IFEAT

SOCIO-ECONOMIC REPORT ON CARDAMOM[1]

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INTRODUCTION

Cardamom is known as the "Queen of Spices" and is one of the world's most expensive spices. It is the dried, fully matured capsule or fruit of several species of the genera *Elettaria, Amomum* and *Aframomum* in the family Zingiberaceae. The species of *E. cardamomum* includes most of the cultivated cardamom entering international trade including:

- Mysore cardamom, indigenous to India and has been introduced to Guatemala, Honduras, Indonesia, Tanzania, and Papua New Guinea. Mysore species dominate international trade – and are often referred to as "true cardamom".
- Malabar cardamom, indigenous to India and suited to elevations up to 500 metres. Only small quantities are traded internationally, and it sells at a discount to Mysore cardamom.

In addition, several species of "large" cardamom (*Amomum and Aframomum* species) are grown commercially in various Asian and African countries. This cardamom is known by several other names but negligible quantities enter international trade outside Asia, since they generally produce less aromatic, larger capsules of lower commercial value. Each type of cardamom has a characteristic flavour and fragrance but both types of seeds offer very similar properties.

Cardamom is recognised by its small seed pods: triangular in cross-section and spindle-shaped, with a thin, papery outer shell and small, black seeds. Green cardamom - *Elettaria* pods - are light green and smaller, while black cardamom - *Amomum* pods - are larger and dark brown.

This report relates almost solely to small "true" cardamom.

GROWTH, CULTIVATION, AND HARVESTING

Cardamom is a demanding crop in all respects from the initial planting, husbandry, and pruning, through to harvesting and processing of the seed capsules. The plant can be over two metres in height but the seed capsules emerge from the rhizome at ground level. Moreover, the individual capsules ripen at different stages and to produce high quality green cured capsules, it is necessary to pick capsules individually, a skilled operation requiring care and good judgement. Women dominate cardamom harvesting while men usually harvest the neighbouring coffee crop.

Cardamom is a large, perennial aromatic herb, with a tuberous, horizontal, hard, and branched rhizome, with fibrous roots that extend horizontally up to 1.5 metres (m) away from the rhizome. It has main stems that reach a height of between 2 m and 3 m. A stem can have one or two flower spikes and up to 40 clusters that can carry five to 10 flowers each. The flowers self-fertilise and are cross-pollinated by the action of different types of bees. The fruit (pod) begins as a green coloured capsule and at maturity becomes yellow-greenish in colour, known in Guatemala as cereza when green and pergamino when dehydrated. The seeds known as oro, have a strong aroma and flavour. They are black, pyramidal, 3 mm to 4 mm long, with a coarse surface. Each pod holds around 20 small black seeds, containing the essential oil.

Cardamom is propagated mainly through seeds and through suckers, each consisting of at least one old and one young aerial shoot. Seedlings are normally raised in primary and secondary nurseries.

Cardamom grows at higher altitudes in tropical forests. In Guatemala some are found in areas fully exposed to the sun, but efforts are being made to move to forested areas to facilitate conservation. If cardamom seeds are planted, the first harvest is obtained after three years, but if the rhizome is planted, then the harvest is one year earlier. Fruit ripening begins about five months after flowering.

Yields vary depending on the location, the variety planted, climatic conditions, and the level of crop maintenance. In Guatemala, with an annual rainfall ranging from 2 m to 3 m and an average temperature of 22°, the average yield is between 35 kg and 45 kg per hectare (ha) of dried cardamom, considering a green/dried ratio of 5:1 (20% yield). Altitude will not only affect yields but also the flavour profile. Thus, more cineole notes at higher altitudes and more terpineol acetate at lower altitudes.

In India cardamom is grown in areas where annual rainfall ranges from 1,500 mm to 4,000 mm, temperatures range from 10°C to 35°C, and at an altitude of 600 m to 1,200 m above sea level. It is grown in forest loamy soils which are usually acidic with a pH range of 5.0 to 6.5. For a detailed discussion of all aspects of cardamom cultivation, including varieties, propagation, nurseries, planting, spacing, manuring, irrigation, and weed control, see Chakravarthy (2021) and Purseglove (1981).

The ripe fruit is harvested every one or two months, depending on the region or age of the plantation, but in Guatemala the bulk of production is obtained in the dry season after October and mainly in January. The green fruits (cereza) are harvested manually from the bunch, starting at the base with the ripest. For quality reasons, it is important that the seeds inside the green pods have changed colour from white to brown or black. To ensure the maturity and uniformity of the seed it is recommended that harvesting takes place every 35 to 40 days. In Guatemala the harvest lasts approximately seven months and the percentages of production each month are estimated at 5%, 15%, 30%, 25%, 15%, 8% and 2%. In India the optimum season is from June to December with peak harvest in October to November. Picking is carried out at an interval of 15 to 30 days with five to six pickings in a year. Ripe capsules are harvested to get maximum green colouration during curing. Ideally those fruits which are just ripe, but not fully, are picked. Fully ripe fruits tend to split on drying and do not develop the desirable dark green colour.

Cardamom is produced by smallholders and on estates but smallholder producers dominate. Sometimes cardamom is grown with other crops, particularly coffee. Because of inter-cropping it is not always easy to obtain a breakdown of production and marketing costs when these activities are inextricably mixed.

PROCESSING AND PRODUCTS

Immediately after harvesting the cardamom is dried either naturally (sun drying) for several days or flue curing. The latter produces a better product. In Guatemala there is no sun drying.

