A process which has been the means of throwing much light on problems in vegetable physiology and agricultural chemistry, namely, a comparison of the analyses of a plant and of its separate members in different stages of growth, has been applied to fifteen familiar species of grasses, and the results are tabulated and briefly discussed.

Many useful suggestions, some of them of the highest practical importance, are to be met with in these pages. Here is one by Prof. Asa Gray which refers to the Teosinte, or Guatemala grass, *Euchlæna luxurians*, a native of Mexico and Central America, and has the true ring of progress about it:—

"To make the *Teosinte* a most useful plant in Texas and along our whole south-western border the one thing needful is to develop early-flowering varieties, so as to get seed before frost. And this could be done without doubt if some one in Texas or Florida would set about it. What it has taken ages to do in the case of Indian corn, in an unconscious way, might be mainly done in a human lifetime by rightly directed care and vigorous selection."

This volume is highly creditable to its authors, and it adds one more to the many useful publications which have emanated from the United States Department of Agriculture. W. FREAM

THE DEVELOPMENT OF THE CÆCILIANS

IN a letter recently published in the *Arbeiten aus dem zoologisch-zootomischen Institut in Würzburg*, Messrs. P. B. and C. F. Sarasin give a preliminary account of the development of *Epicrium glutinosum* as observed at Peraderinia in Ceylon, where these naturalists have taken up their quarters near the celebrated Botanical Gardens. Since the original discovery by Johannes Müller of the larval form of the Cæcilians, almost the only information obtained on this important subject is a short account of the gilled larvæ of *Cæcilia compressicauda* by Peters, founded on specimens procured by Jelski in Cayenne.

The brothers Sarasin show that *Epicrium* is not viviparous, as is *Cæcilia*, but oviparous. In the most advanced stage before hatching the embryo is provided with very long blood-red external gill-filaments, and has also a distinct tail with a strong fin. The gill-filaments are shed previous to the hatching, after which the young Cæcilians make their way to the neighbouring stream, and live in the water, breathing by means of gill-slits. After they leave the water their gill-slits close up, and they breathe by lungs. The brothers Sarasin compare these Cæcilians to Urodeles, in that they pass through the perennibranchiate stage in the egg. As larvæ they are derotrematous, and in the adult stage become true land-animals like Salamanders. Our authors also show that the spermatozoon has a spiral filament, and that there is a fourth gill-arch, from which the pulmonary artery is given off. Both these facts tend to show that the Cæcilians are more nearly allied to the Urodeles than to the Anurous Amphibians.

THE BRITISH ASSOCIATION

REPORTS

Fifth Report of the Committee, consisting of Mr. R. Etheridge, Mr. Thomas Gray, and Prof. John Milne (Secretary), appointed for the purpose of investigating the Earthquake Phenomena of Japan. (Drawn up by the Secretary).—On account of an excursion which I have the intention of making during the coming summer to Australia and New Zealand, I am compelled to draw up this report a month earlier than usual. As the only time when the work of attending to observations and experiments repays itself is during the winter months, I may safely say that my intention of shortening the time usually devoted to earthquake observations is not likely to involve any serious loss. The number of earthquakes felt during corresponding periods in two previous years and this last year were respectively twenty-six, thirty-nine, and eighty, and not only have the earthquakes been numerous, but some of them have been pretty stiff, as is testified by the fact that on several occasions chimneys fell and walls were cracked. The work done during the last year is briefly as follows:—

Seismic Experiments.—Seismic experiments were commenced in conjunction with Mr. T. Gray in 1880. The movements then recorded were produced by allowing a heavy ball, 1710 lbs. in weight, to fall from various heights up to thirty-five feet. Subsequently many experiments were made by exploding charges of dynamite and gunpowder placed in bore-holes. During the last year, whilst working up the long series of records which accumulated, several laboratory experiments were made to investigate the methods to be employed when analysing the diagrams of earth motion. The first of these experiments consisted in projecting a small ball from the top of a tall flat vertically-placed spring, and at the same time causing the spring to draw a diagram of its motion. From the distance the ball was thrown its initial velocity could be calculated. From the diagram, either by calculation on the assumption of simple harmonic motion or by direct measurement, the maximum velocity of movement could be obtained. These three quantities practically agreed. The most important result obtained by these experiments was that they indicated an important element to be calculated in earthquake or dynamite diagrams, and, further, that in these diagrams the first sudden movement, which invariably has the appearance of a quarter-oscillation, ought apparently to be considered as a semi-oscillation. The second set of experiments consisted in determining the quantity to be calculated from an earthquake diagram which would give a measure of the overturning or shattering power of a disturbance. For this purpose a light strip of wood was caused by means of a strong spiral spring and a heavy weight to move horizontally back and forth with the period of the spring. On this strip small columns of wood were stood on end, and it was determined how far the spring had to be deflected and then suddenly released to cause overturning. The more important results of all these experiments are:—

I. *Effect of Ground on Vibration.*—(1) Hills have but little effect in stopping vibrations. (2) Excavations exert considerable influence in stopping vibrations. (3) In soft damp ground it is easy to produce vibrations of large amplitude and considerable duration. (4) In loose dry ground an explosion of dynamite yields a disturbance of large amplitude but of short duration. (5) In soft rock it is difficult to produce a disturbance the amplitude of which is sufficiently great to be recorded on an ordinary seismograph.

II. *General Character of Motion.*—(1) The pointer of a seismograph with a single index first moves in a normal direction, after which it is suddenly deflected, and the resulting diagram yields a figure partially dependent on the relative phases of the normal and transverse motion. These phases are in turn dependent upon the distance of the seismograph from the origin. (2) A bracket seismograph indicating normal motion at a given station commences its indications before a similar seismograph arranged to write transverse motion. (3) If the diagrams yielded by two such seismographs be compounded, they yield figures containing loops and other irregularities not unlike the figures yielded by the seismograph with the single index. (4) Near to an origin, the first movement will be in a straight line outwards from the origin; subsequently the motion may be elliptical, like a figure 8, and irregular. The general direction of motion, is, however, normal. (5) Two points of ground only a few feet apart may not synchronise in their motions. (6) Earthquake motion is probably not a simple harmonic motion.

III. *Normal Motion.*—(1) Near to an origin the first motion is outwards. At a distance from an origin the first motion may be inwards. (2) At stations near the origin the motion inwards is greater than the motion outwards. At a distance the inwards and outwards motion are practically equal. (3) At a station near the origin, the second or third wave is usually the largest, after which the motion dies down very rapidly in its amplitude, the motion inwards decreasing more rapidly than the motion outwards. (4) Roughly speaking the amplitude of normal motion is inversely as the distance from the origin. (5) At a station near an origin the period of the waves is at first short. It becomes longer as the disturbance dies out. (6) The semi-