ver, 36 percent of Alta fescue, and 60 percent of subterranean clover.

Early harvest does not work on all seed crops, however. In the same test, the take of pure live seed of birdsfoot trefoil was reduced substantially by early harvest. The first seed set was beginning to shatter before the germination of harvested seed was high enough to meet the requirements of State and interstate seed laws.

Enough nutrients were left in the windrowed straw of crimson clover for the seed to finish maturing. The result was the largest amount of seed, the highest germination, and the lowest percentage of damaged and shriveled seeds.

Records were kept of the appearance of the stems, the leaves, the floret, the seed, and the moisture content of the seed. Color pictures were used as guides to pinpoint the time to harvest a crop for maximum yields. Only the seed moisture at the time of cutting was a true indication of the time to windrow the crop each year.

Results of research studies indicate that a seed is at its peak in quality at maturity and that it should be harvested immediately in order to get the highest percentage of quality seed. Seeds start deteriorating immediately upon reaching maturity, and all can do is to retard the change by regulating the time and method of harvest and treatment after harvest.

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Producing Seeds of Cotton and Other Fiber Crops

BILLY M. WADDLE AND REX F. COLWICK

Four large companies produce the cotton seed that is used on 90 percent of the planted acreage in the Southern and Southeastern States.

The rest of the acreage in that part of the Cotton Belt is planted with seed produced by public agencies and by several companies that primarily serve their own immediate districts.

In some parts of the Cotton Belt, particularly in Texas and Oklahoma, a large percentage of the planting seed is produced by companies that supply seed for local needs.

Most of the planting seed in the Far Western States is produced by selected growers under the supervision of the grower-owned cooperative organizations, which control conditions rigidly under the supervision of seed-certifying agencies. They make the planting seed available to the producers at prices slightly above costs.

Public agencies conduct the breeding programs in the Western States. When the new varieties are developed and proved, small amounts of early-increase seed lots are made available to the organizations of cotton seed growers. They increase the seed through the steps of foundation, registered, and certified categories and distribute the seed to the growers. In each State, except California, the controls that guarantee purity are under the direction of the State’s official seed-certifying agency.

The seed-distributing agency in California is grower owned and works closely with the breeders at the U.S. Cotton Field Station at Shafter in the
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development and distribution of pure seed to the growers of the San Joaquin Valley. The organization is its own certifying agency. Small amounts of selfed seed are furnished the distributors by the field station. The subsequent increases and sales are controlled by the distributors. Technical supervision in the maintenance of pure seed is furnished by station officials. The result is the production and maintenance of adequate supplies of high-yielding, pure seed of highest quality at a relatively low cost.

Different procedures are used by the seed companies and public agencies in their improvement programs.

One is the pedigree method, which uses inbred lines for composite mixtures, in which inbred lines and the composites are tested for yield and fiber quality.

Another is the selection of numerous open-pollinated plants in pure seed fields and subsequent elimination of undesirable types by yield and fiber tests. The best strains are kept for final increase.

A third procedure is the selection of limited numbers of individual plants from chosen fields of registered or foundation plantings. Such selections are also screened vigorously by strain and fiber tests to give the best stocks.

After the extensive selection and testing phases of the programs have produced the variety or varieties judged to be superior in one or more attributes, the seed-increase program is inaugurated, and the variety is released.

Most of the seed companies utilize a number of similar features in their variety-increase programs. Three steps are usual.

Foundation seed is produced from breeder seed or parent seed. Care is taken to maintain the proper isolation from other varieties and types of cotton—cotton is easily cross-pollinated by bees and other insects—and to assure that no contamination results from volunteer plants in the field. Great care is exercised to prevent the mixing of seed when it is harvested, ginned, and bagged.

The increase phase from the foundation seed is generally known as registered seed and goes through essentially the same procedures as for the production of the foundation seed, except that the requirements for isolation and amount of contamination are not quite so rigid as in the earlier phase.

The final stage is known as certified seed and may be produced for 1 or 2 years, depending on the practices of the seed-certifying agency in a given State. Certified seed usually composes the bulk of planting seed stock for the producers.

In all stages of the work to multiply the seed of a variety, close supervision is maintained by the Crop or Seed Improvement Association to assure varietal purity and the best possible seed for cotton producers.

The responsibility of the seed-certifying agencies in most of the States where cotton seed is produced for planting in the Cotton Belt is to assure purity and germinating ability of the seed. The Crop Improvement Association approves applications from growers to produce seed in the certification program and inspects the fields for proper isolation and possible contamination by weeds and off-type cotton plants. Sometimes an association may supervise the ginning of the cotton and the bagging of the seed.