Flue curing

After harvesting, the seed capsules are immediately cured in a kiln and finally they are subjected to careful sorting by colour and size, and then into whole and split grades. Following harvesting the green pods must be dehydrated within 48 hours to ensure that the pods do not rot. Dehydration is invariably done in ovens and the ratio of green to dry pods is usually 5: 1, i.e., there is an approximate moisture reduction of 80%.

The cardamom pods can be transformed into several different products including spices, essential oils, absolutes, CO2 extracts, and other derivatives (e.g., oleoresins, terphenyl acetate). Dried fruit or cardamom capsule is the dominant product traded. Cardamom can be found as whole cardamom, cardamom seeds, or in ground form and it is also used as cardamom oil and as an oleoresin.

Spices are the dominant use of cardamom and are available in a wide range of qualities and grades (see later).

Essential oils are obtained by steam distillation or hydro distillation of pods, which are invariably those pods not suitable to be sold as a spice. Dried pods are ground to facilitate better oil extraction, before being steam distilled. The distillation process takes between four to five hours and the oil produced undergoes a final preparation to allow it to reach its full aromatic potential. It is estimated that annual production of cardamom oil in Guatemala ranges between 30 - 35 metric tonnes (MT) while in India production is estimated at 35 - 40 MT. There is negligible distillation in cardamom importing countries. In terms of total cardamom production, essential oil output is small.

Absolutes – produced by hexane extraction.

CO2 extraction - supercritical CO2 extraction is a clean technology used to obtain extracts from natural materials and offers superior quality while being benign to the environment. It is free of harmful organic solvents or alcohol and it is eco-friendly being performed at low temperatures without thermal degradation of valuable ingredients. Hence it is very much appreciated by flavourists and perfumers but it is

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very expensive. There is some CO2 extraction in importing countries, but output is thought to be very small.

Other derivatives: extraction of natural terphenyl acetate from cardamom oil which is one of the main constituents of cardamom.

Each client invariably has one standard of olfactive and analytical composition. At the source, the different companies that transform the cardamom into an ingredient, know how to choose their raw material (pods) to comply with their clients' requirements. CO2 extraction and the production of other derivatives, including absolutes, is not currently undertaken in Guatemala although some production is undertaken in India and some consuming countries.

USES AND PRODUCTS

Cardamom use has a very long history being one of the world's most ancient spices and many historical texts refer to its flavouring and medicinal uses. It was used by the Egyptians as a tooth cleaner, and by the Greeks and Romans as a perfume. The Vikings used it in Scandinavia over a thousand years ago, where it is still a popular flavouring ingredient in baked goods. Today, the Middle East dominates cardamom consumption, accounting for approximately two-thirds of global cardamom imports. These imports are predominantly high-quality cardamom for use in gahwa coffee – a strong cardamom coffee, that is an unavoidable habit of the Arab lifestyle. Its main use is as a seasoning in coffee and tea where it is used in its own right. It is also used in combination and works in a range of flavours, predominantly natural flavours.

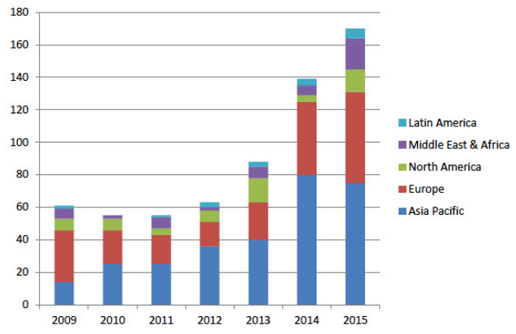
Globally, one estimate suggests that:

- At least 60% of cardamom is used in flavours, predominantly beverages, food, and snacks. As a flavouring agent in beverages, it is particularly used in coffee and tea. Also, in the food industry for flavouring curries and meat dishes, sweets, confectioneries, in bakery products, and as an ingredient of curry (masala) powder. In India it is also used as a taste enhancer in chewing tobacco.
- 35% in fragrances: fine fragrances, body care, home care, and candles. Perfumers describe cardamon as having warm, sweet, woody, spicy, balsamic, resinous, and peppery characteristics. It has a lot more of these characteristics than other spicy materials such as cinnamon, clove bud, black pepper, and ginger. It is used in a range of fragrances from fine to home fragrances. In perfumery it can only be used in small dosages as it is very strong.
- 5% in aromatherapy: this is growing. It has well documented health benefits and is used in Ayurveda and Chinese medicine as a powerful aromatic, stimulant, carminative, stomachic, and diuretic.

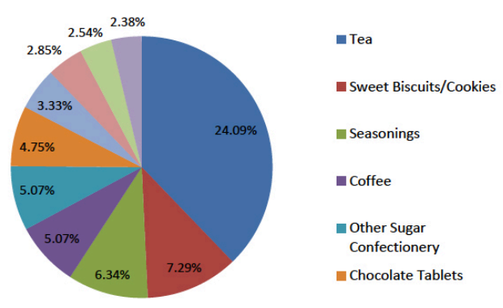
It is increasingly being used in new products for flavouring uses as the diagram illustrates.

