

Appendix III

State Report Summaries

Summary

Report to the Governor's Hemp and Related Fiber Crops Task Force Commonwealth of Kentucky, June 1995

- Most analysts forecast long-term increases in world demand for all types of fibrous materials, and some predict limitations in production capacity. New fiber crops, new industrial uses of nonwood fibers, and agricultural diversification in general are therefore subjects of widespread interest. Kentucky agriculture is not alone in efforts to pursue these possibilities, and will be required to compete with producers in other states and nations.
- Kentucky history, as well as recent research in other temperate zone countries, demonstrates that hemp can be produced in the Commonwealth. Selection of adapted varieties, crop management practices, harvesting technology and several other agronomic aspects may require a significant research and development effort if hemp is to be a large scale crop. Yet there is no reason to believe that these production issues are insurmountable.
- The historical advantages (for example: favorable climate, naturally fertile soils, labor supply) held by Kentucky hemp producers, particularly hemp seed producers, have been made somewhat less important by modern agronomic technology.
- Hemp and kenaf may have a slight advantage over certain other annual row crops with regard to potential environmental impacts. This might result from projected requirements for less pesticide and modest reductions in soil erosion.
- Currently, established markets for hemp in the U.S. are generally limited to specialty/novelty textiles, oils, foods, paper and other materials. The specialized nature of this market does not require competition with other fiber sources. The potential market size is difficult to predict, but it is unlikely to support the large acreage of a major new field crop.
- Bast fibers contribute an exceedingly small fraction of world textile fiber supply, which is overwhelmingly dominated by cotton. Increasing world demand and price for cotton in recent years has generated some interest in alternative fibers. However, extraction and processing of bast fibers for high-quality textiles is more difficult than for cotton. A large investment, and perhaps some technological innovation, will be required by the textile industry if bast fibers are to become competitive as mass market textiles.
- Use of annual fiber crops for most paper applications or for building materials, as a substitute for wood or recycled fiber, could create a very large but relatively low value market. Crop prices above \$60/ton would probably be required to interest most producers; this price might preclude extensive competition in this market. Vast quantities of fibrous waste materials (sugar cane bagasse, straw) are available world wide and would also compete for such applications.
- A large and long-term USDA effort on kenaf has addressed many production and processing challenges. Infrastructure for significant utilization of kenaf fiber is beginning to develop in the southern U.S. The University of Kentucky College of Agriculture is actively investigating kenaf production. Development of this alternative fiber crop in Kentucky will be dependent on nearby location of processing facilities and a profitable market for farmers.
- Legal prohibition of *Cannabis* cultivation is the overriding obstacle to reintroduction of fiber hemp production in Kentucky. Significant progress on agronomics, marketing, or infrastructure development is unlikely, and of relatively little importance, unless legal issues are resolved. Legislative action would be required at both the state and federal level. Such consideration would likely receive strong diverse reactions from both private and public sectors.

Source: McNulty.

Summary
Feasibility of Industrial Hemp
Production in the United States
Pacific Northwest
May 1998

For many centuries hemp (*Cannabis sativa* L.) has been cultivated as a source of strong stem fibers, seed oil, and psychoactive drugs in its leaves and flowers. Environmental concerns and recent shortages of wood fiber have renewed interest in hemp as a raw material for a wide range of industrial products including textiles, paper, and composite wood products. This report assesses the agricultural feasibility of industrial hemp production in the Pacific Northwest (PNW).

Hemp is an herbaceous annual that develops a rigid woody stem ranging in height from 1 to over 5 meters (3 to 19 feet). Hemp stalks have a woody core surrounded by a bark layer containing long fibers that extend nearly the entire length of the stem. Plant breeders have developed hemp varieties with increased stem fiber content and very low levels of delta-9-tetrahydrocannabinol (THC), the psychoactive ingredient of marijuana.

