B-984

Cotton Production

ON THE BLACKLAND PRAIRIES OF TEXAS

THE AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS

TEXAS AGRICULTURAL EXTENSION SERVICE - - - TEXAS AGRICULTURAL EXPERIMENT STATION

College Station, Texas

Contents

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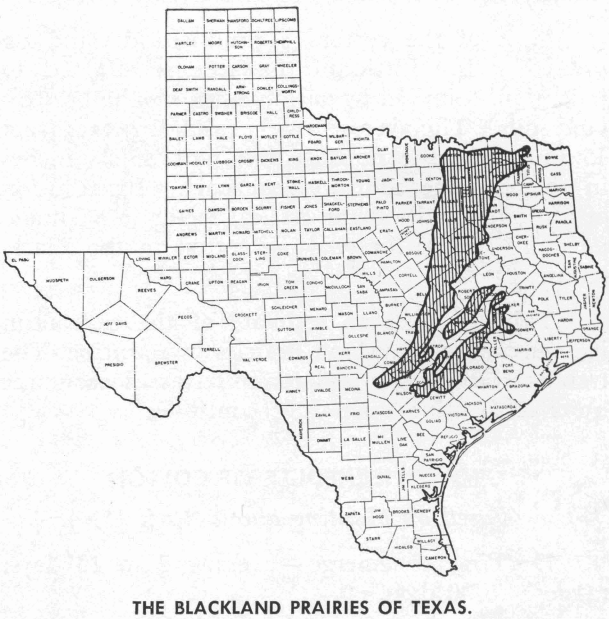
REVOLUTIONARY CHANGES on the Blackland Prairies during the past 15 years demand greater precision and more careful planning of all farm operations. New practices require more off-farm purchases of goods and services. Investment per acre and per worker has increased steadily. Growers who use improved practices and equipment are likely to succeed in cotton production.

Improved efficiency that results from new technological advances should be used energetically and wisely. Changes being brought about in farming operations by technology can be translated into lower costs of production per unit and improved quality. Much of the Blacklands area is well adapted to mechanized farming. Excellent results have been obtained by a number of outstanding cotton growers in every county. In the 46-county area comprising the Blacklands, 8,474 cotton stripper harvesting machines and 506 spindle-type pickers were in operation in 1960. In 1948, there were only 27 stripper harvesters in 12 of these counties and 7 spindle pickers in four counties. Even more spectacular advances have been made in other ways, such as improved fertilizers and their application or the more potent insecticides applied with better sprayers or better airplanes.



THE BLACKLAND PRAIRIES OF TEXAS.

Information in this publication was compiled from current research and extension publications in an effort to provide a ready reference for making decisions on when, where and how to produce cotton in the Blacklands.

SOIL AND CLIMATIC ADAPTATION

The Blackland Prairies often have been referred to as one of the most important and productive agricultural regions of Texas. Cotton has been the most important crop in the area; however, present production is far below the potential. The Blacklands have a total area of about 11,500,000 acres of gently rolling well-dissected prairies. The topography and soils permit rapid surface drainage.

The main body of the Blackland Prairies consists of a large wedge-shaped area extending from Red River County on the north to the vicinity of San Antonio. Smaller portions of the Blackland Prairies are to the east and are separated from the main body. Major upland soils are dark calcareous clays belonging to the Houston Black, Houston, Hunt, Austin, Bell and Lewisville series. The more important bottomland soils are Trinity, Catalpa, Miller, Norwood and Pledger.

Most of the cotton is produced dryland on upland soils. Little of the area is adapted to irrigation. Limited irrigation exists on the bottomland soils. The average yearly rainfall ranges from 45 inches in the northeastern part to 28 inches in the extreme southwestern part. Distribution of rainfall usually is the critical factor in adequate moisture supply for growing cotton in the Blacklands.

Table 1 gives an estimate of the cash farm income on the Blackland Prairies by counties. The trend toward larger and fewer farms as economic units of farming operations continues.

GROWTH SCHEDULE OF COTTON

(Based on planting about April 15)

1. Time to emerge – average 7 to 10 days; range 7 to 30 days.
2. Appearance of third leaf (first true leaf) – 8 days after emergence.
3. Appearance of fourth leaf (second true leaf) – 9 days after emergence.
4. Emergence to square – 35 to 40 days.
5. Square to white bloom – 20 to 25 days.
6. Bloom to open boll – 50 to 65 days.
7. Boll full grown – 20 to 25 days after bloom.
8. Should be ready to harvest in 160 days (25 percent open in 130 days).
9. Number of seed in 1 bushel of average seed – 120,000.
10. Most effective fruiting period – June 20 to August 1.
11. Ratio of bloom to bolls – approximately 35 to 40 percent of blooms make bolls.
12. Last date for normal setting of fruit – generally, August 20.
13. Boll period – 45 to 65 days.
14. Fiber length laid down first – 25 to 30 days.
15. Critical period in length of fiber – 16 to 20 days after blooming.
16. Strength of fiber built up – second 25 to 30 days of boll development.
17. Limiting factor in determining length of lint in a given variety – moisture.
18. Average number of days to blooming peak – 90.
19. Average number of days from first bloom to peak of blooming – 35.
20. Average number of days from first bloom to shed peak – 40.
21. Average percent blooms shed – 60 to 65.
22. Average number of blooms per plant – 40 to 45.
23. 30 percent of crop open – 65 to 75 days after first white bloom.
24. 70 percent of crop open – 85 to 95 days after first white bloom.
25. 85 percent of crop open – 95 to 105 days after first white bloom.
26. Plant population per acre, 40-inch rows – 1 plant per foot of row, 13,068 plants; 2 plants per foot of row, 26,136 plants, etc.

CROPPING SYSTEMS AND SOIL CONSERVATION

Research on the Blackland Prairies indicates that cotton rotated with other crops generally produces higher yields than continuous cotton. Benefits of rotated over continuous cotton include better control of diseases, insects, weeds and soil erosion.

Some rotations that have proved satisfactory are:

1. Two-year rotation – small grain, cotton.
2. Two-year rotation – grain sorghum, cotton.
3. Three-year rotation – small grain, cotton, grain sorghum or corn.
4. Three-year rotation – cotton, grain sorghum or corn, grain sorghum or corn. This rotation requires more fertilizer and gives the land less protection from water erosion.
5. Four-year rotation – small grain, cotton, grain sorghum, Hubam sweetclover for seed or forage.

TABLE 1. ESTIMATED INCOME FROM COTTON, 1959, AND AVERAGE LINT YIELD PER ACRE

County	No. farms reported harvesting cotton[1]	Total acres planted to cotton[2]	Production 500-lb. gross weight bales[2]	1955-59 average yield lint harvested acre[2]	Approx. gross value of lint and seed to county, 1959 30¢ lb. lint, $40 ton seed
Austin	920	18,700	12,200	325	$2,043,500
Bastrop	199	8,230	3,850	166	644,875
Bell	1,122	62,000	23,500	176	3,936,250
Bexar	101	2,250	1,070	146	179,225
Brazos	135	16,300	18,000	479	3,015,000
Burleson	417	23,100	22,100	428	3,701,750
Caldwell	268	18,820	11,400	196	3,152,350
Collin	1,513	79,100	35,600	210	5,963,000
Dallas	371	31,000	14,400	186	2,412,000
Delta	571	35,400	16,100	271	2,696,750
Denton	433	18,600	8,900	182	1,490,750
DeWitt	502	12,000	4,960	156	830,800
Ellis	1,377	121,000	46,000	199	7,705,000
Falls	961	66,000	27,500	188	4,606,250
Fannin	1,172	61,100	21,500	219	3,601,250
Fayette	1,459	26,250	17,300	240	2,897,750
Freestone	329	13,000	3,700	155	619,750
Gonzales	302	7,800	3,770	155	631,475
Grayson	744	31,300	9,000	178	1,507,500
Grimes	420	12,300	8,200	310	1,373,500
Guadalupe	404	15,550	8,480	161	1,420,400
Hays	114	7,360	2,850	164	477,375
Henderson	159	4,650	900	163	150,750
Hill	1,374	122,000	34,900	165	5,845,750
Hopkins	504	20,000	7,400	188	1,239,500
Hunt	1,265	86,000	34,000	209	5,695,000
Johnson	432	34,600	12,400	168	2,077,000
Kaufman	530	45,400	17,300	187	2,897,750
Lamar	747	44,600	16,300	244	2,730,250
Lavaca	1,452	30,350	15,900	199	2,663,250
Lee	453	8,250	3,890	165	651,575
Leon	220	9,000	2,910	209	487,425
Limestone	534	45,000	11,500	142	1,926,250
Madison	180	5,150	2,220	230	371,850
McLennan	1,106	77,000	26,500	161	4,438,750
Milam	748	42,800	21,000	202	3,517,500
Navarro	868	83,000	19,300	159	3,232,750
Rains	176	6,900	2,700	198	452,250
Red River	279	21,000	7,100	262	1,189,250
Robertson	176	24,500	24,900	537	4,170,750
Rockwall	174	18,400	8,100	211	1,356,750
Tarrant	134	8,700	4,400	187	737,000
Travis	543	33,350	13,800	170	2,311,500
Van Zandt	367	13,800	5,800	196	971,500
Washington	1,174	20,200	12,600	297	2,110,500
Williamson	1,164	97,000	50,400	192	8,442,000
TOTAL	29,078	1,588,810	676,530	216[3]	$114,573,350

[1]1959 Census of Agriculture.
[2]Texas Crop and Livestock Reporting Service.
[3]Average.

Never follow cotton with cotton, especially in areas where root rot prevails. Ordinarily, cotton will follow small grain.

The small grain crop can be oats, barley or wheat. Sweetclover may be sown as a companion crop with barley or oats but should not be sown with wheat because the sweetclover odor makes wheat grain undesirable for flour. Hubam sweetclover usually matures before cotton root rot builds up heavily, but biennial sweetclovers may cause an increase in root rot if allowed to grow during July and August.

Many growers use the winter growth of small grains for grazing and also harvest a grain crop. If winter grazing is managed properly, small grain supplies winter feed with little detrimental effect on grain yield. Following the grain harvest, additional grazing from the stubble often is possible.

Following summer grain harvest, or the short period of stubble grazing, begin seedbed preparation for the following year. Bedding, sweep tillage or plowing are about equally effective. Provided no additional weed control is needed, delay further tillage until undesirable volunteer oats have germinated. Then bed the land during October through December. Except when needed for weed control, tillage is undesirable until immediately before planting spring row crops. When cotton is to follow grain sorghum, shred the grain sorghum stubble soon after harvest. Sweep tillage and bedding or a combination of bedding and rebedding with rows on uniform 40-inch centers prepares the land for the next season.

In years of excessive rainfall, a practice of running middles with the wings off the sweep to loosen the soil and permit storage of water may be desirable. Blacklands soils tend to run together and be tight. After the middles become packed, hard rainfall will cause runoff.

Crops in the above-mentioned cropping systems should be fertilized with 20 to 40 pounds per acre of nitrogen (N) and phosphorus (P_2O_5). The fertilizer should be applied at or before planting. However, small grains that are not to be grazed should have no more than 20 pounds of nitrogen applied by planting time to avoid excessive growth and lodging.

There is no known practice or cropping system that will control root rot completely in the Blacklands, but good management practices and rotation systems have helped reduce its severity.

Much of the cotton grown in the Blacklands is produced on the better land where erosion is not a serious problem. Control of soil erosion, however, may be an important consideration in cotton production. On areas with less than about 1 percent slope, no special erosion control practices are needed. On areas with slopes of 1 to 3 percent, a rotation with a small grain crop every other year is recommended. If the cropping system does not give sufficient erosion control, additional measures should be added. More intensive use of row crops will require special water erosion control measures.

Ordinarily, areas with slopes greater than 3 percent are not well suited to cotton production. If used, terracing is essential and a rotation including a small grain crop every other year should be used. Costs of all farm operations increase when growing row crops on steeper land.

FERTILIZATION

Soils of the Blackland Prairies are classed into three groups — blackland, grayland and alluvial. Predominant soils of the Blackland Prairies are dark and fine textured; hence, they commonly are called blacklands or black waxy lands. The true black waxy soils are moderately well supplied with organic matter and, although sticky when wet, they shrink and crumble naturally on drying. The grayland soils are low in active calcium, contain less organic matter and, upon drying, become dense and compact so that penetration of water is slow. Alluvial soils on the Blackland Prairies probably account for about 10 to 15 percent of the region. These soils usually are fine textured and very slowly permeable.

Cotton is a deep-rooted plant and grows best on the deep upland and alluvial soils. Blackland soils have many problems which complicate production practices. Most are susceptible to erosion and many fields are completely denuded of top soil. A problem common to the graylands is keeping the soils open so that plant roots can develop normally. Plow soles or compacted zones are common to many soils of the region; however, the true black waxy soils expand and contract upon wetting and drying and this action helps prevent formation of these restricted layers. Grayland acid soils do not recover their tilth as rapidly and are more susceptible to this problem. Tilling soil while wet further aggravates this condition. Soil tests show that a high percentage of blackland soils are low in organic matter content. Fertilization is not a major problem in the true black waxy lands if soil tilth and organic matter are maintained by a good rotation system. Nitrogen requirements depend on the crops grown in the system. The need for phosphorus can be determined by a soil test. Grayland soils present a fertility problem in most cases and nitrogen and phosphorus applications generally are required for maximum production.

The cropping system on each farm determines largely the amount and kind of fertilizers required for good production. High cotton yields can be expected when the crop is grown following one or more years of adequately fertilized grain sorghum, small grain or sweetclover, or a combination of these crops. Without sweetclover or other legumes in the cropping system, fertilization with nitrogen and phosphorus likely is needed for vigorous and profitable growth. The use of crops susceptible to cotton root rot in rotation with cotton is not recommended where this disease is a problem. Grayland soils, or "raw hide" land, present a greater, more complex problem in management and fertilization than the true blacklands. Continuous cropping of grayland soils to cotton or other row crops will develop serious problems because of the natural tightness of the land and its low fertility level.

Before undertaking any fertilization program, have your soil tested. Be sure to include in the sample all of the soil types on your farm. A soil test will provide a firm basis for a soil fertilization program and an inventory of the plant nutrients in the soil. Through proper fertilizer practices, the farmer can balance the plant nutrients needed for the most economical cotton production.

The cotton plant requires 80 to 100 pounds of nitrogen (N), 40 to 60 pounds of phosphorus (P_2O_5) and 60 to 90 pounds of potassium (K_2O) per bale of production. The fertility level of the soil and the cropping system used will determine the amount of each nutrient needed for optimum production. The nutrient requirement for cotton is lower than that of many other crops produced in this area. Cotton does not drastically deplete the soil of nutrients; however, many production practices of the crop have undesirable effects on the soil. Young cotton plants have a high requirement for nitrogen and phosphorus. The cotton plant will take from the soil approximately two-thirds of its total plant nutrient requirement during the first third of its life cycle. For this reason, fertilization should take place early in the life of the plant, preferably before planting, so that plant nutrients will be available during the rapid uptake period. If the crop is to be side-dressed, complete this operation before the plants are 45 days old, and then only if moisture is adequate.

For best results, apply fertilizers in concentrated bands in the active root zone of the cotton plant. The fertilizer should be readily available to the plant during its early development. To be readily available for plant use, the nutrient elements must be in contact with moist soil. Response to fertilizer often depends on the supply of available moisture. Adequately fertilized crops are likely to make more efficient use of water than the ones unfertilized. Deep placement of fertilizer is important in the Blacklands. The fertilizer should be located so that the young roots will intercept the band in early root development. Once the root system has reached the area of placement, feeder roots will build up rapidly and utilize the fertilizer. Shallow placement is inadequate because the Blackland Prairies are subject to short but severe drouths and the fertilizer will not move far from its original placement during the growing season.

