Plant Characteristics and Growing Requirements

Cannabis sativa L. is often referred to as true hemp to distinguish it from other fiber crops. These include *Musa textilis* (abaca or manila hemp), *Agave sisalina* (sisal hemp), and *Crotalaria juncea* (sunn hemp).

Cannabis sativa is normally dioecious, meaning the species has separate male and female plants. Monoecious varieties, with the male and female flower parts on the same plant, have been developed in a number of countries through breeding and selection (Dempsey, Ehrensing). Several countries, such as France, the Netherlands, Hungary, Romania, and China, have ongoing breeding programs. The industry is seeking high-yielding strains that are low in THC and meet various end-use needs. For example, breeders are looking for fiber lines that are high in primary fiber yields (for pulping), extra-fine fibers (for textiles), and cellulose content (for biomass fuel) and for seed lines with various seed sizes (for easier hulling and assorted food uses), special amino acid profiles (for human and animal feeds), and specific components in the oil for industrial uses (such as industrial lubricants) (Vantreese, 1998).

Hemp is sensitive to day length; the plant matures (sets seed) as days get shorter in the fall. Since production has historically been concentrated in northern temperate regions, industrial hemp varieties have been selected to mature in early fall (Blade; Reichert, 1994).

Industrial hemp can be grown as a fiber, seed, or dual-purpose crop. Hemp is a bast fiber plant similar to flax, kenaf, and jute. The interior of the stalk is hollow, surrounded by a pith layer of woody fibers called hurds (fig. 1). Outside the cambium layer, where cells grow and differentiate, is the phloem or parenchyma layer, which contains the long cells known as bast fiber. Hemp seeds are smooth and about one-eighth to one-fourth of an inch long. The seeds usually contain from 29 to 34 percent oil. The oil is similar in composition to drying oils such as linseed and tung and consists primarily of three fatty acids: linoleic (54-60 percent), linolenic (15-20 percent), and oleic (11-13 percent) (Ehrensing). Both the fiber and seed can be used in a wide range of applications (fig. 2).

Industrial hemp grows well in areas where corn produces high yields (Ehrensing). It can be grown on a variety of soils, but it does best on loose, well-drained loam soils with high fertility and abundant organic matter. Plants require plentiful moisture throughout the growing season, especially during the first 6 weeks (Dempsey; Blade; Baxter and Scheifele, 1999). Hemp also needs substantial amounts of available nutrients to produce high yields. Both Dempsey (1975) and Ehrensing (1998) review numerous fertilization studies and conclude that hemp requires liberal fertilization for high fiber yields.

Hemp diseases are not widespread and occur sporadically. They are usually caused by seed- and soil-borne fungi, which can be controlled by seed treatment before planting or by rotation (Dempsey). Under favorable conditions, hemp is very competitive with weeds so herbicides are generally unnecessary in hemp fiber production (Ehrensing). Due to lower planting densities, weed suppression may be less complete when hemp is grown for seed (Baxter and Scheifele).