UNITED STATES DEPARTMENT OF AGRICULTURE
Bureau of Agricultural Economics

CHANGES IN COTTON PRODUCTION IN WAR AND PEACE

Analysis by Production Areas

By
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CHANGES IN COTTON PRODUCTION IN WAR AND PEACE

An Analysis by Production Areas

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Introduction

Certain striking facts characterize the cotton situation. Great increases in yields are accompanied by great decreases in acreage. This combination of circumstances inevitably raises sharp questions as to future trends.

The average acreage planted to cotton in the United States in the years 1941-43 was only about one-half (52.6 percent) as large as the average of the years 1928-32, (table 1). But the production was only about 20 percent less. Yields per acre increased from an average of 174 pounds in 1928-32 to 253 pounds in 1941-43 - an increase of nearly 80 pounds or about 46 percent.

As a basis for looking forward to the production situation that might prevail in post-war years, it is desirable to examine and analyze past trends, to evaluate recent changes, and to appraise new developments which may influence the extent and location of our future cotton production. It is the purpose of this report to examine these aspects of cotton production.

Trends in Acreage

For a long time the acreage planted to cotton in this country increased steadily, from about 24 million acres in 1900 to about 36 million acres in 1918. A decrease occurred during 1919, 1920 and 1921 (fig.1). This was the period of heavy boll-weevil infestation, when an estimated reduction of more than 21 percent from a full yield was caused by weevil damage. Meanwhile the acreage in the western areas was increasing, but this increase was less rapid than the eastern decrease. Then came a sharp increase, largely through expansion in the western areas, between 1921 and 1926. Then the largest acreage of all time - 46 million acres - was planted in 1926. Following this peak, from 1926 to 1932 came a gradual decline. In 1933, the first year of AAA programs, about 40 million acres were planted. Since then, the trend has been downward. The 20.5 million acres planted in 1944 was the smallest acreage of cotton during this century.

Table 1.- Cotton acreage, production, yields per acre and reduction from full yield due to specified causes, United States, 1928-32, 1935-39 and 1941-43

Item	1928-32 average	1935-39 average	1941-43 average	Change 1941-43 average from: 1928-32 average	Change 1941-43 average from: 1935-39 average
Acreage (mil. acres) 1/	41.4	28.5	22.8	- 18.6	- 5.7
Production (mil. bales)	14.7	13.1	11.7	- 3.0	- 1.4
Reported yield, per acre (lbs.) 2/	174	225	253	+ 79	+ 28
Full yield, per acre (lbs.) 3/	288	335	371	+ 83	+ 36
Reduction from full yield per acre:					
All specified causes (lbs.) 4/	114	110	118	+ 4	+ 8
Boll weevil (lbs.)	32	25	37	+ 5	+ 12
Weather & other climatic (lbs.)	64	61	58	- 6	- 3

1/ In cultivation July 1.
2/ Per harvested acre.
3/ Full yield is a calculation of what yield might have been without damage due to specified causes.
4/ Boll weevil, other insects, deficient moisture, excessive moisture, other climatic and all other.

Trends in Yields

Cotton yields, per acre, remained at about the same level from 1900 to 1914, but the trend was downward from 1914 to 1923, largely because of heavy boll-weevil damage in the humid areas and the westward movement of cotton into low-yielding areas (fig.1). From 1924 to 1936 the trend was

COTTON: ACREAGE IN CULTIVATION JULY 1, YIELD, AND PRODUCTION, UNITED STATES, 1919-44

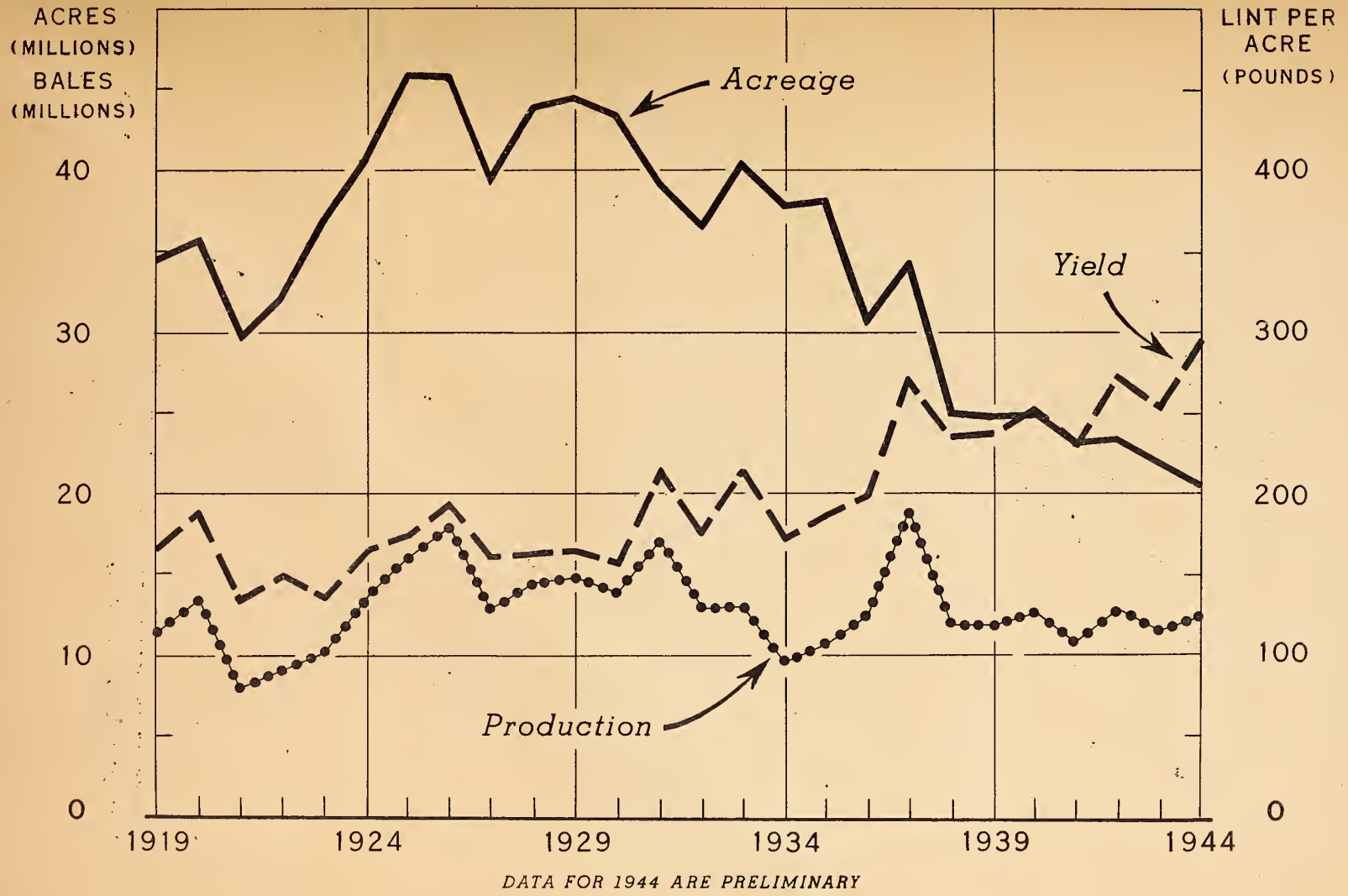

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Figure 1.- Cotton acreage was increased from 1919 to 1926 when nearly 46 million acres were planted. Since 1926 the trend has been downward. Production shows a smaller downward trend than acreage because yields have been increased considerably.

upward; boll-weevil damage was less in those years than during the previous decade (fig. 2). There was a reduction of acreage in some of the low-yielding areas, and an increase in some of the higher yielding areas was taking place. Beginning in 1937 and through 1944 the trend has been decidedly upward.

Important Factors in Recent Increases of Yield

Yields of lint cotton averaged 28 pounds more per acre during the years 1941-43 than during the period 1935-39. Data pertaining to yields in 1944 are not available by production areas. Therefore the years 1941-43 are used throughout this analysis to represent the average of recent years. The indicated national yield of 293 pounds per acre in 1944 is the highest on record. The recent average would have been considerably higher if the year 1944 had been included. Several factors are responsible for this increase.

Weather and Insects.- Weather conditions were slightly more favorable in 1941-43, when the estimated reduction from the calculated full yield because of excessive moisture, deficient moisture, and other climatic conditions was 3 pounds less than during the 1935-39 period (table 1). The estimated reduction from the calculated full yield caused by boll weevil, however, was about 12 pounds greater during 1941-43 than during the 1935-39 period, largely because of the very heavy infestation in 1941, when it is estimated that its damage reduced yields by about 15 percent. This is much above average weevil damage and was the greatest since 1926. The estimated reduction due to other insects and miscellaneous causes was slightly less during 1941-43 than during 1935-39. The net reduction from a full yield due to boll weevil, weather, and other causes was 8 pounds more during 1941-43 than during 1935-39. In other words, average yields would have been 36 pounds more instead of 28 pounds more in the years 1941-43 than in 1935-39, if weather and insect damage had been at comparable levels.

Fertilizer.- Increased application of fertilizer has increased the yields of cotton. During 1935-39, commercial fertilizer was applied on about 37 percent of the land planted to cotton, whereas 45 percent of the acreage was fertilized in the years 1941-43. The rate of application per acre when used also increased from an average of 273 pounds during 1935-39 to 297 pounds in the 1941-43 period. On a per-planted-acre basis, this is equivalent to an increase of 33 pounds. It has been estimated that, on the average for the entire country, a ton of fertilizer applied on the cotton crop will increase production 1.7 bales, which is equivalent to 0.425 pounds of lint per pound of fertilizer. 1/ The increase in the use of fertilizer has been relatively greatest in the areas where response

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1/ Parker and Lundstrom, PISAE Plant Food Memorandum No. 1, 1943.