All seed companies and associations engaged in producing and selling pure seed utilize the services of official seed-testing laboratories.

The laboratories determine the germination percentage (which must not be below a specified minimum), the percentage of impurities in the form of seeds of other crops and weeds; inert matter; and the total percentage of pure seed.

The farmer who buys approved varieties of seed that have been tested by an approved laboratory and carry the label of the Crop Improvement Association therefore is assured of the best possible seed.
In the South and Southeast, the seed companies commonly make contracts with dependable farmers for seed for use by the industry. The contract growers agree to produce the seed under the restrictions and controls of the official certifying agency to guarantee varietal purity.

The production of pure seed by the small companies of Texas and Oklahoma for their own localities usually is confined to the company landholdings, and contractual arrangements are not common.

In the grower-owned seed organizations of California, New Mexico, and Arizona, contracts are made with the farmers to produce the pure seed under stipulated conditions of land cleanliness, isolation, and approved production practices. The seed organizations supervise the contracts.

The production of pure seed in all regions of the Cotton Belt is processed by one-variety gins or by gins that are thoroughly cleaned before the ginning of pure seed. This practice further assures a minimum of risk of seed mixtures and is considered one of the prime requisites in the production of pure seed.

In ginning, the cotton is subjected to a minimum amount of machining. A loose seed roll is used to avoid mechanical damage.

Delinting—the removal of seedcoat hairs and short fibers that remain after ginning—is common throughout the Cotton Belt. Chemical delinting, mechanical delinting, and flame delinting are used.

Chemical delinting uses concentrated sulfuric acid (with later washing in water) or hydrochloric acid gas (later neutralized by soda ash). Chemically delinted seed is used mainly in the western irrigated part of the belt. Commercial acid-delinting plants are in all the Western States.

Mechanical delinting is performed by the same type of machinery that is used by the cotton oil mills to remove seed fuzz before the crushing of the seed. The use of mechanically delinted seed is common throughout the belt, but it is less popular in the Western States than the acid-delinted seeds.

Flame delinting has gained some popularity. It removes some of the seed fuzz. Some large producers in the South use it to remove any patches of fuzz on machine-delinted seed.

The use of delinted cotton seeds allows a more precise seeding rate, which aids in planting to a stand and more rapid germination. Another advantage is the ease with which the delinted seed is graded by gravity grading machines. The light, immature seed can be removed; the quality is improved thereby. Fuzzy seeds also are gravity graded, but the process is not so effective as with delinted seeds.

Fungicides are applied to the seeds before planting to destroy or remove seedborne disease organisms. The treatment is recommended for all planting seed in the Cotton Belt. In the slurry method, the seeds are treated with a water-fungicide mixture.

Fuzzy (nondelinted) seed may be treated by dust applications of the appropriate fungicide, but slurry treatments are also used. Delinted seeds are treated easily by the slurry method.

In localities where the pink bollworm is a problem, quarantine regulations have been established to help prevent its spread. Seeds sent from an area of pink bollworm infestation to another area must receive appropriate treatment to assure bollworm-free seeds in the shipment. Steam sterilization treatment of all cotton seeds is practiced in Arizona. Extreme care is necessary to prevent damage by overexposure to heat and steam. Methyl bromide gas or other approved treatments may be used in other States.

Cotton seeds and the attached fiber (seed cotton) are harvested by hand or machine. About 50 percent of our cotton crop is harvested by hand. The worker grasps the seed cotton and picks it from the bur or snaps the bur containing the fiber and seed from the stem. The seed cotton is placed in a bag or basket and carried to a wagon
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or trailer. When the trailer is fully loaded, it is taken to a cotton gin, where the seeds are separated from the lint by ginning.

The procedure in machine harvesting is like hand harvesting, except that the machine replaces human hands in the removal of the seed cotton from the plant. The two machine-harvesting methods are picking and stripping. Mechanical picking by spindle machine removes only the lint and seed from the plant. The burs, unopened bolls, and plant are left intact. Mechanical stripping removes the burs, bolls, and some leaves and stems from the plant. Stripping is necessarily a once-over operation and must be conducted after frost or defoliation.

Mechanical picking by spindle machine can be done several times as the crop matures. It is often possible therefore to obtain more uniformly mature seed from mechanical picking than from once-over stripping. The Far Western States harvest up to 90 percent of the crop by this method.

Hand snapping and machine stripping are practiced chiefly in the western parts of Texas and Oklahoma, where about 30 percent of the United States crop is grown. Picking by hand or spindle machine is practiced in the rest of the Cotton Belt.

