CLIMATE OF THE COTTON BELT.

By O. C. STINE and O. E. BAKER.

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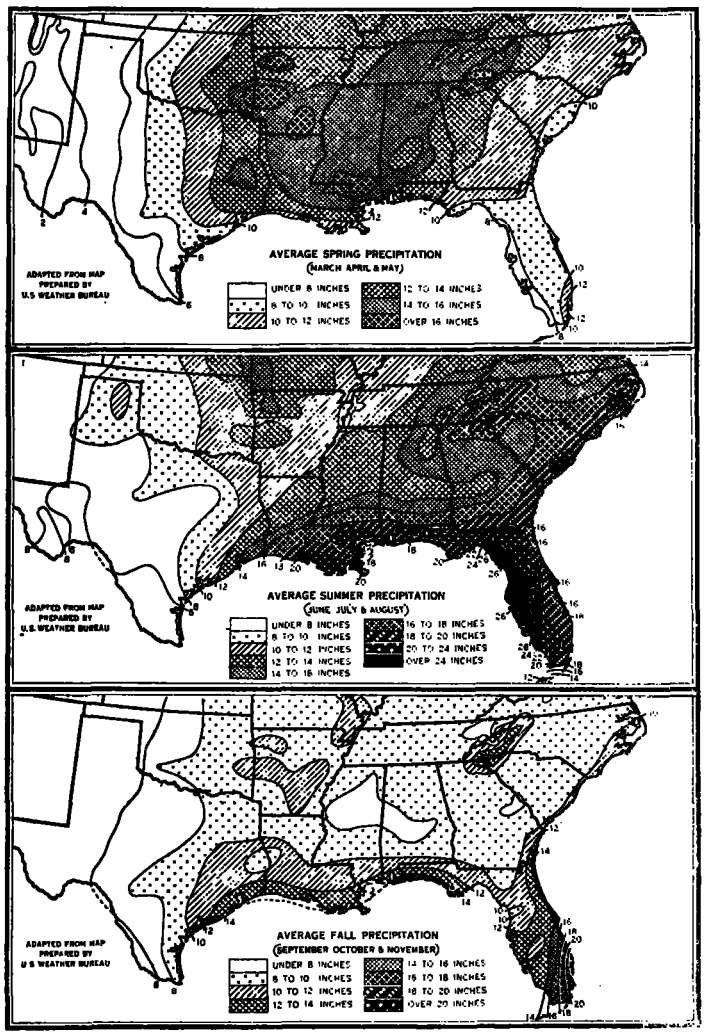
Although the most noticeable differences in the density of cotton acreage and variations in yield per acre within the Cotton Belt are due principally to soil conditions, the outer boundaries of cotton production are determined almost entirely by climatic factors. The Cotton Belt has an average summer temperature of 77° along the northern boundary. (See fig. 28.) This temperature appears to be the limit beyond which commercial production becomes unprofitable. (A very little cotton is grown for household use by the mountaineers in eastern Kentucky, where the summer temperature is only 74°.) In the southern portion of the Cotton Belt the summer temperature is 80° to 85°, and in the Imperial Valley of California it averages 95°. Along the northern margin of the Cotton Belt the last killing frost in spring occurs, on the average, about April 10, and the first killing frost in fall about October 25, so that the frostless season is about 200 days. In the southern portion of the Cotton Belt the last killing frost in spring occurs about March 10, on the average, and the first killing frost in fall seldom before November 25, the frostless season being 260 days or more in length. (Figs. 25–27.)



FIGS. 16 to 18.—In spring the rainfall is heaviest in the Mississippi Valley, and in summer, along the Gulf and Atlantic coasts. In autumn, during picking time, the rainfall throughout the Cotton Belt averages less than 12 inches, and is mostly under 10 inches.

The average annual precipitation in the Cotton Belt ranges from 23 inches in western Oklahoma and Texas to 55 inches in eastern North Carolina and 60 inches in southern Mississippi, but throughout much of the Belt is between 30 and 50 inches (fig. 19). The spring rainfall ranges from 6 inches in western Texas to 16 inches in Arkansas and southern Mississippi, being heavier in the Mississippi Valley States than in Texas or the south Atlantic States (fig. 16). The summer rainfall is somewhat greater than that of the other seasons, especially in the southern and eastern portion of the Belt, reaching a maximum of 20 inches in southern Mississippi and in eastern North and South Carolina; while in the Black Prairie of Texas the amount received averages only 8 inches (fig. 17). Autumn is the driest season of the year, practically all the important cotton regions receiving less than 10 inches of rain during the fall months (fig. 18). February and November are the wettest months in

