Office are sent out from the wireless station of the Air Ministry. The message is given in code form, which is practically the same as that prescribed in Annex G of the "Convention relating to International Air Navigation," Paris, 1919. The forecasts, which are being issued eight times a day, are based on observations taken about half an hour before the time of issue. Detailed explanation of the code can be obtained on application at the Meteorological Office. A new device is also mentioned for making the meteorological reports rapidly available to the public. A large weather map is exhibited daily at the Air Ministry in one of the front windows on the ground floor of the Empire House, Kingsway. All the principal reporting stations in the British Isles, as well as a few neighboring Continental ones, are marked on the chart, which is on the Mercator projection, and is 10 feet high and 6 feet wide. The information on the chart is changed at about 3 h., 8 h. 30 m., and 14 h. 30 m. G. M. T., the data exhibited referring to observations made at 1 h., 7 h., and 13 h. G. M. T. * * *

ON THE APPLICATION OF CIRRUS TO THE FORECASTING OF WEATHER.

By GABRIEL GUILBERT.

[Abstracted from Comptes Rendus, Paris Acad., June 7, 1920, pp. 1398-1399.]

The following rules for the forecasting of weather have been deduced from the observation of cirrus clouds:

1. Cirri come from the center of the depression: Cirri from the north indicate a LOW in the north; cirri from the south indicate a LOW in the south.

2. The speed of the cirrus is directly related to the strength of the cyclone; rapid movement indicates a deep depression, slow movement indicates a shallow depression.

3. In the same manner that cirri can be used to forecast a depression, even before the depression has appeared, the known location of a depression can be utilized for forecasting cloudiness.

The following facts are shown by observation:

1. That the initial direction of the movement of the depression is the same as that of the cirrus, but that the path of the depression is independent of the direction of cirrus. They may coincide, but this is only accidental. The same is true of the speed, i. e., rapidly moving cirrus may precede a slowly moving depression or vice versa.

2. That the cirri form an integral part of the march of cloudiness, which have been designated by the author since 1886 as the *succession nuageuse*, and that this succession of clouds is independent of the depression.

3. That the forecasting of weather by cirrus must be subordinated to the survey of the barometric situation which can readily render the arrival of cirrus an unreliable criterion.

The use of cirri in connection with the weather map may thus afford an accurate and reliable method of forecasting. The author has used this method with success for many years, and has presented his views in a work entitled *Nouvelle méthode de prévision du temps*, published in Paris in 1909.—*C. L. M.*

RELATION OF WEATHER TO FRUITFULNESS IN THE PLUM.

In Paper No. 162, Journal Series, Minnesota Agricultural Experiment Station, Mr. M. J. Dorsey discusses the effect of weather on the setting of plum fruit. The erratic productive nature of this fruit, exemplified in over-production one year and perhaps complete failure in another, sometimes regardless of the number of fruit-buds appearing, led to an attempt to determine the cause of this wide difference from year to year in the fertilization process.

The study is based on meteorological and fruiting data collected during a period of 7 years. It was found that no fruit set from wind-carried pollen when insects were excluded. It was concluded, therefore, that wind may be regarded as having a more indirect than direct bearing on the setting of fruit, in that its influence upon bee flight may be serious at certain times, bees being the chief pollinizer of the plum.

Temperature is considered of primary importance from three standpoints: Its effect upon pollen or pistil; its influence upon pollen tube growth; and its interference with bee flight. The time required for germination was considerably increased as a result of low temperature. The action of low temperature in retarding pollen tube growth is considered as one of the principal causes of the failure of fruit to set, as it was shown that plum pollen does not germinate at temperatures below 40°, and even at 51° there is slow pollen tube growth. Sunshine showed no direct bearing on the fertilization.

Rainfall was found to have a more direct effect than any of the other weather elements. Anthers close rapidly when coming into contact with water and remain closed as long as they are wet, preventing pollination under such conditions, and, furthermore, rain prevents insect flight.