Cardamom Global New Product Introductions
Products of Note

Cardamom New Product Introductions, Global 2009-2015



Cardamom New Product Introductions, Global 2009-2015 by Top Sub-Category



Source: Mintel GNPD

FONA INTERNATIONAL

QUALITY AND GRADES

Cardamon Spice
Both Guatemala and India have complex cardamom grading systems and nomenclature. There are several important factors influencing the quality including the weight in grams per litre (density), the proportion of open pods, the proportion of thrips and the colour. In Guatemala there can be more than 12 different grades of cardamom pods but this mainly relates to cardamom's use as a spice.

The different qualities depend on the maturation grade of the pod when harvested. The greener the pod then the fresher, while yellow seeds are over matured. Examples of Guatemalan grades for conventional cardamom:

- Jumbo green: diameter of 9 mm with an average density of >410 gr/lt
- Large green: diameter of 8 mm with an average density of >400 gr/lt
- Fancy green: diameter of 7 mm with an average density of >380 gr/lt
- Small green: diameter of 5 mm with an average density of >380 gr/lt
- MYQ (mixed yellow quality): mix of sizes and colours with an average density of >360 gr/lt
- Green open: mix of sizes with an average density of >360 gr/lt
- Seeds or oro: mix of sizes with an average > 650 gr/lt

Cardamom Oil
In Guatemala less than 5% of cardamom production is steam distilled to produce an essential oil. The oil produced is a colourless to pale yellow liquid.

- Specific Gravity (200C): (0.918-0.940)
- Refractive Index (200C): (1.460-1.469)
- Optical Rotation (200C): (Between +24˚ and + 39˚)

The main chemical constituents (determined by gas chromatography) of Guatemalan distilled cardamom oil are:

- a-pinene 1-2%
- eucalyptol 25-37%
- terpineol-4 0.5-1.5%
- terpineol, alpha 1-3%
- terpineol acetate, alpha 35-45%

Thus, the two main constituents are eucalyptol, which gives the freshness to the top notes of the oil, and terpineol acetate, which is a more complex aroma giving a more aromatic profile. It is unusual to find both these components together. Indian oil smells more of cineole and eucalyptus in character than Guatemalan oil which is higher in terpineol acetate. The greener the pod then the higher the eucalyptol level, as you move towards more yellowish pods then the terpineol acetate increases and gives more aromatic notes. The "large" cardamom (*Amomum* and *Aframomum* species) has more cineol and hence eucalyptus characteristics. It tends to be dried in more smoky conditions and has a phenolic note. Since it is not included on the FEMA GRAS list this acts as a constraint on its use.

PERCENTAGE COMPOSITION OF CARDAMOM VOLATILE FROM DIFFERENT SOURCES

Component	Var. Malabar (Ceylon)	Var. Malabar (Guatemala)	Var. Mysore	Sri Lanka (Wild)
α-Pinene	1.10	0.71	1.40	13.00
Camphene	0.02	0.03	0.04	0.13
Sabinene	2.50	3.40	3.10	4.90
β-Pinene	0.20	0.34	0.26	4.90
Myrcene + terpinene	1.80	1.50	1.10	2.50
α-Phellandrene	0.01	0.01	0.01	0.42
D-Limonene	0.02	0.12	0.14	2.10
1,8-Cineole	31.0	23.4	44.0	3.30
γ-Terpinene	0.12	0.34	0.10	22.2
Linalool	2.10	4.50	3.00	3.70
Citronellal	0.01	0.04	0.06	0.13
4-Terpineol	0.14	0.28	0.87	15.3
α-Terpineol	1.40	1.90	1.50	0.86

As with other essential oils, especially those with high and fluctuating prices, adulteration of cardamom oil is an issue. This is partly illustrated by the lower prices at which some oil is offered on the market, sometimes designated as "commercial quality". Synthetic terpene acetate is one main adulterant. Adulteration can be minimised with greater traceability and transparency.

PRODUCTION

World production of cardamom is dominated by Guatemala and India. In the mid 1970s, annual global production was estimated at 13,000 – 14,000 MT with Guatemala (6,000 – 8,000 MT) and India (3,500 – 5,000 MT) dominating production. Other producers included Honduras (350 – 400 MT) and Papua New Guinea.

Currently global production is in the region of 55,000 MT with Guatemala, the world's largest producer accounting for approximately 60% of global output. It is followed by India but climatic factors have seen a substantial fall in recent Indian output. It is estimated that Guatemala's current annual production fluctuates around 35,000 MT.

Guatemala

Cardamom is produced as a cash crop by 350,000 smallholder producers in the poorest regions of Guatemala on 63,000 ha of land. Production is mainly concentrated in the departments of Alta Verapaz, Baja Verapaz, Izabal, Huehuetenango, and Quiché, where it is often intercropped with coffee. Cardamom was introduced into Guatemala in 1914 to diversify agricultural production but it only became a major producer and exporter from the 1970s. The altitude, climate, and rich soils in Guatemala were factors in the crop's success, leading to it becoming the world's largest exporter.

