new technologies, is tending to rise. Likewise, the wholesale market for organic herbs is expanding, particularly in Germany and Switzerland, although their price premium seldom exceeds 25%.

Large quantities of **fresh herbs** are traded within the producing countries. In France, for example, demand for fresh herbs is thought to exceed domestic supplies. The major market outlets are restaurants and supermarket chains, and the leading sales items are the bouquet garni and fresh mint. The latter is sold mostly to North Africans living in France.

To meet demand for fresh herbs, European growers have turned to expensive investments in heated greenhouses or to the use of plastic tunnels for early-spring and late-fall growth. In the winter, imports are obtained from warmer areas such as Israel.

The structure of the trade in fresh herbs is much closer to the trade in fresh vegetables than to the trade in dry herbs. Commercialization is generally handled through the major wholesale markets. These are located in Rungis (south of Paris) and in Hamburg, Germany.

3 See page 13 (table 1) for a further breakdown under the EEC Combined Nomenclature.

The international trade in fresh herbs is limited and offers little prospect for substantial penetration by a new producing country. It is for this reason that fresh herbs are not discussed further in this survey.

Frozen herbs have developed a market as replacements for the dried products and as a complement to fresh herbs. Consumers perceive less wastage from frozen products (which are offered in packages from which small quantities can be taken for use at any time) than from fresh herbs (which are generally sold in quantities larger than that required in recipes). Although it remains small, the market for frozen herbs is growing rapidly in France; it is also expanding in Germany, the Netherlands and the United Kingdom.

Herb oleoresins, obtained from herbs by steam distillation and by solvent or CO_2 extraction of essential oils, offer certain advantages over the natural ground herbs from which they are derived. These advantages include higher potency and greater uniformity of the product; quality consistency; convenience in use when dispersed on a neutral carrier such as salt, dextrose or sucrose; freedom from micro-organisms; more uniform dispersion of the flavour of the product; and easier and cheaper handling and storage.

Several companies in the countries reviewed, particularly in the baking and processed meat industries, prefer dispersed oleoresins to dried herbs. However, with the exception of oleoresins from sage and celery seed, herb oleoresins are not widely used. For the time being, dried herbs do not face strong competition from their oleoresin substitutes.

The growth of usage of herb oleoresins will depend on regulations, which have a major impact on the markets for herbs and essential oils. The use of "natural aromas" is a strong selling argument with European food consumers. However, the legislation governing the term currently differs from country to country within the European Economic Community (EEC). In Italy, but not in France, for example, aromatic substances obtained through chemical synthesis that have the same chemical structure as the chemicals in the natural plants can be marketed as natural aromas. Legislation harmonizing food manufacture and other agricultural regulations by 1993 in EEC will have an impact on the production and use of herbs and herb oleoresins.

2. Major end-uses

The culinary herbs discussed in this survey are used mainly to flavour, season and garnish food. These herbs are marketed individually or in mixtures. They are also used in the manufacture of:

- Seasonings, which are blends of herbs and spices. In most cases, their names suggest their principal use (e.g. seasonings for barbecue, chicken salad or steak).

  Among the new products are a wide variety of blends for use in microwave cooking, as dips and for ethnic cooking; a new range of condiments such as herb pepper, dill pepper (from McCormick-Schwartz in the United Kingdom); and herbs formulated for consumers who want to reduce their intake of salt, calories or cholesterol (dietetic preparations).

- Stuffing mixes (for example, herbs and breadcrumbs) for use mainly to stuff meat or to be cooked on their own to accompany meals.

  Sage (and onion) mixtures dominate the stuffing mix market, with other products such as parsley and thyme or apple and herb stuffings taking a small share.

essential oils and pure soya oil of which three drops are claimed to be equivalent to a teaspoon of dried herbs). Passuto supplies both the retail and the catering trade with herbs and spices. The leading British producers of culinary herbs are listed in appendix II.

The own-label market is growing. Multiple grocers such as Asda, Fine Fare, Gateway, Presto, Safeway, Sainsbury and Tesco all have their own range of herbs at the cheaper end of the market. This has a depressive effect on the overall evolution of the market in terms of value.

E. Conclusions and recommendations

Herbs and spices are extensively used in cooking in the four European markets reviewed. Owing to the absence of clear distinctions in the statistical data between fresh culinary herbs and vegetables on the one hand, and between herbs (excepting thyme and bay leaves) and other plants used in pharmacy, perfumery or as insecticides and fungicides on the other, an evaluation of market sizes can be made only on the basis of the estimates of the trade.

Domestic production in the four countries covered consists mainly of parsley, sage, mint, thyme, dill, savory and tarragon. This production covers demand for fresh herbs and part of the requirement for dried herbs.

Current imports of dried herbs into the four markets reviewed are estimated at an average of 12,595 tons yearly (see table 17), of which 37.4% (4,705 tons) are supplied to France, 30% (3,785 tons) to Germany, 20.5% (2,555 tons) to the United Kingdom and 12.3% (1,550 tons) to the Netherlands.

Intra-EC trade is also well developed and much larger tonnages of dried herbs are transshipped through Hamburg and Rotterdam.

Table 17 **Current imports of dried herbs into France, Germany, the Netherlands and the United Kingdom, by quantity**

Herbs	Total Tons	Total % of total	France	Germany	United Kingdom	Netherlands
Sage	1,750	16.5	450	650	500	150
Oregano	1,600-1,750	15.8	350-500	600	500	150
Marjoram	1,682	14.6	530	500	252	400
Mint	1,850-2,350	10.8	1,000-1,500	400	400	50
Thyme	1,510-1,580	10.3	700-770	500	220	90
Rosemary	970-1,020	7.9	350-400	450	90	80
Parsley	650-750	7.0	100-200	50	100	400
Basil	830-880	6.7	300-350	200	250	80
Bay leaves	755-805	6.4	250-300	250	185	70
Savory	265	1.7	120	100	15	30
Tarragon	153	1.3	50	65	13	25
Dill	95	1.0	20	20	30	25
Total	**12,110-13,080**	**100.0**	**4,220-5,190**	**3,785**	**2,555**	**1,550**

Source: Trade estimates.

Over three quarters (77.4%) of imports into the four markets consist of the following six herbs: sage, oregano, marjoram, mint, thyme and rosemary.

Parsley is the most used herb, but the largest part of the demand is covered by domestic growers.

The lack of statistical data makes it impossible to forecast the evolution of demand. According to trade estimates, the market has an average annual growth rate of 1 to 2% in terms of tonnages. Although volumes will continue to rise, factors such as packaging in bulk or in larger quantities will dilute the effect on market growth in value terms. Growth rates differ for the various types of herbs and with the market sector in which the herbs are most used. Growth is expected to be much faster in the industrial food and institutional catering sectors, and more or less stagnant in the retail sector. Demand for marjoram, oregano, sage, thyme and bay leaves is therefore likely to grow faster than demand for the other herbs.

Several factors augur well for growth in Europe of consumption and imports of dried herbs.

- Rising incomes sustain the growth of demand;
- Immigration and travel increase the interest of the population in foreign cooking.
- Television and radio advertising and increased leisure time have a profound effect on the growth of demand for herbs and products required for ethnic or exotic cooking. Chinese, Creole, French, Greek, Indian, Indonesian, Italian, Mexican, Middle Eastern. Thai and Vietnamese cooking are in fashion and specific herb-and-spice mixtures are in demand for these types of food.
- Herbs are increasingly used in industrial food manufacture as natural preservatives and anti-oxidants; oregano and rosemary, for example, are extensively used as anti-oxidants in sausages and other meat products;
- The growing trend in Europe towards foods low in sugar and salt have led to the search for alternative ways of making them more palatable and to the development of herb mixes and spiced herb preparations.
- The boom in fast foods and microwave cooking has increased the use of more aromatic herbs in order to improve palatability.
- The move away from artificial flavourings and colourings in food has benefited the herb market; herbs are natural products which are marketed as "free from artificial colouring and/or preservatives".
- Ethnic and culinary herb display units are increasingly common in supermarkets and food stores, including those of the multiple grocers.

Imports into the three markets considered are handled by a handful of importers/dealers/brokers. The largest part of the trade takes place directly between the exporters and the large grinders/processors which in turn supply the retail, industrial and catering sectors.

Tariffs do not present a real obstacle to trade. However, the stringent quality requirements, phytosanitary control regulations and especially the closed distribution network for retail packs in the European markets are particularly difficult to surmount.

The market for dried herbs is not overly price-sensitive, but it places great importance on quality and on freedom from microbiological infestation. As no common quality standards exist in EEC member countries, exporters have to comply with the quality standards and requirements established by individual importers, grinders and processors.

All the large importers in the three countries covered by this report tend to have close relationships with their traditional suppliers in Egypt, Hungary, Morocco, Spain and Turkey, for example, in order to secure supplies of consistent quality. If they wished to, they could encourage production in other countries by making direct investments and providing technical services in herb cultivation and processing.

Potential exporters should contact established importers or brokers in order to have their samples evaluated and to obtain advice on possibilities for penetrating a given market and market sector.

The current market for dried herbs is not short of supplies and, all things considered, exporters seeking entry will have to compete with traditional suppliers. The only way to penetrate the market is to offer dried herbs of consistently high quality, be they in the crude or crushed form. Clean products of assured quality, good appearance and, if possible, with properties distinguishing them from their competitors (flavour, colour, content of essential oil) can secure a firm place in the European markets and in fact be sold at a premium over products from other origins.

Herb-consuming countries in Europe are quality conscious. Their quality requirements will become more stringent, particularly with respect to cleanliness and the use of herbicides and pesticides. As the major European users prefer to purchase herbs in the unground form, a producer will be unlikely to market herbs that have been processed beyond the initial drying stage unless he can ensure excellent and consistent quality.

COSMETIC WORLD NEWS – PRICES
(NOT UP TO DATE)

Essential Oils

	Price per kilo
Almond Bitter Artificial	£4.75
Ambrette Seed Oil	*
Amyris (W.I. Sandalwood)	£16.00
Aniseed China Star	£8.60
Angelica Root Oil	£490.00
Angelica Seed Oil	£342.00
Armoise	£32.00
Balsam Peru	£7.00
Basil Egyptian	£50.00
Basil Comores	£63.00
Basil French	£70.00
Bay W.I. 50/55	£16.00
Bergamot Italian	£59.00
Bergamot Ivory Coast	£42.00
Bergamot Bergaptene free	£50.00
Birch Tar Rectified	£8.90
Bois de Rose Brazilian	£12.00
Buchu English Distilled	£250.00
Buchu Sth. African	£135.00
Cajeput Indian	£6.00
Calamus USSR	£69.00
Camomile Blue Egyptian	£400.00
Camomile English	*
Camomile Romaine	£350.00
Camomile Wild Moroccan	*
Camphor White Chinese	*
Camphor White Taiwan	£4.00
Canange Java	£18.00
Caraway Dutch/Polish	£33.00
Cardamom Guatamala	£50.00
Cardamom Indian	£170.00
Cardamom Sri Lanka	£72.00
Carrot Seed Indian	£90.00
Carrot Seed French/Hungarian	£100.00
Cascarilla	£1250.00
Cassia Chinese 85/90%	£20.00
Cedarwood American Texas Crude	£4.50
Cedarwood Chinese	£2.50
Cedarwood Kenya Rect.	£4.50
Cedarwood Virginian	£7.75
Celery Herb	£51.00
Celery Seed Indian	£50.00
Celery Seed French	£70.00
Cinnamon Bark Sri Lanka from	£70.00
Cinnamon Leaf Sri Lanka	£4.50
Citronella Sri Lanka	£6.00
Citronella Chinese 85/35%	£8.90
Citronella Indonesia 85/35%	£8.90
Clary Sage French	£80.00
Clary Sage Russian	£80.00
Clove Bud	£23.00
Clove Stem Zanzibar	£7.00
Clove Leaf Indonesian 80%	£1.75
Clove Leaf Madagascar	£2.00
Coriander English	£45.00
Coriander Russian	£60.00
Costus Indian	*
Cumin Seed	£80.00
Cypress	£30.00
Davana Indian	£220.00
Dill Seed Hungarian	£15.00
Dill Weed	£12.00
Eucalyptus Chinese 60%	£6.00
Eucalyptus Portuguese 80/85%	£6.00
Eucalyptus Portuguese 70/75%	£6.00
Fennel Bitter Spanish	£14.00
Fennel Sweet (Spanish)	£17.00
Galbanum French	£180.00
Garlic Egyptian	£96.00
Geranium Bourbon	*
Geranium Chinese	£25.00
Geranium Egyptian	£32.00
Ginger Chinese	£40.00
Ginger Indonesia	£50.00
Ginger Indian	£45.00
Ginger English Distilled	£110.00
Gingergrass Indian	£9.00
Grapefruit Florida	*
Grapefruit Israel C.P.	£5.30
Guaiacwood Paraguay	£8.00