The precautions to be observed in harvesting to maintain high quality are generally like those needed to maintain the quality of the cotton fiber. Timing the harvest when the cotton is fully and uniformly mature is first. Clean harvesting with a minimum amount of such material as grass, leaves, and plant bark permits minimum handling and cleaning in the gin. It reduces the possibility of mechanical damage from excessive machining of the fiber.

To reduce leaf trash in the harvested cotton, the leaves often are removed from the plant or killed by the application of a chemical in spray or dust form. The chemicals that remove the leaves from the plant are called desiccants. Those that kill the leaves on the plant are called desiccants. Defoliation is practiced primarily to aid mechanical picking. Desiccation is used chiefly to facilitate stripping before frost.

Cotton should not be harvested while it is wet from dew or rain. If seed cotton is stored in the trailer or elsewhere at a moisture content of 12 percent or more, heating will occur and damage the seed and fiber. Damp cotton requires more processing in the gin and exposes the seeds to more mechanical damage.

The time of harvest of the cotton crop may affect the quality of seed. In parts of the irrigated West where it is more efficient to harvest only one time by mechanical harvester, it is necessary to defoliate before the first killing frost or to wait until after frost for the single harvest.

For the production of the best seed, it is necessary to harvest the first part of the crop before first frost to assure that all seed saved for planting will be fully matured. Therefore the practice of hand harvesting the early-season crop for planting seed is common in some places. The agencies handling cotton seed will not accept seed harvested after frost except in an emergency.

In the rain-grown areas of the Cotton Belt, adverse weather may lower the quality of the seed. Excess rain in the early or midpart of the harvest season may be harmful. In years of bad weather, such as 1957, substandard seed may be accepted from necessity. Most of the larger companies operate at enough different locations to counterbalance this problem in most years, unless unusual weather occurs generally over large areas.

If the seed is suspected of having poor quality following excessive rainfall, some checks are available to the seedsmen. A preliminary free-fatty acid test of the seed may be used to pinpoint germination potential. Excessive free-fatty acid is an indication of low quality, and this advance information can be of value to the seedsman in saving his planting seeds.
The storage of seed with excess moisture because of rainfall just before harvest may result in the lowering of seed quality or the destruction of the seed. Most distributing organizations have proper storage bins, including facilities for drying moist seed with forced air.

All of the varietal maintenance and production programs we have discussed are efficient and successful. If the farmer plants genetically pure seed of the variety or varieties recommended for his soil and climatic conditions, he is sure he has the best possible seeds.

The production of planting seed of leaf and stem fiber crops is on an experimental basis in the United States. There is no large commercial production of fiber crops other than cotton in the Nation. Flax and hemp are no longer produced for fiber in this country, but seed stocks of the best varieties that have been developed by research agencies are maintained.

Kenaf has shown some promise of being a good substitute for jute in the event of emergency needs. Considerable research on this crop has led to varieties that are high yielding and resistant to some of the major diseases that attack the crop. The seed can be harvested with machines, but the acreage is so small that only limited amounts of seed are maintained.

Other fiber crops—sansevieria, ramie, phormium, and jute—are propagated vegetatively. Research in mechanizing the propagation, growing, and harvesting of some of them is carried on by public agencies.


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Producing and Harvesting Seeds of Oilseed Crops

J. O. Culbertson, H. W. Johnson, and L. G. Schoenleber

The leading oilseed crops grown in the United States are soybeans, peanuts, flaxseed, safflower, castorbeans, and sesame. A large amount of oil is obtained from cottonseed, but cotton is a fiber crop, and we do not consider it here.

The seeds and oil from them have many uses.

Soybean oil is used in margarine, shortening, paints, varnishes, and other industrial products. Although soybeans are generally classified as an oilseed, the monetary value of the protein, or meal, equals or exceeds that of the oil.

Peanut oil is used for edible purposes.

Nearly all linseed oil from flaxseed goes into the manufacture of paints, varnishes, and linoleum.

Safflower oil is used primarily as a drying oil, but an increasing amount is being consumed in edible products.

The major uses of castor oil are as a drying oil and for hydraulic fluids.

Nearly all the sesame grown in this country is consumed as whole seed.

The harvested acreages of soybeans, peanuts, and flax in the United States in 1960 were about 23.6, 1.5, and 3.3 million acres, respectively.

Safflower acreage has been rising steadily, and about 300 thousand acres were grown in 1960. Castorbean acreage in 1960 was about 30 thousand, and that for sesame, 10 thousand.

The same general cultural practices that produce the best yields of high-quality seed for industrial uses also produce the best seed for planting.