ULLETIN 704 SEPTEMBER 1948

Mechanized Production of *Cotton in Texas*

TEXAS AGRICULTURAL EXPERIMENT STATION

R. D. LEWIS, Director, College Station, Texas

The TEXAS AGRICULTURAL AND MECHANICAL COLLEGE SYSTEM

GIBB GILCHRIST, Chancellor

The Cover Picture

A tractor-mounted cotton stripper and extractor developed by the Texas Agricultural Experiment Station is shown stripping the last two rows in a field of cotton near College Station.

Notice the small amount of cotton lost by the stripper on the ground in both the foreground and background.

Detail description of the construction of this stripper and discussion of the performance of such machines are given in Texas Station Bulletins 452, 511, 580, 683, 686, and also in this bulletin. Single copies of these bulletins are available for free distribution, with the exception of No. 511. Our supply of that bulletin has been exhausted.

Preface

Outstanding progress in the mechanized production of cotton in Texas has been made since the introduction of the row-crop tractor less than 25 years ago. Early settlers produced cotton with the hand hoe and the sweep stock. Riding mule-drawn planters and cultivators were not introduced until the 1880's and 1890's. Tractor-mounted middlebreakers, planters and cultivators were developed for the row-crop tractor about 1930. Progressive cotton farmers were quick to visualize and utilize the advantages of these tools in the mechanized production of cotton.

Realizing the great need for information on the various production problems of cotton, the Texas Agricultural Experiment Station has for many years devoted much of its research efforts toward cotton production. Bulletin 26, entitled "Cost of Cotton Production and Profit Per Acre," was published in 1893. Numerous bulletins, circulars, progress reports and scientific papers, which contain information on the production of cotton have been published since that time.

Agricultural workers have, for many years, felt the need of bringing together and summarizing the best recommended practices used in production of cotton. This publication, therefore, is an attempt to summarize the information on "where we are" in cotton mechanization in Texas.

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Mechanized Production of Cotton In Texas

H. P. SMITH, Professor of Agricultural Engineering, College Station, Texas

D. L. JONES, Superintendent, Substation No. 8, Lubbock, Texas

Self-reliant, progressive cotton farmers have been quick to visualize and utilize the advantages of mechanized cotton production. The first successful row-crop tractor was introduced and proved practical in the Corpus Christi area in 1926. This was really the beginning of the present era of cotton mechanization in Texas. Since that time the increase in the number of tractors and various labor and time-saving tractor attachments have decidedly affected the mechanization of cotton and other crops. The latest estimate shows that there are over 200,000 tractors on Texas farms. It is not assumed, of course, that all of these tractors are used in the production of cotton, but surely the majority are being used on farms producing cotton.

The production of a cotton crop can be divided into nine operations: disposal of crop residue and cover crops, preparation of the seedbed, planting, fertilizer application, thinning and spacing of the plants, cultivation, insect control, defoliation and harvesting. A considerable part of Texas cotton, however is produced without the application of fertilizer, insect control or defoliation.

DISPOSAL OF CROP RESIDUE

The proper disposal of previous-crop residue and winter cover-crop residue is essential if planting, cultivating and harvesting are to be done at the best times with a minimum amount of interference by undecomposed residue. The stalks and roots

Figure 1—Rolling type stalk cutter cutting two rows of cotton stalks. Note the height of the stubble and the long uncut sections of stalks.

of cotton, corn and sorghum and other bulky crop residue should be thoroughly chopped so they can be completely disposed of by the use of the tool best adapted to the particular region. The chopped residue should be plowed under and thoroughly covered with soil. Bulky parts of crop residue will seriously interfere with cultivation operations and hamper the cotton grower in his planting. Undecomposed roots and stalks left on the surface near the plants hinder the smooth operation of harvesting machinery. When collected in sufficient quantities with the cotton they tend to lower the quality.

The tractor-drawn rolling stalk cutter is the most generally used implement at present for processing crop residue. Further improvements are needed in machinery to adequately meet the necessary requirements for better disposal of this residue.

Tractor-drawn stalk cutters: When farmers began to use tractors for the production of cotton, a need was created for heavier and larger stalk cutters than those designed to be pulled by horses and mules. Consequently, the rolling cutter was developed. Most factory-built rolling stalk cutters will chop the stalks on only two rows. Two or three units can be hitched squadron fashion if a large tractor is available. As there are no factory-built four or five-row cutters, many farmers have them built at local blacksmith or machine shops.

A four-row stalk cutter pulled at four or five miles per hour should cover 50 to 70 acres in a 10-hour day. In exceedingly heavy crop residue this type of machine fails to thoroughly chop all the vegetation. In Northwestern Texas, the 4 and 5-

row stalk cutter is the accepted tool for chopping up crop residue.

Tractor mounted stalk cutters: A two-row tractor mounted power driven stalk cutter-shredder was used on the Brazos River Field Laboratory at College Station in November 1947. Two cylinders of blades or knives are suspended from a cross shaft in front of the tractor. The rapidly revolving knives pass between stationary knives cutting the stalk in a standing position. The stalks are cut and shredded into short sections ranging from two to four inches in length. These sections are spread uniformly over the ground leaving only the stubble one to two inches above the ground. If the stalks are medium to large, the tractor is operated in either second or third gear. The tractor could be operated in fourth gear in cutting small, dead stalks.

If the cutter is mounted on a tractor with sufficient power, the middles can be broken out at the same time the stalks are being cut.

Tractor mounted disks: A machine consisting of several disks clamped to a tool bar attached to a tractor has been found to have many uses, among which is the cutting and turning under of green winter cover crops.

Other devices: Disks harrows are sometimes used to harrow down cotton stalks, green cover crops and other crop residue. When tractor tandem disk harrows are used on tall and spreading cotton stalks, it is usually necesary to operate the harrow in two directions, with and across the rows. This is necessary to do a satisfactory job of cutting the stalks because

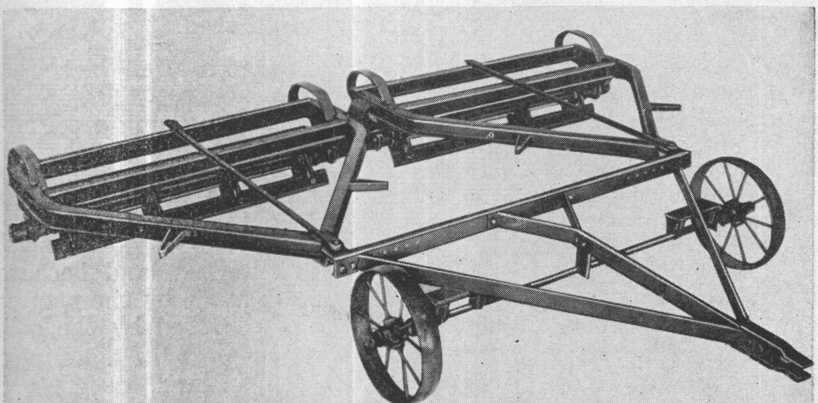

Figure 2—Special "squadron" hitch for hitching two two-row rolling stalk cutters together to make a four-row unit.

at the first harrowing many stalks will pass between the harrow disks and not be cut. Disk harrows are used behind the rolling tractor stalk cutter to further cut the stalks and at the same time harrow the ground and partially cover the stalks.

Both moldboard and disk type plows are used to plow under crop residue. Grain drills for sowing small grains can be operated satisfactorily when crop residue is plowed under.

PREPARATION OF THE SEEDBED

A warm moist, well prepared, well drained and firm seedbed is essential to obtain the proper placement and coverage of the seed, and to obtain good germination and stands of plants.

Extensive studies in the western part of the State have shown that listing to a moderate depth in late winter or early spring has been the best kind of preparation and is the accepted method (45th Annual Report, 1932).

At College Station in East Central Texas, plowing 6 inches deep has produced as large average yields of cotton as 3.9 and 12-inch depths. Plowing has given larger yields than disking with a disk harrow (45th Annual Report, 1932).

Most cotton is planted either on ridges or beds or in the lister furrow. Cotton is planted on beds in the more humid areas where heavy rains are likely to occur about planting time and before the plants are a few inches tall. When the seed are placed in the beds, the surface above the seed is slightly higher than the middles between the rows. Therefore, water from rains has a chance to collect in the depression of the middle. The surface of the bed dries out more rapidly and there is less possibility of the rotting of freshly planted seed.

In areas having an annual average rainfall of 25 inches or less, cotton is planted in the lister furrow to get the seed in moist soil. The undistributed beds protect the young seedlings from windblown sand.

Where irrigation is practiced the land is bedded so that water can flow down the furrows between the beds.

Very little cotton is planted on flat broken land because water from rains will collect in the furrows made by the planter seed furrow opener. When the water is absorbed by the soil, a heavy crust forms hindering the emergence of seedlings. Weed control is more difficult on flat broken land.

If newly flat broken land is being bedded, the lister bottoms break out a strip about 14 inches wide and throw soil upon the plowed soil between the rows to form the beds. If stubble land is being bedded, the middles are broken out and the ground

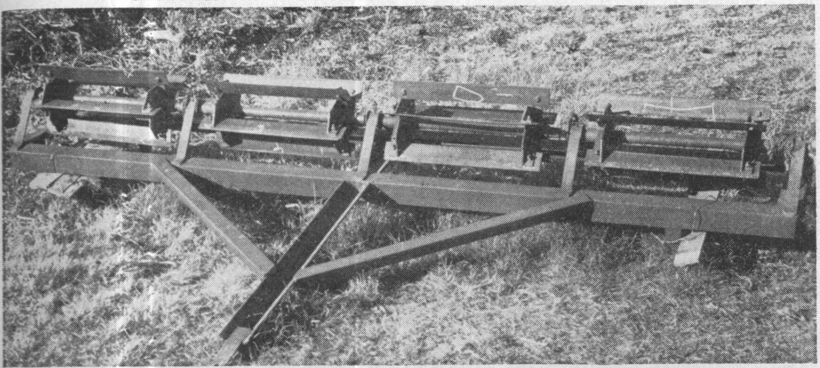

Figure 3—Blacksmith-shop-made four-row stalk cutter. Five-row types are also made.

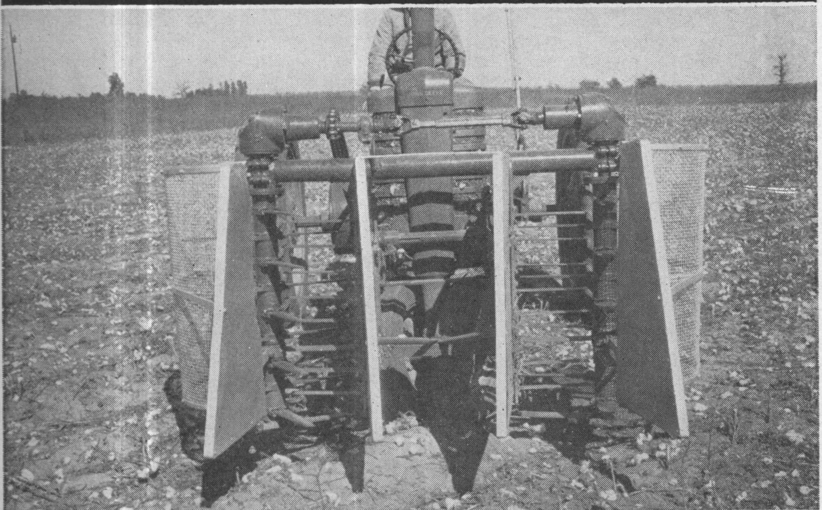

Figure 4—Front view of front mounted power-driven stalk cutter-shredder which cuts the stalks in a standing position. Note in the background how the stalks are cut and spread over the ground.

Figure 5—On right, cutting stalks with front mounted stalk cutter-shredder and breaking out the middles in the same operations. On left, three-row front-mounted lister listing out stubble following the stalk cutter-shredder. The stalks are cut and the ridges formed for planting in two operations.

Figure 6—Tool-bar tractor mounted disks cutting up a green cover crop and reforming the beds at the same time.

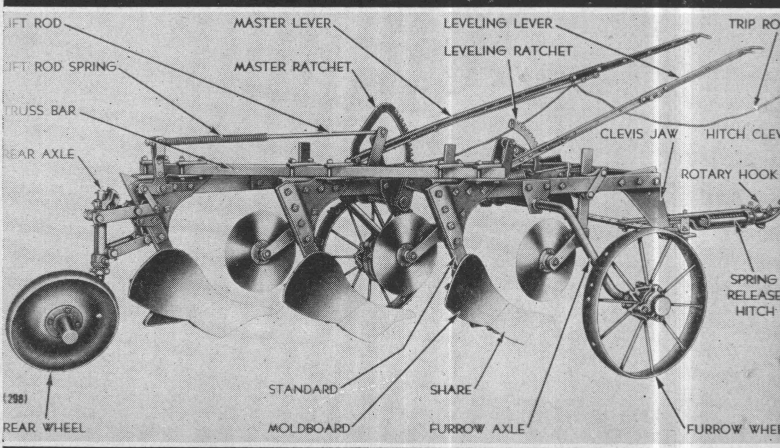

Figure 7—A three-bottom moldboard plow suitable to use with the row-crop tractors and for flat breaking of land for cotton.

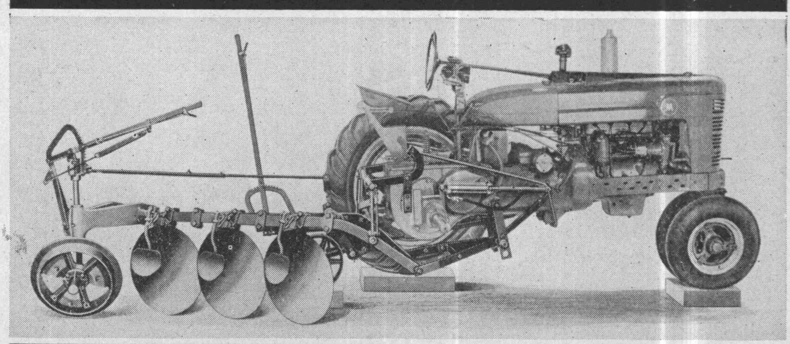

Figure 8—A three-disk direct-connected plow suitable to use with row-crop tractors and for flat breaking of land for cotton.

is relisted to uproot the stubble, break the land and form new beds for next year's rows where the middles were the previous year. Thus the land is broken at the time the beds are made. Most rows for tractor cultivation are spaced 40 inches apart.

The beds for cotton are usually thrown up in the fall soon after the crop is harvested and the stalks cut. Some farmers may wait until later because of wet soil, or the urgency of other work. To get the best germination, the beds should be thrown up at least long enough before planting to permit rain to wet and settle them.

In the northwestern part of the State where the planting is done in the lister furrow, listing predominates as the seedbed preparation method. This is usually done in late January or February and consists of one operation; that is, "listing up" the previous crop stubble. The tool bar type lister is used. Three-row equipment is standard, allowing approximately 30 acres to be prepared per day. This leaves a furrow some 8 to 10 inches deep, varying according to soil type. The middles of the previous year's crop are not listed. After weed growth starts in the spring, the beds are "knifed"; that is, knives approximately 48 inches long cut through the sides of the beds. Approximately four acres per hour are covered with this tool.

Harrowing: Large lumps or clods may be thrown up on the beds when bedding heavy clay soils. These clods should be broken up and pulverized as much as possible before planting time so that the planter may place the seed in the soil and cover them uniformly. Land rollers and drags such as logs, planks and sections of railway rails are often used. Spike tooth harrows help to break up the clods and to drag down the beds if they are very high. Stalk cutters are frequently used to chop the clods and at the same time loosen the surface soil and kill early weeds. The harrow is seldom used in the northwestern part of the State as it induces soil blowing.

Other devices for seedbed preparation: If the beds have been formed several weeks they may become covered with weeds. In this case they should be cultivated. If weeds are abundant, it may be advisable to rebed the land. The rolling stalk cutter is a good tool to use on high, cloddy or weed-covered beds. A new tool called the "Cropmaker" is equipped with disks that can be arranged and set so that the beds can be cut and reformed in a single operation. It also appears to be suitable for turning under green winter cover crops when planted in the furrow.