Essential Oils

	Price per kilo
Ho Leaf 90%	£10.50
Hop	£400.00
Horseradish	£1650.00
Hyssop	£198.00
Juniper Berry Dalmation	£35.00
Juniper Berry BPC	£75.00
Laurel Leaf Russian	£75.00
Lavandin Ordinaire 22/24	£8.00
Lavandin 30/32% Abrialis	£11.00
Lavender Oil 46/48% English	£40.00
Lavender French 40/42%	£22.00
Lavender Spike Spanish	£10.00
Leek	£1700.00
Lemon Argentina	£10.00
Lemon California CP	£12.40
Lemon Sicilian	£10.60
Lemon Spanish	£16.80
Lemongrass Cochin 75%	£9.60
Lemongrass Guatamalan 75%	£4.75
Lime W.I. Distilled	£16.50
Lime Mexican	£16.50
Litsea Cubeba 75%	£5.90
Lovage Root	£1000.00
Mandarin Expressed Green Spanish	*
Mandarin Italian Cold pressed	£27.00
Marjoram Egyptian	£40.00
Marjoram Spanish	£20.00
Myrrh English Distilled	£28.00
Myrtle Spanish	£14.00
Nutmeg Indonesian	£22.50
Nutmeg Sri Lanka	£22.50
Olibanum	£230.00
Olibanum English Distilled	£250.00
Onion Belgian Distilled	£450.00
Opoponax English Distilled	£21.25
Orange Bitter	£19.00
Orange Florida C.P. Valencia	£2.25
Orange Florida C.P. Mid-Season	£1.60
Orange Israeli	£1.60
Orange Sweet Brazilian	£1.00
Orange Sweet Spanish	*
Origanum Spanish 60/65%	£22.50
Palmarosa Brazilian	£34.00
Palmarosa East Indian	£31.00
Parsley Herb	£109.00
Parsley Seed English	£63.00
Parsley Seed European	£65.00
Parsey Seed Indian	£63.00
Patchouli Indonesian	£12.00
Patchouli Chinese	£12.00
Pennyroyal Spanish	£10.00
Pepper Black Indian	£50.00
Pepper English Distilled	*
Pepper Sri Lanka	£48.50
Peppermint Brazilian	£10.00
Peppermint Chinese	£8.50
Peppermint English	£50.00
Petitgrain Paraguay	£10.00
Petitgrain Citronnier	£100.00
Petitgrain Bigarde Egyptian	*
Pimento Berry W.I.	*
Pimento Leaf 80%	£19.60
Pimento Berry English Distilled	£60.00
Pine Pumilionis	£40.00
Pine Sylvestris	*
Pine Needle Siberian	£24.00
Pine Needle Chinese	£8.50
Rosemary Spanish	£12.00
Rosemary Tunisian	£8.60
Rose Bulgarian	*
Rose Turkish	*
Rue Spanish	£40.00

Essential Oils

	Price per kilo
Sage English	£85.00
Sage Spanish	£15.00
Sage Dalmation 30%	£35.00
Sandalwood Mysore	£100.00
Sandalwood E. Indian	£97.00
Sandalwood W.I. (Amyris)	£16.00
Sassafras Brazilian 84%	£4.00
Spearmint Chinese 80%	£12.00
Styrax	£18.50
Tagetes	£65.00
Tangerine California	£19.00
Tangerine Florida	£19.00
Tarragon	£108.00
Ti-Tree	£16.00
Thyme Red 40/55%	£24.00
Thyme Red 60/65%	£26.00
Thyme White 40/60%	£32.00
Valerian Root Chinese	£100.00
Verbena French	*
Vetivert Bourbon	£80.00
Vetiv t Java	£23.00
Vetiv. t Haiti	£45.00
Vetivert Chinese	£25.00
Wormwood	£46.00
Ylang Ylang Extra	£70.00
Ylang Ylang No.1	£60.00
Ylang Ylang No.2	£48.00
Ylang Ylang No.3	£32.00

Absolutes & Concretes

Beeswax Absolute	£120.00
Boronia Absolute	£1750.00
Cassie Conc. Egyptian	£325.00
Castoreum Absolute French	£194.00
Civette Absolute French	£1060.00
Jasmin Absolute Egyptian	£1100.00
Jasmin Absolute Maroc	*
Jasmin Absolute Egyptian – Benzol	£575.00
Jasmin Concrete Egyptian	£500.00
Labdanum Absolute French	£70.00
Lavender Absolute	£34.00
Mimosa Absolute French	£600.00
Mimosa Absolute Selection	*
Mimosa Concrete French	*
Mousse de Chene Absolute Yugoslavian	£100.00
Mousse d'Arbres Absolute French/Yugoslav	£60.00
Orris Absolute French	*
Orris Absolute Maroc	*
Orris Absolute Italian 15% Butter	*
Orris Concrete Extra Fine	*
Rose de Mai Absolute Surfine	*
Rose de Mai French	*
Rose Absolute French	*
Rose Absolute Maroc	*
Rose Concrete Egyptian	£1600.00

United States Department of Agriculture

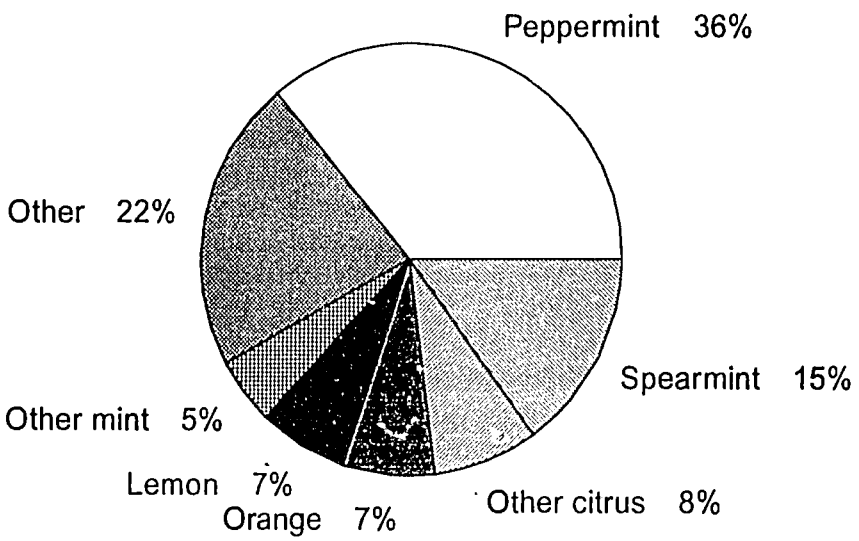
Foreign Agricultural Service

Circular Series
FTEA 2-93
May 1993

U.S. Essential Oil Trade

1992 U.S. Exports of Essential Oils by Type

Percent by Value



Source: Bureau of the Census

U.S. exports of essential oils totaled $147 million in 1992, down from $157 million in 1991. Peppermint was the most important oil exported, accounting for over a third of the market. Mint oils, as a group, accounted for 56 percent, while citrus oils made up 22 percent of the export market.

Approved by the World Agricultural Outlook Board - USDA

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Note: All tons are metric (2,204.6 lbs). 1 kilogram = 2.2046 lbs.
1 hectare = 2.471 acres.

This circular was prepared by Rex E.T. Dull, Horticultural and Tropical Products Divison, FAS/USDA, (202) 720-2974.

SUMMARY

U.S. exports of essential oils in 1992 totaled $147 million, 6 percent below the record 1991 shipments of $157 million. The smaller shipments largely reflected lower exports of mint and citrus oils, in response to poor economic conditions in principal importing markets. Mint oil exports amounted to $81 million, compared with $87 million in 1991, while citrus oil exports fell to $32 million from $38 million. Peppermint was the most important essential oil exported, with sales of nearly $53 million, followed by spearmint oil, $21 million, and orange and lemon oils accounting for slightly over $10 million each.

U.S. imports of essential oils, however, were at record levels in 1992, with shipments totaling nearly $187 million, 21 percent greater than the previous all-time high of $155 million a year earlier. Orange oil imports more than doubled to $12 million, while lemon oil shipments increased to nearly $28 million from $22 million in 1991, and lime oil imports were up 10 percent to $14 million. Higher market prices for cassia oil pushed import values to $15 million from $12 million a year earlier, as unit import values increased 42 percent to nearly $34 per kilogram.

Essential oils are obtained from natural raw materials by distillation or through a mechanical pressing process. These oils are widely used in perfumery, cosmetic, and pharmaceutical products, and to flavor food and soft drinks. Mint oils are widely used in chewing gum, toothpaste, mouthwashes and in a wide variety of confectionery and pharmaceutical products. Citrus oils are widely used by the soft drink industry, as well as to flavor confectionery and other food products.

Consumer demand for natural flavorings and fragrances continues to expand, but the market share controlled by artificial flavorings and ingredients is still large because of their wide availability, lower cost, and more stable pricing.

United States
Department of
Agriculture

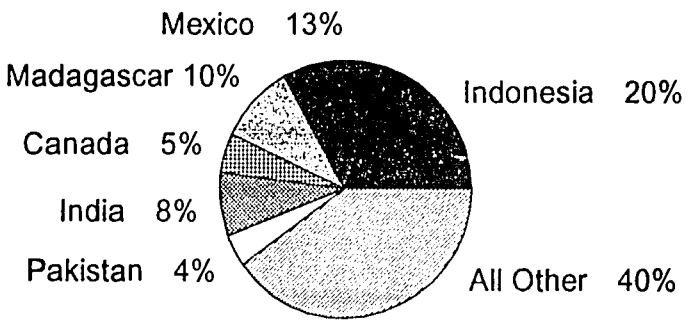
Foreign
Agricultural
Service

Circular Series
FTEA 1-93
April 1993

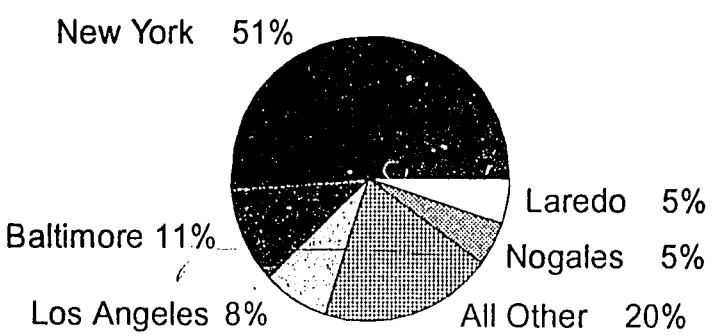
U.S. Spice Trade

Indonesia Accounts for Largest Share of U.S. Spice Imports

Country of Origin, Percent by Value



Port of Entry, Percent by Value



U.S. imports of specified spices and herbs in 1992 totaled $369 million. New York was the principal port of entry for these items, accounting for slightly over half of the total. Indonesia, Mexico, Madagascar, and India were the major sources of these imports.

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Note: All tons are metric (2,204.6 lbs). 1 kilogram = 2.2046 lbs.
1 hectare = 2.471 acres.

This circular was prepared by Rex E.T. Dull, Horticultural and Tropical Products Division, FAS/USDA, (202) 720-2974.

SUMMARY

U.S. imports of specified condiments, seasonings, and flavorings in 1992 increased nearly 2 percent over a year earlier to $369 million, largely reflecting increased shipments of capsicum peppers, cumin seed, and turmeric. However, lower prices for black pepper resulted in a $10.5 million drop in value for that item to $41.7 million, despite a 4 percent increase in volume. Pepper (black and white) is the most important spice in world trade and ranks third in importance in terms of value ($50.1 million) in total U.S. imports of specified condiments, seasonings, and flavoring materials. Although down slightly from 1991 levels, vanilla bean imports continued to be the most important item, with shipments totaling $65.7 million. Other important items in U.S. condiment import trade are capsicum peppers (including paprika), $60.4 million; sesame seed, $42.7 million; cassia and cinnamon, $26.6 million; and mustard seed and products, $25.2 million. On a unit value basis, saffron, vanilla beans, and cardamom are the most expensive spices.

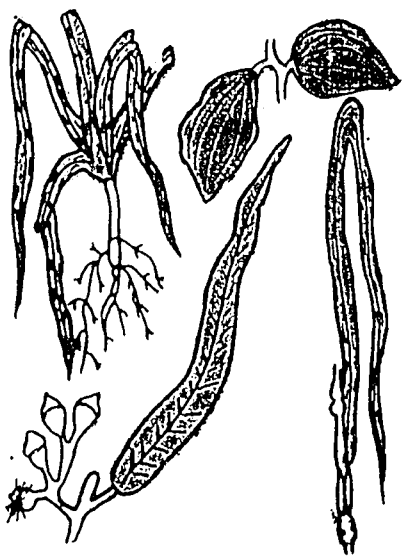
The United States depends on imports for two thirds of its seasoning requirements. Increased demand for ethnic foods has contributed to rising usage of spices. Additionally, the trend towards less salt in foods, has stimulated more condiment use to compensate for flavor loss. Food manufacturers and institutions now account for nearly two-thirds of U.S. spice usage, up from 40 percent a decade earlier, reflecting increased consumption of prepared foods and more families eating meals away from home.

U.S. imports of spice oleoresins in 1992 were valued at $30.1 million, slightly below the record 1991 level, because of smaller shipments of black pepper oleoresin. Total imports of specified condiments, seasonings, and flavorings, including spice oleoresins, in 1992 were $399 million, compared with $395 million a year earlier and $385 million in 1990.

