sphere with the following wave-lengths:—Lockyer λ 4685·90, Dyson λ 4685·86, and Mitchell λ 4686·00. The wave-lengths which the authors have now deduced from fifteen plates of the star are as follows:—

Frost: 4685·897 ± 0·016 (15 plates).
Lowater: 4685·903 ± 0·018 (15 plates).
Mean: 4685·90.

Other important lines, the stellar wave-lengths of which are here deduced, are λλ 4116·33, 4097·55, and 4089·12, closely approximating to the wave-lengths given by Lockyer in ε Orionis, namely, 4116·54, 4097·59, and 4089·14. With regard to the radial motion of the star, the motion of the system is given as probably −12 km., almost wholly due to the solar motion. From one plate they give the velocities of the two components, but state that the data are insufficient for indicating the period of the star, but "there seems to be little to suggest a period of less than several days."

THE ORBITS OF δ ORIONIS, R.Z. CASSIOPEIÆ AND R.X. HERCULIS.—Nos. 15 and 16 of vol. iii. of the Publications of the Allegheny Observatory describe the researches by Mr. Frank C. Jordan on the orbits of δ Orionis and R.Z. Cassiopeiæ. In the case of the former, thirty-six spectrograms of the star were secured with the Mellon spectrograph during the period 1908 to 1912, and these were used for the determination of the orbit and at the same time to rediscuss Hartmann's results. A comparison of the elements derived shows that the shape and size of the two orbits are practically identical. The radial velocity of the system has different values in the two derived orbits, but this difference is stated to be apparent rather than real. If, however, it should be proved to exist, the author states that "it would imply a third body, making the system similar to that of Algol." R.Z. Cassiopeiæ exhibits a light variation of an Algol-type star, and Mr. Jordan summarises the various values of the period derived by previous workers. The earliest spectrographic observations of the star were made in 1906 by Hartmann, and while he found a velocity range from +33 to −112 kilometres, this agrees well with the range of the definitive curve here given, namely +28 to −111 kilometres. For the present discussion seventy-one plates were employed, taken during the years 1910 to 1913, and tables are given showing the velocities deduced from each plate, the wave-lengths and origins of the line employed, etc.

Mr. Harold Shapley, in the *Astrophysical Journal* for November (vol. xl., No. 4, p. 399) contributes a paper entitled "The Spectroscopic Orbit of R.X. Herculis Determined from Three Plates with a New Photometric Orbit and Absolute Dimensions." He shows that the solution for the elements of the spectroscopic orbit of a faint star is possible when only a few measures of the radial velocity have been determined, provided that the system is an eclipsing binary and that the period, epoch of minimum, eccentricity, and longitude of periastron have been derived from the light curve. In his summary he states that the new photometric orbit of R.X. Herculis has been computed from unpublished observations obtained at Harvard and Princeton. The alternate minima are found to differ in depth by nearly a tenth of a magnitude. The stars are nearly equal in size, and are sensibly spherical. Their surfaces are separated by three times the radius of the larger star. From measures of lines on three plates it has been possible to derive very satisfactory spectroscopic orbits of both components. The combination of elements from the photometric and spectroscopic orbits gives the actual dimensions of the stars. The parallax of the system is found to be 0·006″.

AGRICULTURE AND THE WAR.

AT the half-yearly meeting of the Agricultural Education Association, just held in London, a discussion was held upon "Agricultural Products Deflected by the War." The chairman of the association, Prof. Somerville (Oxford University), presided, and there was present a large gathering of members, including Sir Patrick Wright (Board of Agriculture for Scotland), Mr. J. F. Blackshaw (Board of Agriculture), Prof. Barker (Bristol University), Profs. Seton and Crowther (Leeds University), Prof. Gilchrist (Armstrong College, Newcastle-on-Tyne), Dr. Goodwin (Midland Agricultural College), Drs. Russell and Hutchinson (Rothamsted), Prof. Hendrick (Aberdeen University), Prof. Bryner Jones (Aberstwyth), the hon. secretary, Mr. P. Hedworth Foulkes (Harper Adams Agricultural College), and others.

We give a summary of the remarks made by Dr. Russell, director of the Rothamsted Experimental Station, in opening the discussion:—

The object of to-day's discussion is to see how agriculturists are likely to be affected by the dislocation caused by the war, and what line we, as expert advisers to the farmer, ought to take. There can be no doubt about the main duty of the farmer in the present crisis. He must by all means in his power increase the saleable output from his farm, particularly of those things which the community needs most—a need which is expressed by an increase in price. In framing this advice it must be remembered that the ordinary unit of time for the farmer is the length of the rotation, but in these special circumstances the unit might well be altered to the duration of the war. Thus a scheme which would usually be condemned as bad husbandry from the ordinary rotation point of view might nevertheless be advantageous in the new conditions.

Roughly speaking we may classify the agricultural products affected by the war into two groups: those which are permanently affected, and those which are only temporarily affected. Correspondingly there must be two methods of ascertaining their value to the farmer: careful investigations for permanent purposes, and more rapid and necessarily less accurate trials for temporary purposes.

Palm nuts are fortunate in coming within the purview of the West African Committee, under the guidance of Sir Owen Phillips, and thanks to their enterprise all of us here have been duly informed of the character of this product, while a number of experiments have been put in hand to test its possibilities for British agriculture. For permanent purposes a full investigation is required, and will, of course, be given. Continental experience has shown that the material is good; at the same time we know that it has been put on the market before, and it did not take permanent hold. Apparently no serious fault was found with it, yet it never became part of our regular concentrated food for stock. There must be a reason for this, and the object of the investigation will be to ascertain what it is.