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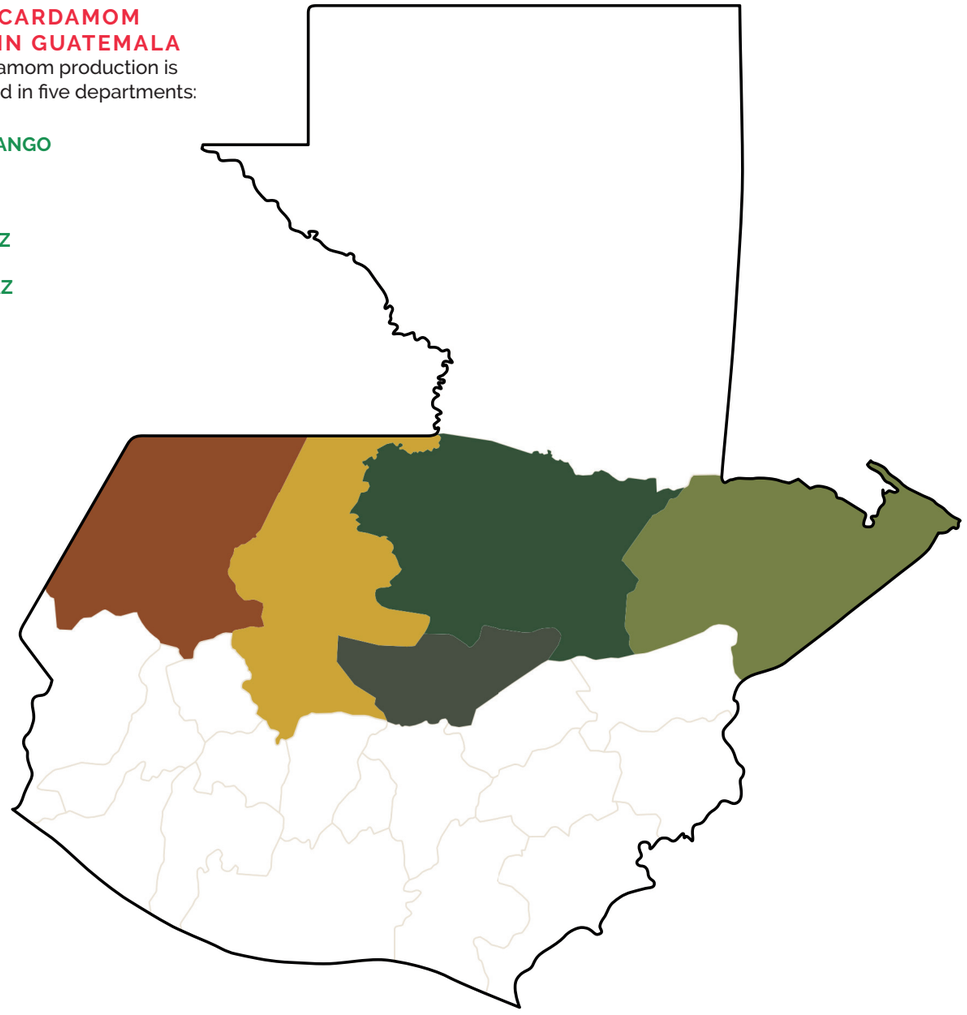
LOCATION OF CARDAMOM PRODUCTION IN GUATEMALA

In Guatemala, cardamom production is mainly concentrated in five departments:

- HUEHUETENANGO
- QUICHÉ
- ALTA VERAPAZ
- BAJA VERAPAZ
- IZABAL



Annual exports of pergamino (dried cardamom) were relatively stable, fluctuating between 32,000 MT and 37,000 MT between 2015 and 2020. In sharp contrast, the rise of cardamom prices in recent years resulted in a dramatic increase in the value of exports, which exceeded US$ 1 billion in 2020 – higher than the estimated international trade in pepper. Estimates of Guatemalan production for the 2022-23 harvest range between 38,000 and 40,000 MT. This is higher than the 2020-21 crop, which was badly impacted in November 2020 by hurricanes Eta and Iota, the worst tropical storms in decades, causing heavy rains, flooding, and avalanches in the growing areas.

Unlike India, domestic consumption is negligible and almost all cardamom production is exported predominantly as a dried spice. Thus, 95% of the seeds or pods are exported as such and only 5% used in the country to be distilled and exported as an oil and related products. The Middle East is the dominant export region, with Saudi Arabia and the UAE being the main destinations, although other important export markets include Bangladesh, Pakistan, Egypt, Kuwait, Jordan, Syria, and Singapore.

After harvesting the green cardamom pods are dehydrated and there are some 3,500 dehydration ovens in the growing areas. The pods need to be dehydrated within 36 to 48 hours or they will begin to rot. Hence a grower's location is a key factor in delivering them to intermediaries and/or the ovens. There are many thousands of intermediaries who are usually those who have vehicles in the communities. There can be one or two or even more intermediaries, it depends how far away they are from the dehydration ovens. Once pods are dehydrated to *pergamino* there are several options prior to export. There may be one or several intermediaries between the oven and the final purchaser. Sometimes there may be no intermediaries between the ovens and the final purchasers - who are the exporters or the distillers.

GUATEMALA CARDAMOM VALUE CHAIN

SOURCE: ADAPTED FROM ARAGON (2021)

Small Producers	Intermediaries (Coyotes)	Dehydration Ovens	Intermediaries (Coyotes)	Exporters or Distillers
Approx 45,000 cultivated 350,000 families producing in different regions of Guatemala	Usually people from the communities which own a vehicle Buy the green seeds named "cereza" from producers and bring them to the oven, they have 48h to transport the green pod Can be 1 or more intermediaries between producers & ovens	Dry the green seeds into dried seeds "pergamino" Usually finance the first intermediaries 3,500 ovens distributed within the cultivated area	Collect from various ovens and sell to exporters or distillers Can be 1 or more intermediaries between ovens and final purchaser	Exporters separate the seeds into 12 grades Distillers process the dried pod to produce oil

India

Cardamom - *Elettaria cardamomum* (L.) - is native to the evergreen rain forests of the Western Ghats in South India and is cultivated in the states of Kerala, Karnataka, and Tamil Nadu. Thick shady areas with loamy soil are ideal for cultivating cardamom.