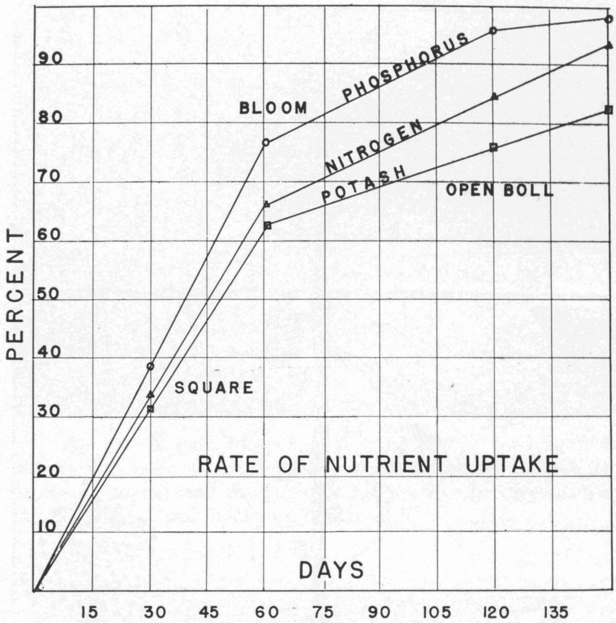


Fig. 1. The rate of nutrient uptake is faster when cotton plants are young.

Several methods of fertilizer application can be used. One that has been successful in many locations is applying the fertilizer behind a chisel at a depth of 2 or more inches, depending on the depth desired. After the fertilizer has been applied, prepare the seedbeds directly over the fertilized zone. Leave these beds undisturbed until planting time. Plant in the normal manner. This places the seed several inches above the fertilizer band. If the fertilizer is applied 2 or more inches deep before final seedbed preparation, the seed at planting should be 4 or more inches above the fertilizer band. If seed are placed closer than 2 inches to a band of fertilizer, severe seedling damage can occur, resulting in slow emergence and poor stands.

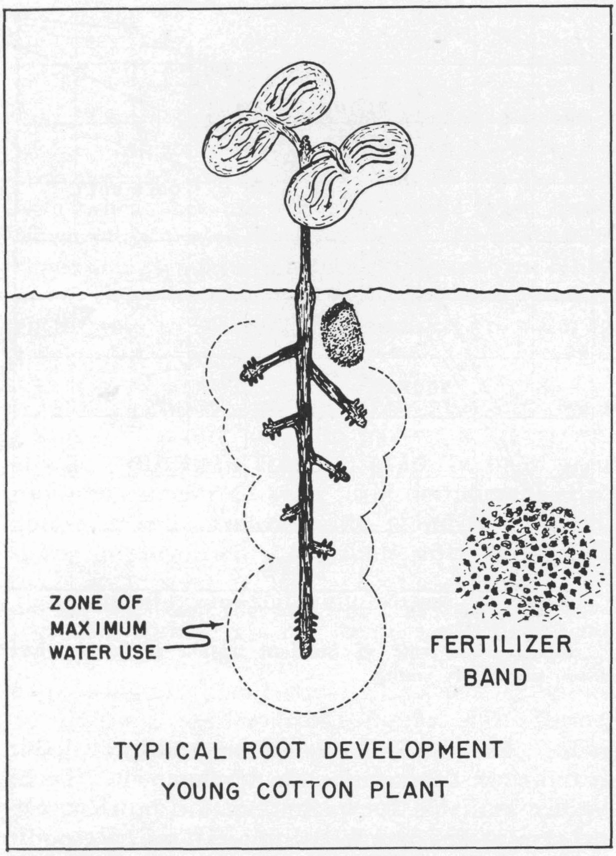


Fig. 2. Fertilizer should be applied in concentrated bands in the active root zone of the young plant.

If deeper placement is preferred, use a chisel 4 to 6 inches deep in each middle before final bedding. However, this practice requires extra power and equipment.

Another method is applying the fertilizer behind chisels on 20-inch rather than on 40-inch centers. Prepare the seedbeds in the usual manner and if rebedding or replanting is practiced, the seed will be no further than 10 inches from a band of fertilizer when placement is made on 20-inch centers. The roots will not reach the fertilizer band as quickly as with other methods, but once they do, there should be little difference in response to fertilizer. This method of application may work well on land that is flat-broken or disked following small grain and prior to the bedding operation.

The aforementioned methods of application offer several advantages. If compacted areas are in the soil, rupturing or fracturing will result from the use of the chisel during application. Deep placement will allow the fertilizer to be in contact with moist soil for the longest possible time, which may result in a longer period of availability to the cotton plant. Losses to leaching, erosion and volatilization should be less. The fertilizer also will be so deep that young grass and weed seedlings cannot make use of it readily. Finally, when the fertilizer is applied prior to seedbed preparation, the seedbed can remain undisturbed, thus lessening the risk of moisture losses.

In most instances, comparable yields of cotton are obtained regardless of the source of the plant nutrient concerned. However, ammonium forms of nitrogen are less mobile than the nitrate forms. Urea and anhydrous ammonia are toxic to germinating cotton seed, and should not be banded too near the seed furrow. This danger is reduced if at least 3 weeks elapse between fertilization and planting. Phosphorus materials differ in the degree of water solubility, and this factor should be considered in selecting the type of fertilizer. If two fertilizers are comparable in chemical analysis, availability and solubility, but different in price per ton, buy the cheaper fertilizer.

For maximum yields of cotton on the Blackland Prairies, consider carefully the structure, tilth and organic matter content of your soil. Keep crop residues on the soil surface until you are ready to mix them in the top 6 inches of the soil during seedbed preparation. In cases of hard pans or compacted layers, chisel plowing, subsurface sweep plowing or bedding and rebedding are satisfactory methods of seedbed preparation. Where heavy stubble or stalks are left from a previous crop, some temporary depletion of soil nitrogen may occur. In this case, add 20 to 25 pounds of nitrogen per ton of residue.

Cotton burs serve a useful purpose in adding organic matter to Texas soils. Apply cotton burs

Fig. 3. Applying fertilizer deep in bands in the middle just ahead of rebedding is an excellent way to fertilize cotton in the Blacklands. Notice contoured row conservation practice. (Photo courtesy of Texas Cottonseed Crushers Association.)

to the soil at rates of 2 to 4 tons per acre. (See Texas Extension MP-476.) Often two or more successive applications of cotton burs are needed before marked increases in yields become evident. After three or more successive applications of cotton burs, the treatment can be discontinued for 2 or 3 years before yields begin to drop appreciably. The addition of 12 to 15 pounds of nitrogen per ton of burs used is profitable with the first application. Cotton following legumes will require little or no additional nitrogen. After small grain, some nitrogen will be required for good production. Following forage or hybrid grain sorghum, give attention to the nitrogen requirements of the crop. Phosphorus (P_2O_5), potassium (K_2O), and calcium (CaO) should be applied according to soil test recommendations.

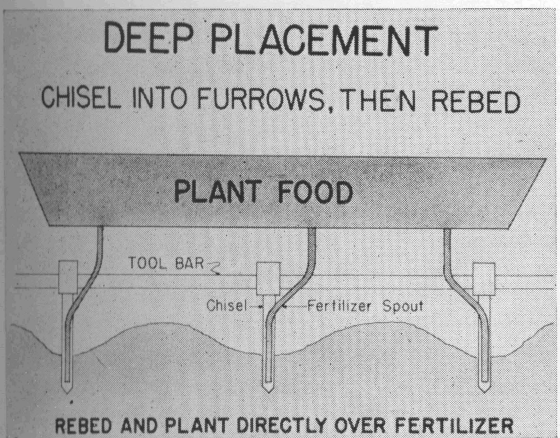


Fig. 4. Deep placement application of fertilizer for cotton is recommended on loam, clay loam and clay soils. Materials, liquid or solid, should be chiseled into middles before rebedding during October, November, December and January.

Fig. 5. If fertilizer cannot be chiseled deep into the middle before rebedding, a second choice would be a medium placement in a band in the bottom of the furrows; then rebed.

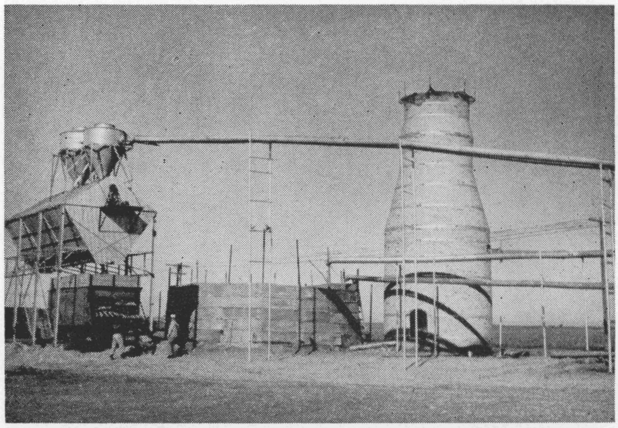


Fig. 6. A bur hopper and truck for spreading costs about the same as a Masonry-type bur burner. Both the open-pit burner and the jug-type burner can be discontinued and the burs put back on the land.

Fig. 7. Burs should be spread dry on the land at the rate of 2 to 4 tons per acre.

PLANTING

Such variables as seedbed preparation, soil moisture, seed viability, temperature, seed treatments and seed storage conditions influence germination. Actual planting operations, such as rate of seeding, depth of covering, type of planter, method to roll or firm the soil after planting and other factors influence the emergence of the cotton seedlings.

Varieties

High yields usually determine the choice of varieties grown on the Blackland Prairies; however, yields are only one factor to consider. Aspects such as disease resistance, fiber properties, boll and plant characteristics, adaptation to machine

Fig. 8. Organic matter from cotton burs made the difference. Plant on left received 4 tons per acre. Plant on right, none.

harvesting, seed sources and local preference should be evaluated. Some 70 to 80 varieties of cotton are now available. Varieties that perform well in another area of Texas may not be adapted to the Blacklands. The latest compilation of cotton types in the Blacklands is given in Table 2. This is only an approximate distribution of the varietal types, since the percentages may vary from year to year.

The method of harvest is a big factor in selecting varietal types. When mechanical strippers are used, all of the fruit is stripped from the plant in one operation. For this reason, a variety which matures rapidly and uniformly over the plant and its seed cotton stays well in the bur, is necessary.

The mechanical picker uses a series of revolving spindles to remove seed cotton from the open bolls without damaging or removing the unopened bolls. Varieties for mechanical picking should be open-boll types with a wide-opening boll with fluffy locks. They should have enough storm resistance to prevent damage or loss by moderate winds, yet loose enough to permit efficient picker operation.

The storm-resistant, big boll type prevails in the Blackland Prairies. It differs from the Texas big boll group principally in the degree of storm resistance. Current varieties included in this group are Anton Stormproof 99, Bagley's Storm-Tex 157, Kasch SS strain, Lankart Sel. 57, Lankart Sel. 611, Northern Star 5, Northern Star 411, Stormking, Stufflebeme Stormproof and Watson's Stormproof. This group is well-adapted for stripper harvesting.

TABLE 2. APPROXIMATE DISTRIBUTION OF BLACKLAND PRAIRIES COTTON TYPES

Type	Percent acreage occupied
Storm-resistant big boll	70
Texas big boll	20
Medium-staple open boll	5
Other	5

The high popularity of the Texas big boll group has lessened in recent years. Many varieties of this type, such as Bagley's B17 Rowden, Malone's Rowden, Malone's Mebane, New Mebane, Anton 22, Qualla 60, Kasch LL No. 7 and Floyd 8G, still are in production. These varieties are only moderately adapted for mechanical stripping.

Where mechanical picking is anticipated, the medium-staple, open-boll type is recommended. This class has bolls of medium size with average-to-poor storm resistance and with staple lengths averaging mostly 1 to 1 1/32 inches. Such varieties available for the Blacklands include Deltapine 15, Coker 100A (WR), D&PL Fox 4, Delfos 9169, Stoneville 3202, Stoneville 7, Auburn 56, Plains, Stardel, Empire WR, Deltapine Smooth Leaf, Coker 124, Pope, Rex, Dixie King, Deltapine TPSA, Watson's Empire, Texacala, Austin, Brazos and Tideland.

Consult your county agricultural agent for more information on varietal performance. Other aspects, such as disease resistance and seedling vigor, should be considered in selecting the variety. No one variety possesses all of the desirable plant and fiber characteristics. In many cases, there is little difference in the overall performance of the recommended varieties for the Blacklands. Preference of the producer will be a deciding factor in many instances.

Seed

Use only good-quality, treated planting seed. Treatment with an approved fungicide helps to reduce losses in stand caused by seedling disease. Treatment also helps to prevent seed decay and damping off from soil and seedborne organisms. (See Texas Station Progress Report 2001 for recommended methods of mixing fungicides with the soil and Progress Report 2003 for the recommended fungicides.)

Type of seed affects the stand of plants obtained. Fuzzy, mechanically delinted and acid-delinted seed are available. In cold, damp weather, fuzzy seed generally withstand the dormant period before germination without as much seed decay. However, with other conditions equal, delinted seed usually give quicker emergence and more uniform stands.

Ask your county agricultural agent for seed sources for planting purposes.

Date

Slow germination and cold soils are closely associated. Cotton should not be planted until after the average date of the last killing frost in the spring. A reasonable frost-free growing season exists on the Blackland Prairies.

In most cases under dryland farming in the Blacklands, moisture conditions determine the date of planting, which may not coincide with the optimum date. For best results, the minimum soil temperature at a 3-inch depth should not be lower than 70 degrees F. at 7 a.m. for three mornings in a row preceding planting. Extension Leaflet 219 gives the planting periods for portions of the Blackland Prairies that fall under pink bollworm regulatory requirement.

Planting too early seldom justifies the risk involved in having seed and young plants unduly exposed to rain, hail, cold, disease and insects. Cotton planted extremely early will not necessarily be harvested earlier.

Rate

Faulty planting rates or improper stands can cause inefficient or hampered operations throughout the entire season, as well as lowered yields. The use of modern, mechanical equipment demands a uniform stand. Growers frequently lose 5 to 6 bales per 100 acres because of poor stands.

Cotton can compensate to a degree for a variation in stand; however, a population of 40,000 to 50,000 plants per acre lends itself to efficient mechanical harvesting. This is an average of three to four plants per foot of row. Usually, 18 to 24 pounds of good-quality seed per acre will insure this stand under normal conditions. This relatively heavy plant population helps to reduce branching of the cotton plant and tends to raise the lower fruiting branches higher above the groundline. Regardless of the type of seed used (fuzzy or delinted), there should be little difference in planting rates. Where acid-delinted seed are used, do not reduce the poundage by more than 10 percent. Table 3 gives the quantity of cotton seed required to give desired plant spacing in 40-inch rows, assuming 60 percent emergence.

See Texas Extension L-491 for more information on calibration of planting equipment.

Methods

The use of drill-type row planters is recommended for the Blackland Prairies. The practice of drilling to a stand is desirable, and further thinning should not be necessary. Conventional drill planters are recommended and no special devices are needed to insure covering the seed. Because of the sticky condition of most Blackland soils, delay rolling the seeded area from half to a full day to allow the soil to dry. As soon as practical, roll with a surface press wheel. This conserves moisture and makes a satisfactory situation where lateral oiling for weed control is planned. The use of seed-press wheels at planting time is not recommended.

