

Spices, Chemistry & Sri Lankan Economic development

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Historical anecdotes about Sri Lankan spices have always been highlighted in all printed and electronic media. However apart from Ceylon Cinnamon (*Cinnamomum zeylinicum*) and pepper (*Piper nigrum*), and other spices concerned, as a country I doubt we could talk about others with the same spirit. When considering cultivated areas with some degree of increase on two major spice crops most of the other spices (eg. Chilli (*Capsicum annuum*), Ginger (*Zingiber officinale*), turmeric (*Curcuma longa*), cardamom (*Elettaria cardamomum*), cloves (*Eugenia caryophyllus*), citronella (*Cymbopogon nardus*), lemongrass (*Cymbopogon citratus*) show statistically a marginal decrease and production volumes are also lower than the 20th century.

With other major spice producing countries and their progress with science and technological inputs, we are far behind. Even amidst the popularity of Cinnamon and to some extent pepper, Sri Lanka has still not moved into large scale organized cultivation of spices when compared to neighbouring India, one of the largest spice producers.

From the cultivation perspective, development and emergence of high yielding, disease-resistant climatically tolerable improved varieties are rare to see. The involvement of chemistry and a chemist's role in the development of fertilizers, pesticides and weedicides with minimum environmental and biological impacts need to be in place for the cultivation and crop protection.

Value Addition

Value addition is a very common term and many feel that rather than exporting raw material why can't we add value to those and earn more foreign exchange. If the crop or product produced could be sold for a better price, maybe minimum 25-50% higher price, I consider it as a value-added product otherwise when the end product market value is lesser than the raw material there can't be value addition. As an example, one could produce cinnamon bark oil as a value-added product from Cinnamon bark. With the current value of quality

Cinnamon bark (quills), one has to spend at least 100kg of bark to get 1kg of cinnamon bark oil merely with highest quality characteristic special grade cinnamon bark oil may be a maximum value of Rs 65,000/- producer incurred cost of Rs. 240,000/- for 100 Kg of Cinnamon bark which is currently selling a minimum of Rs.2400/- (C5- Cinnamon quills).

Hence though the technology is available (for a nominal cost) one should not try to convert all available raw material to the so-called value-added product such as its oil, oleoresin or extract.

When considering the requirement of spices as a food ingredient, the highest quality has the maximum value when they are packed with customer's expected quality with the attractive hygienic package. Hence, value-added good quality spice is the best form with the most economically significant returns. As value addition is concerned with microbiological cleanliness, well preserved chemical characteristics with unique Sri Lankan spice flavour, attractively packed with international packaging and labelling requirements always give maximum returns. Ceylon cinnamon, Sri Lankan pepper and ginger will certainly fetch the highest market price provided that they possess;

- excellent cleanliness
- high and consistent quality
- steam sterilization
- grinding and blending ability, depending on the specific product.

Branding and marketing are key if you want to supply consumer-packaged spices and herbs. Moreover, packaging requires serious attention. You need to make sure that your logo and the packaging design fit the European market and match your buyer's preferences.

When considering the market segment for value-added spices China is the main supplier of crushed/ground spices and herbs, mainly paprika and ginger (87% and 11% respectively). India is the second-largest supplier of crushed/ground spices and herbs. In addition,

it is the largest supplier of all types of mixtures to Europe. For spice and curry mixtures, Pakistan plays a relatively major role as the second-largest supplier. While Indonesia is a relatively large and a developing supplier of crushed and ground spices, Vietnam and Thailand are smaller but still, significant suppliers of value-added spices and herbs.

The European or American market for value-added spices and herbs in crushed or mixed form that are directly sourced from developing countries, is growing, but competition with European processors remains fierce. Especially for consumer-packaged spices and herbs, the first step in adding value to a spice would be crushing or grinding a spice or producing mixtures in consumer-packed form. An important first step to value addition is investing in the quality and food safety of your product.

