Kenaf and Hemp
Identifying the Differences

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Introduction

It has been reported that The Declaration of Independence, the Constitution, the Bill Of Rights, and or the Articles of Confederation were written and or drafted on hemp paper. (1) All of these historic documents are written on parchment, made from animal skin, according to the National Archives.(2) This type of reporting error is indicative of the confusion that exists regarding hemp as nonwood fiber source for paper production. This paper will discuss hemp and kenaf from a papermaking perspective, and identify some of the differences.

Discussion

Kenaf is a Hibiscus (Hibiscus cannabinus L.), which is part of the Malvaceae (Mallow) family. It is related to cotton, okra and the state flower of Hawaii. Hemp is Cannabis (Cannabis sativa), the same plant as marijuana and classified as a member of the Moraceae family (Mulberry). Thus, kenaf and hemp are not related to each other.

Both plants are fast growing annual fiber sources. They are both dicotyledons, which means their stalks have an outer bast fiber and an inner core fiber. Both crops have roughly the same type of agricultural requirements, including a nitrogen requirement (hemp is not a nitrogen fixer, as has been sometimes reported).(3) Both crops can be grown over a broad geographic range. They are both being touted as alternative crops that can help farmers and the environment. But it seems there are as many differences as there are similarities.

Physical differences

Seed Shapes

Hemp seeds are almost round, with a smooth surface, and a seam around the circumference. They are brown and tan speckled in color, and about 1/8 to 1/4 of an inch long.(4,5) Kenaf seeds are grayish brown 1/4" long, and semi-pyramided in shape, described in one article as "resembling a tiny sharks tooth."(5) (See Illustration 1.)

Stalk Shapes

Kenaf stalks are generally round, and depending on variety, thorns on the stalks range from quite tiny, to as large as on a blackberry bush. (6) The kenaf stem contains two types of fiber, one comprising long fibers situated in the cortical layer, and another containing short fibers located in the ligneous zone. The central area, corresponding to pith, consists of sponge-like tissue.

Hemp stalks are four sided with no thorns.(7) They are described as being a rigid herbaceous stalk with well marked nodes at intervals of 4 to 20 inches that are obtusely four cornered and are fluted or channeled.(8) From the inside moving outward, the stalk has a hollow core, except at joints, and a pith which is also called hurd, comprising 60-75% of the total mass. The cambium is next and it is the differentiating layer. The Cambium is pith on the inside and bast and bark on the outside. Phloem or Parenchyma, short cells containing chlorophyll and long cells that are the bast fibers are next, followed by the cortex which is a thin wall of cells having no fiber but containing chlorophyll. The epidermis is the thin outside protective layer of plant cells.(9)

Leaf Shapes

Some varieties of kenaf have a solid leaf shape, common to many hibiscus varieties. Other varieties of kenaf can be quite similar to hemp. "Some deeply palmate varieties appear much like marijuana, even to serration" reports the Maryland Trooper Magazine in its article "Is It Pot, or Is It Not?" A hemp leaf consists of seven or nine individual leaves joined at a common stem. There are variations in hemp leaves based on specific variety, just as kenaf leaves have variations, but a kenaf leaf is clearly a single leaf with seven lobes.(10) (See Illustration 2.)

Fiber characterization and content

The fiber makeup of kenaf and hemp is significantly different. Whereas a kenaf stalk consists of approximately 40% bast fiber and 60% core fiber, the hemp stalk is made up of 25% bast fiber, with primary and secondary layers, and 75% core or "hurds" as they are referred to in relation to hemp.(11)

The fiber structure is significantly different. The kenaf bast fiber measures 2.6 mm in length and is roughly equal to a softwood (pine) fiber. Softwood fibers are the high quality type commonly used in commercial scale paper production. Hemp bast fiber is much longer and stronger, measuring between 15 and 50 mm, with 25 mm being a commonly reported average. This type of fiber is most commonly used in textiles and rope making. Both kenaf and hemp core fibers are shorter than the bast, measuring .6 mm and .5 mm respectively. Table 1 illustrates the fiber lengths of hemp and kenaf, as well as wood and straw for comparison.

A common reporting error regarding hemp is the claim of excellent fiber properties, particularly the use of the hurd for papermaking. These claims probably stem from a 1938 Popular Mechanics article, which incorrectly stated that the woody core of hemp was 77% cellulose. Scientific and technical literature indicates that the cellulose content of hemp's core ranges from 30-40%.(12) The difference in cellulose content is substantial when one is evaluating pulping efficiency. This incorrect claim has been repeated and reprinted widely.(13)

It has been erroneously reported that hemp is the longest and strongest fiber in the world. Common fibers such as flax and cotton have a longer average fiber length than hemp.(14)

Yields

The yield per acre is notably different. Kenaf is commonly reported to produce 6 to 10 tons of dry fiber per acre in 4 to 5 months time. Hemp's fiber production is generally less than half that with yields of four tons being considered good. Ian Wood, of Australia's CSIRO reports that kenaf yields can be 3 times the yields for hemp.(15)

It has been reported that hemp produces more biomass per acre than any other plant.(16) Corn, sugarcane, kenaf and papyrus, to name a few, produce more biomass per acre than hemp.(17)

Cost Effectiveness

The Kenex Company, a major hemp producer in Canada, offered contracts to farmers in 1998 and projected total yields of 3.5 tons per acre. They reportedly paid between CN $200-$275 ($135 - $188 U.S.) per ton for baled hemp delivered at 15 per cent moisture or less.(18) The price being offered for raw hemp indicates it would be economically disadvantaged, to a substantial degree, compared to wood fiber or kenaf for paper making. Prices for pulpwood vary based upon region and other market factors, and are typically $40-$75 per ton. The price paid for raw kenaf fiber is roughly the same as for pulpwood.

Hemp pulp sells for as much as $2,500 per ton(19), and wood based pulp was selling for one-quarter of that price, $630/ton, in February 2,000.(20)

Political differences - Prohibition and subsidies.

Prohibition

Kenaf is a legal crop with no drug value. Industrial hemp's relationship to marijuana is a more problematic issue. Hemp proponents claim it has no drug value, but according to Dr. Mahmoud A. ElSohly, Research Professor at the Research Institute of Pharmaceutical Sciences, University of Mississippi, "THC can be extracted from hemp leaves and, obviously, the concentration of THC in the extract will be several-fold higher than that in the plant material." Supporting Dr. ElSohly's position, a chemist at the University of Kentucky in Louisville, indicates that "a means could be devised to extract almost any organic chemical from any biological material."(21) While a definition of the exact means of such extraction is beyond the scope of this paper, it is clear that such a process is possible.

Subsidies

Hemp is being grown in Europe, Canada, and parts of Asia. While U.S. kenaf farmers get no subsidies, European hemp farmers are heavily subsidized.(22)

Conclusion

Kenaf fiber characteristics are similar to wood fibers, while hemp fibers, particularly the

bast, are substantially different. Kenaf yields are greater than hemp yields, therefore providing a more cost effective raw material. Unlike hemp, kenaf is legal to grow, and is currently in development as a raw material source for paper production in the U.S.

References

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Illustration 1.

Hemp seeds Kenaf seeds

Illustration 2.

Hemp leaf Kenaf leaf (Tainung 2) Kenaf leaf (Everglades 41)

Table 1.

Fiber length comparison (mm).