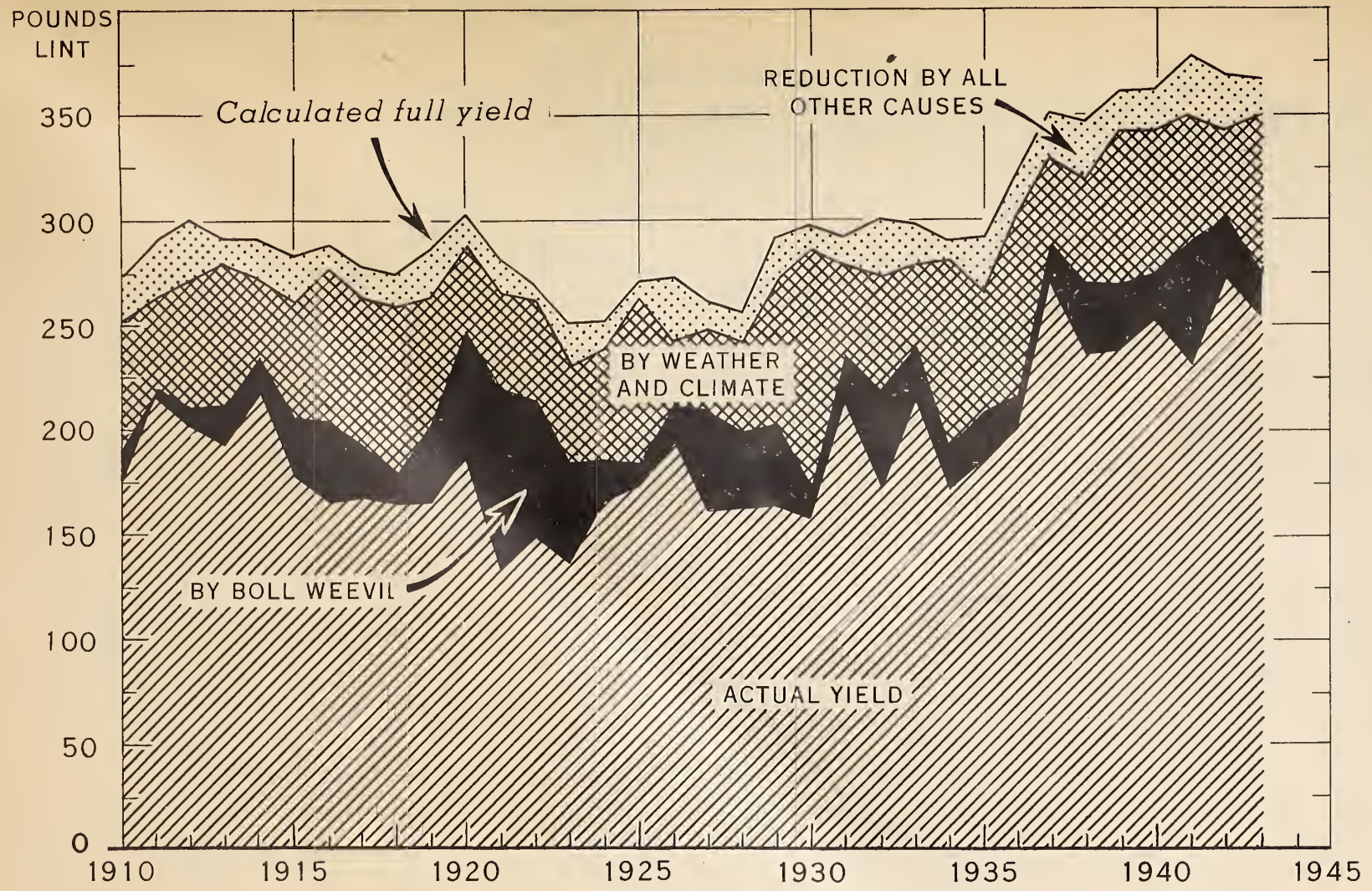


Figure 2.- The reductions from full yield due to the various causes have varied from year to year. Damage by boll weevil was greatest from 1920through 1923, from 1927 through 1929 and in 1941. Reductions due to unfavorable weather were greatest in 1918, 1925 and 1930.

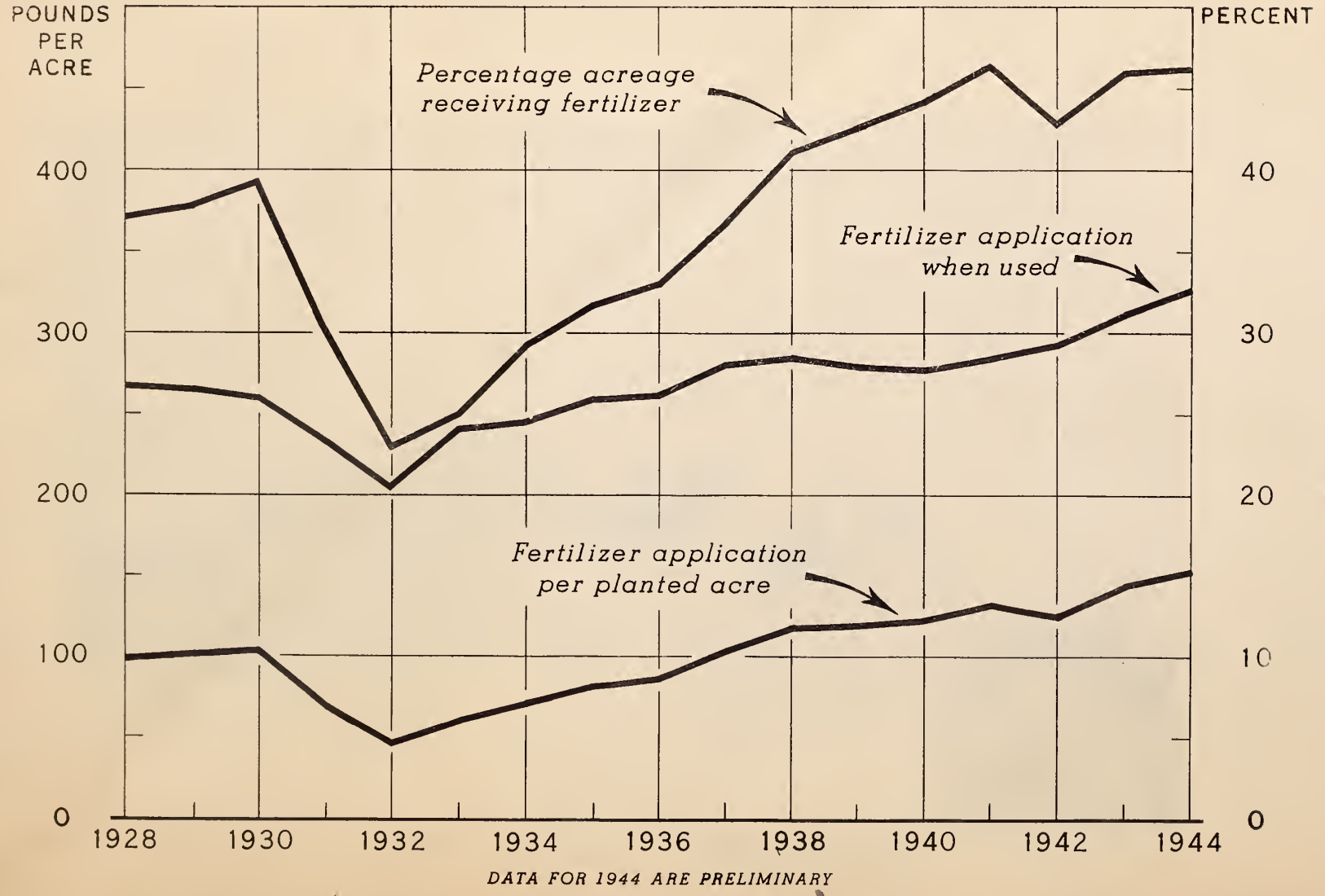


Figure 3.- Considerable increases have occurred during recent years in the quantity of fertilizer used per acre on cotton. The proportion of cotton land receiving fertilizer also has increased. This is responsible for part of the recent large increases in yields.

to fertilizer is better than average. Furthermore, the plant-food content of fertilizer has been increased in recent years. On the other hand, the response to heavier rates of application probably are not so great per pound of fertilizer as to smaller applications.

Weighing these factors, an average of 0.45 to 0.50 additional pounds of lint per pound of fertilizer appears to be reasonable. On this basis, the increase of 33 pounds per acre in the use of fertilizer may account for an increase of 15 to 17 pounds in the yield of lint per acre between the two periods.

Shift to Higher Yielding Areas.- The proportion of the total cotton acreage that is planted in the higher yielding production areas has increased. Table 2 shows the changes in acreage, yield, and production of cotton by 14 production areas that are delineated on the map shown as figure 4. These areas will be discussed separately later, but it is evident that shifts in acreage among these areas has brought changes in the national average yield per acre. For example, the acreage in the Deltas which are high-yielding areas, represented 14.4 percent in 1935-39 and 16.3 percent in 1941-43. On the other hand, the acreage in the Sandy Lands areas, which are low-yielding areas, represented 9.3 and 7.9 percent of the total acreage during 1935-39 and 1941-43 respectively. If the same percentage distribution of acreage had occurred in 1941-43 as in 1935-39, with 1941-43 area yields, the average yield per acre for the United States would have been about 9 pounds less. In other words, it appears that shift in acreage among production areas is responsible for an increase in yields of about 9 pounds per acre between the two periods.

Other Factors.- At least three other important factors contribute to increased yield per acre, but do not lend themselves to a quantitative analysis. (1) Land selection - as the acreage of cotton has decreased it is probable that the better lands within an area and within the boundries of individual farms have been planted to cotton, for this crop usually has the first choice of land on most cotton farms. (2) Better varieties of seed - there has been an increase in the proportion of the acreage planted to locally adapted varieties of seed. (3) Increased use of legumes - the acreage of both winter and summer legumes that are left on the land or turned under green has increased. AAA records indicate an average of about 5.7 million acres so used annually during the period 1936-39 and about 8.9 million acres per year in 1941-43.

The factors affecting changes in yields from 1935-39 to 1941-43 may be summarized roughly in tabular form.

Yield changes due to:	Lbs. lint per acre
Increased use of fertilizer	15
Shifting of acreage among areas	9
More favorable weather	3
Less damage by causes other than weather and boll weevil	1
Land selection, better varieties of seed, more legumes turned under, other conservation practices and other factors	12
Decrease caused by greater boll-weevil damage	- 12
Net increase 1941-43 over 1935-39	28

Yield Changes from 1928-32 - 1941-43

A similar analysis of the factors responsible for the increase in average yields per acre between 1928-32 and 1941-43 may also be summarized.

Yield changes due to:	Lbs. lint per acre
Increased use of fertilizer	25
Shifting of acreage among areas	20
More favorable weather	6
Land selection, better varieties of seed, more legumes turned under, other conservation practices and other factors	38
Decrease caused by greater boll-weevil damage	- 5
Greater reduction from causes other than weather and weevil	- 5
Net increase 1941-43 over 1928-32	79

One factor included in the 1928-32 and 1941-43 comparison was not a factor in the 1935-39 and 1941-43 comparisons - that is, the possible change in the concept of an acre. Before the AAA program began, farmers usually thought in terms of "gross acres" which did not make allowances for land occupied by ditches, turn rows, house sites, and the like. In later years they have thought in terms of "net acres" - of land that is actually growing cotton. It is difficult to place a quantitative estimate on its effect on yield. It is no doubt of some importance in some areas.