The chisel-tool type implement is used in the northwestern part of Texas to a limited extent, especially when the soil is too dry for listing and to break up the "hard pan."

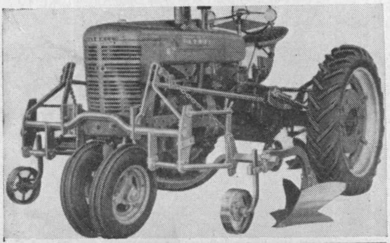

Figure 9—Front view of front-mounted or push-type middle-breaker or lister.

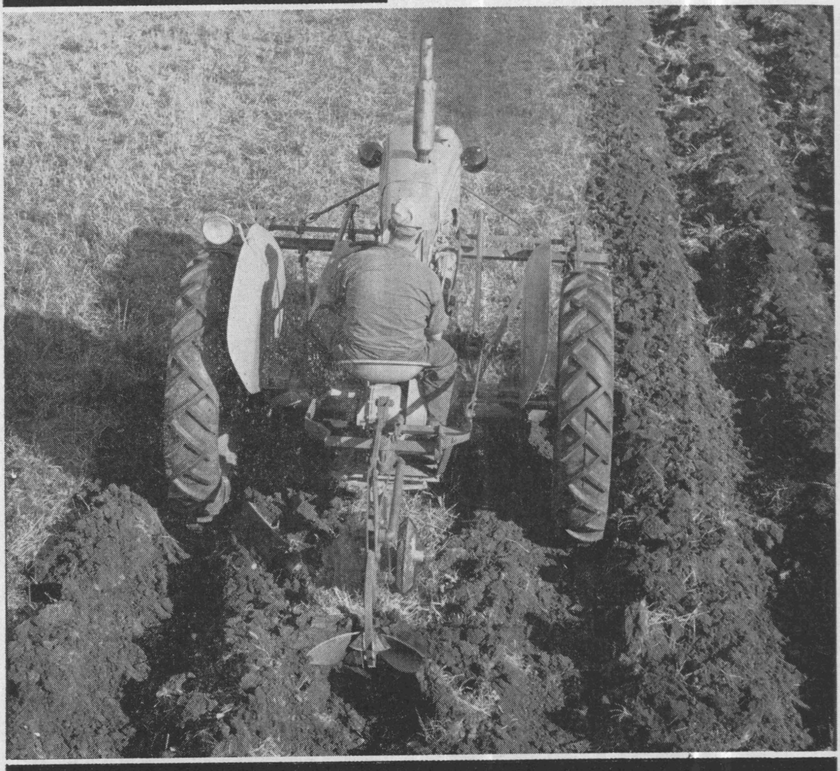

Figure 10—Rear view of front-mounted lister in operation.

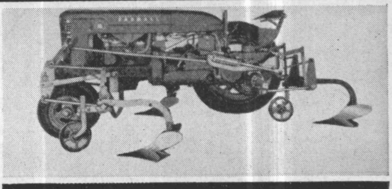

Figure 11—Side view of front-mounted or push-type middle-breaker or lister.

The number of operations necessary to obtain a good seedbed and a good stand of plants is materially influenced by the thoroughness of crop residue disposal, soil type, topography of the land, rainfall, power available and the type of machinery used in preparing the seedbed.

Plowing: When a farmer wishes to make sure that the soil is thoroughly broken, he may plow the land before bedding or listing. He may plow the land or flat break it if he wishes to change the row spacing. Unprotected flat plowed land is more subject to erosion from wind and water than bedded land unless the land is level. Level lands involve drainage problems in some parts of Texas.

Row-crop tractors are available to handle from one to five 14-inch moldboard bottoms, multiple disk plows and harrow plows.

Listing or bedding: As stated before, most cotton is planted either on beds or in furrows. Beds and furrows are made with the same type of tool called locally by different names, such as, middlebreaker, middlebuster, lister and bedder. It is also classed as a plow as it has a double-winged share and two moldboards so that half of the furrow slice is thrown to the left and half to the right. The size or number of bottoms used varies from one to four, depending upon the size and power of the tractor and the area in which work is done.

There are two types of middlebreakers determined by the way they are attached to the tractor: the rear-mounted, or tool bar, and the front-mounted. The rear-mounted may have one, two, three or four bottoms. The front-mounted may have two or three. If two, there is one bottom in front of each drive wheel of the tractor. If three, there is a third bottom to the rear behind the center of the tractor. The front or centrally-mounted arrangement makes it possible to use tractors equipped with pneumatic tires when the surface is wet enough to cause excessive wheel slippage if the wheels are not running in the furrow.

Under irrigation, as practiced in the western part of the State, beds are sometimes formed which are wide enough for two rows on the same bed. The irrigation water is run down the furrows in alternate middles.

PLANTING

The art of placing the seed in the soil to obtain good germination and stands without having to replant, is the goal of all cotton growers but not attained by many. There are several factors that influence the germination and stand obtained, such as quantity of seed planted, viability of the seed, treatment of the seed with chemicals to kill soil microorganisms, use of fuzzy seed, use of delinted seed, planting depth, type of soil, moisture content of soil, temperature of soil, firmness of soil, crusting of the soil, checking of planter parts, types of dropping mechanism, size of cells in planting plate, keeping seed hoppers full, uniform distribution or dropping of the seed, type of furrow opener-runner-shovel, width of shovel opener, prevention of loose soil getting under seed, uniform coverage, type of covering device, pressing or firming the soil around the seed, type of press wheel or device, placement of fertilizer in relation to seed at planting time, cleanliness of seedbed, time of planting in relation to season, water standing in furrow after planting, and experience, skill and attention of the operator.

Factors Influencing Stands

Quantity of seed: The quantity of seed planted per acre varies from 8 to 32 pounds, depending on the grower's judgment (Bulletin 526). Smaller amounts are needed for sandy loam than for the heavy clay soils. When planting delinted seed and when seeds are hill-dropped, smaller amounts are needed than when fuzzy seeds are drill-planted.

Viability: The viability of cottonseed should be tested to determine the percentage of germination and the quantity that should be planted.

Seed treatment: The treatment of seed with chemicals to kill seed and soil-borne microorganisms has been a paying practice in most areas. A higher percentage of the seed planted emerge as seedlings when seeds are treated, and there is less possibility of their rotting in cold wet soil (Bulletin 531). Most seed breeders treat their seed before shipment.

Fuzzy seed: Most cotton growers plant regularly ginned seed which may have good coverage of short fuzzy lint. The fuzzy seed have a tendency to hang together and the planter dropping mechanism cannot accurately drop a continuous, uniform amount of seed (Bulletin 531).

Delinted seed: There is a strong trend toward the use of delinted seed. Such seed should not be planted as deep as fuzzy seed as they are affected more by cold soils. Normally, seedlings from delinted seed will emerge a day or two earlier than seedlings from fuzzy seed.

Planting depth: The depth at which cotton seed should be planted will vary with the soil type and the moisture in the soil. In sandy loam soils, fuzzy seed are usually placed 3/4 to 2 inches deep, depending upon the area. The shallow depth is suitable for the moist East Texas while the greater depth is suitable for the low rainfall area of Northwest Texas. In heavy clay soils, cotton seed should be covered with 1½ to 3 inches of soil. Uneven

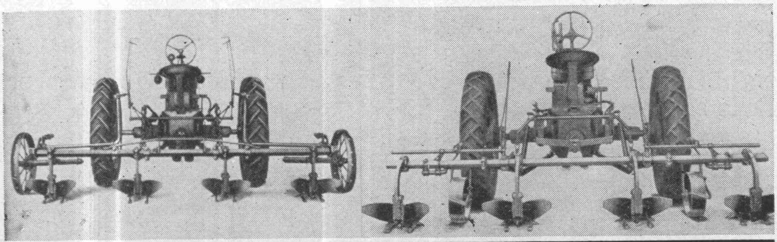

Figure 12—Four-row tool-bar integral mounted middlebreakers, showing two arrangements of gage wheels.

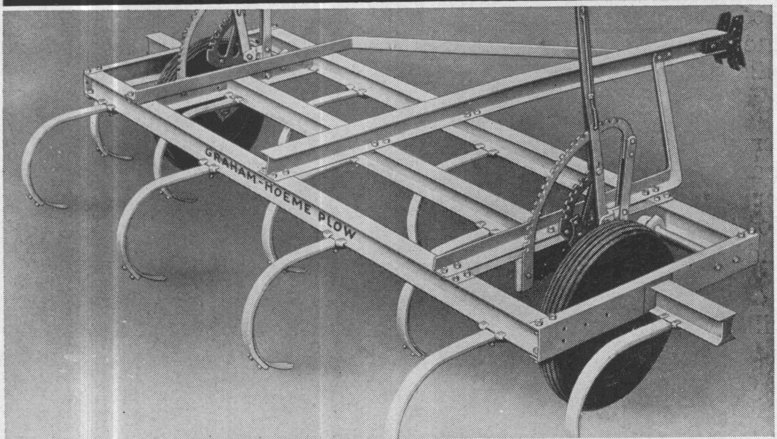

Figure 13—Chisel type plow that is becoming popular with cotton farmers.

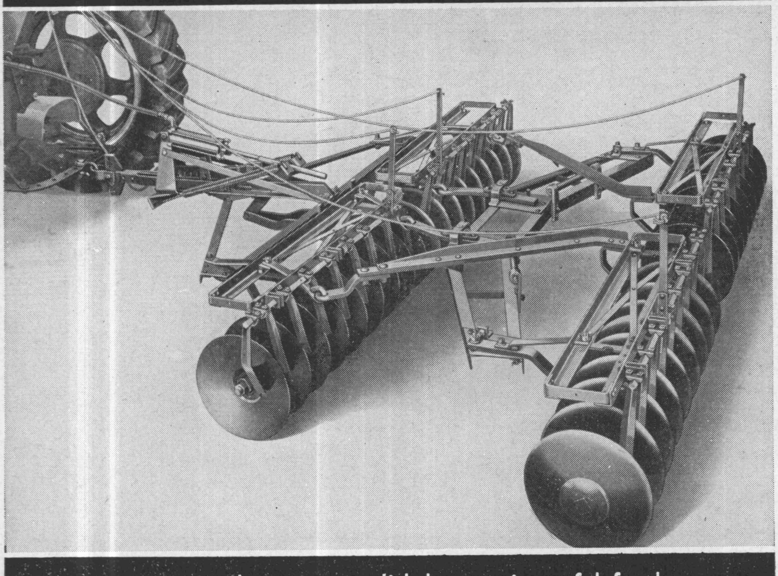

Figure 14—A tandem tractor disk harrow is useful for harrowing beds before planting and for disking crop residue.

height of beds or depths of furrows will affect uniform coverage of the seed.

Soil type: Generally, it is easier to obtain stands of cotton on sandy loam soils than on heavier clay soils.

Soil moisture: A moist well drained soil is essential for good germination of cotton seed.

Soil temperature: For good and rapid germination, the soil temperatures should be above 60 degrees F. at the depth the seed are placed. Cold soils and slow germination go together. There is more danger of seed rotting in cold soils than in warm soils.

Soil firmness: A firm seedbed gives better and more rapid germination than a loose seedbed. Disturbing the soil deeper than the planting depth retards germination and reduces stands because the loose soil under and around the seed loses moisture. Good stands are obtained where the seed are dropped on firm undisturbed moist soil (Bulletin 616).

Soil crust: Rainfall after planting but before emergence will cause a crust to form on most Texas soils. Where the crust is thick, single cotton seedlings cannot break through. A number of seedlings pushing together sometimes cannot break through a thick crust. When the soil dries and cracks appear, many seedlings will emerge through some of the cracks. Under such conditions, stands may be saved if the soil crust is broken and pulverized. This can be done on bed-planted cotton with either the broadcast rotary hoe or the rotary hoe cultivator attachment. The cultivator attachment is also suitable to use where cotton is planted in the furrow.

Narrow spoke points are best to use on cotton before and after emergence. Wide blunt points will likely dig up an excessive number of plants. The flexible broadcast rotary hoe should be provided with gage wheels to gage the depth of penetration.

Spike-tooth harrows are also useful in breaking up the soil crust.

Check of planter parts: All parts of the planter should be checked before starting to plant. This includes seed plates, agitator, cut-off, knockout and all chains, gears, bearings and seed tubes. A thorough check of these parts will result in better stands and prevent much loss of time at the critical planting period.

Dropping mechanism: The type of dropping mechanism will have some influence on the quantity of seed dropped (Bulletin 526).

The cell-drop types have several plates with each plate

Figure 15. Four-row stalk cutter being used to break the clods, loosen the soil, and destroy young weeds on beds before planting.

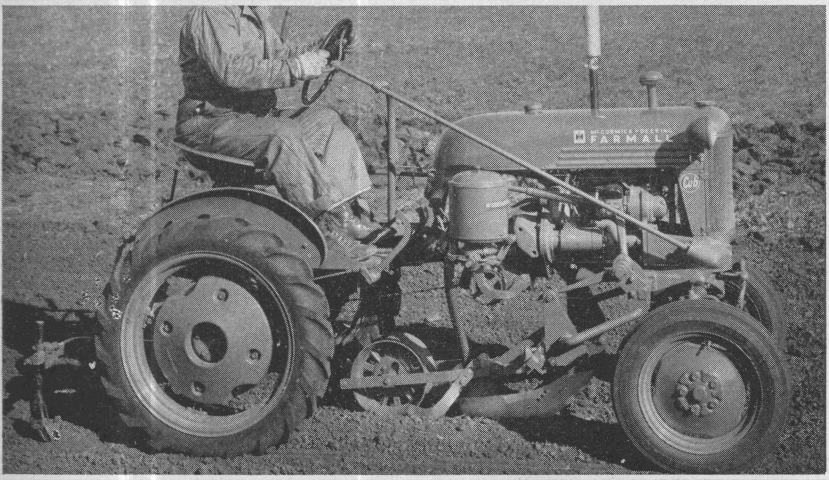

Figure 16—A single-row planter mounted on a small tractor. Note the runner seed furrow opener and the press wheel cover. A scrapper coverer throws extra soil over seed between furrow opener and press wheel.

Figure 17—Rear view of rows after planting cotton with a runner opener equipped with wings and press wheel.

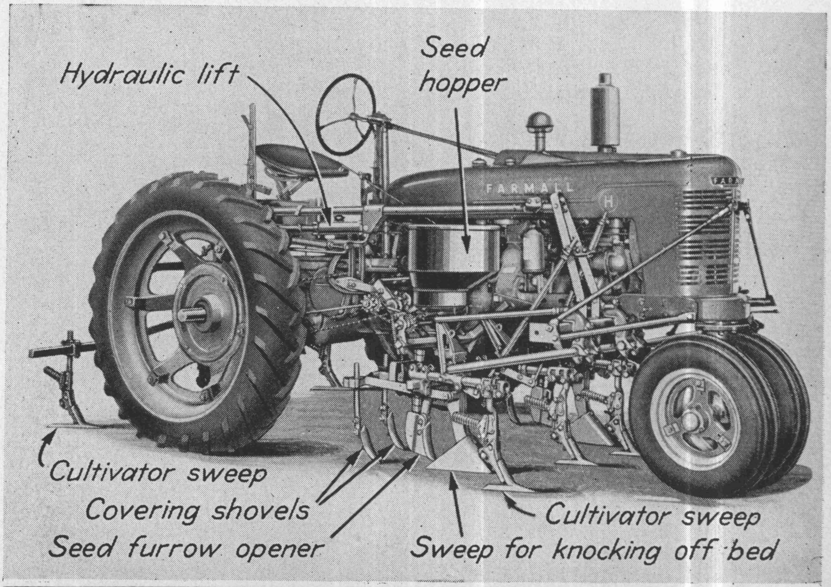

Figure 18—Two-row front or centrally-mounted cotton planter equipped for planting on beds. Note the cultivator sweeps for cultivating the beds and the middles.

