

Table 2.4 Composition of cocoa beans.

Whole dried cocoa beans (as traded)				
	%	Typical range (%)		
Water/moisture	7.5	5–8		
Shell (dry basis)	12.5	10–16		
Nib (dry basis)	80	78–82		
	Unfermented cocoa beans (dry, fat free)		Fermented cocoa beans (dry, fat free)	
	mg/g		mg/g	
Total polyphenols	150–200		40–140	
Procyanidins	61		23	
Epicatechin	–		3–16	
	Nib		Shell	
	Mean (%)	Range (%)	Mean (%)	Range (%)
Water/moisture ^a	3.7	2–5	7	4–11
Fat (cocoa butter and shell fat)	53.5	48–57	2.8	2–6
Protein	12.7	11–16	14.7	13–20
Starch	6.7	6–9	8.1	6.5–9.0
Fibre (crude)	2.5	2.1–3.2	16.6	13–19
Ash	2.9	2.6–4.2	8.2	6.5–20.7
Theobromine	1.30	0.8–1.4	0.87	0.2–1.3
Caffeine	0.22	0.1–0.7	0.13	0.04–0.3

^a Will vary according to storage conditions and the degree of drying or roasting.

Note: values depend on type of beans and method of analysis.

Polyphenol compositions after Wollgast and Anklam (2000) and Nestlé data.

Nib and shell compositions after Minifie (1989) and Kirk and Sawyer (1991).

where the products are to be sold. Any cocoa failing to meet food safety standards must not enter the human food chain. The fermentation and drying process results in high microbial levels on raw cocoa beans and the occasional presence of *Salmonella* bacteria. This hazard is controlled at the roasting stage and/or by debacterisation prior to or after roasting (see Chapter 25). The presence of *Salmonella* is not a reason to reject a consignment of raw cocoa beans.

2 Economic factors. These relate to yield of useful material and are key determinants of the price a manufacturer is prepared to pay relative to other cocoas.

3 *Qualitative aspects.* This includes desirable flavours and absence of off-flavours and some physical properties such as cocoa butter hardness. Qualitative factors determine whether a type of cocoa will be included in blends or recipes for chocolate.

In addition to these three areas, consumers are increasingly concerned about environmental and ethical aspects and some want environment friendly, organic or Fairtrade certification and labelling. This requires total traceability of the cocoa through the supply chain and compliance with the necessary standards (see Section 2.5).

The quality requirements from a manufacturer's view are summarised in Table 2.5. However, most cocoa is purchased using standard trade contracts, which may not include all the aspects considered important by the manufacturer. In Europe, the Federation of Cocoa Commerce (FCC) sets contract standards for cocoa bean quality. In the United States, the Food and Drugs Administration (FDA) and The Cocoa Merchants' Association of America (CMAA) set the standards (see Table 2.6). The cocoa trade associations have arbitration schemes to cover the situation when the lots of cocoa tendered fail to meet the contract terms and this may result in the supplier having to pay an allowance or replace the disputed beans. The producing countries usually have their own internal standards that are often mandatory (ITC, 2001).

2.6.3 Cocoa beans: sampling and the "cut test"

Proper sampling is an essential first step to making an assessment of quality. Cocoa beans in sacks are sampled using a trier or sampling stick, which is inserted between the fibres of the bag. Typically between 20% and one-third of the sacks will be sampled according to one of several prescribed procedures. Alternative arrangements are made for cocoa shipped in bulk. The samples maybe combined and bulked or mixed and then reduced in size ("quartered").

First, beans are classified by weight (usually the number of beans in 100g (3.5 oz).

Second, the level of unsatisfactory beans (also termed faulty or defective beans) is determined by the "cut test" (see Figure 2.17). This test identifies beans that are visibly mouldy, slaty (i.e. unfermented), infested, germinated, or flat (i.e. containing no nib or cotyledon). The cut test normally uses the same beans that have been weighed and counted. Many methods specify that 300 beans will be cut lengthwise to expose the cotyledon. This is somewhat tedious and the number of beans is frequently reduced, which also lowers markedly the statistical validity of the results. Alternatively, a guillotine device is available (Magra cutter), which will cut 50 beans at a time.

Mould is especially undesirable. Indeed, even as few as 3% mouldy beans can give unpleasant musty or mouldy flavours to chocolate. Some moulds under certain conditions also produce harmful fungal toxins collectively called mycotoxins (see Section 2.6.4). Mouldy beans can have high levels of free fatty acids (FFA) which affect the quality of the cocoa butter (see Section 2.6.5).