Increasing demand for ethnic cuisines and exotic food products in European consumers could be an opportunity for those categories of value-added products. Most of the consumer-packaged products and brands from developing countries are available in the ethnic food shop market. These shops sell spices and herbs traditionally used in countries outside of Europe and used to primarily serve ethnic communities in Europe. As an example, if you go through some branded spice company websites they have a range of consumer-packaged products from developing countries. Buyers linked to these shops and webshops are experienced in trading consumer-packaged foods and are an interesting target for value-added spice products.

However, European and USA buyer requirements are very strict and the competition is strong. Sustainability is becoming more important in the spice and herb market and it is an important value-addition as consumers want to know under which social and environmental conditions the product was produced. When packed spices and herbs are responsible for producing sustainability codes, it needs to ensure that packaging is sustainable; options include Rainforest Alliance, organic and fair trade. Stringent buyer requirements on sustainability and traceability throughout the chain of production is an important aspect, that is what the buyer relies upon (e.g. supplier codes or certification standard as proof to demonstrate traceability).

Furthermore, one has to comply with legal

requirements for all spices, if not the product can be refused at the entry point. If it doesn't comply with the European legal requirements, your product can be refused at the border or withdrawn from the market. Moreover, it should comply with mycotoxins contamination risk for many spices. The EU sets maximum levels for mycotoxins for specific spices. For example, for pepper, ginger, turmeric or nutmeg, the maximum limit of aflatoxin B1 that can be present is 5.0 µg/kg (aflatoxin B1) and that of total aflatoxin content B1, B2, G1 and G2 is 10 µg/kg. The presence of banned pesticides or higher amounts of pesticides than allowed in the product is another issue faced in spice and herb exports. Salmonella is the most common type of microbiological contaminant found in spices and herbs, and is the major cause for the banning spices and herbs from the European market. Custom authorities reject spices and spice blends when containing undeclared, unauthorized or too high amounts of extraneous adulterants and additives. The contamination with PAHs is the result of bad drying practices.

Labelling

Consumer-packaged spices and herbs must adhere to strict food labelling requirements, presentation and advertising of foodstuffs as well as providing information on the nutrient content (such as protein, fat, fibre and carbohydrates content), making information easier to read and understand, with minimum font size for mandatory information;

- Indicate any allergens in the food product including information on the content of certain nutrients.
- Identical labels for products sold online (i.e. product labels in a shop and for distance-selling must meet the same requirements).

The focus of labelling requirements is to provide information to the consumer as much as possible; name of the food, ingredients/processing aids, net quantity, "Use by" date, storage conditions, name and address of the business, country of origin, lot No. In addition, any certification logo, or retailer logo in the case of private label products, should be displayed on the label.

The American Spice Trade Association (ASTA) has developed cleanliness specifications for spices to ensure

that the spices meet federal regulatory requirements for safety and cleanliness. They were designed to meet or exceed the U.S. Food and Drug Administration's Defect Action Levels. (For more information Pl ref. ASTA website). The Quality Minima Document prepared by European Spice Association laid down requirements for the unprocessed spices and herbs, as well as additional buyer requirements which were not laid down in the legislation as the main reference for Europe and many key players in the market. Although this document does not cover consumer-packaged spices and herbs, you can use it to understand the chemical and physical parameters for unprocessed products.

In the case of each spice, there are specific grades, quality characteristics, and unique chemical and physical characteristics, to identify the best among the lot. However, in any raw material, there are off-grade immature crops that are broken or contaminated, those that do not meet minimum quality characteristics (eg. shape, size, low percentage of active ingredients, microbiologically not fit for human consumption).

Sustainability

Certain buyers require to prove sustainability as well as traceability from the supplier. Buyers will demand that you comply with their supplier codes or certification standard. The use of self-verification systems is expected to grow, and can use sustainability certification as proof to demonstrate traceability.

For consumer-packaged spices and herbs, one may find most opportunities in fair-trade certification. When you pack spices you will also be responsible for producing sustainability codes for your suppliers, you need to ensure that your packaging is sustainable. Options for sustainable packaging include alternatives to polluting materials (e.g. polyvinyl chloride (PVC), polyurethane (PU) or polystyrene (PS)).

