Effects of Agricultural Practices, Handling, Processing, and Storage on Legumes and Oilseeds

Walter J. Wolf

Legumes and oilseeds are important sources of protein and oil for the human diet. Major legumes used as foods include peas, beans, lentils, peanuts, and soybeans. In some countries legumes are the main source of dietary protein, but in the United States, where animal protein consumption is high, legumes provide only a minor portion of the daily protein intake. Although they are legumes, peanuts and soybeans are high in oil content and are also classified as oilseeds. Other oilseeds of economic importance in the United States are cottonseed and sunflower seed.

EDIBLE LEGUMES

There are more than 13,000 species of legumes, but only about 20 are eaten by man (Aykroyd and Doughty 1964). In the United States, annual per capita consumption of peas and beans in 1983 was only 227 and 2815 g, respectively (USDA 1984), or a total of about 8 g/capita/day. This quantity supplies about 2 g of protein/day or 2% of the protein intake. In contrast, in many tropical and subtropical regions of the world, legumes provide the major supply of dietary protein and calories. For example, in India the per capita consumption of legumes is about 40 g/day (Udayasekhara Rao and Belavady 1978), and in Latin America, the common bean, *Phaseolus vulgaris*, is a staple, along with corn, in the traditional diet (Bressani and Elias 1974). Many legumes are rich in lysine, whereas cereals are low in this essential amino acid; consequently, legumes and cereals complement each other, with cereals providing

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1 Contribution from the Northern Regional Research Center, Agricultural Research Service, U.S. Department of Agriculture, Peoria, IL 61604.
methionine and cystine, which tend to be low in legumes. Legumes also provide several B-complex vitamins plus minerals and dietary fiber.

For purposes of discussion here, the term edible legumes is restricted to mature seeds of peas and beans; peanuts and soybeans are covered in the section on oilseeds. Five groups of peas and beans important as foods include chick-peas (Cicer arietinum, also called garbanzo, Bengal gram, chenata, or chana); peas (Pisum sativum var. arvense Poir., field or smooth pea, and P. sativum L., or wrinkled pea); broad beans (Vicia faba, also called horse or field bean); lentils (Lens esculenta); and beans (P. vulgaris, P. lunatus, P. aureus, and P. mungo). More detailed information on these legumes (often referred to as pulses) can be found elsewhere (Pattee et al. 1982; Reddy et al. 1982A,B; Sgarbieri and Whitaker 1982). Other legumes, such as certain Lathyrus species that contain toxic compounds, have been excluded; they have been reviewed recently (Padmanaban 1980).

Seed Structure

Pea and bean seeds consist of a seed coat (hull), hypocotyl-radicle axis, plummule, and two cotyledons. In chick-peas (C. arietinum), for example, the distribution is seed coat, 15%, cotyledons, 84%, and the remaining portion of the embryo, 1% (Lal et al. 1963). The seed coat is a protective barrier during storage and handling, and generally legume seeds with thin seed coats absorb water more rapidly than seeds with thick seed coats (Sefa-Dedeh and Stanley 1979). The cotyledons make up 80–90% of the seed and are sites of the energy stores, which in peas and beans is starch. Typically, cotyledon cells contain ovoid starch granules 10–40 μm long and 8–25 μm wide embedded in a matrix of protein bodies that contain the storage proteins (Fig. 6.1).

Composition

Representative proximate analyses of various peas and beans (Table 6.1) indicate that protein contents range from 22 to 31%, whereas fat contents vary from 1 to 6%. Ash (2–4%) and fiber (4–7%) constitute the remaining minor fractions. The major constituents are the carbohydrates that make up from 58 to 68% of the legumes. Composition of some legumes may vary considerably; in peas, for example, protein content varied from 14.5 to 28.5 (dry, dehulled basis) in one crop year (Reichert and MacKenzie 1982).

Proteins

The proteins of legumes include metabolic, structural, and storage types. Storage proteins are laid down during seed development and are mobilized as nitrogen and carbon sources during germination; they make up as much as 80% of the total protein (Sgarbieri and Whitaker 1982).