The Flax Industry of To-day

NO PLANT not yielding food to man is more valuable than the flax plant. It is highly valuable both for the fibers of the inner bark and for its seed. Yearly millions of tons of flax straw, which is grown in nearly every corner of the earth to a greater or lesser degree, goes through the retting process and is spun into the finest fabrics. From the seed countless millions of gallons of oil are yearly manufactured and consumed in numerous ways.

Of all the plants cultivated for fiber, flax (linum usitatissimum) is doubtless one of the earliest, and we know of its existence from the times of the first authentic records. Even cotton, which was mentioned in the writings of Herodotus in 445 B.C., must take its place as a comparatively modern product with reference to its forerunner linen. Because of this very antiquity the origin of the flax plant is rather uncertain; but it is believed that it arose in the region between the Caspian Sea and the Persian Gulf. That is was cultivated and manufactured by the Swiss lake dwellers in the Stone Age in Europe is proved by the well preserved specimens of straw, fiber, yarn and cloth to be found in the museum. This ancient flax was, however, from another species (linum angustifolium). The Egyptians produced and used flax thousands of years ago, and the Chaldeans and Babylonians carried its use to the highest state of development, particularly in tapestry work. Three thousand years ago the Phoenicians extended the culture, the Greeks and Romans made it a household industry, and it subsequently became the aristocratic fiber. It is claimed that the ancient Mexicans were acquainted with both flax and hemp, and the culture in that country goes back far beyond the earliest date of our civilization. It was introduced to America in Massachusetts as early as 1630.

Grown World Over

While the plant can be grown in nearly every portion of the temperate world, flax is cultivated principally for the production of the fiber in Central and Northern Russia, in Holland, Belgium, Ireland, and Northern Italy. In Southern Russia, British India, Argentine, the United States and Canada it is grown almost exclusively for seed production; in these regions the straw is used for fuel, stable bedding and sometimes for forage. In a few localities of the United States the straw is used for paper stock, or is made into upholstering tow; this latter industry has been carried on extensively in Scotland by the farmers in by-gone days.

While the cultivation of flax for seed and the manufacture of this into oil and oil cake has grown into industries of enormous proportions in the United States and is fast coming into prominence in Canada, only in a few instances is the plant grown for the production of spinning fiber. At Yale, in Eastern Michigan, at Northfield and Heron Lake, Minn., and at Salem and Scio, Oregon, the flax is cultivated for its fiber.

While flax was extensively grown and its fiber spun and woven during colonial times, it was used almost entirely as a home product for consumption in the families of the weavers, and it is probable that very little linen was manufactured for purposes other than this. While it was possible that after the successful termination of the Revolutionary war the industry would have grown to considerable importance in the hands of the American people, with the abolition of England's repressive colonial policy in regard to manufactures, the invention of the cotton gin by Eli Whitney checked its future development at once. This invention placed within reach of the manufacturer a fiber that was cheaper than flax, that required less care in preparation, was more easily worked, superior for many purposes, and decidedly inferior for very few, and in consequence the manufacture of linen was practically abandoned. Until within comparatively recent times the attempts to re-introduce it have been few and generally unsuccessful.

Nearly all the flax fiber used in the United States is imported from Russia, Holland, Belgium and Ireland, while Canada and Italy contribute small quantities. A great deal of the so-called "Irish flax" is grown in Belgium and sent to Ireland for preparation.

Culture of Flax

The culture of flax requires a deep, well-tilled soil in a high state of fertility. Wet soils, such as some clays, are disastrous to the crop. Similarly fatal are soils filled with the seeds of weeds. Moist, deep strong loams upon upland in a moderately moist climate are especially favorable to the plant. The land must be fairly deeply plowed and thoroughly packed and harrowed, especially in the Middle West of the United States and in the three Western provinces of Canada where periods of drouth are frequent. Flax, in the older countries, is generally sown broadcast, the seed being sown at a depth of one-half an inch to an inch. Though the root system is small the growth of the plant is rapid, maturity being reached in about one hundred days. Owing to the fact that the plants derive a great deal of their nourishment from the ground during their first month it is absolutely necessary that a firm well pulverized seed-bed be prepared before the seed is sown. It is absolutely necessary that the crop be clean, as the plants are easily choked out by weeds.

