

Lecture 36
Spice Crops



Spices are dried plant product which add flavor, relish, and piquancy to food.
All parts of the plant may be used as spices.
The “zing” comes from essential oils, flammable terpene compounds.
In general spices are tropical plants while their temperate counterparts are known as herbs.

Spices



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Romance of Spices

Spices were very important to early civilization because of their many uses including food preservatives, balms, medicinals, aphrodisiacs, and perfumes.

This led to a very early trade in spices.

Even in biblical times oriental spices reached the near east through the ancient spice route, probably carried along on the silk road but also by sea from China to India, and to Arabia, (via the Red Sea or Persian gulf) and ultimately to Europe through present day Turkey (Constantinople).

The Old Testament mentions anise, basil, balm, cassia, cinnamon, coriander, frankincense, marjoram, mint, myrrh, nutmeg, and thyme.

Cassia and cinnamon while mentioned in the bible do not grow in the Mideast but were imported from the Far East.

The spice merchants kept the origin a trade secret and for years Europeans thought Arabia was the source of spices.

The spice trade was controlled by Arab merchants and Venetian merchants were the middlemen until their monopoly was broken by the Portuguese who found a sea route around Africa to India.

The age of exploration was brought about originally to find a quick route to the far east for valuable products including spices.

Thus, the "discovery" of America by Columbus is part of the romance of spices.

When the origin of spices were discovered, European powers attempted to control their production and trade through large companies such as The Dutch and English East India Company.

Five spices account for >75% of world trade

Black pepper	33%
Capsicums	22%
Cinnamon	10%
Turmeric	8%
Ginger	6%

Spice Trades

Europe is the greatest world spice importer—
leading with Germany

United States is the world's leading spice
importing country in both volume and value

Japan is 2nd worldwide importing country

Spice Trades

Port of Baltimore is the traditional Port of Entry
for American-bound spices

Baltimore is also home to McCormick's which
owns Ducros [France] and Schwartz [UK]

American Spice Trades Association (ASTA)
maintains quality standards and promotes
marketing of spices

Major Exporting Countries

Asia	Africa	Americas
India	Madagascar	Brazil
Indonesia		Mexico
Malaysia		Guatemala
Sri Lanka		
China		

Black Pepper: *Piper nigrum*, Piperaceae

Piper is indigenous to the southwest (Malabar) coast of India and is now extensively cultivated in southeast Asia.

It is presently planted in the Amazon area of Brazil (Pará).

The plant is adapted to Af climates as it flourishes in warm moist conditions.

Piper is a perennial vine normally propagated by cuttings.

Seedlings take 4 to 5 years to bear; cuttings take 3 years.

It is trained to living trees or hardwood supports.




Piper species

- P. nigrum*
- P. longum*
- P. guiniensis*
- P. cubeba*



Piper guiniensis



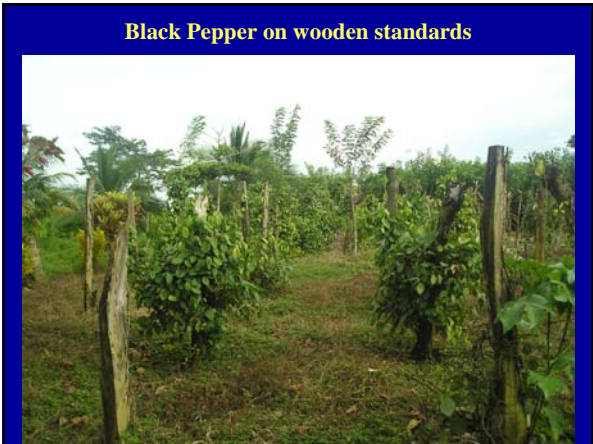
Leaves are more commonly used as piquant flavoring. Known in Nigeria as "Hot Leaf"

Dried fruits also used in the same manner as peppercorns.



Black pepper on *Erythrina* supports—Nicaragua

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Maximum yield is achieved in 8–12 years but declines after 20 years.

There are two spice products: black pepper and white pepper.

Black pepper is the table spice but is widely used to flavor and preserve meat (particularly sausage, pepperoni, pastrami (pepper beef).

Black pepper is prepared by harvesting the ripe (red) berries, steeping them in boiling water for about 10 minutes, and then sun drying for about 3–4 days.

The hot water turns the skin black.

The end product is dried black pepper.

