

HEMP

A War Crop for Iowa



AGRICULTURAL EXPERIMENT STATION — AGRICULTURAL EXTENSION SERVICE, Cooperating
IOWA STATE COLLEGE AMES, IOWA

Foreword

The production of war crops is as essential a contribution to the national war effort as the production of planes and tanks. Much has been asked of the Iowa farmer, and he has responded willingly to the call. Acreage adjustments have been called for, along with increases in the livestock population. Now the farmers of a certain area, comprising 15 or so north-central counties, have been asked, in addition, to grow at least 60,000 acres of a wholly new crop, hemp.

Although small plantings have been made in Iowa at various times, commercial production of hemp has been confined to Wisconsin and Kentucky. Even there the total hemp acreage has not approached that asked of Iowa in 1943. Because hemp is a new crop to the state, this bulletin has been prepared in order to put into the hands of those who will be concerned a summary of the best information available on hemp production. This has been related as far as possible to Iowa conditions, but obviously is not based on Iowa experience as are the majority of our bulletins. Concurrently we have set up a comprehensive program of research and extension activities that is aimed at giving every possible aid to those participating in the production and processing of this essential war crop.

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Cover picture: Hemp harvester in operation near Waupun, Wisconsin.
(Courtesy of Bur. Agr. Chem. and Engr., U. S. D. A.)

Hemp

A War Crop for Iowa

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Hemp is an annual crop grown for the production of fiber. It is sown in the spring like small grain and produces a thick stand of slender unbranched stalks, growing usually to a height of 6 to 10 feet. The fiber is found extending the length of the stalk, between the thin bark on the outside and the woody central pith on the inside. To obtain the fiber the stalks are retted (partially decomposed) and then put through machines that separate the fiber from the rest of the stalk.

Although hemp has been grown in the United States since early colonial days the acreage of this crop has not been very extensive. Due primarily to competition from cotton, jute, sisal and abaca (Manila fiber) domestic hemp production declined until a low of 1,200 acres was reached in 1933. Since 1939, because of the stimulation of an increased demand due to war conditions, production has again increased. In 1942 there were about 7,500 acres grown for fiber in Wisconsin, 5,000 in Kentucky, 600 in Minnesota and 500 in Illinois.

PRESENT NEED

The production of hemp in the United States has become a war necessity. There is an urgent need for large quantities of hemp for the manufacture of rope and other types of cordage for the Army, Navy, Merchant Marine and essential civilian uses. The source of abaca, the hard fiber ordinarily used in making rope, has been cut off, and hemp is the best known substitute. Hemp fiber is extremely strong and not only makes satisfactory rope but also is in great demand for the preparation of special threads and twines. Iowa farmers have been asked to produce 60,000 acres of hemp in 1943 as their share of the 300,000 acres to be grown in the United States. Other states participating in the hemp program are Minnesota, Wisconsin, Illinois, Indiana and Kentucky.



Fig. 1. Tops of hemp plants at the flowering stage. Male plant at the left and female at the right. (Courtesy of Bur. Agr. Chem. and Engr., U. S. D. A.)

Steps have been taken looking to the construction of 15 mills in as many different locations in Iowa, each mill to process the hemp from about 4,000 acres. Because of the nature of the crop, hemp can be grown profitably only when a processing mill is located in the immediate vicinity of production.

GROWING THE CROP

SOILS

Although hemp is known to grow on a wide variety of soils, the dark, fertile prairie soils are considered best for the production of high yields of good grade fiber. Level, or almost level, well-drained areas only should be used. Peat, muck and bottomland soils are unsuitable because the stalks

produced thereon are often too coarse, and the fiber weak. Sandy or drouthy land is unsatisfactory, and heavy clays with slow drainage should be avoided.

Planted closely as it must be, hemp is very sensitive to variations in soil fertility. A prime requirement in the selection of the individual fields will be that they shall be as uniform as possible. It will be much better to plant an irregular shaped area than to include land that will produce plants that vary greatly in height.