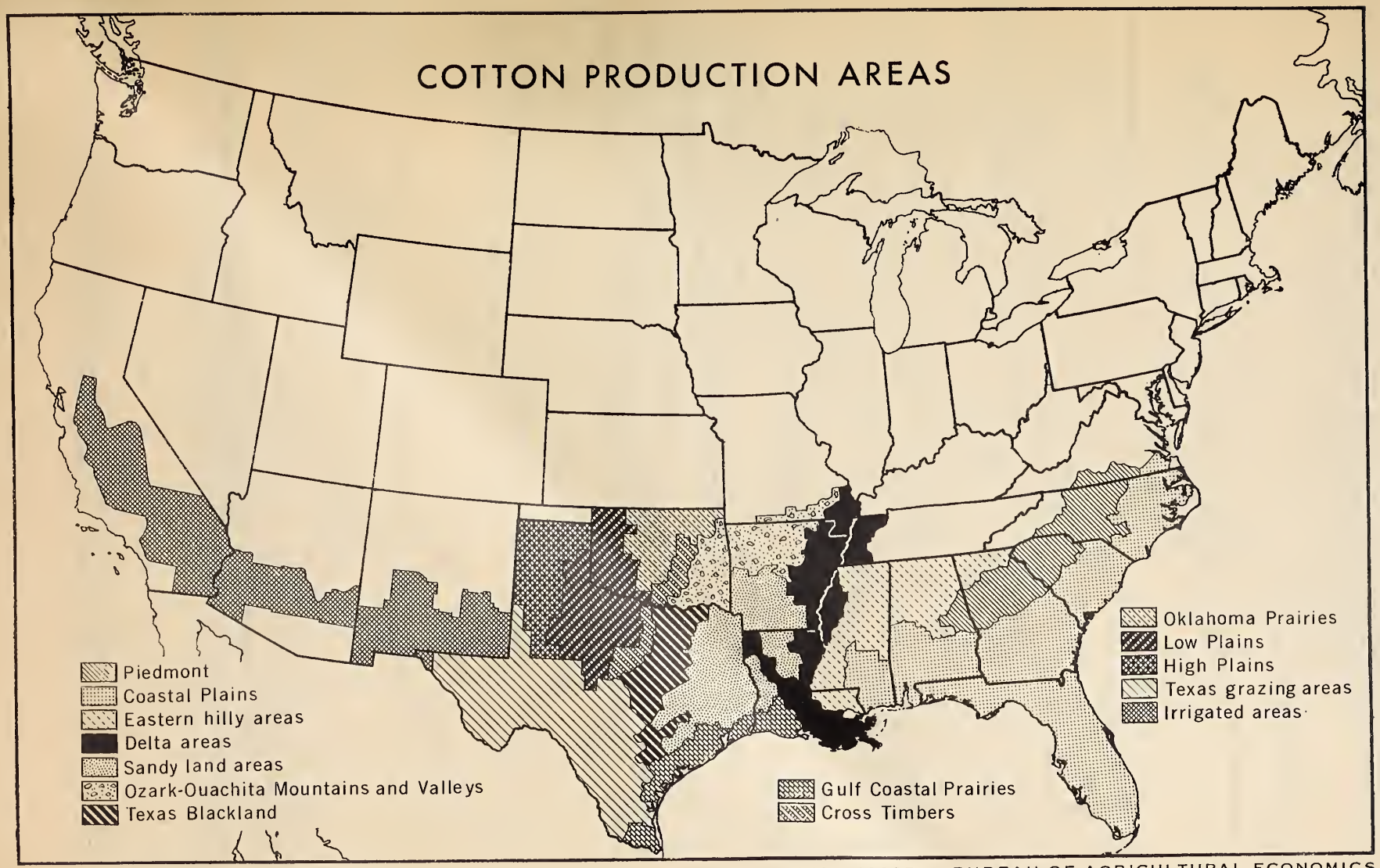
Changes by Production Areas

Although both acreage and yields for the Cotton Belt as a whole have shown rather definite trends, the changes have not been uniform as between different parts of the belt. An examination of changes by areas is therefore desirable. For this analysis the Cotton Belt has been delineated into 14 production areas, as indicated in figure 4. The land within each of these production areas is fairly homogeneous in regard to physical conditions, and the types of farming followed are rather similar.

Table 3 and figures 5, 6 and 7 show wide variation in acreage, yield and production changes among the areas. An analysis and discussion of the situation in each area follows.

Coastal Plains Areas

The trend in the acreage of cotton in the Coastal Plains areas has been downward since the advent of the boll weevil, about 1915. The acreage decreased about 25 percent between 1909 and 1923; weevil damage was greatest in the latter part of this period. Between 1924 and 1931, a period of relatively favorable prices and of less damage by boll weevil, the acreage was maintained at a fairly uniform level of about 6 million acres but following the low prices of 1931 and 1932, it dropped to about 5 million acres in 1933. Since the inauguration of the AAA programs the trend has continued slightly downward.



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COTTON ACREAGE TRENDS BY PRODUCTION AREAS, UNITED STATES, 1928-43

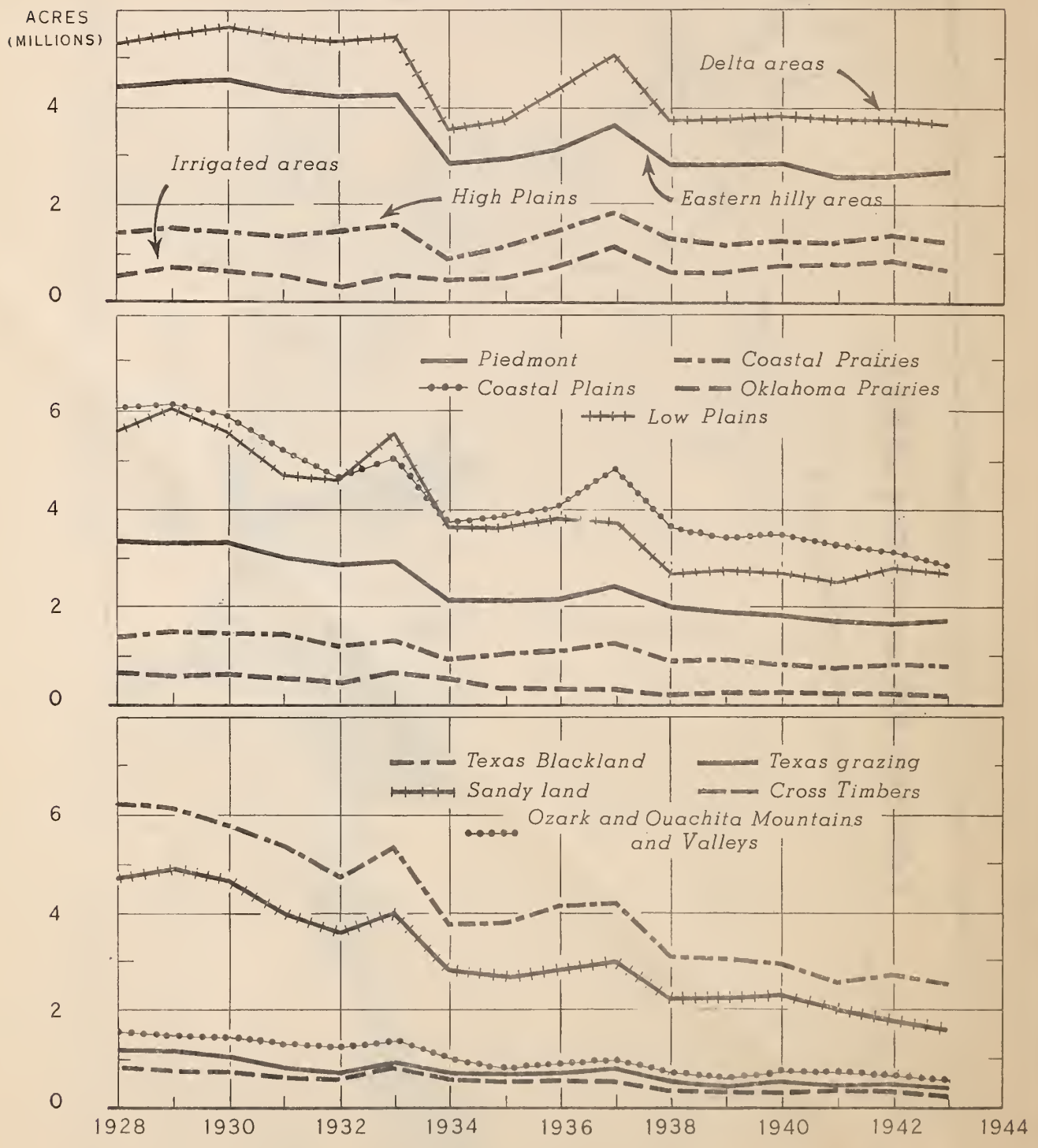

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Figure 5.- Trends in cotton acreage have been downward in all areas except the irrigated areas since the 1928-32 period. But the decrease has been much greater in some areas than in others.

