Texas Cooperative EXTENSION
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Making Replant Decisions in Cotton

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Introduction

The stand establishment period generally encounters more hazards than any other phase of cotton production. Cool temperatures, excessive moisture, hard, packing rains, wind and sand abrasion, hail and environmentally induced disease outbreaks are among the hazards that impact germination, emergence and seedling survival. Stand reductions due to these occurrences are usually beyond the control of the cotton producer, but force unwanted and difficult decisions on whether to replant damaged fields.

Unfortunately, there are no universal rules on which to base cotton replanting decisions. The "right" decision depends on the circumstances pertaining to each situation and may vary from field to field or even among areas in a given field. In making replant decisions, critical assessments should be made of the following factors: the plant stand density remaining after damage, stand uniformity (presence of skips), condition of the surviving plants, the calendar date and the costs associated with replanting.

Remaining Stand

Cotton plant population studies have been conducted in the United States for more than a century. The optimum plant density, for both optimum production and harvesting efficiency ranges from about 25 to 50,000 plants per acre, or 2 to 4 plants per row-foot in conventional 30 to 40 inch row spacings. Grower experiences and field tests have demonstrated that acceptable yields can be obtained from stands as low as 13 to 26,000 plants per acre (1 to 2 per row-foot) if the plants are uniformly spaced.

The lower limits of acceptable population densities are influenced by a number of factors including the production region and the varieties planted. In the southeastern U.S. a researcher observed good yields from fields with average, uniform spacings of 24 inches between plants, whereas one in the Texas High

Plains reported rapid declines in yields of irrigated cotton when plant populations dropped below 1.5 plants per foot, or about 20,000 plants per acre (Figure 1). In all likelihood, later maturing, more indeterminate varieties grown in the Southeast were better able to compensate for low plant densities than were the early maturing, relatively determinate varieties grown in the Texas High Plains during that time period.

When making replant decisions, the first rule is to not make the final judgment on the extent of crop damage too quickly. Cotton has a tremendous capacity to recover from adversities. Consequently, it is usually best to delay the final stand evaluation until after the crop is exposed to 2 or 3 days of good growing conditions. During this initial period, it is important to protect the crop from further damage by using timely tillage operations. Tillage of crusted fields will minimize wind and sand damage, improve aeration, and hasten warming and drying of the soil that in turn will slow development of seedling disease.

To determine after-damage plant populations, count and record the number of plants that are showing signs of recovery in a predetermined length of row (e.g. 50 feet). Periodically, dig up the plants in a 3 to 5 foot section of row and critically examine the root systems, stems and terminals to insure the plants are capable of recovery. Many times, damage from blowing sand or stem bruising from hail make decisions very difficult. Make several stand counts at random locations in the field. In addition to plant counts, make note of the number and length of skips in the rows being counted. Also, indicate the locations within the field where the counts were made. In many instances, replanting may be necessary only in certain areas of a field.

As a general rule, if 2 or more reasonably healthy plants remain per foot of row (in 30 to 40 inch row spacings) and there aren't too many long skips, the stand is likely adequate to obtain near optimum yields.

Stand Uniformity

Plant spacing uniformity is a critical consideration in replant decisions. Poor spacing uniformity (skips in the row) may cause significant yield reductions even though the average number of plants per acre is adequate for optimum production. In the Rio Grande Valley of Texas, skips which reduced plant populations 25 and 40%, respectively, in single-drilled cotton lowered yields 16.8 and 23.2%, respectively. Research in the Texas High Plains showed that skips which decreased stands by 26 and 45%, respectively, lowered yields by 13 and 26%, respectively, even though final plant densities were in excess of 2 plants per foot of row. However, that data was obtained using older varieties and the project was conducted about 20 years ago.

Yield reductions from skips depend on the frequency and length of skips. Research from California indicated that a 6-foot skip with plants on either side would result in a 13% loss of yield potential for the portion of the field with such skips. Potential yield losses increased as the length of the skips increased. Studies in Arkansas indicate that stand losses of 20 to 30 percent can occur without yield decreases if the skips are bordered by rows with adequate stands. Research in the Southeast showed that skips on adjacent rows greater than 3 feet in length are likely to result in higher yield losses than longer skips within the row. Yields tend to decline in proportion to the area without plants when skips exceeding 3 feet in length are on adjacent rows.

Crop Condition

The degree and rate of crop recovery will depend on the type and extent of damage sustained and the growing conditions following the injury. The types of crop damage can be broadly classified as acute and chronic. Damage resulting from hail events and wind and sand injury can be considered acute. Although such damage may be severe, it is usually of short duration and growing conditions are likely to return to normal in a relatively short period of time.