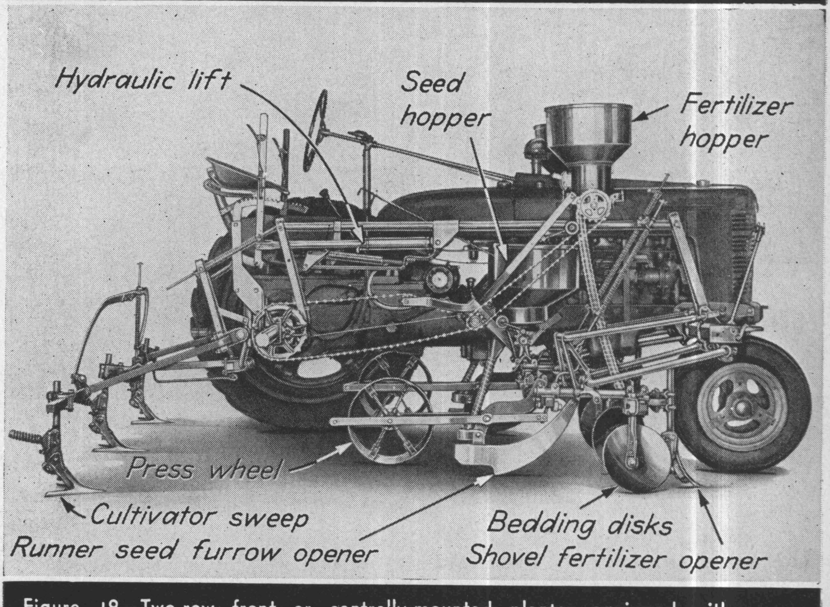

Figure 19—Two-row front or centrally-mounted planter equipped with a runner opener and press wheel coverer. A fertilizer attachment is also shown which places the fertilizer to the side and below the seed level.

having a different number and size of cells. The quantity of seed is varied by changing the plate and the speed of the plate.

A rotary valve is usually used when cottonseed are hill-dropped (Bulletin 526). The seed are dropped from the hopper by either the cell or picker-wheel dropping mechanism. Rotary valves are essential for high speed hill-dropping.

Size of plate cells: The number of cottonseed in a pound varies from 3,500 to 5,000. The size of the seed should influence the selection of the proper plate and adjustment of the dropping mechanism. The number of viable seed planted is one of the basic factors in obtaining the number of plants required per acre for a good yield. A good stand varies from 15,000 to 20,000 plants per acre depending on the area to be planted.

Seed in the hopper: The planter may be in perfect operating condition but unless there are seed in the hopper, the dropping mechanism cannot drop them. The hopper should be checked often so that plenty of seed can be kept in it. The top of the hopper should be left off so that the quantity of seed can be checked quickly and easily.

Uniform distribution of the seed: Poorly ginned cottonseed covered with excessive lint have a tendency to hang together and the planter dropping mechanism cannot drop them uniformly. Such seed will cause many "skips" where there are few or no plants. Clean close ginned seed or delinted seed should be used.

Type of furrow opener: The type of furrow opener will materially influence the manner in which the seed are placed in the soil. At College Station, the knife or runner opener gives better stands than either the narrow or wide shovel openers (Bulletin 621).

Width of shovel openers: Shovel openers 1 to 1½ inches wide give better stands than shovel openers 2 to 3 inches wide but not as good as is obtained with the knife opener (Bulletin 621).

Loose soil under seed: Shields should be used with a shovel opener of any size to prevent loose soil from falling in the furrow under the seed. If much loose soil gets under the seed and dries, preventing the seed to be in contact with the firm moist furrow sole, germination may be delayed and reduced.

Uniform coverage: Uniform coverage of the seed is essential to obtain uniform germination and stands of cotton.

Types of covering devices: Covering shovels are usually used in combination with shovel openers in the heavier soils and humid areas. Press wheels are commonly used with the knife or runner openers. Better coverage can be obtained if shovel covers are used with the runner openers. A homemade U-shaped "fish-tail" scraper covering device is widely used on the light soils in the low rainfall areas where planting is done in the furrow. The fish-tail, which weighs about 11 pounds, is attached to the rear of the lister planter by two small chains. The chains are about two feet long or just long enough to hold up the closed end of the U so the flattened points will drag soil to the center over the seed.

Pressing the soil after planting: Most cotton growers in the more humid areas either use a press wheel on the planter or roll the soil a few hours after planting to compact the soil and thereby hold the moisture around the seed. It is not the general practice to roll and press the soil after planting where cotton is planted in the lister furrow.

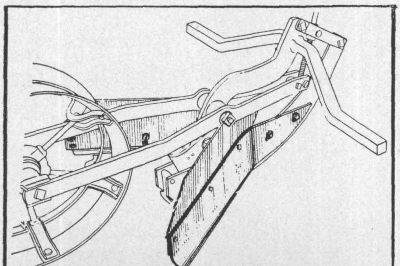

Figure 20—Wings used on each side of a runner seed furrow opener levels the bed. Level beds are aids to the use of the rotary hoe attachment, the flame cultivator and the use of sweeps.

Types of press wheels: The open center type press wheel gives good results when used on the planter in Lufkin fine sandy loam at College Station (Bulletin 621). When moist, most Texas soils will stick to press wheels. For this reason rollers are used a few hours after planting. A Texas farmer has found that a small partially inflated rubber inner tube placed on a small implement wheel makes an excellent device for pressing and firming the loose soil behind the planter.

Fertilizer placement: When commercial fertilizer is placed within approximately one inch of the seed at planting time the dissolved fertilizer salts are likely to delay germination of the seed and reduce the stands.

Clean seedbed: A clean, well prepared seedbed free of undecayed stubble, trash and weeds permits better placement of the seed in the soil and more uniform coverage and results in better stands of seedlings.

Date of planting: The date of planting should be delayed until after danger from frosts. Too early planting is a gamble with the weather. Planting of cotton in Texas begins in the Lower Rio Grande Valley in February and ends in the High Plains in June.

Standing water: When heavy rains occur after planting, cottonseed are likely to rot if water is allowed to stand many hours on the soil over the seed. The beds should be left high enough so most of the water will drain into the middle. If the land is level, drainage ditches should be provided to take off the excess water. These conditions, however, rarely apply to the sub-humid areas where planting is done in the lister furrow.

Operating the planter: The skill and judgment of the planter operator in properly adjusting and operating the planter often determine whether a good or bad job of planting is done. Frequent, momentary shifting the eyes from the rows ahead to the planter will very likely result in crooked rows which will later prevent rapid cultivation. The best operators focus their eyes over the radiator cap several feet ahead of the tractor.

Planting Equipment

Tractor planters: Integral mounted tractor cotton planters are available in one, two and four-row sizes. The single-row types on the smaller tractors are mounted in a central position on the tractor so the hoppers are in front of the operator. Two-row rear-mounted planters are available but the front or centrally mounted types are the most popular. Planters can be obtained equipped either with sweeps to knock off the bed and shovel openers for planting on beds or with runner openers, with or without wings for planting on level ground or on low beds. Most four-row integral-mounted cotton planters for planting either on beds or in listed furrows are mounted to the rear of the tractor. Most two and four-row planters are equipped with power lifts.

Attachments for tractor planters: Among the many attachments are fertilizer attachments, gage wheels, press wheels, disk coverers, different types of furrow openers, wings for runner openers, hill-drop attachments and bedding disks.

One and two-row tractor mounted planters can be equipped with fertilizer attachments for placing the fertilizer to the side and below the seed level. The four-row rear mounted planters can also be equipped with fertilizer attachments.

Gage wheels may be used to aid in holding the furrow openers at a uniform depth.

In most instances, press wheels are an integral part of the runner opener but are optional with the planters equipped with sweeps and shovel openers and coverers.

Disk coverers can be obtained for use in place of the shovel coverers but have not been popular with cotton growers because it is more difficult to obtain uniform coverage when the height of the beds and soil type varies. Fish-tail scraper coverers are generally used on lister planters.

Shovel openers have been used more generally on cotton planters than runner openers because they take up less space when used behind the large sweep. Runner openers fitted with wings leave the bed comparatively level, which is essential for flame cultivation and also more suitable when the rotary hoe cultivator attachment is used. Better stands are usually obtained with the runner opener when properly set (Bulletin 548).

Hill-drop attachments have been available for use on cotton planters for more than 15 years but were not extensively used because too many seed were deposited in each hill for a desirable stand. It required more care and time to thin the closely bunched plants in the hill than was required to chop out and thin plants where the seed are drill planted. The use of delinted seed, which can be handled more accurately by the planter dropping mechanism, and the rotary valve at the bottom of the seed tube make it possible to plant only enough seed per hill to furnish a desirable stand (Bulletin 621).

Bedding disks can be obtained for use with runner openers.

On Lufkin fine sandy loam, cottonseed planted at constant or uniform depths give better stands and yields than do cottonseed planted at variable depths (Bulletin 621).

FERTILIZER APPLICATION

Experiments with fertilizers on cotton have shown that the soils in East Texas, which are predominantly sandy, need nitrogen, phosphoric acid and potash for satisfactory yields of cotton. The use of fertilizer has been found profitable on the dark prairie soils of the Gulf Coast. A mixture of ammonium phosphates has given good results on the Houston soils in the Blackland Prairie, although fertilizers are not used extensively in the region.

The application of fertilizers under dry land conditions has been disappointing in the High Plains area of Northwest Texas. The hand method of placement at planting time under irrigation failed to give any increase. Indications are that deep placement of fertilizers ahead of planting offers the best possibility.

In the mechanized production of cotton, the equipment for applying fertilizers are attachments used in combination with other machines.

Planter fertilizer attachment: Until about 15 years ago fertilizer attachments for planters placed the fertilizer so that it was mixed in the surface soil above the seed. Most fertilizer attachments for tractor planters, now available, are designed to place the fertilizer to the side and below the seed level.

Tests covering a 10-year period at Temple, Nacogdoches, College Station and in the Brazos River Valley show that when regular amounts of fertilizer are placed in the soil near the seed, germination is retarded and reduced. At these locations, the best placement of fertilizer in relation to the cottonseed appears to be about 2½ inches to the side and from 2 to 3 inches below the seed level (Bulletins 548 and 616).

Cultivator fertilizer attachments: To save time and reduce the cost of operation, special fertilizer attachments which function in connection with the cultivator have been developed.

A fertilizer attachment for tractor cultivator is useful to apply a side dressing of fertilizer after the plants are well advanced. The hopper for the fertilizer is mounted above the cultivator gangs and releases the fertilizer through a long tube, the lower end of which is attached behind the cultivator sweeps. The fertilizer is deposited in the furrow behind the front sweeps. The rear sweeps cover the fertilizer. The application of fertilizers as a side dressing is found to increase yields profitably in certain regions.

Furrow sole application for fertilizer: This method of applying fertilizer to cotton lands has not proven popular in Texas largely because the method does not suit the common practice of preparing the seedbed.

Other methods of applying fertilizers: Very little liquid or gaseous fertilizers are being used in Texas at the present time.

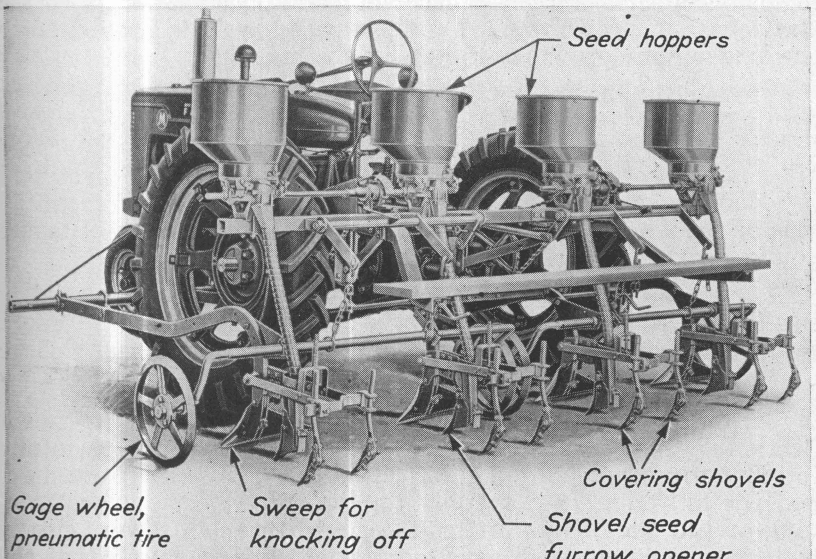

Figure 21—A four-row integral rear-mounted cotton planter equipped for planting on beds. The same type of planter is used for planting in the furrow.

THINNING AND SPACING OF PLANTS

Extensive experiments on the spacing, or thinning, of cotton over a period of years have shown clearly that the cotton plant has the power to adjust itself to produce satisfactory yields within a comparatively wide range of spacing. The spacing ranged from 3 to 36-inch intervals in rows 3 feet apart. In general, a spacing of 9 to 15 inches gives the highest yields. Cotton thinned at the usual time (when the plants have four to six leaves) produced larger yields than cotton thinned later. When mechanical plant thinners are used, better results are obtained if the plants are thinned early.

If, however, cotton must be thinned late, the results indicate that it would be better to leave more plants to the row than is normally the practice (Bulletins 340 and 360).

Tests conducted for a 2-year period on Lufkin fine sandy loam showed that 2 plants per hill, when hills were spaced 14 inches apart, gave higher yields than did 1, 3 or 4 plants per hill. When planted on Yahola clay soil, 3 plants per hill gave the highest yield (unpublished data). Spacing 6 to 15 inch is best for the High Plains area.

Mechanical thinning: A series of tests conducted at College Station to compare hand-thinned and mechanically-thinned cotton showed that higher yields were obtained when the cotton was mechanically thinned. The increase in yield is attributed to the larger number of plants left by the machine.

Flame thinning: About 30 acres of cotton were thinned satisfactorily in 1947 and 1948 with flame on the Brazos River Field Laboratory. Half cylinder cups about 14 inches in length spaced approximately 14 inches apart on the rim of a wheel protected the plants when three burners were directed downward from the axle of the wheel. The flame killed the surplus cotton plants and young grass between hills.

Cross plowing: Cross plowing has been successfully used on the Brazos River Field Laboratory and the Texas A&M College plantation, both located in the Brazos River bottoms near College Station.

Hill dropping of cotton: The Texas Agricultural Experiment Station developed a rotary valve hill-drop and used it successfully to plant fuzzy, undelinted cottonseed. Too many seed were dropped per hill from 1938 to 1941 to obtain the best stands. Thinning of the plants was difficult because the plants were closely bunched. Delinted seed were not tested. It was found that the notches or cells in the rotary wheel should be about 3/4 inch deep and about 1 inch wide at the wheel rim surface. The bottom of the notch should be round. Notches with sides too straight tended to scatter the seeds. The entire surface of the notch should be smoothly polished to prevent any tendency for seed to hang in the notch and not fall freely when the notch is exposed to the furrow. It was also found that the lip-type hill-drop valve would not function properly at speeds faster than 2½ miles per hour (unpublished data).

CULTIVATION

Experiments at several points in Texas over a period of years show that the main function of cultivation under Texas conditions is to destroy weeds. Just enough cultivation to control weeds is the most efficient cultivation.

The best and cheapest way to kill weeds is to get them while they are young and small, otherwise they are likely to grow faster than the crop.

Soil-stirring tools are generally used to kill weeds. The most common tool has been the winged sweep. More recently the rotary hoe and flame are being used to kill weeds. Experiments are being conducted with chemicals for weed control in cotton. In the areas where planting is done in the furrow, the "go-devil" or lister cultivator is used until cotton reaches a height of 8 to 10 inches.

Tractor cultivators: The general purpose or row-crop tractor with the "tricycle" wheel arrangement was developed primarily as a power unit on which cultivator equipment could be integral-mounted for the rapid cultivation of row crops. The number of rows cultivated at a time depends largely on the size of the tractor and the power available. Of course, soil type, the kind of crop, and the depth of cultivation are also influencing factors. Generally, the one-plow-size tractor is equipped with a cultivator attachment for cultivating one row. The two-plow tractor is generally equipped with two-row cultivators. The three and four-plow tractor operates a four-row cultivator.

