Chapter 5

Vanilla

Introduction

Tlilxochitl, or "black flower" (*Vanilla planifolia*), is indigenous to Mesoamerica, along with the related, but organoleptically inferior *Vanilla pompana*. The flavoring properties of the cured beans were discovered by the Mexican Totonaca Indians. The Totonacas (literally Aztec for "people of the hot lands") lived in Totonacapan, the region extending from the rainforests on the eastern slopes of the Sierra Madre Oriental to the Gulf of Mexico. This is now the north central region of Veracruz State. They developed a four-stage curing process for the raw beans. They were first allowed to dry and shrivel, then covered and sweated. Next they were dried and then finally matured in closed boxes.

The Aztec empire was established around 1100 and they conquered the Totonac city-states around 1400. The Totonac Federation became part of the Aztec empire, but their culture was not entirely absorbed by the Aztecs. The town of Misantla (place of the deer) was the main center of vanilla production. Vanilla beans were used not only to impart flavor, but also as an herbal medicine reputed to increase strength and courage. Under Aztec rule the Totonacas had to pay taxes in the form of vanilla beans. The Aztecs used ground cured vanilla beans to flavor chocolatl, a drink made from water (not milk), ground roasted cocoa beans and a little honey.

It is tempting to speculate that vanilla had a much longer history of use. There are records of cocoa and the chocolatl drink stretching back to the Mayan (200 BC to AD 1550) and Olmec (1150 to 300 BC) civilizations.

Cortez first landed on Totonac shores in 1519. The Aztec emperor Moctezuma II greeted Cortez in Tenochtitlan (now Mexico City) with a golden cup of chocolatl. Cortez returned to Spain in 1526, bringing vanilla and cocoa

beans (plus substantial quantities of plundered gold). They were an instant success. The first commercial shipments to Spain began in 1585 and the formulation of the new drink remained a secret until 1606, when it was introduced into Italy. It quickly spread to the rest of Europe and Sir Hans Sloane (the founder of the British Museum) hit on the idea of using milk instead of water. Eighty years later, in England, vanilla was first used as a flavoring in its own right.

Vanilla was planted in India and Java, in climatic conditions similar to Mexico, but could not be induced to produce beans. In 1836 Charles Morren discovered that the unusually shaped orchid flowers could only be pollinated by the *Melipona*, a tiny Mexican bee. The art of hand pollination, using a short wooden toothpick, was quickly perfected and allowed the rapid expansion of vanilla planting across the tropics. Madagascar soon became the main center of production.

Vanilla Species And Trade

Virtually all commercial vanilla production is from the original *planifolia* species. Madagascar dominated the trade until the turn of the century, when it was overtaken by Indonesia. Vanilla *tahitensis* is characterized by high levels of anisyl derivatives. Forty years ago around 150 tonnes were produced annually, but despite the high price, only small quantities are produced today. A little *pompona* is still grown, but this species is not covered by the US Federal Regulations and hence may not be used in the United States. *Pompona* beans have a character that is similar in some respects to *tahitensis*, but markedly inferior. The only advantages of *pompona* are that the plants flower readily and are easily pollinated.

Annual production levels have been very volatile in recent years. Shortages can be caused by the weather or disease, driving prices and planting up. New plantations take three years to deliver useful output and by that time the effect is often to drive prices artificially low. The growing locations and approximate annual production for each species are as follows:

Vanilla planifolia

Madagascar	1,700 tonnes (stable)
Indonesia	1,900 tonnes (increasing)
Comoros	170 tonnes (stable)
Papua New Guinea (PNG)	150 tonnes (increasing)
Uganda	50 tonnes (increasing)
China	40 tonnes (increasing)
India	20 tonnes (increasing)
Reunion	10 tonnes (decreasing)
Mexico	10 tonnes (decreasing)

Vanilla tahitensis	
Tahiti	10 tonnes (decreasing)
Vanilla pompona	
West Indies	
Vanilla granderi	
Brazil (non-commercial)	
Vanilla odorata	
Ecuador (non-commercial)	
Vanilla phaeantha	
West Indies (non-commercial)	
Vanilla appendiculata	
Guyana (non-commercial)	

Two thirds of the global crop is imported by the United States, with the European Union accounting for most of the remainder. The dairy sector accounts for approximately half of all use of natural vanilla extract. The beverages sector and retail sales are also important.

Cultivation

The vanilla vine grows naturally in warm, moist, partially shaded tropical forests and can climb up trees to a height of 20 m. The cultivated plant is pruned or bent back to encourage fruiting. The vine will flower in the second year but beans are not normally produced until the third year. The plant reaches its peak of vitality at about eight years old. The odorless pale yellow flowers only open for part of a day, but a vine can only support the growth of 30 or 40 beans, so less than one-tenth of the flowers are fertilized. All pollination, even in Mexico, is carried out by hand.