Probably the best soil series in Iowa for hemp production are Clarion, Webster, Carrington, Tama and Muscatine, if the sandy types of the former are omitted. Past management of the soil is important, and the best hemp will be grown where good crop rotations have been followed, soil building legumes incorporated, and barnyard manure applied. Experience has indicated that hemp requires a good supply of nitrogen. Hence soils naturally high in organic matter, the available nitrogen in which has been supplemented by the practices just mentioned, are likely to give the best results. In general the hemp area should be selected from the best corn land on the farm.

FERTILIZERS

Hemp closely resembles corn in its plant nutrient requirements with the exception that it needs more calcium. Practices, such as the liberal application of barnyard manure and the plowing under of legumes or grass sods, which increase corn yields, are likely also to bring about a good growth of hemp.

Commercial fertilizers suitable for corn usually give good returns with hemp. In those areas of Wisconsin where hemp has been grown for 30 years, applications of from 200-300 pounds per acre of complete fertilizers such as 3-18-9 or 3-12-12 are giving good results on the Carrington (Parr) and Miami soils. However, most of the highly productive soils of central and north central Iowa are likely to produce excellent yields without direct applications of commercial fertilizer, provided their fertility has been maintained by good management practices. In any case it is improbable that any nitrogenous fertilizer will be available in 1943 for use on hemp in Iowa.

RAINFALL

A rainfall of 30 inches or more annually is desired. Adequate frequent rains in the growing season, without long drouthy periods, are needed. Hemp is not drouth resistant. For natural field or stubble retting, heavy dews, reasonably high humidity and well scattered rains through late August, and in September and October are important.

PLACE IN IOWA ROTATIONS

In the common rotation—corn, corn, oats, clover—hemp may follow either the first year of corn or be planted after the clover. Experience for many years in Wisconsin has shown that hemp does well after corn, alfalfa, clover or bluegrass sod. It is recommended that hemp should not follow small grain unless sweet clover or other legume for soil improvement has been grown with the small grain.

SEEDBED PREPARATION

A well-prepared seedbed is essential for a uniform stand of hemp. While both fall and spring plowing have been found satisfactory, usually fall plowing is considered preferable. The soil should be disked and harrowed thoroughly to make a fine but firm seedbed. The use of the cultipacker both before and after seeding is of great assistance in putting the seedbed in that fine, compact condition favorable to rapid germination and establishment of a thick stand.

It is especially important in spring plowing to work the soil thoroughly so that a fine, firm seedbed will be obtained.

DATE, METHOD AND RATE OF SEEDING

Early planting is desirable, usually just after oats seeding. While hemp may be planted at any time between the first of April and May 15, the period between April 10 and May 1 probably is the most satisfactory for Iowa conditions.

Drilling is the best method of seeding, using a closely spaced drill, seeding rows not over 6 inches apart and preferably 4 inches. If 7-inch or 8-inch spaced drills only are available it is better to sow half of the seed in one direction and the remainder of the seed crosswise.

Where drills are not available, the seed can be broadcast, harrowed and compacted with a cultipacker. Even distribution of the seed is very important so that stems will be of uniform size. Seed should be covered not more than 1 inch deep.

About 5 pecks, or 55 pounds of seed per acre, are recommended. The stand should be fairly thick and uniform so that the stems near the base will grow to about the size of a lead pencil. Larger stalks running up to 1/2-inch or more in diameter are not desirable.

Hemp seed will run through the average drill or seeder at about the same rate as wheat, and somewhat faster than oats. Although different seeders probably will not sow the same amount, a seeder set for 4 pecks or 1 bushel of oats per acre probably will sow about 5 pecks of hemp. When there is doubt about the setting of the seeder to obtain a uniform distribution of the seed it is particularly desirable to set the seeder at as nearly the half rate as possible, sow over the entire field, calculate the amount of seed sown, reset the seeder, and sow the remainder of the seed, driving in the same direction, but lapping half way on the original seeding.

