## Green Coffee

One of the few chemical investigations of the growing tree is the examination by Graf of flowers from 20-year-old coffee trees, in which he found 0.9 percent caffeine, a reducing sugar, caffetannic acid, and phytosterol. Power and Chestnut found 0.82 percent caffeine in air-dried coffee leaves, but only 0.087 percent of the alkaloid in the stems of the plant separated from the leaves. In the course of a study[ instituted for the purpose of determining the best fertilizers for coffee trees, it developed that the cherries in different stages of growth show a preponderance of potash throughout, while the proportion of P2O5 attains a maximum in the fourth month and then steadily declines.

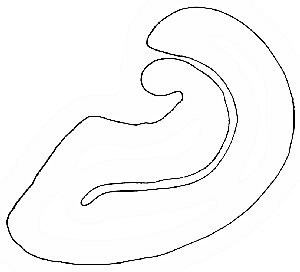
Experiments are still in progress to ascertain the precise mineral requirements of the crop as well as the most suitable stage at which to apply them. During the first five months the moisture content undergoes a steady decrease, from 87.13 percent to 65.77 percent, but during the final ripening stage in the last month there is a rise of nearly 1 percent. This may explain the premature falling and failure to ripen of the crop on certain soils, especially in years of low rainfall. Malnutrition of the trees may result also in the production of oily beans.

The coffee berry comprises about 68 percent pulp, 6 percent parchment, and 26 percent clean coffee beans. The pulp is easily removed by mechanical means; but in order to separate the soft, glutinous, saccharine parchment, it is necessary to resort to fermentation, which loosens the skin so that it may be removed easily, after which the coffee is properly dried and aged. There is first a yeast fermentation producing alcohol; and then a bacterial action giving mainly inactive lactic acid, which is the main factor in loosening the parchment. For the production of the best coffee, acetic acid fermentation (which changes the color of the bean) and temperature above 60° should be avoided, as these inhibit subsequent enzymatic action.

Various schemes have been proposed for utilizing the large amount of pulp so obtained in preparing coffee for market. Most of these depend upon using the pulp as fertilizer, since fresh pulp contains 2.61 percent nitrogen, 0.81 percent P2O5, 2.38 percent potassium, and 0.57 percent calcium. One procedure in particular is to mix pulp with sawdust, urine, and a little lime, and then to leave this mixture covered in a pit for a year before using. In addition to these mineral matters, the pulp also contains about 0.88 percent of caffeine and 18 to 37 percent sugars. Accordingly, it has been proposed to extract the caffeine with chloroform, and the sugars with acidulated water. The aqueous solution so obtained is then fermented to alcohol. The insoluble portion left after extraction can be used as fuel, and the resulting ash as fertilizer.

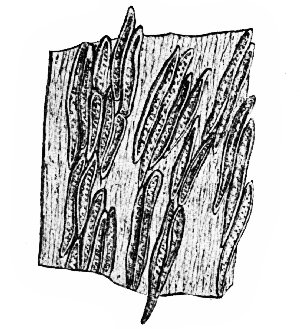
The pulp has been dried and roasted for use in place of the berry, and has been imported to England for this purpose. It is stated that the Arabs in the vicinity of Jiddah discard the kernel of the coffee berries and make an infusion of the husk.

Quality of green coffee is largely dependent upon the methods used and the care taken in curing it, and upon the conditions obtaining in shipment and storage. True, the soil and climatic conditions play a determinative rôle in the creation of the characteristics of coffee, but these do not offer any greater opportunity for constructive research and remunerative improvement than does the development of methods and control in the processes employed in the preparation of green coffee for the market.

Cross-Section of the Endosperm or Hard Structure of the Green Bean

Storage prior and subsequent to shipment, and circumstances existing during transportation, are not to be disregarded as factors contributory to the final quality of the coffee. The sweating of mules carrying bags of poorly packed coffee, and the absorption of strong foreign aromas and flavors from odoriferous substances stored in too close proximity to the coffee beans, are classic examples of damage that bear iterative mention. Damage by sea water, due more to the excessive moisture than to the salt, is not so common an occurrence now as heretofore. However, a cheap and thoroughly effective means of ethically renovating coffee which has been damaged in this manner would not go begging for commercial application.

That green coffee improves with age, is a tenet generally accepted by the trade. Shipments long in transit, subjected to the effects of tropical heat under closely battened hatches in poorly ventilated holds, have developed into much-prized yellow matured coffee. Were it not for the large capital required and the attendant prohibitive carrying charges, many roasters would permit their coffees to age more thoroughly before roasting. In fact, some roasters do indulge this desire in regard to a portion of their stock. But were it feasible to treat [p. 157] and hold coffees long enough to develop their attributes to a maximum, still the exact conditions which would favor such development are not definitely known. What are the optimum temperature and the correct humidity to maintain, and should the green coffee be well ventilated or not while in storage? How long should coffee be stored under the most favorable conditions best to develop it? Aging for too long a period will develop flavor at the expense of body; and the general cup efficiency of some coffees will suffer if they be kept too long.



Portion of the Investing Membrane, Showing Its Structure

Drawn with the camera lucida, and magnified 140 diameters

The exact reason for improvement upon aging is in no wise certain, but it is highly probable that the changes ensuing are somewhat analogous to those occurring in the aging of grain. Primarily an undefined enzymatic and mold action most likely occurs, the nature of the enzymes and molds being largely dependent upon the previous treatment of the coffee. Along with this are a loss of moisture and an oxidation, all three actions having more evident effects with the passage of time.