Black cardamom, also known as brown, greater, large, longer, or Nepal cardamom, comes from the species *Amomum subulatum* and is native to the eastern Himalayas and is mostly cultivated in Eastern Nepal, Sikkim, and parts of the Darjeeling district in West Bengal, India, and southern Bhutan. It is also produced in Sri Lanka.

For centuries India used to be the dominant global producer but has in recent decades been overtaken by Guatemala. Recently climatic factors in India have led to a substantial fall in Indian output. Current production for the 2022-23 season is estimated at 15,000 - 17,000 MT but at the time of writing, the harvesting had not been completed.

Cardamom oil production in India is estimated at approximately 35 - 40 MT of which a sizeable amount is consumed domestically. Availability of cardamom is not a constraint on oil production – since only a small proportion of cardamom is processed into oil.

The diagram on page 26 (based on Hameedu 2014) summarises the cardamom supply chain in Kerala, the dominant producing region. It shows the channels through which the cardamom passes and the key players and activities involved. The first column indicates the major functions in the chain, namely production, collection, trading, and marketing of cardamom. The second column indicates the key players and their activities. Thus, following production and harvesting of the cardamom capsules, they are washed and dried in curing chambers – a process taking 18 to 24 hours. The dried capsules are then graded based on size and colour and then moved along the supply chain. They are transported by road via collectors, village traders, merchants, wholesalers, and eventually sold in domestic or foreign markets. The third column lists the major players involved from farmers through to traders, input suppliers, exporters, and then to customers. The final column lists the support services that assist and facilitate the key players in performing their functions. These include government institutions, non-government organisations, auctions, farmers' organisations, warehouses, credit, and input suppliers. Approximately half of Indian cardamom production is sold through public auctions, the remainder in the open market.

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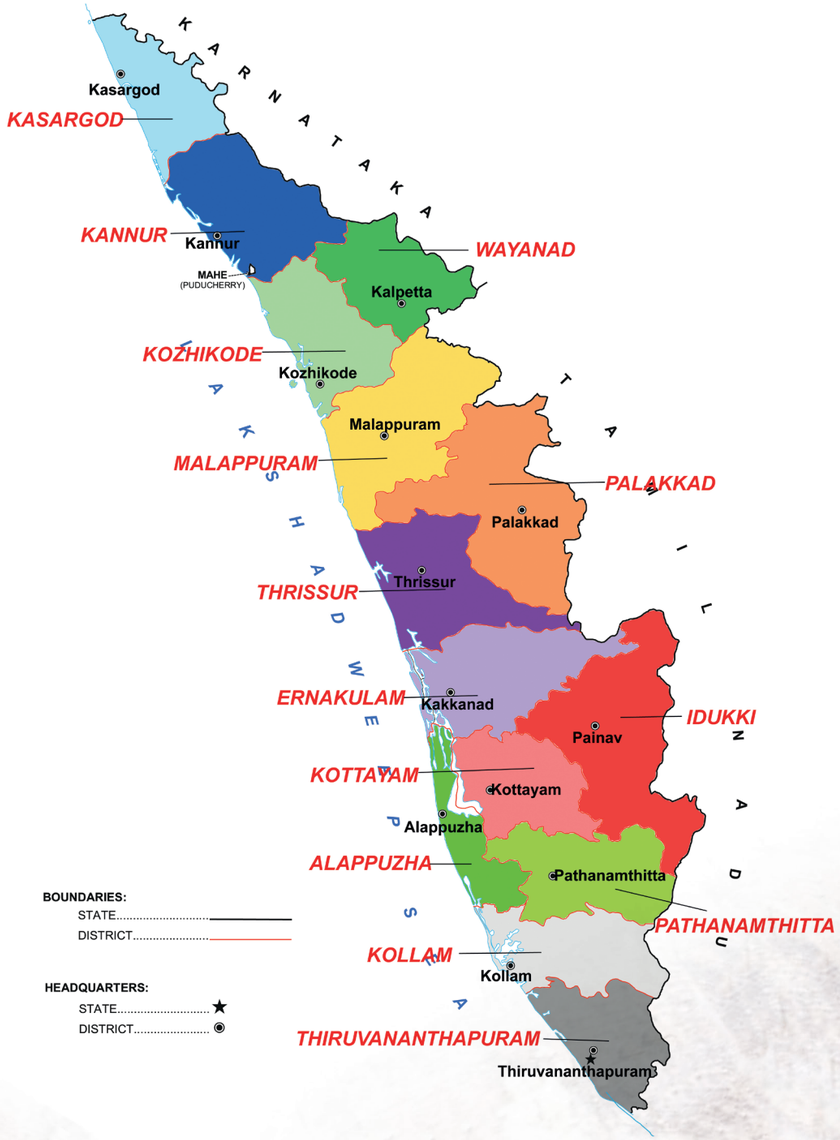
INDIA