BORDER ON FIELDS

Because it is impossible to make a back-cut around the field with the hemp harvester, a 16- to 20-foot border of oats, sudan grass, soybeans (drilled) or other uncultivated crop should be planted all around the hemp field. A cultivated crop used as a border may cause the hemp to grow coarse and extremely tall at the edge of the field, a condition undesirable at harvest time. To avoid the difficulty of having a scattering of hemp mixed with the border crop (when an endgate seeder is used), it is suggested that the planting of the border be delayed until the hemp is about 2 or 3 inches tall. The border can then be re-disked and planted with little danger of hemp mixture in the border crop.

KIND OF SEED

Seed available for planting in Iowa in 1943 was produced under contract for the Commodity Credit Corporation in 1942 in Kentucky. There is only one variety available and it is commonly known as Kentucky hemp. It is the variety that has been grown commercially in Wisconsin for a number of years and originated as the progeny of adapted selections from several foreign introductions, principally Chinese.

WEEDS

Hemp does not require any cultivation and is a fairly good smother crop. It should not be seeded in fields badly infested with persistent perennial weeds, however, without having

the weeds well checked by thorough cultivation. Hemp has been observed to smother out scattering infestations of Canada thistle, but cannot be expected to crowd out heavy infestations of either Canada thistle or quack grass. When hemp is planted early, and germinates quickly, annual weeds have little chance to grow.

INSECTS, DISEASES AND HAIL DAMAGE

While diseases and insect pests usually do not damage hemp materially, some injury to young plants has been caused by army worms and white grubs. Grasshoppers appear to be fond of hemp and in years of severe infestation might cause damage. Stem borers, including the European corn borer, have been known to attack the crop.

Hemp is exceptionally resistant to lodging and usually is not affected by ordinary storms. A severe hail storm, however, may damage the crop by reducing the leaf area so much that normal growth cannot proceed. Hail insurance therefore might be a wise precaution.

YIELDS

On the fertile, prairie soils in Wisconsin, hemp produces about 10 to 12 tons of green stalks, or 2 to 3 tons of dry, retted stalks per acre. Preliminary experiments in 1942 at Kanawha, Iowa, and at Ames have indicated that yields equal to or greater than those reported for Wisconsin may be expected on the better soils in north central Iowa.



Fig. 2. Hemp lying in the swath near Brandon, Wisconsin, as spread by the harvester for retting. (Courtesy of Bur. Agr. Chem. and Engr., U. S. D. A.)

HARVESTING AND HANDLING THE CROP

HARVESTING

Hemp is cut when the male plants (those bearing pollen) are in full bloom or just past that stage. The lower leaves have fallen and the plants are yellowing, especially near the base. Harvesting begins usually about the last of August and continues to mid-September or later. Early harvesting gives the best opportunity for retting, and September weather conditions are likely to be more favorable for retting than those later in the fall.

The crop is cut with a special hemp harvester owned by the processor and taken from farm to farm. In harvesting, an operator is furnished with the machine, and the grower must supply a tractor (two-plow size equipped with power take-off) with operator, and pay rental for the use of the machine. The harvester cuts a swath 8 to 9 feet in width and spreads the stalks evenly on the ground at right angles to the direction in which the machine is moving.

RETTING

The fiber in the hemp plant constitutes only about one-fifth to one-sixth of the total weight, and in order that it may be easily separated from the woody material the stalks must first be allowed to ret. Proper retting is most important since the quality and value of the crop depend largely on this process. The fibers occur in a soft sheath round the central woody pith and are loosened by the action of molds and bacteria. Retting is the beginning of rotting; if carried too far the fibers themselves also are attacked and their strength reduced, or, if not carried far enough, the woody pith does not break away easily from the fibers, resulting in unsatisfactory separation.

