10 Minor Uses

Cannabis sativa is an exceptionally versatile crop. Fiber (Chapter 7), oilseed (Chapter 8), and cannabinoid drugs (Chapter 13) are the main economic products. Essential oil, of minor significance, is discussed in Chapter 9. Other actual or potential uses are examined in this chapter. The following sequence of subchapters is arranged in decreasing order of probable potential usefulness.

BIOMASS

Merits of *Cannabis sativa* as a Source of Biomass

Biomass refers to material from living or recently living organisms, especially from plants, which is usually employed as an energy source, either burned to produce heat or converted to biofuel. Numerous plants are capable of generating considerable biomass, and *C. sativa* is one of them (Poiša et al. 2010; Figure 10.1). Concern over rising prices and ecological damage associated with the use of petrochemicals has led to attempts to reduce fossil fuel use by substituting biomass plants to produce energy. Most biomass is currently derived from wood, but as discussed in Chapter 16, dealing with sustainability, trees are a diminishing resource, and crops are being considered as new sources of biomass. Hempseed-based biodiesel is discussed in Chapter 8. Biodiesel is usually produced from edible oilseed crops (such as rapeseed) and bioethanol is usually manufactured from edible carbohydrate crops (such as maize and sugar cane). This is controversial, since using cropland to produce biomass instead of food can reduce the availability and increase the cost of food, especially in low-income nations. It has been argued that using crops that produce only inedible "lignocellulosic biomass" (such as fiber hemp) avoids the ethical problem, but it does not, since the land could be used for food production (including oilseed hemp). Rehman et al. (2013) explored the possibility of using harvested wild-growing hemp in Pakistan as a source of biomass, which certainly would be an ethical strategy. As discussed in Chapter 16, *C. sativa* is an especially sustainable, environmentally friendly plant, and so when grown as a crop for whatever purpose, possibly including biomass production, it is relatively benign to the planet and to people. Compared to other crops grown for energy, hemp is considered to be a reasonably efficient source (Finnan and Styles 2013).

It has been contended that hemp is notably superior to most crops in terms of biomass production, but Van der Werf (1994b) observed that the annual dry matter yield of hemp (rarely approaching 20 tonnes/ha) is not exceptional compared to corn, beet, or potato. Meijer et al. (1995) also noted that there are constraints to the biomass production of hemp. However, most hemp varieties have been selected for production of fiber, not for biomass. Hemp has been rated on a variety of criteria as one of the best crops available to produce energy in Europe (Biewinga and van der Bijl 1996). Hemp, especially the hurds, can be burned as is or processed into charcoal, methanol, methane, or gasoline through pyrolysis (destructive distillation). Hemp could be used to create cellulosic-based ethanol (Sipos et al. 2010; Kuglarz et al. 2016). González-García et al. (2012) showed that ethanol derived from hemp hurds under some scenarios could be practical. However, conversion of hemp biomass into fuel or alcohol is impractical in areas where there are abundant supplies of wood, and energy can be produced relatively cheaply from a variety of sources. Prade et al. (2012) concluded, "The main competitors for hemp are maize and sugar beets for biogas production and the perennial crops willow, reed canary grass and miscanthus for

FIGURE 10.1 Scenes illustrating considerable biomass production by hemp (from a Canadian medicinal marijuana plantation in Ottawa in 1971, described in Small et al. 1975).

solid biofuel production. Hemp is an above-average energy crop with a large potential for yield improvements."

Biogas

"Biogas" (especially methane) is produced in some countries from various feedstocks, particularly animal waste, crop residues, household organic waste, and sewage sludge. In Germany, maize has been used as a source of biogas (Rehman et al. 2013), and other crops have been considered for the purpose. Mallik et al. (1990) studied the possibility of using hemp for methane production and decided that it was unsuitable for this purpose. Pinfold Consulting (1998) concluded that while there may be some potential for hemp biomass fuel near areas where hemp is cultivated, "a fuel ethanol industry is not expected to develop based on hemp." Kreuger et al. (2011a,b) were more optimistic, considering hemp to be a potential source of biomass for biogas generators, based in part on their observation that steam pretreatment notably increased the conversion of hemp straw into methane.