Furthermore, to enhance the value of your product in the current scenario, some of the features one could incorporate into their spice product are;

1. **Food safety certification:** A guarantee that the product is safe. The most important food safety management systems in Europe are the BRC (British Retail Consortium) Global Standard, Food Safety

System Certification (FSSC 22000), Quality Food Program (SQF). It's always better to find the buyer's preference for a specific food safety management system, as some may prefer one system over the other.

2. **Quality management:** If your organization is with ISO 9000, you can show your buyers that you are taking quality seriously.
3. **Corporate social responsibility (CSR):** Almost all international companies have different requirements for CSR: signing their code of conduct or following common standards, such as Supplier Ethical Data Exchange (SEDEX), Ethical Trading Initiative (ETI) or the Business Social Compliance Initiative Code of Conduct (BSCI).

Quality spices that comply with the above, fetch a very high price. It is the real value addition if one expects to earn more profits from the spices.

So as far as value addition is concerned, those who could produce clean and sound spices are always in high demand. To maintain such standards, product manufacture with good agricultural practices (GAP) and also with good manufacturing practices (GMP) fetch a high value. Hence, maintaining all standard requirements, including sterilization, is the key for value addition. This also entails the product being produced as per Organic product certification guidelines set by internationally accredited certifying agencies such as Control Union, Royal Cert or the recently introduced Sri Lankan Organic Product Certification.

Ready-made spice powder and paste

Powdered spice in airtight packaging material is in enormous demand. Increased urbanization paired with a rise in the number of working women has reduced the time of cooking. Consequently, home-makers have started to demand readymade spice powder that includes chilli powder, black pepper powder, turmeric powder. Also popular are ready-made pastes of onion, garlic, ginger in packet form. An official report from Everest Spices Ltd. Reveals its exports about 10 per cent of its products to the US, West Asia, Singapore, Australia, New Zealand and East Africa. The total market size of branded spices is estimated to grow at 14 per cent annually.

Pepper (*Piper nigrum*)

It is a fact, that in the recent past pepper was imported from other major producing countries in very large quantities, claiming to be for value addition as pepper oil or pepper oleoresin. As one of the conditions of BOI, registered foreign and local companies are allowed to import raw material and turn them into value-added product and export (HS code of the end product should not be the same when value add) thereby helping the Government to earn foreign exchange and also establishment of companies to employ to cater to the local workforce. Based on this, several Indian processors such as Plant Lipid has established their massive extraction plants at our BOI zones (Mirigama). With the high reputation which we earned historically as one of the best quality pepper producers, India too exports a large amount of Sri Lankan pepper mainly as light berries for extraction process carrying out in India. However, as the largest pepper producer in the world, Vietnam annually produces more than 150,000 mt. Vietnam pepper, which is imported at a cheaper price, is used in the above plants; however, some lots which are believed to be released to the local market and claims to have Sri Lankan origin, was actually imported and re-exported again to India, resulting in heavy losses to Sri Lankan pepper producers.

Pepper is known as the king of spices; it is the most consumed spice in the world. Its pungency is due to a Nitrogen-containing alkaloid named piperine, Sri Lankan pepper contains more than 5% piperine whereas other major producers have only 3% piperine. At the same time, volatile pepper oil with terpene hydrocarbons which are responsible for its unique flavor, is much higher in local pepper. As Sri Lanka produced less than 2% of world production we should look into niche markets for value-added products such as high-quality black pepper, white pepper and green pepper products. As explained in the previous chapter high-quality pepper is not only about its physical and unique chemical characteristics but also about attractive clean black colour (could be achieved by blanching /steaming), consistent size of berries, microbiological cleanliness and so on., Though local pepper is rich with its flavour and supreme pungent taste, lack of microbiological quality found, the presence of unacceptable foreign and extraneous matter generally classified with the grade of Fair Average Quality (FAQ),

indicates that value addition needs to start by avoiding the factors that lead to the deterioration of quality. Similarly, by appropriate sterilization, final clean product could be achieved which meets international standards. Still Sri Lankan pepper has a reputation as a pepper producer with minimum pesticide residue contaminants compared to other major producers.