It can be used whole, as peppercorns, or can be ground producing the familiar gray product.

Fresh pepper is quite pungent and loses quality upon aging.

Hot substance due to an alkaloid called piperin ($C_{17}H_{19}NO_3$).

At the present time the grinding of pepper in salads is one of the ceremonies of restaurant “dining.”

Black pepper was declared a strategic material in World War II because soldiers found food without pepper, bland and unpalatable.

White pepper is somewhat less pungent than black pepper.

The berries are kept moist, or soaked in gunny (jute) sacks in running water to remove the pericarp and are often trampled or rubbed by hand.

The dried white pepper is a light yellow gray and consists of the seed coated with the inner pericarp.

It can also be prepared from mechanical abrasion of black pepper.

White pepper is used in products such as mayonnaise where the black specks would be objectionable.



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Chile, Red, or Hot Pepper: *Capsicum* spp., Solanaceae

Chili peppers are native to the New World.

Columbus was searching for black pepper but serendipitously found a spice much more pungent and "hot."

Chili pepper has now traveled around the world and is the basis of many cuisines including Mexican, as well as Indian, Chinese (Szechwan), and Indonesian, which derive from introductions made in the 16th century.

Although often known as red pepper, many are not red and the appropriate name is chili peppers.



Chili pepper is now grown as a summer annual throughout the temperate world but is well adapted to the tropics.

There is tremendous diversity of peppers and many species are involved particularly *Capsicum annuum*, *C. frutescens*, and *C. chinense*.

The hot principle is due to capsaicin, a stable alkaloid ($C_{18}H_{27}NO_3$)

Pungency expressed in Scoville units.

A volatile phenol that is similar in structure to vanillin.

It can be detected in as little as 1 part per million and activates the heat receptors in the tongue.

A number of chilies (particularly *C. annuum*) do not contain capsaicin in the fruit flesh (but may in the seed) and are known in the United States as sweet peppers or bell peppers (because of their shape).

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Until recently most US sweet pepper consumption was the immature, slightly bitter, green types but at present mature sweet peppers are consumed that are red, yellow, or purple.

A related type is called paprika, and is not very pungent but is widely used as a food colorant and very popular in Hungary. e.g. chicken paprikash, which is roasted chicken covered with paprika causing it to turn reddish; the related pimento is used to stuff olives.

Capsicum frutescens includes such fiery hot chillies as cayenne and Tabasco.

Recently, hot food is increasing in the US (Tex Mex) and salsa, a very spicy tomato product, has surpassed ketchup.

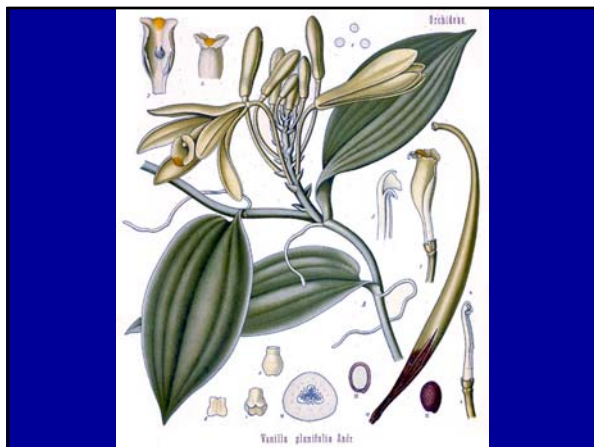
Vanilla: *Vanilla planifolia*, Orchidaceae

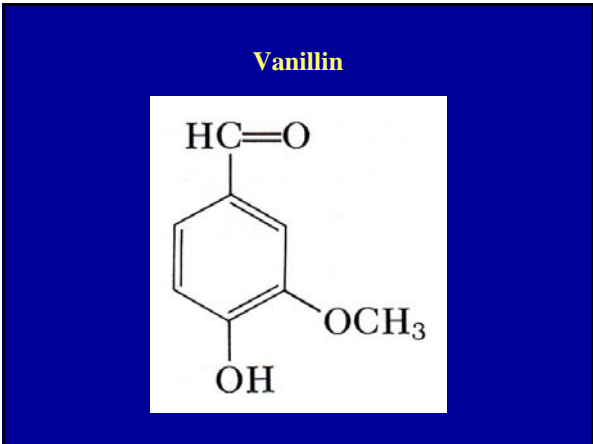
The name vanilla means "little bean;" *vaina* means bean in Spanish.