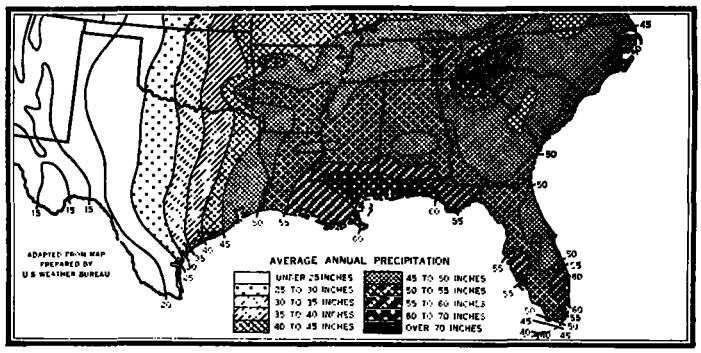


FIG. 19.—The average annual precipitation in the Cotton Belt ranges from 20 to 60 inches, but is mostly from 30 to 50 inches. The heaviest annual rainfall occurs in southern Alabama and Mississippi.

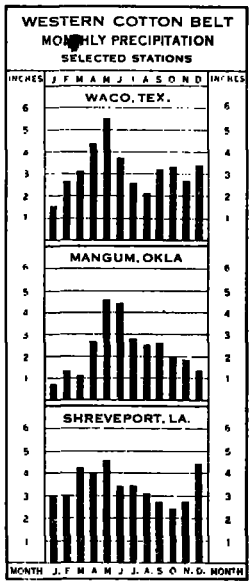


FIG. 20.

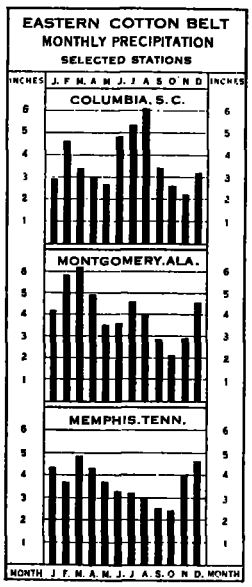
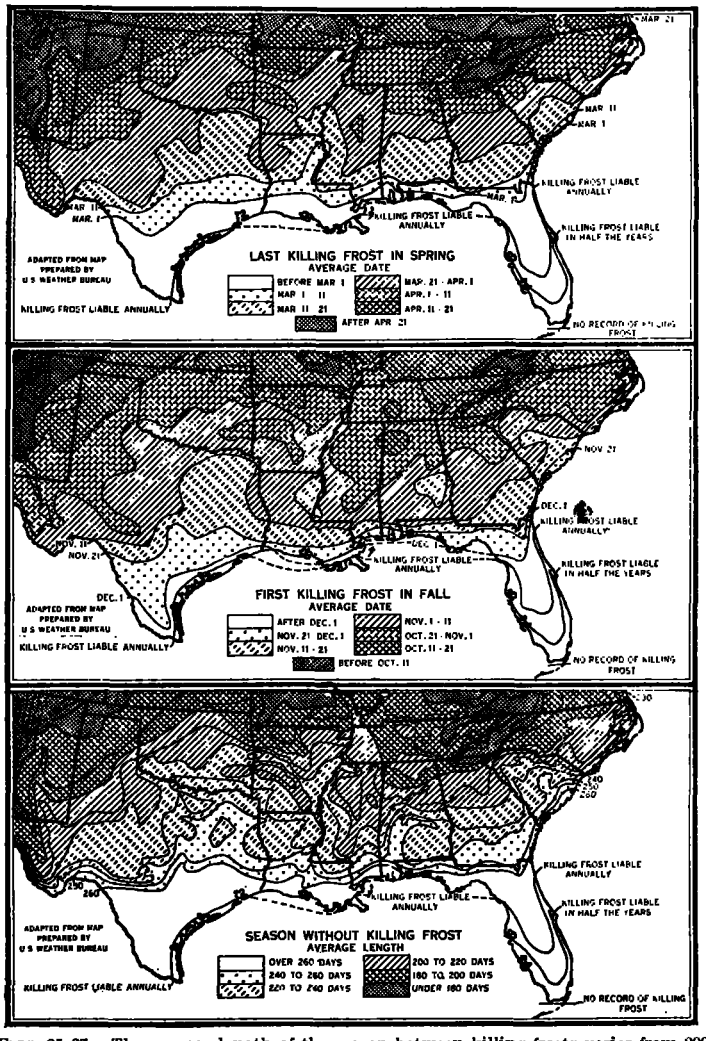


FIG. 21.

the Mississippi Valley States, in Alabama, and in northern Georgia. August is the wettest month in the Carolinas and May in Texas and Oklahoma. October and November are the driest months throughout practically the entire Cotton Belt.