In summarizing it is pointed out that unfavorable weather at blooming time may completely prevent the setting of fruit, even though there be a full bloom, and that rain and low temperatures are the most important factors, although strong wind when prolonged is important. The greatest damage from low temperature is in the retarding of pollen tube growth. Cloudiness has no injurious effect in the setting of fruit, but rain, by causing the anthers to close or preventing them from opening, prevents pollen dissemination. In one season, rain during bloom may be the limiting factor, while in another it may be low temperatures during the period of tube growth.—*Nat'l Weather and Crop Bull.*

MONTANA RAINFALL.

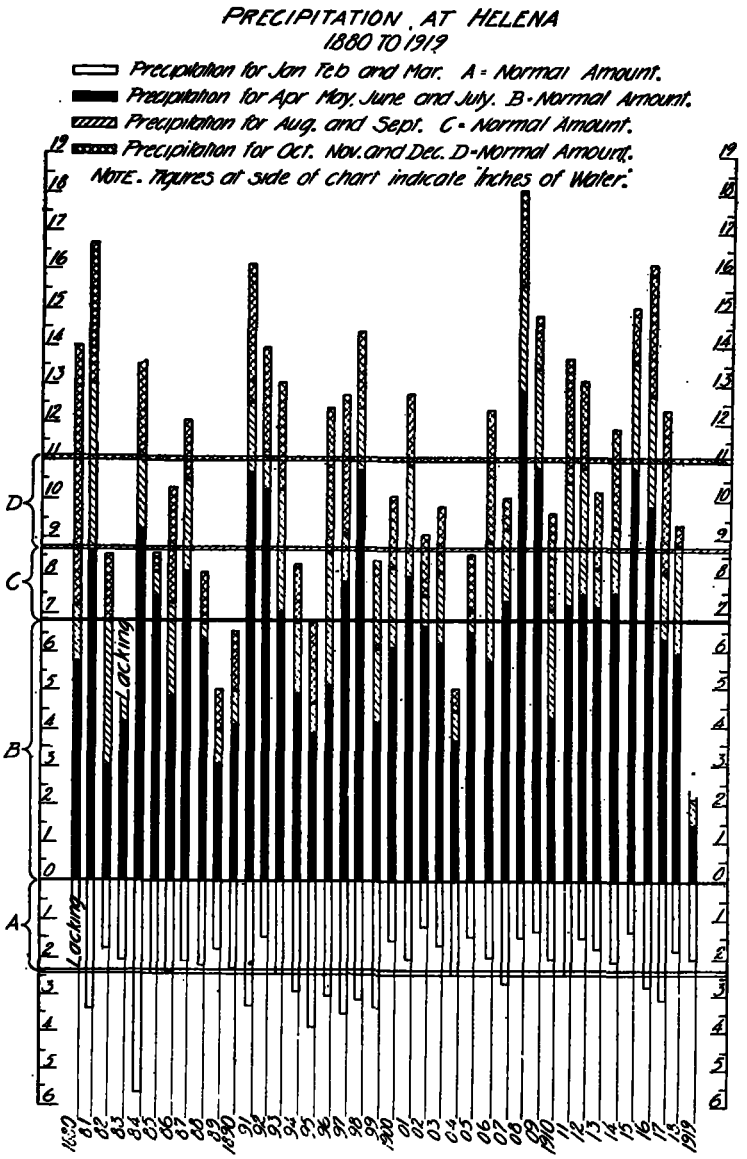
By EDMUND BURKE and REUBEN M. PINCKNEY.

[Excerpts and abstract from "A further report on Montana climate," Circular 87, Univ. of Montana Agricultural Experiment Station, Bozeman, Mont., Sept., 1919, 15 p.]

The growing season 1919 was the third consecutive one with light precipitation in Montana, and it was "not only the driest of the three but also the hottest and driest of which we have any record. This, coupled with a light snowfall last winter, has caused the greatest scarcity of water, not only for dry-land farming but for irrigation and city supplies, ever known. The scarcity of moisture has probably never been felt more keenly than this year, and it is therefore but natural that the people are unusually interested in weather conditions. It is the purpose of this circular to present sufficient data to give the public a comprehensive idea of precipitation in the past, since it is safe to assume that like conditions will occur in the future. The data given are taken from stations with fairly complete records and so located that the State as a whole is well represented."