Vanilla is native to Mexico and Central America and was long used by the Aztecs (to flavor chocolate made from cacao) and was introduced by the Spanish colonists throughout the tropics.

At the present time the most important producer is Madagascar but it is also produced in Mexico.

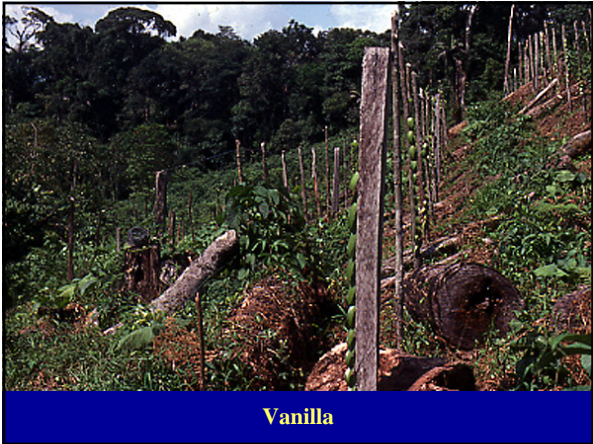
Production is declining because vanillin ($C_8H_8O_3$), the basis of the vanilla flavor can be made from the fractional distillation of clove oil.







Vanilla, Costa Rica

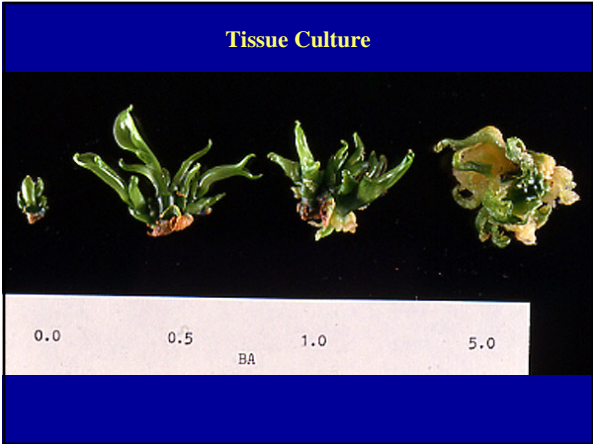


Vanilla

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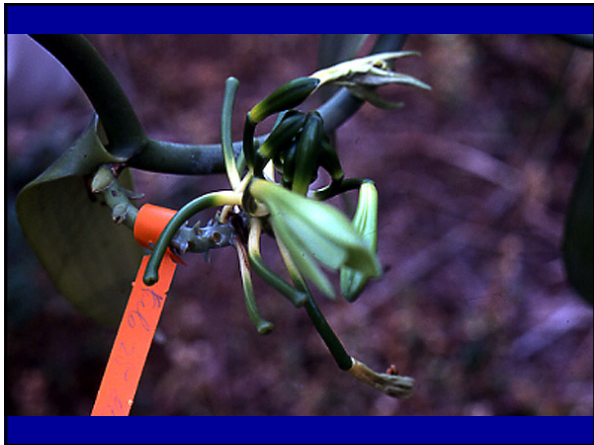


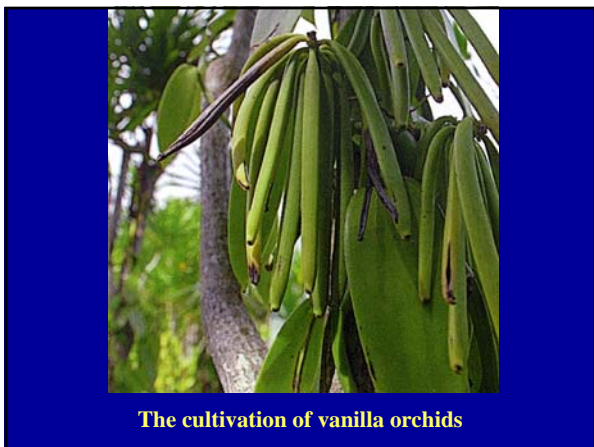




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The cultivation of vanilla orchids

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Pollinating vanilla



The plant is a typical orchid, adapted to tropical monsoon and requires 70 inches of rain with a three months dry season; adapted to 25°C and 80% humidity.

The “bean” is the seed pod which is fermented to produce the characteristic vanilla aroma.

