

nitrates, a quantity as great as is contained in a 24-lb. bushel crop of wheat.

It appears that this wastage of nitrates in winter can be greatly reduced, but the process requires suitable crops and rapid cultivation methods. Neither of these ought to be beyond the power of the agriculturist to provide. The possibilities are many. Wibberley has discussed several schemes of continuous cropping that satisfy these requirements, giving a succession of crops which cover the land at the critical time when losses would occur. And our implement-makers are steadily increasing the number and effectiveness of the implements, while motor traction promises also to increase the speed of working.

A further direction in which improvement is possible is in cultivation. Reference has already been made to the necessity for increasing the speed of ploughing so as to get the work forward and enable the farmer to plough just as much as he likes in autumn, or, if he wishes, to get in a bastard fallow or a catch-crop. The motor-plough seems the only solution, and as soon as the difficulties of engine construction are got over and the price becomes sufficiently low, I think it must displace the horse-plough as inevitably as the railway displaced the stage-coach. Both the soil and the human factors tend this way. So long as a man and two horses, and in some parts of the country a man and a boy and three horses, can only manage to plough an acre a day, it is obvious that the farmer cannot afford to pay more than a small wage for the work; but when a man on a motor-plough can do several acres a day a considerably higher wage becomes possible.

The last economy to which I shall refer is the choice of crops. The farmer grows his crops for profit, and clearly ought to select the most profitable for the purpose. This can only be done by keeping accounts. No crop ought to be grown that does not pay its way; it should be displaced by one that does. On our own farm we find that wheat, oats, and barley are about equally profitable; but the crops in the root- or fallow-break vary enormously—potatoes bringing in most profit, while swedes, on the other hand, are invariably grown at a loss on our land. I believe this would be found not uncommon in the southern part of England. Amos and Oldershaw have recently gone into the cost of silage crops in these conditions. More experiments and inquiries are greatly needed to widen the range of this class of crops, and give us something that will be as useful as swedes but more profitable.

Besides these improvements in crop-production which affect all farmers, even the best, there are two other ways in which we can hope for further developments.

One is to raise up the ordinary farmer to the level of the good one. The average crop of wheat for the country is officially reported to be 32 bushels, but no good farmer would be content with less than 40. If we accept the official average there must be a good amount of wheat grown at much less than the best that is possible even now. A vast amount of educational work has to be done to spread the knowledge of the best methods, varieties, manures, etc.

The other is to extend the area of land under cultivation. There are still wastes to be reclaimed, as Mr. Hall is reminding us, while even on farmed land the proportion under the plough each year is only small, and is constantly decreasing. Grass-land only produces about one-half of what arable-land yields, and it is imperative to the proper development of the country that some of it should be broken up. The farmer knows this, but he does not put his knowledge into practice. He cannot always afford the risk. There is a fundamental distinction between farming and manufacturing that is often overlooked in discussions on the subject. Except in rare cases—sugar beet and some

kinds of seeds—the farmer does not grow for contracts, but always for what manufacturers would call "stock." The manufacturer makes a contract to supply certain goods at a certain price; he knows what his machinery will do, he can insure against many of his risks, and get out of the contract if others befall him. He knows to a penny how much he will be paid, and so he can calculate to a nicety how much he can afford to spend, and how far he can go in introducing new methods. Now the farmer cannot do this. He cannot be certain what yield or what price he will get. He starts spending money in August on a crop that will not be sold for fifteen months, and he has no idea how much money he will receive in return. The whole thing is a hazard which cannot be covered by insurance. Obviously, then, the farmer must leave a big margin for safety, so he balances his risks by laying down some of his land to grass, where the risks are at a minimum. But when you ask him to intensify his methods, and, as a necessary corollary, to break up some of his grass-land, he has a perfect right to ask who is going to bear the extra risk.

The problem has been burked in the past, but must be faced in the future. It is essentially a question of distribution of risk, and it ought not to be beyond the political insight and economic wisdom of those whose business it is to settle these matters.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

SHEFFIELD.—Dr. W. E. S. Turner has been appointed lecturer in charge of the new department of glass technology. Mr. G. A. Birkett, formerly of the University of Liverpool, has been appointed to the new Vickers lectureship in Russian. A permanent appointment is deferred until the conclusion of the war.

The council has nominated Mr. A. J. Hobson, J.P., to be a pro-chancellor of the University in succession to the late Sir George Franklin.

MISS H. DE PENNINGTON, assistant lecturer in chemistry at the Blackburn Technical School, has been appointed research assistant to Prof. J. B. Cohen at the University of Leeds.

We learn from the *Münchener Medizin. Wochenschrift* that the medical faculty of the University of Göttingen has received two legacies, each of 10,000 marks, under the wills of the late Prof. von Esmarck and of the late Prof. Paul Ehrlich, of Frankfurt. The money will form a fund for assisting needy medical students.

IN connection with the present campaign for the preservation of infant and child life, the governing body of the Battersea Polytechnic has arranged for a public lecture to be given by Dr. C. W. Saleeby. The lecture will be entitled "The Saving of the Future," and will be held at the Battersea Polytechnic, Battersea Park Road, S.W., on Thursday, December 7, at 7.30 p.m. No tickets of admission are required.

THE fifth annual Conference of Educational Associations is to be held in the University of London on January 1-6 next. The inaugural address is to be delivered on January 1 at 3 p.m. by Mr. A. L. Smith, master of Balliol. Among the associations taking part in the conference this year are the School Nature Study Union, the Child Study Union, the Committee for the Development of Regional Survey, the Association of Science Teachers, and the National Association for Manual Training. Among the large number of addresses arranged for may be mentioned the following:—The possible educational value of kinemas, by

Prof. R. A. Gregory; the response of plants to light, by Dr. Harold Wager; nitrates from the air, by Mr. E. K. Scott; and handwork as character training, by Mr. A. H. Angus and Dr. P. B. Ballard. Full particulars of the arrangements can be obtained from the conference secretary, Mr. Frank Fairman, 9 Brunswick Square, London, W.C.