Hemp Solid Fuel

Hemp can be burned directly for energy (Rice 2008), but there has been limited interest in this. However, because of its high biomass productivity, hemp is a potential feedstock for the production of solid biofuels such as briquettes and pellets (Prade et al. 2011; Aluru et al. 2013). Pelleted combustible material that can be used as fuel for pellet stoves and boilers represents a niche market. Today, fuel pellets are made almost exclusively from wood, although other biomass energy crops (such as cereal straw, miscanthus, switchgrass, and hemp) are being explored for the purpose (Kolarikova et al. 2013). Hemp produces relatively little ash when burned (often under 2%) and is comparable in corrosive effect to wood pellets (pellets from straw, miscanthus, and switchgrass can be relatively corrosive), and these are advantages for most pellet stoves currently marketed. However, Kolarikova et al. (2015) found that utilization of hemp for briquettes was not economically feasible.

NONSEED USE OF HEMP AS LIVESTOCK FEED

As noted in Chapter 8, hemp seed and its derivatives make excellent feed for animals. However, feeding entire plants is another matter because the leaves are covered with resin-producing glands. The herbaceous material (not the seeds) appears to have toxic potential if eaten in very large amounts. While deer, groundhogs, rabbits, and other mammals will nibble on hemp plants, mammals generally do not choose to eat hemp. Jain and Aroroa (1988) fed marijuana refuse to cattle and found that the animals "suffered variable degrees of depression and revealed incoordination in movement." Driemeier (1997) reported that four of five cattle died after consuming bales of dried marijuana leaves. Companion animals, especially dogs, occasionally are intoxicated as a result of consuming relatively small amounts of herbal marijuana but rarely are seriously harmed (foods such as brownies prepared with marijuana extracts can result in large amounts being consumed and consequent greater risk; see Chapter 12).

The EFSA Panel on Additives and Products or Substances Used in Animal Feed (2011), a comprehensive committee-based evaluation of hempseed as animal feed, came to the following evaluation (pertaining to low-THC hemp): The whole hemp plant (including stalk and leaves), due to its high fiber content, would make a suitable feed material for ruminants (and horses), and daily amounts of 0.5 to 1.5 kg whole hemp plant dry matter could likely be incorporated in the daily ration of dairy cows. However, due to observations that cows so fed secreted milk with THC and concern that other products (meat, eggs) could be similarly affected, the panel recommended that "whole hemp plant, hemp hurds, hemp flour (ground dried hemp leaves) should be placed on the list of materials whose placing on the market or use for animal nutritional purposes is restricted or prohibited."

Letniak et al. (2000) conducted an experimental trial of hemp as silage. No significant differences were found between yield of the hemp and of barley/oat silage fed to heifers, suggesting that fermenting hemp plants reduces possible harmful constituents.

ORNAMENTAL USE

Hemp has, at times in the past, been grown simply for its ornamental value. The short, strongly branched cultivar Panorama (Figure 10.2), bred by Iván Bósca, was commercialized in Hungary in the 1980s (*Journal of the IHA* 1994) and has been said to be the only ornamental hemp cultivar available. It has had limited success, of course, because there are very few circumstances that permit private gardeners to grow *Cannabis* as an ornamental today. By contrast, beautiful ornamental cultivars of opium poppy are widely grown in home gardens across North America, a very curious situation widely tolerated by the police and governments despite their illegality according to a strict interpretation of certain legislation. Tall fiber *C. sativa* has been employed in France as an ornamental maze (Figure 10.3). Doubtless, should it became legally permissible, many would grow hemp as an ornamental.

