

of the alarm it caused. Forecasters were, however, instructed to predict 'severe local storms'. From 1938, however, the word 'tornado' has been permitted, and a strenuous effort has been made to specify more exactly the meteorological conditions favourable for the formation of tornadoes. The latest stage was the setting up by the United States Weather Bureau in 1952 of a research unit called the Severe Local Storms Centre, which formed at Washington and moved to Kansas City, in the heart of tornado country, in 1954.

The booklet under review is the first publication of the Centre. The climatology of tornadoes in time and space is described in some detail. Next are given the favourable air mass types in terms of the vertical distributions of temperature and water vapour. These are all naturally unstable in one way or another. The most important type of air mass is one with convective instability in which condensation begins at the bottom if the air mass is lifted. Once condensation has begun in the lower part, the upper part cools on lifting at the dry adiabatic rate compared with the smaller saturated adiabatic rate of the lower part so that the degree of instability quickly increases. Tornadoes are nearly always associated with thunderstorms and with the south-east sector of a depression. They seem to be associated with definite centres of low pressure and do not occur in sporadic 'air mass' or 'heat' thunderstorms. The instability has to be released by vertical ascent and the variations of wind speed with height favourable for convergence and vertical movement have been studied at the Centre. The forecast is formulated from consideration of the advection of heat and water vapour to produce a suitable vertical distribution and of the suitability of the wind structure for convergence. It is stated that in the first seven months of 1955, 1 in 3 of all areas for which tornadoes were forecast, each area averaging 20,000 sq. miles, contained at least one tornado during the period of the forecast. For so exceptional a phenomenon this seems a very useful proportion.

No mention whatever is made in the booklet of how a tornado actually forms; everything is devoted to determining the likelihood of convective overturning. This is certainly necessary, but is it sufficient? Lamb (Meteorological Office Geophysical Memoir 99, in the press) has suggested that surface features producing opposing winds are source points for tornadoes. The distribution of formation points of tornadoes might be worth examining for points of concentration.

MINERAL NUTRITION AND AMINO-ACIDS IN TOMATO

THE level and the quantitative composition of the free amino-acid fraction of tomato plants grown in full nutrient and in cultures deficient in zinc, copper, manganese, iron and molybdenum have been determined by J. V. Possingham (*Austral. J. Biol. Sci.*, 9, 539; 1956).

The methods used in the investigation include the quantitative estimation of amino-acids by a technique involving paper chromatography, and the culture of tomato plants in highly purified nutrient solutions. All the deficiencies investigated except that of molybdenum brought about increases in the free amino-acid fraction. In every case there was a

change in the quantitative composition of this fraction. Iron and zinc deficiencies were associated with large increases in the free levels of the two amides asparagine and glutamine, while with copper and manganese deficiencies many individual amino-acids increased in concentration, but not the two amides. The level of total free amino-acids and amides was low in molybdenum-deficient plants. The qualitative differences between deficient- and full-culture plants were not large, but included the accumulation of β -alanine with deficiency of zinc, copper or molybdenum, and of pipercolinic acid with deficiency of manganese or iron. Other differences were the absence of histidine with copper, manganese, iron and molybdenum deficiency, of phenylalanine with copper deficiency, and of lysine with copper, manganese and molybdenum deficiencies. Additionally many quantitative changes in amino-acid concentration were found. In the deficient plants there were changes in the concentration of most amino-acids relative to the levels in the controls. These changes were not uniform, and the relative amounts of the different amino-acids were altered with each deficiency.

The significance of these experimental results is discussed in relation to the known interactions between the mineral nutrition and the amino-acid composition of plants. Although a characteristic spectrum of free amino-acids is associated with each individual deficiency, the differences are not considered sufficiently large to make analysis for these compounds an additional method for the diagnosis of mineral deficiencies in this plant.

'L FORMS' OF BACTERIA

THE members of the "Réunion sur les Formes L et sur les formes évolutives des bactéries", held in Lausanne during May 17-18, 1956, have issued the following statement:

(1) Numerous cycles of different bacteria have been described under different names—L forms, filtrable invisible forms, evolution forms, etc. Often enough, all these bacterial forms have been described under the name of 'L cycle'. At the present state of our knowledge, it seems preferable to use different designations, in order to describe phenomena and appearances which are perhaps not the same.

(2) E. Klieneberger-Nobel has used in all her papers published in English the expression 'L forms' in order to designate bacterial colonies of new appearance which occur *in vitro* spontaneously or by stimulation. It seems, however, that the English word 'form' has been interpreted incorrectly by a number of microbiologists using Latin languages. They have used this expression for the 'individual morphology of bacterial elements'. This incorrect interpretation manifests itself to-day when in the written or spoken language the following expressions are used: 'formes L naines', 'formes L globuleuses', etc. (Klieneberger-Nobel herself has occasionally made a similar mistake by using the expression 'L elements'.) E. Klieneberger-Nobel rejects completely the translation of the English 'form' into the French 'forme' and desires that it should be translated by the French word 'formation' and in German by 'Phase'. She is of opinion that one should designate as 'formation L' (L = Lister), 'L form', 'L Phase', the growth-form which can arise spontaneously or