Cover the seed at a depth of 1 to 2 inches, when the seed are likely to remain in moist soil until they sprout and emerge. Planting on the bed is desirable and germination is best on a firm, undisturbed seedbed. Allow the beds to settle and receive moisture before planting. Usually, some type of cultivation, either a drag harrow, disk or shallow cultivator, should immediately precede the planting operation to lower the beds and control seedling grass and weeds. A shovel-type planter opener is used and a large sweep flattens and cleans the bed.

Skip-row Planting

In some areas, growers plant two rows and skip one, plant two rows and skip two, or use other combinations of skip-row planting. Under dryland conditions on the Blackland Prairies and considering principally the yield, this practice is not recommended. Under irrigation, the practice may be warranted; however, it is optional from the standpoint of yield.

One drawback to this practice is the increased vegetativeness of plants in relationship to machine harvesting. The larger stalks can especially hinder machine stripping. Other disadvantages might be insect control problems and insecticide wastage, cultivation problems and fertilizer distribution. Since terraces are widespread throughout the Blacklands, the skipping of rows might increase the problem of handling and cultivating point rows.

TABLE 3. COTTONSEED REQUIRED TO GIVE DESIRED PLANT SPACING IN 40-INCH ROWS[1]

Plant spacing (in.)	Plants per ft. of row	Plants per acre	Lb. seed per acre
1	12	156,816	58.0
2	6	78,408	29.0
3	4	52,272	19.4
4	3	39,204	14.5
6	2	26,136	9.7
8	1½	19,602	7.3

[1]Assume 4,500 seed per lb. and 60 percent emergence.

IRRIGATION

The cotton plant makes effective use of nutrients and water. With its deep roots, cotton can utilize water from depths of 5 to 6 feet. The soil should contain the maximum amount of available moisture to the sixth foot if the soil profile is capable of storing moisture to this level. During its early life, the cotton plant sends roots down quickly if it is not restricted by compacted zones or hard-pan layers. During the first 4 to 5 weeks, the cotton plant uses little moisture. Moisture stored in the plant root zone of the soil before planting is of more value than any other moisture that the cotton plant receives during the growing season. The peak period of use occurs with blooming and continues throughout the boll period. During this 45-day period, the plant may utilize up to 75 percent of the total moisture required to produce the crop.

The first fruiting forms appear at the end of the fourth or fifth week. These forms produce blooms within an additional 3 to 3½ weeks. When blooms first occur, the demand for moisture increases sharply. This demand must be met or production will be reduced. The young boll develops into full size in 18 to 21 days after blooming. It requires 45 to 65 days to open, depending on environmental conditions. Cotton continues to develop new fruiting forms until the plant is killed by frost. The best-quality lint which brings the highest price is that which develops from the early forms. The cotton plant normally hits its blooming peak at 80 to 90 days of age. An adequate supply of moisture and nutrients plus good insect control at this time will insure a good crop of cotton. Under average conditions, the cotton plant sheds about 65 percent of the squares, blooms and young bolls. A production practice that will cause the plant to retain any of these forms will increase production.

The cotton plant responds to moisture levels in various ways. Where growing seasons are long, water can be applied to the crop over a longer period without adverse results. In short growing season areas, the irrigation shut-off date for the crop must be earlier in the season, so that the plants can harden and mature before frost.

RATE OF WATER USE IN RELATION TO PLANT DEVELOPMENT

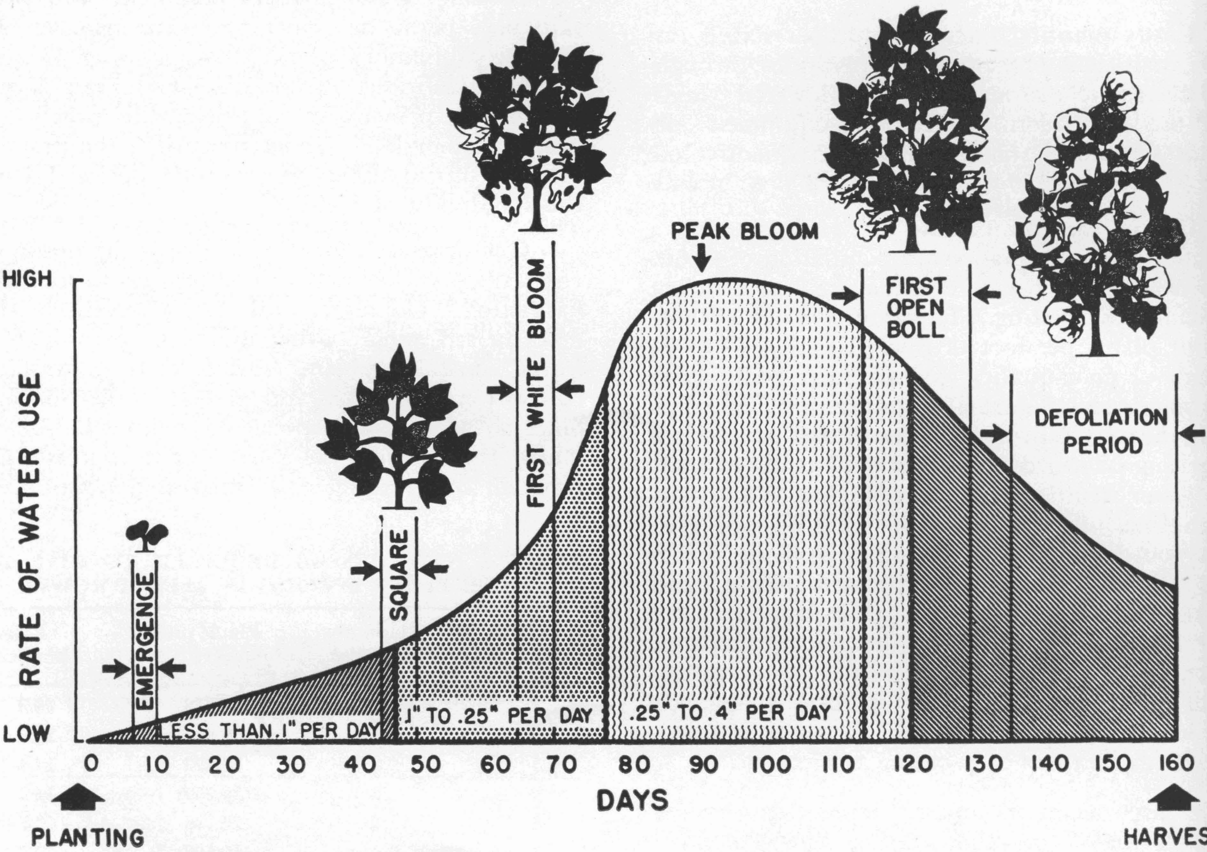


Fig. 9. The cotton plant uses more moisture during the peak bloom period of 80 to 110 days after planting than any other period in its life cycle.

The rate at which the plant uses water throughout the season varies from very little during early life to as much as .4 inch per day during peak use and extreme weather conditions.

In the Blacklands, irrigation should not be necessary until the cotton plant has reached the bloom stage if the soil moisture storage reservoir was filled to capacity before planting. Irrigation schedules for the growing season should be planned to fit local moisture conditions during the balance of the growing season. Texas Extension B-896 will be helpful in developing an irrigation schedule on the Blackland Prairies.

WEED CONTROL

Mechanical

Good cultivation is the most important and most economical weed control measure. Rotary hoeing is the key supplementary practice.

Cultivation, just often and deep enough to control grass and weeds, usually is done with sweeps. Approximately 40 acres can be cultivated with a four-row rig in a 12-hour day by an experienced operator.

Keep these points in mind about cultivation:

1. Use a line-diagram to set the cultivator. Paint accurate lines on a flat, smooth floor to represent rows and middles. (See Figure 10.) Plan No. 400, "Implement Setting Frame," is available from your county agricultural agent.

2. Adjust spacing according to the line-diagram, and set all sweeps flat so the toe and heel will touch on a flat surface. (See Figure 11.)

3. Make final adjustments for row profile in the field.

4. Proper speed of tractor is essential — 2 to 7 miles per hour with normal sweeps, depending on plant size and soil type.

5. Weeds in the seedling stage are easier to kill. Large weeds often must be removed by hand hoeing.

6. Proper cultivation leaves a cover of loose soil, not an exposed face of shear marks.

7. Normal cultivation depth is about 2 inches. Deep cultivation, if necessary to shape beds for irrigation or in heavy Johnsongrass, should be done early. Shallow cultivation minimizes moisture loss and prevents cutting feeder roots.

8. Do not cultivate in dry weather just to "fill the cracks."

9. "Heavy dirting" late in the season is undesirable for machine harvesting. Only a slight elevation in the drill row is desired to prevent the accumulation of defoliated leaves.

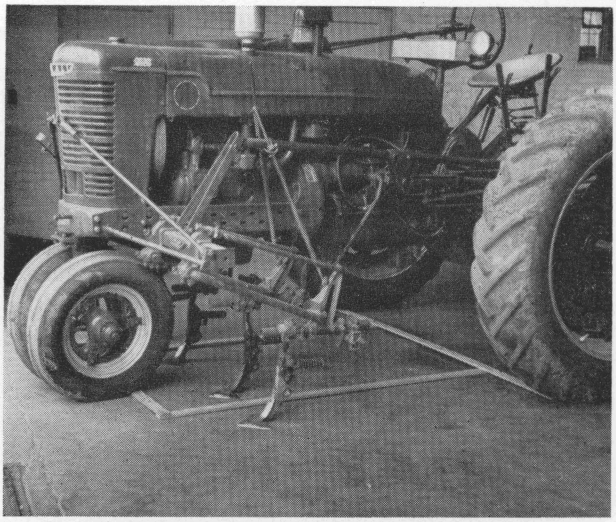


Fig. 10. Setting two-row cultivator with an implement setting frame. It can be used as a portable line diagram.

10. If more dirt is desired, as in irrigation, a different style sweep should be selected instead of tilting the sweep on the point. Setting on the point speeds wear and causes increased cutting of cotton roots.

Keep these points in mind about rotary hoeing:

1. The destructive power of the rotary hoe on weeds increases as the speed increases. Reductions up to 75 percent in hand hoe labor are common. In most cases run the hoe at speeds of 4 to 6 miles per hour.

2. On contoured rows and terraced fields, the broadcast rotary hoe is easier to use at high

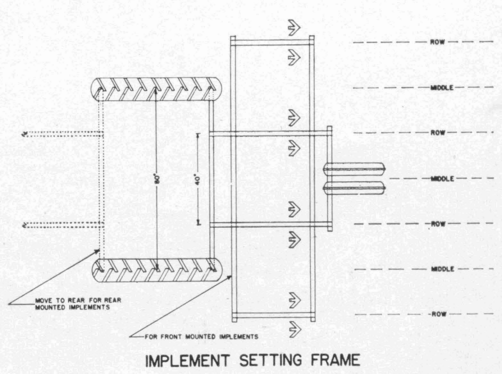


Fig. 11. Line diagram for setting two- or four-row tractor-mounted implements on 40-inch row width. The shop floor is a good place to paint this diagram.

speeds than the cultivator-mounted type, since it does not have to be held on the row.

3. The rotary hoe should be used immediately after the soil surface has dried and formed a crust. It breaks up the crust, dries out the top half inch of soil and kills emerging weeds. (See Figure 13.) The rotary hoe will not kill weeds and grass that have become established.

4. Light-weight tractors with pull-behind types can get in the field sooner after rains and can rotary hoe before it is dry enough to sweep cultivate. Spread front wheel-type tractors can operate safely at high speeds.

5. The cultivator-mounted, row-type rotary hoe is an effective rotary shield to keep sweeps from covering young cotton. Tests show this use makes it possible to increase sweep cultivation speed in young cotton by 60 percent.

6. Various shop-made rotary hoes are available. One popular model has three "gangs" per row. (See Figure 15.)

Cross-plowing

Cross-plowing is primarily a method of thinning. Where practical, it can reduce hand hoeing. Fields should be relatively large and level so that erosion will not be a problem.

With an increase in machine harvesting, the practice of cross-plowing has disappeared largely because it reduced efficiency and lowered yields.

Choppers

Mechanical choppers will do a satisfactory job of thinning heavily drilled stands and a certain amount of weed control as the row is blocked out.

Fig. 13. Cultivator mounted rotary hoe "floats" inside the front sweeps. Sweeps should be new type, low crown, broad, low wings for high-speed cultivation without heavy "dirting."

The power take-off driven types are more positive-acting under all conditions than the ground-driven types. However, under favorable conditions, several of the ground-driven choppers have worked satisfactorily at less cost.

Use of mechanical thinning devices has not been extensive in the Blacklands because it is felt that cotton should be planted to a stand, and that thinning is an unnecessary operation on an efficient mechanized farm.

Spring-action Weeder

After cotton has reached the six-leaf stage, a spring weeder attachment on the front cultivator

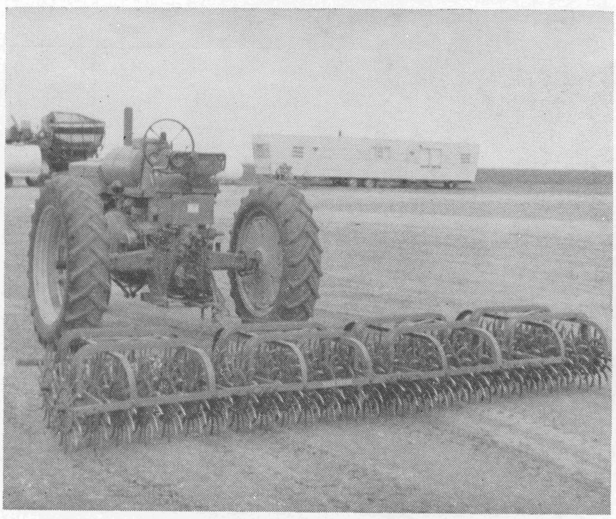


Fig. 12. The broadcast-type rotary hoe is an effective weed control tool when cotton and weeds are small.

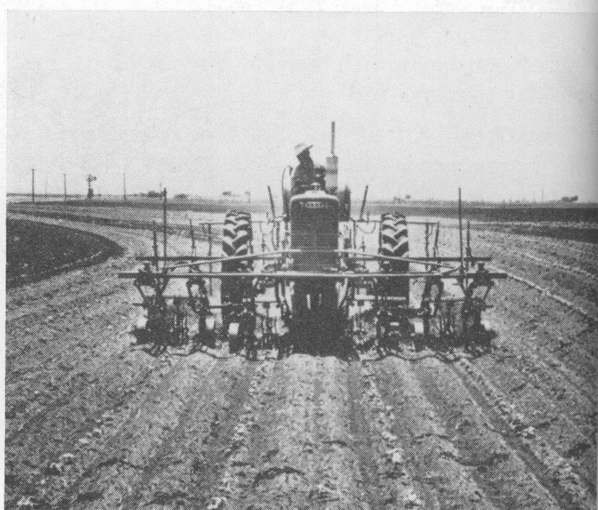


Fig. 14. The rotary hoe is the key weed control tool, and avoids covering small cotton.