The stalks, spread evenly on the stubble by the harvester, have to be left for several weeks for retting to take place and should not be picked up until this is completed. The time required depends entirely on weather conditions. If the fall is warm and moist, with frequent rains or heavy dews and continuous high humidity, 2 to 3 weeks may be sufficient. Usually, however, it takes longer, and if the weather is dry with low humidity the molds cannot develop well, and 6 to 8 weeks or more may be required. The upper side or exposed part of the stalks seems to ret first, and



Fig. 3. After the upper surface has retted, the hemp straw is turned over to hasten the completion of the process and keep the retting uniform.

accordingly, the stalks are turned over once in the field in order to obtain uniformity in retting. In the past this has been a hand operation, but it is anticipated that simple machines may be perfected to do this now that a large acreage is involved. One man by hand can turn about 3 acres of stalks per day.

Some skill is needed in deciding when retting has proceeded far enough. Several stalks may be held and worked back and forth between the hands, so breaking the woody pith into small pieces. If these pieces shake out readily, leaving the steely grey fiber exposed, retting is complete. If the fiber itself is weak and may be broken easily, over-retting has occurred. Under Iowa conditions under-retting is more likely than over-retting.

HANDLING THE CROP AFTER RETTING

When the hemp is properly retted it is picked up and bound into bundles with a machine called the gather-binder

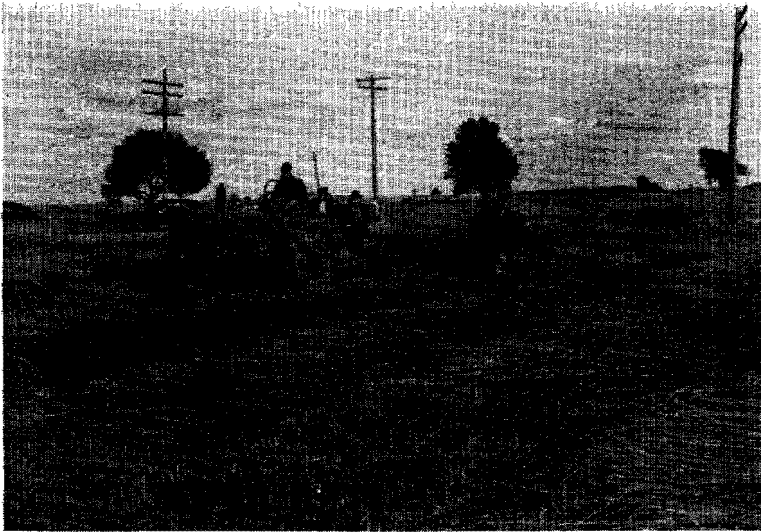


Fig. 4. Picking up and binding hemp near Waupun, Wisconsin, after field retting has been completed. (Courtesy of Bur. Agr. Chem. and Engr., U. S. D. A.)

or "picker." This binder, like the harvester, is owned by the processor and is sent from farm to farm.

In fields that have been cut on all sides it may be necessary to bind some of the hemp on the corners by hand, to prevent the tractor and binder from running over the hemp on the ground. If the field has been cut on two sides only (going across the ends empty) no hand binding should be necessary.

After binding, the hemp is shocked and when thoroughly dry in the shock, may be loaded on trucks or wagons and hauled to the mill where it is stacked. Dry hemp stacks are highly inflammable, and a concentration of a large number of stacks in one small area presents a serious fire hazard. This hazard can be greatly reduced by having much of the hemp stacked on the farms where it is grown and delivered to the mill at different times during the milling season.

It should be emphasized in all field and hauling operations that great care should be taken to keep the stalks straight. This will keep broken and tangled stalks at a minimum and will aid in obtaining a high quality of fiber.



Fig. 5. The retted hemp after being bound in bundles by the gather-binder is shocked in the field until stacked or hauled to the processing plant. (Courtesy of Bur. Agr. Chem. and Eng., U. S. D. A.)