Pure vanilla is one of the most delightful and best appreciated flavors.

Vanilla is propagated by stem cuttings.

The flowers must be hand pollinated to insure set which is one of the major production input.

Plants require shade and support.

Pods are harvested after 9 months.

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Processing of vanilla has the following steps:

Pods are wilted for 24 hours, the “preliminary” fermentation.

Sun dried, a continuous fermentation.

The pods become dark brown.

Many keep pods in blankets, called sweating, for 8–12 days.

Pods are packed in tins and sealed.

The pods may be sold separately or in alcohol as tincture of vanilla.

Natural vanilla is better flavored than the synthetic and many compounds seem to be involved in the fermentation.

Breyers ice cream used to use natural vanilla, appears as brown flakes in the product.

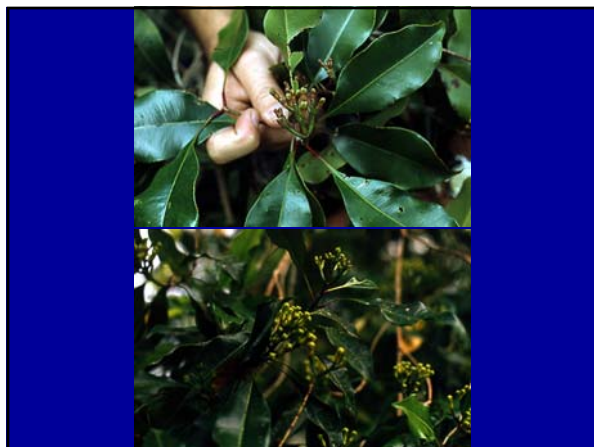
Clove: *Eugenia caryophyllata*, Myrtaceae

The name clove is derived from the French word *clou* for “nail” because cloves resemble a round headed nail.

Chinese who spoke to their emperor had first to sweeten their mouths with cloves.

Cloves are native to the Moluccas (Spice Islands now part of Indonesia) and was once confined by the Dutch to a single island in order to prevent competition.

The spice is the aromatic dried unopened flower bud and twig tip, picked when they turn red at the base.



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Fruit is known as “mother of cloves.”

The clove tree is evergreen, 16–40 feet in height.

It is now cultivated in Madagascar, Zanzibar, Malaysia, India, and Sri Lanka (Ceylon).

The cloves are harvested by hand and dried but care must be taken not to break the stems.

The volatile oils of clove contains 70–90% eugenol which provides their characteristic odor.

Eugenol can be transformed to artificial vanillin.

The best known use of cloves in the US is a flavoring, for perfumes, flavoring agents for mouthwashes and toothpaste, and as a spice for meat (Easter ham).

In Indonesia it is mixed with tobacco and smoked (Kretek cigarettes) and the odor of strong tobacco and cloves is ever present.

Clove oil has been used to fix stains in anatomical preparations.

Clove oil applied to the mouth acts as a numbing agent and is used as an analgesic (pain preventer) for toothaches.

Cinnamon: *Cinnamomum zeylanicum*, Lauraceae

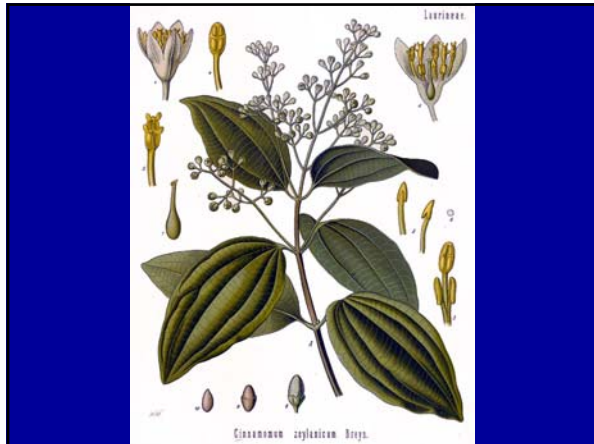
One of the classic spices.

An evergreen tree native to Sri Lanka (Ceylon) and the southwest (Malabar) coast of India.

Found in the humid forests of Ceylon up to 5000 ft.

Tree is up to 30–50 feet tall.

In cultivation however, it is grown as a bush 6–8 feet high, generally grown from seed but can be propagated by cuttings.