COTTON PRODUCTION TRENDS BY PRODUCTION AREAS, UNITED STATES, 1928-43

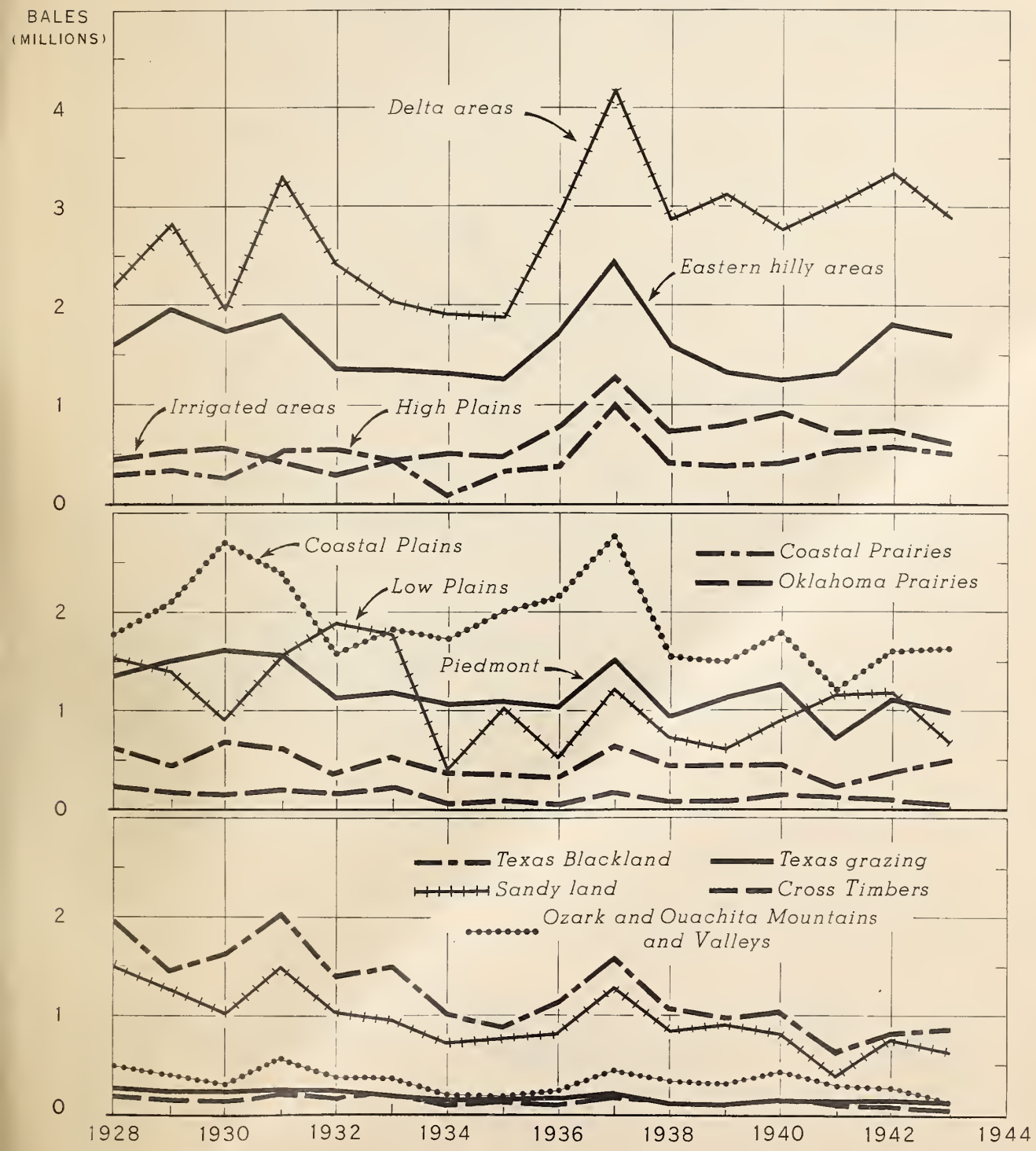

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Figure 6.- Cotton production, in most areas, has been smaller in recent years than during the 1928-32 period. Three areas, however, show an increase.

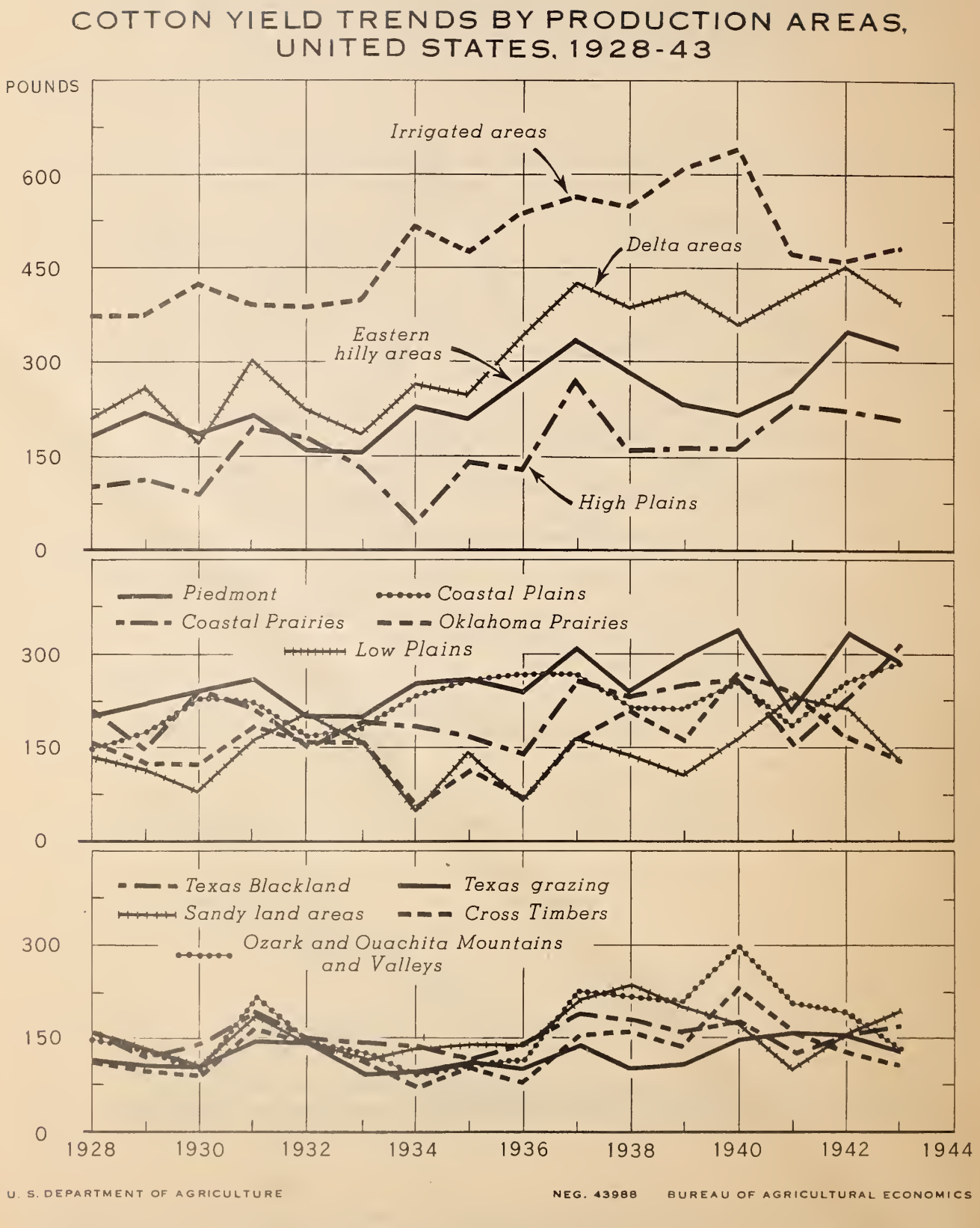

Figure 7.- Yields, per acre, have increased during recent years in most areas. But the increase has been much greater in some areas than in others.

With the decrease in cotton planted have come increased acreages of peanuts, vegetables, and feed crops; but there has been a decrease in the acreage devoted to crop production.

During the war the acreage of peanuts has increased materially and the decrease in the cotton acreage has continued. It is estimated that only about 2.8 million acres were planted to cotton in 1943 and that the a creage was still less in 1944.

The trend in yields per acre was slightly downward between 1909 and 1923, the period of heaviest boll-weevil damage, but it has been upward since 1923. The average yield in the years 1928-32 was about 190 pounds compared with 240 pounds in 1935-39 and 243 pounds in 1941-43. In much of the area farms are small, and small-scale equipment is used in growing cotton. Therefore, the man labor required to produce an acre of cotton is high in comparison with areas using larger equipment. Practically all of the land on which cotton is planted is heavily fertilized with complete commercial fertilizer.

Piedmont Areas

In general, changes in acreages and yields in the Piedmont areas have been rather similar to those in the Coastal Plains areas and have been subject to the same influences. But as there are fewer opportunities for substituting other cash crops in the Piedmont areas, the reduction in cotton acreage has resulted in a relatively greater decrease in acreage of land devoted to the production of all crops. The staple length and quality of cotton produced in the Piedmont is generally superior to that produced in the Coastal Plains.

The topography of much of these areas is rough and the soils are rather erodible. Continuous row-crop farming and leaving of the land bare during the winter have accelerated erosion. Reductions in the acreages of row crops together with increases in small grain, other close-growing crops, and winter legumes are needed to conserve the soil. These adaptions probably will mean larger farms.

During the war a considerable number of farm people have left the Piedmont areas to take other work. If they remain in these jobs the farmers who remain will have a chance to increase the size of their operations, and perhaps to become less dependent upon cotton for income.

Eastern Hilly Areas

There was a steady increase in the acreage planted to cotton in the Eastern Hilly areas, from about 3.5 million acres in 1909 to about 4.5 million acres in 1930. A slight decline occurred between 1930 and 1933. During the period 1938-42 the acreage was decreased only slightly which indicates that most farmers planted fairly close to their allotment acreages. This is accounted for partially by the fact that cash-crop alternatives are limited and partially by the tremendous increases in yields which tended to increase the competitive position

Table 2.- Proportion of the United States cotton acreage and production in various production areas for specified periods 1/

Production area	Acreage			Production		
	1928-32 average	1935-39 average	1941-43 average	1928-32 average	1935-39 average	1941-43 average
	Percent	Percent	Percent	Percent	Percent	Percent
Delta	13.2	14.4	16.3	17.4	22.8	26.5
Eastern Hilly	10.7	10.9	11.5	11.7	12.8	13.8
Coastal Plains	13.6	14.0	13.6	14.5	16.8	12.8
Low Plains	12.9	11.7	11.8	9.9	6.3	8.7
Piedmont	7.8	7.5	7.6	9.8	8.7	8.1
Texas Blackland	13.7	12.7	11.6	11.7	8.7	6.7
Irrigated	1.4	2.6	3.3	3.1	6.2	6.1
High Plains	3.6	4.9	5.5	2.7	3.8	4.7
Sandy Lands	10.6	9.3	7.9	8.7	5.6	4.6
Gulf Coastal Prairies	3.4	3.7	3.5	3.7	3.4	3.2
Ozark Ouachita Mountains and Valleys	3.4	2.9	2.8	2.9	2.2	2.2
Texas Grazing	2.5	2.4	2.2	1.5	1.2	1.2
Oklahoma Prairies	1.4	1.4	1.1	1.2	.6	.7
Cross Timbers	1.8	1.6	1.3	1.2	.9	.7

1/ Areas arrayed by their relative importance in production in the years 1941-43.