The most common and the most popular method of mounting the two and four-row cultivator units is to place the frame and gangs well forward on the tractor and in front of the operator. The sweeps at the rear sweep out the middle and loosen the soil behind the tractor wheels. The cultivating gangs are mounted well forward on the tractor to facilitate steering. As the frame of the four-row cultivator must be long, gage wheels are provided to support part of the weight of each gang and gage the depth of penetration of the sweeps. Where the ground is level and large acreages are to be cultivated, a four-row tractor-mounted cultivator will materially reduce the man and tractor-hours and the cost per acre.

Sweeps: Sweeps are attached to shanks clamped to gangs suspended on each side of the tractor, making what is called tractor cultivators. The size of sweeps vary in size from 4 to 32 inches. Sweeps are made only in even-inch sizes. The Texas,

Figure 22—A four-row roller is a popular tool with cotton farmers who farm the heavy clay soils. The roller is used a few hours after planting and when the soil has dried so it will not stick to the rollers.

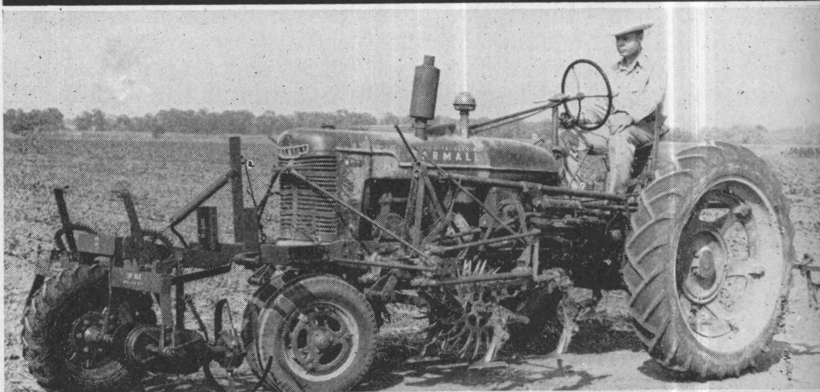

Figure 23—Chopping and cultivating two rows of cotton in the same operation.

Figure 24—Two-row tractor equipped with two-row front-mounted mechanical cotton chopper, two-row cultivator and rotary hoe attachments between the front sweeps of the cultivator.

Joyce, McGregor and Hi-speed types are used for the cultivation of cotton. The Texas sweep is very popular in this State.

Sweeps should be set flat so that both the point and the rear part of the wings will touch the ground when the gangs are lowered.

When cotton is small, 4-inch sweeps are used on the front shanks next to the cotton. Eight or 10-inch sweeps are used on the rear shanks nearer the middle. Larger sweeps are used for taller plants.

Rotary hoe attachment: Three or four rotary hoe wheels or spiders attached to and between the gangs and front sweeps stir the soil around young plants. This is an excellent attachment to control young weeds. The rotary hoe attachment permits more rapid cultivation. The wheels deflect lumps and clods but permit soil to shift through the wheels and fall around the plants without covering them.

If there are many old cotton roots from the previous crop on the surface around the young cotton seedlings, these roots will hang in the rotary hoe wheels and slide along the row and damage the young plants. When such conditions exist, the rotary hoe wheels should be run backwards. Tall weeds will also hang on the wheels and be wrapped around the axles.

The rotary hoe as a cultivator attachment was found to be useful at Lubbock in controlling young annual weeds after the cotton plants had emerged and also before emergency of cotton seedlings. No hand hoeing was necessary when the rotary hoe attachment was used in the early stages of culture. For best results, it is essential that the rotary hoe be used at the proper time, and this means early use. The rotary hoe apparently has greater promise of early general adoption in the High Plains area than flame for the control of young weeds.

The broadcast rotary hoe: The rotary hoe is an implement used to cultivate the soil and to destroy young weeds around plants. When rains cause a hard crust to form over the soil and hinder the emergency of young seedlings, the rotary hoe is an excellent tool for breaking the crust. Some two and three-row units have solid axles while the larger units are made in sections so that each section can follow the contour of the soil. Rotary hoes should be used at a speed of 6 to 8 miles per hour. Poor work will be done at 2½ to 3 miles per hour. In cultivating young cotton plants, the points of the rotary hoe spokes should be slender and rounded at the points. The broad shovel-pointed spokes, made to use on fallow land, should not be used on cotton plants.

Under some conditions, gage wheels should be attached to each section to control the depth of penetration of the spoke points. At present, the attachment type is preferred in the area where furrow planting prevails.

Flame cultivation: The use of flame for the control of weeds among plants of row crops is comparatively new. The equipment consists of a fuel tank, feed lines, control valves and burners. The system is mounted on the rear of a tractor with skid supports for the burners. Burners are provided for each side of each of two or four rows. The burners are mounted so that they will direct a hot flame close to the ground on the weeds but around the plants. Butane and propane have proved the most satisfactory fuel for flame cultivation.

The use of flame for the control of weeds in cotton on the Brazos River Field Laboratory reduced hoeing costs by one-half. Scattered bunches of Johnson grass and trumpet vines were not controlled to the point that hand hoeing was eliminated. The grass was not thick enough to warrant the use of double burners.

It was found at Lubbock that flame could be used in lister furrows 8 to 10 inches wide. By proper setting of burner, the flame followed the curve of the furrow without injury to the plants. The flame was more effective on young weeds and goat heads (puncture vine) than on tall weeds. Where the flame was used on cotton, it was not necessary to use the hand hoe. However, the rotary hoe attachment has proven more practical.

Tractor-drawn lister cultivator: The four-row tractor-drawn lister-furrow cultivator has wheels to support and guide the gangs for each row. For the first cultivation, the disks are set to throw the soil away from the row of plants. For all later cultivation, the disks are set to throw the soil toward the plants. Long knives are used to slice through the sides of the listed beds to destroy weeds.

In areas where furrow planting is practiced, the four-row machine shop or blacksmith-made power lift lister or "go-devil" cultivator is extremely popular.

Spoke wheel cultivator: A straight spoke rimless wheel makes a cultivator when substituted for the cutterhead of a cotton chopper.

Chemical control of weeds: Experiments with chemicals to control weeds have not progressed sufficiently to determine the possibilities for cotton. It is known, however, that cotton is quite sensitive to injury from 2, 4-D.

COTTON INSECTS

The U. S. Department of Agriculture has estimated that approximately one-seventh of the Texas cotton crop is destroyed annually by insects. The Department estimated that for the 10-year crop-reporting period 1937-47, insects caused the loss of

464,767 bales of lint and 210,043 tons of cottonseed, which were valued at $44,176,866.

Machines for Applying Insecticides

The problem of controlling insect pests of cotton makes it necessary for a large percentage of cotton farmers to include in their equipment machines for the application of chemicals, either as dusts or as sprays. Practically all cotton farmers use chemical dusts for the control of cotton insects. Most chemical dusts can be purchased in 100 pound packages ready for use. These packages are easily handled and little storage space is required. Most liquid chemicals must be diluted and mixed before use. Liquids are heavy in comparison with dusts. Large quantities of water necessary for the dilution of the chemicals and to cover large acreages are often difficult to obtain and additional equipment is necessary to transport the water. Most farmers prefer dust for this reason.

Machines are available to apply insecticides in either the dust or liquid form.

From a mechanized standpoint, only the motorized ground machines and the airplane will be considered in this bulletin.

Motorized ground machines: The most popular type of mechanized ground duster is the tractor mounted duster. It consists of a large hopper with a driven agitator and feed in the bottom. The feed drops the dust into an air stream created by a fan operated either from the power-take-off of the tractor or by an auxiliary engine mounted on the platform. More uniform power and operation of the duster is obtained with an auxiliary engine than with the power-take-off of the tractor. The dust is conveyed and directed onto the rows of plants by a metal flexible hose. From four to eight rows may be dusted at one time. This type of machine is suited for dusting 100 to 300 acres of cotton.

Ground sprayers may be mounted on the tractor with the sprayer boom at the rear or in front of the tractor. Some sprayer units made of aluminum with a 150-gallon capacity are light enough to be carried in a ½-ton pick-up truck.

There is now a trend toward the use of low pressure low volume spray nozzles.

Airplane dusting and spraying: Airplanes have been used for the application of cotton insecticides for at least 25 years and for the application of defoliants for approximately 6 years. Spraying equipment for airplanes is a more recent development.

For dusting, a V-shaped hopper capable of holding 500 to 800 pounds of an insecticide is built inside the fuselage in the space ordinarily occupied by the front seat. The opening in the top is covered with a close fitting lid, hinged in front. A propeller-driven agitator stirs the dust and feeds it into a venturi nozzel mounted underneath the fuselage.

An airplane can dust approximately 350 acres or more per hour.

Most airplane dusting is done on a contract basis as the average cotton farmer cannot afford to purchase a plane for this purpose and hire a trained pilot to fly it. The contract price for applying insecticides ranges from 3 to 5 cents per pound, depending on the distance the fields are from a landing strip and the acreage to be dusted.

When equipping an airplane for spraying, a leak-proof tank is installed in place of a hopper. Booms with spray nozzles are attached underneath the wings and fuselage. As liquid sprays are heavier than dusts, less acreage can be sprayed as more landings for refilling of the tanks are necessary.

Airplanes have been used to apply liquid defoliants to cotton to a limited extent.

General Recommendations

Dust applications should be made when the air is calm or nearly so. A strong movement of air greatly reduces the effectiveness of the contact insecticides. The presence of dew is not necessary but some of the materials seem to be more effective when dew is present. Applications should be repeated if washed off by rains within 24 hours. It is not necessary to repeat applications when chlorinated camphene, benzene hexachloride or DDT is used against the fleahopper.

Insect control pays best when the land is capable of producing one-third bale or more per acre.

Plowing under cotton stalks immediately after harvest is a good farm practice. The stalks may improve the soil and their destruction helps to control such insects as the boll weevil. This practice is more effective if done on a large area.

DEFOLIATION OF COTTON PLANTS

The defoliation of cotton plants by the use of chemicals has created unusual interest, particularly on the part of the farmer who expects to harvest his crop mechanically. The chemical that has been used most extensively is calcium cyanamide as a dust. Other chemicals applied as a spray have been tried. Some show promise of being useful.

To defoliate cotton plants, it is essential that the chemical be relatively slow in its reaction on the cotton leaves. The action should be slow enough to permit the leaf or plant to form an abscissa layer at the leaf's connection with the limb. The formation of this layer will cause the leaf to fall from the plant, in many cases while the leaf is still green.

The defoliant is applied at the rate of 20 to 35 pounds per acre, when most of the bolls are mature or when only a few are younger than 30 days. The fiber in a cotton boll 21 days old has usually reached its mature length. Therefore, when the foliage drops off the plant, sunshine causes the bolls to open, and harvesting can begin much earlier than when plants are not defoliated. Farmers find that by defoliating cotton fields which are to be picked by hand, they can get over the field faster and a higher percentage of the crop harvested, as the laborer can see bolls that would otherwise have been hidden by the heavy foliage. Immature or second growth leaves are practically impossible to defoliate with some dust defoliants. Since leaves appear some 2 or 3 weeks after defoliation, unless frost occurs, the grower should not defoliate his plants too far in advance of harvesting especially if he contemplates machine harvesting of the crop.

The defoliant should be applied when there is a heavy dew and when there is a high relative humidity of the air. Through experience, it has been found that to be effective, the moisture or dew should remain on the leaves for at least 2 or 3 hours after the dust has been applied. The dust can be applied ahead of dew.

Ground dusting machinery is not as satisfactory for the application of defoliants as airplanes where tall plants are encountered. Most ground dusters were designed to handle small quantities of a light weight material. As calcium cyanamide dust is heavy and three times more of it is applied than the lighter calcium arsenate, it is doubtful that there is sufficient velocity and volume of air to break up the dust sufficiently for it to be completely air-borne unless a large fan is used.

Calcium cyanamide will react on fully matured leaves but has little effect on young, tender freshly-sprouted leaves.

While plant maturity is the most important plant factor in securing good defoliation, it was found that some varieties of cotton are more sensitive to the defoliant than others. Varieties having average size leaves react more favorably to the application of defoliants than varieties having many large leaves on the plant. Some varieties will revive and start new growth sooner than others.

Cotton in a good healthy state of plant activity defoliates better than cotton partially dormant from lack of moisture (Progress Report 949).

Excellent results, on an experimental basis, have been obtained using a soluble grade of monosodium cyanamide as a spray. This prevents the necessity of waiting for a dew.

Figure 25

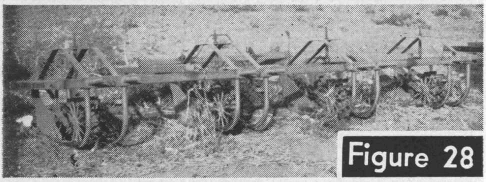

Figure 28

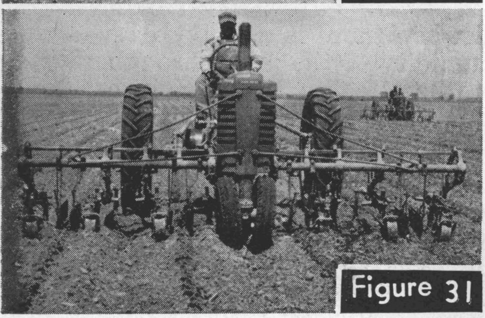

Figure 31

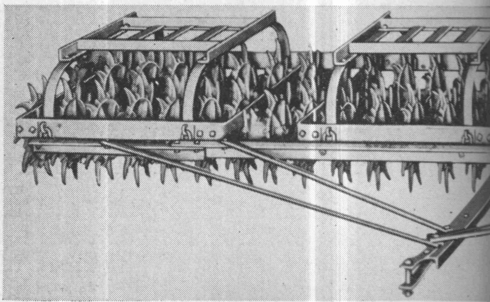

Figure 25—Rear view of flame cul
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31— A four-row front-mounted cul
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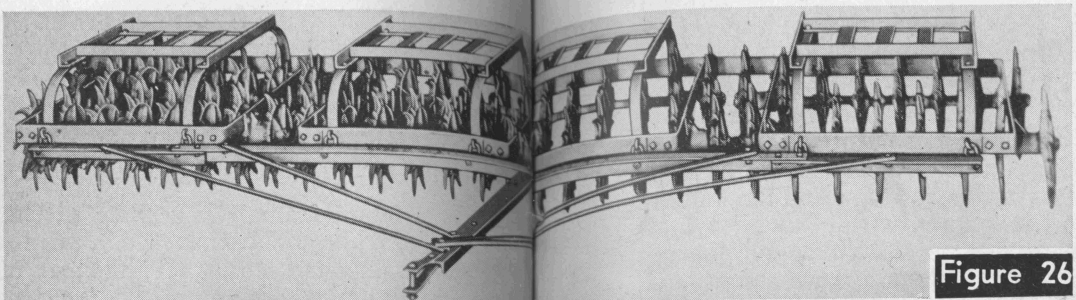

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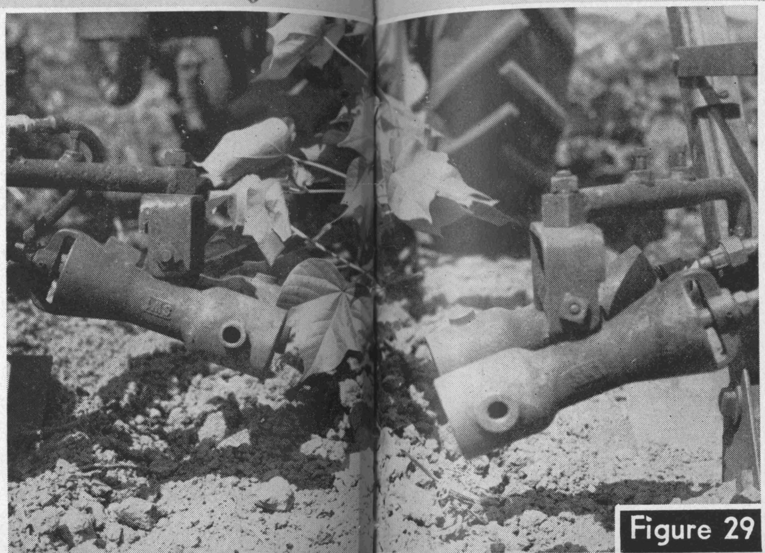
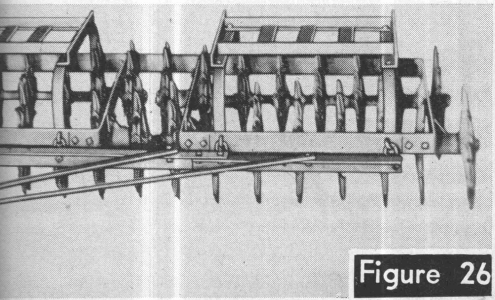


Figure 29

Figure 25—Rear view of flame cultiv uipped with plant blocker wheel and cups being used to flame thin cotton Figure 26—The flexible type rotary hoe is an excellent tool to cultivate and to destroy young weeds around cotton plants. It is also a good tool fo g up and pulverizing the soil crust which may obstruct the emergence of cotton seedlings. Figure 27 — The rotary hoe cultivator attachment cultiv soil and destroys weeds around the cotton plants and makes possible high cultivation while the plants are still small. Note the two units shown are the ide of a four-row tractor-mounted cultivator. Figure 28—Machine shop ctor mounted go-devil lister cultivator equipped with small stalk cutter-li s and blades to break-up the soil around and over young cotton seedli e and after emergence. For later cultivations, the wheels are removed knives bolted to the sides so that the ridges can be 'knifed." Figure 29—A view of a double burner for the flame cultivation of cotton. If there is a he th of grass and weeds, two burners are more effective than one burner. F —Some farmers have found that a straight spoke wheel is useful in destro ng weeds in small cotton. Figure 31— A four-row front-mounted culti g used to cultivate young cotton. It is equipped with shields to protect t Figure 32—Tractor-mounted large-size blow torch burners have been ful in some areas for flaming and killing of young grass and weeds in otton plants.