Cinnamomum species

True or Ceylon Cinnamon is *Cinnamomum verum* (*C. zeylanicum*)

Cassia Cinnamon is *Cinnamomum cassia* also called Chinese Cassia or Canela

Indonesian Cinnamon is *C. burmannii*

Saigon Cinnamon is *C. loureirii*

Nepal Cinnamon is *C. tamala*

Preparation of Cinnamon

Shoots are cut and bark is peeled.

Stacked within each other and put in bundles and fermented.

Bark is placed in cylindrical wood and scraped, placed together to form a 36 inch length.

Bark dries and becomes a "quill" or "pipe."


Spice merchants package the short quills but often grind the spice.

Cinnamon—Cassia



Bark is carefully hand stripped into quills

Cinnamon—Cassia




Easy to ID with parallel leaf veins

Crushed *C. verum* leaves smell like cloves whereas other species do not

Coppiced at base to produce softwood shoots

Cinnamon trees in Ghana



**Nutmeg and Mace: *Myristica fragrans*,
Myristicaceae**

Native to the Moluccas (Indonesia) but now grown extensively in Grenada.

Tree is dioecious but growers maintain 1 staminate to 10 pistillate trees.

Tree is 30–40 feet tall.

The fruit consists of a husk and seed (which is the nutmeg), and is enclosed by a leathery membrane or aril which is the true mace.

The nutmeg, and mace are dried separately, a slow process.

Mace is yellow, nutmeg is brown and sold whole or ground.





Allspice: *Pimenta officinalis*, Myrtaceae

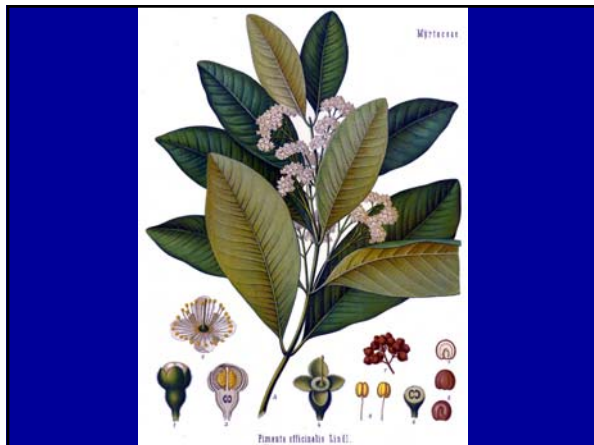
Native to the West Indies and cultivated in Jamaica, Guatemala, Honduras, and Mexico.

It is the only major spice grown exclusively in South America.

Tree is 25–30 feet.

Fruits gathered when mature but green and dried in the sun.

Flavor resembles a combination of cinnamon, nutmeg, and cloves.



Zingiberaceae (Ginger family)

Zingiber officinale—Ginger

Curcuma longa—Turmeric

Elettaria cardamomum—Cardamom

Amomum subulatum—Nepal Cardamom

Alpinia spp.—the Galangals

Aframomum melegueta—Grains of Paradise

Ginger:
Zingiber officinale, Zingiberaceae

Herbaceous perennial consisting of underground stem or rhizome and erect leafy shoot.


Native to tropical Asia.

Cultivated through most of the tropical world.

Usually harvested after 9 months.

Rhizome sundried, sometimes scalded first and scraped.

Marketed when dried to 7–12% moisture.



Ginger




Elettaria cardamomum—Cardamom

Cardamom is the third most expensive spice—only saffron and vanilla more valuable by weight

From India, but Guatemala is leading worldwide producer

Nearly all cardamom is consumed in Arabia and Scandinavia

Cardamom



Flowers and fruits (cardamoms) located at base

Amomum subulatum—Nepal Cardamom




Large-scale tissue culture program for commercialization of clonal material—Kathmandu

Amomum subulatum
Nepal or Greater Cardamom



- Native of Himalaya sub-tropic zones
- Larger, more robust than true cardamom
- Widely consumed in India
- Rarely exported, despite being a quality substitute for real cardamoms

Aframomum melegueta
Grains of Paradise




Hot piquant seeds once more popular than black pepper in Europe—nowadays forgotten

Native to the Gulf of Guinea, widely traded from Liberia to Cameroon



Aframomum melegueta
Paradise Grains, Alligator Pepper



An alternative source of spicy flavor to *Capsicum* and *Piper* species

Associated with Juju traditions in W. Africa

Reputed to having strong aphrodisiac properties
