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The 1995 Production Season

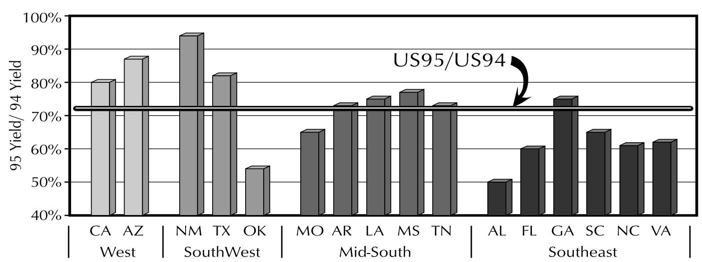
Anne F. Wrona, David S. Guthrie, Kater Hake, Tom Kerby, Ken E. Legé, Jeffrey C. Silvertooth

This overview of the 1995 production season is a compilation of information provided by extension agronomists and entomologists from across the Cotton Belt. With the exception of last year, producers can be pleased with recent trends in upland cotton yields in the United States (Figure 1).

Figure 1. U.S. upland cotton production graphed as average pounds of lint per acre.

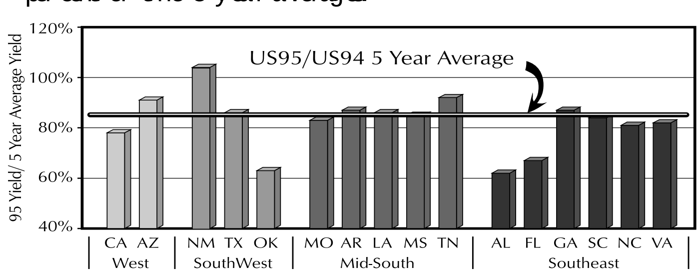
However, whereas records for yield, production and price were set in 1994, the 1995 season was disappointing (Figures 1 & 2).

Figure 2. Upland cotton yields by state for 1995 expressed as percentages of 1994 yields.



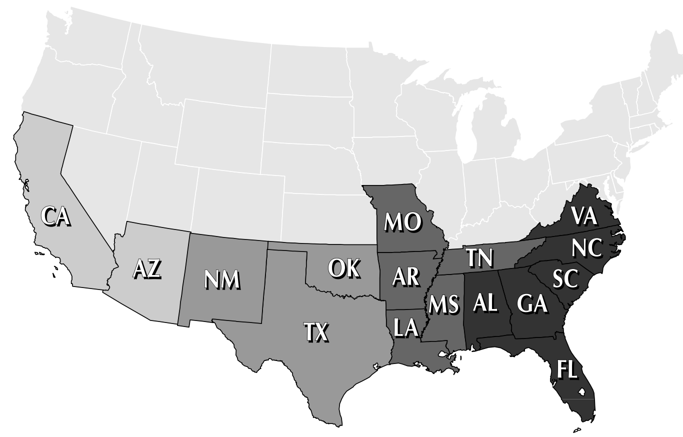
Yields for 1995 look slightly better when compared with five-year yield averages for each of the cotton producing states (Figure 3). This improvement reflects the fact that 1994 was an exceptionally good year – making 1995 appear that much worse.

Figure 3. Upland cotton yields by state for 1995 as a percent of the 5 year averages.



Although a natural inclination would be to move on and forget the pain associated with a bad season, some valuable lessons can be learned from such years. Dividing the Cotton Belt regionally (Figure 4) allows us to focus on recurring themes, largely a result of regional environmental and weather factors, to help explain last year's cotton development.

Figure 4. Map showing 4 regions of the Cotton Belt – West (CA, AZ), Southwest (NM, OK, TX), Mid-South (AR, LA, MO, MS, TN), Southeast (AL, FL, GA, NC, SC, VA).



In spite of an increase in acreage planted to cotton in all four regions, yields in terms of pounds of lint produced per acre decreased (Table 1). Production, as total bales produced, also decreased across the Belt with the exception of the Southeast where a resounding 59% increase in acreage compensated for the decreased yields also experienced in that region (Table 1).

Table 1. Acreage, production and yields for U.S. upland cotton grown in the 1995 season compared to 1994's data.