Table 3.- Acreage, yield per acre, and production of cotton by production areas, 1941-43 average as a percentage of 1928-32 and 1935-39 averages

Production area	1941-43 average as a percentage of 1928-32 average			1941-43 average as a percentage of 1935-39 average		
	Acreage	Yield	Production	Acreage	Yield	Production
	Percent	Percent	Percent	Percent	Percent	Percent
Coastal Plains	55	128	71	77	96	68
Piedmont	54	122	65	81	102	82
Eastern Hilly	59	159	94	84	114	96
Delta	68	179	121	90	115	103
Sandy Lands	41	101	42	68	84	58
Ozark Ouachita Mountains and Valleys	46	124	57	77	105	81
Texas Blackland	47	98	46	73	94	68
Gulf Coastal Prairies	57	120	68	75	111	83
Cross Timbers	39	114	45	61	110	67
Oklahoma Prairies	41	122	50	62	175	110
Low Plains	50	139	70	81	152	122
High Plains	84	153	138	91	122	110
Texas Grazing	48	125	65	72	131	94
Irrigated	127	122	155	101	86	86

of cotton. The average yield of 308 pounds obtained in these areas in 1941-43 is 60 percent higher than the 1928-32 average, and over 15 percent higher than the 1935-39 average. Perhaps the most influential factors in these increases are increased use of commercial fertilizer and legumes and the selection of the better land for cotton. The application of fertilizer is still not so heavy as in the Piedmont and Coastal Plains areas, nor has the percentage of acreage fertilized been so great. Further substantial increases in the use of fertilizer might occur which would bring further increase in yields.

In general, family-sized owner-operated farms predominate in these areas, and one-row mule equipment is the most common type used. Much of the area is hilly and so is not conducive to the maximum use of large-scale equipment.

Delta Areas

Cotton has had a decided income advantage over other crops in the Deltas of the Mississippi River and its southern tributaries for many years. Large increases in per acre yields in recent years have tended to increase this advantage. Average yields of 413 pounds, obtained in 1941-43, are nearly 80 percent higher than the 1928-32 average and nearly 15 percent above the 1935-39 average. The increase in yields has been so great that these areas have actually produced more cotton in recent years than they produced in the 1928-32 period when a considerably larger acreage was grown (fig. 6).

The trend in cotton acreage was upward from about 2.5 million acres in 1909 to nearly 5.5 million acres in 1933. When AAA allotments were in effect these farmers planted very close to their allotments. Little change in the acreage has occurred since 1934. The acreages planted in 1943 and 1944 were slightly less than in 1941, mainly because of a shortage of laborers—when more are available the cotton acreage is likely to increase materially. It is doubtful, however, that farmers in these areas would plant as large a percentage of their cropland in cotton as they did in the 1928-32 period, even without acreage restrictions. But since new land has been and is being brought into cultivation, the total acreage of cotton in these areas, under conditions favorable to cotton production, might exceed that planted in the 1928-32 period.

The Delta areas have increased in relative importance as cotton producing country. During the years 1928-32 they accounted for about 17 percent of the total production in the United States, whereas in 1941-43 they accounted for nearly 27 percent of the total.

A considerable portion of these areas is in large farms or plantations. The land is level and is well adapted to the use of tractors. The proportion of the cotton planted and cultivated with tractors has been greatly increased within the last 10 years. If the performance of the mechanical cotton picker and the flame cultivator that are now being reported upon can be realized in common practice, these implements are likely to be adopted rapidly in these areas, especially if wages are high. This would give cotton additional advantage over competing crops within the Delta areas, and perhaps over areas that are not so well adapted to mechanization.

Added expansion and an intensification of the use of commercial fertilizers and winter legumes are likely to occur and this will further increase yields per acre.

Sandy Lands Areas

Cotton acreage in the Sandy Lands areas increased rapidly between 1909 and 1925. The period of greatest expansion in this as in many other areas west of the Mississippi River coincided with a period of considerable reduction in the eastern part of the Cotton Belt. The area was overexpanded, however, and after 1925 the cotton acreage decreased about as rapidly as it had expanded. In 1933 about 4 million acres were planted in these areas--representing a decrease of about 22 percent from the peak acreage of 1925. The decline continued during the period of acreage restrictions and during World War II. In 1943, only about 1.6 million acres were planted and the acreage in 1944 is still smaller.

Farmers here have not used fertilizer to the extent that farmers have in the eastern part of the belt. In most sections of these areas the yields are much lower than they are in the Eastern Hilly areas. Yields have not increased in recent years as much as in most other areas. In fact, the average 1941-43 yields were about the same as 1928-32 average yields.

The methods of production are virtually similar to those in the eastern production areas. Preharvest labor requirements are somewhat lower because less hoe work is required on the lesser weed and grass growth. There are many small owner-operated farms that are not well adapted to mechanization because of topography. Many farm people have left to work elsewhere, and some of the cropland has been left idle; if a substantial number of them remain in off-farm jobs after the war, the acreage devoted to cotton probably will continue to decline.

Ozark Ouachita Mountains and Valleys Areas

Cotton acreage in the Ozark Ouachita Mountains and Valleys areas, particularly in the hill and mountain sections, has declined rapidly for 15 years. In fact, cotton has disappeared entirely from many hill farms. The valleys of the Arkansas and Red Rivers and their tributaries in Arkansas and Oklahoma account for a considerable part of the remaining acreage, and are responsible for the relatively high average yield. In the rougher parts of these areas, feed crops, pasture, and livestock numbers have increased. These appear to be desirable long-time adjustments.

Cotton production probably will continue as an important enterprise on the valley farms but seems likely to decline further in the hill and mountain sections.

Texas Blackland Areas

Acreages planted to cotton in the Blackland increased rapidly from 1909 to 1925 when almost 7 million acres were planted. Since 1925 the trend has been downward, and it is estimated that only about 2.6 million acres were planted in 1943. The relative importance of these Blackland areas in United States cotton production has declined materially during recent years. In the 1928-32 period they produced nearly 12 percent of the total cotton, whereas in 1941-43 they produced less than 7 percent.

Evidently, in most of these areas cotton does not give much response to commercial fertilizer and very little is used. Yields have increased less in the Blackland than in any major producing area, in fact the average yield during 1941-43 was 3 pounds less than the 1928-32 average. Continuous cropping and erosion have reduced the fertility of the soil in many parts; in other parts root rot materially reduces the yield. Acreages devoted to feed crops and pasture have been increasing, particularly on the shallow soil phases, and on the more rolling lands. Livestock numbers also have increased. In the level areas and on the deeper soils cotton yields are relatively higher, and cotton has a relatively greater advantage.

Much of the cotton acreage is worked with tractors, and labor required for chopping is considerably lower than in the eastern part of the belt. Despite these offsetting advantages the trend toward feed crops and livestock may continue unless cotton prices become more favorable in relation to livestock prices than they are at present.

Gulf Coastal Prairies Areas

In the western part of the Gulf Coastal Prairies areas cotton is the most important cash crop. About one-third of it is grown in the Corpus Christi area in Texas, (Nucces and San Patricio Counties). Farmers in the Corpus Christi area plant a larger percentage of their cropland in cotton than do farmers in any other part of the Cotton Belt. Before 1934, over 75 percent of the cropland was devoted to cotton and in 1943 nearly 50 percent was so used. Farms are rather large and cotton is planted and cultivated with tractors and picked by itinerant wage laborers. In other parts of these Coastal areas cotton is grown on the well-drained dark soils where it has an advantage over other crops under usual price relationships.

The acreage trend has been slightly downward in recent years, whereas during this war the acreages of grain sorghum and winter and early spring vegetables have increased materially.

The level topography and the fact that weed and grass growth is only moderate, particularly in the western part, are conducive to complete mechanization of cotton production. Cotton planting probably will be increased after the war if price relationships are reasonably favorable to cotton production.

Cross Timbers Areas

Cotton yields are very low in the Cross Timbers areas, particularly in the Texas portion. The soil, which was not very fertile in its virgin state, is very susceptible to erosion and has been badly depleted. The trend in acreage has been decidedly downward. In 1943 the acreage in the Texas portion was only about one-fifth as large as in 1928 and in the Oklahoma portion it was only about 40 percent of the 1928-32 average.

In parts of these areas peanuts have replaced cotton to a large extent, and this crop appears to have a considerable advantage with present price relationships. Acreage is likely to continue downward, unless cotton prices are very favorable in relation to those of other crops and to wages off the farm.

The topography of most of these areas is rough to rolling and does not lend itself well to mechanization.

Oklahoma Prairies Areas

In the Prairies areas the clay soils predominate; they are better adapted to the production of small grains than to cotton. Therefore, under past price relationships wheat has had an income advantage over cotton in most years. But within these areas, particularly in the southern part, are some sandy soils upon which cotton, under usually existing price relationships, has an income advantage over wheat. This is one of the areas in which cotton and wheat meet. The trend in acreage has been downward particularly since 1934 when drought reduced the yields per planted acre to only 59 pounds. If prices for wheat and other small grain are favorable in relation to prices for cotton a continued decline in cotton acreage may occur.

High Plains Areas

The High Plains area is characterized by large-scale, low-cost production and by coarse, short-staple cotton which is frequently low in quality.

Cotton production is highly mechanized. Only a small amount of labor is required for chopping, and the cotton is harvested by snapping the entire boll, which is largely done by itinerant wage workers. One man can handle 200 to 300 acres up to harvest time except for a little extra labor in chopping out big weeds. It is estimated that with 2-row tractor equipment cotton can be produced up to that time with about 6 man hours per acre (3 hours for preparation, planting and cultivating, and 3 hours for hoeing). The total labor required for land preparation, planting, and cultivation are 1 to 1½ hours less where 4-row equipment is used. Harvesting and hauling to the gin together requires about 15 hours when cotton is snapped by hand.

Acreage was expanded rapidly from about 1915 to 1933, and reached its peak in 1937, when about 1.9 million acres were planted. During the last 10 years, except for 1937, the acreage has been fairly uniform from year to year.

With the price relationships th t prevailed for 10 years before this war, cotton had a high income advantage over other crops. During the war years grain sorghum prices have been relatively high. This, coupled with the introduction of a high-yielding grain sorghum that can be harvested with a grain combine, has placed grain sorghum production in a more favorable position and shortage of labor also has favored the combine type of grain sorghum. Had it not been for these developments the cotton acreage in 1944 probably would have been increased over recent years.

Mechanical cotton strippers have been developed and were in limited use in 1944. It is reported that these strippers are both mechanically and economically satisfactory, and that an acre of cotton yielding 200 pounds of lint can be stripped with 2 hours of man labor. If this holds true in general practice an acre of cotton can be produced and harvested with 8 hours or less of man labor. This development may stimulate an increase in acreage in the immediate post-war period.

Low Plains Areas

Cotton production in the Low Plains is rather similar in many respects to that in the High Plains and has similar possibilities. In general, however, the land is more rolling and is not quite so well adapted to mechanization. Cotton is grown to some extent on what is locally known as "tight land", and on these soils wheat competes more favorably than on sandy lands. Weed growth is something of a hazard, as the average rainfall in part of these areas is higher than in the High Plains, therefore, more labor is usually required for chopping.

The acreage planted to cotton has decreased relatively more since the years 1928-32 than in the High Plains. Yields during the last few years have averaged considerably above 1928-32 yields, largely because of above-average rainfall and better land selection.