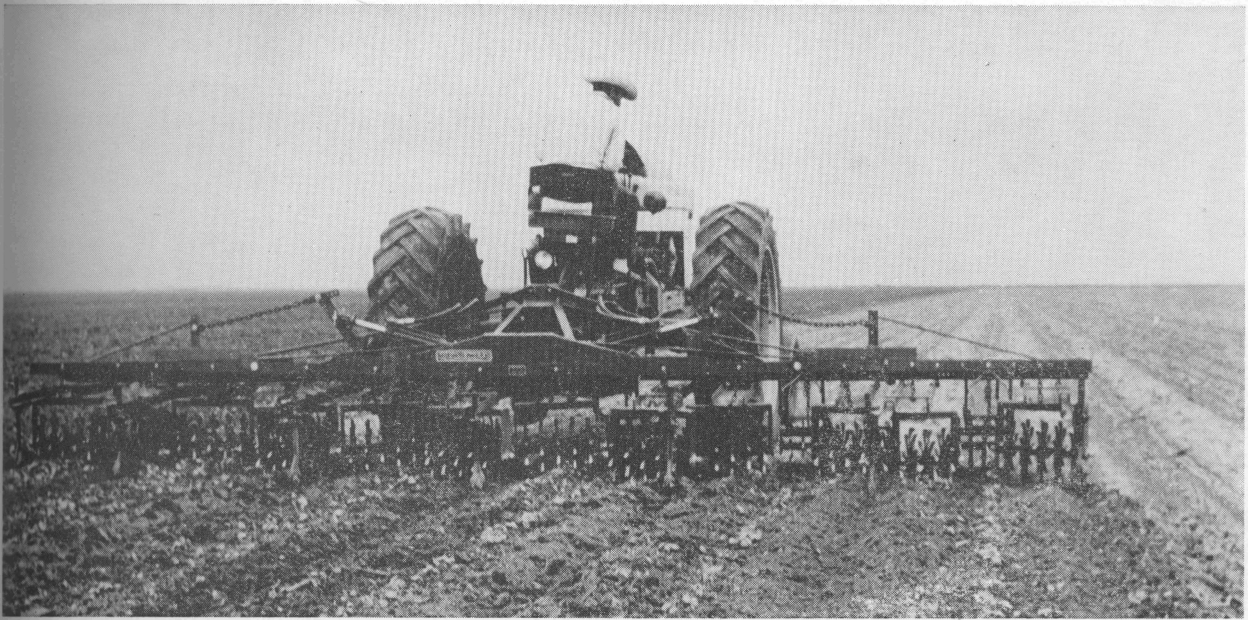


Fig. 15. There is a wide selection of rotary hoes. This type has proved highly satisfactory.

sweeps controls small weeds in the drill if a slight ridge is maintained at the base of the plants. (See Figure 16.)

Chemical

Pre-emergence Treatment

Pre-emergence chemical treatment at planting time is popular in some states, but has not been used widely in Texas.

Pre-emergence chemical treatment of a 10 to 14-inch band over the row at planting time is effective for killing shallow-germinating weeds and grasses under some soil conditions without injury to cotton. Such treatment usually costs $3 per acre. Pre-emergence treatments are most effective when the soil surface is sealed by rain and left undisturbed. "Dirting" too quickly in cotton that received a pre-emergence treatment throws grass seed into the row.

Pre-emergence chemicals work best on soils that crust without cracking. Poor results are common in dry areas and on soils that crack after rain. Pre-emergence chemicals usually fail 40 percent or more of the time under such conditions.

Karmex DL is the pre-emergence chemical in most general use. It is a suspension (not a solution) and should be stirred thoroughly before and during each application. One-half gallon of Karmex DL used as a band application will treat 3 to 6 acres of cotton, depending on the dosage, width of band and row spacing.

Mix Karmex DL with water and apply it to the soil as a pre-emergence spray immediately after the crop is planted. If possible, planting and spraying should be one operation. The soil should be well prepared and as free as possible from trash and clods. Spray equipment should be cleaned and calibrated carefully, and the nozzles adjusted to deliver the proper amount of spray mixture to cover the area treated. Shut off spray booms while starting, turning, slowing or stopping, since injury to the crop may result.

Equipment: Use a low-volume herbicide sprayer. Some growers equip the planter to apply

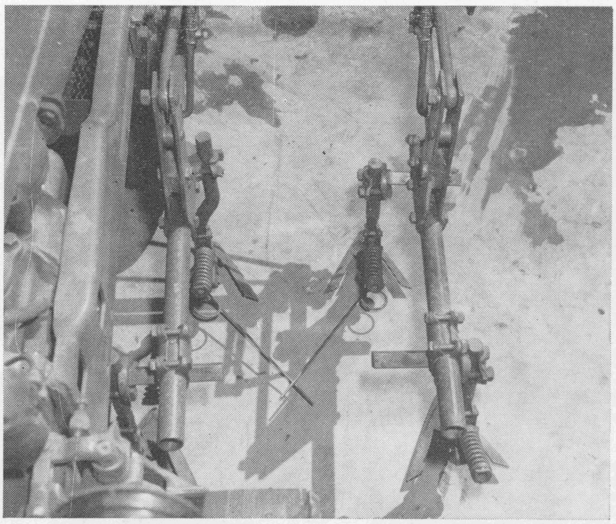


Fig. 16. The spring action weeder controls weeds in the drill after cotton reaches the six-leaf stage or larger.

the chemical. Others prefer to use high-clearance spray machines to apply the Karmex DL in a separate operation after planting. Both are satisfactory, but follow instructions on the manufacturer's label for calibrating the spray equipment. Make certain the tank is clean and free of scale. Strainer and nozzle screen, 50-mesh size, are suggested. Do not use flannel or cloth-type strainers. Constant agitation of the spray mixture is required; if a return line is used, it should reach the inside bottom of the tanks. Size of nozzles should be such as to deliver 0.3 to 0.4 gallon per minute per nozzle at 40 pounds pressure. Exceeding 40 pounds pressure will cause the spray to "fog" and blow. Use a large nozzle which will put out the material at a lower pressure and will not "fog" the spray. Usually for speeds of 3 to 4 miles per hour, use 8003-size nozzles; for 4 to 5 miles per hour, 8004; for 5 to 6 miles per hour, 8005.

Calibration: The following procedure is based on the width of band treated and is not affected by row spacing.

1. With the tractor gear and throttle setting that will be used for actual application, determine the number of seconds required for the tractor to travel the measured distance shown opposite the desired band width (full throttle is preferred to insure maximum pump capacity) as follows:

10-inch band	326 feet
12-inch band	272 feet
14-inch band	232 feet
16-inch band	204 feet

2. Adjust the height of boom to obtain the desired band width. With water only in the tank and using the same throttle setting, but with tractor standing still, adjust the pressure so that each nozzle delivers 1 quart of spray in the exact number of seconds as determined in (1) for the selected band width. Equipment is now ready to apply the required spray volume, provided the gear and throttle setting are not changed.

Mixing spray: For use on heavy soil types high in clay or organic matter, use ½ gallon of Karmex DL for each 53 gallons of spray mixture. On light soils low in clay or organic matter, use 3 pints for each 53 gallons of spray mixture. Do not use this mixture on very sandy soils lacking in clay or organic matter, since its leaching downward may damage the crop.

Fill spray tank one-fourth to half full of water through a large top fuel funnel with strainer. Start the pump to agitate the water in the spray tank. Karmex DL must be stirred thoroughly before measuring. Pour the proper amount into the funnel while the remaining water is being added to the tank.

Replanting: If bad weather makes replanting necessary, it can be done in soil treated with Karmex DL. The soil should be reworked before replanting. Do not re-treat the field with Karmex DL during the same crop year or injury to the crop may result. Do not replant to crops other than cotton within 4 to 6 months following treatment.

Lateral Oiling

Herbicidal oils have been used since 1949 to control grass and weeds after cotton is up to a stand. The practice is reliable and economical. More than 71,000 acres were "oiled" in 1960 in 75 counties. Many growers believe it is more economical to use the oil and eliminate using pre-emergence chemicals. The first application can be made when cotton is about 3 inches high, or 7 to 10 days old. Three applications at 7-day intervals can be made. Oil should not be applied after the bark begins to crack at the base of the plants. When the stalks reach the size of a lead pencil (3/16 inch in diameter), oiling should cease.

Lateral oiling works best where the bed is level and before cotton is cultivated.

Equipment needed includes a low-gallonage, low-pressure insect spray rig and parallel-action oiling shoes which cost about $75 for a two-row setup. These oiling shoes use two fan-type nozzles placed 10 inches apart and one on each side of the row, usually operated at 2½ miles per hour at 25 to 40 pounds pressure.

Young cotton contains enough natural wax on the stem below the seed leaf or seed leaf scar to shed the oil without damage. The oil is a petroleum naphtha containing no added fortifying agent, it generally has a boiling point range of 300 to 400 degrees F. and an aromatic content of 18 to 25 percent. Five gallons per acre usually are sufficient. In heavy grass, 7 to 10 gallons per acre may be required. Cost at bulk station dealers is about 20 to 25 cents per gallon, depending on transportation. Cost of labor and tractor application per acre is about $1. Many farmers report saving $6 to $25 per acre over hand hoeing untreated grass in cotton.

For more information, ask your county agricultural agent for Texas Extension MP-504.

1. *Ipazine in Bayol D,* an experimental post-emergence herbicide, gives promise for controlling small annual weeds and nutgrass in young cotton. It may be on the market for limited trials by 1962. Should this herbicide be registered under Public

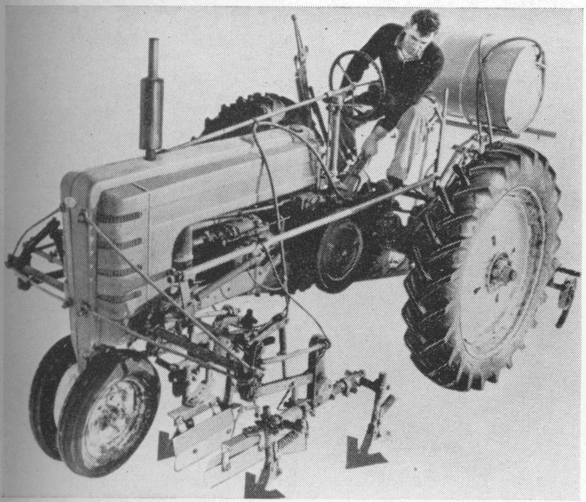


Fig. 17. Conventional two-row lateral oiling equipment for controlling grass in small cotton.

Law 518 for use on cotton, research data justify only trial use material on a limited acreage.

In such trials, the material should carry 1.5 pounds of the material per 40 gallons of mixture. Twelve gallons of this mixture should be applied per acre in a 12-inch band centered on the drill.

Application equipment is fairly simple, but not now commercially available. Satisfactory application can be obtained by modifying the end of the delivery lines of a conventional pre-emergence spray machine or regular insect control sprayer. This modification and the proper setting of the nozzles are shown in Figures 18 and 19. Two off-center nozzles per row, 0C02 or 0C03 or their equivalent, are required at the delivery end of the line as opposed to one nozzle on a pre-emergence spray machine. The tank of the spray machine also should have highly efficient hydraulic agitation or a good mechanical agitator. In setting the nozzles, the fan pattern is directed to minimize contact with cotton leaves, as shown in Figure 19, but this factor is not as critical as it is with herbicidal oil.

Do not apply this herbicide until the cotton is at least 4 inches tall or after bark cracks form on the cotton stem. Make no more than two applications. Temporary yellowing of cotton leaves treated with this herbicide may occur. Cases of slight-to-moderate chlorosis have not resulted in yield decreases in research tests except where unnecessarily high rates were involved. Treatments should be applied before annual weeds develop beyond the seedling stage.

2. *Dicryl* also has shown much promise for the post-emergence control of annual weeds in young cotton where applied as a directed spray. Use regular lateral oiling equipment or spray nozzles as shown in Figures 18 and 19. Limited research data and demonstration results in several Texas counties were inadequate for recommendation in 1961. If tried on a few acres, instructions on the manufacturer's label should be followed.

Spot-spraying Johnsongrass

Established Johnsongrass can be eradicated in cotton by spot-spraying. It is faster and cheaper than hand hoeing. Hoeing usually does not eradicate the grass. Spot-spraying was introduced by the A&M College of Texas in 1954. It became popular immediately as a supplement to cultural practices for the control of Johnsongrass, particularly for scattered infestations in cotton.

Herbicidal oils and water solutions of sodium dalapon are used for spot-spraying Johnsongrass. Oils are applied to the crown or stem at the groundline only. Water solutions of dalapon are applied as wetting sprays to the foliage. These and other sprays suitable for spot-spraying Johnsongrass must be applied selectively if plants in the treated spots are to be saved.

A 50-50 mixture of naphtha and diesel fuel oil is the oil spray most commonly used. Various

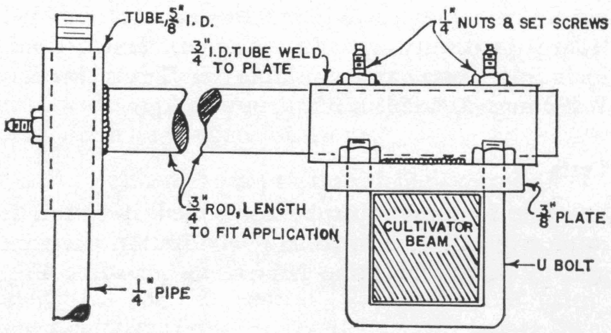


Fig. 18. Bracket for mounting post-emergence nozzles for Dicryl and Ipazine.

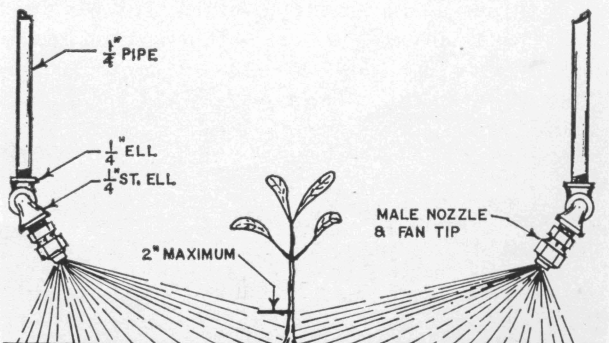


Fig. 19. Nozzle arrangement for applying Dicryl and Ipazine post-emergence materials using off-center nozzles, 0C02 or 0C03.

other oil mixtures may be used for economy, for increased contact toxicity or for a combination of contact toxicity and residual effectiveness. A new jet gun sprayer developed at College Station now permits selective use of this herbicide in cotton and sorghum. Oil sprays kill on contact and are most effective when applied to the crown of Johnsongrass sprouts 6 inches or less high.

If Johnsongrass infestation is not heavy, you can do a faster job by modifying the regular insect control spray rig on your tractor. (See Figure 22.) Four spray lines, 12 feet long, the same as the spray lines of the jet gun or gravity flow sprayer, can be attached to the tractor sprayer boom. A crew of four men can walk behind the tractor and spot-spray the grass on 8 rows. Another adaptation would be to fasten two seats for operators, the boom and two spray lines on front of the four-row tractor cultivator. Two spray men can then ride and spot-spray the Johnsongrass in four rows.

Sodium dalapon is used at a concentration of 20 pounds in 100 gallons of water. It is a translocated herbicide but also has a residual effect. Sodium dalapon kills the grass tops and many underground buds. It formerly was used primarily for nonselective treatment of large spots of Johnsongrass in sparsely infested cotton fields and for treatment of noncrop sites.

Information on this practice can be obtained from your county agricultural agent. Instructions, including costs, are available in Texas Station B-902 and MP-423.

Costs

Johnsongrass must be controlled if cotton is to receive full benefit from a fertilization program and to permit machine harvest of grass-free lint.

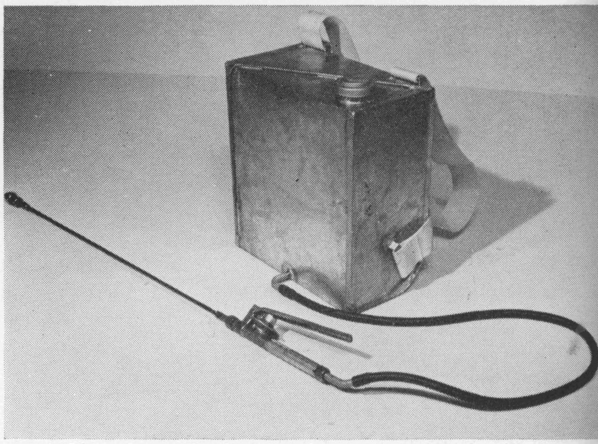


Fig. 21. The jetgun sprayer is efficient for selective spot application of any weed control spray material.