	ACREAGE		PRODUCTION		YIELDS, LBS/ACRE	
	Million Acres	Change from '94	Million Bales	Change from '94	1995	1994
Mid-South	4.7	+16 %	5.9	-14 %	593	816
Southeast	3.4	+59 %	3.8	+ 6 %	515	826
Southwest	6.1	+10%	4.7	-10 %	414	509
West	1.5	+9 %	3.1	-12%	995	1197

Regional Environmental Events

Weather and other environmental events affected this year's crop in a big way. Some regions experienced cold temperatures at planting, others before harvest. Excessive rains alternated with drought in some areas. High temperatures, humidity and insects also adversely affected this year's crop.

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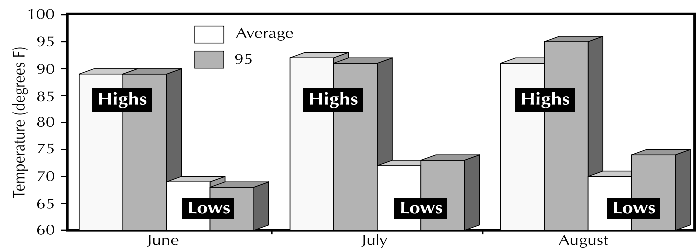
West. The Far West's abnormal start included decreased heat units and intense lygus pressure followed by extreme heat. Fields in Arizona were up to 4 weeks late. Cool temperatures along with hail, rain and accompanying disease pressure resulted in poor stand establishment. Lygus pressure reduced square retention. The poor stands, combined with low square retention and low degree day accumulation through early June, followed by extreme heat in July and high humidities and night temperatures in August, resulted in a long and difficult boll loading period. One redeeming factor was a long period of warm, dry weather in the fall.

Southwest. Feast or famine characterized the Southwest – either too much or too little moisture occurred throughout this region. Insufficient subsoil moisture in the High Plains made planting a calculated risk. Growers needed spring and summer rains to produce a crop. Starts were delayed because of drought. Other locales within this region, such as Oklahoma and the Rolling Plains, were wet. Some planting was delayed because the soil was too wet to work. Other fields had to be replanted because of poor stand establishment and reduced seedling vigor as a result of the soggy conditions. In New Mexico prolonged cool temperatures in the spring caused significant disease problems (*Rhizoctonia* and *Fusarium*). Some fields needed to be replanted. Even after emergence, a month of strong, dry winds stunted and delayed cotton on the High Plains. These situations all meant growers needed warm days into the fall. Unfortunately, the season ended abruptly in late September with cold temperatures terminating boll development in Oklahoma and West Texas.

Yet another scenario played in this region – namely intense heat from the start of the season, but no rain. Without available irrigation, these crops burned up. When a growing region already limited by moisture or heat units suffers a drought, low yields are expected. Much of South Texas suffered this fate in addition to intense pressure from a variety of insects.

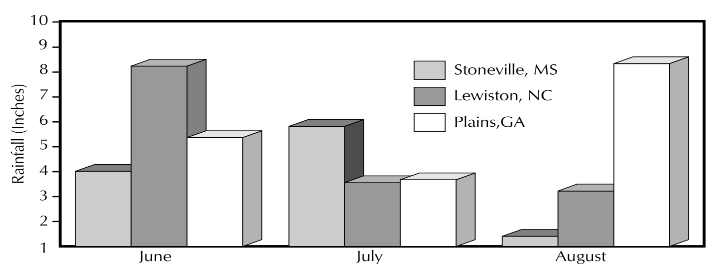
Mid-South. The Mid-South crop had a decent, if unspectacular, start. There were no major delays except some excessive water in scattered pockets. An average, perhaps somewhat dry June, meant the crop needed moisture by early bloom. Rain the week of July 4th was heaven-sent and gave the crop exactly what it needed. The crop looked great, the stage was set for success. Good-to-excellent square retention, good moisture, adequate vigor, and moderate temperatures all contributed to the health of the crop. The rain stopped in much of the southern Delta but continued sporadically to excessively in the northern Delta. By the end of July there was big talk of great yields. However, heat stress (Figure 5), drought (Figure 6, Stoneville site), and insect pressure, particularly in the southern Delta, were to undo what to this point had been a promising crop. Extreme heat in late July and August, including high nighttime temperatures (i.e. 74° instead of the 30 year average of 70°), adversely affected the crop (Figure 5). The Stoneville site shows more steady rain through June and July than the Southeast sites, but no rain to speak of to carry the crop in August (Figure 6). Both the Stoneville and Lewiston sites went 4 to 5 weeks with only 2 inches of rain. During boll loading evaporative demand can exceed as much as an inch per week, so this did not begin to meet the crop's needs at either of these locations. At peak bloom the northern Delta experienced some excessive rain and cloudy weather.