Historically, hemp fiber was used mainly for cordage, but it can also be made into textiles, paper, and composite wood products. Demand for hemp cordage peaked in the late 1800's, and world hemp production has continuously declined since that time, except for brief increases during both World Wars. Hemp fiber

has largely been replaced by relatively inexpensive natural and synthetic fibers.

Although hemp is well adapted to the temperate climatic zone and will grow under varied environmental conditions, it grows best with warm growing conditions, an extended frost-free season, highly productive agricultural soils, and abundant moisture throughout the growing season. When grown under proper conditions, hemp is very competitive with weeds, and herbicides are generally not required in hemp production. Although a number of insect pests and diseases have been reported on hemp, significant crop losses from pests are not common. High levels of soil fertility are required to maximize hemp productivity. Cultural requirements and production costs are quite similar to those of corn. Reported hemp yields range from 2.5 to 8.7 tons of dry stems per acre.

The climatic and soil requirements of hemp can be met in some agricultural areas of the PNW, however, hemp will almost certainly require irrigation to reliably maximize productivity in the region. The requirement for supplemental irrigation will place hemp in direct competition with the highest value crops in the PNW, limiting available acreage. Stem yields will have to be substantially higher than those previously recorded for hemp to be economically feasible in the PNW at current prices. It is unlikely that the investment needed to improve hemp production technology will be made until legislative restrictions are removed from the crop.

Source: Ehrensing.

Executive Summary

Economic Impact of Industrial Hemp in Kentucky

July 1998

In recent years, industrial hemp has been viewed worldwide as a versatile and environmentally friendly plant that has many industrial applications. Although it is currently grown in many European and Asian countries and even in Canada, industrial hemp is still prohibited from being grown in the United States.

This situation exists even though the current consumer and business environment in the United States may make industrial hemp cultivation and processing commercially feasible. Many consumers are starting to prefer products made from natural materials. The industrial hemp plant is a good source of natural raw materials for a number of products and is a superior source in some cases. Moreover, many farmers in Kentucky and throughout the nation are looking to alternative crops to replace their current crops, and some have touted hemp as an excellent rotation crop with much potential for agriculture.

Kentucky should be in a position to benefit from the establishment of an industrial hemp cultivation and processing industry in the United States. Historically, Kentucky has been a good location to grow hemp. Before hemp cultivation was outlawed, it had been a major crop in Kentucky and grew well in the climate. In the 1800's, Kentucky regularly accounted for one-half of the industrial hemp production in the United States. The climate, soil, and growing season in Kentucky also make the state a superior location for growing certified hemp seed to be planted by farmers raising an industrial hemp crop.

The Kentucky Hemp Museum and Library contracted with the University of Kentucky Center for Business and Economic Research to conduct an analysis of the potential economic impact of industrial hemp in Kentucky. This study looks at the different markets for hemp products, examining both the current markets in which foreign-grown hemp is being used, and potential or burgeoning markets that may have uses for industrial hemp.

In the report, we estimate costs for growing industrial hemp in Kentucky and provide information on potential prices farmers could expect for their hemp crop.

We also compare the return from cultivating industrial hemp with the returns for other crops in Kentucky. In addition, we detail the costs of a hemp processing facility to separate the hemp into fiber and other materials. Finally, we estimate the potential jobs and earnings impacts of growing industrial hemp in Kentucky under several scenarios.

Among the key findings of this report are:

- A market for industrial hemp exists in a number of specialty or niche markets in the United States, including specialty papers, animal bedding, and foods and oils made from hemp.
- Additional markets could emerge for industrial hemp in the areas of automobile parts, replacements for fiberglass, upholstery, and carpets.
- Using current yields, prices, and production technology from other areas that have grown hemp, Kentucky farmers could earn a profit of approximately \$320 per acre of hemp planted for straw production only or straw and grain production, \$220 for grain production only, and \$600 for raising certified seed for planting by other industrial hemp growers. In the long run, it is estimated that Kentucky farmers could earn roughly \$120 per acre when growing industrial hemp for straw alone or straw and grain, and \$340 an acre from growing certified hemp seed.
- Industrial hemp, when grown in rotation, may reduce weeds and raise yields for crops grown in following years. Several agronomic studies have found that industrial hemp was more effective than other crops at reducing selected weeds. One study found that industrial hemp raised yields by improving soil ventilation and water balance.
- The economic impact if Kentucky again becomes the main source for certified industrial hemp seed in the United States is estimated at 69 full-time equivalent jobs and \$1,300,000 in worker earnings. The total economic impact in Kentucky, assuming one industrial hemp processing facility locating in Kentucky and selling certified seed to other growers, would be 303 full-time equivalent jobs and \$6,700,000 in worker earnings. If two processing facilities were established in Kentucky, industrial hemp would have an economic impact of 537 full-time equivalent jobs and \$12,100,000 in worker

earnings. If one processing facility and one industrial hemp paper-pulp plant were established in Kentucky, industrial hemp would have an economic impact of 771 full-time equivalent jobs and \$17,600,000 in worker earnings.

- These economic impact estimates reflect possible outcomes for Kentucky given a national industrial hemp industry that is focused in specialty niche

activities that have been demonstrated to work in Europe. It is important to remember, however, that technologies are under development that may allow industrial hemp products to compete in bulk commodity markets. The economic impacts that would occur if these technologies were found to be commercially feasible would be substantially greater than those identified in this report.

Source: Thompson et al.

Executive Summary
Industrial Hemp as an Alternative
Crop in North Dakota
July 1998

This preliminary study reports on current efforts to define existing world markets and possible United States markets for industrial hemp as well as resulting economic feasibility should production be legalized. A large percentage of the information available on industrial hemp is by non-agriculturists. This indicates a need for North Dakota to continue working with its agricultural counterparts to bring this potential alternative crop into the agricultural research domain.

- The industrial hemp world market consists of over 25,000 products in nine submarkets: agriculture, textiles, recycling, automotive, furniture, food/nutrition/beverages, paper, construction materials, and personal care. These products are made or manufactured from raw materials derived from the industrial hemp plant: fiber, hurds, and hemp seed/grain.
- World hemp fiber production has declined from over 400,000 tons in 1961 to 113,000 tons in 1996. India, China, Russia and Korea are the major low cost producers. This constitutes about 250,000 acres under production worldwide. Preliminary figures for 1997 indicate that this downward trend continues.
- A revitalization of industrial hemp may be occurring as indicated by projected increased demand (retail sales) from \$75 million in 1997 to \$250 million by 1999 worldwide (*Wall Street Journal*, April 24, 1998). Various reasons that would explain this phenomenon include technological advances in processing, an increase in pricing, or interpretation of existing information.
- The largest market opportunity for North Dakota identified in this report may be hemp seed oil. This opportunity was also identified by the University of Kentucky (July 1998).

- North Dakota may have a comparative advantage because a state of the art multi-oil processing facility already exists that is capable of processing hemp seed.
- Hemp hurds appear to be price competitive with wood chips, fine wheat straw, other types of animal bedding, and other high-end pet needs. Hurds may also be a complement or substitute material in strawboard production.
- Certified seed production is a market opportunity.
- Initially, hemp appears to be comparable to barley. However, a 1998 Kentucky study projects higher returns from \$220.15 per acre for producing hemp seed for crushing to \$605.91 for certified seed.
- Historically, imported jute and abaca were intense competitors with American industrial hemp.
- Law enforcement agencies have legitimate concerns about their ability to enforce laws regulating industrial hemp production. Advances in biotechnology such as terminator genes may create solutions.
- Recommendations. Since industrial hemp may have potential as an alternative rotation crop, it is recommended that the North Dakota Legislature consider action that would allow controlled experimental production and processing, then, necessary baseline production, processing, and marketing data could be collected and analyzed. For example, all new enterprises would require a critical threshold volume in order to succeed in terms of economic profit. What is the volume and the acreage required to produce it? At the same time the concerns and costs of law enforcement agencies could be addressed.

Source: Kraenzel et al.