U.S. exports of spices and seasonings (excluding re-exports) in 1992 amounted to nearly $88 million, up from $85 million in 1991 and $78 million during 1990. Dehydrated onions continued to be the most important export item, with shipments totaling $36.1 million, followed by capsicum peppers, $8.9 million; dehydrated garlic, $7.3 million; black and white pepper, $5.8 million; and mustard products, $4.8 million.

Canada, Japan, and Germany are the principal markets for U.S. exports of spices, seasonings and condiments. Exports consist of U.S. processed and packaged imported items and include domestically produced items such as dehydrated onions and garlic, capsicum peppers, ginger, sesame, and mustard.

SERIES ON AROMATIC
PLANTS OF SRI LANKA
BOOKLET NO. 6.



CULTIVATION OF ESSENTIAL OIL BEARING PLANTS

Section of Natural Products
Ceylon Institute of Scientific & Industrial Research
Colombo, Sri Lanka

Rs. 50/=

SRI LANKAN AROMATIC PLANTS OF ECONOMIC VALUE

Booklet No. 6. Cultivation of Essential Oil Bearing Plants

By

Rohini Wijayaratne
and
Nirmala Pieris

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PREFACE

The subject of Essential oils and Spices has been investigated in depth by the Natural Products Section of the CISIR for the past 15 years. Although significant findings have evolved in nearly all areas of this subject, it appears that Industry is largely unaware of many advances in this field. In order to remedy this lack of awareness it is proposed to publish 'The Aromatic Plant series' of booklets. These will hopefully provide information on spices and essential oils in those areas where CISIR research can make a direct contribution to Industry.

Previous booklets in this series were:

No. 1. Distillation of leaf essential oils

2. Pine Oleoresin

3. Spice Oleoresins

4. Quality control of Essential oils

5. Spice processing

This booklet deals with the cultivation of four important essential oil bearing crops. Although the area of cultivation is not within the programmes of the CISIR it was felt that there was a need for such a booklet as this knowledge is not freely available. The booklet was written with data collected from various sources and will be of interest to those who are new to the field of essential oilsas well as to those who own exsisting plantations.

The authors thank Dr. E.R. Jansz Head, Natural Products Section, CISIR for advice and encouragement and Miss C.L.M. Nethsingha, Librarian, CISIR for advice on printing. We also express our thanks to Miss D. de Zoysa, Mrs. Devika Tennekoon and Miss Shanthi Samarakkody for secretarial assistance.

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SRI LANKA.

CINNAMON

1. *INTRODUCTION*

The cinnamon of commerce is obtained from *Cinnamomum zeylanicum* (Kurundu). Four other species of cinnamon endemic to Sri Lanka commonly known as "wild" cinnamon are also present.

The present extent of cinnamon is estimated at 15,200 ha. concentrated in the Matara and Galle Districts. However, the bulk of the cinnamon produced in Sri Lanka originates from the Ambalangoda area.

2. *CLIMATE AND SOIL REQUIREMENTS*

Cinnamon requires a warm climate of about 27°C to 30°C with a mean rainfall of 198 to 210 cm per year. It is commonly found growing wild in the wet zone forests of Sri Lanka up to an elevation of 1500 m. A sandy soil mixed with humus and sheltered situations are most favourable. The best cultivated cinnamon is grown at low altitudes upto an elevation of 500 m, on gravelly and light white sandy soils.

3. *PROPAGATION*

3.1 *By seed*

Cinnamon is usually propagated by seed. The fruits are protected from birds by covering the tree with a net or a bag. In organised plantations the fruits are collected and heaped in the shade until the pulp turns black and rots. The seeds are then washed and dried in the shade. These seeds should be sown fresh after the removal of pulp as it loses its viability very soon.

3.1.1 *Raising the nursery*

Seeds are sown thickly in nurseries about 20 cm. apart in rows. These are watered and sheltered. The seeds are germinated within 2 to 3 weeks and the seedlings are ready for planting in about six months.

3.1.2 *Transplanting*

A spacing of 120cm.x120cm. or 90cm.x90cm. at the rate of about 5,000 to 8,000 plants per ha. is ideal for cinnamon cultivation. The usual time for transplanting is October to November.

In planting forest land it is advisable to leave tall trees at 15m. intervals to provide shade. The usual spacing between planting holes is 2 to 3 m.

3.1.3 *Field sowing*

For direct sowing in the field seeds are placed 20 cm. apart in circular clusters the circles being separated from centre by 3 m.

3.2 *By cuttings*

Cinnamon can be propagated by using either cuttings of young 3 leaved shoots, by layering or by the division of old root stock. By using the latter method the time for harvest is reduced.

4. *FERTILIZER APPLICATION*

A fertilizer mixture of 2 parts of urea (17%N_2) 1.5 parts of rock phosphate (8% P_2O_5) and 1.5 parts muriate of potash (18% K_2O) is recommended.

The rate of application to young (1 to 3 years) and mature plants is 40 and 60 to 100 kg (depending on yield potential) per ha. per annum respectively. The annual dose of the mixture is divided into two parts and applied bianually at the commencement of the rains between April and August and October and January.

The field is weeded 2 to 4 times a year. The weeds are dug in as a green mulch.

5. *DISEASES*

The commonest diseases in Sri Lanka are grey blight disease (*Pestalitia cinnamon*) and "korahedi". The former causes severe damage to the foliage of the plant and the latter renders the bark unpeelable.

6. *HARVESTING AND PROCESSING*

Under systematic cultivation the plants are coppiced regularly and kept as a bush to a height of 2 to 3m. In two to three years after planting, depending on the soil and rainfall the palnt with three or four shoots reaches a height of 1.5 to 2m and is ready for harvesting.

Two to three harvests are usually taken annually. Harvesting is carried out during the rainy season when the bark is more easily detached from the stem. After harvesting the leaves and the tender stems are removed and the shoots are taken for peeling. The soft outer bark is first scraped off with a fine rounded rasp or peeler. Two longitudinal cuts are made in the bark and the rest of the bark which is in a tubular form is gradually loosened and peeled off with a blunt knife. The peeled bark is then carefully rolled one into another to form a packing of concentric tubes of length about 1m. Small pieces of the bark left after peeling are stuffed inside these tubes. They are allowed to dry initially in the sun and then on coir rope racks in the shade, with periodical hand compression to help acquire the tubular form which is known in commerce as quills. The harvesting and making of quills continues throughout the year, but the main crop reaches the market during July/August and December/January.

The plant material used for distillation varies according to the type of oil required. Cinnamon chips are used to obtain oil with 30 to 55% cinnamic aldehyde content. Cinnamon quills and quillings are used to produce oil with a much higher cinnamic aldehyde content and a finer aroma. The cinnamon bark oil is obtained from the inner stem bark.

Cinnamon leaf oil is obtained from the leaves and cinnamon root oil from the root bark.

Cinnamon leaf oil is regarded mainly as a by product in the processing of cinnamon. Distillation of cinnamon leaf oil is carried out throughout the year.

7. *YIELD*

The average yield of cinnamon is around 100 to 125 kg of quills and 25 kg of chips/ha/annum.

8. *SUBSIDIES*

Cinnamon is considered to be one of the 6 high priority crops. The subsidy payable for establishment of a new plantation is a total of Rs.2,500/ha staggered over a period ranging from 4 to 6 years. For replanting a subsidy of Rs. 3,750/ha is payable. At present no incentives are granted for rehabilitation. The estimated establishment, replanting and rehabilitation costs are Rs. 11,000/-, Rs. 13,200/- and Rs. 7,670/ha respectively for the 1st two years.

CITRONELLA

1. *INTRODUCTION*

Cymbopogan winterinus Jowitt "mahapengiri" grass although originated in Sri Lanka is cultivated chiefly on the islands of Java and Formosa. The Sri Lanka species *Cymbopogan nardus* Rendle "lena batu" grass is cultivated exclusively in Sri Lanka and is a hardier grass than the Java species. The Java species in addition to being less hardy, requires more fertile soil, more rain fall and more cultural care than the Sri Lanka species. However the Java species gives a higher yield of oil of a better quality. The current extent under citronella is estimated at approximately 4,400 ha, localised in the southern part of the island and confined to the Matara and Hambantota distircts with some cultivation in the Ratnapura District.

2. *CLIMATE AND SOIL REQUIREMENTS*

Citronella grows at all altitudes up to about 600 m. The grass needs abundant rainfall, preferably at regular intervals throughout the year; and plenty of sunshine, specially at harvest time. Most kinds of soil are suitable provided they are sufficiently fertile. Citronella will not thrive in soils of poor texture, which are heavy, loamy, water logged or in calcarious soils with only a thin topsoil. Sandy soils, deep and sufficiently fertile are often better than loamy or even fertile soil. Very rich or virgin soils produce a greater yield of grass, with an abnormally low oil content.

3. *PROPAGATION*

Citronella is propagated by means of root divisions at the beginning of the rainy season. Clumps of healthy mature plants are divided, each clump producing about 10 "seed pieces". Usually the tops of segments are trimmed before planting. They are planted in holes 10 to 15cm deep, 45 to 90cm. apart. The spacing depends on the fertility of the soil and the length of time between successive harvests. Two, to four root segments are planted in each hole. In Guatemala the segments are planted along rows about 90 cm. apart to permit the use of mechanical cultivators. During the growing period weeding is done once a month. It may also be necessary to draw up the soil around the plants as the grass has a tendency to work its way out of the

ground. After the first year the plantation requires weeding only once or twice a year. The period of growth is generally 8 months (sometimes 12 months) at the end of which the plant is 1 to 1.5m tall. If care is taken, a plantation lasts for about 15 years at which time it has to be replanted.

4. *FERTILIZER APPLICATION*

A biannual manuring is given to the soil with the ashes of distilled and burned citronella grass. Ammonium sulphate and potassium phosphate have been recommended as fertilizer for the crop.

On large estates in Java, the land is regenerated after about 5 years by green manuring using *Tephrosia candida*, *Tephrosia vogelli*, *Crotalaria* species and various varieties of *Mimosa*. Small native producers cannot afford to adopt this practice as it will immobilise the land at least for two years.

5. *HARVESTING*

In Sri Lanka the plant is harvested after 8 to 12 months of planting and subsequent cuttings are taken at 3 or 4 monthly intervals. Cutting is done with knives or sickles during March and April, June and July, and November and mid February. The grass should be cut above the first node for regeneration, specially during subsequent dry weather. No cuttings take place during spells of rain as the grass would ferment whilst lying in the field as well as be too wet for distillation. In Java the plants are not harvested before they are two years old. Flowering stalks yield no oil and are removed before harvesting and the plantation is cleared of all foreign grasses.

The grass is generally dried in the field or near the still for 1 to 3 days before distillation. In Sri Lanka the grass is left in the field for up to 3 days. In wet weather the grass is dried on racks in the shade near the boiler and is turned frequently to prevent fermentation or mould formation.

6. *YIELD*

In Sri Lanka an annual yield of 20 to 25 tonnes of fresh leaves/ha/annum with an oil content of 1 to 2% could be obtained.

LEMONGRASS

1. *INTRODUCTION*

Two main types of lemongrass are commercially recognised, *Cymbopogen flexuosus* or the West Indian type and *Cymbopogen citratus* the East Indian type. The cultivation of Lemongrass is a recent introduction to Sri Lanka. The total extent at present is about 480 ha.concentrated in the Matale and Badulla Districts.

2. *CLIMATE AND SOIL REQUIREMENTS*

Lemongrass could be cultivated from sea level to an elevation of 150m. The plants require a warm climate with plenty of sunshine and sufficient rainfall uniformly distributed throughout the year. On higher slopes of mountains where rainfall is usually greater, the grass grows more abundantly but yields less oil than plants grown in lower elevations. A temperature of 24 to 27°C with a mean rainfall of 200 to 250 cm/year is ideal for lemongrass cultivation. In areas where humidity is high and the annual rainfall is between 200 and 250 cm. and well distributed over the year, supplemental irrigation is not necessary. In drier months however, irrigation may be provided and this increases the yield. If grown in areas where rainfall is low and limited to each season, the crop requires heavy irrigation. The plant is hardier and has a higher degree of drought resistance than citronella, therefore it could be planted in areas where citronella does not thrive.

The soil conditions influence the yield of grass and the yield and quality of oil to a marked extent. Well drained sandy loam, light sandy soils or sufficiently fertile sandy soils are most suited for lemongrass cultivation. Dark, heavy, rich and fertile soils give a higher yield of grass but the oil usually contains a lower citral content. In *Cymbopogen citratus* or the East Indian type the moisture content of the soil influences the citral content of the oil. Citral content of the oil is greatest with a soil of 60 to 80% water capacity.

3. *PROPAGATION*

3.1 *Cymbopogon flexuosus*

C. flexuosus is propagated by seed. Seeds are collected from plants which are not subject to regular harvest. The whole inflorescence is cut, dried for 1 to 2 days, thrashed and the seeds separated. In direct seeding the land is ploughed and seeds sown in March at the commencement of the rainy season.