In order to answer the frequent question, "How much moisture falls in Montana"? the authors selected 30 stations representing the entire State and averaged the records. For convenience the State was divided into

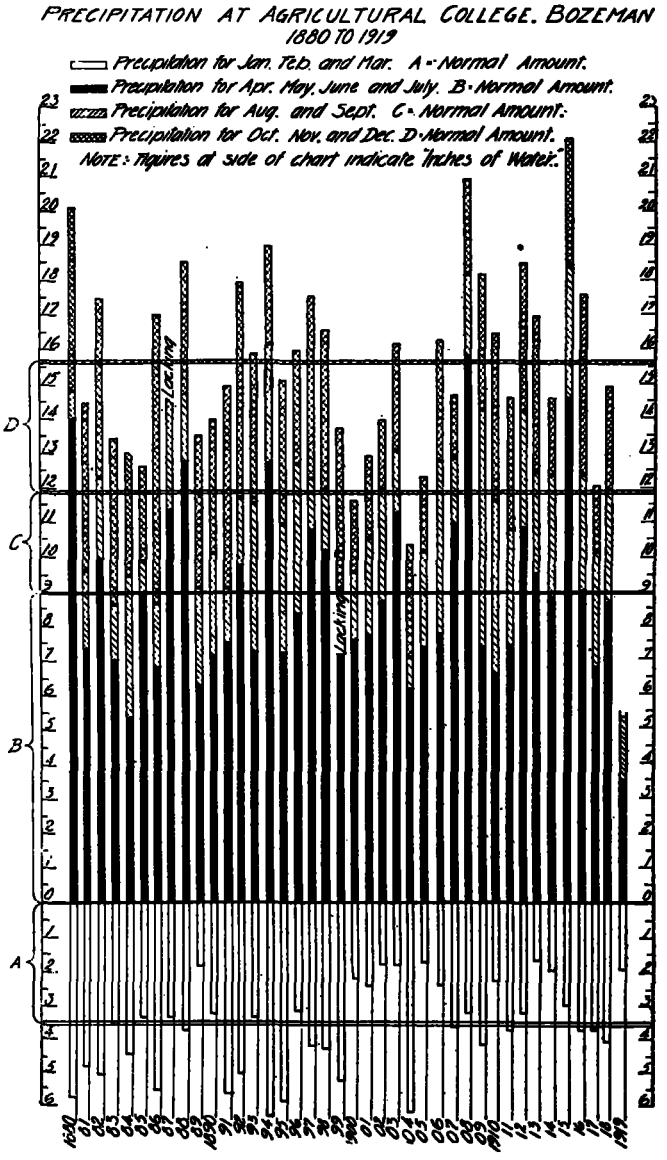
three natural rainfall sections, which they designated the Eastern Mountain District, the Western Mountain District, and the Plains District. The details of the observations are shown in tables: Normal rainfall for the growing season and for the year; Rainfall in the wettest year (1908) and the driest year (1904); Rainfall for the years 1917, 1918, and 1919; Monthly mean humidity for the growing season at Bozeman (the Agricultural Experiment Station); and Monthly mean temperatures for the growing season.



To quote from the authors: "The mountain district west of the main range shows an annual rainfall of 15.75 inches, with geographic extremes ranging from 11.65 inches to 22.13 inches. The average rainfall for the growing season of April, May, June, and July is 6.23 inches, or but 40 per cent of the annual. In the northwestern corner of the State the seasonal rainfall is even a smaller proportion. Only 26 per cent of the rain of the year comes in May and June. This district must make a special effort to conserve the fall and winter precipitation.

In the Mountain District east of the main range the average yearly rainfall is 16.22 inches, varying from 11.09 inches at one place to 23.53 inches at another. The rainfall for April, May, June, and July is 53 per cent of the annual and that for May and June is 35 per cent of the annual.

"* * * The plains area of the State is drier than either of the mountain areas. The average yearly precipitation is 13.63 inches, with a geographic range from 12.06 inches to 15.51 inches. The rainfall for the growing season is about 55 per cent of the annual and that for May and June is 37 per cent of the annual.