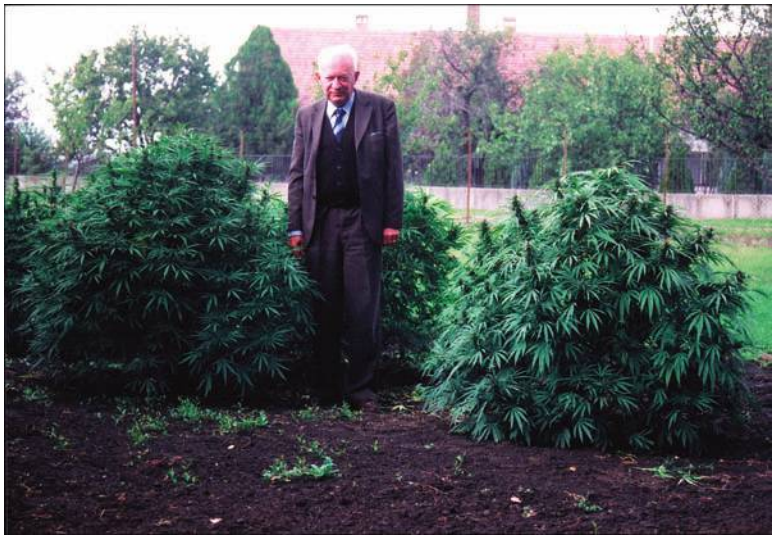

FIGURE 10.2 Panorama—the world's only ornamental hemp cultivar, with the breeder, Iván Bócsa. Photo courtesy of the late Professor Bócsa. According to De Meijer (1998, based on information provided by Bócsa), this arose as a back-cross hybrid between a globe-shaped dwarf mutant of a Lebanese drug strain and the monoecious cultivar Fibrimon.

FIGURE 10.3 Ornamental hemp maze in France. Photo by Barbetorte (CC BY 3.0).

HEMP AS A PROTECTIVE COMPANION PLANT

"Companion plants" are pairs of species, at least one of which benefits by being grown near the other. Sometimes, plant species are toxic to mobile insects, and their mere presence seems to safeguard nearby plants to some degree. Sometimes, plant species are allelopathic: toxic chemicals diffuse from them, particularly from the roots, and suppress nearby species, such as harmful soil organisms. As reviewed by McPartland (1997a), hemp near cotton and vegetable crops has been shown to protect them to some degree against certain of their pests, particularly nematodes, the reduction of these making the soil less threatening for subsequent different crops.

Crop rotation is a form of companion planting in which one species is deliberately planted in the same place as its benefactor grew the previous season. For most crops, rotation tends to reduce pests and diseases, in part because the unwanted organisms that build up on a given crop tend to have less success on the next season's different crop. As noted in Chapter 7, hemp is best alternated with several different crops in sequence over a period of years. Hemp benefits particularly from being planted where legume crops with nitrogen-fixing bacterial associates, such as alfalfa and clovers, have grown. In turn, hemp can benefit other crops in the rotation.

NATURAL PESTICIDES

McPartland (1997a) reviewed research on the pesticide and repellent applications of *Cannabis*. Powdered material and extracts of *C. sativa* have been used as antifeedants, repellents, and insecticides (Bouquet 1950; McPartland 1997b). Mukhtar et al. (2013) found that *C. sativa* is effective against nematodes. Gorski et al. (2009) found that hemp oil repelled aphids. There are numerous studies of the effects of crude preparations of cannabis on various classes of noxious organisms, but there is often insufficient evidence to attribute the effects to particular chemicals present. Nevertheless, dried plant parts and extracts of *Cannabis* have received rather extensive usage as homemade repellents in the past, raising the possibility that research could produce formulations of commercial value. Natural plant pesticides tend to be relatively benign to the environment and biodiversity compared to synthetics, so they are often welcomed in the marketplace. However, the commercial value of cannabis extracts is uncertain at present.

HEMP JEWELRY

Hemp jewelry combines colored hemp twine and (usually) colorful beads in the form of anklets, bracelets, necklaces, purses, and various other (usually female) accessories (see Figure 10.4). Wearing hemp jewelry has been popular among youth, frequently as an expression of "eco-chic." As expressed by Dvorak (2004), "Around college campuses and at concerts and village greens, hemp twine jewelry worn by the younger generation has become ubiquitous. Many people wearing it consider this to be a statement that they are for the environment and against cannabis hemp prohibition. Others simply wear it because it's cool." Complex knitting and knotting are often employed. Kits

FIGURE 10.4 Examples of hemp jewelry. Headbands by Totally Hemp (CC BY 2.0).

FIGURE 10.5 Gorgeous handbags made with hemp, exhibited in the Yunnan Nationalities Museum, Kunming, Yunnan, China. Photo by Daderot (released into the public domain).

for preparing hemp jewelry are widely available and so are preparation instructions on the Internet and in books (e.g., Baskett 1999; Lunger 1999). The recent interest in using hemp fiber for arts and crafts preparations mainly for women's attire is ironic, given that since ancient times, the Chinese have employed hemp to prepare astonishingly artistic items of the same nature (Figure 10.5).