Weather conditions favorable for cotton.—The best conditions for cotton production are found where a mild spring with light but frequent showers merges into a moderately moist summer, warm both day and night, followed by a dry, cool, and prolonged autumn. Too cool weather in the spring retards growth, and too much rain may induce the seed to rot rather than to germinate, or later cause the development of surface roots to the sacrifice of the deeper roots, with resultant wilting and shedding of leaves and bolls during drought in summer. May and June particularly are critical months, when heavy rainfall, especially if accompanied by low temperatures, is very detrimental. Rainy weather in these months also interferes with cultivation. On the other hand, drought in the spring and early summer often kills the young shallow-rooted seedlings. A wet summer promotes vegetative growth, or "weed," at the expense of boll production, and favors the growth of weeds, while drought stunts the plants, causes early maturity, and reduces the yield, as does also a spell of cool weather. The most unfavorable conditions for the crop are a cool and wet May and June followed by a hot and dry July and August. The ideal rainfall is of the thundershower type with several days of bright, warm weather between rains. Plenty of sunshine is especially important in June and early July when the plants are in bloom. As the cotton matures and the bolls begin to open, in the latter part of August, rainy weather is undesirable, as it retards maturity, interferes with picking, and discolors or damages the exposed fiber. Moderate rain in in early September, however, favors the production of a large "top crop" of late maturing bolls. The greater daily range in temperature in a dry fall is also favorable to the maturing crop as it checks vegetative growth and induces fruiting. Early frost in the fall kills the "top crop" on the upper branches of the plant, or causes the bolls to open prematurely, often seriously reducing the yield. In northern Texas and Oklahoma, where the winds dry out the cotton in the unopened frost-bitten bolls, this "top crop" is "snapped" from the stalks, and, after being run through a machine which removes the burrs, is ginned and sold as "bollies." In other sections rains may cause the frost-bitten bolls to rot.

Dates of planting and picking (see maps, *Monthly Weather Review*, May, 1919, 47:318).—Cotton planting generally begins in the southern portion of the Cotton Belt about March 20, and progresses northward with the



FIGS. 25–27.—The average length of the season between killing frosts varies from 200 days along the northern margin to 260 days or more in the southern portion of the Cotton Belt.

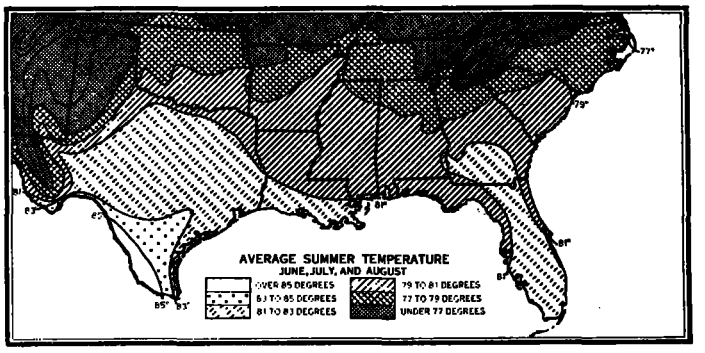


FIG. 28.—The averag summer (June, July, and August) temperature along the northern margin of the Cotton Belt is about 77° (F.).

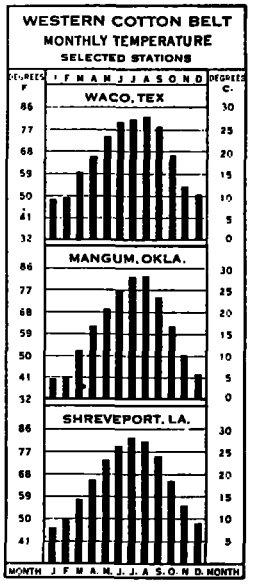


FIG. 29.

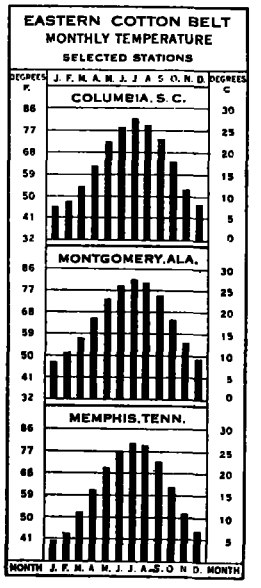


FIG. 30.

advance of temperature at the rate of 10 to 20 miles a day, so that in the central portion planting begins during the first week in April, and in the northern portion about April 20. The planting usually requires two to three weeks to complete, hence is over in the southern districts about April 15 and in the northern districts a month later. When the cotton is a few inches high the rows need to be thinned, which process is known as "chopping out," and is the most laborious task in the cultivation of cotton except that of picking. Chopping out begins in the southern districts of the Cotton Belt usually about the 1st of May, in extreme southern Texas as early as April, and continues for about a month. In the northern districts it begins about June 1 and ends from June 20 to July 5, being usually two weeks later in Arkansas and western Tennessee, especially on the river bottom lands, than at corresponding latitudes in the Carolinas. Cotton picking begins about August 10 in the southern portion of the belt, usually the last week in August in the central portion, and in the northern portion about September 10. The cotton is picked by hand, a slow and laborious process, and three or four pickings are commonly given each field, the first picking of the early maturing bolls and the last picking of the late maturing bolls being much smaller than the midseason pickings. It is usually the first of December before picking is completed in the southern districts and from December 20 to January 1 in the northern districts. Where the acreage is large and the labor insufficient, the picking may drag along into midwinter, though the cotton is by this time likely to be considerably injured by the weather.