3.1.1 *Raising the nursery*

For raising a nursery the soil is ploughed 6 to 8 times before sowing of seeds. The seeds are sown between April and May. The seedlings produced by 10 to 12 kg of seeds will be sufficient for transplanting into an area of one hectare.

3.1.2 *Transplanting*

The seedlings are transplanted when about 60 days old. The tips of seedlings are cut leaving the planting material 15 to 20 cm. long. They are then planted along ridges of about 90 cm, in holes about 10 to 12 cm. apart. Two to three seedlingsare planted in the same hole. A spacing of 15 to 20 cm. has been reported to give high yields of oil containing a high percentage of citral.

3.2 *Cymbopogen citratus*

C. citratus is propagated by means of root divisions at the onset of the monsoons. The clumps of healthy, mature plants are divided carefully into a number of slips each slip containing 1 to 5 tillers. The tops and fibrous roots of the slips are trimmed off before planting. One old clump could yield as much as 50 new stools.

The soil must be loosened thoroughly by ploughing before planting. Holes about 20 cm. deep are dug with a crow bar and the slips are planted 45 to 60 cm. apart in rows about 90 cm. apart. One to four segments are planted in each hole depending on the fertility of soil. The planting holes are lightly filled with earth to facilitate the development of a good root system. A 100 sq.m nursery would yield sufficient root segments to plant 1 ha, with two root segments per planting hole. Thus 15,000 to 20,000 segments can be planted/ha.

4. *FERTILIZER APPLICATION*

Lemongrass in not frequently manured as it is known to be a soil exhausting grass. However the application of fertilizer when the plants have become well established is said to be beneficial. In addition to nitrogen the plants require potash and phosphates. The recommended economical fertilizer contains 4% nitrogen, 5% potash and 8% phosphoric acid. This is given as a side application at the rate of 600kg/ha. Fertilizer can also be applied by introduction into holes in which the grass is to be planted and covering with 3 to 6 cm. of soil. It could also be broadcast, hold or disked. Better growth has been obtained when potash was supplied as the sulphate and when part of the nitrogen was organic. The use of at least 38 tonnes of compost and 225 kg of potassium sulphate/ha before planting has also been recommended.

5. *DISEASES AND PESTS*

Lemongrass is subject to attack by many pests and diseases. *Helminthosporium* organisms cause eye spot disease where the spots appear at first as minute yellow flecks with a rusty brown centre. This is controlled by removal of infested plants to prevent infestation of the whole plantation and also by spraying Bordeaux mixture or lime sulphur dust. The leaf tips and margins are attacked by the fungal pathogen *Curvularia andropogonis*. Infected tissue turns brown and eventually becomes necrotic giving the appearance of scorched tips. Infection could be controlled by fungicides such as Captan, Zineb and Ziram. Prolonged rain causes attack of rust. Lemongrass is also attacked by the aphid *Sipha flava* which causes the grass to become reddish brown and dry. Sugar cane borer *Sesamia infereus* and the Madagascar beetle *Heterohychus plebejus* also attacks freshly planted lemongrass. Roots are attacked by Nematodes and the infested clumps turn yellow, wilt and wither away. Plants exhibit chlorosis on peat soil and this could be controlled by foliar application of ferrous sulphate.

6. *HARVESTING*

The time for the first harvest varies from 3-9 months and subsequently the grass may be harvested every 3 or 4 months. The highest yields of leaves and oil are obtained from the second to the sixth year: after which there is a steady decrease.

The grass is usually cut within 8 cm. from the base of the clump with sickles, and tied into bundles. The cut grass is transported to the stills as soon as it is cut or left in the field for a day or two to dry partially. The life of a plantation would generally depend on the fertility of the soil and on the amount of cultural care it has received. Generally the normal porductive life of the plant is between 8 to 10 years.

7. *YIELD*

Cymbopogen flexuosus gives a average yield of 6,000 - 8,000 kg grass/ha and 30 to 40 kg of oil/ha/annum with 4 cuttings. The average yield of oil obtained from the grass of *Cymbopogen citratus* is between 0.5 and 1.5%.

EUCALYPTUS

1. *INTRODUCTION*

The genus Eucalyptus is native to Australia, though several important species have now naturalised in various tropical and subtropical countries. Some possess paper pulping quality, while certain other species are used for their industrial, medicinal and perfumery grade oils.

Five main species of Eucalyptus are grown in the up-country region of Sri Lanka. *E. grandis, E. citriodora, E. globulus, E. robusta* and *E. microcorys*. Of these *E. grandis* forms the bulk., whilst *E. citriodora* and *E. globulus* (grown in a limited extent) are used for oil extraction. *E. robusta* and *E. microcorys* are grown for its timber. Three species are grown in the dry zone of Sri Lanka of which *E. camaldulensis* consists the bulk whereas *E.citriodora* and *E.tereticornis* are grown in small extents. Due to the extensive demand for citronellol, the main constituent of *E. citriodora* oil, there is considerable scope for cultivation of this tree and every encouragement should be given for its cultivation in Sri Lanka. In addition to the oil the wood obtained can be used for paper pulp. In Sri Lanka *E. globulus* acts as the mian oil producer. *E. camaldulensis* which is extensively grown in the dry zone is also known to contain appreciable quantities of oil. The CISIR is now carrying out investigations on this species.

2. *CLIMATE AND SOIL REQUIREMENTS*

E. grandis, E. microcorys and *E.robusta* are suited for cultivation in elevations of 750m and above. *E. citriodora* and *E. camaldulensis* can be grown from sea level to an elevation of 120m and even in very dry locations. *E. deglupta* is a newly introduced species to be grown at low elevations in the wet zone where there is very high rainfall. A fine loamy soil is the most suitable for Eucalyptus cultivation.

3. *PROPAGATION*

Propagation is only by seed; vegetative propagation is still not known. Healthy and bold seeds should be used. Shrivelled seeds must be discarded. Germination commences 3 to 4 days after sowing. A commercial cultivation of the crop requires either raising a nursery or direct seeding of the well prepared field at the proper season.

3.1 *Raising the nursery*

For raising the nursery the soil must be first weeded, pulverised and levelled. Nursery beds are generally 90cm. x 10 m. raised 15 cm. to permit adequate drainage. The seeds should not go deeper than 1 cm. under soil while sowing. After sowing, seeds should be lightly covered with soil by gentle working with hands and irrigated so as to keep the soil fairly moist till the commencement of germination. Newly sown beds should be shaded during germination against strong sun and heavy rain. Germination commences in 3 to 4 days after sowing.

The next phase of propagation is transplanting of the nursery raised seedlings in suitable containers. Polythene bags (perforated at the bottom) 15 to 20 cm. long and 10 to 12 cm. broad or tubes 20 cm. to 10 cm. or 20 cm. to 15 cm. which have been filled with a suitable loamy potting mixture are considered to be good. Seedlings are transplanted after 4 to 5 weeks of sowing when the plant is about 2 to 3 cm. tall with 2 to 4 pairs of leaves. Seedlings are handled by the top of the leaves and not by the stem. The plants in polythene bags or tubes should be shaded in the initial stages and watered. Seedlings are allowed to grow for 2 to 6 months in the bags.

The nursery can also be raised in bags. About 10 seeds are sown in each bag mixed with soil and irrigated. Plants are thinned off after germination and are grown as such for 2 to 6 months. This method is better and economical than the conventional method of raising a nursery, since the cost of raising a nursery in beds and transplanting in bags is eliminated, besides reducing the risk of mortality after transplanting in bags.

3.2 *Transplanting*

The land is cleared and made weed free to the maximum possible extent. It should be levelled and free from boulders and stones for a normal growth of roots. The land is ploughed 2 to 3 times and pulverised well.

The plants are planted at 3 m x 3 m wide spacing. Holes of 20 cm. in diameter and 45 cm. deep are made and partly filled with soil. The polythene bag is slit and fully removed to permit free root development. The planting must be done during the beginning of the rainy season.

In the case of *E. citriodora* which is planted for the extraction of oil a spacing of 90 cm. between rows and 75 cm. between pits is recommended. Initially each pit can have 4 to 5 plants and the population should be thinned subsequently.

3.3 *Field sowing*

Field sowing is more economical than raising a nursery and transplanting seedlings. This method, practised in India with *E. citriodora* needs a very good preparation of land, thorough removal of grass and irrigation. Ridges about 10 cm. high and 10 cm. wide are made 90 cm. apart and seeds are sown on the ridges. The plantation can be thinned according to requirements.

4. *FERTILIZER APPLICATION*

In Sri Lanka fertilizer is not applied to this crop due to its high cost, but if applying slopes should be terraced to make subsequent application of fertilizer and irrigation meaningful for the crop.

A basal dose of about 20 kg. nitrogen, 30 kg. phosphorous, and 30 kg. potassium/ha is applied at the time of ploughing. Three top dressings of nitrogen in the form of urea or ammonium sulphate should be given at the rate 20 kg./ha; preferably after every harvest. Fertilizer application should necessarily be followed by irrigation or in rainfed areas fertilizer should be applied during rains. When transplanting about 60 g of N.P.K. fertilizer can be added to the soil in the partly filled holes prior to planting. A basal dose of superphosphate 60 kg./ha has been recommended.

5. *HARVESTING*

In Sri Lanka Eucalyptus is mainly grown for its timber. The growth rate will depend on the site and the treatment given to the plantation. If the area is deep ploughed prior to planting the growth rate will be increased considerably.

In India *E. citriodora* is cultivated in large acres for the extraction of oil. When harvesting for oil care is taken to harvest the crop when leaves are the richest in oil content and also when the weather is

quite clear. The first harvest can be taken from 6 to 8 month old plantations. At this stage the yield of the herb as well as the oil is rather negligible but coppicing the plant is very necessary since it promotes vigorous sprouting of side branches. Fresh shoots sprout in about four weeks after coppicing and are again ready for coppicing after 4 to 5 months. This process results in regular increase in yield of herb which is almost stabilized after plants are 3 years old.

The first coppicing is carried out at about 30 to 45 cm. above ground and then subsequently at 75 to 90 cm. above ground. Level of coppicing has been found to be advantageous for subsequent cultural operations.

The Australian method of coppicing plants at about 15 cm. above ground makes each plant a huge bush even from ground level. This requires more spacing between plants and the number of plants/ha is accordingly reduced.

In India three harvests are taken annually from an irrigated plantation. Maximum oil content is reached between mid February and mid March, mid July and end of October to early November. This time lapse from one harvest to another allows the fresh shoots to grow for nearly four months during which period the leaves also reach adulthood, the best stage for maximum oil content.

It has repeatedly been observed that at the above spacing and coppicing the yield of green herb/ha during the first year is approximately 7 tonnes, during the second about 30 tonnes and about 40 tonnes during the third year in irrigated areas. This yield is almost stabilized after this age and a plantation is expected to remain economical for about ten years if properly maintained.

Only the leaves attached to pencil thick or thinner branches are suitable for distillation. The herb should be immediately distilled without storing. The separation of leaves completely from thin branches is not economical.

6. *YIELD*

In India approximately a 7:3 mixture of leaves and thin branches from a hectare of irrigated land yields an average of 200 litres of oil while from unirrigated land about 150 litres of oil is obtained. Besides oil a hectare of plantation also yields about 11 tonnes of dry wood; suitable for paper pulp industry and fuel.

A 10 to 15 year plantation of *E.grandis* should give a minimum of 200 cubic meters of timber/ha. If the long rotation Eucalyptus species are allowed to grow to 35 to 50 years about 300 to 500 cubic meters of timber could be obtained in log form.

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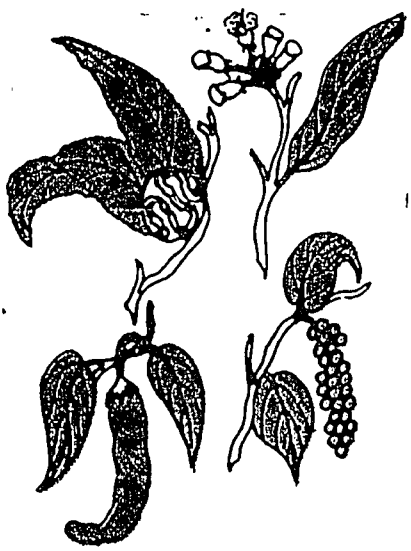

QUALITY CONTROL OF ESSENTIAL OILS

Section of Natural Products
Ceylon Institute of Scientific & Industrial Research
Colombo, Sri Lanka

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SRI LANKAN AROMATIC PLANTS OF ECONOMIC VALUE

Booklet No. 4. Quality Control of Essential Oils

By

U. M. Senanayake

Edited by E. R. Jansz and A. L. Jayewardene.

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PREFACE

The subject of Essential oils and Spices has been investigated in depth by the Natural Products Section of the CISIR for the past 15 years. Although significant findings have evolved in nearly all areas of this subject, it appears that Industry is largely unaware of many advances in this field. In order to remedy this lack of awareness it is proposed to publish 'The Aromatic Plant series' of booklets. These will hopefully provide information on spices and essential oils in those areas where CISIR research can make a direct contribution to Industry.