In countries where flax is grown for linen the best is pulled out by the roots. This is done to avoid stain and injury, which would result from soil moisture while the cut stems were in the shock, to secure straws of the greatest length, to ensure better curing of the straw and ripening of the seed, and to avoid the blunt cut ends of the fiber. The straw is often allowed to dry on the ground, and then to cure for two or three weeks in the shocks, though the practice varies somewhat in different countries. The seeds and leaves are removed by a process called rippling. This is done today by machinery, the heads of the unbound bundles being pressed between rapidly-revolving corrugated rollers, which crush the seed pods. The seeds and leaves are then removed by means of a fanning mill. After this the straw is stacked until required for the retting. The flax fibers which appear to consist of pure cellulose and show no signs at all of being lignified, are held together by an intercellular substance consisting mainly of calcium pectate.

Retting

The object of the retting is to decompose or make soluble these woody tissues inclosing the cellulose or bast fibers, so that they can be removed from the latter. The water-retting of flax is a biological process. The action of the water causes the outer bark to decay, leaving the fibers clean and unaffected.

On the retting process depends the quality of the linen, and it is that stage of the industry which presents the greatest difficulty. There are three methods which can be employed, and of these the simplest and least irksome is dew-retting. The straw is simply spread evenly over the fields like hay to be retted by the action of the dew and the elements. The fiber resulting from this method is the most uneven and the least valuable product of the three processes. With the exception of a few instances this is the process usually employed in the United States. The second method called pond-retting consists in immersing the bundles of straw in stagnant pools, the softest water, such as rain water, giving the best results. Holes are dug in the ground for this purpose, though a great part of the Irish flax is retted in "bog-holes". The resulting flax fiber is better than dew retted product and is lighter in color, being a fairly light bluish-brown. The third method consists of immersing the straw in running water. This is the form practiced in Belgium where the finest product of this kind in the world, the famous Courtrai flax is retted in the murkey waters of the sluggish river Leys. The flax straw in bundles is placed in crates which are weighed with stones and submerged in the water of the stream for two periods, each of from four to fifteen days according to the temperature and other conditions. After the first immersion the straw is taken out and carefully dried before the second retting. The Coutrai flax is of a light color and of superior tensile strength. Its excellent qualities appear to be due not so much to the retting in sluggish running water as to the actual qualities of that water and the peculiar ferment contained therein.

Decorticating Process

After the flax has been retted it undergoes a decorticating process which removes the bark and the loosened underlying, woody tissues and isolates the linen fibers in a purified condition. The first operation consists of passing the straw through a breaker, which loosens the woody portion of the stems and reduces them to fragments to facilitate the following operation, the scutching, which whips out the "chive" and all other waste matters, leaving the pure flax fiber. Within recent years machinery has been designed that successfully performs all operations subsequent to retting, but in former times the work was done by hand or with very crude mechanical aids. Rapidly revolving blades smashed the waste material from the bundles of flax straw which were held against a flat surface parallel to the plane of the wheel. The scutched flax is subsequently hacked or dressed by repeated combings, which remove the short and broken or tangled fibers and thereby produce tow. Each hackling improves the quality and, of course, adds to the cost.

Numerous chemical methods have been proposed for retting flax, to improve and shorten the natural processes, and numerous patents have been granted in the United States and abroad, covering these artificial methods. Amongst them are processes consisting of heating with water under pressure, boiling with solutions of oxalic soda or the addition of various chemicals to the retting water, such as hydrochloric and sulphuric acids. Numerous patents also exist on retting pools or tanks. Few of all these processes have proven of any industrial value. However, one of the exceptions to this appears to be a process issued by two Belgians, Dr. Georges Loppens and Honore' Deswarte. Briefly, the process consists in covering a mass of vertically-arranged flax straw in special tanks with water, constantly delivering fresh water, preferably rain water, beneath the mass and at the same time constantly withdrawing the same quantity of impure water from below the level of the fresh water. This method is now in use in the United States. During the first season it was not employed with success, but it appears that this deficiency may be ascribed to inexperience in the handling of the apparatus rather than to any fault of the process. There is little doubt that in the future Loppen's method, as it is called, will prove entirely successful, for it is extremely simple in operation and absolutely under the control of the operative.