Damage resulting from prolonged or recurring periods of cool, wet weather possibly combined with hail or wind-sand injury can be considered chronic because it occurs and intensifies over a long period of time. Diseased or damaged plants may or may not recover, depending on how long adverse growing conditions persist.

Evaluation of acutely damaged crops can be relatively straightforward, especially if normal growing conditions prevail after injury occurs. The rate and extent of crop recovery will be largely dependent on the level of damage to the stems and leaves. Plants cut-off below the cotyledonary nodes will not survive. Likewise, those with deep stem bruises may eventually die or only partially recover. Plants that have terminals destroyed may survive if viable buds remain on the plant and the portion of the stem below these buds is intact. Likewise, plants that are essentially defoliated can survive if stem damage is minimal. Any remaining viable leaf tissue (whole leaves, portions of damaged leaves) will increase the chance for survival and hasten recovery of plants with intact stems.

Plants subjected to long periods of adverse growing conditions are often afflicted with seedling diseases that infect roots, the vascular system and leaves. During periods of cool, cloudy conditions the crop may appear relatively normal but will deteriorate rapidly when the weather turns sunny and hot. As noted earlier, the condition of the root system should be periodically checked when making stand counts in damaged fields. Use a shovel to dig up the plants; check the condition of the tap root and also inspect the stems for lesions at ground level. If the tap roots have a black water soaked appearance, the disease is still active and further damage may occur. On the other hand, if the tap root is still intact and outer covering of the root (though discolored) has hardened, chances of recovery are improved.

One should cut the stem lengthwise with a sharp knife and check for discoloration in the vascular tissues, especially if foliar disease damage is evident. Disease organisms can defoliate leaves and/or invade and eventually block the water and photosynthate conducting vessels within the plants.

If weather conditions remain marginal, count only the healthiest plants as potential survivors. With improved growing conditions, a larger percentage of plants showing signs of recovery will survive and develop into productive plants.

How well a crop recovers from weather and disease damage depends in part on the initial vigor of the seed and seedlings. Rapid, uniform emergence and good early growth indicates strong plants capable of recovery from moderate levels of stress and damage. On the other hand, a slow emerging crop is likely to have a higher mortality rate under similar adverse conditions and is more likely to sustain permanent damage that limits its yield potential. Rapid emergence and timely crop development has been related to seed quality and to heat unit accumulation during the 5-day post planting period.

Calendar Date

Optimum cotton planting periods vary by regions and take into account numerous production variables. These include maximizing the length of the growing season, matching critical growth stages with normal rainfall and temperature patterns, minimizing late season insect and disease pressures and avoiding unfavorable weather conditions during crop termination and harvest. Cut-off dates for planting cotton usually coincide with the last practical dates for planting without incurring significant reductions in yield potential.

Data obtained in the Texas High Plains in the 1960s and 1970s demonstrated that cotton planted on June 1, June 10 and June 20, yielded 7.6, 23.6 and 48.9%, respectively, less lint than cotton planted on May 15. In California, cotton planted on April 15, April 25 and May 10, yielded 4.0, 8.0 and 17.0%, respectively, less than that planted on April 1. Similar planting date-yield relationships have been established for other production regions in the U.S. Cotton Belt.

In addition to lower yield potentials, later plantings often result in reduced fiber quality, delayed harvest and increased harvesting costs. Texas High Plains research showed that micronaire, lint percentages and color grades tended to decrease as planting dates were delayed. In a Mississippi study, a 2-week delay in crop maturity extended the harvest period by 60 days, reduced yields by 23% and reduced revenues 25%.

Costs vs. Benefits of Replanting

Replanting incurs additional costs for seed, labor and machinery use. In some instances, replanting may also require additional inputs for irrigation, herbicides, insecticides and fungicides. Other considerations regarding replanting may include crop insurance coverage, farm program options and the yield-price outlook for alternative crops. Secondary factors such as benefits from rotational crops or even a fallow period may also warrant consideration in making replant decisions. With the advent of transgenic varieties, many seed companies now provide replant programs that are highly beneficial to producers in some areas. Check with your seed and technology provider representatives for available programs.

Replanting Decision

The decision to replant or save the existing crop may require integration of the best available field and research data. For example, consider a crop in the Texas High Plains that has a skippy stand which still averages 2.0 plants per foot of row. Available older research indicates that the grower could expect the existing stand to produce only 70 to 75% as much cotton as a normal stand (Table 1). If the replant decision has to be made around June 1, research results would indicate that he could expect only a 7 to 10% yield decrease due to the later planting date (Table 2). In this case, the field should be replanted. On the other hand, if the replant decision had to be made around June 15, the producer would probably be better served to keep the existing stand.