Previous booklets in this series were:

No. 1. Distillation of leaf essential oils

2. Pine Oleoresin

3. Spice Oleoresins

This booklet conveys the fundamentals of Quality Control of Essential Oils and will be of use to the producer, exporter and buyer of essential oils.The booklet also outlines the significance of the role CISIR has to play in this field.

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1. INTRODUCTION

An "Essential Oil" is defined as the volatile oil obtained by the steam distillation of aromatic plant material. Such a definition is clearly intended to make a distinction between the fixed fatty oils and the oils that are easily volatile. Chemical analyses have shown that essential oils are composed of two main classes of organic chemical compounds, the terpenoids and the phenyl-propanoids which are naturally occurring (organic) products of secondary plant metabolism. Their volatility renders these compounds easily noticeable in plant material. In contrast, the fixed fatty oils are the esters of glycerol with long chain fatty acids. Most terpenoid compounds occur free (uncombined with other compounds) in plant tissues, but a few are found as glycosides or esters of organic acids or similar water soluble compounds; the water solubility being essential for transport to various parts of the plant.

The biosynthesis of essential oils is connected with the photosynthetic activity of the plant. Essential oils so formed are stored in various plant organs eg. (i) leaf (citronella,lemongrass, cinnamon), (ii) flower and flower-bud (clove), (iii) fruit (nutmeg, cardamom, pepper), (iv) fruit rind (citrus), (v) bark (cinnamon) and trunk (sandalwood, pine) (vi) root, (vetiver) and (vii) underground stem (ginger, turmeric).

Essential oils have been known to man from antiquity, having been isolated from plants and used since then for a variety of purposes. They are readily obtainable by simple distillation of leaves, wood and blossoms. These essential oils are used for such purposes as flavouring of foods, perfumery, cosmetics and in pharmaceuticals

With the advent of modern technology, it has been possible to separate and isolate the more important chemical compounds from the complex mixture in essential oils. Chemical manufacturers who use these compounds, insist on quality standards for the essential oils they purchase.

A very significant feature observed by many workers including the team at the CISIR who have investigated essential oils is the (very wide) variation in composition of the essential oil (from the same plant variety) when grown in different locations. Even individual plants of the same variety grown in the same area show wide variations in the composition of the oil they produce. Therefore when studying essential oils one must always remember that the composition reported is the average of a mixture of oils of related composition. For the purpose of standardization and quality assessment the limits of the parameters concerned are set by the Sri Lanka Bureau of Standards. Such limits are accepted by international trade and quoted in all published literature. A range of values is quoted for each physico-chemical parameter used in the assessment.

2. FACTORS AFFECTING QUALITY OF ESSENTIAL OILS

2.1 Stage of harvesting

Many studies have shown that the chemicals in essential oils undergo a gradual change in the direction of the biosynthetic pathway. As the plant matures these gradual changes take place simultaneously under the influence of light, air and water, following a definite pattern. Although this is true for nearly all plant products, the variation among essential oils is more marked than for most other plant products. Experiments on peppermint show an increase in the menthone content with an accompanying decrease in menthol content due to an oxidative process and vice versa. At the same time, the percentage of components other than menthol and menthone increases, indicating dehydration and transformations.

Similar observations have been made in many other essential oil bearing plants. In order to obtain a reasonably constant composition, the plant materials need to be harvested at the proper stage of maturity. For example, citronella grass *Cymbopogon nardus*) is usually harvested after three months growth. If the plant material is harvested earlier, the hydrocarbon content of the essential oil is found to be higher, resulting in a low quality oil.

It has been frequently observed in Sri Lanka that plant material is prematurely harvested whenever there is a demand and the plantation is neglected when there is no such demand. In certain cases among spices like pepper,clove and cardamom harvesting is carried out prematurely to avoid losses by pilferage. Farmers need to be educated that harvesting of the plant material at the correct stage of maturity is essential as otherwise the quality of the final product will suffer.

2.2 Post harvest handling

The chemicals in most of the essential oils are volatile and also prone to chemical transformations.Improper post-harvest handling will not only cause losses of these valuable chemicals but may also give rise to undesired compounds. Many types of leafy materials have to be handled with special care. The oil is contained in sacs usually located in the outer epithelial layer; they may rupture during rough handling. This is evident from the strong smell emanated when handling leafy material.

Direct exposure to sunlight may not only cause the loss of as much as 50%of the available volatile oil but also produce a host of new compounds due to photochemical reactions.Stacking of raw or moist material often promotes mould growth which also affect the quality of the final essential oil. Such observations have been made in many leafy, fruit and seed type raw materials. If it is necessary to store the raw material for a prolonged period, the water content of the material should be reduced to below 10 per cent. The following guidelines may be useful.

Leafy material: *eg:* Citronella, Lemon grass, Cinnamon leaf, Eucalyptus leaf.

The material should be spread out and dried in the shade. Direct drying in the sun should be avoided as far as possible. This category of raw material should be distilled as soon as possible. If it has to be stored, stacking in the shade is recommended. Wetting of the dried leaf material should be avoided at all costs.

Fruits, seeds and underground stems: *eg:* pepper, nutmeg, cardamom, and coriander (fruit and seed type) ginger and turmeric (under-ground stems).

This type of raw material should be dried in diffused sunlight, or in special hot houses. Generally, drying on coir mats is satisfactory. The dried product should be protected from light during storage and if possible stored in air tight containers until required for further processing. These materials are very readily attacked by vermin and thus liable to contamination. Such contamination should also be carefully avoided if quality essential oils are required.

Bark: *eg:* Cinnamon, Cassia.

This type of raw material should only be dried in the shade. After drying they are bundled and stored in this form. Most of the cinnamon produced in Sri Lanka is processed by skilled personnel and require only proper storage to maintain good quality. Cassia bark on the other hand is produced mainly in the form of chips or broken quills in China and many East Indian nations and packed in sacks.

3. METHODS OF EXTRACTING ESSENTIAL OILS

3.1 Steam distillation and quality control

Essential oils are mixtures of volatile liquid (and solid) compounds which vary widely in regard to chemical composition and boiling point. Every substance posseses a definite vapour pressure, at a given temperature which depends upon the prevailing temperature. The intensity of an odour may therefore be considered, to a certain extent, to be an approximate measure of the volatility of the substance which emits the odour.

Distillation with steam is the normal practice used to isolate volatile products from plant material. Distillation may be defined as 'the separation of the components of a mixture of two

or more liquids by virtue of the difference in their vapour pressure. Here the two liquids that are not miscible form two phases. The plant material could be boiled directly with water, or steam could be introduced from a steam generator.

Maceration of plant material immediately before distillation leads to a higher oil yield as mechanical rupture of oil sacs during these operations helps volatilisation of the oil.

Distillation Temperature. One advantage of direct water distillation is that the temperature of the distillate will not rise above 100°C. However, a number of factors could affect the quality of an essential oil. Prolonged boiling with water may partly hydrolyse most of the esters. If low pressure steam distillation is employed the degree of hydrolysis is lower. Super-heated high pressure steam may volatilise undesirable fatty compounds present in the plant material. The latter phenomenon is observed during the distillation of seed material such as nutmeg and cardamom.

Distillation time. In most cases prolonged distillation of plant material is undesirable. Most of the available essential oils will distill over within three hours of the start of distillation. Prolonged distillation does not add appreciably to the final yield. On the other hand unwanted high boiling compounds and oxidation products may distill over and affect the final of the essential oil.

Materials of constrution. Care must be taken to avoid the use of iron and copper in the distillation still body, condenser tubing and oil collectors. These two metals react with phenolic and acidic constituents of the oils resulting in deep colours. Use of copper tubing will not seriously affect the quality of the oil of citronella, but this metal should be scrupulously avoided in the case of other essential oils. This is especially true in the case of spice oils most of which are used in the food industry.

Many distillers are so unaware of the colour of the pure oil and the deleterious effects of metallic contaminants to the quality of essential oils that they accept the dark colour as normal. If metallic impurities are present in oils such as cinnamon bark oil they cannot be used in the food industry unless purified of this contamination. For the fine spice oils,stainless steel is the choice material of construction. This material may in some cases be substituted by aluminium which is much less expensive. Oil collectors of glass have also been found to be convenient.

3.2 Other methods of extraction.

In Sri Lanka, water distillation (direct boiling with water) and steam distillation are generally used. Solvent extraction, fat extraction, and 'cold' processing methods are not practised in this industry.

4. STORAGE OF ESSENTIAL OILS

In preparing essential oils for storage, care must be taken to avoid the usual contaminants viz., traces of water and suspended matter(by filtration through dry cotton wool).It is also necessary to ensure that the oil is of the standard colour and free from any undesirable-odour. Stocks of essential oil samples should be stored in suitable containers, that do not add further contaminant. Most volatile oils contain a large number of chemical compounds many of which could react with a number of metals eg.phenolic chemicals may react with metallic containers. Volatile components of essential oils may escape through plastic containers which are porous to small molecules. Some compounds may even be absorbed into the plastic, while chemicals(plasticizers) could easily be extracted by the oils.

Many oils are sensitive to light and heat and are liable to oxidation.Experience has shown that dark bottles,filled so as to leave a minimum of empty head space,provide the best conditions for storing essential oils.The fragile nature of these containers can however be an obstacle during transport. Stainless steel containers are ideal for bulk shipment. However, the prohibitive cost

of such containers has resulted in the use of galvanised iron,aluminium and resin coated containers which are satisfactory for a wide variety of essential oils.

Essential oils like cardamom and eucalyptus oil have to be stored with care. Cineole, the major component compound of both these oils is highly volatile. Even the smallest opening in the container could result in rapid selective loss of this compound by vaporisation.

Many essential oils absorb foreign odours if stored improperly. If these oils (in poor packaging) are stored in close proximity to a material with a strong odour, there can be cross contamination of odours.

Minimising the head space(or the empty volume above the oil surface) reduces the chances of oxidation; and also any loss of volatile components. Some essential oils are rich in readily crystallisable compounds like camphor, menthol and cedrol. These compounds tend to separate out of the essential oil and deposit at the bottom on prolonged storage at low temperature. In such cases care must be taken to dissolve the crystals by gentle warming. This must be followed by mixing to uniformity.

5. CRITERIA FOR DETERMINING QUALITY

There are a number of standards laid down for essential oils. These include the specification of Sri Lanka Bureau of Standards and these of the Indian, British and International Standards Organisation (ISO). Some of the relevant standards of Sri Lanka Bureau of Standards are CS. 170 (1972) for Citronella oil, CS. 184 (1972) for Cinnamon Leaf and Bark oils CS. 192 (1973) for Lemon Grass oil and SLS 247 and 248 (1973) for Clove bud and stem oils.

The majority of these standards are mainly based on physico-chemical characteristics among which are appearance, colour, odour, relative density, refractive index, optical rotation, of solubility in ethanol (70—80%), residue on evaporation,content of carbonyl compound and total ester value before and after acetylation.

5.1 Appearance and colour

Essential oils should have a clear and clean appearance. Traces of water or suspended matter give a milky or opaque appearance. Moisture should be removed by drying and filtering. Drying on a large scale can be carried out by saturating the oil with sodium chloride and filtering. The pure chemical constituents of essential oils are colourless, but due to oxidation of various chemical constituents a light, pale yellow colour may persist. If the oil has reacted with metals such as copper, a dark brownish-yellow colour results. The intensity of the colour may increase if the oil is exposed to direct sunlight.As pointed out earlier, it is therefore advisable to store the oil in the dark or in amber coloured glass containers.

5.2 Odour and flavour

Each essential oil has its own characteristic odour (there is usually an agreement on odour between contracting parties). Often the odour may change on long storage or storing in 'bad company'. Due to this reason essential oils should be used as soon as possible after distillation.

The Essential oil of cardamom deteriorates with age. This is mainly due to the loss of the highly volatile constituent cineole. The remaining oil, which is rich in terpenyl acetate smells rather like 'Dettol' with age. Even citronella, or lemon grass oil gives an off odour with age,as a result of the oxidation of the terpene hydrocarbons.

5.3. Relative density, refractive index and optical rotation

According to standard specifications, essential oils should give characteristic values for the above parameters at a given temperature. The use of immature raw material, poor distill-

ation techniques or the introduction of foreign matter are some of the reasons why a sample fails to meet specifications even when the oil is distilled from authentic raw material.

5.4 Solubility

The standard specifications are given for the solubility of most essential oils in a specific volume of ethanol of known strength. For example lemongrass and citronella oil, one volume of the oil should dissolve in three volumes of 70% (vv) ethanol. The final solution should be clear.It has often been noticed that even some genuine oils fail this test (see section 6 for details).

5.5 Carbonyl compound content

Many essential oils contain chemicals with functional groups, such as hydroxy, aldehyde and ketone. Each of these groups can be estimated using a standard chemical reaction. Alcohols (eg. geraniol) ketones (eg. menthone), aldehydes (eg. cinnamic aldehyde, citral) react quantitatively with certain reagents like hydroxylammonium chloride, or acetylation reagents. The chemical method of estimation of constituents gives a value with an approximately 10% deviation from the actual value. A more accurate method of estimation is that using Gas Liquid Chromatography. This method is discussed below in a separate section.