Figure 5. Maximum and minimum 1995 temperatures compared to 30 year averages for Stoneville, Mississippi.



Southeast. Untimely rainfall is clearly illustrated by this region's precipitation patterns (Figure 6). Some of the Southeast's crop experienced a delay because of drought. Ramifications of early drought included poor herbicide activation and heavy weed pressure. By the time rain came to regions such as southern Georgia, the crop had already cutout. The rains were too late to benefit boll development. Heavy, even torrential rains in parts of the Carolinas – some areas received 30" in June – leached nutrients and produced nutrient-deficient, stunted plants and premature cutout. When the rain stopped, heat set in. Subsequently, harvesting operations were hindered by frequent rainfall in much of the region. When rain was not falling, moist, damp conditions allowed only 3 to 4 hours of harvesting per day.

Figure 6. Rainfall patterns for Mid-South and Southeast regional sites in 1995.



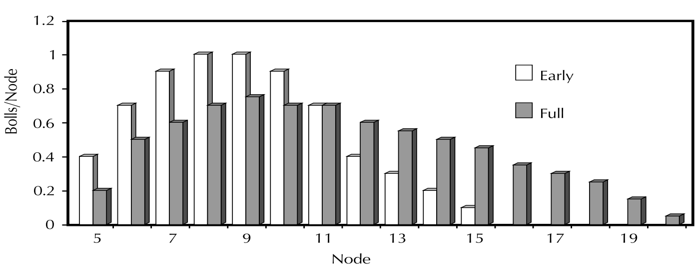
Developmental Consequences

Adverse environmental conditions experienced throughout the Belt had serious developmental consequences for the cotton crop. Factors contributing to reducing 1995 yields included extremes of heat, drought, poor prebloom vigor, low square retention, cloudy weather, decreased carbohydrate supply, poor boll retention, cold injury, incomplete boll development, reduced boll size and seed numbers. Here we will focus on a few of the developmental consequences to better understand this year's crop.

Boll maturation. Unfortunately, environmentally-induced problems with boll development recurred throughout the Cotton Belt this year and contributed to decreased yields. When mid-season drought caused problems with boll development, earlier maturing varieties had better performance than the full-season varieties. The hypothetical graph of final plant map data in Figure 7 illustrates why. The early varieties had loaded and set the majority of their fruit by node 13 when the mid-season drought occurred. (Early varieties set more bolls earlier in the season and take fewer fruiting branches to produce their lint than full-season varieties). However, the full-season varieties with longer boll loading periods never had a chance to mature bolls produced past node 13 when the drought struck. Insufficient photosynthate was produced by the full-season plants to mature late bolls. A significant portion of the crop was shed and, consequently, did not contribute to yield.

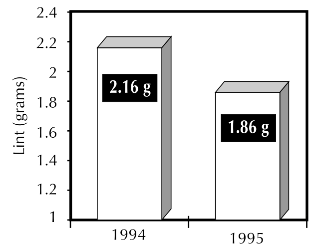
In some areas crops had a wet start, plant vigor was low, seedling disease high, stand establishment poor, so fields were replanted. Consequently, longer seasons were needed to mature the crop in these fields. The cold temperatures experienced in parts of Oklahoma and Texas in early fall stopped boll development and, again, resulted in yield loss. Just as in the previous drought scenario, early-maturing varieties outperformed full-season ones.

Figure 7. Performance, measured as bolls retained per node, of early and full-season varieties in the presence of mid-season drought.