A variety of products are being made from black pepper. Furthermore, a range of green pepper-based products are, canned green pepper, green pepper in brine, bulk-packaged green pepper in brine, cured green pepper, frozen green pepper, freeze-dried green pepper, pepper mayonnaise, pepper cookies, dehydrated green pepper, green pepper pickle, mixed green pepper pickle, green pepper sauce and green pepper-flavoured products. In this instance too, value addition as pepper oil or as pepper oleoresin also need to be properly evaluated before the establishment of the processing plant.

Furthermore, real value addition is in effect when the industry is manufacturing consumer end product such as flavours and fragrances from the essential oils or oleoresins. However, quantities required for such an industry need to be properly evaluated and also the need to assess the real value of such natural products when compared to synthetic counterpart arises.

Ginger (*Zingiber officianalle*)

The use of raw ginger as a culinary spice or as a herbal preparation is common in Sri Lanka. For Ayurveda, almost all dried ginger is exported from India. It is estimated at least 5-6 kg of raw ginger is needed for the production of 1kg of dry ginger. When browsing through supermarket shelves, among ginger-based products, ginger beer is the most famous and delicious bottled drink, its flavour is unique as it is produced from local ginger variety though fleshier Rangoon and Chinese varieties are also grown in Sri Lanka. As a value-added product, Elephant House Ginger Beer could be rated as the best among similar products in the market, which is made out of using only local ginger (ginger oleoresin). The final product is made from oleoresin obtained from the dried ginger, a complex process where solvent extraction followed by evaporation of residue solvent resulting in thick slow-flowing ginger oleoresin (5-6%).

Ginger has been reported to contain usually

1-3% of volatile oil, pungent principles *viz.*, gingerols and shogaols and about 6-8 lipids and others. Ginger oil contains Zingiberene and bisabolene as major constituents along with other sesqui- and monoterpenes. Ginger oleoresin contains mainly the pungent principles of gingerols and shogaols as well as zingiberone. Shogaols have recently been found to be twice as pungent as gingerols¹⁻⁴. Gingerol and shogol are two major compounds responsible for ginger flavor; comparatively the percentage of those and the collective presence of several minor compounds in local ginger is unique for its difference from the other two varieties. When value-added products are concerned, dried ginger is a raw material that one could store for years itself and one of the main herbs used in Ayurveda. Sri Lanka imports a large amount of dried ginger for Ayurveda herbal preparations. However, apart from a few organized, systematically maintaining plantations of ginger (out growers attached to Ceylon Cold Stores) no large scale ginger cultivations supply sufficient raw material for further processing. Apart from a few products (eg. ginger preserve in sugar solution, ginger cocktail prepared from fresh ginger), there are no sufficient value-added products processing in Sri Lanka targeting the export market.

Turmeric (*Curcuma longa*)

Turmeric happened to be the most talked-about spice in the recent past due to the ban of its importation. The Sri Lankan requirement was mainly satisfied from India, the largest producer of turmeric in the world. The use of turmeric not only as a nutraceutical but also as a cosmeceutical made its current importance more than its use as a culinary spice. However, the natural appealing colour it imparts on food and also its antibacterial activity makes it a popular culinary spice as well as a herbal medicine. Value addition is commonly done to introduce turmeric as clean sound fingers or as a powder. Apart from this, turmeric oleoresin is popular as a natural colouring agent (curcumin) in many foods such as butter and margarine. A product called Vegitone happened to be established as a safe yellow colour dye prepared from turmeric for industrial use. The cosmeceutical usage of turmeric is ever-increasing for facial and body lotions and creams due to not only its historically known benefits but published scientific literature in many reputed journals

and also several patents already obtained by many countries (mainly India). As per several research papers published by Sri Lankan scientists from Universities, the Department of Export Agriculture (DEA) and by Industrial Technology Institute (ITI) curcumin content in local turmeric is much higher than the imported ones. However, as large-scale turmeric processors with improved technologies are not available in Sri Lanka, it will be hard to satisfy the turmeric requirement in the form of turmeric fingers, which was the common product imported to Sri Lanka, even though currently we have a large crop of turmeric. But it is good to see turmeric powder packets are now emerging into the market for a reasonable price. However, as it is common to find adulterated products one has to be vigilant when purchasing those powdered spices not only turmeric but other powdered spices as well.