One application of a pre-emergence chemical costs about $3 per acre. One lateral oiling application costs about $1.25 to $2.50, depending on whether 5 to 10 gallons per acre are used on the grass infestation. Spot-spraying Johnsongrass varies from $4 to $18 per acre, depending on the infestation.

The total cost may vary from about $8.25 to $23.50 per acre. Subtract $3 for pre-emergence chemicals and the range is about $5.25 to $20. This may be a savings over the conventional methods of hand hoeing and plowing, depending on the rainfall, labor cost and weediness of the land.

It stabilizes the cost of weed control to a figure most Blackland growers feel is worth incurring.

Flaming

Flame cultivation has been in limited use in Texas since about 1947. Improvements have been

Fig. 20. Field crew spot-spraying Johnsongrass in cotton at the right stage.

Fig. 22. A regular insect control spray rig can be adapted for a crew of four to spot-spray grass in cotton.

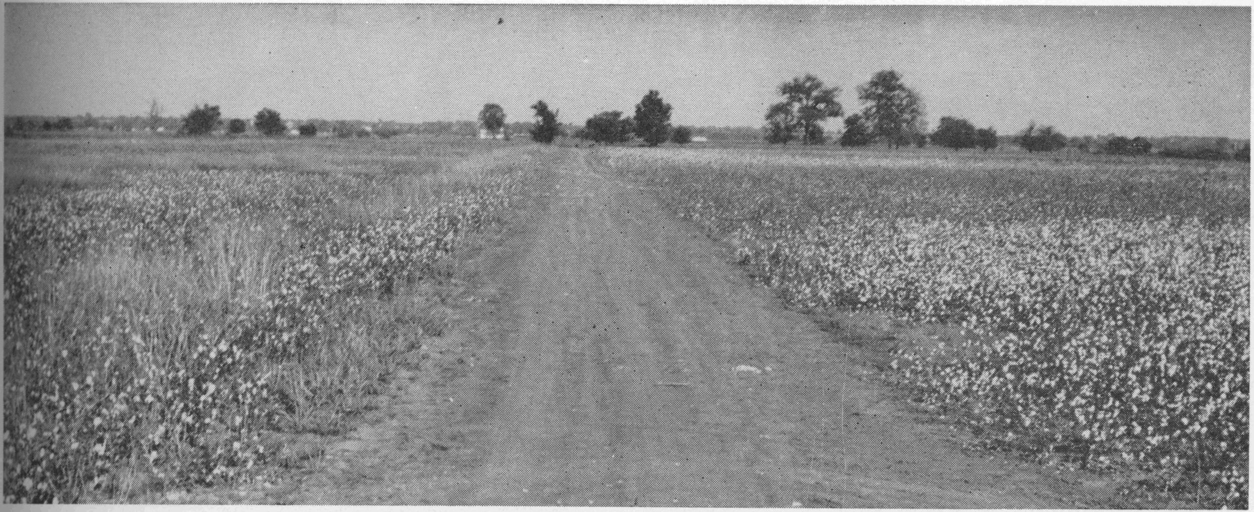


Fig. 23. Comparison of hand-hoeing Johnsongrass, left, versus spot spraying, right.

made in recent years in the equipment used. This practice offers more promise in river bottom crops or those under irrigation than under upland conditions.

Flame is used to control small weeds and grass in the drill area of cotton after the stems grow to about the size of a lead pencil. Flame works best if applied across relatively level and smooth row profiles. It should not be used where the row profile is such that the flame is deflected toward the upper parts of the cotton plant. This might happen if a single, late flaming is attempted.

Flaming involves a series of treatments. Although conditions vary widely, the first flaming normally is done at a pressure of 30 to 40 pounds and a speed of 2½ to 3 miles per hour. Later operations may be increased to 55 to 60 pounds pressure and a speed of 4 to 5 miles per hour.

One flame application, including 4 to 6 gallons of LP gas as fuel, equipment, labor and cultivation of the middles, will cost about $1.45 per acre.

The practice of flaming should be studied carefully. Your county agricultural agent has detailed information on flame cultivation.

INSECT CONTROL

Insect control is only one of the essential practices in efficient cotton production, but in some years it may be the most important one determining profit or loss. Cotton insects can be controlled effectively and economically if the proper program is carried out at the right time. No single method can be used year after year and give effective results. The control program must be modified throughout the season to fit the insect situation.

Successful cotton insect control is dependent on thorough analysis of the situation before the control program begins and between applications. Knowing *when not to* make applications is just as important as knowing *when to* begin the control program.

Important steps in successful control of cotton insects are:

1. Make periodic examinations of the cotton fields throughout the season to determine the presence and identity of injurious insects. Making insecticide applications when no damaging infestations occur is a waste of money.

2. Select the proper insecticide or insecticide combination to control existing and potential pests. No single insecticide will control all major cotton pests. Insecticide resistance has developed during the past 5 years in several insect pests and many insecticides that once were effective no longer give satisfactory control. In some cases, two or more insecticides are recommended for the control of resistant pests. The presence of aphids and spider mites also may influence the choice of insecticides. The grower should select the insecticide or combination that he can use most effectively and economically.

3. Apply the proper dose of insecticide to obtain control. All ground machines should be calibrated by determining the amount of material applied to a measured area. After calibration, it is a simple matter to add the necessary amount of insecticide to obtain the recommended rate for effective control.

4. Make applications thorough to obtain maximum benefit from the insecticides. Adjust properly the spouts and nozzles on ground equip-

Fig. 24. One nozzle per row will give good coverage.

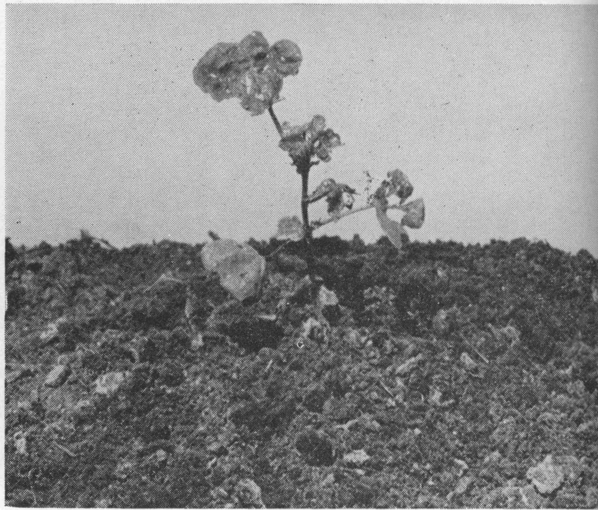


Fig. 25. Severe thrips injury resulting from early infestation.

ment above the cotton terminals. Generally, if rain occurs within 24 hours, the application should be repeated. Dust applications should be made when the air is calm or nearly so. Sprays may be applied with winds up to 10 miles per hour. When airplanes are used to apply insecticides, flagmen are necessary to insure uniform coverage of the field with either sprays or dusts.

5. In case of persistent damaging insect infestations, repeat applications at proper intervals. In general, early season applications are made on a 7-day interval, and late season applications on a 5-day interval. In case boll weevils infest 50 percent or more of the squares, three or more applications on a 5-day interval may be required to bring the infestation under control. Watch bollworm infestations closely during July. Once treatment is necessary, a 5-day application schedule is required until the infestation is brought under control.

Fit the Program to the Farm

The type of land on which cotton is grown is one of the main factors influencing the kind of control program needed in the Blacklands. Cotton growing on upland soils generally has lighter insect infestation and buildups do not last as long. Consequently, fewer applications are needed than for cotton grown in creek or river bottoms.

During a normal season, three or more insecticide applications may be needed for cotton growing in upland soils, whereas cotton growing in bottom lands may require six or more. A thorough checking of the plants to determine the degree of insect infestation will determine the number of applications needed. In addition to basing the control program on insect infestation counts, it also is a good practice to calculate the potential yield of the crop. It is questionable if insecticides will result in profitable returns when used on cotton which can produce only 1/3 bale per acre.

Guides for the control of insects injurious to the cotton plant are prepared annually by the Texas Agricultural Extension Service. These guides, shown in the References section, are available through the county agricultural agents.

Early Season Control

Control of early season insects is an important phase of the insect control program in the Blacklands. In some years, if this program is carried out properly, it may not be necessary to make additional applications in mid or late season. This may be true especially where cotton is growing on upland soil. Almost every year, the three main early season pests are thrips, overwintered boll weevils and fleahoppers. Insecticides should be applied at 7-day intervals.

1. *Thrips.* These insects usually damage cotton from the time it emerges until the plants are 4 to 6 weeks old. Plants should be observed soon after emergence to determine if thrips are present in damaging numbers. These insects cause the greatest damage to seedling cotton. Early planted cotton in most areas may not need thrips protection until the four-leaf stage. In some years, depending on the time of infestation, two applications of insecticides at 7-day intervals may be needed. Heavy thrips infestation may delay maturity 10 days to 2 weeks.

2. *Overwintered boll weevils.* The control of overwintered boll weevils is an important phase

Fig. 26. Regular checking for late season insect infestation should be a regular practice on all cotton farms.

of the early season control program. All cotton in the Blacklands is subject to boll weevil attack, but the degree of infestation would depend on the location of the field. Cotton fields in creek or river bottoms or fields surrounded by woods are the most likely location for weevils to hibernate during the winter.

Many overwintered weevils have emerged in cotton fields by the time the squares form. Make applications for overwintered boll weevil control between the time the plants begin to square and before the first squares become one-third grown to prevent egg laying. Early control of overwintered boll weevils will protect early squares and delay mid or late season infestation buildups.

3. *Fleahoppers.* Fleahoppers are an important economic pest in some areas. They should be controlled before they destroy the early squares. The control for overwintered boll weevils also will control fleahoppers. Plants should be checked during the early fruiting period to determine if controls are necessary.

Application of insecticides near the time bollworms usually appear may create conditions favorable for these pests to build up in damaging numbers. A well-planned, early season program should be used to control early season pests such as thrips, overwintered boll weevils and fleahoppers, but time these treatments to cease at least 30 days before bollworms usually appear, unless injurious *infestations are present. Avoiding insecticidal* applications during this period generally permits beneficial insects to build up as an aid to bollworm control.

Although beneficial insects may aid in controlling cotton pests such as the bollworms, cotton aphids and spider mites, growers should never rely entirely on beneficial insects to control cotton insects.

Late Season Control

In most years, the boll weevil and bollworm are the two major pests. All poison applications should be based on infestation counts. In most cases, insecticides should be applied at 5-day intervals.

1. *Boll weevils.* In many areas, boll weevils have become resistant to certain insecticides. It is important that the proper insecticide be used at the recommended rate. Boll weevils tend to migrate from one field to another late in the season. A late insecticidal application may be necessary to protect young or half-grown bolls from migrating

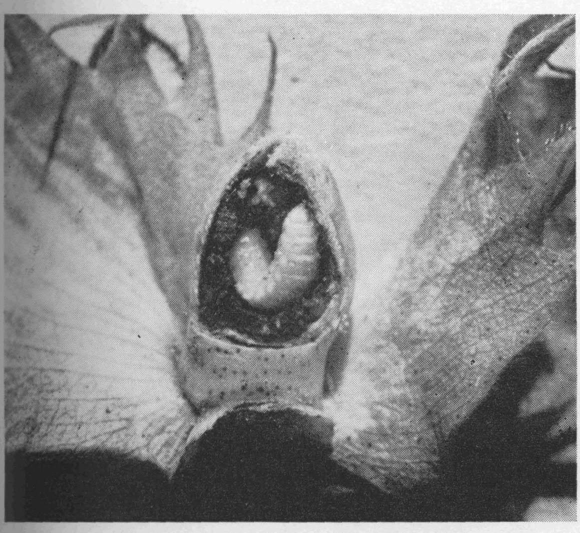


Fig. 27. Boll weevil grub in a cotton square.

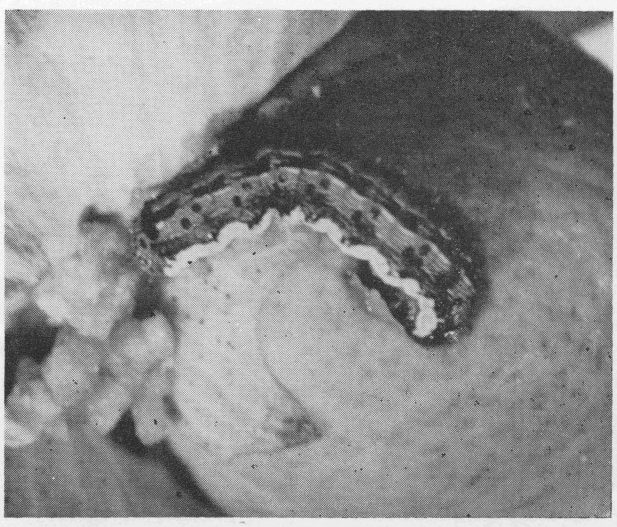


Fig. 28. Bollworm feeding on a cotton boll.

boll weevils. Bolls are not considered safe from weevil injury until they are 16 to 20 days old.

2. *Bollworms.* Many growers have difficulty controlling bollworms because the application is not made at the proper time. It requires time and effort to check the plants to find eggs and small worms. Insecticides must be applied when the worms are small. During the bollworm season, fields should be checked every 3 or 4 days to detect the presence of this pest.

Cultural Practices

Early harvest of the crop and immediate stalk destruction and plowing under of the residue are best for the Blacklands. These practices result in the harvest of a better grade of cotton and reduction of the insect populations in the fall. If stalks are destroyed before frost, both boll weevils and pink bollworms are deprived of food and breeding sites which results in fewer numbers surviving the winter. Defoliation or desiccation of the cotton plants also destroys insect food and breeding sites and accomplishes the same results as frost, but much earlier in the season.

DISEASE CONTROL

Cotton diseases are a problem on the Blackland Prairies. Individual fields with losses as high as 50 percent occur some years under severe root rot conditions.

Following is a discussion on control of the major diseases on the Blackland Prairies. For identification of these diseases, see Texas Station B-938 and MP-471, and USDA Farmers' Bulletin 1745.

Root Rot

The fungus which causes root rot occurs from the soil surface to a depth of 6 to 9 feet (see Figure 30), but most of it is in the top 18 inches. The problem is to reduce the population in this area, especially in the top 12-inch zone where most of the cotton roots grow. For this reason, the depth of any curtural operation for root rot control is important.

Three weaknesses of the causal fungus may help to reduce its population in the soil. These are: the fungus is killed easily by drying and aeration; the strand and seed body stages can be inactivated and in some cases destroyed by microbial activity; and the organism becomes inactive and dies out in soils where nonsusceptible crops are grown 2 or more years.

Fig. 29. A stalk shredder is a good investment and has many uses.

Drying and aeration of the soil to reduce the fungus population can be done by flat breaking a field in the early fall 6 to 12 inches deep with a moldboard or disk plow. About 2 weeks are needed for the turned soil to dry and aerate properly. If heavy rain occurs shortly after deep plowing, the desired results may not be obtained fully.

High microbial activity to reduce the population of the causal fungus can be obtained by burying organic matter from crops such as grain sorghum, small grains, clovers and winter peas. The organic matter should be turned under and buried during the fall or winter. Organic matter is not effective in increasing microbial activity when left on or near the surface. Microbial activity will be in proportion to the amount of organic matter turned under. Sufficient nitrogen for decomposition of the organic matter and for the growth of cotton should be available during the growing season.

