

result is obtained for several seasons running, one may be sure of being right.

All that is old; it is, of course, Ville's method over again. The new part consists in trying to extend the results to other soils. For this purpose a soil survey of the area, usually the county, is arranged. In this way a collection is made on one hand of the agricultural properties, on the other of the chemical, bacteriological, and physical data, of typical soils. It is obvious that the possession of these standard soils helps the analyst and expert adviser very considerably; if a farmer asks for information it is much easier and safer to compare his soil with the standard than to attempt any absolute measurements. Moreover, these soil surveys are greatly facilitating advisory and analytical work.

They do far more than that, however. The normal case of crop production can never be decided on purely laboratory methods because there are always two or three varying factors, whereas in the ideal laboratory experiment there is only one factor varying. We are not, however, confined to the ordinary laboratory methods. Statisticians have to deal with problems involving two or three variables, and they have worked out a method—the method of correlation—which, when intelligently applied, gives valuable results. It is hoped to apply this to crop production. The necessary masses of data are slowly being accumulated, and it is anticipated that very interesting results will be obtained.

The ordinary laboratory method, however—the one factor method—may still on occasions work satisfactorily. It sometimes happens in nature that one of the various interacting factors overshadows all the rest and virtually eliminates them, so that here, too, it is possible to apply laboratory methods with satisfactory results.

For example, on a certain type of clay soil the whole situation is controlled by the circumstance that phosphates are almost absent, whilst the need of the plant for phosphates is particularly great. The addition of basic slag in these circumstances has caused most remarkable improvement. The best instances are seen at Cockle Park, and the results are given in their bulletins.

Another illustration is furnished by our work on the partial sterilisation of soils. The simplest explanation of the phenomena is that the soil population can roughly be divided into two groups: one favourable to the production of plant food, the other not. The useful population is, on the whole, more resistant to adverse circumstances than the harmful organisms, and therefore survives more drastic treatment. Hence any method that kills some, but not all, of the soil population effects an improvement and leads to good results. A continued spell of favourable conditions, however, enables the harmful organisms to establish some sort of superiority. This hypothesis throws important light on the behaviour of the soil in natural conditions, and it reveals another factor in crop production.

We have not yet succeeded in making much of it in the normal case; indeed, we have scarcely attempted to do so, because there are so many interacting factors. There are, however, cases where this one factor largely dominates the situation. In glasshouses run at a high pitch, where the soil temperature and water content are high, and where large dressings of organic manures are used, the bacterial efficiency falls off so much that the plants begin to suffer. The soil, in the picturesque language of the practical man, is said to become "sick." This sickness proved so difficult to deal with in practice that the soil was thrown out and new soil brought in to take its place.

It was not difficult, however, to suggest a remedy. The reduction of bacterial activity seemed clearly due to an excessive development of the detrimental organisms. It was only necessary to adopt partial sterilisation to get rid of these and to give the useful organisms a better chance of action. The basis of a suitable method was already in existence; steam had been used to kill insect pests in the houses, and by suitable modification this process was successfully used for the treatment of sick soils.

The most fruitful ideas for working out the development of our subject have often been got from abnormal cases brought in by the growers. Practical men have the great advantage that they are compelled to keep their eyes open for nature's problems; they cannot shirk them, or they find their crops suffering and themselves losing money. The close association of science with an industry is, therefore, a great advantage, because it brings in new problems which, if properly investigated, may prove extremely valuable in opening up new fields of knowledge. There is an exhilarating freshness about all this work that one often misses in the more academic investigations.

All the same, while speaking in praise of applied science, one must recognise that science cannot be applied until it is developed. We have seen, and instances might have been multiplied, how the hydrolysis of protein throws light on the proper management of a manure heap, and how the adsorption isotherm worked out for charcoal and dilute acids clears up a difficulty in the manuring of turnips. It is impossible to set any limit to the value of good work in science honestly carried out. The fact is that science and creative industry are one and indivisible, and any attempt to divorce them may only end in disaster.

#### UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE *Morning Post* of January 18 announces an anonymous gift of ten thousand guineas to King Edward's Hospital, Cardiff, towards the cost of new extensions.

THE *Times* of January 14 announces that Sir Alexander M'Robert has given to Aberdeen University an endowment of about 750*l.* per annum for a Georgina M'Robert lectureship on pathology, with special reference to malignant diseases.

THE National Diploma Examination in Agriculture of the National Agricultural Examination Board will be held at the University of Leeds on April 14 and following days, and examinations in the science and practice of dairying will take place in September at the British Dairy Institute, Reading, and at the Dairy School, Kilmarnock. Entries for the first-named examination must be sent in not later than March 1, and those for the latter ones not later than August 15.

THE December issue of the *Reading University College Review* is largely a record of the continued effect of the war upon the work of the college. All the conditions during the first year of the war have affected also the first term of the present session, but in greater measure. The number of men day-students at the beginning of the term had fallen to about forty, and of this number some left at the end of last term in order to undertake military service. More members of the academic staff have undertaken military or Government service, and others are likely to follow their example. Wantage Hall is again in military occupation, and the council has agreed to place rooms

and offices at the disposal of the Flying School which is about to be formed in Reading. Munitions work has been instituted in the physical laboratory, and the making of splints for use in hospitals is being carried on in the building devoted to craft work. The lists of military distinctions and of officers killed in action, as well as the list of present members of the staff, past and present students, and present servants of the college serving with the Forces of the King or in the French Army, printed in the magazine, are a splendid tribute to the loyalty and patriotism of the institution.