Other products of like nature are no doubt available or will become so—and will probably form the subjects for investigation. But there is an emergency problem that is quite different in nature and wants altogether different treatment. We have seen during the last five months a marked rise in the price of cereals. This is an expression of the fact that the community wants these particular goods, and the farmer must do his best to supply them. Now many farmers do not grow their winter oats entirely for sale. Part—often the greater part—of the stock is kept back for their own horses. Much food also is produced for stock. The important emergency

problem arises: Can we recommend any ration in which imported or other products, cheap in price because they are not now needed by the community, can replace and liberate from the farm home-grown produce that is wanted elsewhere? Time will not allow of a full investigation, and the advice must often be based on foreign work or on past experience elsewhere. Short, rapid trials alone will meet the case. It is not necessary that the whole stock should be liberated; an increased sale of only 10 per cent. from every farm would add very materially to the quantity available for the community.

The replacement, of course, must be done without prejudicing the total food supply; thus we must not advise the production of grain at the expense of milk or of meat; our main concern will be to increase the saleable output.

Another type of product is only temporarily affected. A certain amount of guano which used to go to Belgium is now available. Shoddy or wool waste may be confidently expected in quantity whilst the Yorkshire mills are kept going so busily. There are also considerable amounts of sulphate of ammonia obtainable.

In time of peace cereals are often grown simply on residues of previous crops. Probably in every district the agricultural adviser knows of some manurial scheme that would make use of these products and increase the yield. It cannot be too strongly urged that demonstrations should be put in hand as speedily as possible to show how this can be done. The cost of the manurial scheme should not be too high; these are not times when speculative propositions can be undertaken, but only those that are likely to prove successful. It is certain that the area under wheat has been increased this year; the efforts of the agricultural adviser should be extended now to an increase in the yield per acre. Potash must remain a difficulty until the present search for new supplies is rewarded with success.

A third problem of importance is this:—Are any rearrangements possible whereby products not likely to be in much demand shall cease to be produced? This applies more particularly to horticulturists and market gardeners than to agriculturists. Early cucumbers, for example, have hitherto gone almost entirely to Germany, and this fact was realised in time to prevent growers from trying to raise them. The production of certain fruit and other market garden produce may require similar readjustment.

In conclusion, the time is appropriate to urge on all our farmers the need for reducing all waste to a minimum. The ordinary farm compares badly with modern manufacturing concerns in this respect; considerable amounts of material are left to waste on the plea that it is not worth while doing anything better. It can never be too strongly urged that waste is a sign of bad farming, and the present is a good time for reform.

NEW CANADIAN DINOSAURS.

TWO very remarkable new types of Canadian Cretaceous dinosaurs are described by Mr. Barnum Brown in the first and last of a consecutive series of three papers published in vol. xxxiii., pp. 530–65, of the Bull. Amer. Mus. Nat. Hist. The first of the triad is devoted to Anchiceratops, a member of the horned group (Ceratopsia) from the Edmonton beds of Alberta, characterised by the great size of the knobs bordering the nuchal flange, and the pair of large oval vacuities by which the latter is pierced. Special interest attaches to this type from the fact that it serves to explain the mode of origin of the ceratopsian flange. In the smaller and less specialised type represented by Monoclonius the supra-occipitals form a pair of hook-like opposing processes on the hind border of the upper surface of the skull, leaving a mushroom-shaped interval between them, and a pair of very large vacuities in the skull-roof. In Anchiceratops the supra-occipital processes have united in the middle line, where only a remnant of a central fontanelle is left, while the vacuities in the lateral portion of the cranial roof are very much smaller. Finally, in Triceratops, which is both the largest and latest member of the whole group, all vacuities have disappeared from the cranial roof and the nuchal flange attains its maximum development.

In the second paper the author describes and illustrates a nearly complete skull of the aforesaid Monoclonius from the Belly River beds of Alberta, which exhibits very clearly the features just referred to. But by far the most interesting of all is the skull (associated with the skeleton) of a trachodont dinosaur from the formation last mentioned, remarkable for the elevation of the cranial region into a tall, helmet-like crest, formed by the nasals, prefontals, and frontals. This unique conformation recalls the skull of the helmeted cassoway—a feature commemorated in the specific portion of the name (*Corythosaurus*

Skull of *Corythosaurus casuarinus*. About one-tenth natural size. *Den*, dentary; *Ex.O*, exoccipital; *Fr*, frontal; *Ju* jugal; *La*, lachrymal; *Mx*, maxilla; *Na*, nasal; *Pmx*, premaxilla. *Po.f*, postfrontal; *Pr.den*, predentary; *Pr.f* prefrontal, *Qu*, quadrate; *Sur*, surangular; *Sq*, squamosal.

casuarinus) proposed for this new type. As minor features of the skull (the figure of which is herewith reproduced on a reduced scale) may be mentioned its relative shortness, the narrow beak, and the small size of the narial aperture.

At the close of this paper Mr. Brown proposes a revised classification of the Trachodontidæ, which he divides into the two families Trachodontinæ and Saurolophinæ, the latter characterised by the presence of a cranial crest which is lacking in the former. The first group is represented by the genera Trachodon, Kritosaurus, Hadrosaurus, and Claosaurus, and the second by Saurolophus, Hypacrosaurus, and Corythosaurus. R. L.

GEOLOGY IN AUSTRIA-HUNGARY.

THE widely representative character of the work of the Geologische Reichsanstalt of Vienna is fully maintained in recent issues of the *Jahrbuch*. One of the most notable publications from the point of view of students and teachers of geology is that by O. Ampferer and W. Hammer, entitled "Geologischer