STACKING

Mill operators are of the opinion that the fiber breaks out better after hemp has been in a well-built stack for several weeks.

In stacking, the same principles which apply to stacking small grain or corn should be kept in mind. The middle must be kept high so that the bundles slope toward the outside, exposing only the ends of the butts to the weather. Careless stacking may result in considerable loss due to decomposition of exposed stalks.

In Iowa, hemp harvesting, binding, shocking and hauling may compete for labor with silo filling and the harvest of soybeans and corn. Fortunately, however, hemp is not a perishable crop and after being bound and shocked will not deteriorate if left in the field for several weeks. It should be removed from the field, however, before the shocks freeze to the ground or become covered with snow, making handling and hauling difficult.

PROCESSING OF FIBER

At the mill the retted stalks are taken from the stack and put through a long conveyor-drier which removes al-

most all of the moisture and leaves them very brittle. They are then put through a "hemp brake" which is made up of a series of sets of fluted rollers. The stalks are crushed, thereby breaking the woody pith into small pieces called "hurds," most of which fall out leaving the fiber intact. The remainder of the hurds are removed and the fiber cleaned with a "scutching" machine, which consists essentially of two large rotating drums that exert a brushing and combing action on the fiber. The long, straight fiber which remains, known as "line fiber," is then twisted into "hands," graded for quality, and baled. The scutching machine not only removes any adhering hurds but also combs out short, snarled or tangled fiber. This is known as "tow," as is also the fiber produced from very short or branched stalks. The tow is baled after the hurds have been removed from it by loosening and shaking in a special tow machine. Since the value of the tow is less than half that of the line fiber, every effort should be made at all stages in handling to prevent tangling of the stalks, which may cause perfectly good fiber to be removed as tow.

The waste hurds are burned for fuel to supply heat for the dryer and some or all of the power for the mill. Some



Fig. 6. After being shocked in the field, hemp is stacked on the farm or in the stack yard adjacent to the processing mill. (Courtesy of Bur. Agr. Chem. and Engr., U. S. D. A.)

hurds still may be left over, and these make excellent bedding for livestock.

CONTRACTS FOR HEMP ACREAGE

The hemp mills in Iowa, established under the direction of the Hemp Division of the Commodity Credit Corporation, are to be financed and built by the Defense Plants Corporation, which was created to finance war industries. These mills will be operated by War Hemp Industries, Incorporated, or another duly authorized agent of the Commodity Credit Corporation.

With the assistance of the State War Board, the Commodity Credit Corporation has determined sites for mill locations and growing areas. The sign-up for acreage will be made through the A.A.A., individual contacts with farmers being made by the township A.A.A. committeemen.

Hemp growers will obtain contracts with the Commodity Credit Corporation specifying the obligations of each party in the growing, harvesting, processing and sale of the crop. Tentative contracts as of Dec. 1, 1942, include the following provisions: The grower agrees to plant a specified acreage to hemp, deliver all hemp straw produced to a designated mill, and sell such straw to Commodity Credit only. He agrees further to follow good cultural practices in growing, harvesting and handling the hemp until it is delivered to the mill, so as to deliver hemp of the highest quality possible.

Commodity Credit agrees to furnish the grower hemp seed at the rate of $1\frac{1}{4}$ bushels per acre contracted, at the price of \$11 per bushel delivered in the county. Commodity Credit agrees also to furnish harvesters and pickers together with an operator for each machine at the price of \$5 for each acre harvested. All other labor shall be furnished by the grower at his own expense, although Commodity Credit will assist, insofar as is possible, in obtaining and making available at the grower's expense, additional labor for harvesting. The amount which the grower is to pay for seed and rental of machinery shall be collected only out of the proceeds of the hemp straw or fiber sold by the grower to Commodity Credit, unless there is violation of the contract on the part of the grower.

A harvesting schedule will be arranged to insure efficient and equitable use of harvesting machinery, and the grower agrees to observe this schedule.