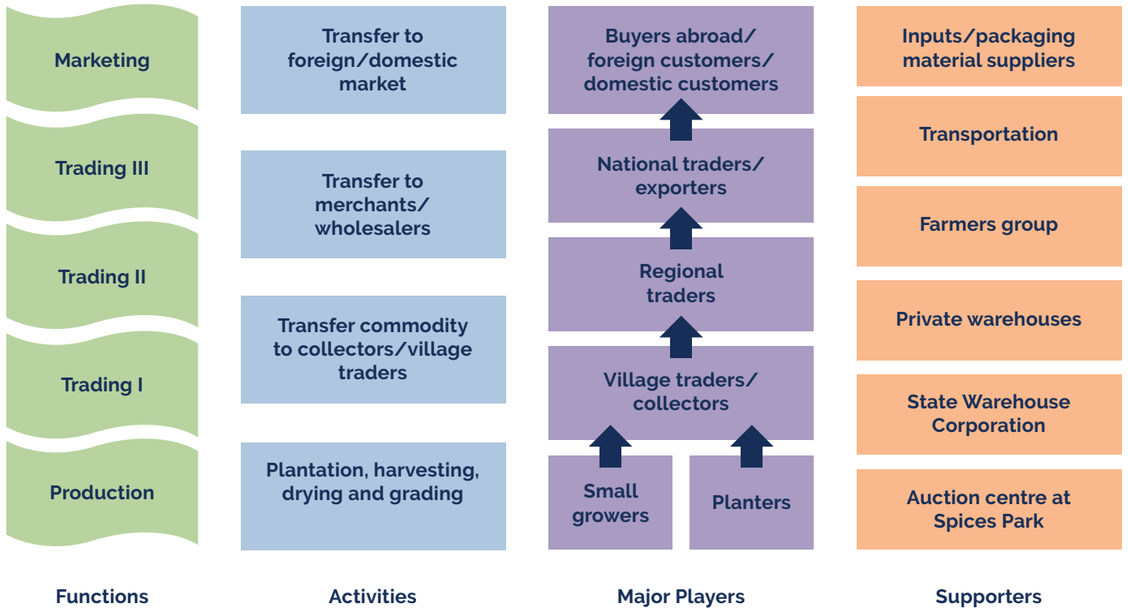
KERALA



Map credit: Kambliyil, CC BY-SA 4.0 <https://creativecommons.org/licenses/by-sa/4.0>, via Wikimedia Commons

SOCIO-ECONOMIC REPORT ON CARDAMOM

INDIA CARDAMOM SUPPLY CHAIN
SOURCE: ADAPTED FROM HAMEEDU (2014)



Papua New Guinea
In PNG cardamom is grown by smallholders and on estates. In small farmers' gardens the crop is usually planted in monoculture on relatively fertile soils; production technology is simple and effective using low inputs. The gestation period is two and a half to three years. Mean yields have been estimated to range from 120 to 200 kg/ha dried capsules. Mean labour requirements were estimated at 0.5 to one person per day per kg of dry cardamom produced. Estate production technology is more advanced with fertilisers, pesticides, and more regular maintenance. Yields can range from 450 to 750 kg/ha or more dry capsules.

Honduras
Cardamom was introduced into Honduras in the late 1970s by large estates on the border with Guatemala. The stimulus was the poor coffee price along with awareness of Guatemala's increasing export success. It was then adopted more widely by both estates and smallholders at altitudes between 800 and 1,000 metres, intercropped with coffee and often on slopes as steep as 45°. Production is concentrated in the mountainous north-western Departments of Copan, Santa, Barvara, and Cortes.

Around the year 2000 annual production was estimated at 250 - 270 MT. No direct exports have been undertaken but rather capsules and seeds are sold to neighbouring Guatemala for re-export. Some production of cardamom oil was undertaken from the late 1980s but is now thought to be very small or non-existent. Several factors account for this, namely limited availability of seed, because of sales to Guatemala; limited knowledge of essential oil production, and a reluctance to invest in further added value operations.

Tanzania
In the mid-1970s Tanzania ranked as the world's third-largest producer of cardamom, accounting for an estimated 20% of global output, producing both green and black cardamom. However, by 2011 this had fallen to approximately 3% of global volume. Cardamom is still produced in the Usambara Mountains in the northeast region of Tanga, the Uluguru Mountains in central Tanzania, and in the southern highlands, particularly the Mbeya region, all good natural environments for growing cardamom. Production is still small, with estimated annual production of 150 – 200 MT of dried cardamom.

Sri Lanka
Sri Lanka – also known as the "Spice Islands" - is a small producer of cardamom and is most unlikely to become a sizeable producer. It is grown in the central hill country at elevations over 600 m. There are three varieties classified by the shape of the inflorescence, namely Malabar, Mysore, and Vazhukka. While cardamom can be propagated both through suckers and seedlings, suckers are better and commonly used. It starts to bear three years after planting and the harvesting takes place from September to January. Capsules are picked before they are fully ripe and clipped off using scissors. Harvesting is done at three to six week intervals. The capsules are then washed to remove dirt and borer-attacked capsules, then well drained and dipped into a 2% solution of sodium carbonate (washing soda) for 10 - 15 minutes to help retain the green colour. Drying is done in hot air barns in which capsules are spread on shallow wire mesh-bottomed trays and placed on shelves in the chamber at 45 - 50°C. The drying process takes place over 35 – 40 hours in curing chambers with trays interchanged every 10 – 12 hours. After drying, the capsules are rubbed on wire mesh to remove stalks and then winnowed. The final product is stored away from strong sunlight in black polythene sacks to preserve the colour. The dried yield is around 60 kg/ha but can be as high as 250 kg /ha under good management. The cardamom is graded into five categories according to the SLS 166:7980 standards. Production in the early 2000s ranged between 60 – 70 MT per year.