Rotating cotton with nonsusceptible crops to reduce the fungus population and to prevent an additional population buildup involves advance planning. The best crops to use are grain sorghum, small grains and corn. Two to 3 years between cotton crops is highly desirable. Many weeds are susceptible to the root rot fungus. For this reason, weeds in the nonsusceptible crops should be controlled as much as possible.

An example of a 4-year rotation system to use the three control practices follows:

Cotton: Shred stalks and deep plow soon after harvest is completed.

Grain sorghum or corn: If grain sorghum is used, shred stalks and bury the residue soon after harvest is completed. If corn is used, keep free of weeds.

Hubam sweetclover: Harvest for seed and bury residue by deep plowing.

Small grain: After harvest, bury residue by deep plowing.

Cotton: Fertilize properly and attempt to produce early cotton.

A second system, using only two of the control features, which may be practical on a few farms with large cotton allotments of more than 50 percent of the total acreage follows:

Cotton: Shred stalks and deep plow soon after harvest is completed.

Winter green manure crop: Three to 4 weeks after deep plowing, disk land and plant. Turn under the green manure crop in late February. Disk and bed the land for row planting.

Cotton: Fertilize properly and attempt to produce early cotton.

This system usually is effective when deep plowing and burying organic matter can be done each fall and winter between cotton crops.

A rotation system itself will not control root rot. It is only a means of using control practices in a production program.

Seedling Diseases

The use of high-quality planting seed is the main key to getting good cotton stands. Seedlings from such seed are susceptible to only two to three organisms, while seedlings from low-quality seed are susceptible to about eight other soil-borne organisms. The vigor of seedlings from high-quality seed frequently causes them to escape attack by the main organisms.

Poor-quality seed can be detected best by using a dual temperature germination test. High-quality seed will have the same germination at both 65 and 80 degrees F. Poor-quality seed will have a marked reduction in germination at 65 degrees as compared with the germination at 80 degrees F.

For acid delinted seed, compare 5-day germination with 12-day germination; for fuzzy or mechanically delinted seed, compare 7-day germination with 12-day germination. If the difference between the early and 12-day percentage in either test exceeds 5 percent, the seed are poor-quality. If the difference is less than 5 percent, the seed can be considered good-quality.

Sometimes it is difficult for growers to obtain high-quality planting seed. When low-quality seed must be used, precautionary practices should be taken to prevent seedling diseases from occurring.

Prepare the seedbed so that excessive amounts of the old crop residue will not be in the seed placement area. Whenever possible, raise the seedbed so that drainage and drying will occur after rains.

Avoid planting when the soil temperature has been below 68 degrees F. for any length of time, especially if fair-to-poor quality planting seed are used. High-quality planting seed can be planted at soil temperatures of 62 to 68 degrees F., but high-quality seed can become poor-quality if soil temperatures drop below 60 degrees F. for several days after planting. The germination of cotton-

Fig. 30. **Strand growth and seed bodies of the root rot fungus.**

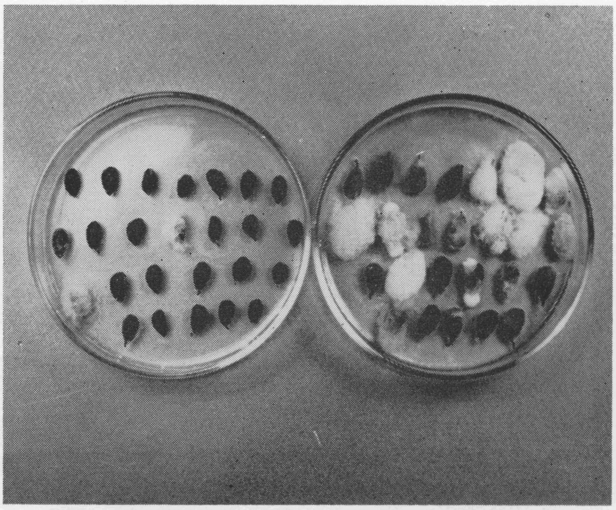


Fig. 31. Good-quality seed (left); poor-quality seed (right). Molds grow readily on the poor-quality seed.

seed and the growth of cotton seedlings are slow at soil temperatures below 70 degrees F. Slow-growing seedlings remain susceptible for longer periods; thus, they are more apt to be attacked and killed.

The use of acid-delinted graded seed often helps reduce seedling disease. All planting seed should be treated uniformly with a recommended seed protectant fungicide at the dosage given. See Texas Station L-383. Seeding rates should not exceed 30 pounds per acre. Seedling diseases are more severe when higher rates are used.

Mixing fungicides in the covering soil at planting also is recommended to control seedling diseases. Even though the cost of such a practice ranges from $3 to $5 per acre, the returns are much higher, especially where getting good stands is a yearly problem.

The two fungicide mixtures following are suggested:

Mixtures	*Active per A., lb.*
Captan	0.75
PCNB	1.13
Zineb	1.30
Captan	0.75
PCNB	1.13
Thiram	0.98

A band of soil about 1.5 inches wide, extending from around the seed to the surface, should be treated uniformly. Application can be with dust or spray equipment. Dust equipment is on the market. Spray equipment parts can be purchased and assembled by farmers. Details on the equipment can be obtained from your county agricultural agent. See Texas Station PR-2001 and PR-2181.

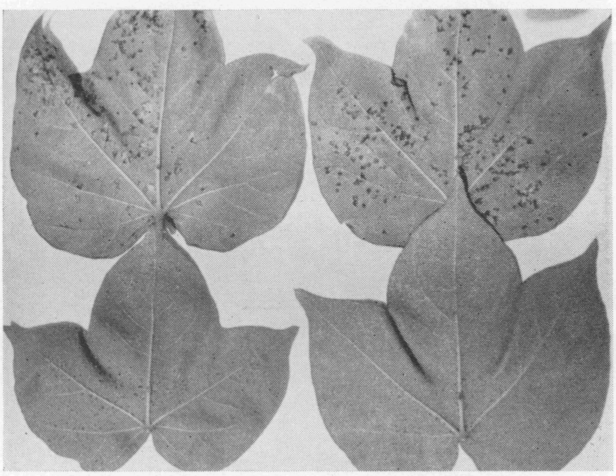


Fig. 32. Leaves at top show typical bacterial blight lesions on susceptible variety. At the bottom are typical resistant reaction lesions on leaves of resistant variety.

When fungicide dust formulations are mixed with the seed in the planter box this is known as hopper box treatment. Mixing the dust with the seed reduces the seeding rate about 5 to 10 percent. In areas where seed are covered with less than an inch of soil, this method usually is effective when the reduced seeding rate is corrected. In Texas, the seed usually are covered with 1 to 2 inches of soil. For this reason, the hopper box or planter box application of fungicides should not be used.

Bacterial Blight

Bacterial blight can be controlled by rotating cotton with other crops, planting disease-free seed, growing resistant varieties and using nitrogen fertilizer.

Rotating cotton with other crops helps to reduce soil carryover of the pathogen from the previous cotton crop. However, a field of sorghum or other crops can be contaminated by leaves from a cotton field. Therefore, a field that was in sorghum the previous year would not necessarily be free of the disease. The organism also can be carried by running water and equipment from plant debris in an old field to a disease-free cotton field.

Planting disease-free seed is important because the blight organisms are carried from year to year by seed. Planting seed should not be saved from fields that are infected with bacterial blight. Delinting and treating seed will reduce the carryover by removing the organism from the seedcoat, but even acid-delinted seed can have organisms inside the seed. Sanitation must be practiced if the use of disease-free seed is to be effective.

Planting resistant varieties is the practical way to control bacterial blight. Crop rotation, sanitation and planting disease-free seed also should be practiced. Blightmaster, Austin and Rex are highly resistant to bacterial blight race 1. Blightmaster is susceptible to race 2 while Austin and Rex are only slightly susceptible. Gregg and Mebane B1 are resistant to races 1 and 2. All of these varieties are susceptible to other races of the disease.

Nitrogen fertilization is important in controlling bacterial blight. Resistant and slightly susceptible varieties become fully susceptible when grown under nitrogen-deficient conditions. These types become immune and resistant when grown in the presence of adequate nitrogen. The plants should have a healthy green color at all times.

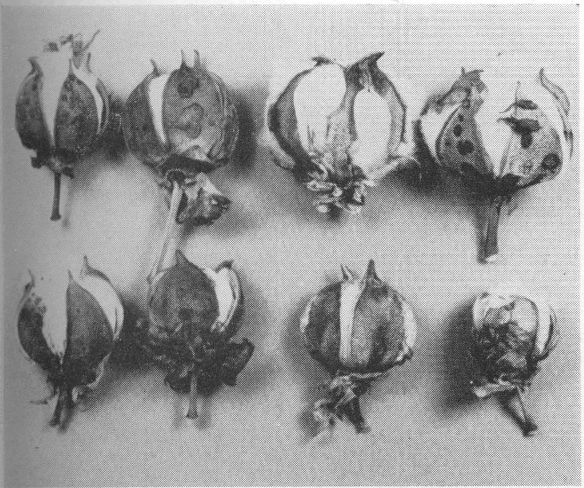


Fig. 33. Bolls affected by bacteral blight tend to be smaller in size and do not fluff.

Pseudomonas Wilt

This disease causes stunting and slow emergence of the seedling. Plants from these seedlings frequently remain stunted. In cool weather, seedling leaves tend to remain yellow for a long time. The roots may have only slightly constricted wounds near the soil surface, or they may become so severe that the primary roots are destroyed. Leaf signs are influenced by environment, especially light and temperature, and by whether the signs develop slowly or rapidly. The leaves may yellow and become reddish with dead areas in the leaf blade and along the margins. Marginal points of the leaves frequently die first. In other cases, the leaves redden along the margins. These areas die and shatter. Occasionally, leaves may die very fast, turn gray and not shed. On splitting the main stem of plants lengthwise, brown to black areas will be in the center. This usually is more pronounced in the upper areas of the root.

Another sign of the disease is dying of the boll bracts. If this occurs in boll development, the entire young fruit dies and is not shed from the fruiting branch.

Evidence indicates that pseudomonas wilt organisms live in the soil and can be carried in seed, soil and plant debris.

Planting high-quality, disease-free seed and rotating cotton with corn or sorghums and small grains should give some control of the disease. Early maturing varieties seem more susceptible than the intermediate and late-maturing types.

Nematodes

Nematodes must be controlled to insure profitable cotton production. Growing resistant varieties is the most economical way to control nematode injury in cotton. Varieties such as Coker 100WR, Austin, Rex and Dixie King have a low degree of resistance and should be planted only where nematode infestations are low. Varieties such as Auburn 56 should be used to assure satisfactory control.

Unfortunately, only a few resistant varieties are available. None is available in the stormproof types.

Other practices will aid in nematode control. Rotating cotton with nonsusceptible crops, such as corn and sorghum, helps to keep down nematode populations. Flat-breaking land to destroy cotton roots will help. Soil fumigation with recommended fumigants gives control and is economical in some areas. See Texas Extension MP-356.

PREPARATION FOR HARVEST

A rapid shift from hand to machine harvesting has resulted in savings to the grower. Records on one test show a saving of $11 per bale with a low yield of 117 pounds of lint per acre and a saving of $29 per bale with a 300-pound lint yield. The higher the yield, the greater the saving per bale.

The preparation of cotton for machine harvesting is important. There are two types of machines, two types of materials to prepare the cotton for these machines and two general types of cottons.

Defoliants

A true defoliant is a chemical, either dust or spray, applied to cotton to cause mature leaves to shed or drop. A thin layer of cells, called abscission layer, forms at the base of the leaf stem, resulting in a break at that point. The leaves fall in about 7 to 9 days.

A true defoliant should be used in preparing open-boll type cotton for spindle pickers. This practice usually costs about $3 per acre. The cotton can be machine picked for about $20 per bale, depending on conditions, as compared with about $50 per bale for hand picking or pulling. This type of operation usually is on the heavier soils or in the river bottoms where plant growth is medium to large.

In general, true defoliants are recommended for preparing cotton for machine picking even though 100 percent leaf drop is not always obtained. Under favorable dry weather conditions, a good job of machine picking usually is done with 75 to 85 percent leaf drop.

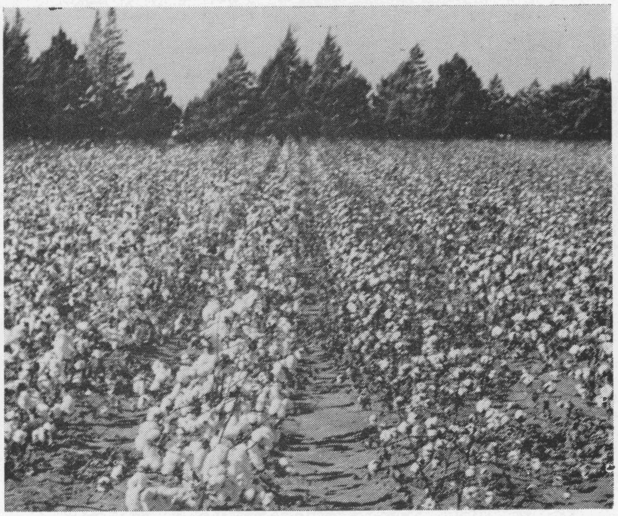


Fig. 34. Open-boll cotton on the left is best suited for spindle picking. Storm-resistant boll types, right, are best suited for stripper harvesting.

Fig. 35. Large-to-medium size cotton on heavier, river bottom soils is machine harvested more efficiently with a spindle picker in open-boll types.

Recommended defoliants are listed in Extension L-145. Dusts consist of calcium cyanamide, organic phosphorus materials and a sodium chlorate-sodium metaborate material. The sprays consist of sodium chlorate-borate mixtures, magnesium chlorates and organic phosphorus compounds. Dews are necessary to activate dust materials. There should be at least 2, preferably 4, hours of moist exposure. Sprays should be used if no dew is expected. Early morning or late afternoon application during hours of higher humidity is helpful.

1. Sodium chlorate-borate mixtures have as the active ingredient a sodium chlorate with borate salts added as a fire retardant. This mixture ranges in active ingredient from 18.2 percent (as liquid concentrate) to 60 percent (in granular form), and for the most part is formulated with sodium metaborate. All are equally efficient when applied at rates equivalent to those of sodium chlorate.

2. Magnesium chlorate is available as magnesium chlorate hexahydrate and as magnesium chloride and sodium chlorate mixed together in water. Magnesium chlorate is hydroscopic and offers its own fire retardant properties. There are at least three magnesium chlorates, and four or more companies list a mixture of magnesium chloride with sodium chlorate. There is little or no difference in defoliation efficiency between the two types. All are slightly more herbicidal than the sodium chlorates and thus are preferred if the foliage is tough and the temperature drops. Under ideal conditions, there is little choice among all chlorates on an equivalent active ingredient basis. Magnesium formulations also are sold as dry salts and as liquid concentrates.

3. Organic phosphorus compounds appear to have systemic properties, and are highly efficient in inducing the fastest leaf fall of any defoliant. They often remove immature leaves and sometimes partially defoliate the older leaves of second growth. These compounds are effective at low concentrations of active ingredient. On drouth-stressed cotton, they can be applied in clear diesel oil instead of water.

Timing of the application, more than anything else, determines how much a grower will benefit from defoliation. When up to 80 percent of the bolls are open is the best time and avoids immature fiber. The bolls should be firm and not dent when pressed between the thumb and forefinger. Bolls at the top or ends of limbs should not be sliced easily with a knife; the fiber should string out. Warm temperatures give best results. Efficiency is reduced at less than 70 degrees F. in daytime and 50 degrees F. at night. Stagger the application, applying at about the rate the field will be harvested unless applying just ahead of average frost date.

