

# TECHNICAL NOTE NUMBER 220

FOREST PRODUCTS LABORATORY U. S. FOREST SERVICE MADISON, WISCONSIN

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## USEFULNESS OF FIBROUS PLANTS IN THE PAPER INDUSTRY

The Forest Products Laboratory receives frequent requests for information regarding the possible use of plant fibers, such as sugar cane (bagasse), corn stalks, bamboo, and the various straws and grasses, for pulp and paper manufacture. Its investigations of these materials have not been very extensive, but the indications are that the pulping of these fibers for print paper manufacture is not economical under present conditions in this country.

Unfortunately none of the plant materials pulped were found very suitable for newsprint. Even when the groundwood pulp shortage becomes more acute and the price of pulpwood increases to the point where the fibrous plants can compete with spruce, balsam, and hemlock, the newsprint market, which with the exception of paper board is the largest market in the paper industry, will probably not be opened to these materials. Some of the fibers can be pulped and made into fairly good grades of book, magazine, lithograph, and writing papers which under favorable economic conditions can compete with papers made from the standard pulp materials. Practically the only use any of the fibrous plants find at the present time in the paper industry, however, is in the manufacture of corrugated board, the cheaper board products, and specialties.

The chief difficulties standing in the way of the economic utilization of fibrous plants and waste crop products as pulp materials are the following. The cellulose suitable for pulp contained in such materials is usually in such small amounts or is so difficult to purify that the cost is prohibitive. Many of the plant stalks contain large percentages of pith. The pulp produced from them is weak and requires high chemical

consumption. Because of the bulkiness of the raw material, the yield from a digester charge is small as compared to the yield for wood pulp. The difficulties of collection and the high costs of transportation limit the amount of material available: As most of the fibrous plants are seasonal crops, facilities must be provided for the storage of a large volume of stock in order to permit the paper mill to operate throughout the year. The susceptibility of the material to decay adds greatly to the costs and difficulties of storage. The fire hazard is also very great.

A summary of the pulping characteristics of the more important fibrous plants and waste crop products, as determined by trial runs at the Forest Products Laboratory, the Bureau of Plant Industry, and one or two commercial mills, is given below.

**STRAW.** By ordinary pulping processes two types of pulp can be made from the common varieties of straw, one a bleachable material suitable for book and magazine paper and the other a fairly tough product adapted to the manufacture of wrapping papers and container board. The latter is especially valuable in the manufacture of egg-case board and corrugated board. The standard straw for board is wheat straw, although oat, rice, rye, and flax straw could be used. Flax straw can be made into a very tough paper, almost as good as currency paper, but the process is rather expensive, and the cost of the raw material is high.

**HEMP.** Hemp flyings, the waste of the rope industry, can be used in the manufacture of a very thin, strong, opaque paper known as "Bible" paper. Hemp hurds can be pulped and run into book paper.

**JUTE.** Jute fiber is used extensively in the manufacture of wrapping and tag paper. The product is of excellent strength and durability, second only to hemp. As jute is not a pure cellulose fiber but is a ligno-cellulose, the paper can only be bleached to a bright

yellow color which places certain limitations on its use. Jute fiber comes to a paper maker in the form of waste twine and burlap. The cost of converting the raw fiber into a suitable form for paper would be excessive.

**STALKS.** Corn stalks can be pulped by a slightly modified caustic soda process so that not only the fibrous casing but the pith as well can be made into fair book paper. Broom corn stalks and sugar cane (bagasse) could be used for book paper. Bagasse is being used commercially in the manufacture of wall board and for the mulching paper in sugar cane and pineapple cultivation. Cotton stalks have been found to have very short fibers and the pulping process is very expensive. Cotton stalks may find a use as pulp for cheap paper or board.

**BAMBOO, PALMETTO, GRASS, AND YUCCA.** No bamboo is being used for paper in this country. In India only four or five of the several hundred species have been found suitable for paper-making purposes. The Forest Products Laboratory has pulped bamboo by a mixture of sodium carbonate and sodium sulphate, and made paper that compares favorably in some respects with kraft. Cabbage palmetto can be used for sulphate pulp and possibly for magazine or book paper when mixed with small quantities of sulphite pulp for strength. Among the grasses that can be pulped by the soda process are saw, esparto, Japanese, and zacaton. The fibers are usually quite short, and the pulp would be most useful as a filler with the longer fibered pulps. Esparto grass is used quite extensively in Europe. Spanish bayonet or yucca can be pulped by the milk of lime process and made into strong paper rivaling "rope" and kraft paper. Soap weed can be pulped and made into cheap wrapping or packing paper.

**COTTON LINTERS.** High-grade stock can be produced from second-cut cotton linters, shavings, and hull fiber. Under favorable economic conditions, this stock competes with wood and rags in the manufacture of the better grades of paper.