PRICES
For a variety of reasons cardamom prices fluctuate widely and when prices are low smallholders tend to neglect harvesting and decrease plantings, leading to lower production. In periods of higher prices, the opposite is true. The 2019-20 harvest began in October and thanks to favourable weather and higher yields a good crop was anticipated leading to a price decrease. However, the impact of COVID-19 and climatic factors could limit this downward price pressure, as could a projected decrease in 2022-23 production.

As regards cardamom oil prices, for several years, until late 2018, the oil price remained relatively stable at around US$ 200/kg. During late 2018 and until recently, supply issues, particularly in India, led to a three-fold increase in oil prices.

SOCIO-ECONOMIC IMPACT

Guatemala
In Guatemala cardamom is produced as a cash crop by 350,000 smallholder producers in some of the poorest regions of the country producing cardamom on plots of 0.5 to 1 ha covering an estimated surface area of 45,000 ha. Guatemala is one of the countries with the largest indigenous populations on the American continent and up to six different indigenous communities work in cardamom production. Moreover, since cardamom is not consumed locally it represents a vital cash crop to these growers as well as others in the value chain. As in India, approximately half the labour force is female, who dominate harvesting while the men are working on planting and crop maintenance.

Alongside the hundreds of thousands of growers there are many other stakeholders in the cardamom value chain moving the green cardamom from the field to the final consumer. These include numerous small and wholesale intermediaries, oven operators, wholesale distributors, raw material and other input suppliers, transport operatives, processors, traders, exporters, and retailers.

As production volumes increased from the 1970s so exports began to have greater economic importance. Along with coffee, sugar, and bananas, cardamom has now become one of Guatemala's largest agricultural exports. There has been a sizeable upward trend in cardamom's foreign exchange earnings but with substantial annual fluctuations. Thus, the value of cardamom pod exports increased five-fold between 2016 and 2020. Values rose from US$229 m in 2016; US$367 m. in 2017; US$434 m in 2018; US$648 m 2019; and US$1,134 m in 2020, reflecting the rapid rise in cardamom prices in recent years. Export earnings are likely to decline in the early 2020s.

In addition, cardamom generates environmental benefits since it is one of the best land uses, including the protection and conservation of the local biodiversity if the crop is not produced in full sun exposure.

India
More than 50,000 people are involved in the cardamom industry in India. The Spices Board of India has produced detailed data on cardamom production, producers, area, and exports. The table below shows that almost 70,000 ha are devoted to small cardamom in India, although there is some intercropping. Production has shown wide annual fluctuations, peaking recently in 2020/21 at approximately 22,250 MT for small cardamom and 8,800 MT for larger cardamom, according to Spice Board data.

INDIA: CARDAMOM AREA (HA) & PRODUCTION (TONNES)

	2016-17		2017-18		2018-19		2019-20*		2020-21*	
	Area	Production	Area	Production	Area	Production	Area	Production	Area	Production
Cardamom (Small)	69,357	17,990	69,330	20,650	69,132	12,940	69,994	11,235	69,190	22,520
Cardamom (Large)	26,617	5,572	26,617	5,906	42,826	8,669	44,082	8,530	44,701	8,803

*Figures subject to revision. Source: Spices Board India

Some 60% of growers are over 40 years old and 60% have had secondary education and above, while 14% have had no formal education. Some 77% of farms are below 2 ha, 19% range between 2 - 4 ha with 4% above 5 ha. Just over 80% is monocrop, while 39% had annual production below 3 MT, 57% of producers ranged between 3 – 6 MT and 4% of producers had annual production above 6 MT. One quarter of producers had yields less than 0.5 MT, 62% had yields of 0.5 – 1.0 MT and only 13% had yields of 1.0 - 1.5 MT.

Field survey data are also collected on cardamom production and assembling costs, which totalled an estimated 941 Rp (US$ 12.5) per kg.

This can be broken down into:

1. Farmer/grower costs estimated at 775 Rp/kg, of which labour accounts for 500 Rp/kg, processing costs 125 Rp/kg and other input costs at 100 Rp/kg. The average

price is 830 Rp/kg.

2. Local trader and wholesaler assembling costs add a further 47 Rp/kg and 37 Rp/kg respectively.

Cardamom cultivation not only has a great impact by providing employment and income-earning opportunities but also the plantations attract tourists and can give further earnings to the growers. In addition, cardamom exports make a considerable contribution to Indian export earnings, although as the table illustrates, both the volume and value of exports have shown wide annual fluctuation.

INDIA: CARDAMOM EXPORTS 2016-17 TO 2020-21
SOURCE: SPICES BOARD OF INDIA

(Quantity: Tonnes & Value Rupees. Millions)

	2016-17		2017-18		2018-19		2019-20*		2020-21*	
	QTY	VALUE	QTY	VALUE	QTY	VALUE	QTY	VALUE	QTY	VALUE
Cardamom (Small)	3,850	4,215	5,680	6,090.8	2,850	3,562.5	1,850	4,253.7	6,500	11,067.5
Cardamom (Large)	780	826.5	760	564.66	860	610.6	1,310	709	1,325	912.6

CHALLENGES AND SUSTAINABILITY

The F&F sector is making serious efforts to implement sustainable practices when sourcing natural ingredients – and cardamom is no exception. In Guatemala and India efforts are being made to implement sustainable and traceability practices to try to ensure a fair and transparent relationship with the producers alongside efforts to protect the environment and its biodiversity.