The beans take about eight months to ripen fully and are individually hand-picked when they are just beginning to ripen and have only turned yellow at one end.

The main hazards are hurricane, *Fusarium* disease, and in lawless countries, theft of the valuable green beans.

Curing

The process in Madagascar begins with scalding the green beans. The beans are dipped for about three minutes in hot water at 60°C. This prevents dehiscence and destroys the chlorophyll. The process also increases the activity of the glucosidase, peroxidase and polyphenoloxidase enzymes.

The beans are then spread out on blankets in the sun during the day and wrapped in the blankets during the night. This process is referred to as sweating and is repeated for about 10 days. Enzymatic hydrolysis takes place at this stage resulting in the formation of vanillin and p-hydroxybenzaldehyde. Sugar fermentation also takes place generating butane-2,3-diol, formic acid and lactic acid.

The beans are placed in open trays in a well-ventilated warehouse to dry for two months. They lose about 80% of their weight during this period and develop flavor by a number of processes. Furans and pyrans are produced by heat. Aliphatic aldehydes are formed from lipids, and Maillard reactions involve sugars and amino acids. The beans may be sorted, graded and aged for some months before sale.

The Mexican process is similar, but rather more complex. It does not involve the initial scalding step. Green beans are partially dried and then sweated repeatedly in covered wooden boxes. After two weeks the beans are slowly dried and then aged for three months.

The Indonesian process does not include the scalding or complex sweating stages. The beans are also often harvested immature because of widespread rustling. This problem is particularly bad in years when natural disasters have driven up the price of the green beans. The beans are then dried over fires, giving a pronounced phenolic/smoke character. In recent years most Indonesian beans have been harvested mature, with some attempt to replicate the Bourbon process to produce high-vanillin beans, with similar vanillin levels to Bourbon. This does not precisely replicate Bourbon character and often has a notable smoked note.

Dried beans weigh only about 20% of the original weight of the green beans. A residual moisture level of 25% is ideal. Higher levels of moisture may give better flavor, but can lead to mildew. Lower levels are often indicative of poorer flavor.

Beans that are split have traditionally been regarded as inferior to unsplit beans, but that is probably because of their unsuitability for the culinary market rather than any inferiority of flavor.

Naturally cured beans, left on the vine, will invariably split and will end up with a red rather than a black appearance. These beans have a very attractive, but rather mild flavor. For many years they were regarded as inferior, or "red foxy," beans and commanded the lowest price. The situation has now reversed and this subtle character is much appreciated. Red foxy beans now command a 10–15% premium and in good years up to one-third of all beans produced are of this type.

Extraction

Maceration was originally used to extract vanilla beans. Whole beans were soaked in an alcohol and water mixture for up to three months at ambient temperature. The low temperature and long maturation time gave an exceptionally fine flavor.

Percolation is now universally used. The beans are chopped into pieces 1 cm in length and loaded into perforated baskets in a sealed, heated percolator. A 45% alcohol / 55% water mixture at between 40°C and 70°C (commonly 50°C), is pumped over the beans for up to a day, and then drained off over several hours. Each batch of beans is extracted with three or four different portions of solvent. The later extracts may be reused as the first solvent for a subsequent batch of beans. Some manufacturers will use decreasing quantities of ethanol in the later extracts.

Extracts of single- and twofold strength are normally made by this process. Fourfold extracts can also be made in this way or produced by evaporation of solvent from a twofold extract. A few tenfold extracts are made by extraction, with great difficulty, but most are made by concentration. All stronger extracts up to oleoresin, which may represent a 25–35 fold extract, are produced by concentration. When the final objective is an oleoresin, the concentration of alcohol used in the extraction process can vary quite radically and is usually higher (often around 70%) than when the final product is an unconcentrated extract. All extracts are filtered and pasteurized after processing.

Blending of beans is common practice to give some control over the wide variability of bean quality. A typical blend would contain two-thirds high quality beans and one-third low vanillin or lesser quality beans.

The process of extraction with ethanol enhances the fruity and damson characters of vanilla. Acetals and esters are formed together with aromatic ethers produced from vanillin and p-hydroxybenzaldehyde. Long-term storage of ethanolic extracts results in a gradual increase in rum characters because of *trans*-esterification. Concentration of alcoholic extracts results in a loss of the more volatile part of the aroma and this is especially pronounced in an oleoresin. Lower alcohol levels during the extraction process favor the candy and caramel notes, as do higher extraction temperatures.

Solid extracts may also be produced using other solvents. Carbon dioxide is used commercially and produces an extract with a high vanillin content, lacking in caramel characters and rather difficult to dissolve in use.

Adulteration And Legislation

The quantity of "genuine" vanilla extract sold throughout the world far outstrips the world production of vanilla beans. Much of this "vanilla extract" is very simply adulterated with vanillin and natural extracts such as St. John's Bread. Many other nature identical components can also be added. Some producers go