"Contrasting the districts east of the continental divide, it is noted that while the plains district has over $2\frac{1}{2}$ inches less annual rainfall it has only $1\frac{2}{10}$ inches less during the growing season and about seven-tenths of an inch less in May and June. * * *."

"In addition to the tables, we are presenting four charts so constructed that the rainfall for the growing months is easily distinguished from the preceding and following months of each year. The points selected are Helena, Havre, Miles City, and the Agricultural College [at Bozeman], the four stations in the State that have the longest records, three of them dating back to 1880. These charts present the most reliable information obtain-

able and bring out the seasonal and annual variation in a very striking manner.

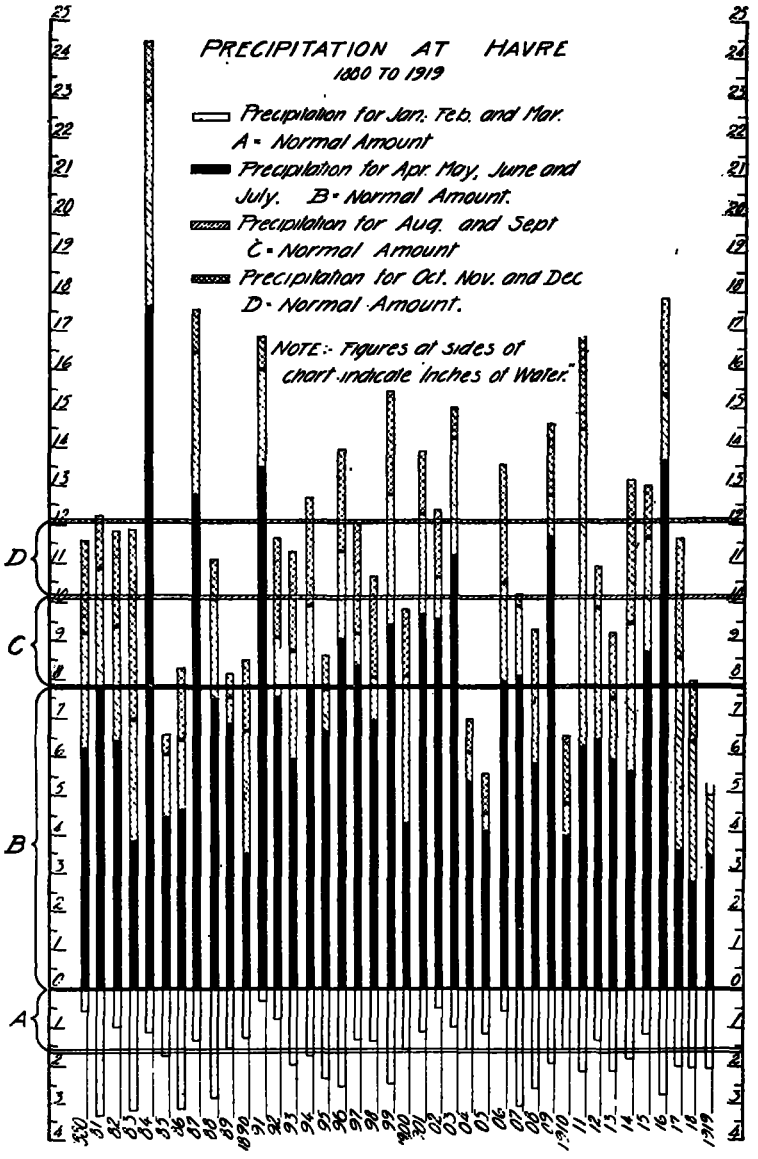
"In studying these charts it should be remembered that the rain which falls just when the crop needs it is subjected for only a limited time to the forces that tend to remove it, so this seasonal rainfall has a much greater value, so far as producing crops is concerned, than that which falls before the crop is ready to use it. * * *