5.6 Use of Gas Liquid Chromatographic (GLC) methods in the quality control of essential oils

All essential oils give characteristic GLC patterns,when analysed under specific conditions. These GLC patterns of oils are comparable to finger prints,when they are chromatographed on a given stationary phase, under ideal conditions. If the composition of the oil deviates 'from that of a standard sample' due to reasons such as adulteration or inferior quality these can be readily detected in the chromatogram, through either the absence or the presence of certain compounds which appear as peaks on a GLC chart recording.

In the search for improved detection techniques GLC has become an important instrument in quality control of essential oils.Most of the physical and chemical methods can be replaced by examination by GLC. The CISIR possess considerable expertise in GLC analysis and uses this technique as the main method of analysing essential oils.

The standards specified earlier are now gradually being replaced by the modern GLC methods. Determination of geraniol in citronella oil, eugenol in cinnamon leaf and clove oil, cineole in cardamon oil, limonene in peppermint oil are now determined by GLC methods. One advantage in GLC method is the degree of accuracy. The compound to be determined can be estimated with an error less than one percent. The gas liquid chromatographic technique also has marked advantage in that a large number of samples could be analysed in a very short time.

5.7 Infra-Red Spectroscopic methods

Infra-red spectroscopy (IR) has become complementary to GLC methods in the standardisation of essential oils.Many chemical compounds in essential oils have functional groups such as phenolic and alcoholic —OH, aldehydes, ketones, benzene rings and a degree of unsaturation These characterstics can be conveniently determined by IR methods.

6. SOME ANALYTICAL PROBLEMS MET WITH AT CISIR

Some essential oils fail to satisfy the standard specifications even though they are known to be genuine. There may be one or more reasons for this failure.

Inferior quality of raw material, improper distillation techniques, deliberate manipulation, (such as mixing with lower quality oils) varietal differences or climatic variations could be another underlying reason. In some cases even the method of testing may be at fault.

At one time it was suspected that Sri Lanka citronella oil was being adulterated with kerosene oil. Surprisingly, even genuine samples prepared from the best quality raw material

sometimes failed to pass the Schimmel's test (solubility in alcohol). The problem was finally solved by our scientists with the help of Gas Chromatographic techniques. Using these modern instruments it was shown that the Sri Lanka type citronella(*Cymbopogon nardus*) had a high percentage of hydrocarbon compounds which are similar to kerosene in solubility. As a result, the results in the solubility test were misleading.This clearly indicates immense benefits to industry that the application of modern analytical and quality control techniques could bring.

Steam distillation at high pressures (sometimes used for increasing the rate of distillation) can lead to unexpected problems. During the distillation of nutmeg and cardamom with high pressure steam, substances with low volatility (fattymaterial) could distill over. It has been observed many times that such oils contain a large quantity of non-volatile material and fail to conform to specifications such as those for specific gravity, refractive index and non-volatile residue.

Careless storage techniques of both raw material and product also contribute to low quality in essential oils. Cardamom oil normally has a constant ratio between the proportions of its main components 1, 8 cineole and terpenyl acetate. Cineole is highly volatile and tends to escape from samples leading to loss of quality.

The mixing of high grade oil with a low grade one is another form of adulteration. Such practice has been noted in the cinnamon industry.High grade cinnamon bark oil is mixed with low grade 'katta' or chips oils or with lower quality cinnamon leaf oil.As cinnamon bark oil is priced according to cinnamic aldehyde (CA) content, this practice not only lowers CA content but also boosts eugenol content. The increased eugenol content further lowers the quality of the oil as the standards specify a maximum percentage of phenolics such as eugenol for each grade of oil. The same problem arises when cinnamon leaf oil is added to cinnamon bark in the belief that it aids oil recovery.

Another important factor affecting the quality of an essential oil is the inadvertent distillation of a mixture of related varieties. A case in point is that of cinnamon,*Cinnamomum zeylanicum* where there are many varieties eg.a safrole type,astringent type and mucillagenous type. Varietal studies have shown that leaf oil of these varieties are different (the safrole type has a high percentage of safrole, 25—30%) These varieties have slightly different appearances and farmers could be educated to recognise such differences.

Similar observations have been made with *Eucalyptus spp*, where some varieties have a high percentage of alpha-pinene (in addition to cineole).

Some distillers fail to understand the implication of using the same still to distill essential oils from different raw materials, such as nutmeg and pepper. When such a situation arises, the still has to be thoroughly cleaned by "steaming out" all the residual odour of the distilled essential oil.

Over the past 15 years the CISIR has gained considerable expertise in the analysis and quality control of essential oils. The institute is not only in a position to analyse essential oils (using modern techniques)and issue certificates of conformity but also tender advice to clientele in many a related areas. For example, industry could consult the CISIR for technical advise on how to upgrade their essential oils. By identifying the cause for low quality in any given oil it is possible to recommend ways and means of remedying the situation. The role CISIR can play in the quality control of essential oils is therefore extremely significant.

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SERIES ON AROMATIC
PLANTS OF SRI LANKA
BOOKLET NO. 3.

SPICE OLEORESINS

Section of Natural Products
Ceylon Institute of Scientific & Industrial Research
Colombo, Sri Lanka

Rs. 50/=

SRI LANKAN AROMATIC PLANTS OF ECONOMIC VALUE

Booklet No. 3. SPICE OLEORESINS

By D. V. M. Geevaratne

Edited by E. R. Jansz

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PREFACE

The subject of Essential oils and spices has been investigated in depth by the Natural Products Section of the CISIR for the past 15 years. Although significant findings have evolved in nearly all areas of this subject, it appears that Industry is largely unaware of many advances in this field. As part of a publicity drive for this area of work, it is proposed to publish a series of 8 - 10 booklets on the topic which will be known as the "Aromatic Plant Series." These booklets will cover areas where CISIR research can make a direct contribution to Industry.

It is envisaged that this series will cover the following topics. (i) Distillation (ii) Cultivation (iii) Chemical constituents. (iv) Quality control (v) Storage and packaging and (vi) Marketing - all with relation to essential oils; the subject of spices being covered in the following booklets: Spice Oleoresins and Non-traditional Products from spices. These booklets will be in addition to a second edition of the Cinnamon monograph; the 1st edition of which was published by this institute a few years ago.

These booklets will be written with emphasis on the Sri Lankan context, the text covering historical development, current status and prospects for the future.

This booklet is the third of our series on aromatic plants. We thank Mrs. Malini Mallawaratchie for stimulating discussions, Mrs. Vajira Silva for assistance in editing, Miss Padma Devendra for drawings in the booklet and Miss. Ramani Perera for secretarial assistance.

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1. INTRODUCTION.

A spice oleoresin is a spice extract prepared by solvent extraction. The solvent is chosen so as to extract all that the spice has to offer by way of flavour, odour and pungency. The extract on evaporation of the solvent gives a concentrate that nearly recreates the effect of the natural whole spice.

Oleoresins may be prepared from many spices and culinary herbs.

Pungent spices		
	Red pepper (chilli) Cayenne Tabasco	— *Capsicum sp.*
	Ginger	— *Zingiber officinalis*
	Pepper	— *Piper nigrum*
Aromatic Fruits & Seeds		
	Nutmeg and Mace	— *Myristica fragrans*
	Cardamoms	— *Elettaria cardamomum*
	Fenugreek	— *Trigonella foenum-graecum*
Umbelliferous Fruits		
	Aniseed	— *Pinpinella spp.*
	Caraway	— *Carum carvi*
	Celery	— *Apium graveolens*
	Coriander	— *Coriandrum sativum*
	Dill	— *Anethum graveolens*
	Fennel	— *Foeniculam vulgare*
	Parsley	— *Petroselium crispum*
Phenolic spices		
	Clove bud	— *Eugenia caryophyllus*
	All spice	— *Pimenta officinalis*
Coloured Spices		
	Paprika	— *Capsicum annum*
	Saffron	— *Crocus sativus*
	Turmeric	— *Curcuma domestica*
Barks		
	Cinnamon	— *Cinnamomum zeylanicum*
	Chinese cassia	— *Cinnaamomum cassia*
Culinary herbs		
	Bay, Rosemary, Sage, Origanum, Mayorum, Savory, Oregan, Thyme, Basil, Parsley, Tarragon, Mint.	

Oleoresins have many advantages over the alternate methods of presenting spice flavouring principles: the whole spices and the ground spices.

These advantages can be broadly classified into 6 categories.

(1) Reduction of contamination

(2) Uniform quality (and strength)

(3) Improved appearance

(4) Reduced non-flavour material

(5) Easy storage, handling and dispensation.

(6) Flavouring efficiency

Contamination. Whole spices are very often contaminated with dirt, dust, vermin, insect parts etc. accumulated during harvest, drying and storage. Further, whole spices are frequently attacked by moulds and also have high bacterial loads.

Uniformity. Whole spices show wide variations in quality. This variation is brought about by nature (such as climatic and edaphic factors giving the expected patterns of biological variation) and also due to immature harvest. The latter is common in Sri Lanka, where, encouraged by high prices and threatened by pests and pilferage, harvest before full maturation takes place.

Improved appearance. Extraction of the active principles into a homogeneous easily dispensable form results in the elimination of specks of dark colour and a spikey appearance which is detrimental to the appearance of many processed foods.

Reduced non-flavour material. By presenting the spice this way the introduction of non-flavour material is vastly reduced.This concerns not only bulk, in the form of cellulose and other plant constituents but also (i) enzymes (which could have deleterious effects on processed foods by reducing shelf life) and (ii) tannins (which can react to form intensely coloured products with food constituents).

Easy storage, handling and dispensation. Particles of ground spice are not the same size; very fine particles cause problems by forming dusts which pose handling problems especially in the case of the pungent spices. The smaller volumes of oleoresin will also reduce inputs for storage and transport. Bulk samples of oleoresin will also afford easy amenability to quality control and standardization.

Flavouring Efficiency. As taste and odour depend on the contact time of the active principles with the sensory cells of the mouth, oleoresins have another advantage over whole and ground spices as less flavouring material will be required to produce the same effect.

2. MANUFACTURE OF OLEORESINS.

The manufacture of oleoresins comprises a number of common unit processes such as: grinding, drying, steam distillation, solvent extraction and solvent recovery.

2.1 Grinding of spices

This is the first stage of the operation. The dried spice is ground to the optimum particle size. Fine grinding results in clogging and chanelling in the extraction process while too coarse a particle results in ineffective extraction. Particle size is pre-determined during pilot plant trials.

The hammer mill is the conventional method of spice grinding. This consists of a high speed rotor to which is attached a disc bearing a number of hammers. These rotate inside a close fitting casing. One half of the casing is held with a toughened metal breaker plate. Reduction in particle size is due to impact forces from the rotating hammer. The lower end of the casing is fitted with a screen with perforations for particles of the desired diameter.

2.2 Steam distillation

In the case of some expensive spices (eg. cinnamon and cardamom) steam distillation is done prior to percolation. This process is not carried out in the case of many other spices. Distillation is carried out in a stainless steel still body using steam under pressure.

2.3 Drying

Steam distilled material is dried before solvent extraction in a hot air dryer called the cabinet, tray or compartment dryer. It consists of an insulated cabinet containing a fan which moves air through a heater and then through adjustable baffles directing air horizontally through the trays containing the spice powder. Heating of air is carried out by steam coil heat exchangers lining the wall internally.

2.4 Solvent extraction

Oleoresins are prepared by cold percolation of the ground spice with the selected solvent. The solvent used varies from spice to spice. Some of the solvents used are given below.

Acetone-	Cinnamon Nutmeg Ginger
Methylene chloride-	Clove Fennel Cumin
Hexane: Methylene chloride- (90: 10)	Cardamom Coriander

2.5 Preparation of some Oleoresins

Pepper: A typical operation for preparing pepper oleoresin from Sri Lankan pepper is described below.

Six hundred kg of powdered pepper is charged into a percolator and a circular weight applied on the charge to prevent it from floating when the heavy solvent (methylene chloride) is run in. The lid is fixed and 1200 l. of the solvent is run in. The charge is allowed to soak for 8 h. and then continuously percolated running in about 450 l. of solvent/ h. The percolate is removed from the tank by means of an exit at the lower end (Figure 1).

From this tank the percolate passes through a pre-heater which consists of a coil within an insulated shell. Steam is passed into the space between the coil and shell. The pre-heated percolate now enters a climbing and falling film evaporator where it is heated with steam. The fully heated percolate then enters a vapour separator, where the solvent vapour rises and is led off for condensation (Figure 2).

The percolate is concentrated to a consistency with which it can still flow freely. Due to the presence of fixed oil in the concentrate it does not dry but forms scales in the film evaporator. The concentrated extract is stored in a tank for use in the final concentration and finishing off process.