A regular cotton insect control ground sprayer can be used. Apply in enough water to insure thorough coverage (usually 20 to 30 gallons per acre). Nozzle arrangements vary with the size of cotton (five to eight nozzles per row usually needed); spray 8 to 10 inches away from the cotton with low pressure to give large droplets (25 to 40 pounds per square inch).

Aerial application is equally as effective as with ground spray rigs. Less water per acre is required, usually 8 to 10 gallons, for good coverage. A uniform spray pattern over the entire swath, limited to wing spread, low pressure, about 30 p.s.i., relatively large droplet size, has given good results and is recommended. A flagman should be used.

If good results are not obtained or the plants are large, a second application in 6 to 7 days or following maximum leaf drop from the first application may be needed.

Desiccants are not recommended in preparing cotton for spindle picking, only as a second application where cotton is not large. A desiccant "freezes" the leaves on the plant and in large cotton the spindles thresh excessive leaf trash into the seed cotton.

The addition of a spreader or sticker, such as coloidal X-77 or Multifilm "C" at 1½ pints to 100 gallons of field mixture, will increase defoliation under unfavorable conditions such as cool days and nights or where cotton is under moisture stress. The increased cost will be about 10 cents per acre.

Some advantages of defoliating are:

1. Higher picker efficiency is possible. "Tagging" is reduced.

2. Green leaf stain and trash are reduced.

3. Fields can dry out about an hour earlier in the mornings. Machines can start earlier and run later.

4. A higher percentage of bolls open for the first picking.

5. Fields appear more attractive to hand pickers.

6. Lodged plants tend to straighten up after defoliation.

7. Populations of damaging insects are lessened.

8. Earlier harvest is possible as well as earlier plow-up and planting of winter legumes or other crops.

9. Grass and weed control programs are aided.

When a range in rates is given, use the lower rates with small plants early in the season or in warm weather. Use the higher rates with moisture stressed or large, leafy plants, uneven or immature growth late in the season or during cool weather.

Directions on the manufacturers' label should be followed strictly. Do not use a defoliant that is not labeled as to exact chemical content. Do not use homemade chlorate or other preparations because of possible fire hazards.

Desiccants

A desiccant is a chemical applied to cotton to dry the leaves in preparation for stripper harvest of the open bolls. Desiccants do not cause all leaves to fall. Because of faster action on the tissue of the leaf, it may not "abscise," but dry and stick to the stalk.

Desiccants used in preparing cotton for machine stripping usually costs $2 or more per acre. This type of operation is best suited to uplands where cotton is 30 inches or less high.

Desiccants have been more effective in preparing cotton for stripping than true defoliants.

All defoliants and desiccants must be registered for use under the regulations of Public Law 518. No material should be used unless label approval is shown under these regulations.

Desiccants should be applied only if the cotton is fully mature and more than 60 to 80 percent open, preferably 90 percent.

Pentachlorophenol has been used for several years as a desiccant at the rate of 2 to 3 quarts per acre. It is applied with diesel oil after the dew dries. It does a satisfactory job in hot, dry weather, but may require two applications. A shower before "penta" completes its action reduces its effectiveness.

Arsenic acid, applied in 8 to 12 gallons of water per acre with ground equipment or in 5 gallons of water per acre with a plane, has provided excellent desiccation. It is poisonous and the safety directions on the manufacturer's label should be followed strictly. It also is corrosive to equipment. Sprayers should be flushed with water and baking soda solution after each spraying. In 1960, arsenic acid was granted a 1-year extension under Public Law 518 (The Miller Amendment to the Federal Food, Drug and Cosmetic Act) and again for 1961.

A regular cotton insect control sprayer with three to five cone-type X3 or X4 nozzles per row 8 to 10 inches from the cotton; pump pressure 40 to 50 p.s.i.; 50 mesh strainer and tractor speed 3 to 5 miles per hour can be used. On cotton under 24 inches high, use three nozzles per row; over 24 inches high, five nozzles. All leaves of the plants should receive the spray. Under windy conditions, protect the operator and the machines from spray drift. It may be necessary to spray in one direction of travel only.

Cotton is ready for stripping when the leaves near the bottom of the stalk crumble in the hand

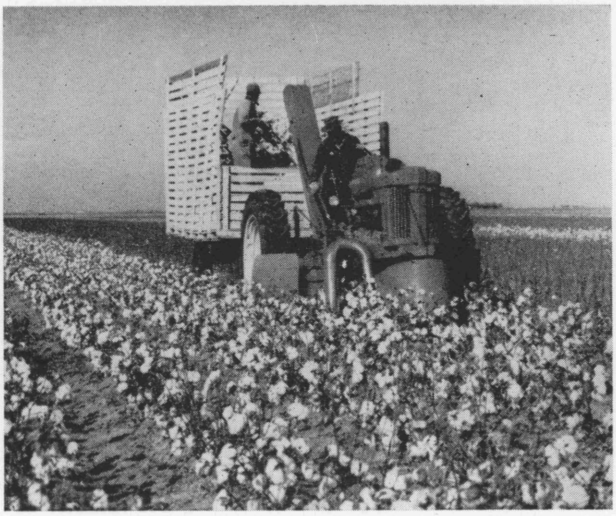


Fig. 36. Smaller size plants on upland soils can be machine stripped efficiently. Good insect control is important.

and the leaf stem breaks. Normally, this is 7 to 8 days after applying the desiccant. In the mornings, the leaves are tough and will not crumble. Higher grades come with dry harvest. It might be well to start the stripper about 11 a.m.

A second application of a desiccant is necessary if more than 4 percent of the old leaves remain green. Better grades will pay for the second treatment.

Desiccated fields should not be grazed, especially if arsenic acid was used or if the stalks are shredded. There is danger of a strong wind drifting desiccants. Arsenic acid may drift into grazing areas and endanger livestock. Home plantings, vegetables, flowers, shrubs and trees may be damaged by any desiccant.

Organic phosphorus compounds, such as Folex, DEF, De-Leaf and Fos-Fall, can be used on drouth-stressed cotton at 2 pints in 3 to 5 gallons of clear diesel oil per acre.

Conditions of cool days and nights or plants under moisture stress are unfavorable to desiccation. Additions of spreaders or activators to water-carried materials tend to help under these conditions; however, they are not satisfactory when used with desiccants in oil. Generally, 1 to 1½ pints per 100 gallons of spray solution is recommended.

Stagger the desiccant applications. The field should be desiccated at about the same rate harvest is expected. This will help avoid greening up before harvest.

Ask for Texas Extension L-145 for details on defoliants and desiccants.

HARVESTING AND QUALITY PRESERVATION

Grades obtained from mechanically harvested cottons now compare favorably with hand-harvested grades of a few years ago. This has come about through the use of better harvesting practices and improved methods of handling.

Proper Cultural Practices

A clean field at harvest time is essential. Grass and weed particles or bark from the cotton stalk cannot be removed efficiently from cotton in the gin. The crop should be laid-by on a row with a broad low profile row slightly lower in the middle than at the row. This will give trash a place to collect away from the base of the plants in the row where it will not get into the seed cotton during the harvesting process. At the last cultivation, form the row profile uniformly. The low part of the middle should be equal distance from the two rows rather than near one row or the other. This will make the harvesting machine hold the row better and result in more efficient harvesting. Follow approved cultural practices to maintain high quality with mechanical harvesting.

Recommended Moisture Level

Moisture content of the fiber is the most important single factor affecting quality during the harvesting, handling and ginning processes. For optimum results, lint moisture should be 8 percent or less at the time the crop is harvested mechanically. When harvested by hand, lint moisture should be 10 percent or less. Fiber moisture content should be determined by the use of an electrical resistance-type cotton moisture meter, of which several types are available. Any of these meters will pay good dividends in quality preservation. Cotton harvested at 8 percent moisture by machine or 10 percent by hand will contain less trash than cotton of higher moisture content. Such cotton stores safely and grades better without much machining at the gin. Both are important if high quality is to be maintained.

When an electrical resistance-type moisture meter is not available, delay harvesting until 8 or 9 a.m. or until dew has dried completely. See Texas Extension MP-297. Lint moisture begins to increase late in the afternoon as the relative humidity rises. For this reason, stop harvesting by 6 or 7 p.m., and possibly sooner, when days are shorter near the end of the season.

Cotton will arrive at the gin in good condition when these moisture guidelines are followed, the harvesting machine is adjusted properly as outlined in the Machine Operator's Manual and the

Fig. 37. A moisture meter can be used in the field to determine moisture content of seed cotton.

seed cotton is placed in a trailer large enough to permit handling without tramping.

Efficient Handling of Seed Cotton

USDA Farmers' Bulletin 1748 states that the average capacity required to hold a full bale of seed cotton is 220, 270, 325 and 440 cubic feet, respectively, for hand-picked, machine-picked, hand-snapped and machine-stripped cotton. Four-wheeled, large-capacity, wood-slatted, chicken-wire or expanded metal-sided trailers are recommended. The slatted-wood or metal-sided trailer allows much of the trash to be blown from the cotton as it is harvested with a stripper. These sides also aid circulation and help keep the cotton from heating. Hauling dry cotton in loose condition on these open-sided trailers does much to preserve quality during hauling. Blueprints and specifications for recommended trailers are available from county agricultural agents.

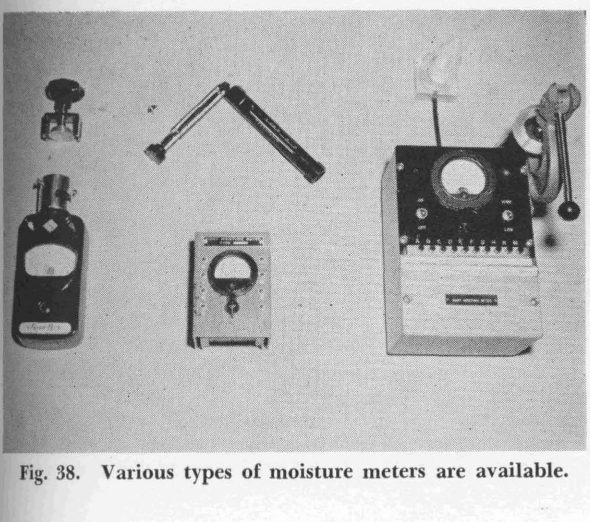


Fig. 38. Various types of moisture meters are available.

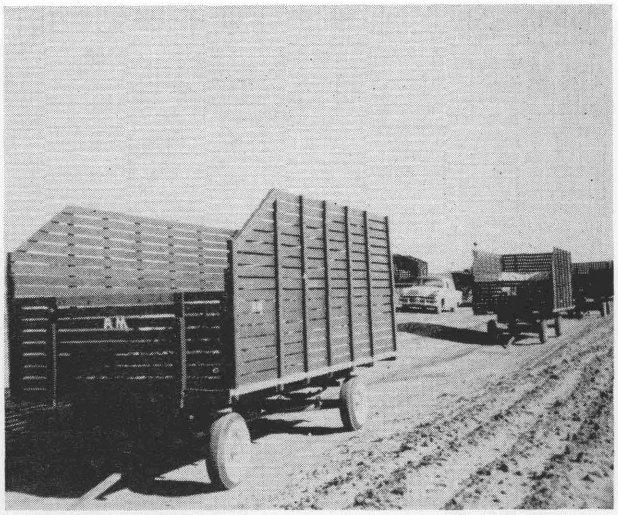


Fig. 39. Enough good cotton trailers contribute to good harvesting and good grades.

For best stripper harvesting results, make provisions for catching green and unopened bolls and keep them separate from the seed cotton. A green boll box, false end gate or catching sheet can be used for this purpose. Green, unopened cotton will lower the grade and quality of the sample when ginned and blended with good cotton because of its immature condition. Such bolls should be dried and ginned separately.

The condition of seed cotton when it reaches the gin largely determines the final quality of the lint in the bale. Therefore, cotton should be produced, harvested and handled so that it reaches the gin as dry, loose and clean as possible.

Ginning

For the best interests of all segments of the cotton industry, a Four-point Ginning Program has been developed:

1. *Use only enough drying for smooth ginning and proper cleaning.*
   a. Five to 7 percent lint moisture is best for quality preservation.
   b. Use a moisture meter on lint samples to adjust drying.
   c. Adjust burners to provide desired temperature with minimum flame fluctuation.
2. *Use only necessary seed cotton and lint-cleaning equipment.*
   a. Clean cotton requires minimum treatment.
   b. More cleaning is needed for machine-picked cotton.
   c. Additional extracting is needed for snapped and machine-stripped cotton.

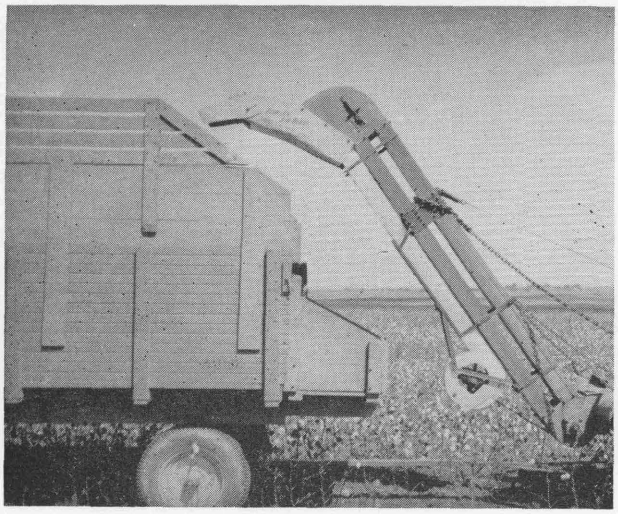


Fig. 40. A green boll box built on the front of a stripper trailer.

d. Bypasses are necessary to attain proper machinery selection.

3. *Maintain uniform flow of seed cotton through the ginning system.*
   a. To improve drying.
   b. To improve cleaning.
   c. To reduce overflow.
   d. To increase capacity.
   e. To reduce chokage.

4. *Maintain uniform loose rolls.*
   a. For smooth preparation.
   b. For better cleaning.
   c. For less fiber damage.
   d. For fewer neps.
   e. For better spinning performance.

By grouping seed cotton according to trash and moisture content, farmers can receive maximum benefits from the ginning process. Drying can be regulated properly and machinery utilized most efficiently by ginning on a group basis instead of a "first-come, first-served" basis.

Machinery in a modern cotton gin can turn out a high grade product without damage to inherent quality. Ginners are making excellent use of information gained from years of ginning research, and can turn out a sample practically "custom made."

Efficient ginning can be done with the gin machinery sequence shown in Figure 42. The first machine in the sequence is a green boll trap to remove immature, unopened bolls. The bulk uniform feed control unit which follows feeds seed cotton to the machinery of the plant at the proper continuous rate, insuring that each machine will operate at highest efficiency. The first stage of drying conditions the seed cotton in moderate temperature air for approximately 20 seconds. During this period, blending, drying and fluffing are done, and the cotton is prepared for the cleaning and extraction operations that follow. First stage cleaning serves as an opening operation in stripped cotton. A seven-cylinder cleaner is recommended for this purpose. This operation fluffs the cotton by opening the burs as they are moved over a concave screen or grid section under threshing cylinders. Leaf particles, dirt and small sticks are dropped out of the cotton at this point. Most burs are extracted in the master bur machine when the first stages of drying and cleaning have been used effectively. Green leaves and sticks generally present in stripped cotton can be removed efficiently by a green leaf and stick machine placed on the rear of the bur machine or as an independent machine at any convenient location in the overhead machinery sequence. Second stage drying exposes seed cotton to warm air for 15 to 20 seconds. Since most of the trash has been removed before this point in the ginning operation, efficient drying of the cotton fiber is possible. Temperatures in both stages of drying are regulated in combination to dry seed cotton to a moisture content range of 5 to 7 percent as it enters the gin stand. The second stage cleaner serves as a finishing cleaner in which small leaf trash, shale and stems are removed. A seven-cylinder cleaner is recommended for this purpose. The final operation of the overhead machinery is done in an extractor feeder over each gin stand. Alternate cleaning and extraction principles are incorporated into this machine to make it efficient.