Advantages accruing to the High Plains from the development of a successful and economical stripper will be shared by most parts of the Low Plains areas. The acreage is likely to increase over the present if the price relationship between cotton and grain sorghums is favorable to cotton.

Texas Grazing Areas

The grazing of cattle, sheep, and goats is the predominating enterprise in the Trans-Pesos, the Edwards Plateau, and the Rio Grande Plains areas of Texas, but some crop farming is scattered throughout these areas. In 1928 and 1929, years of relatively high prices for cotton, about 1.2 million acres were planted to this crop. The acreage trend in general, however, has been decidedly downward, particularly during the last 5 years when an average of about 0.5 million acres have been planted annually.

In some sections within these areas cotton is produced under irrigation; and increased acreage in these sections, along with favorable

weather, may account for the increases in yields. Under dry-farming conditions yields are variable and on the average are very low, being only 134 pounds in 1928-32 when rainfall averaged above normal. Extensive methods of production are used.

Grain sorghums and other feed crops have tended to replace cotton during the last few years. If favorable feed prices in relation to cotton prices prevail, the reduction in cotton acreage may continue, with the result that cotton will be produced only in the most favorably situated areas. The acreage of irrigated cotton may increase.

Irrigated Areas

A major portion of the cotton in California, Arizona and New Mexico and in El Paso County, Texas, is grown under irrigation; in this report all in these areas is considered as irrigated cotton.

The acreage in these areas has increased rapidly since 1910, when only about 275,000 acres were planted to cotton. About 1,125,000 acres, the largest acreage on record, were planted in 1937. Since then the acreage has been decreased and averaged about 750,000 acres during 1941-43. The acreage of vegetables and alfalfa have increased during this war largely because of relatively favorable prices for these commodities. Mainly in response to the program of the War Food Administration the acreage of American-Egyptian cotton was increased materially in 1942 and 1943 when an average of about 165,000 acres were planted. When it became apparent that the need for domestically produced cotton of this kind was not urgently needed the acreage in 1944 was reduced to about 14,000 acres.

Yields also have increased materially - from an average of 390 pounds per acre in 1928-32 to an average of 474 pounds per acre in 1941-43. This increase is due in large part to better irrigation methods. Other causes are the adoption of varieties better adapted to irrigation and a shift of the acreage into sections within these areas that are better adapted to cotton production.

The irrigated areas probably have expanded cotton acreage to near the limit of land and water resources and of profitable competition with other crops. Therefore, cotton acreage in these areas may remain at about the levels of recent years unless new land is brought in or unless the relationships between the prices for cotton and the prices for competing crops change materially.

Variations within Production Areas

This discussion has been primarily in terms of rather large areas within which the resources used in cotton production, as well as the problems involved, are fairly homogeneous. The more important differences in the changes in cotton production among these areas have been mentioned. An analysis involving smaller areas might show other variations within each of the production areas discussed in this report. It should be emphasized that even though they are not brought out in this comparison,

important differences do exist among farms and localities within each of these broad areas. Furthermore, only the major changes have been discussed. Data showing year-to-year changes in acreage, yield, and production of cotton by production areas are presented in supplementary tables 7, 8, and 9. Data pertaining to the application of fertilizer, by States and by years, are shown in table 10.

Post-war Implications of Recent and Impending Changes

Some of the adjustments made during this war, and some of the factors that were influencing cotton production before the war will continue in effect in the post-war years.

Yield Prospects

Higher yields are here to stay. Yields per acre have increased in nearly all production areas during recent years, but the extent of increase has varied considerably among them. A small part of the increase for the Cotton Belt as a whole can be attributed to more favorable weather but, as previously indicated, a large part of it must be attributed to other causes.

The rather sharp recent increase in yields resulting from successively larger applications of fertilizer per acre may not continue at the same rapid rate, but in most production areas, where the land responds to fertilizer, experimental data indicate that, under most farm conditions, the point of diminishing financial returns has not been reached - even with prices for cotton and cottonseed considerably lower than at present. A continued expansion of the use of winter legumes also is likely, and this practice will tend to increase yields.

Some very important results have been obtained from the development of better variations and strains of planting seed - seed which produces heavier fruiting and plants that mature more quickly, thus lessening the damage done by boll weevil. Increasing attention is being given by plant breeders to the selection and development of strains adapted to local conditions. The increase in the use of the better proven varieties, as well as the breeding and selection of new and higher yielding varieties, is likely to be accelerated. Intensification of boll-weevil control can be expected and techniques improved in accomplishing this task.

All of these developments will tend to increase the yields, so it seems reasonable to expect that with average weather, yields in the post-war years will be considerably above the recent high yields, unless there are significant shifts from higher-yielding to lower-yielding areas.

Cotton and Alternative Crops

Several factors have contributed to a decrease in the acreage devoted to cotton during the war. Perhaps the two most important are: (1) The decrease in the supply of farm laborers and the attendant high wages and (2) The increase in the acreage of other crops. Prices for

peanuts during the war have been sufficiently attractive for this crop to compete favorably with cotton for the use of land and labor in many areas. Grain sorghums and wheat have competed favorably in some other areas, and vegetables in still other areas. All this naturally brought a decrease in the acreage of cotton. Feed crops have been increased at the expense of cotton in some areas, not necessarily because this meant higher net returns per acre, but because a given labor force could handle a larger acreage, resulting in a greater total net farm income.

Will these factors continue to affect the size of the cotton crop after the war? It seems reasonably safe to assume that more laborers will then be available for farm work. Will war workers from the farms return to the same areas they left? In general, people will return to less remunerative farm jobs only if better paying jobs off the farms are not available. Some who return to farming will try to go to the areas that have the best possibilities. If off-farm work is not available and the better farming areas are already fully occupied some will return to the poorer farming areas.

Will as much land in the Cotton Belt be used after the war for the production of cash crops other than cotton as has been used during the war? Indications point toward reduction in some of these crops, but higher levels will be maintained under prosperity conditions than if depression conditions prevail.

In recent years and particularly during the war there has been considerable industrial development in the South. If this can be accelerated it will provide work for farm people who are not needed in cotton production and will furnish an expanded market outlet for locally produced milk, eggs, meat, fruits, and vegetables.

Maintenance and improvement of soil fertility in the South needs much more attention. Systems of farming that have less row crops but more small grains, other close-growing crops, and winter cover crops should be adopted in many areas in the Cotton Belt. The adoption of systems of farming that will bring soil improvement and that will provide additional quantities of fruits, vegetables, and livestock products to meet expanded local markets would require a reduction in the cotton acreage in some areas compared with the acreage grown in the years that immediately preceded this war.

Mechanization of Cotton Production

Little change in the type of machinery used in producing and harvesting cotton has taken place during the last 40 years, except for the increased use of tractor power for land preparation and cultivation. Increased use of larger power units has brought a reduction of man-labor requirements in land preparation, planting, and cultivation, but it has had little or no effect on the peak labor operations -- chopping and picking. To some extent the continuance of these labor peaks has limited or retarded the adoption of tractor power in cotton production. The only significant exception is found in some of the subhumid areas where the work is minimized because of the relatively small infestations of

weeds: and where the harvesting, although still performed by hand, has been speeded up materially by snapping the entire boll instead of picking the lint. Separation of burrs from the lint is a pre-ginning operation performed mechanically at the gin; it has been limited to the subhumid areas where short and rather coarse-fibered cotton is produced and where all the cotton bolls open at about the same time.

Engineers for many years have attempted to develop a machine that would harvest cotton. Two types of harvesters are now in limited use. Many think that each of these types of machines will harvest cotton successfully and economically. One is a stripper type which removes the entire boll from the plant and is designed for use in areas where snapping is practicable. The other is a mechanical picker which picks the lint from the boll, leaving the burrs on the stalk.

The flame cultivator, a machine designed to reduce or eliminate hoe work in cotton, though still in the experimental stage, is being used to a limited extent. Other types of mechanized cotton choppers are being experimented with. Cross cultivation to reduce hoe work is being practiced in some areas.

These machines may or may not be improved to the stage at which they will be ready for widespread use. Nevertheless, some appraisal should be made of their possible effects on cotton production. If their performance in general farm use proves as successful and economical as recent reports would indicate, they are likely to affect cotton production much as the adoption of the more recent machine methods affected wheat growing.

The following discussion and tables 4 and 5 should be considered only as rough approximations of probable results from use of these machines. As soon as more information becomes available a more accurate appraisal should be made. (The Bureau of Agricultural Economics is cooperating with several State Experiment Stations in obtaining information on performance and costs of operating mechanical pickers and strippers.)

When they are mechanically satisfactory, one-row units of these machines could be expected to cover 6 to 8 acres per day. Two-row units could cover 10 to 15 acres per day. Using these assumptions and estimated labor requirements for pre-harvest operations, estimates of man-labor needs for producing cotton with different sizes of equipment and harvesting methods have been calculated and are given in tables 4 and 5.

These estimates indicate large reduction in man-labor requirements with the use of these machines. On the basis of these assumptions, total man-labor requirements in the High Plains areas would be only about one-third as great with the use of a two-row stripper as with hand snapping. In the Delta areas the percentage reduction would be even greater. With the use of a one-row mechanical picker and a two-row flame cultivator, the estimated man-labor requirements would be less than one-fifth as great as when one-row mule equipment was used and the picking was performed by hand.

Table 4.- Estimated man labor needed per acre to produce cotton with different types of power and equipment and various methods of harvesting, in specified production areas

Production area	Type of equipment	Method of harvesting	Prepare seed bed and plant	Cultivate	Chop and hoe	Total pre-harvest	Pick or snap	Total all operations 1/
			Hours	Hours	Hours	Hours	Hours	Hours
High Plains	2-row tractor	Snapped by hand	1.2	1.4	3.0	5.6	17.0	22.6
High Plains	4-row tractor	Snapped by hand	.7	.7	3.0	4.4	17.0	21.4
High Plains 2/	4-row tractor	2-row mechanical stripper	.7	.7	3.0	4.4	2.0	6.4
Blackland	2-row tractor	Picked by hand	2.4	2.6	10.0	15.0	30.0	45.0
Sandy Lands	1-row mule	Picked by hand	14.0	10.0	20.0	44.0	30.0	74.0
Delta	1-row mule	Picked by hand	10.0	13.0	33.0	56.0	85.0	141.0
Delta	4-row tractor	Picked by hand	5.0	4.0	33.0	42.0	85.0	127.0
Delta 2/	4-row tractor	1-row mechanical picker	5.0	4.0	33.0	42.0	4.0	46.0
Delta	4-row tractor and flame cultivator	1-row mechanical picker	5.0	3.0	3/ 13.0	21.0	4.0	25.0
Coastal Plains	½-row mule	Picked by hand	15.0	21.0	35.0	71.0	50.0	121.0
Coastal Plains	1-row mule	Picked by hand	12.0	12.0	35.0	59.0	50.0	109.0

1/ Does not include hauling to gin.