The concentrated extract is finally finished off in batches in a vacuum still system (Figure 3). Here nearly all solvent is removed. To carry out this operation a small quantity of demineralised water is added at the same rate as the solvent distills; charring being prevented by the natural fixed oil present in the extract. The oleoresin is now run into rectangular metal molds of 6 kg. capacity. The sides of the molds are scratched and the oleoresin stirred with a knife to promote solidification. The spent pepper charge in the percolator is steamed to remove any remnant solvent and the solvent-free residue discarded.

Figure 1

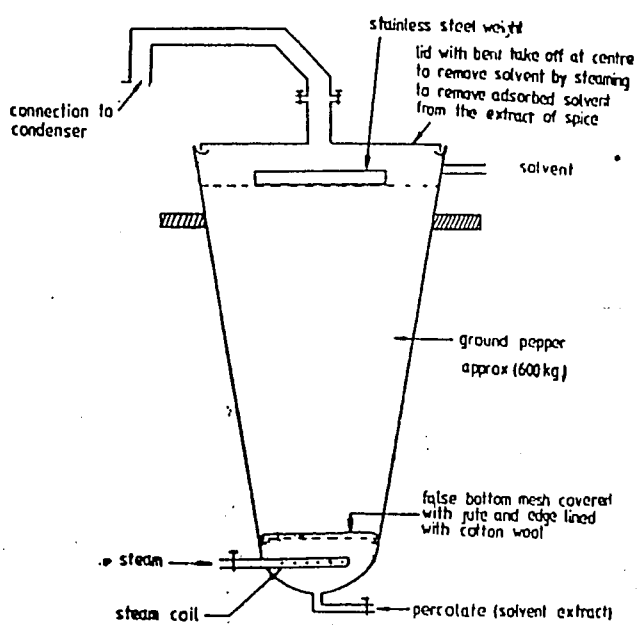
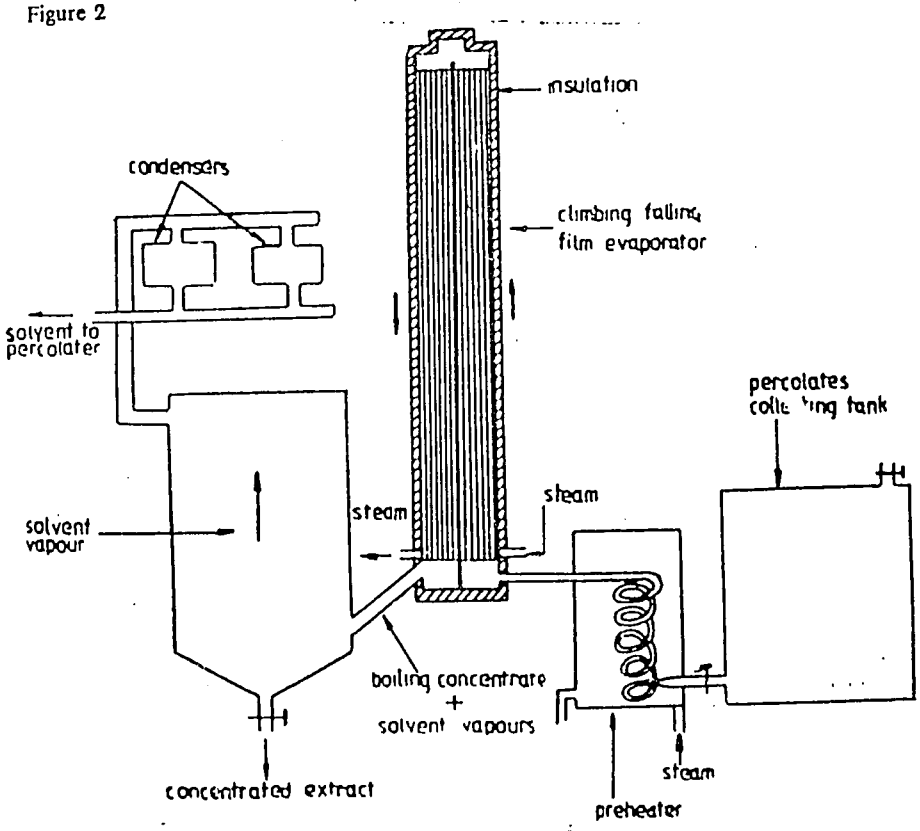
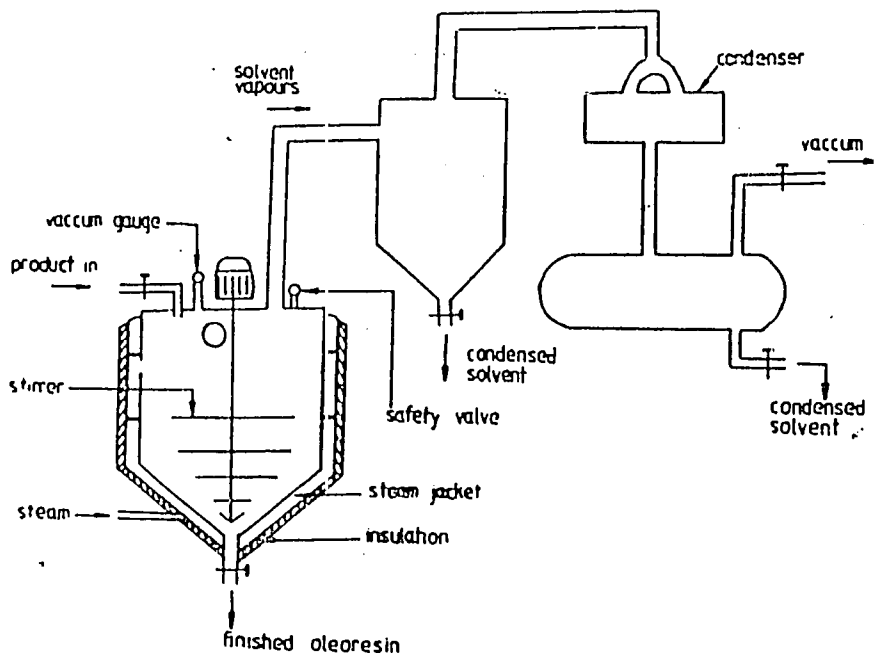


Figure 2





Cinnamon: An example of an oleoresin prepared from a spice with no fixed oil is cinnamon bark oleoresin. The process of manufacture includes the following steps: (1) grinding, (2) steam distillation, (3) cabinet drying, (4) percolation with acetone and (5) distillation of solvent.

The cinnamon bark percolates are not concentrated in climbing and falling type evaporators due to the absence of fixed oil and the danger of charring in such evaporators.The temperature in the vacuum still is maintained at 75 - 80°C and when the distillation rate is reduced to a drip, demineralised water is injected at the same rate as the distillate output. The oleoresin from the vacuum still is run into trays and dried in a cabinet dryer to a brittle mass. This is broken up and powdered.

3. FORMS OF PRESENTATION OF OLEORESINS.

Oleoresins may be presented in the following forms.

(1) Straight (undiluted) oleoresins.

(2) Dispersed oleoresins

(3) Encapsulated oleoresins.

3. 1 Straight oleoresins

This form has one major disadvantage, viz., they are very concentrated and therefore small errors of calculation in dispensation result in major differences in flavour strength. Further, oleoresins are very often solids or viscous liquids, which cannot be incorporated easily into food without causing ' hot spots '.

3. 2 Dispersed oleoresins

This is dilution of the oleoresin and its dispersion in a free-flowing, dry powder. Taking the example of pepper, the oleoresin is triturated in a large stone wheel grinder with glycerine and passed through a colloid mill to obtain a free flowing liquid. Dilution may also be done with hydrogenated peanut oil or any other cheap edible oil.

The diluted oleoresin is dispersed on a dry powder base using rib and wane mixers and revolving worm mixers. The dry powder may be salt, dextrin, rusk, starch, etc. and these are rendered free-flowing by the addition of 3% calcium phosphate.

Usually a ' premix ' of oleoresin and powder base is first prepared and this subsequently mixed in with the bulk powder base. This process reduces the chances of lumping and the causing of hot spots.

A free-flowing product of even particle size, dispersed oleoresins are easily handled and dispensed. Its easy use in spice seasonings brings about its prolific use in seasoning formulae.

The major disadvantage of dispersed spices arise out of its large surface area which results in rapid loss of flavours during both high temperature processing and storage.

3. 3 Microencapsulated oleoresins

Microencapsulation is a technique of enclosing a minute quantity of material in an impervious shell. The encapsulent should be ideally edible, tasteless and colourless. Common encapsulents are gum acacia, dextrin, CM-cellulose and sugar. The micro-capsules are spherical and 10-200 microns (average 50 microns) in diameter, free-flowing, single or in conglomerates.

The process of encapsulation is a spray-drying operation. An example of the process may be taken from the preparation of encapsulated onion flavour. Here a mixture of white dextrin and milk whey powder is added to onion oil and mixed. The resulting liquid which has 50% solids is spray dried at 50-65°C.

Encapsulation is an expensive process and therefore spices are encapsulated at 10-fold normal flavour strength. Dispensation now becomes a difficulty. Nevertheless this form of presentation has many advantages such as: (1) better shelf life, (ii) withstanding of higher processing temperatures (this is of special interest in bakery products), (iii) easy use in surface dressings (eg. fried fish and biscuits), (iv) direct use in picklings, (reducing boiling time), use in products allowing very small quantities of non-meat fraction, eg. sausages, (vi) use in processing involving more than one strong flavour - to prevent cross-contamination.

4. SPICE EQUIVALENTS OF OLEORESINS.

Table 1. Spice oleoresins - Some important characteristics

Spice	Yields %	Vol. of essential oil %	Replacement Strength	Maximum Residual solvent
Cardamom	10	50	1 : 20	30 ppm
Cinnamon	5	—	—	30 ppm
Clove	20	40	1 : 20	30 ppm
Ginger	10 — 15	25 — 30	1 : 28	30 ppm
Mace	30 — 35	10 — 15	1 : 12	30 ppm
Nutmeg	35 — 40	7 — 9	1 : 13	30 ppm
Pepper	10 — 15	18 — 20	1 : 25	30 ppm

The two important factors here are the yield and the replacement strength. Taking cardamom as an example, 100 kg of cardamom yields 10 kg of oleoresin and the replacement strength is 1: 20. Therefore the spice equivalent of the 10 kg of oleoresin is 200 kg of cardamom spice. In other words by preparing and using the oleoresin the original 100 kg of cardamom has been doubled to 200 kg. The economics of oleoresin manufacture lies in this increase.

5 STANDARD SPECIFICATIONS.

The use of oleoresins in the food industry is rapidly increasing in the developed world where the housewife spends less time in her kitchen and relies more and more on processed convenience foods. These foods are made in automated food factories. This has resulted in many developed nations laying down standards for oleoresins. There are also international standards (ISO and FAO/WHO) for oleroesins. A list of organisations in USA and other countries prominent in stipulating standards for spices, spice products and oleoresins is given below.

American spice trade association (ASTA), Essential oil association of the USA (EOA), Association of Official Analytical Chemists of the USA(AOAC),US Military StandardsEE-S-06456 and EE-S-631F), British Standards Institution (BSI), Indian Standards Institution (ISI), Ceylon Standards Bureau, Deutches Narmanasschuss, Hungarian Office for Standardisation and Rumanian Standards Organisation.

The standards laid by the above organisations are concerned with oleoresins that have the largest markets (the oleoresin of Cinnamon does not have standard specifications). Different oleoresins, are appraised by different analytical criteria. This is summarised in table 2.

Table 2. Key tests for oleoresins.

Seasoning	Essential oil	Valuable components of essential oil	Non-volatile lipids	Pungent principle	Colour
Pepper-black	X	X		X	
Pepper-white	X	X		X	
Capsicum				X	
Mace	X	X			
Nutmeg	X	X			X
Onion				X	
Ginger	X	X			
Clove	X	X			
Coriander	X	X			
Cardamom	X	X			
Cinnamon	X	X			

An important test that is specified for all oleoresins is the residual solvent test. The method adopted is a gas chromatographic method by P. H. Todd reported in Food Technology 1980, 14, 16, 301 - 305. The method has been published in the Federal Food and Drug Administration 1965, Food Additives manual. The method has been modified by various sources since 1960.

Apart from these standards and tests, oleoresin manufacturing companies have their own practices in terms of house standards and tests. Specifications and tests for a number oleoresins are given in table 3.

Table 3. Some specifications and tests for oleoresins.

Oleoresin	Volatile oil	Special tests	Replacement strength
Cardamom	Modified Clavenger method, ASTA method 5 50% oil content maximum		1 unit weight should replace 20 unit weights of spice ie. 1 : 20
Cinnamon	There are no specifications		
Cloves	ASTA Analytical method 16 - 40% oil maximum		1 : 20
Ginger	Modified Clavenger or ASTA Method 5,25 - 30% maximum oil		1 : 20 (1 : 28)
Mace	Modified Clavenger or ASTA Method 5 10 - 15% oil		1 : 12
Nutmeg	Modified Clavenger ASTA Method 5,7 - 9% oil		1 : 13
Pepper	Modified clavenger ASTA method 5,18 - 20% oil	**Piperine content** 50 - 55% by Kjeldahl 35 - 40% UV Spectroscopy	1 : 25
Turmeric		Colouring power of turmeric oleoresin modified ASTA method.	