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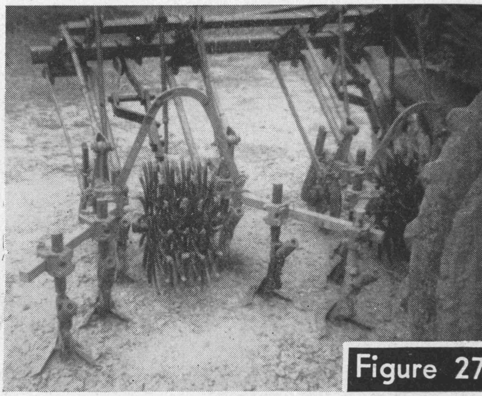
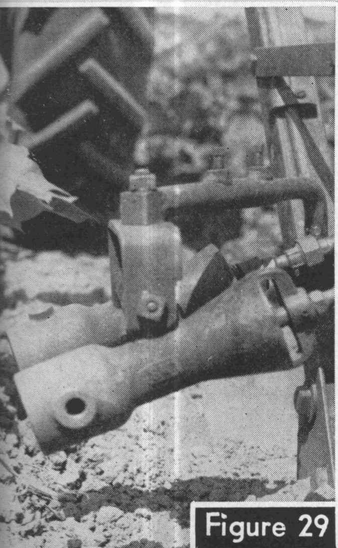


Figure 27



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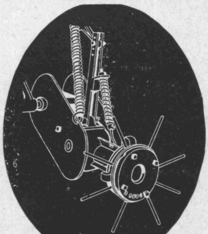

Figure 30

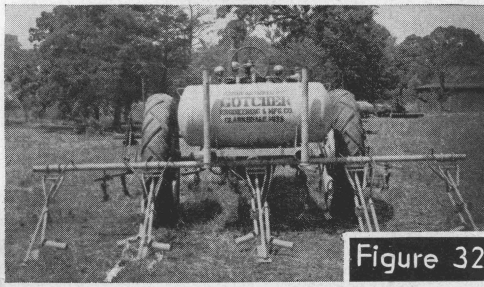

Figure 32

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Experimental application of liquid defoliants indicate that it is difficult to obtain complete coverage of the field and of large plants 3 to 6 feet tall. Where the plants are large and have dense foliage, it is difficult to get sufficient quantities of the defoliant on the lower 1/3 of the plant to cause good defoliation. To get good coverage with liquid defoliants, a flagman is needed at each end of the row to guide the pilot.

HARVESTING

Cotton was grown for its fiber in the United States for approximately 170 years before a young Southern widow inspired Eli Whitney to invent the cotton gin. More than 100 years passed before the invention developed into the modern gin plant. The first mechanical cotton picker was patented in 1851 and almost 100 years passed before this invention developed into a successful machine. The mechanical cotton stripper was first patented in 1871 and 75 years passed before the tractor-mounted stripper came into extensive use. Thus, we can see that mechanical harvesting and processing of cotton has been slow, in comparison with the development of the automobile, airplane, radio, radar and the atom bomb.

The development and the acceptance of the mechanical cotton harvester has been slow for several reasons. The foremost and most outstanding reason is the characteristics of the cotton plant. The plant is very sensitive to varying climatic conditions, fertility of the soil and the moisture available during the growing season. The plant is small when some of these factors are deficient. When there is sufficient plant food and ample moisture and climatic conditions are favorable, the plant will grow six or seven feet tall and produce branches or limbs having a spread of five or six feet. Another reason for the slow development of the mechanical cotton harvester has been the inability of the engineer to develop a machine that could harvest cotton from plants that varied so much from field to field, from section to section or region to region, and from year to year. The engineer has been striving for almost 100 years to adapt his machine to the hundreds of varieties, which vary greatly in plant, boll and fiber characteristics as developed and provided by the plant breeder. There was very little progress in the introduction of the mechanical harvester until attention was given to the effect of the varietal characteristics on the performance of the machine. The engineer insists that if the cotton breeder will give him a type of cotton having consistent growth habits and boll and fiber characteristics within certain limits he will furnish a machine that will give satisfactory performance in harvesting the cotton.

Because of the wide variation in the varietal characteristics of the cotton plant, due to the varying environmental conditions of the different regions of the Cotton Belt, there are two types of cotton harvesting machines—the stripper harvester and the picker harvester.

It is generally conceded that machine harvested cottons contain more foreign matter than cottons that are carefully hand harvested. Therefore, the engineers who are working on the development of mechanical cotton harvesters are tremendously interested in the ways and means of harvesting the cotton with the least possible foreign matter.

The Mechanical Cotton Stripper

Development of the cotton stripper: Records in the United States Patent Office show that the mechanical cotton stripper was 77 years old on March 28, 1948. In terms of man's life span, that's a ripe old age, but the use of cotton stripping machines is in its infancy.

Figure 33—A fertilizer attachment for tractor-mounted cultivators is useful in the application of fertilizers as a side dressing to cotton.

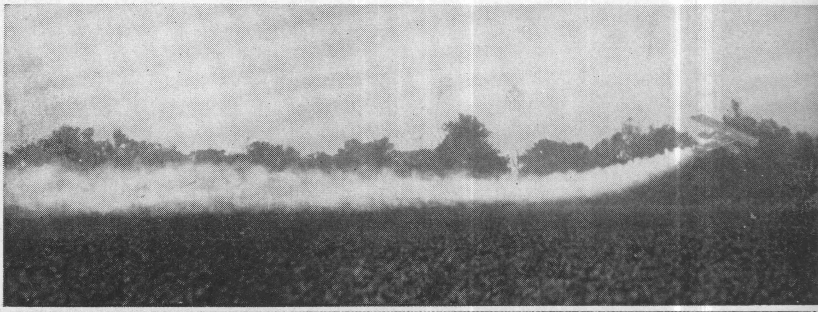

Figure 34—Airplane being used to apply an insecticide dust to cotton.

A search of patents covering cotton harvesting equipment reveals that a patent was granted to John Hughen of New Berne, North Carolina, on March 28, 1871. The construction and operation of the machine was described as follows: "—the machine may be constructed and adapted to a single or double team, and to gathering or picking of one row or more at a time,—. This machine strips from the plants the unopen as well as the open bolls or cups, and loose cotton, which can afterward be separated by another machine for that purpose." This description of a cotton stripper and the handling of the stripped cotton pretty well fits our modern set-up of today.

Z. B. Sims of Bonham, Texas, was granted a patent, September 3, 1872 on a finger-type cotton stripper which severed or peeled the bolls from the plant. The bolls were raked by hand back into a bag or receptacle suspended from hooks.

The fundamental principle of the modern roller stripper was covered in a patent granted to W. H. Pedrick of Richmond, Indiana, on January 27, 1874. This stripper used revolving rollers or picking cylinders provided with teeth or brushes to strip the "ripe" cotton from the plants without material injury to the plants or to the "unripe" bolls.

A total of 25 patents had been granted by the U. S. Commissioner of Patents up to 1931. No doubt, almost this number have been granted in recent years.

It is well to note that much of the history of the development and use of mechanical cotton strippers is not recorded in the U. S. Patent Office.

Even though the machine for stripping cotton was invented 77 years ago, the method was not put into practice until about 1914. D. L. Jones, et al., state in Texas Station Circular 52 that the first attempts at stripping cotton bolls by mechanical means probably were made by a cotton farmer in Northwest Texas in 1914 with a section of a picket fence.

When farmers attached wood or steel fingers to the front of sleds and used these to strip cotton, the method was called sledding cotton. For a number of years following the development of the sled stripper, gins were not equipped with machinery to handle the cotton direct from the sled and the farmers had to continue to run the cotton through a thresher before taking it to the gin.

By 1926, gin manufacturers had developed extracting equipment and hundreds of bales of "machine stripped" cotton were ginned that year.

As the sled strippers were crude affairs, mechanically minded farmers and blacksmiths began making improvements. They substituted metal for the wooden teeth and mounted the sleds on wheels. They also widened them and put two sets of teeth so two rows could be harvested at a time. Farmers used such a large number of sled strippers in 1926 and 1927 that the farm machinery manufacturers became interested and sent their engineers to develop commercial machines. Several commercial strippers appeared by 1927 and 1928. The implement manufacturer most interested in the development of a cotton stripper was Deere & Company.

The Texas Station began a study in 1927 to determine some of the essential principles involved in construction to obtain

Figure 35—Dusting cotton with a tractor-mounted duster. The mechanism of the duster is driven by the power-take-off of the tractor. It may also be driven by an auxiliary gasoline engine mounted near the hopper.

Figure 36—Cotton on the left received 6 applications of 3 per cent gamma benzene hexachloride—5 per cent DDT-sulphur mixture and yielded 1,417 pounds seed cotton per acre. Cotton on the right was not treated and yielded 721 pounds seed cotton per acre. Experiments conducted at the Brazos River Field Laboratory near College Station.

satisfactory operation of a cotton stripper. The work done from 1927 to 1929 may be considered preliminary to the work begun in 1930. During this 3-year period several types of homemade strippers were constructed and tested.

The first attempt to construct a cotton stripper by engineers

Figure 37—Applying defoliant dust to a field of cotton with an airplane.

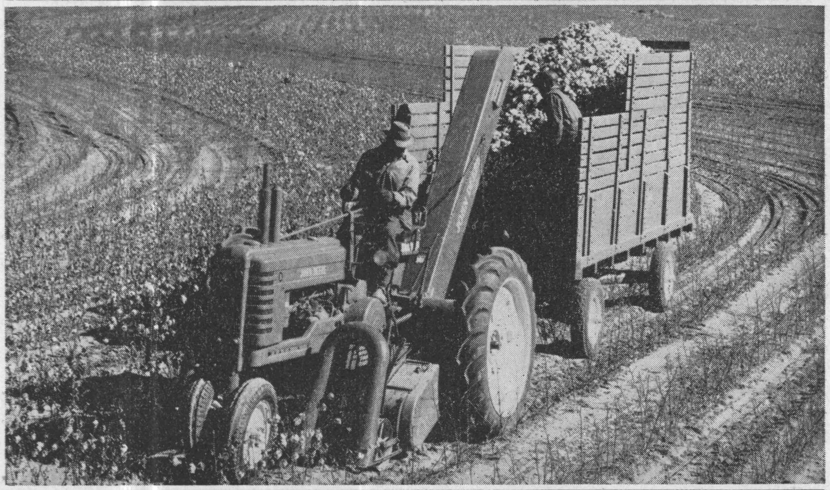

Figure 38—A two-row tractor-mounted cotton stripper harvesting storm resistant cotton near Lubbock. A stripper can be used on contour rows if carefully operated.

of the Texas Station was to mount stripper fingers on the framework of a corn binder. This proved impractical. After testing the sled type strippers and attempting to modify a commercial type stripper, a tractor mounted single-row stripper was built in 1930. Smooth rollers 2½ inches in diameter were constructed of several sizes of rubber radiator hose. The machine was changed and improved to where in 1931 it harvested better than 90 percent of the cotton from commonly grown varieties. During the period 1936 to 1939, the machine harvested an average of 98 percent of the cotton from 25 selected varieties and crosses.

A field extractor was constructed in 1935 and mounted on the rear of the tractor so that the cotton could be extracted as it was harvested. This unit also screened out most of the green bolls and much of the trash.

When using the machine at Lubbock to harvest storm resistant bolls from small plants, the field losses were less than 1 percent under experimental conditions.

The experimental work on cotton stripping continued through the depression years when there was little interest on the part of either the farmer or the farm machinery manufacturers in mechanical cotton strippers.

C. E. Morris obtained permission in 1943 to use the principles developed by the engineers of the Texas Station. His organization developed a two-row tractor mounted stripper which is called the "Marco" cotton stripper. C. T. Boone acquired the development in 1945 and has continued the improvement and manufacture of the machine, which is called the Boone cotton stripper.

The studies and developments of the Texas Station have influenced the design of most commercial roller strippers.

Texas Station Bulletin 26 published in 1893, entitled "Cost of Cotton Production and Profit Per Acre," reports the use of a Cunningham cotton harvesting machine by Jeff Welborn, New Boston, Bowie County, Texas. Mr. Welborn reported that cotton was harvested at a cost of 10 cents per hundred or $1.50 for 1,500 pounds of seed cotton including interest and wear and tear on the machine. The grade of the cotton was not reported. A search of patents obtained by Cunningham shows that the machine was evidently a stripper type machine.

Mechanical factors affecting performance of cotton strippers: Mechanical factors that affect the efficiency or performance of mechanical cotton strippers are: type of pick-up or limb lifters, the size, length, angle with ground, type of surface, flexibility, tension, and peripheral speed of the stripping rollers. The rate of travel is also an important factor affecting field losses (Bulletins 511 and 580).

Properly designed and constructed limb-lifters or pick-up fingers are essential to obtain high performance of any type of mechanical cotton harvester. They must slide under and lift up low limbs and bolls so the bolls on them will be collected. The adjacent edges of the fingers should be close enough together to actually strip off low bolls. The adjacent edges should be fairly flat so a boll will lay on them and be swept back into the conveying system by the branches of the plants.

Stripping rolls made of steel pipe or wood having a slightly roughened surface gave an efficient performance when used to strip cotton.

The most efficient angle for operating stripping rolls is between 25 and 30 degrees with the ground.

The peripheral travel of the roll surface should be 25 to 50 percent faster than the forward travel of the tractor.

Stripper rolls made of steel pipe with a knurled surface were as efficient as rolls made of rubber radiator hose. In harvesting Lone Star cotton, the rubber hose rolls harvested 95.5 percent and the knurled surfaced steel rolls harvested 96.2 percent (Bulletin 511).

When cotton was stripped at College Station in September and when the plants were in full foliage, the Texas Station stripper, equipped with smooth rolls, left from 75 to 84 percent of the green leaves on the plant.

When cotton is harvested from green plants and the stripper rollers rub the sides of the stalks, plant juices from the stalks, limbs and leaves stick to the surface of the stripper rollers. This causes dust and dirt to collect, in a hard crust and creates an artificial surface. This coating increases the diameter of the stripping rolls and affects the adjustment and possibly the performance of the machine.

