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MAKING REPLANT DECISIONS

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Weather and disease problems frequently contribute to cotton stand losses. When adverse conditions result in poor emergence or uneven thinning, replanting may be necessary. Decisions regarding replanting should be based on objective evaluations of the remaining stand, stand uniformity, condition of the surviving plants and the costs associated with replanting. Inadequate, skippy stands are usually the primary considerations in the replant decision. Once the decision to replant has been made, consideration must be given to fine tuning the production system to optimize productivity of late planted cotton.

Introduction

Stand establishment usually encounters more hazards than any other phase of cotton production. Cold weather, 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 such catastrophes are usually beyond the control of cotton producers and force unwanted and difficult decisions on whether or not to replant damaged crops.

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 remaining after damage, stand uniformity (skips), condition of the surviving plants, the calendar date and the costs associated with replanting.

Remaining Stand

Cotton spacing 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 25,000 to 50,000 plants per acre or 2 to 4 plants per foot of drill in conventional 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 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 cultivars used. In the Southeast, Harvey (1989a) observed good yields from fields with average, uniform spacings of 24-inches between plants whereas on the Texas High Plains, Ray (1975) reported rapid declines in yields of irrigated cotton when plant populations dropped below 1.5 plants per foot (20,000 plants per acre). In all likelihood, later maturing, more indeterminate varieties grown in the Southeast are better able to compensate for low plant densities than are the early maturing, relatively determinate varieties grown on the High Plains.

In making replant decisions, the first rule is to not make the final judgement on the extent of damage to the crop 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. In the meantime, it is important to protect the crop from further damage with timely tillage operations. Tilling 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 populations.

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 (i.e. 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. Make several stand counts at random locations in the field. In addition to plant numbers, 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 area of a field.

As a general rule, if 2 or more reasonably healthy plants remain per foot in 38 to 40 inch rows and there aren't too many long skips, the stand is adequate for optimum lint production.

Stand Uniformity

Plant spacing uniformity is a critical consideration in replant decisions. Poor spacing uniformity, or skips, may cause significant yield reductions even though the average number of plants per acre is adequate for optimum production. Heilman, et al. (1976) showed that skips which reduced plant populations 25 and 40%, respectively, in single-drilled cotton lowered yields 16.8 and 23.2% respectively, in the Rio Grande Valley of Texas. Supak and Wanjura (1988) found 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.

Yield reductions from skips depend on the frequency and length of skips. In California, Kerby et al. (1989) reported 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 (Bonner, 1989). Harvey (1989a) observed 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.

McCarty (1989) noted the effects of skips on yield vary with their length, the planting pattern (skip row vs. solid), and soil type. Surviving plants on highly productive soils are better able to compensate for skips than those being grown in field with shallow, less fertile soils. Chambers (1986) established an index based on skip length (skips 12 to 18 inches were assigned a value of 1 and the index value increased by 1 for each additional 6 inch of skip length). Generally, no yield reductions were observed until the skip index reached 40 to 60.

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 apt to return to normal in a relatively short period.

Damage resulting from prolonged or recurring periods of cold, 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 straight forward, especially if normal growing conditions prevail after the injury. 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 lost terminals 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 chances 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 attack 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. Also, cut the stem lengthwise with a sharp knife and check for discoloration in the vascular tissues, especially if foliar disease damage is evident. Wet Weather blight and possibly other disease organisms can invade and eventually plug 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, sickly crop is apt 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 (Wanjura et al., 1969) and to heat unit accumulations during the 5-day post planting period (Kerby et al., 1989).

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.

On the Texas High Plains, Bilbro and Ray (1969) 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 (Kerby et al., 1989). Similar planting date-yield relationships have been established for other production regions in the U.S. Cottonbelt (i.e. Harvey, l989b; Burch, 1989; Silvertooth, 1989).