The cardamom sector faces many challenges which vary between the two major producing countries. The challenges include:

- Price volatility – cardamom is sold predominantly as a spice which limits the ability to limit price fluctuations.
- Dependence on many intermediaries, particularly in Guatemala, leading to a long value chain and substantially reducing transparency and traceability.
- Issues of low production yields and quality in part due to diseases such as thrips which lower the quality of the seeds.
- Use of forbidden chemicals leading to pesticide residues on the cardamom pods.
- Location of dehydration ovens – often a long distance from cooperatives.
- End use companies are increasingly requiring traceability for their ingredients. The long supply chain in Guatemala involving many intermediaries ("coyotes") makes implementing increasing client demands for traceability more difficult. There are often many intermediaries both for green and dried cardamom, making it difficult to track the product, especially when dealing with very small lots of a few kgs. In addition, intermediaries are often reluctant to divulge their sources. To try to overcome this some companies try to incorporate intermediaries in their supply chain to facilitate greater traceability and transparency.

Other actions being adopted in an effort to overcome these challenges include:

- Giving technical assistance at source to facilitate better practices and higher yields, along with improved quality and fewer pesticides.
- Integrating intermediaries as part of the value chain, thus raising transparency, and helping to integrate the local actors and make monitoring and traceability easier to establish.
- Introduction of efficient ovens operated directly by grower cooperatives or the establishment of ovens in distant regions close to producers so that there are fewer intermediaries involved. This keeps the value of drying within local communities and helps strengthen the cooperatives and cardamom production.
- Price volatility can be limited by being within proximity of producers and the implementation of sustainable value chains.
- Most cardamom is grown under some form of cover but if grown under full exposure to the sun there can be issues of deforestation and biodiversity. In some areas of Guatemala trees are being added over the production site to encourage forestation and biodiversity.
- Most Guatemalan cardamom production is integrated into the forest and the day-to-day living of the people as well as protecting the biodiversity.
- Following processing the waste products are utilised for a variety of purposes including sources of energy for the boilers and as manure.

Pests and diseases

In both Guatemala and India pests and diseases are a major problem for cardamom. In Guatemala thrips (*Liothrips vaneeckei*, *Frankliniella occidentales*, *Thrips palmi*) damage around 20% of the total harvest. Thrips stop the seed maturing and damage the husks, producing small pods which are difficult to sell in the spice market.

The use of insecticides among a few producers around Guatemala and India has resulted in traces of chemicals in the final product, but also the interruption of the reproduction cycles of pollinating insects. However, given the extent of the cardamom production, most batches are compliant with pesticide limits, even if it is better to test systematically.

Training needs to be implemented at the source, including regulation of shade, pruning, cleaning of the crop and the use of biological controllers to regulate the management of the thrips in a more agro-ecological way. However, in India pesticide residue is a major problem and limits the meeting of the regulatory requirements. The regulations are becoming more demanding with reduced levels of PPM (parts per million) requirements.

CONCLUSIONS

Cardamom is the black seed contained in the capsular green fruit of the plant E. *cardamomum*, known as small cardamom. It is one of the world's most valuable spices with recent annual export value in excess of US$ 1.0 billion. Production is dominated by two countries, Guatemala and India, although several other tropical countries produce both small cardamom and the larger cardamom (from *Amomum* and *Aframomum* species). Over the past few decades, the trend in production is upwards and current annual production of small cardamom exceeds 55,000 MT, with Guatemala accounting for approximately 60%. Almost all Guatemala production is exported, but India consumes a sizable proportion domestically. Cardamom is used in both flavours (c. 60%), especially beverages, and fragrances (c. 30%) with small but growing quantities in aromatherapy. It is primarily consumed as a spice, while cardamom oil output is small. Estimated annual oil production in Guatemala is between 30 - 35 MT and in India production is around 35 - 40 MT. There is negligible distillation in cardamom importing countries. Small quantities of expensive CO2 extract are also produced. The crop is produced by smallholders on small plots of land ranging from 0.5 ha to 5 ha. The crop is vital to the livelihoods of many hundreds of thousands of people: there are an estimated 350,000 smallholder producers of cardamom in Guatemala and some 50,000 in India. In addition, there are many thousands working in the cardamom supply chains: collectors, traders, warehouse keepers, distillers, input and packaging suppliers, farmers' groups, transport agents, auctioneers, exporters etc.

The cardamom sectors in both Guatemala and India face many challenges: price volatility, pests and diseases, pesticide residues, long supply chains, issues relating to quality and yields. In both countries considerable efforts are being made to overcome these challenges, including technical support and processing improvements. In addition, efforts continue to protect the environment and its biodiversity including implementing sustainable and traceability practices to try to ensure a fair and transparent relationship with the producers, many tens of thousands of whom are dependent on cardamom for their livelihoods.

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1 This article is based partly on the Cardamom Session held at IFEAT's Online Conference 9th - 10th November 2021. Alongside presentations from Elisa Aragon and Mithun Chakravarthy Rajamannar, the two other presenters, Jill Costa and John Wright, discussed the fragrance and flavour aspects of cardamom respectively.

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