Linseed Oil

Flaxseed, commonly called linseed, grown in tropical countries is much larger and more plump than that obtained in temperate climes, but the seed from the colder countries, on the other hand, yields a finer quality of oil. The oil is not used to any extent as food, but a great deal of it is used in various medicines and perhaps nothing is better known to the sick than linseed poultices. Linseed cake, the marc left after the expression of the oil, is a most valuable feeding substance for live stock, especially cattle.

The most important use of linseed is certainly found in the preparation of oil paints and varnishes. By painters both raw and boiled oil are used, the latter not only forming the principal medium in oil painting, but also serving separately as the basis of all oil varnishes. The oil is obtained by pressing the seeds. Preliminary to the operation of pressing, the seeds are crushed between a pair of revolving rollers and ground to a fine meal under heavy stones on a stone bed. For the extraction of the fine quality of oil known as "cold drawn," the meal is, without further preparation filled into woollen or canvas bags and inclosed in horse-hair envelopes for pressure, either in a Dutch mill worked by means of wedges and falling stampers or in a screw press, or, what is now more common, in a special form of hydraulic press. The oil so obtained is of a clear yellow color, and is comparatively devoid of odor or taste. The yield of oil from different classes of seed varies, but from 23 to 28 per cent. of the weight of the seed operated on should be obtained. A good average quality of seed weighing about 392 pounds per quarter has been found in practice to give about 109 pounds of oil.

Boiled Oil

Boiled oil is prepared in a variety of ways, that most common being by heating the oil in an iron or copper boiler, which, to allow for frothing, must only be about three-fourths filled. The boiler is heated by a furnace and the oil is brought gradually to the boiling point, at which it is maintained for two hours, during which time moisture is driven off and the scum and froth which accumulated on the surface are ladled out. Then by slow degrees a proportion of "dryers" is added—usually litharge being used to the extent of 3 per cent. of the charge of oil; and with these a small proportion of umber is generally thrown in. After the addition of the dryers the boiling is continued two or three hours. The fire is then suddenly withdrawn, and the oil is left covered in the boiler for ten hours or more. Before sending it out it is usually stored in settling tanks for a few weeks during which time the uncombined dryers settle at the bottom. Boiled oil being treated with dryers accounts for it being poisonous. Mistakes have occurred, boiled oil being given to horses instead of raw oil, with serious effects. Boiled oil is now very largely used in the manufacture of linoleum. Linseed oil is one of the principle ingredients in lithographic inks and in printing.

Flax in the West

Of recent years the growing of flax has increased rapidly in the Middle West and the western provinces of Canada. The high prices offered for flax seed during recent years has undoubtedly urged the farmers of Manitoba, Saskatchewan and Alberta to go into the industry. That there is a shortage of linseed in America is evident, and the increasing demands for the manufactured products of flax seed have caused the prices to soar high. The fertile lands of the West are splendidly adapted for the production of flax seed, but on account of the dryness of the climate the straw is not considered of any great value. Samples of the straw have been sent to Belfast, Ireland, but even after being treated under the retting process of that country, it has not turned out anything better than a coarse cloth fiber. Retting cannot be done in the West on account of the shortness of the season, and there has not yet been invented a successful dry scutching machine. With a successful dry scutching machine the straw could be converted into fiber suitable for coarse fabrics, such as bagging, rough toweling, etc.

The Western straw is not considered of sufficient value to bail and export to Ireland to be manufactured into fiber. It is altogether probable, however, that valuable use will be made of the Western straw and in due time linen mills will be established for the purpose of manufacturing grain bags and coarse materials which at the present time are imported in large quantities.

Although a very profitable crop, flax has long been considered to be very hard on the land. Recently, however, Prof. Bolley, of North Dakota Experimental station, has conclusively proven in his exhaustive research that the damage is not altogether done to the land; flax itself deteriorates on account of a fungus growth at the roots and this accounts for the seemingly nomadic prosperity of this crop. Seed should be changed every few years to exterminate what is known as flax wilt. One practical method of treating the seed is spraying formalin from a force pump, stirring the seed at the same time to prevent it running into lumps. In the West on new land forty pounds to the acre has given the best of satisfaction, and the sowing period extends from May 15 to June 10. The best growth is from the early seeding; late seeding always occasions a loss from frost.

Russia Produces Much

Russia is undoubtedly the largest flax producing country in the world. As high as four-sevenths of the world's supply has frequently been grown by that country. Of late years, however, the Argentine has produced a large crop and has sent heavy exports to Ireland and the United States. In Ireland the

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