2/ It should not be inferred that tractors, mechanical harvesters and flame cultivators can or will be used only in the High Plains and Delta areas. These areas are used to illustrate the effect of these machines on labor needs. They may be among the first areas in which these machines are adopted.

3/ Four times over with a 2-row flame cultivator, 3 hours per acre, plus 10 hours hand chopping. Labor needed has been based on yield per acre as follows: High Plains, 200 pounds; Blackland, 150 pounds; Sandy Lands, 150 pounds; Delta, 425 pounds; Coastal Plains, 250 pounds. These yields very closely approximate averages obtained during recent years.

Table 5.- Estimated man labor needed, per bale, to produce cotton with different types of power and equipment and with various methods of harvesting, in specified production areas

Production area	Type of equipment	Method of harvesting	Total man labor, all operations 1/
			Hours
High Plains	2-row tractor	Snapped by hand	54
High Plains	4-row tractor	Snapped by hand	51
High Plains 2/	4-row tractor	2-row mechanical stripper	15
Blackland	2-row tractor	Picked by hand	143
Sandy Lands	1-row mule	Picked by hand	235
Delta	1-row mule	Picked by hand	160
Delta	4-row tractor	Picked by hand	143
Delta 2/	4-row tractor	1-row mechanical picker	52
Delta	4-row tractor and flame cultivator	1-row mechanical picker	3/ 28
Coastal Plains	½-row mule	Picked by hand	230
Coastal Plains	1-row mule	Picked by hand	208

See footnotes to table 4.

Although specific production areas are used in tables 4 and 5 to illustrate the effect of these machines on the labor needed to produce cotton, it should not be inferred that the High Plains and Delta areas are the only areas in which mechanical equipment can or will be used. But they may be among the first to adopt the new machines. In general, the areas in which the land is relatively level and the farms are large will be the first in which mechanization will be increased.

Two Ways of Reducing Costs

There are two important ways in which production practices may affect the cost of producing cotton in relation to the value of the product. One is mechanization which reduces the labor required to produce cotton. The other is by increasing the yields per acre - often at the same time improving the quality of the product. Both of these factors are likely to be in operation in the post-war years. In general, the production areas and farms which have the greatest advantage in one or both of these developments are likely to maintain favorable competitive positions in cotton production. This is true in regard to their relation to other areas and farms in this country and in their relation to foreign production.

COTTON ACREAGE TRENDS IN SPECIFIED PRODUCTION AREAS, 1909, 1919, AND 1923-27

INDEX NUMBERS (1928-32=100)

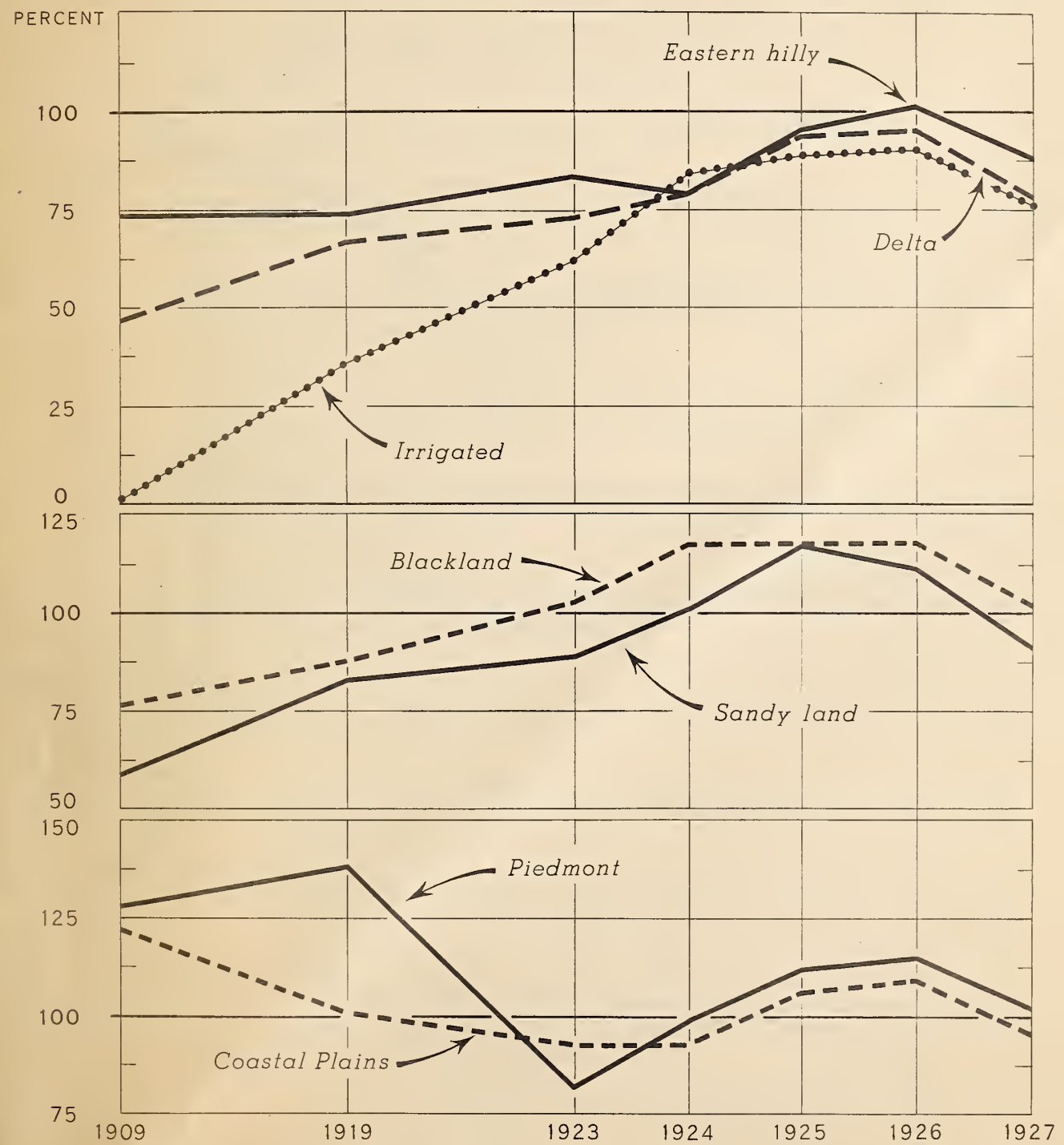

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Figure 8.- The acreage of cotton in all areas except the Piedmont and Coastal Plains was smaller in 1909 and 1919 than during the period 1928-32. Between 1919 and 1926 the trend in all areas was upward.

COTTON YIELD TRENDS IN SPECIFIED PRODUCTION AREAS, 1909, 1919, AND 1923-27

INDEX NUMBERS (1928-32=100)

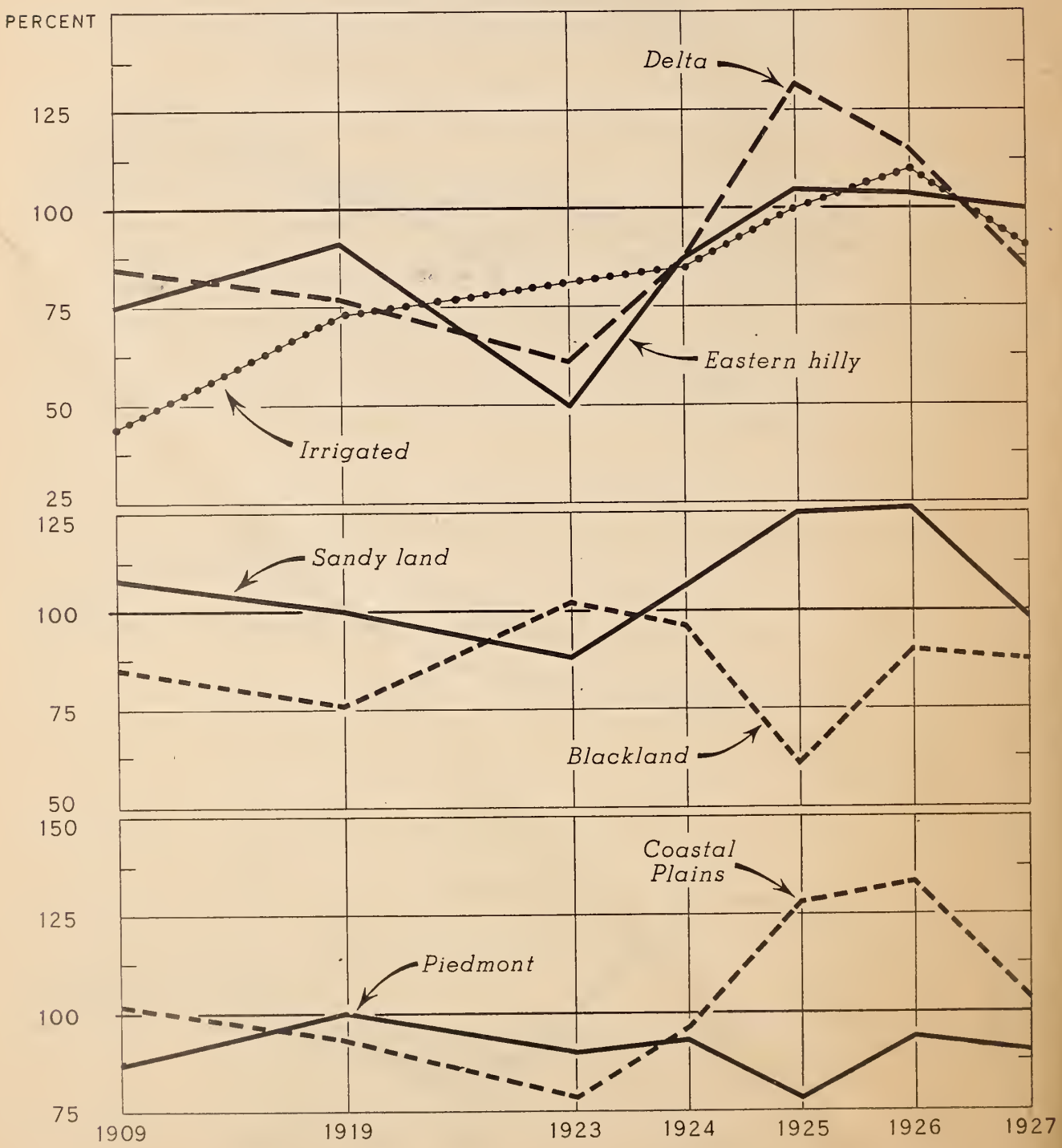

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Figure 9.- In general, average yields during the 1928-32 period were higher than yields in earlier years--1926 was an exception when high yields prevailed in most areas.