Tests made in 1933 revealed that only 16.5 percent of the green leaves on the plant in September were removed when the cotton was harvested with the Texas Station stripper at College Station. The leaves contained 71.6 percent moisture. There was 60.8 percent moisture in the unopen mature green bolls, and 71.7 percent moisture in the unopen immature green bolls (Bulletin 511).

Traveling at the rate of 2.6 miles per hour caused greater field losses where normal bolled cottons were used than when traveling 1 mile per hour.

The Texas Station stripper harvested an average of 91.6 percent of the cotton on the plant at College Station in 1931 (Bulletin 452).

The performance or efficiency of the stripper harvester varied from year to year with the climatic conditions, type of plant growth and the varieties grown.

The average efficiency of the stripper harvester at College Station for the 7-year period, 1939-45, was 89.0 percent.

Figure 39—A two-row cotton stripper mounted on a small tractor. Note the special type trailer used with the stripper.

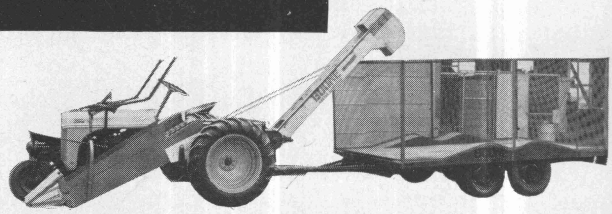

Figure 40—Aerial view of well defoliated field of cotton being mechanically picked September 20, 1945 in Central South Texas.

The average efficiency of the stripper harvester at Lubbock in harvesting 15 to 25 varieties each year for the 7-year period, 1939-45, was 96.4 percent.

Without defoliation the stripper-type cotton harvester is not generally recommended until after a killing freeze has caused the green bolls to dry and the leaves to shed.

The stripper-type cotton harvester may be used with defoliation provided the cotton is well open. Any green bolls harvested should be separated from the mature open cotton before reaching the gin (Bulletin 686).

Varietal characteristics affecting performance of cotton strippers: The effects of varietal characteristics on the performance of mechanical cotton strippers are discussed in Bulletins 452, 511, 580, 683 and 686.

It was found that many commonly-grown varieties of cotton are not well suited to harvesting with machinery, particularly with the stripper-type cotton harvester.

A variety of cotton most suitable for machine-stripping should produce a semi-dwarf plant having relatively short fruiting, short noded branches, storm resistant bolls borne singly but with fairly fluffy locks for good extracting; and have a medium size boll stem that can be pulled from the limbs fairly easily with 3 to 5 pounds pull. The bolls should not be resting on the ground.

A variety that produces a wide spreading plant with numerous vegetative and fruiting branches is not suitable for the stripper-type harvester. It will reduce the efficiency of the machine and cause excessive field losses.

Medium-size cotton plants up to 36 inches in height with a limb spread from 24 to 28 inches can be successfully stripped with the tractor-mounted roller type strippers. Several long branches per plant increase field losses. Large, wide-spreading plants cause excessive amounts of leaves and plant parts to be collected by the mechanical stripper, especially if harvesting is done without first defoliating the plants.

The first branches on the plants should be 3 or 4 inches above the ground to enable the limb lifters or pick-up fingers to slip under and lift up the branches so the low bolls can be engaged by the harvesting unit of the machine. The effect of height of the limbs above the ground on the performance of cotton strippers was noted as early as 1930 when stripping the Wacona and Cliett varieties. The Cliett variety had limbs almost to the ground while the lowest limbs of the Wacona variety was 3 or 4 inches above the ground (Page 47, Bulletin 452).

Efforts were made to reduce the leaf area on varieties for machine-stripping by breeding varieties with leaves of a deeplobed or cut leaf type, the leaf area was not sufficient to assimilate enough plant food to produce high yields.

Varieties of cotton having an unusual hairy condition give greater losses and lower grades for the machine-stripped cotton than varieties having smoother leaves (Page 45, Bulletin 452).

Large storm resistant bolls borne singly are more suitable for machine stripping than when two or more bolls are attached to the same peduncle or stem.

Extremely storm resistant cottons are hard to extract and cause excessive boll shale in the lint.

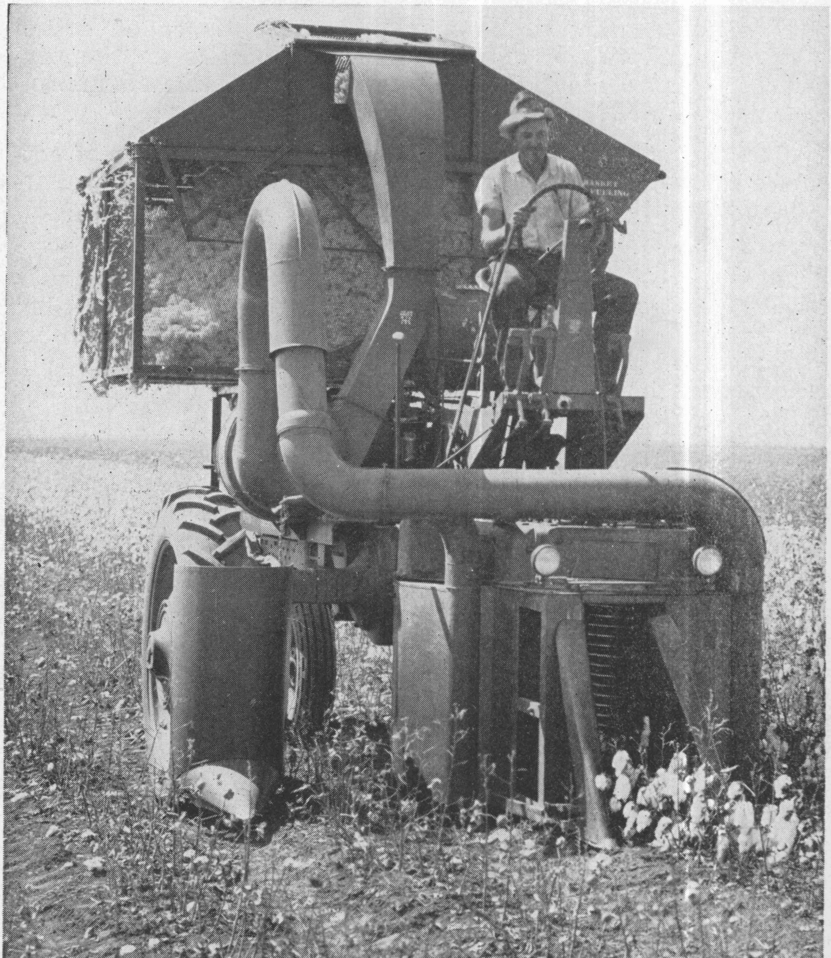

Figure 41—Single-row tractor-mounted cotton picker working in well defoliated cotton.

Bolls having a thick bur wall will not crush as easily as a thin bur having a thin wall.

Bolls of cotton which open wide and have very fluffy locks cause more field losses than where the boll does not open so wide and the locks are less fluffy.

Progress in breeding for determinate fruiting types for the stripper offers good opportunities. The Lubbock station has several strains in which the overall maturity rate has been shortened by approximately 7 days without loss of yield. This can be of great significance to grade and fiber utility. Some progress has been made in shortening the bract which will reduce the leaf trash.

In testing a number of varieties at College Station and Lubbock in 1932, 1933 and 1934, the highest efficiencies, 96.6 to 99.0 percent, were obtained in harvesting varieties having short branches and large storm resistant bolls.

When the same varieties were tested at College Station and Lubbock, the stripper harvester was 7.4 percent more efficient at Lubbock than at College Station, thus showing the effect of location and climatic conditions on the performance of the machine and the effect of the growth habits of the plants.

At College Station, there was a difference of 9.3 percent in the machine performance between varieties, while at Lubbock, the difference between the best and the poorest varieties was 6.8 percent. These differences may be attributed largely to differences in varietal characteristics such as size of plants, stormproofness and fluffiness of the cotton.

Cultural practices affecting performance of cotton strippers: Uniformly spaced rows are essential to good performance.

Clean cultivation is important.

A slight ridge from ½ to 1 inch high at the base of the plant is needed to prevent trash from collecting around the plants and to set the plants higher so the low bolls will be more accessible to the stripping rolls.

The plants should be evenly spaced along the row to cause them to be more uniform in size.

Factors affecting the extracting of cotton: In studies on extracting cotton, the harvested cotton was conveyed directly to the extractor, which was mounted on the drawbar of the tractor; and the burs, green bolls, and as much of the green-leaf and other trash as possible were removed before the cotton was conveyed to the trailer.

The function of an extractor, as used in the field in combination with a cotton harvester of the stripper type, is the removal of burs, green unopened bolls, dry hard bolls resulting from insect injury, sticks, rocks, sections of limbs, leaf stems and leaf sections of various sizes.

Factors affecting the efficiency of extracting equipment used in combination with harvesting equipment may be classed as varietal characteristics, and mechanical and other factors.

Varietal characteristics affecting extracting are: feeding

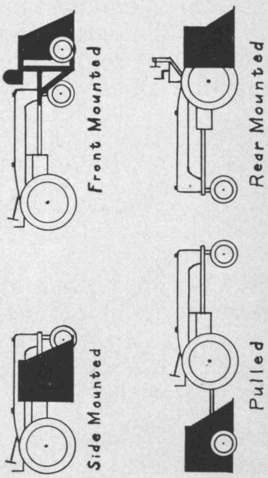

Figure 42—Methods of mounting and operating mechanical cotton picking units.

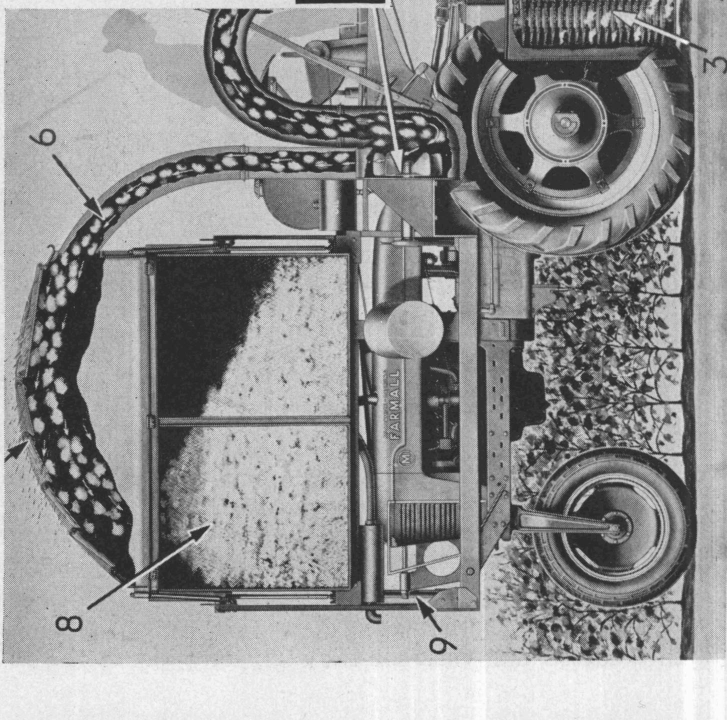

Figure 43—A cutaway view of a mechanical cotton picker showing passage of cotton from picking spindles to basket.

rate as affected by yield, amount of foreign matter in cotton, size of boll, shape of boll, weight of bur, degree of boll spread, fluffiness of the cotton, degree of storm resistance and interseed fiber drag.

Mechanical factors which affect extracting are: rate of flow of material through machine, rate of tractor travel, speed of extractor saws, compactness of material, uniformity of distribution of material over extractor saws and agitation of stripped cotton being presented to the extractor saws (Bulletin 580).

The difference in the percentage of burs and trash removed from cotton harvested by hand-snapping and by machine-stripping is not significant.

When varieties are compared one with another, the difference in the content of the burs and waste is significant.

The adaptation of tractor-mounted field extractors is doubtful because it would require a large machine to successfully extract cotton at the rate a two-row cotton stripper can harvest cotton. Where the yield is around a bale per acre a two-row cotton stripper can harvest a bale in approximately 30 minutes.

A tractor-mounted field bur extractor which does a good job of removing burs and waste from stripped cotton has been developed by agricultural engineers of the Texas Station. Even though, it has an 18-inch saw driven 48 inches long it has a limited capacity of one row where the yield is less than a bale per acre.

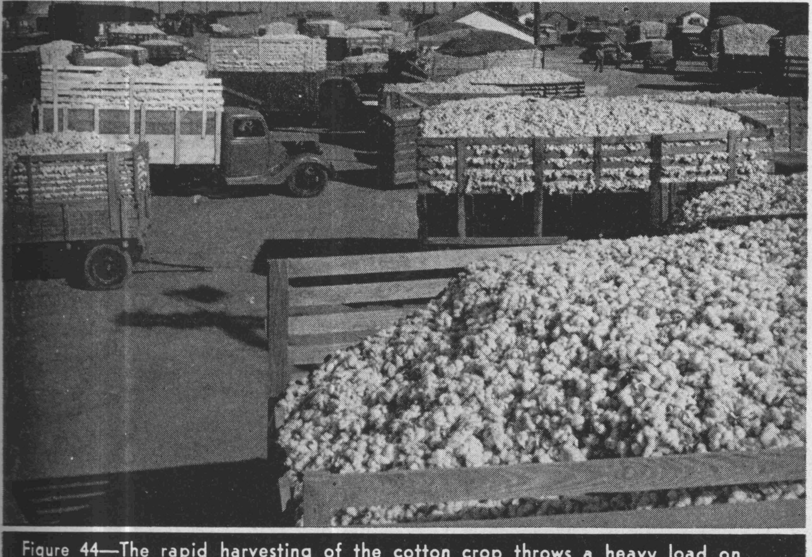

Figure 44—The rapid harvesting of the cotton crop throws a heavy load on the gin. It was estimated that approximately 150 bales of cotton were on this gin yard waiting to be ginned. The gin was operating 24 hours a day.

Factors affecting the cleaning of stripped cotton: Cleaning is the third process in handling mechanically-stripped cotton, and it has much influence on the gin injury and grade of lint. The quality of work done by a cleaner is affected by several

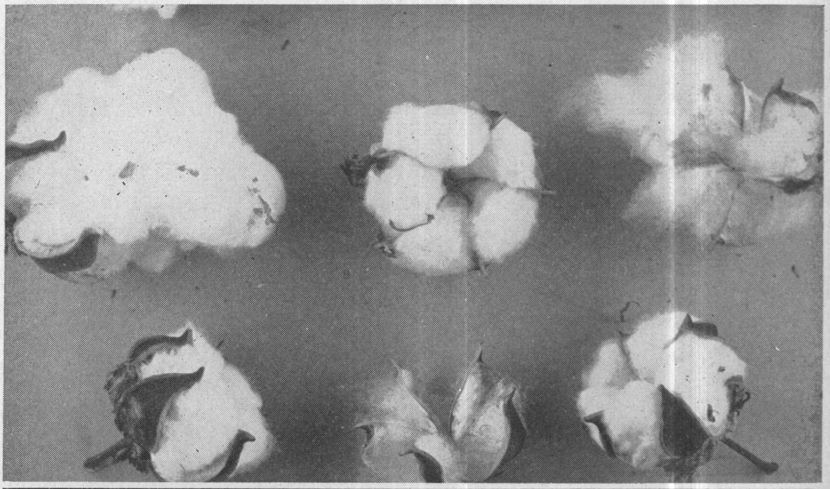

Figure 45—Type of extra storm-proof type of cotton that is extremely hard to remove from the boll. Note how the cotton fibers adhere to the bur.

Figure 46—Typical variety of cotton that is easy to pick and is lacking in storm resistance.

varietal characteristics. These are the amount and kind of foreign matter, density of fiber on seed and fineness and length of fiber.

Mechanical factors affecting cleaner are: previous handling, type of cleaner, speed of revolving parts, kind and condition of screens, rate of feeding, moisture content of the cotton, and weather conditions after cotton opens and length of time left in the field (Bulletins 511, 580, 538 and 686).