Cotton has a tremendous capacity to recover from adverse situations. After an assessment has been made of the existing crop and if there is some doubt about whether to replant, **it is usually best not to replant.**

Other Considerations

Once the decision to replant has been made, consideration should be given to optimizing the potential of the late-seeded crop. The first thing to consider will be obtaining an acceptable stand with the replanting operation. When replanting fields damaged by seedling diseases, placement of seed into the old seed drill should be avoided unless appropriate seed treatment fungicides are used.

In low rainfall areas where pre-emergence herbicides were used with the first planting, it may be necessary to push off the top of the bed to remove potentially high concentrations of the chemicals from the seed zone. In some instances, it may be necessary to use a lister type planter for replanting in order to place the seed in moist soil and place replant seed below existing herbicide residues.

Other considerations for replanting and management of a late planted crop include:

1. Selection of earlier maturing varieties for replanting if growing season will be significantly shorter.

2. Use of good quality seed and adjusting seeding rates to conditions expected during the replanting period.

3. Adjusting nitrogen levels to coincide with yield potential of a later planted crop.

4. Adjusting irrigation water usage to enhance early fruit retention and to regulate cut-out during the latter part of the growing season.

5. Protection of early set fruit from insect damage.

Crop damage evaluations and replanting decisions are never easy but all too frequently are necessary. The correct decision depends on a critical evaluation of the condition and production potential of the existing crop. When replanting is necessary, management strategies should be altered and fine-tuned to match the available growing season.

Table 1. The effects of skippy stands on cotton yields* at Lubbock, TX, 1981-1984.

Treatment	Average stand Plants/row-foot	Relative lint yield %	Yield decrease %
Normal stand	4	100	--
25% stand loss	3	87	13
50% stand loss	2	74	26

*Tests conducted using Paymaster stripper varieties (909, 266, 404).

Table 2. Yield reduction of irrigated cotton due to delayed planting at Lubbock, TX, 1960-1966.

Planting date	Relative lint yield %	Yield decrease %
May 15	100	--
June 1	93	7
June 10	76	24
June 20	51	49

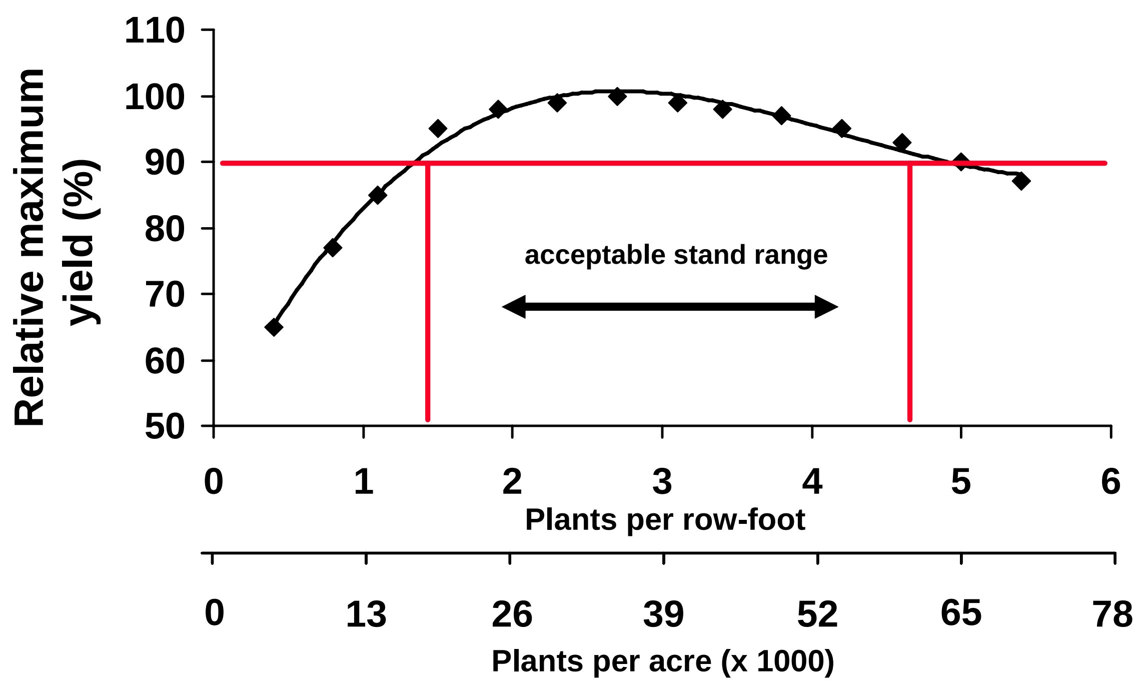

Figure 1. Yield-stand relationship for 40-inch row irrigated cotton in the Texas High Plains.

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