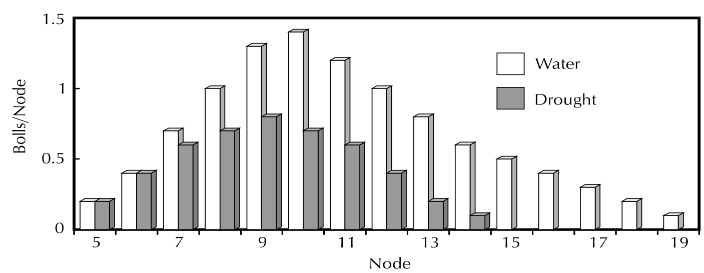
Some regions experienced extreme heat that affected the amount of lint produced per boll. High temperatures during July and August nights pitted high respiration demands against the photosynthetic gains of the day. Often there was not enough carbohydrate to adequately complete seed and fiber development and fill the bolls. For example, in one Mid-South variety, grams of lint produced per boll decreased from 1994 values (Figure 8). These data support similar grower observations. Interestingly, Mid-South cotton classing reports indicated near normal values for both staple length and micronaire. Together these data lend support to the argument that reductions in boll size stemmed from fewer seeds per boll and/or fewer lint fibers per seed.

Figure 8. Lint per boll of a Mid-South variety in 1994 versus 1995.



Square and boll retention. Drought early in the season also caused significant yield losses for growers without a source of irrigation water to supplement rainfall. Another hypothetical graph of a final plant map (Figure 9) compares the seasonal progression of well-watered (irrigated) plants with those that experienced early season drought. The water-stressed plants experiencing drought produced primarily first position fruit, but retained fewer of them, and the number of second and third position fruits were reduced as well. Reduced photosynthesis, as a result of water stress, meant these plants had reduced vigor, accelerated aging and experienced premature cutout. Overall, there were fewer fruiting nodes and less production per node. There simply were not enough carbohydrates being produced to satisfy all of the plants' needs. Many plants only had 15 or 16 nodes when normally they would have had 20. Cutout occurred at node 12 rather than at their genetic potential of 16. Decreased production per node (as a result of shed squares and bolls) and fewer fruiting branches added up to decreased yields.

Figure 9. Effect of drought on boll retention expressed as bolls per node.



Conclusions

In the 1995 season the weather was a severe test of growers' management. More than ever timeliness of planting, weed control, side-dress nitrogen applications, defoliation and harvesting made the difference between a decent crop and a poor crop. However, in spite of the best of management efforts, untimely weather patterns in many areas of the Belt made it difficult to make a decent crop.

Plans for 1996 Crop

Plant monitoring and scouting of fields are of critical importance to successful management — whether preventing economically damaging populations of insects from developing or assessing plants' needs for nutrients, water, or growth regulators so that applications can be made in a timely fashion. Sample soils for nematodes and fertility and plan accordingly. Rotate if possible. To spread risk, choose a mix of varieties adapted to your region. Irrigate to ensure prebloom vigor, boll retention and timely cutout. Manage for earliness. "Faster" varieties can help to minimize pesticide costs.

Over much of the Cotton Belt, Mother Nature is helping. The cold, severe winter should help reduce the numbers and distribution of pests like boll weevil, beet armyworms and budworm/bollworm complex. However, in some areas (i.e. the West) winter temperatures have been mild, allowing a larger population of silverleaf whiteflies to overwinter. Expanding insecticide options can be good for improving resistance management and conserving beneficial populations. Bt cotton and new crop protection products should also be a great help. Since resistance is a key issue to tobacco budworms and whitefly, follow insecticide resistance management guidelines as recommended for your area, as each region is different.

New Editor for Cotton Physiology Today

Anne Wrona has assumed responsibility for Cotton Physiology Today and other activities of the Cotton Physiology Education Program. Anne comes to the NCC from California's Imperial Valley where she was Agronomy Farm Advisor with the University of California. Anne received her Ph.D. in Plant Physiology from the University of California at Davis

Dave Guthrie has moved on to serve as Director of Technical Services for Stoneville Pedigreed Seed Company in Stoneville, Mississippi. We thank him for his service here and his continued dedication to the cotton industry. We wish him the best of success in his new endeavors.

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