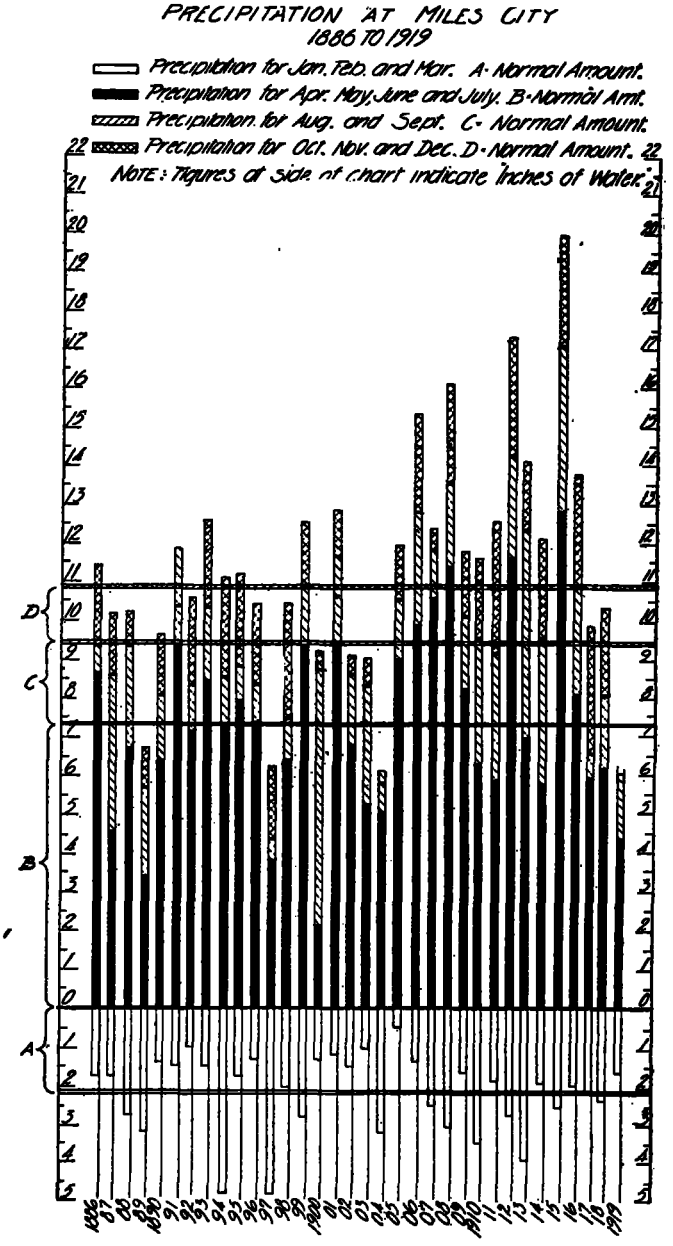
"* * * The average rainfall for all points which have long records proves to be very constant" [i. e., shows no secular change].

"But not all the water that falls on the land is used by the crop planted. The various sources of loss of moisture are (1) water that runs off; (2) water that sinks too deep for crops to reach it; (3) water that evaporates from the soil; (4) water used by growing weeds."

The four months for 1919 had higher mean temperatures than any of the similar dry years—1904 (driest), 1917, 1918—thus reducing the value of what moisture the soil had, so far as influenced by temperature, and reducing the available supply below that of the other years.

In preparing this bulletin the writers had the able cooperation of Mr. William T. Lathrop, meteorologist, Montana section, United States Weather Bureau, in assembling the data from official sources.—*H. L.*





RAINFALL AND LAND DRAINAGE.[1]

Dr. Brysson Cunningham reviews in Nature of March 11, 1920, the three papers listed in the footnote below. These papers, as indicated by their respective titles, treat of the disposal of rainfall from several points of view.

In the first paper the proportion of runoff to rainfall is discussed a problem that has also been studied extensively in this country. Col. Craster finds that 0.065 inch of water is required to wet a crop of rough grass about 5 inches in height, the aftermath of a hay field,

[1] Estimating river flow from rain all records, by Lieut. Col. J. E. E. Craster. *Engineering*, Jan. 2, 1920. Land drainage from the engineering point of view, by C. H. J. Clayton. Land drainage from the administrative point of view, by E. M. Konstam. (The last two are papers read before the Surveyors' Institution on Jan. 12, 1920.)