Hand-snapped, machine-stripped and machine-picked cotton should not be tramped in the trailer or truck because it makes the trash and foreign matter harder to remove (Page 20, Bulletin 580). The cotton should be fed into the sucker pipe only at a rate to keep the chutes above the gin stands full.

In general, for the 3 seasons the cottons grown at College Station were lower in grade, of approximately equal length, slightly coarser, stronger, more immature, and contained more trash than the cotton grown at Lubbock the same seasons.

There were wide differences in fiber properties of the cottons grown at each station, which are attributed to season and to variety. Although there is no apparent close relationship between the amount of rainfall and fiber properties, rainfall plus heavy irrigation and fertilizer at Lubbock in 1942 resulted in a larger plant, more trash and more immature fibers. It has been observed that seasons of heavy rainfall produce a higher percentage of immature fibers.

Of the fiber properties studied, only three — immaturity, length and fineness—appear to be closely associated with the cleaning quality of the cotton. The longer, the finer and the less mature a cotton the greater is the amount of trash retained by the fibers. However, statistical analyses show that the effects of length and fineness are due to their close relationship with immaturity. Of the three properties, only immaturity, as such, affects the waste. It appears that the difficulty of removing trash from long, fine cottons is not due to the length and fineness of the fibers but to the relatively high percentage of thin-walled or immature fibers which occur in long, fine cottons. Those varietal and seasonal factors which produce long, fine fibers may also produce immature fibers which retain waste. Heavy rainfall, heavy applications of fertilizer and irrigation probably acted in two ways in increasing the waste. First, the plants became rank with a relatively large number of leaves and branches and a large amount of trash was harvested. Second, there was a higher percentage of immature fibers due to the large amount of water applied. When there is heavy rainfall or irrigation during the time of the formation of the secondary layers of the fibers, relatively large numbers are observed to be thin-walled or immature. Thus, there were more immature fibers, more trash was harvested, and more trash was retained by the immature fibers than in seasons of less rainfall.

This study raises the question whether there are factors which have greater influence than fiber properties on the cleaning quality of cotton. It seems quite probable that the nature of the trash may have greater influence on the quantity clinging to the fiber after cleaning than do the properties of the fiber. The shape, size, number and thickness of leaves, the pubescence of leaves and stems, number and size of branches, nature of bracts and burs, and other physical properties of the plant may have greater effect on the extent to which trash and fibers adhere than do the length, fineness, strength or other properties of the fiber (Bulletin 697 and Progress Report 954).

Removal of foreign material and green bolls from stripped cotton: The removal of foreign matter from stripped cotton should begin at the limb lifter fingers. They should be of open design to allow dirt to sift through them rather than be swept into the conveying system of the stripper.

Cleaning should begin when the boll is removed from the plant and it enters the conveying system. The bottom of the conveyor should be as open as possible. Much dirt, leaf trash, pieces of burs, small sticks and stems can be screened out as the cotton is conveyed toward the trailer. The screen under the conveying system of the stripper should have more than 50 percent open area. A perforated screen for this purpose, designed by the engineers of the Texas Station, has approximately 70 percent open area. The slots are ½ x 3½ inches in size with ¼ inch strips between the slots. The screens should be made of 16 to 18 gage metal.

All strippers now being offered for sale use an entirely mechanical conveying system. A few experimental strippers use air. One commercial machine changed from air to mechanical conveying because excessive amount of pin trash was embedded in the cotton fiber when air was used.

A means for trapping and separating green bolls should be developed and used on cotton strippers when harvesting is done before a killing freeze. With the normal boll types, it is difficult to find cotton 100 percent open before frost. The field extractor developed by engineers of the Texas Station, does an excellent job of separating green bolls along with the burs and much leaf trash and dirt. If the field equipment is not provided with a green boll eliminating device, then the gin should be provided with such equipment. In fact, it would be desirable that both the harvester and the gin be provided with devices to screen out green bolls to be sure that none of the green, wet and immature cotton reached the gin saws.

Effect of method of harvesting on grade, staple and manufacturing performance: The varietal characteristics that affect the grade of mechanically harvested cotton are: amount of trash collected in the harvesting process, kind of trash collected with

Figure 47—Field scenes showing differences in fluffiness of storm resistant and the normal boll types of cotton. Top, shows CA122. Bottom shows Deltapine. These cottons were grown at Lubbock in 1947.

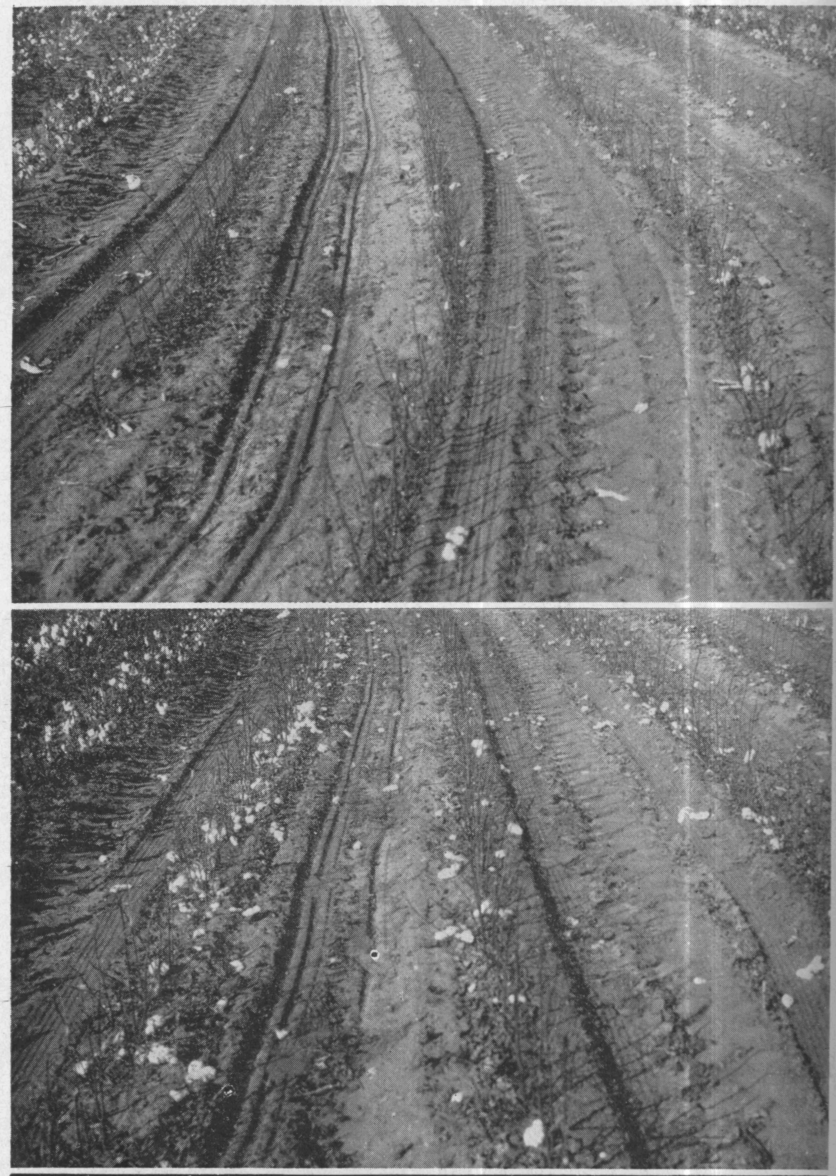

Figure 48—The variety of cotton being harvested materially affects the amount of cotton lost by the stripper. Top, shows a clean job of harvesting a storm resistant variety even on contour rows. Bottom, shows heavy losses where a non-storm resistant variety was stripped.

the cotton, fineness of the fiber, density of the fiber on the seed and length of the staple. Any one of these factors, if present, will influence the grade of mechanically harvested cotton. Some, however, are of greater importance than others and will influence the grade regardless of the method of harvest (Bulletins 452, 511, 580, 683 and 686).

Factors other than varietal characteristics that may affect the grade of cotton harvested with machinery are: method of harvesting, type of extractor, type of cleaning equipment, weather conditions between the time the boll opens and harvest, length of time cotton is left exposed in the field and tramping of the cotton in the truck or trailer.

Machine harvesting and extracting did not affect the staple of the cotton to any appreciable extent (Page 27, Bulletin 683)

The grade of machine stripped cotton is definitely affected by the condition of the plants at the time of harvest. Grades are highest in the early part of the harvest and gradually become lower as the season advances.

Method of harvest had no significant effect on staple length (Bulletin 683).

The Mechanical Cotton Picker

As nearly as can be determined, the first attempt to develop a mechanical cotton picker was made by S. S. Rembert and J. Prescott of Memphis, Tennessee, September 10, 1850, when patent No. 7,631 was issued to them. Their machine was equipped with both picking cylinders and picking discs, the cylinders being placed upon vertical shafts and the discs on horizontal shafts. They had a clear vision regarding the future development of cotton culture in mind as they made the following statement in their patent claims: "Our cotton picking machine may be multiplied and extended to such a width as to embrace several rows of cotton plants at once."

August Campbell obtained his first patent (No. 542,794) on a cotton picker July 16, 1895. He applied for and was granted several other patents on cotton harvesters and one covering a cotton picker spindle. They were assigned to the American Cotton Picker Company of Pittsburgh,Pennsylvania. On November 19, 1912, patent No. 1,004,611 was granted to B. C. White and A. Campbell of Woonsocket, Rhode Island, which was assigned to the Price-Campbell Cotton Picker Corporation of Wilmington, Delaware. T. H. Price was granted a patent on a cotton harvester as far back as 1904 (No. 770,653), which was assigned to the Utility Cotton Picker Company of New York. It appears that Price and Campbell joined in forming the Price-Campbell Cotton Picker Corporation a short time prior to the granting of the patent in November 1912. They interested the late J. A. Kemp of Wichita Falls, Texas, and formed the Mechanico-

Agricultural Company for the purpose of manufacturing the Price-Campbell Cotton Picker. One of the machines this organization made was on display at the Texas State Fair at Dallas about 1920. Several years later, the International Harvester Company acquired the patent rights held by this organization and developed a rear-mounted tractor cotton picker. After years of testing and improving, International built a plant devoted

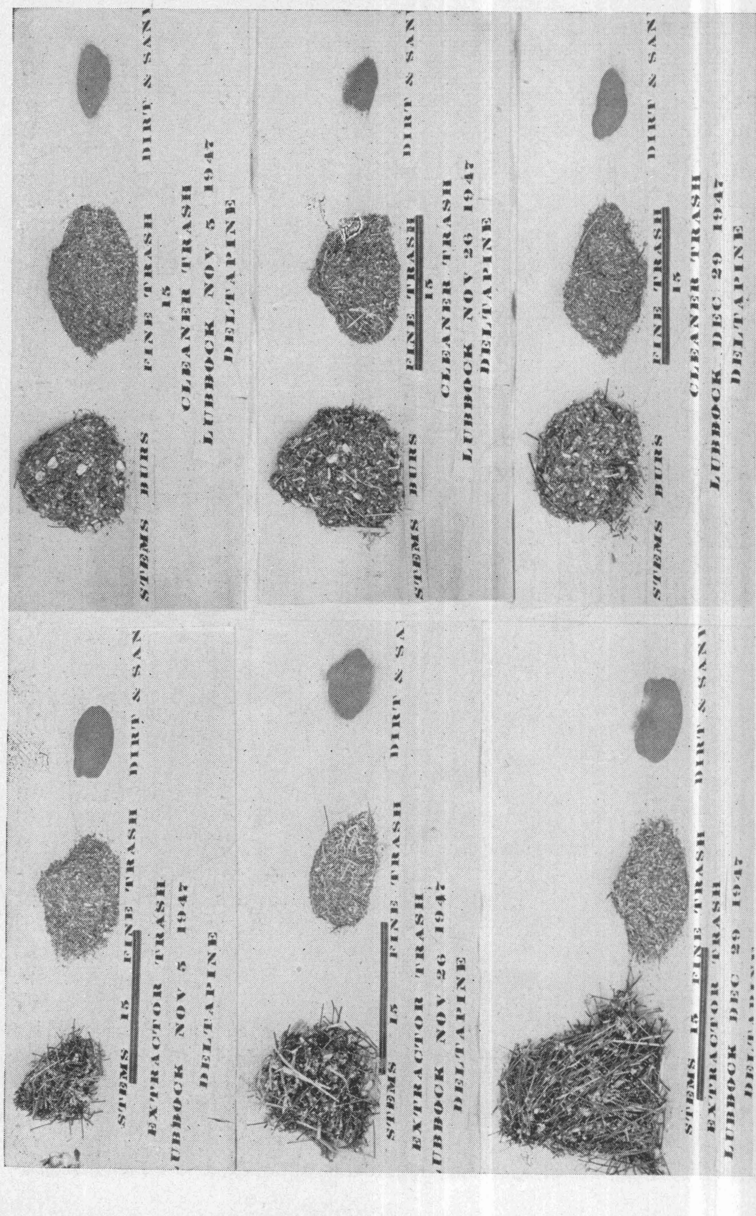

Figure 49—Comparison of the amounts of different kinds of trash removed by extractor and cleaner from approximately 50 pounds of normal boll cotton stripped at Lubbock early, mid-season and late. Note the amounts of stems increase as the date of harvest becomes later. Also note that more stems were removed from the normal boll type than from the storm resistant type at each date of harvest.

largely to the manufacture of mechanical cotton pickers (Bulletin 452).

A cotton picker invented by H. N. Berry of Greenville, Mississippi, has been financed by several individuals during its development. The patents on this development were acquired by Deere and Company about 1945. They are carrying on experimental work to further improve the machine.

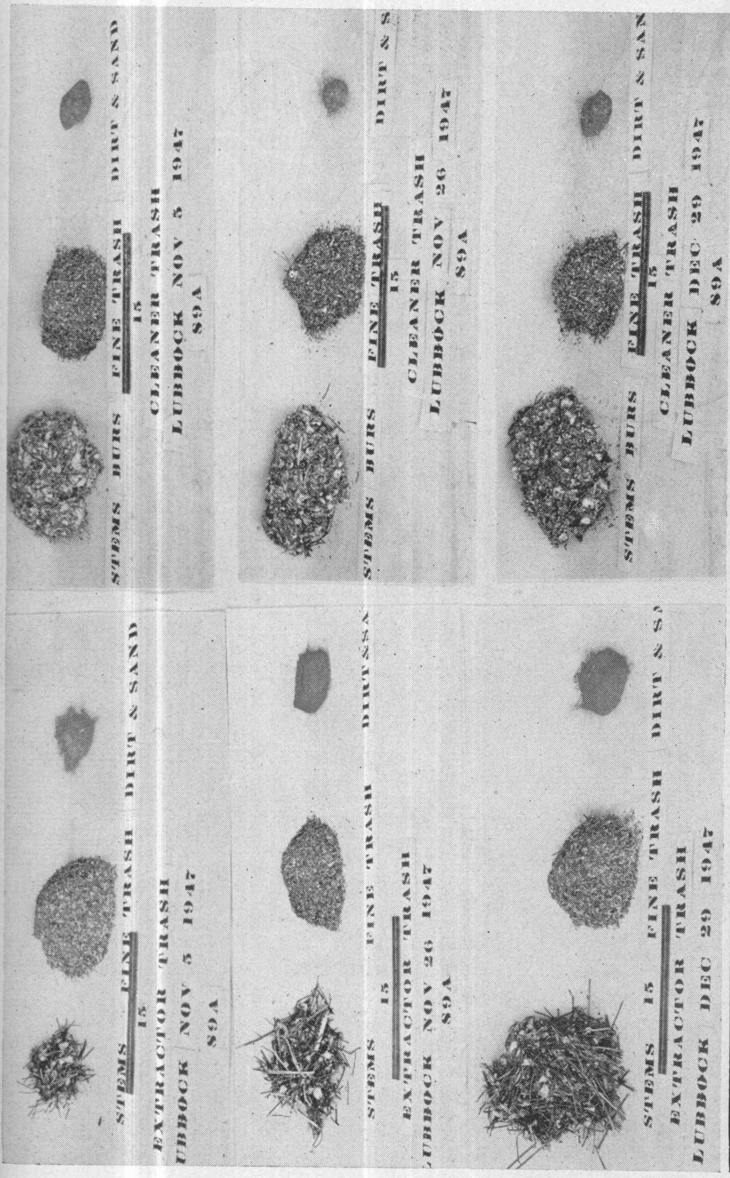

Figure 50—Comparison of the amounts of different kinds of trash removed by extractor and cleaner from approximately 50 pounds of stripped cotton of a storm resistant type at Lubbock 1947. Harvests were made early, mid-season and late. Note that the amount of stems increased as the date of harvest became later. The amount of burs, not shown, remained about the same for each date of harvest.