LORD MILNER presided at a lecture on November 22 at King's College, by Dr. Fisher, Vice-Chancellor of the University of Sheffield, on "The Intellectual Groundwork of Politics." In moving a vote of thanks to Dr. Fisher, Lord Milner referred to recent discussions on the place which science should occupy in the school curriculum. He expressed the opinion that the great progress which the human race has made in recent times has given such an enormous importance to applied science that a man is now scarcely at home with the problems of the day—certainly not with the economic questions—without some knowledge of the sciences, and consequently not fully able to master the political problems which depend upon them. The training in physical science is not, he said, so much book learning as actual science and practical acquaintance with some form of science. Whatever the effort, an important share in the educational life of every boy and young man in future should be to bring him into close relation with the great achievements of science. That he believes is essential, and as important to men who are going to devote themselves to a political career as to men who are going to devote themselves either to scientific research or to the pursuit of some business which largely depends on the results of science.

A LECTURE delivered at Stellenbosch, by Prof. S. J. Shand, of Victoria College, on the occasion of the passing of the University of Stellenbosch Act, is published in the Stellenbosch *Students' Quarterly* for June last. Prof. Shand took as his subject the making of a university, and drew distinctions between colleges and universities. The aim of college teaching, he said, is the imparting of existing knowledge with the specific object of enabling a man to pass certain tests and to satisfy necessary conditions in order that he may advance his prospects in life. The only aim of a university, he urged, is, or ought to be, the advancement of learning in the widest sense. When a professor does not work at his subject and is content merely to teach it, he may find a useful place in a school or college, but there is no room for him in a university. It is perhaps, Prof. Shand continued, the most serious charge that can be brought against the South African colleges that they have done nothing to encourage research and discovery. It should be the business of the newly constituted universities to remedy this state of affairs by recognising that the advancement of knowledge is the most important service they owe to the State. It should be insisted upon, therefore, that the professors shall not be regarded simply as teachers; their business is the advancement of knowledge no less than the spreading of it, and that this object may be pursued they must not be too much burdened with formal teaching.

THE council of the Institution of Naval Architects offers for competition the "Martell Scholarship in Naval Architecture" of the annual value of 100*l.*, and tenable for three years. Candidates must forward a written application to the secretary of the institution, 5 Adelphi Terrace, W.C., by January 15, 1917. They must not be less than eighteen or more than twenty-one years of age on March 1, 1917, and must at that date have been continuously employed for at least two years upon naval architecture or marine engineering. The scholarship will be awarded in connection with

the competitive examinations for scholarships held by the Board of Education next May and June, in the following subjects:—Naval architecture, pure mathematics, applied mechanics (materials and structures), and either machines and hydraulics or heat engines. Candidates will be required to furnish by January 15 next evidence that they have passed some literary test in English. If a candidate can produce similar evidence of a knowledge of French, German, or Spanish, credit will be given for such knowledge. Successful candidates will be required to undergo a three years' course of study in naval architecture in a college approved by the council, and this course will be combined with practical training in a shipyard or marine engine works. The council of the institution administers other scholarships which are offered for competition among students of the institution, particulars concerning which may be obtained from the secretary.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, November 10.—Prof. C. V. Boys, president, in the chair.—B. W. Clack: Diffusion in liquids. The paper contains the results of the experiments described by the author in *Proc. Phys. Soc. Lond.*, xxi., p. 374, 1908; xxiv., p. 40, 1911; and xxvii., p. 56, 1914, collected and recalculated in accordance with a theoretical correction recently communicated by Dr. Griffiths (*Proc. Phys. Soc.*, xxviii., p. 255, 1916). It is found that in the solutions employed the correction is not considerable, except in the case of the strongest solutions of KCl (2.7 normal), where it amounts to 6 per cent. The paper contains the corrected theory of the method, and the value of the coefficient of diffusion is tabulated at different limiting concentrations and at various temperatures.—Prof. H. Nagaoka: The regularity in the distribution of the satellites of spectrum lines, with a note on the structure of the green line of mercury, and terms of correction in using a concave grating. The paper describes a further development of the work done by the author and Mr. Takamine on the distribution of the satellites of the mercury lines. It is shown that much of the discord between the results of various observers of these satellites is due to the unsatisfactory nature of the principal line as a datum from which to define their positions, and that if the distances be measured from one of the distinct satellites good agreement is obtained. If these separations be expressed as differences of wave-number, instead of wave-length, a remarkable symmetry in their distribution becomes apparent. For example, among the satellites of the green line, 5461, can be found three groups of symmetrical triplets, of which the wave-number differences are in the simple ratios 1:3:12. Similar results are obtained for other lines, the principal component of λ 4359 being shown for the first time to consist of a triplet, of which the middle component is relatively weak. A similarity in the distribution of the satellites exists for all the lines examined, and certain wave-number intervals are common to all.

CAMBRIDGE.

Philosophical Society, November 13.—Dr. Marr, president, in the chair.—Prof. Wood: The surface law of heat loss in animals. Figures expressing in pounds of starch equivalent a number of successful and economical rations for fattening cattle were shown within the limits of error of experiment to fall on a curve expressing the theoretical food requirements calculated according to Rubner's surface law for live-weights varying from 80 lb. to 1400 lb.—Prof. Punnett and Capt. P. G. Bailey: Inheritance of henny plumage in