In addition to lower yield potentials, later plantings often result in reduced fiber quality, delayed harvest and increased harvesting costs. Bilbro and Ray (1969) showed that micronaire, lint percentages and grades tended to decrease as planting dates were delayed. Parvin and Smith (1986) reported that in Mississippi, a 2-week delay in crop maturity can extend the harvest period by 60-day, lower yields 23% and reduce 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 coverages, 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.

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 on the Texas High Plains that has a skippy stand which still averages 2.0 plants per foot of row. Available 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, he'd probably be better off to save the existing stand.

Cotton has a tremendous capacity to recover from adverse situations. After an assessment has been made of the existing crop and there is some doubt about whether or not 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 productive potential of the late-seeded crop. The first order of business will be to obtain an acceptable stand with the second planting. In replanting stands damaged by seedling diseases, placement of seed into the old seed drill should be avoided unless an in-furrow fungicide is being applied.

In low rainfall areas where pre-emergence herbicides were used in conjunction 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.

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 have to be altered and fine tuned to match the available growing season.

Table 1. The effects of skippy stands on cotton yields on the Texas High Plains, 1981-1984 (Supak and Wanjura, 1988*).

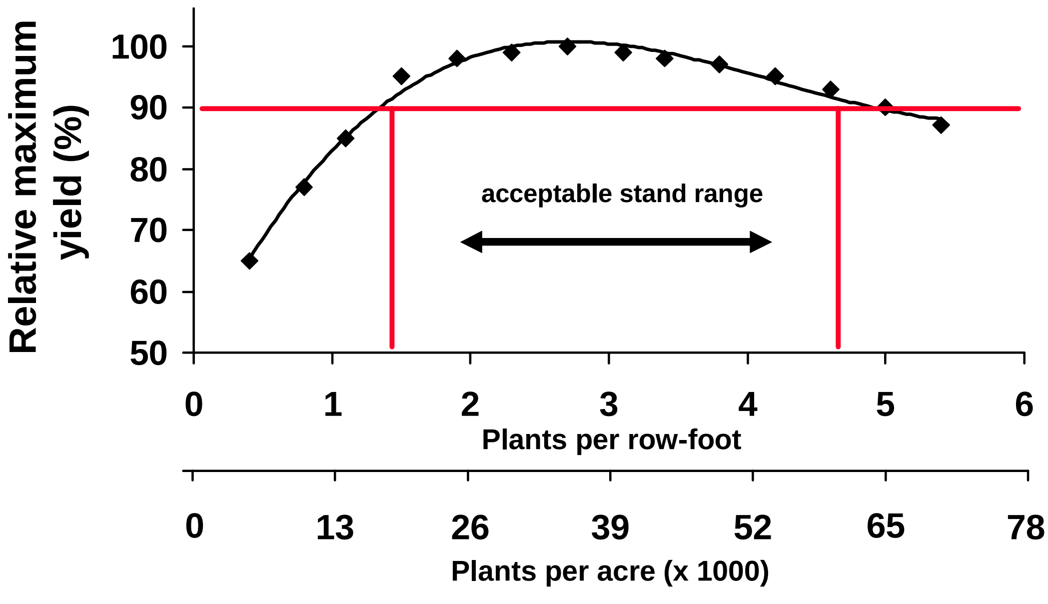
Treatment	Average stand, Plants/foot	Relative lint yield, %	Yield decrease, %
Normal stand	4	100	--
25% stand loss	3	87	13
50% stand loss	2	74	26

*Tests conducted at the Texas A&M University Research and Extension Center at Lubbock by Dr. Don Wanjura, Ag Engineer-USDA, and Dr. James Supak, Extension Agronomist – Cotton using Paymaster varieties (909, 266, 404). The study was partially funded by Cotton Incorporated.

Table 2. Yield reduction of irrigated cotton due to delayed planting Lubbock, 1960-1966 (Bilbro and Ray, 1969).

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

Figure 1. Cotton yield-stand relationship for 40-inch row irrigated cotton in the Texas High Plains (Ray, 1975).



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