B. Johnson of Temple, Texas, obtained patents on a rotary, reciprocating spindle for the picking of cotton in 1912. Wm. N. Smith later acquired the Johnson patents and has recently developed a cotton picking unit which is attached to the front of a tractor.

John and Mack Rust obtained patents on a cotton picking machine using a moist smooth spindle.

A. R. Nisbet of Plainview, Texas, has developed a cotton picker using a blast of air in combination with several saw cylinders. This picker is now being manufactured.

Mechanical factors affecting performance of mechanical cotton pickers: As the function of a mechanical cotton picker is to remove the locks of cotton from the bur, as is done by handpicking, the mechanical factors as a whole are different from those enumerated for the mechanical stripper.

Both the stripper and the picker-type machines, however, should have well designed and well constructed limb lifters or pick-up fingers. The function of the limb or plant lifters on the picker-type machine is to slide under and lift low limbs high enough so that bolls on these limbs will be contacted by the picking spindles. Otherwise, the field losses will be greater.

Other mechanical factors affecting the performance of mechanical cotton pickers are: type of spindle; number, shape and length of spindles; size; barbs on spindle and their height, sharpness and angle on spindle; dampness and cleanliness of spindle; r.p.m. of spindles; spacing of spindles in picking zone; synchronized movement of the spindle or r.p.m. of picker drum with the forward travel of the machine; width of throat adjacent to spindles; tension or pressure given the plate holding the plants into the spindles; fingers attached to the pressure plate; use of picking spindles on one side or both of the row, and the thoroughness of removal of the cotton from the spindles by the doffing device.

The functions and relation of each of the foregoing factors could be discussed in detail. As the various parts of the mechanical cotton picker have been adjusted at the factory, the operator is concerned largely with general operation and servicing of the machine. The rate of travel along the row will influence the ability of the spindles to engage and remove the locks of cotton from the bolls and their ability to hold the locks.

The position of the picking unit in relation to the tractor has a marked influence on the performance of the mechanical cotton picker. If field losses are held to the minimum, it is essential that the picking unit be the first part of the machine that comes in contact with the cotton plant. Otherwise, many locks of cot-

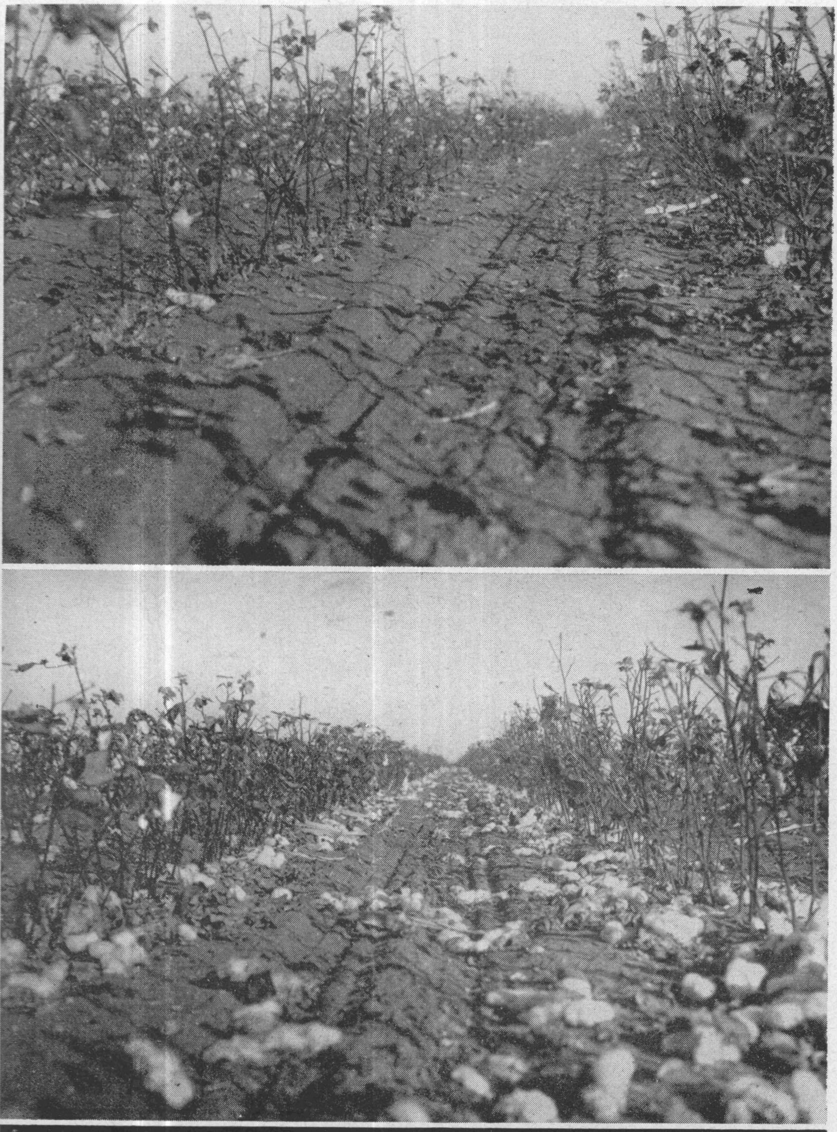

Figure 51—The top view shows the small amount of cotton lost in stripping CA122 early, a storm resistant strain developed at the Lubbock station. The bottom view shows a close up of the amount of cotton lost in stripping Stoneville 2B. Note that the plants are small for each type of cotton.

Figure 52—The height of the first limbs on the plant affects the performance of cotton strippers. Top, shows a normal boll type of cotton where the limbs and fruit are close to the ground. The bottom view shows a type of cotton where the limbs and fruit are well above the ground. The later type is desirable for mechanical harvesting.

ton are knocked from the bolls when some part of the machine or tractor strikes the plant. At present, cotton picking units may be found attached to the tractor in four different positions. The most popular machine has the picking unit mounted on the rear of the tractor and the tractor travels backwards. Other machines have the picking units mounted either in the front of the tractor, on each side of the tractor or pulled behind the tractor as a separate unit.

Varietal characteristics affecting performance of cotton pickers: The mechanical cotton picker is affected by varietal characteristics, probably more than the mechanical stripper. This is because the picker must engage and remove the locks of cotton from the boll and hold them until the drum rotates and brings the spindle in contact with the doffing device.

Varieties most suited for stripping are not suitable for the picker. And the best varieties for picking are not suitable for stripping.

In general, a variety of cotton for the mechanical picker should have plants of medium size with a relatively narrow spread and not too tall. It should have a wide-opening boll with fluffy locks and a staple length long enough to wrap well around the spindle. There should be enough storm resistance to prevent the locks from falling out of the bur or being blown out by moderate winds, and from being beaten out by rains. Varieties that fruit fairly high off the ground can reduce maintenance cost as the picker drums can be operated higher, thereby reducing the amount of the sand and dirt collected with the cotton.

When the Meyercord cotton picker was tested at College Station in 1931-32, the machine did a much better job of picking the Cliett's Superior and Lone Star varieties, which produces well open bolls and fluffy locks, than it did in picking Wacona, which produces bolls that do not open wide and the locks are not so fluffy. The picker drums could be operated higher off the ground in picking the Wacona cotton, as the lowest limbs are 3 or 4 inches up on the plants, than in picking Cliett's Superior, which has limbs almost to the surface (unpublished data).

During the 3-year period, 1944-46, the latest model International Harvester cotton picker was used at College Station to pick varieties having different boll, fiber, stormproofness and other plant characteristics. The results showed that the varietal characteristics materially affected the performance of the machine and the field losses (Bulletin 683).

The size of the plant and the type of growth has more influence on the field losses by the machine than the acre yield; that is, the machine can harvest high yields as effectively as low yields if the plant characteristics are suitable to the type of machine used.

Cultural practices affecting performance of cotton pickers: One of the most important cultural practices that will influence the operation of mechanical cotton pickers is that of complete control of grass, weeds and vines. When a considerable amount of tall grass is present among the cotton plants, the picking mechanism will collect sprigs which are hard to remove by the gin cleaning equipment. Large weeds present masses of vegetation that fill up the throat of the machine and prevent the spindles from properly engaging the locks of cotton. Weeds, limbs and leaves will be collected with the cotton. Vines, such as morning glories, will become entangled on the spindles and excessive foreign matter will be collected.

The rows should be as straight as possible and when planted on the contour, the curves should be gradual and even. The rows should be uniformly spaced so that the tractor wheels will not knock out excessive amounts of cotton from plants as when the rows are close together.

The plants should be uniformly spaced along the row and there should not be over more than 3 or 4 plants per hill to avoid excessive vegetative masses. Cross plowing leaves bunches of unthinned plants and depressions across the middles which will affect the performance of mechanical pickers.

At "lay by" time, the soil should be slightly ridged along the base of the plants. This practice will cause leaves and trash to fall in the low areas in the middles. The limb lifters can slide under the low limbs better.

Cotton picking machines are difficult to operate across fields having shallow drainage furrows and washes which cut across the rows.

A cotton picker should not be operated in fields where rocks, bricks, chunks of wood, low stumps and other obstacles are likely to be hidden by the plants. Such objects will easily damage the spindles.

Drying and cleaning of mechanically picked cotton: Most of the mechanical pickers now available have a means of moistening the spindles before they are projected into the plant to engage the cotton. When the cotton is wrapped around the spindle and then doffed off, the moisture is wiped off in the process. Even though each spindle in only damp, the thousands of times the spindles are wiped in picking a bale will cause picked seed cotton to have too much moisture in it for ginning until it is first run through a good drier at the gin.

Sections of green leaves will be collected by the machine if the cotton is not well defoliated. The ordinary drier at the gin will not dry green leaves to the point of brittleness necessary for the cleaning machinery to remove them. Particles of green leaves are more difficult to remove than particles of dry leaves.

Figure 53—Cultural practices, particularly at the last cultivation, affect the place where the leaf trash will collect. At top, the soil was slightly ridged around the plants at the last cultivation and the leaves have collected in the depression in the middle. Bottom, shows that the lister furrow in which the cotton was planted was not filled with soil at the last cultivation and the leaves have collected around the base of the plants. In stripping, much of this trash will be picked up by the limb lifters and mixed with the cotton. Such excess trash is likely to lower the grade of the cotton.

The damp, freshly picked cotton should not be tramped in the trailer box. Damp cotton will compact more than dry cotton and it is more difficult to separate into single locks, which is essential for the best cleaning and ginning.

Effect of mechanical picking on grade and staple: Tests made at College Station in 1944 and 1945 to compare the effect of the method of harvesting cotton showed that machine-picked cotton, Hi-Bred, a short staple variety, and Macha, a stormproof variety, graded one-half to one and one-half grades lower than hand-picked cotton of these varieties. There was no significant difference in the length of the staple. When spun, the machine picked cotton was very slightly stronger. When Deltapine and Rogers Acala varieties were machine-picked in comparison with hand-picked, hand-snapped and machine-stripped methods of harvesting, the machine-picked graded about one grade lower than hand-picked cotton but about one grade higher than hand-snapped and machine-stripped cotton. The staple length and strength were about the same for all four methods of harvest.

Spinning tests show that the most important factor of manufacturing quality, as affected by method of harvest, is that of the amount of waste or foreign matter in the lint.

The quality of the yarn manufactured was not affected by the method of harvesting except for a slight lowering of the appearance grade for the longer and finer fibered cottons (Bulletin 683).

Figure 54—Loss of cotton largely due to tractor driver watching the stripper instead of looking ahead at the row.

Publications of the Texas Agricultural Experiment Station Containing Information on the Production of Cotton

BULLETINS

- * 26 Cost of Cotton Production and Profit Per Acre (1893).
- *340 The Effect of Spacing on the Yield of Cotton (1926).
- 360 The Effect of Spacing and Time of Thinning on Yield, Growth and Fruiting Characteristics of the Cotton Plant in 1925 (1927).
- *362 Large-Scale Cotton Production in Texas (1927).
- *364 Varieties of Cotton in Northwest Texas (1927).
- *394 Boll Weevil Control by Airplane Dusting (1929).
- 452 The Mechanical Harvesting of Cotton (1932).
- *469 Fertilizer Experiments with Cotton (1932).
- 474 The Effect of Sunlight and Other Factors on the Strength and Color of Cotton Fabrics (1933).
- 475 Ingestion of Poison by the Boll Weevil (1933).
- 490 The Effect of Time and Rate of Application of Nitrate of Soda on the Yield of Cotton (1934).
- 494 Growing Cotton Under Irrigation in the Wichita Valley of Texas (1934).
- 506 Further Studies of the Effect of Sunlight on the Strength and color of Cotton Fabrics (1935).
- *511 Progress in the Study of the Mechanical Harvesting of Cotton (1935).
- 526 Calibration of Cotton Planting Mechanism (1936).
- *531 Chemical Dust Treatment of Cottonseed for Planting Purposes (1936).
- 538 The Effect of Exposure in the Field on Grade, Strength, and Color of Raw Cotton (1936).
- 548 Machine Placement of Fertilizer for Cotton (1937).
- 568 An Economic Study of Farm Organiaztion and Operation in the High Plains Cotton Area of Texas (1939).
- 580 Mechanical Harvesting of Cotton as Affected by Varietal Characteristics and Other Factors (1939).
- 616 Germination of Cottonseed as Affected by Machine Placement of Fertilizer and Soil Disturbance (1942).
- 621 Effects of Planter Attachments and Seed Treatment on Stands of Cotton (1942).
- *624 Gearing of Texas Cotton to War Needs (1942).
- 683 Comparison of Different Methods of Harvesting Cotton (1946).
- 686 Factors Affecting the Performance of Mechanical Cotton Harvesters (Stripper Type); Extractors and Cleaners (1946).
- 697 Cleaning Quality of Raw Cotton as Affected by Physical Properties of Fibers (1947).

CIRCULARS

- * 29 Dusting Cotton for the Control of the Boll Weevil (1921).
- * 32 Cotton Boll Weevil Control in Texas (1924).
- 39 Cotton Production in Texas (1926).
- * 40 Control of the Cotton Flea Hopper in Texas (1926).
- 52 Mechanical Harvesting of Cotton in Northwest Texas (1928).
- * 77 Control of the Cotton Flea Hopper (1936).
- 117 Cotton Statistics for Texas (1947).

PROGRESS REPORTS

- 304 Destruction of Cotton Stalks Urged (1933).
- 319 Spacing Cotton, Corn, and Grain Sorghum in Texas (1934).
- 361 Preserving the Quality of Cotton Through Proper Methods of Harvesting and Ginning (1936).
- 396 Weathering of Cotton in the Field Causes Loss (1936).
- 402 Experiments Show How Boll Weevil is Poisoned (1936).
- 668 Seed Treatment of Cotton (1940).
- 717 Harvesting Cotton by Machinery (1941).
- 733 Placement of Fertilizers for Cotton (1941) .
- 912 Estimates of the Cost of Producing Cotton in Eight Selected Areas in Texas (1944).
- 949 Cotton Defoliation in the Plains Area of Texas (1945).
- *952 Harvesting Cotton in the High Plains Area of Texas (1945).
- 954 The Effect of Foreign Matter on the Grade, Staple and Price of Cotton (1945).
- 1029 Factors Influencing Cotton Harvesting Methods on the High Plains (1946).
- 1103 New Organic Insecticides for the Control of Cotton Insects (1948).
- 1111 Waste in Harvesting Cotton with Mechanical Strippers on the High Plains of Texas, 1947 (1948).

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*Supply exhausted.