6. SENSORY EVALUTION.

6.1 Methods of evaluation

The choice of a food item is biased to a great-extent by the aesthetic pleasure the food can provide.A study of the properties responsible for the aesthetic value and the method of establishing slight differences among several products of a type of food material is termed organopepsis, organoleptic evaluation or sensory evaluation. Unlike physio-chemical methods of analysis which are objective in nature, sensory evaluation is subjective. Sensory evaluation is the overall impression compounding individual sensations or separate physio-chemical stimuli (such as sour, bitter, sweet and aromatic etc.) on the tongue and the olfactory organs.

The results of objective analysis of flavour carried out with instruments can never be correctly and usefully interpreted unless they are connected to sensory evaluation. On the other hand conclusions from sensory evaluation can be given an objective interpretation when sensory differences can be measured analytically.

The success of a sensory analysis depends on the application of appropriate techniques by a taste panel specifically designed for the purpose.

Sensory analytical techniques can be categorised into 3 main groups.

Group I Threshold value studies.

Group II Analytical studies.

(1) Difference tests
- (a) Single stimulus test
- (b) Paired stimuli
- (c) Duotrio test
- (d) Triangle test
- (e) Mutiple test

(2) Ranking test

(3) Quality tests
- (a) Scoring test
- (b) Descriptive test
- (c) Flavour profile

Group III Hedonic tests.

(4) Preference test
- (a) Paired preference tests
- (b) Triangle preference test

(2) Hedonic scaling.

Threshold value studies serve to establish ability to recognise certain tastes and odours, or in other words the minimum quantity of an oleoresin or spice formulation that is detectable. The analytical tests help to detect a difference and the extent of the difference in taste, odour, quality, etc. between samples.

Quality tests range from simple descriptions of the qualities present to a semi-quantitative assessment of all the individual flavour notes.

6. 2. Taste panels

Hedonic tests are concerned with the tasters subjective evaluation from which conclusions are drawn about the degree of appreciation with which the product will enter the market.

As sensory judgement is subjective in nature depending on individual tastes and preferences, groups of persons known as taste panels are employed for this evaluation.

There are three types of taste panels, differing greatly in composition and function. They are research panels, quality control panels and consumer panel

Research panels have the following functions.

(a) To correlate sensory properties with physio-chemical analytical results.
(b) To identify semi-quantitatively the differences in flavour between similar products.
(c) To correlate sensory properties with physio-chemical analytical results.
(d) To prepare new recipes and identify changes during processing, storage, etc.

Quality Control Panels. These panels help to evaluate the quality of the product leaving the factory.

8. USERS OF OLEORESINS.

The ultimate customer for oleoresins is the 'big' food manufacturer of the developed world. The U.S.A.is the biggest user of oleoresins and together with the European Common Market and Japan accounts for 60% of the spice market. These countries do not purchase most of their oleoresins direct but use spices for oleoresin manufacture.

Although food manufacturers rarely, if ever, manufacture oleoresins themselves, they are in close contact with flavour houses. These flavour houses both manufacture and import oleoresins; the latter mode accounting for about 20% of the oleoresin used. The flavour house plays the key role in the oleoresin market, their close contact with the manufacturer leads to a condition of mutual confidence which is difficult to compete with. This is specially so for an overseas oleoresin manufacturer who will also have to contend with delays while meeting the demands of the market

An interesting new trend in the oleoresin market is the small sized packages of oleoresins which is directed at the American housewife (who often prefers to do her own spicing). As a result there appears to be some demand therefore for small spice packages of dispersed and encapsulated spice oleoresins.

9. PROSPECTS FOR OLEORESIN MANUFACTURE IN SRI LANKA.

9.1 Raw Materials

Most of the raw materials for oleroresin manufacture are either grown in sufficient quantity or can be grown in a relatively short peroid. This would specially apply to cinnamon bark, pepper, cardamom, chillies, ginger and turmeric.

9.2 Technology

Oleoresins are manufactured only on a very small scale in Sri Lanka and that too by a few food manufacturers who prepare them for their own use. The technology for large sacle manufacture is not available here at the moment. There are two alternate technologies: (i) highly sophisticated technology from the western world and (ii) the lower capital investment demanding Indian Technology. The latter is advertised for sale by the National Research and Development Centre (NRDC) of India. The estimated capital outlay is Rs. (Indian) 1.62 million for a unit producing 300 metric tons per annum.

9.3 Economics

The concept of added value by processing primary products is very often a myth due to artificially low prices quoted by buyers in order to discourage processing in the developing world and also due to import tariffs. Very careful economic evaluation of each individual oleoresin appears necessary. A vital factor in the economics of production is an efficient solvent recovery system.

9.4 Marketing

Marketing of oleoresins suffers from the problem of inaccessibility. Inaccessibility affects the lower priced straight oleoresins less than dispersed or encapsulated oleoresins. This is primarily due to the important step of blending of straight oleoresins which necessarily takes place in the flavour houses (to meet the highly specific needs of their customers). A detailed market intelligence survey is necessary prior to launching any oleoresin producing industry especially as the product will be totally exported. It is visualised that the most practical way of achieving this would be to set up the industry with established manufacturers who have ready access to markets abroad.

In the final reckoning, it appears likely that the extra inputs needed for local oleoresin manufacture will have to be weighed against the main advantage gained, namely, the reduction of freight costs.

The Distillation of Essential Oils

Manufacturing & Plant Construction Handbook

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ESSENTIAL OILS AND OLEORESINS

A SURVEY OF THE NETHERLANDS AND OTHER MAJOR MARKETS IN THE EUROPEAN COMMUNITY

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Appendix 5 Statistical information on the EC-market

1 INTRODUCTION

The report is split up in two parts, part A and part B. Part A deals with the Dutch market for essential oils. Most of the information also applies to the European Community. The subjects discussed in the chapters titled Product Characteristics, Trade Structure, Prices, Market Access, Promotion and Sources of Information are of a more general nature. In chapter 3 The Netherlands in Brief and chapter 5 The Market, mainly Dutch items are discussed. Part B deals with the European market. Only the main other markets will be discussed in this part.

2 SUMMARY

The survey deals with the market for the trade in essential oils and oleoresins. Essential oils can be defined as a volatile mixture of organic compounds derived by physical means from odourous plant material, for example flowers, herbs, fruits, woods and roots. Essential oils are used in a wide range of industrially prepared food products, perfume and cosmetic preparations, tobacco, pharmaceutical products and detergents. They are also used as a source of derivates.
Oleoresins are liquid preparations consisting of essential oils and resinous materials. Oleoresins are mainly used in the British food industry.

The essential oils discussed in this report are: bergamot oil; citronella oil; clove oil; eucalyptus oil; geranium oil; jasmine oil; lavender oil; lemon oil; orange oil; peppermint oil; rose oil; vetiver oil and ylang-ylang oil. The selection of these oils is based on available statistics and covers the most important large-volume essential oils as well as the main expensive low-volume oils. Statistics of oleoresins are not specified as single products. Therefore they are discussed as one group.

The main EC (European Community) markets for essential oils are: France, The United Kingdom, Germany, The Netherlands. About 78% of the essential oil volume-trade is in their hands. In 1989 these markets had a value of respectively 127,104 ECU (European Currency Unit), 63,603 ECU, 52,130 ECU and 39,243 ECU. The imports in tons were respectively 7,705 tons, 8,005 tons, 7,800 tons and 3,381 tons. The total EC market had a value of 374.1 million ECU and a volume of 34,608 tons in 1989.

In 1989, about 33% of the essential oils imported into the EC came from developing countries with a value of 81.1 million ECU and a volume of 11,552 tons. Among the main developing countries for the EC trade are Argentina (lemon oil), Brazil (orange oil), China (eucalyptus oil, citronella oil, geranium oil, peppermint oil), Egypt (jasmine oil), Haiti (vetiver oil), Indonesia (vetiver oil, citronella oil). The essential oil trade between the member states of the EC in 1989 amounted to 28% of the total imports of essential oils into the EC with a volume of 9,590 tons and a value of 117.7 million

ECU. The main EC suppliers were Italy (bergamot oil) and France (rose oil, lavender oil).

In 1989 about 39% of the essential oils were supplied by countries other than developing countries and wich are not member states of the EC. The USA is the main supplier of essential oils in this catagory (lemon oil, peppermint oil).
The most important import channels are brokers, dealers and flavour and fragrance manufacturers. The multinational processing and compounding industry of foods flavours and fragrances increasingly dominates the trade.

Fluctuations of the price level of essential oils are influenced by quality and economic factors, such as supply and demand. The inconsistent quality, the indequate flow of supplies and the severe price fluctuations have led in some cases to the production of synthetic substitutes for essential oils. However natural essential oils do not have to fear competition on a large scale of synthetic substitutes. By no means every essential oil has a chemical substitute, because it is very difficult to approach nature and for a lot of essential oils it is economically not worth substituting.
Synthetic substitutes exist for the following oils: lemon oil; bergamot oil; lime oil; geranium oil; mint oils; jasmine oil; lavender oil. Besides the legislation for both natural essential oils and synthetic substitutes is not the same. In most countries the use of synthetic substitutes in the food industry is restricted, because of health and safety reasons.

The EC trade in essential oils is visualized in the following figure:

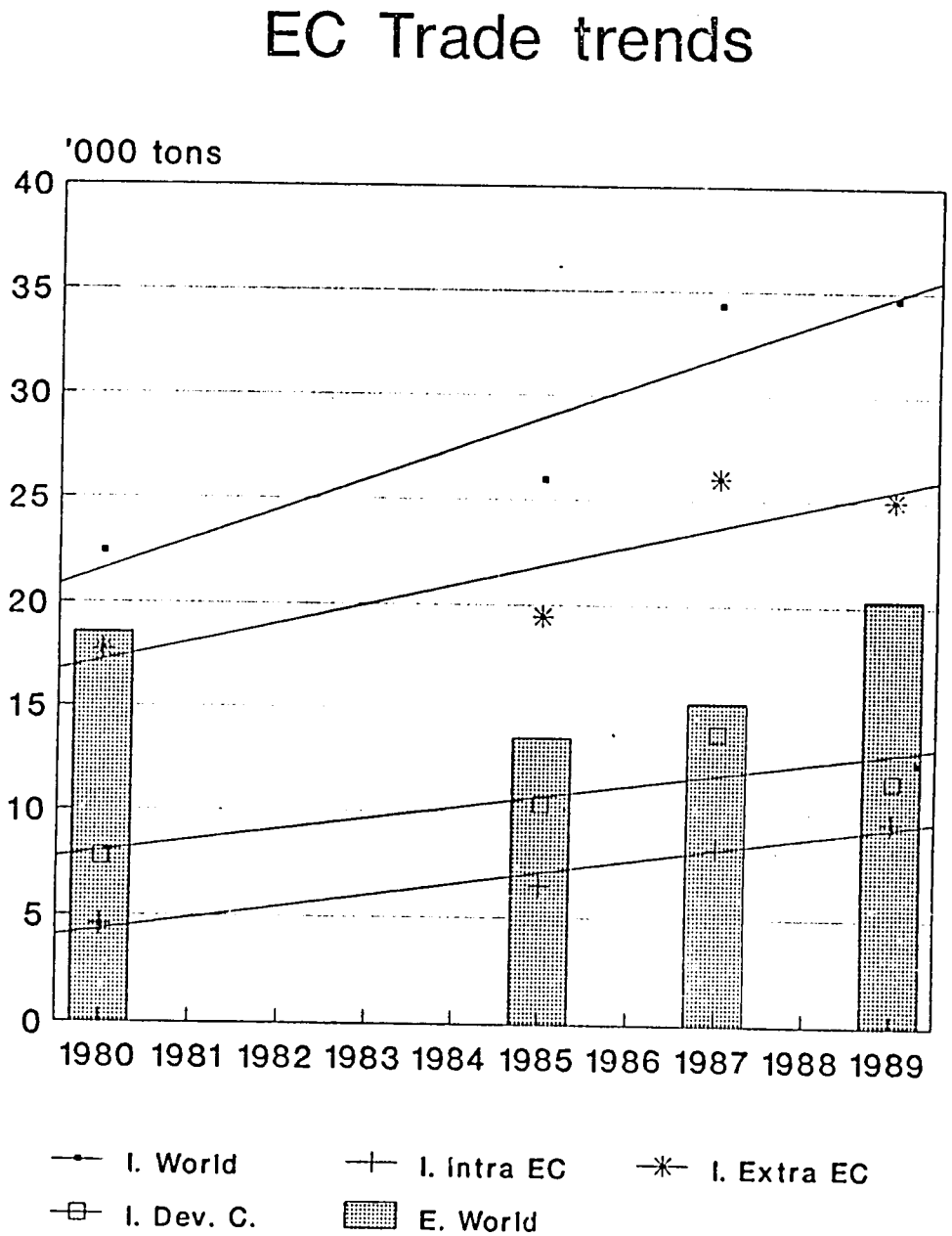

Figure B.5.4 EC trade trends