FOUR points relating to the place of science in education are dealt with by Sir E. Ray Lankester in a letter to the *Times* of January 14. The first consideration is that instruction in the elements of physics, chemistry, and biology must not be limited to the few, but be a part of the education of all; for they are equally necessary for the conduct of public affairs in a progressive spirit as for the development of industries. The view that attention to scientific knowledge necessarily leads to the barbarisms committed by our German adversaries is as illogical as it is untrue. The men who are responsible for the present conflict are not men of science but historians and other official advocates of world-power by Germany; and the military authorities have made use of whatever forces scientific discovery can give them. The third point referred to is that science in the public schools and universities is regarded as specialisation, whereas Greek and Latin and allied subjects are considered to be parts of a general education. This view is a legacy of past centuries, and should be the reverse of the truth for modern times, though classical headmasters will not understand the different needs of to-day, and will not depart from the ways of traditional instruction. Sir Ray Lankester places the chief burden of responsibility for existing conditions upon the Civil Service Commissioners, who assign an overwhelming excess of marks for classical and literary learning in examinations for the chief posts in the national service. He would give one-half of the possible total to science, which should be compulsory for all candidates, one-quarter to mathematics, and one-quarter to the classical and literary group; and he believes that "the one and only way of saving the country from utter inefficiency and consequent ruin is for the Legislature entirely to remodel the competitions for the valuable posts of the Home and Indian Civil Services."

An interesting supplement on "War and Education" appeared in the *Times* of January 14. It is a commonplace that a great war is invariably followed by educational reform, and in the first article this is illustrated in English education from Alcuin to the South African war. It was the last-named which led to measures—medical inspection and provision of meals—for securing better physical care of school children. In most of the articles the importance of character training receives due recognition, the columns headed "A Lesson of Empire" and "Teaching Patriotism" being written with force and judgment. The editor directs attention to the great need of the immediate future, the training of boys and girls between the ages of fourteen and seventeen. At present two millions below the age of seventeen are receiving little or no education either in school or in skilled work. All who have given thought to the matter are in agreement as to the importance of educating our adolescents, both from the point of view of ethical training for citizenship and of increasing productive efficiency, but not all thinkers will agree as to the methods advocated by the editor of the "Educational Supplement." Dr. M. E. Sadler

discusses the comparative merits of German and English education, and gives as the defects of English education: (1) too low a standard of *mental* training, hence failure to realise the value of pure science; (2) uninstructed parental opinion; (3) failure to stimulate intellectually the average boy and girl; (4) inertness of mind towards science in industry, public administration, and domestic management; (5) neglect of personal hygiene in its widest sense. British schools must impart love of knowledge and care for conduct; love of adventure and readiness to endure routine; capacity for individual initiative, and patience in the work of scientific co-operation. All the articles are useful so far as they go; it is a matter for regret that Dr. Sadler is alone in recognising the necessity for greater attention to science. The unfortunate and serious omission to give proper consideration to this vital need is a defect in an otherwise able and helpful symposium.

With the approval of the War Office, Colonial Office, and Board of Education, and of the High Commissioners of the Dominions beyond the Seas, an organisation has been formed with the title of "The Fighting Forces Book Council." This organisation, of which Lord Bryce is president, and Sir Edward Ward the chairman of the executive committee, is intended to supplement, and not in any way to overlap, existing bodies, such as the Camps Library, which is the recognised collecting and distributing *dépôt* for the books sent through the medium of the General Post Office, the Red Cross, and St. John's Ambulance War Library, which supplies the hospitals, and the Young Men's Christian Association. Through the machinery of these various organisations large quantities of books—mainly light fiction—are being regularly distributed to the forces on active service, naval and military hospitals, and convalescent camps, both at home and abroad. It has been found, however, that books of a more solid kind are asked for by an immense number of educated men now in the military service of the Empire. The objects of "The Fighting Forces Book Council" are to try to meet this need, and at the same time to assist the existing organisations in every possible way. It proposes to: (1) raise funds for providing reading matter of the kind indicated above for his Majesty's Forces at home and abroad, including the wounded and convalescent and the British prisoners of war; (2) procure, by purchase or gift, books of this kind in sufficient quantities, and arrange for their distribution through the Camps Library to the various organisations and corps; (3) draw up lists of such books required by, or suitable for, various types of men. An appeal is made for funds to carry on this work, and we trust that it will meet with a ready and generous response. Contributions should be forwarded to Dr. I. Gollancz, treasurer of the Fighting Forces Book Council, Seymour House, Waterloo Place, London, S.W., or to the London County and Westminster Bank, Law Courts Branch, W.C.

#### SOCIETIES AND ACADEMIES.

LONDON.

**Aristotelian Society**, January 3.—Dr. H. Wildon Carr, president, in the chair.—Prof. A. N. Whitehead: Space, time, and relativity. Mathematicians have succeeded in defining diverse Euclidean measure-systems without any reference to distance. There are alternative groups of such congruent transformations of space all equally applicable, but, while the distance  $P_1P_2$  may equal the distance  $Q_1Q_2$  for one measure-system, it