Fig. 41. Growers should work with their ginner in a seed cotton grouping program. Cotton trailers can be grouped according to moisture and trash content, thus resulting in higher grades. (Courtesy Tru-Fab Metal Products Company.)

The extractor feeder apron is a convenient location to check the moisture content of seed cotton and determine the efficiency of the drying operation. By observing the condition of the cotton at this point, the effects of the complete overhead machinery sequence can be evaluated. This recommended overhead machinery sequence is composed of two stages of drying, cleaning and extraction. Principles of machinery operation used in this order give maximum overhead efficiency. The effects of over-machining can be avoided when the basic guidelines set forth here are followed.

Provided the moisture content of the cotton is 5 to 7 percent as it enters the gin stand, the stand is in proper adjustment and is operated according to factory recommendations, grades and quality generally will be preserved at a high level during the separation of the lint from the seed. Under these conditions, fiber breakage and nep formation will be minimized, the sample will have a smooth appearance and the turnout will be good.

Tandem lint cleaning generally is economical on spotted, light-spotted or low-grade cotton. Spinning quality can be maintained satisfactorily during lint cleaning when the moisture content of the cotton is maintained at the 5 to 7 percent level throughout this operation. Lint cleaner adjustment and operation is important in preserving quality, and factory recommendations should be followed closely. Lint cleaners and all of the overhead machines should be equipped with bypasses to facilitate altering this basic recommended machinery sequence to fit the cleaning needs of the cotton being ginned.

Use of Gin Wastes

Trash handling is an increasing problem at gins as a result of mechanical harvesting. In some

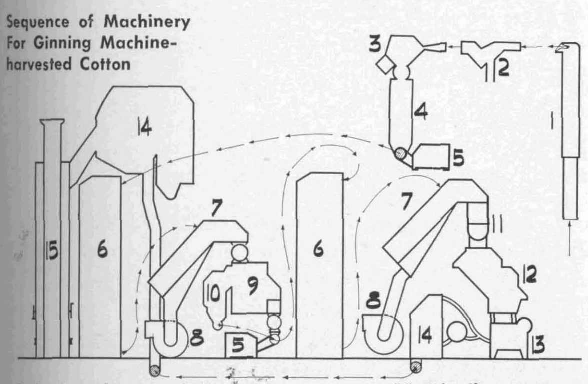


Fig. 42. Recommended sequence of gin machinery for ginning machine-harvested cotton.

cases, burs are collected in hoppers for easy loading and transfer back to the farm. Farmers are finding this profitable. Equipment now available makes it practical and efficient from the ginner's viewpoint. Plans and specifications for this equipment are available from your county agricultural agent.

CLASSIFICATION AND MARKETING

Classification of cotton is based on grade and staple. Grade is determined by color, trash content and gin preparation of the sample. Staple is the length of most of the fibers in the sample. This combination of factors has been the means of determining the value of cotton in the United States and throughout the world.

Tests have been devised to give additional fiber characteristics helpful in determining the marketing and end use values of cotton. The Suter-Webb array test was developed to determine the fiber length distribution in a sample. It shows lengths of fibers in a sample, and the numbers of fibers in each length group. By the Suter-Webb array method, fiber length distribution is determined by hand sorting the fibers into length groups which is time-consuming and tedious. The fibrograph machine was developed to do this test mechanically. The Pressley test was developed to measure the breaking strength of cotton fiber. Fineness and maturity of fibers in a sample of cotton are shown by the Micronaire and Causticaire tests. The Shirley Analyzer was developed to determine the nonlint content of a sample. Pilot spinning tests are conducted by laboratories across the Cotton Belt to give additional information on the end use value of cotton. Private and public research are underway to further improve these tests and devise others to measure cotton fiber spinning quality.

Each year, more buyers and spinners use some of these tests to supplement grade and staple information as aids in commercial marketing practices. This is particularly true of the Micronaire and the Pressley tests.

While more scientific methods for determining fiber quality and value are being developed and accepted, the guideline of proper moisture in harvesting and ginning will serve producers and ginners well in protecting quality and value. The total bale value should be the measure sought and not grade and staple alone.

ECONOMIC IMPORTANCE OF COTTON

Cotton probably will continue to be the number one cash crop on the Blackland Prairies.

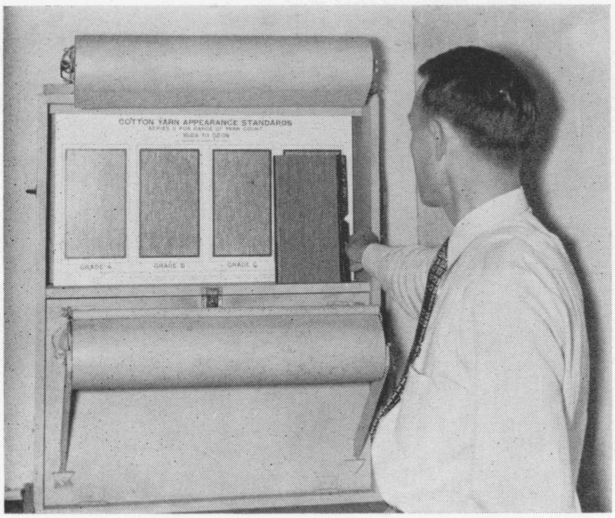


Fig. 43. This yarn, wound on a blackboard for examination, is being compared with a set of cotton yarn appearance standards to determine the yarn grade.

However, cotton acreage planted each year has been dwindling. In the 12-year period, 1948-59, the acreage planted to cotton ranged from a high of 3.7 million to a low of just over 1.4 million. The acreage planted to cotton in 1959 was approximately 1.6 million.

If cotton is to maintain its economic importance in the Blacklands, per acre yields must be increased and the per unit cost must be decreased.

The average per acre yield of cotton has fluctuated from 115 to 234 pounds during this 12-year period. The average for this period is 173 pounds of lint cotton. During 5 years out of this period yields were greater than the average, while in 7 years they were below average.

The approximate gross income from cotton has varied from a high of $267 million in 1953 to a low of $86 million in 1956. The gross income from cotton in 1959 was approximately $114.5 million. The major causes of such a wide variation were high yields and greater planted acreage. The difference between 1956 and 1959 was due mainly to higher yields since there was less acreage planted in 1959 than in 1956.

Adjustments

In 1954, 62 percent of the commercial farms in the area were classified as cotton farms and approximately 40 percent of the harvested cropland was planted to cotton. In 1959, only 43 percent of the commercial farms were classified as cotton farms and only 30 percent of the harvested cropland was planted to cotton. Three types of adjustments are taking place in the Blacklands. They include a change from cotton to other cash crops, specializing in livestock and grazing crops and off-farm employment. These adjustments and the release and reapportionment of cotton allotments make it possible for individual farmers to increase their cotton acreage. They also aid in increasing labor and machinery efficiency in cotton production.

Trends in Size of Farms

The average size farm in the Blacklands in 1940 was 144 acres; in 1959 it was 270 acres, an increase of 126 acres. Mechanization has influenced this trend. In the 1940's, many farmers changed to tractor power and found they needed to farm larger acreages to justify the expense. Additional acreage was needed in the 1950's when many farmers replaced these tractors with larger ones.

The number of hours a tractor is used greatly influences machinery costs. For example, the estimated cost to operate a four-row farm tractor (on butane) and equipment 700 hours annually with 10 years of useful life is $1.89 per hour. If the annual hour operation is increased to 1,000, the cost would be decreased to $1.59 per hour. Or, if the annual hours of operation are decreased to 500, the cost would increase to $2.29 per hour. This example underlines the importance of keeping the farm size and equipment in balance for efficient operation.

Financing Cotton Production

The problem of financing farming operations has become increasingly important in recent years. Adequate capital is available for those who have shown they are skilled in the art of farming, have the capacity to adopt improved technology and have adequate collateral. Credit should be considered in the same way as the use of fertilizer, insecticides or other items that may be used in production.

A farmer should study his credit needs. A partial budget is a good tool to use in determining the amount and type of credit that fit them.

Some sources of credit are commercial banks, Production Credit Associations, Farmers Home Administration, National Farm Loan Association, life insurance companies, commercial loan companies and individuals.

Production Costs and Returns

The cost to produce, harvest and gin an acre of cotton has increased steadily during the past 12 years. The per acre operating costs of cotton with yields of 165, 210, 375 and 500 pounds and have been estimated at each level of production. It was assumed that the potential fertility was present to produce these cotton yields. Estimated costs are:

SPECIFIED PRODUCTION COSTS PER ACRE

	Yield, lb. lint				Your farm
	165	210	375	500	
Tractor and equipment	$ 4.20	$ 4.20	$ 4.50	$ 4.50	______
Labor	9.37	9.37	9.60	9.60	______
Seed	2.13	2.13	2.13	2.13	______
Fertilizer[1]			4.95	6.90	______
Insecticides		1.85	10.60	16.35	______
Total	$15.70	$17.55	$31.78	$39.48	______

SPECIFIED HARVESTING COSTS PER ACRE

	Yield, lb. lint				Your farm
	165	210	375	500	
Desiccation	$ 2.50	$ 2.50	$ 3.50	$ 3.50	______
Harvest					
Hand (43%)	5.50	7.00	12.50	16.75	______
Strip (57%)	4.00	4.00	4.50	5.00	______
Ginning	5.80	7.37	13.16	17.55	______
Total	$17.80	$20.87	$33.66	$42.80	______
Total specified production and harvesting costs[2]	$33.50	$38.42	$65.44	$82.28	______

[1]Based on Extension L-225.
[2]Total specified operating costs do not include interest on investment in land and machinery, depreciation, taxes and insurance.

The return to land, capital and management from an acre of cotton has declined generally over the past few years, because of lower prices received per pound and gradual increases in costs of production. The return to land, capital and management from an acre of cotton by levels of production is shown in the following example:

Return per acre	Yield, lb. lint				Your farm
Lint, lb. per acre	165	210	375	500	______
Seed, lb. per acre	264	336	600	800	______
Price, lint, cents per lb.	30	30	30	30	______
Seed, dollars per cwt.	2	2	2	2	______
Income—lint	$49.50	$63.00	$112.50	$150.00	______
seed	5.28	6.72	12.00	16.00	______
Total	$54.78	$69.72	$124.50	$166.00	______
Less total specified production and harvesting costs	$33.50	$38.42	$ 65.44	$ 82.28	______
Return to land, capital and management[3]	$21.28	$31.30	$ 59.06	$ 83.72	______

[3]This example assumes an owner-operated unit. For a tenant-operated farm, the landlord's share of the income and expenses would have to be deducted.

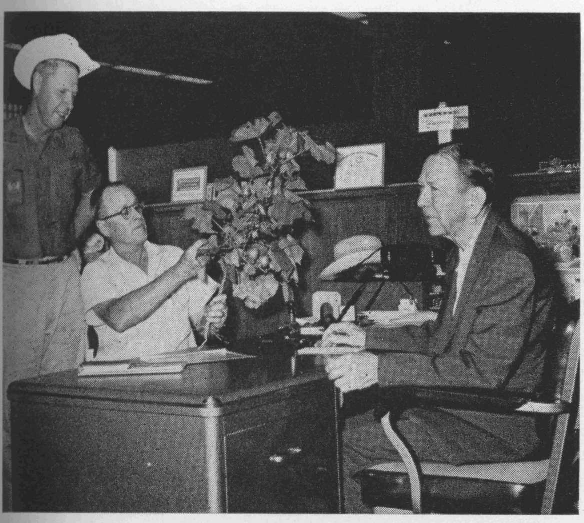


Fig. 44. The cotton producer and his financial institution hold the key to many successful management operations.

Landlord-Tenant Teamwork

A large number of Blacklands farms are operated by tenants. Tenancy in this area in 1959 was 23.3 percent.

A tenant is a person who rents land from one or more parties. This agreement may be on a cash or a share basis. Leasing arrangements take several forms.

To solve the problem of low yield, close teamwork of landlord and tenant is necessary.

RESEARCH AND EDUCATIONAL PROGRAMS

Texas agricultural experiment stations in the Blacklands are located at Temple, Denton and McGregor. The Main Station at nearby College Station contributes to the total research picture. Cooperating with the Texas Agricultural Experiment Station are U. S. Cotton Field Station at Greenville, the Blacklands Experimental Watershed at Riesel and the Cotton Insects Research Branch at Waco, field units of the U. S. Department of Agriculture.

Closely allied with requirements for cotton production know-how is the need for a continuing source of new knowledge from which those working in application and education phases can make more logical analyses to achieve a high-quality product and highest production efficiency. In

Fig. 45. Record keeping is important in the production of cotton and related enterprises.

1946, the Texas Agricultural Extension Service initiated the 7-Step Cotton Program. Now, 7-Step Cotton Committees operate in the major cotton-producing counties in Texas. This brings together people in each county who influence cotton production — the banker, county agent, vocational agriculture teacher, implement, insecticide and seed dealers, representatives of the press, radio and television, ginners, cotton growers and others.

Sufficient manpower and leadership exists in every Blacklands county to improve its conditions and to influence the programs and future of that county's progress by the work accomplished through its committee. An active committee will study the county situation, identify the major problems and agree on long-range objectives. Once this is done, a sound plan of action should be carried out. This plan should be reviewed regularly and brought up to date as the need arises. This review may point out the need for a revision of the problems and long-range objectives, depending on the progress made or changes that have occurred.

With this organized approach in each county, county agricultural agents and growers have actively carried out the 7-Step Cotton Program:

1. Fit cotton into balanced farming.
2. Take care of your soil and water.
3. Get together on the best variety.
4. Follow practical mechanization.
5. Control insects and diseases.
6. Harvest, handle and gin for high grade.
7. Sell for grade, staple and quality value.

Under this framework, the findings from more than 35 research projects and numerous growers' demonstrations have been made available to all cotton producers. Results from this program show that the cotton producer has been able to apply effectively the findings of science and technology. Dramatic improvements have taken place in the past and future progress can continue.

ACKNOWLEDGMENTS

This bulletin was prepared by a committee appointed from the Agricultural Extension Service and Agricultural Experiment Station staffs by the two directors and the dean of agriculture of the A&M College of Texas.

Fig. 46. The Williamson County 7-Step Cotton Committee at one of its regular meetings.

Fred C. Elliott, committee chairman, coordinated assembly of the manuscript, prepared the introduction and the sections on Growth and Fruiting Habits of Cotton, Weed Control, Preparation for Harvest and Research and Educational Programs; *Shelton G. Black* prepared the sections on the Blacklands as a Cotton Producing Area and Planting; *Ralph W. Baird* and *M. J. Morris* prepared the section on Cropping Systems and Soil Conservation; *John Box* wrote the sections on Fertilization and Irrigation; the chart on Rate of Water Use in Relation to Plant Development was taken from Extension B-896; *Connie F. Garner* and *Richard L. Ridgway* wrote the section on Insect Control; *Luther S. Bird* and *Harlan E. Smith* prepared the section on Disease Control; *B. G. Reeves* prepared the sections on Harvesting and Quality Preservation, and Classification and Marketing; *Cecil A. Parker* and *Tom E. Prater* prepared the section on Economic Importance of Cotton.

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