Commodity Credit agrees to purchase all hemp straw delivered to the mill by the grower at the following prices:

\$50 per ton for class 1 straw
\$40 per ton for class 2 straw
\$35 per ton for class 3 straw
\$30 per ton for class 4 straw

Grading of straw is to be done by persons approved by Commodity Credit in accordance with classes and regulations to be established. Commodity Credit agrees to stack the hemp straw at the mill.

Because parts of the growing hemp plant contain a narcotic substance known as "marihuana," it is necessary for all growers and processors of hemp, and all persons handling or transporting hemp seed, to register under the Federal Marihuana Act of 1937. The Commodity Credit Corporation agrees to pay the registration tax for growers with whom contracts are made.

LANDLORD-TENANT RELATIONS IN HEMP PRODUCTION

On rented farms the usual arrangements between landlord and tenant may not be entirely satisfactory for growing hemp. The following methods of handling this problem are suggested:

(1) On crop-share rented farms the crop-share tenant furnishes all the labor required, pays three-fifths of the cost of seed and rental of harvesting machinery and receives three-fifths of the gross receipts from the crop. The landlord pays two-fifths of the cost of seed and rental of harvesting machinery and receives two-fifths of the gross receipts.* In view of the fact that more labor is required for harvesting, turning, binding, shocking and hauling hemp than for harvesting corn, that the labor tasks are new to the tenant and involve some changes and risk in his farm organization, a two-fifths—three-fifths division of costs and receipts between landlord and tenant appears to be a fair arrangement. Since the acre value of a good hemp crop is high, the value of the landlord's share of the crop can be expected to be higher than the value of the landlord's half of a comparable corn crop.

* A division of 30 percent of the gross receipts to the landlord and 70 percent to the tenant has been suggested if the tenant bears all the costs of seed and harvesting.

(2) On stock-share rented farms, because of the additional labor costs involved in harvesting and handling hemp, the two-fifths—three-fifths arrangement, suggested for crop-share rented farms, may be used for the hemp crop. If the one-half—one-half arrangement, commonly used on these farms, is preferred, adjustments can be made to take care of the additional labor costs, especially the costs of turning the hemp and hauling the crop to the mill.

(3) On cash rented farms no special arrangements are necessary as the tenant bears all operating costs and usually is free to use his cropland as he desires.

(4) On both stock-share and crop-share rented farms the field on which hemp is to be grown may be rented for cash, the tenant bearing all operating costs and receiving all returns from the hemp crop.

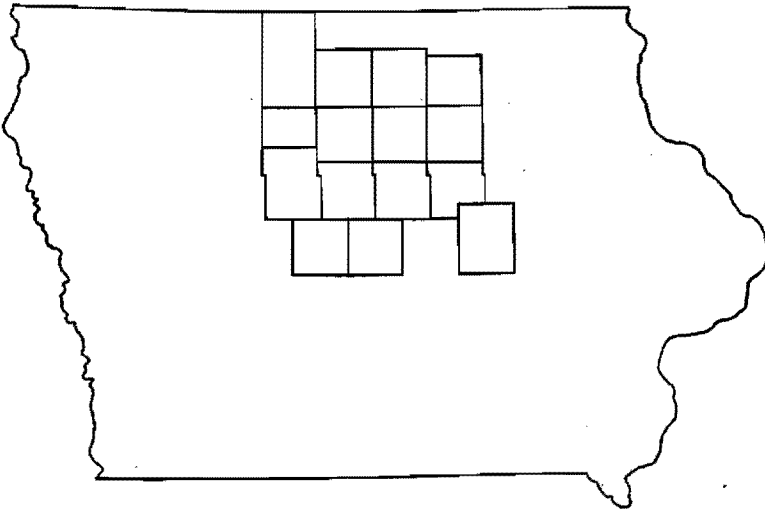


Fig. 7. Map indicating counties in north-central Iowa where hemp mills and growing areas probably will be located in 1943.

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