Cinnamon (*Cinnamomum zeylinicum*)

Ceylon Cinnamon, also known as true cinnamon, is a commodity much expensive when compared to Cassia (*Cinnamomum aromaticum*). World market share for cassia variety is much more than that of Ceylon Cinnamon (85000mt:15000mt). Almost more than 95% of Ceylon cinnamon is produced in Sri Lanka while Madagascar and Seychelles are the other two major producers.

In both Cassia and Ceylon cinnamon, Cinnamaldehyde is the major compound where it is present 85-95% and 55-74% in the two volatile oils respectively. The flavour bouquet of Ceylon cinnamon is unique as in addition to cinnamic aldehyde and eugenol, several other oxygenated terpenic hydrocarbons are also found in Ceylon cinnamon. One of the major advantages of Ceylon cinnamon is that it does not contain the carcinogenic compound coumarin. Even in the instances when it is found to be present, it is very low compared to cassia (less than 0.004mg/kg).

Ceylon cinnamon bark is processed as a cigar like quill in several grades whereas Cassia is just a curled bark which is much harder when compared to Ceylon cinnamon. Presently, as a consumer item, cinnamon quills are cut in different sizes. 7.5, 10 or 12cm has a huge demand when packed in attractive packaging. In addition, cinnamon tea and cinnamon powder are the

two other major consumer products that are exported. According to recent research carried out in Sri Lanka and all over the world, it is now well-proven that cinnamon has medical benefits in blood sugar control, hypertension etc., which in turn effectively increases its market share. South American region, Scandinavia and Europe are the major consuming countries.

Cinnamon leaf oil, bark oil and oleoresin are also manufactured in Sri Lanka. Cinnamon leaf oil is a real value-added product made from cinnamon leaves that remains after getting the stems for the production of cinnamon quills, quillings, featherings and chips. As its high value is concerned the use of quills for the distillation or extraction is never taking place; instead chips and other offcuts of bark are used for the extraction purposes. Several grades of Ceylon Cinnamon bark oil depending on the high aldehyde (55-70%) and also low eugenol (1-10%) content are in the trade. Cinnamon leaf oil has only one grade which needs to be more than 75% eugenol. In addition, the minimum presence of safrole and coumarin contents are also considered by most flavour houses.

Oleoresins, oils, extracts and seasonings

With the extensive usage of natural extracts, flavour and fragrance manufacturing company's all over the world are switching to process spice oleoresins. The demand for oleoresins and seasonings has led many players including Indian spice processing giants like Synthite, Plant Lipids and Kancor, to focus on research and technology to manufacture innovative value-added products such as oleoresins, extracts like essential oils,

seasonings and organic spices. Flavours that can be used in the ready-to-cook and ready-to-eat food segments are some of the latest innovations. Some of them are isolating top aromas of spices through the carbon dioxide process for improving the fresh notes of spices in the final product. Absolutes from spices for various segments such as cosmetics, perfumes and even high-value food segments are also in demand such as new blended natural colours as per customer requirements.

Conclusion

Spices and value-added products of spices are in huge demand in the export market, particularly in Europe and the USA. The demand is ever-increasing with the growth of the population. By increasing the export of these products the nation's economy can be improved. GDP growth together with foreign exchange earnings could be much improved from the spice sector provided that the processors are knowledgeable with the current requirements of foreign buyers, in particular adherence to clean, unique Sri Lankan produce. Hence government must emphasize the promotion of high-tech equipment such as driers, sterilizers, grinders etc. for the spice processors with subsidiary prices. Though Sri Lanka is very much rich as a source of exceptional spices, unless we produce value-added spices and penetrate the modern consumers, we may remain as a bulk spice supplier allowing European, American or Indian giant companies to earn maximum profit through value addition at the destinations. Hence to get maximum economic benefits for the farmers and small scale spice suppliers, processors should switch to new technologies to produce value-added spice products.

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