HEMPSEED AS FISH BAIT

In some European countries, hempseed is considered to be an outstanding fish lure and is often sold in bait shops as dry, sterilized seeds. The seeds are usually prepared by boiling to the point that a hook will pass easily through them. Many anglers simply toss the intact hulled or ground-up seeds into the water to attract fish, using hooks baited with other materials to actually catch the fish. Instructional videos on the use of hempseeds for fishing are available online. In the United Kingdom, where hempseed is a popular fish bait, some fishermen with hempseeds intended for fishing have been arrested and charged with possession of a narcotic—an obvious misapplication of the law.

HEMPSEED AS A GROWTH MEDIUM FOR FUNGI AND OTHER MICROORGANISMS

Mycologists frequently employ boiled hempseed in sterile water to culture aquatic fungi, and indeed, this is the medium of choice for numerous water molds. Since hempseed is very attractive to many fungi and some other microorganisms that grow in water, hempseed is also often placed in natural aquatic (and even terrestrial) habitats for a period as "bait," and after the seeds have been colonized by these organisms, the material can be examined to determine exactly which species are present in the location.

HEMP AS AN AGRICULTURAL POLLEN BARRIER

One of the most curious uses of hemp, occasionally observed in Europe, is as a tall fence to physically prevent pollen transfer in commercial production of seeds. Isolation distances for ensuring that seeds produced are pure are considerable for many plants and are sometimes too large to be

practical. At one point in the 1980s, the only permitted use of hemp in Germany was as a fence or hedge to prevent plots of beets being used for seed production from becoming contaminated by pollen from ruderal beets. The high and rather impenetrable hedge that hemp can produce was considered unsurpassed by any other species for the purpose. As well, the sticky leaves of hemp were thought to trap pollen. However, Saeglitz et al. (2000) demonstrated that the spread of beet pollen is only partly prevented by hemp hedges. Tall fiber varieties of hemp were also once used in Europe as wind-breaks, protecting vulnerable crops against wind damage. Although hemp plants can lodge (bend over permanently), on the whole, very tall hemp is remarkably resistant against wind.

EDIBLE SHOOTS (STEMS AND FOLIAGE)

The extensive edible uses of the seeds and their fixed seed oil and the possible use of seedlings as sprouts are discussed in Chapter 8. The flavoring use of the essential oil is discussed in Chapter 9. As noted in Chapter 4, honey bees collect pollen from *C. sativa*, and so some of this may end up in honey, although almost certainly in insignificant amounts. Recreational marijuana is widely incorporated into edible preparations (Chapter 12). However, eating the foliage, stems, or floral material is unpleasant and at least slightly toxic, and edible material for humans generally has been prepared by extracting THC (usually in fats such as butter when used in brownies and the like or in alcohol in liquid preparations), so that the marijuana itself is not eaten. Despite the lack of palatability and potential toxicity, there are statements from various authors (not well documented) that leaves, twigs, or flowers are occasionally eaten (Cheatham et al. 2009, pp. 38–39). As noted in Chapter 12, bhang is a traditional Asian beverage made with chopped cannabis foliage.

CURIOSITIES OF SCIENCE, TECHNOLOGY, AND HUMAN BEHAVIOR

- The use of plant biomass to generate fuels is widely regarded as an important environmentally beneficial way to reduce the consumption of fossil fuels and the consequent generation of greenhouse gases contributing to greenhouse gases and climate change. Until 2012, the European Union (EU) heavily subsidized crops such as hemp and flax that are regarded as good for the environment. In the 1990s, the EU provided a subsidy of more than $1000 per hectare (approximately $400/acre) for farmers who grew flax and hemp. In a classic example of how good-intentioned legislation can be abused, in 1998, thousands of hectares of flax were grown in Spain and Ireland, the subsidies were collected, and all of the crops were simply unharvested or burned in the fields, worsening environmental pollution.
- Supercapacitors are energy storage devices using activated carbon electrodes to provide quick bursts of power. They are used currently in braking systems for buses and fast-charging flashlights. Heating and chemically treating hemp phloem fibers have been found to produce a material with potential to store much more energy in supercapacitors than the activated carbon electrodes currently used (Wang et al. 2013).
- According to *Popular Mechanics* (1938), "Thousands of tons of hemp hurds are used every year by one large powder company for the manufacture of dynamite and TNT." Hemp hurds (the woody interior of hemp stems) are highly absorbent and so would have been useful to soak up the explosive chemicals in cylinders or sticks. However, the use of organic materials such as hemp hurds and sawdust to hold the explosives has generally been discontinued in favor of more stable absorbents.