Table 6.- Acreage of cotton as a percentage of 1928-32 average, by production areas, 1928-43

Year	Coastal Plains	Piedmont	Eastern Hilly	Delta	Sandy Lands	Gulf Coastal Prairie	Ozark Ouachita Mts.	Texas Blackland	Cross Timbers	Okla. Prairie	Texas Grazing	High Plains	Low Plains	Irrigated
	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
Average:														
1928-32	100	100	100	100	100	100	100	100	100	100	100	100	100	100
1935-39	71	66	70	76	60	76	59	64	64	66	67	93	62	126
1941-43	55	54	59	68	41	57	46	47	39	41	48	84	50	127
1928	108	106	100	97	108	104	108	110	114	117	117	99	106	104
1929	109	106	102	100	111	106	104	108	107	111	115	101	113	123
1930	106	104	104	104	107	102	103	102	106	108	106	101	105	113
1931	94	95	98	99	91	103	94	95	92	87	87	94	89	94
1932	84	89	96	99	83	85	91	84	81	77	75	103	86	66
1933	90	93	97	100	93	96	99	95	112	112	96	108	104	94
1934	67	66	65	66	63	70	71	66	84	88	70	64	69	84
1935	69	66	67	69	62	75	58	67	71	59	71	76	68	86
1936	73	68	71	79	67	80	66	72	76	59	77	99	71	125
1937	87	77	83	92	69	91	70	74	78	55	80	125	71	193
1938	65	62	65	68	51	70	51	54	49	34	54	87	51	117
1939	62	59	70	70	51	64	52	53	46	41	46	80	52	111
1940	63	59	65	70	53	62	52	52	47	47	52	87	51	123
1941	59	55	58	69	45	56	51	46	43	43	49	81	48	132
1942	56	53	59	68	41	59	49	48	43	47	52	89	53	139
1943	51	53	60	67	37	56	38	46	32	47	44	84	51	111

Table 7.- Production of cotton as a percentage of 1928-32 average by production areas, 1928-43

Year	Coastal Plains	Piedmont	Eastern Hilly	Delta	Sandy Lands	Gulf Coastal Prairie	Ozark Ouachita Mts.	Texas Blackland	Cross Timbers	Okla. Prairie	Texas Grazing	High Plains	Low Plains	Irrigated
	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
Average:														
1928-32	100	100	100	100	100	100	100	100	100	100	100	100	100	100
1935-39	95	80	98	118	58	82	70	67	67	46	69	125	55	179
1941-43	71	65	94	121	42	68	57	46	45	50	65	138	68	155
1928	84	94	94	87	119	112	108	115	106	126	119	73	102	96
1929	100	105	115	111	100	82	94	86	87	94	106	86	93	118
1930	128	112	101	77	81	126	71	96	83	90	103	69	59	123
1931	112	110	110	130	118	113	138	120	126	109	116	136	103	95
1932	75	79	80	95	82	67	89	83	99	83	97	138	126	65
1933	86	83	79	80	75	95	86	90	107	121	83	110	119	97
1934	83	74	77	75	58	67	45	60	52	35	63	22	26	111
1935	95	76	74	74	61	65	43	53	62	47	73	102	69	105
1936	103	72	101	115	65	59	53	68	53	28	71	95	35	173
1937	131	106	143	165	100	121	107	93	100	61	102	251	82	280
1938	74	66	94	113	66	82	75	64	66	47	50	103	50	165
1939	71	78	77	123	72	83	75	58	53	45	46	97	41	174
1940	85	88	73	109	64	83	105	61	92	84	71	106	60	201
1941	58	50	77	119	31	44	71	38	59	69	70	137	78	161
1942	76	78	105	132	46	69	64	48	47	53	73	147	80	164
1943	77	68	100	113	50	91	36	51	30	29	51	129	45	139

Table 8.- Yield of cotton as a percentage of 1928-32 average, by production areas, 1928-43

Year	Coastal Plains	Piedmont	Eastern Hilly	Delta	Sandy Lands	Gulf Coastal Prairie	Ozark Ouachita Mts.	Texas Blackland	Cross Timbers	Okla. Prairie	Texas Grazing	High Plains	Low Plains	Irrigated
	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
Average:														
1928-32	100	100	100	100	100	100	100	100	100	100	100	100	100	100
1935-39	130	119	138	155	128	108	119	104	105	97	93	127	90	141
1941-43	129	122	160	178	103	120	121	98	111	106	120	161	136	122
1928	78	89	94	89	110	108	99	105	91	105	93	74	97	96
1929	93	98	113	111	89	77	90	79	80	83	86	83	83	96
1930	121	107	97	73	75	124	68	94	76	83	86	67	58	108
1931	120	116	112	131	128	111	147	125	135	123	119	143	116	101
1932	89	89	84	96	99	79	97	98	119	106	116	132	147	99
1933	96	90	81	79	81	99	86	95	94	105	77	101	115	103
1934	123	112	119	114	91	96	64	91	73	40	80	34	37	132
1935	136	115	110	107	97	87	72	78	86	79	92	104	103	122
1936	141	106	141	145	95	74	79	93	68	47	84	95	50	138
1937	142	138	173	182	144	134	153	125	125	110	114	199	117	145
1938	115	106	148	165	163	120	147	118	132	139	84	116	100	141
1939	114	131	120	176	139	130	143	107	114	110	89	121	79	157
1940	134	150	113	154	121	134	201	119	191	179	122	121	119	164
1941	98	92	133	173	67	80	140	83	135	158	130	168	163	122
1942	136	148	180	193	110	117	130	100	107	112	125	163	153	118
1943	151	128	167	169	134	164	92	112	90	84	104	152	91	125

Table 9.- Proportion of United States cotton acreage in the different production areas, 1928-43

Year	Coastal Plains	Piedmont	Eastern Hilly	Delta	Sandy Lands	Gulf Coastal Prairie	Ozark Ouachita Mts.	Texas Blackland	Cross Timbers	Okla. Prairie	Texas Grazing	High Plains	Low Plains	Irrigated
	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
Average:														
1928-32	13.6	7.8	10.7	13.2	10.6	3.4	3.4	13.7	1.8	1.4	2.5	3.6	12.9	1.4
1935-39	14.0	7.5	10.8	14.4	9.3	3.8	2.9	12.7	1.6	1.4	2.4	4.9	11.7	2.6
1941-43	13.6	7.6	11.5	16.3	7.9	3.5	2.8	11.6	1.3	1.1	2.2	5.5	11.8	3.3
1928	13.9	7.8	10.1	12.1	10.8	3.4	3.5	14.3	1.9	1.6	2.8	3.4	13.0	1.4
1929	13.8	7.7	10.1	12.3	11.0	3.4	3.3	13.8	1.8	1.5	2.7	3.4	13.6	1.6
1930	13.7	7.8	10.6	13.2	10.8	3.3	3.4	13.4	1.8	1.5	2.5	3.5	13.0	1.5
1931	13.5	7.8	11.1	13.9	10.3	3.7	3.4	13.8	1.7	1.3	2.3	3.6	12.2	1.4
1932	12.9	7.9	11.6	14.7	10.0	3.3	3.5	13.1	1.7	1.3	2.1	4.2	12.7	1.0
1933	12.5	7.4	10.7	13.6	10.1	3.4	3.5	13.4	2.1	1.7	2.4	4.0	13.8	1.4
1934	13.5	7.6	10.3	12.9	9.9	3.6	3.6	13.5	2.2	1.9	2.6	3.4	13.2	1.8
1935	13.9	7.6	10.6	13.3	9.8	3.8	3.0	13.5	1.9	1.3	2.6	4.0	12.9	1.8
1936	13.3	7.2	10.3	14.1	9.7	3.7	3.1	13.4	1.9	1.1	2.6	4.8	12.4	2.4
1937	14.3	7.3	10.7	14.8	8.9	3.8	2.9	12.3	1.7	1.0	2.4	5.5	11.1	3.3
1938	14.5	7.9	11.3	14.9	9.0	4.0	2.9	12.2	1.5	.8	2.2	5.2	10.8	2.8
1939	14.1	7.7	11.6	15.4	9.1	3.7	3.0	12.3	1.4	1.0	1.9	4.8	11.4	2.6
1940	14.2	7.6	11.5	15.4	9.3	3.6	3.0	11.8	1.4	1.1	2.1	5.2	10.9	2.9
1941	14.3	7.6	11.1	16.2	8.6	3.4	3.1	11.3	1.4	1.1	2.2	5.2	11.1	3.4
1942	13.5	7.3	11.1	15.9	7.8	3.6	2.9	11.7	1.4	1.2	2.3	5.7	12.1	3.5
1943	13.0	7.8	12.2	16.7	7.3	3.6	2.5	11.8	1.1	.9	2.1	5.7	12.3	3.0

Table 10.- Commercial fertilizer used on cotton, per acre in cultivation July 1, by States, 1928-44 1/

Year	Virginia	North Carolina	South Carolina	Georgia	Florida	Tennessee	Alabama	Mississippi	Arkansas	Louisiana	Oklahoma	Texas	Missouri
	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
1928	366	436	305	250	219	132	244	108	75	79	2	12	6
1929	377	429	304	255	201	131	248	117	75	92	4	13	7
1930	386	411	300	261	225	120	241	128	81	94	3	12	10
1931	366	327	245	206	186	61	162	63	46	52	2	5	7
1932	241	261	183	152	164	22	107	37	22	29	2	2	6
1933	301	318	279	205	174	36	158	46	21	27	2	2	6
1934	356	342	294	228	190	51	185	74	21	31	1	3	9
1935	368	374	331	247	230	54	214	87	24	43	3	3	9
1936	385	402	336	257	228	59	230	107	33	56	2	5	9
1937	398	426	378	284	236	80	270	128	42	74	1	6	10
1938	390	426	388	294	244	106	294	153	58	96	1	9	16
1939	373	425	388	297	246	105	306	162	70	102	1	10	13
1940	388	411	393	302	245	116	302	163	74	119	1	12	52
1941	405	431	421	322	290	131	317	174	97	112	3	14	41
1942	450	455	426	332	295	133	328	143	101	108	1	8	31
1943	475	470	465	361	301	161	367	184	101	129	1	9	43
1944	445	505	500	396	306	151	392	192	104	113	1	11	44

1/ These figures are smaller than those shown in other series which represent application per acre fertilized.