THE CLIMATE OF SOUTH AFRICA.

By H. E. Wood.

[Extracts from The South African Geogr. Journ., 1918, 2:5–8.]

* * * In winter the pressure system over South Africa strongly resembles, but is not quite the same as, an anticyclonic system. And as within an anticyclonic region, there is no well-marked wind system, so in winter there are no definite prevailing winds over the Union of South Africa.

As we approach the fringes of the high pressure area the tendency of the wind to have a well-marked prevailing direction increases. Thus, on the northern fringe, at Bulawayo, the wind during the winter months is generally from the east-southeast. At Cape Town, on the southern fringe, there is a certain percentage of winds from the northwest during the winter months. These directions are in accordance with Buys–Ballot's law of the winds according to which, in the Southern Hemisphere if one is standing back to the wind, the higher pressure is on the left hand, the lower on the right.

In general, it may be said that the wind system over the Union in the winter months is such that the surface air tends to move outward. This explains the general absence of rainfall over the Transvaal, the Free State, Natal, and the greater part of Cape Colony during the winter. The air is moving over the surface of dry land, and has no opportunity of becoming laden with moisture. The conditions are rather different over the southwest corner of the Union or the Western Province of Cape Colony. The northwest wind which frequently blows here has traveled for some considerable distance over the South Atlantic Ocean and brings with it some rain to the Cape.

The summer conditions over the Union are of a more complicated character. In the first place, owing to the coming south of the sun the high-pressure belt is pushed south over ocean and land. Further, owing to the greater absorption of solar radiation by the land, the temperature of the land surface becomes higher than that of the ocean on either side. The result is that the high-pressure belt which extends across the land during the winter months now breaks and a large tongue from the equatorial low-pressure belt pushes its way in and lies over South Africa. Thus in the summer months (October-February) the barometer over the interior of South Africa is rather lower than round the coasts, east, west, and south. The barrier of moderately high pressure along the south coast is, however, very weak, and is frequently broken through by cyclones passing off the coast. Now, there is on the whole, an inward draft of surface air from the high-pressure regions over the ocean to the low-pressure system over the land and with the inward drift moisture is brought in to the interior. In not many cases, however, does this fall directly as rain. Occasionally when, owing to a combination of circumstances, there is a strong pressure gradient for northeasterly winds extending over eastern South Africa the moisture is precipitated at once over Natal and the eastern and central Transvaal in a steady rainfall, but generally the precipitation of moisture does not take place directly.

In the great tongue of low pressure over the interior, where the pressure gradient is small and there is very little lateral movement of the surface air, the effect of intense solar radiation is to give rise to local vertical movements of the atmosphere. These are evident in the great cumulus clouds which grow generally during the summer afternoons. * * *

The general direction of motion of the thunderstorms across country is from southwest to northeast.

The summer rainfall over the interior of South Africa may thus be divided into two classes (*a*) the steady rains, which are associated with northeasterly winds and a fairly steep pressure gradient, and (*b*) the thundershowers, which occur with very shallow gradients. The steady rains can be forecast as they follow a well-marked distribution of pressure, but it is a very difficult matter to forecast by even a few hours the occurrence of thunderstorms. Thunderstorm conditions may exist over a huge area of country, but the actual falls of rain are very localized: Johannesburg may have a great downpour of rain whereas Pretoria, a little over 30 miles away, may not receive a drop.

The great frequency of summer thunderstorms over South Africa is due partly to the intense solar radiation and probably also partly to the generally bare character of the country. If the country were more wooded it is quite probable that evaporation would be so modified that the rainfall would be more distributed and lighter in character and the frequency of thunderstorms less. Over the Witwatersrand district 56 per cent of the rainfall is distributed by heavy showers of over one-half inch in amount, whereas at Greenwich, England, only 25 per cent falls similarly in heavy showers.

The region over which rain falls in the winter months is very limited, and is practically confined to the Western Province of the Cape. Such rainfalls are probably associated with cyclonic systems which approach South Africa from the South Atlantic Ocean. Owing to the presence of the high pressure core over the land they can rarely penetrate into the interior and are forced to skirt the