FUEL ECONOMY

The Fuel Efficiency Committee of the Mines Department has recently published four brochures dealing with the urgent necessity of saving fuel and has courteously placed a sufficient number at our disposal to issue to readers of the Journal.

The memoranda have been prepared with the object of achieving efficiency and economy in the use of fuel in existing plants. So wide a subject calls for very detailed consideration and a careful perusal of the brochures in conjunction with the memorandum on the subject which appeared in the February issue of this Journal (p. 34) and the reports of discussions held at the Sections of this Institute and published in the June issue (p. 142) should be very helpful and suggestive to those who are responsible for fuel consumption in breweries.

The first of the series of reprints deals with problems concerned with the generation of steam and power in small plants, the second with the subject of lagging to ensure heat insulation, the third with correct methods of condensate and air removal and the fourth with how to make the best use of condensate.

These four pamphlets are written in simple terms and they constitute a most useful and up-to-date contribution to the raising of steam and its treatment.

In the discussion on fuel economy at the Sections of the Institute reiterated complaints were made that the fuel available was frequently not suited to the boiler plant and that deliveries of fuel were in many cases not uniform. It is not surprising under such difficult circumstances that with the best of plant and supervision the weight of fuel used shows an increase. This point is not dealt with fully by the Fuel Efficiency Committee, but in the brewer’s interests it is well that it should have been made.

It is to be anticipated that the Ministry of Mines may expect some information from us as to the result of its propaganda in the form of the brochures and the Institute’s memorandum and publicity on the saving of fuel.

The brewing industry is doing all it can in this direction, and its efforts are closely watched by the Fuel Economy Committee of our Institute.

From such enquiries and investigations good can only accrue, and it may well be that they will lead to the reduction of one of the prime costs of the brewing process when the present anxious time is over.

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SCIENCE AND THE LAND

The continued existence of the human race is dependent to a very large extent upon the land which indirectly provides all food and clothing and whilst primitive nomadic man was able to satisfy his needs from uncultivated vegetation the development of civilisation some seven thousand years ago has necessitated the application of husbandry to an ever increasing extent. At the present day the cultivation of food crops for both men and animals demands more human activity than any other industry and the many aspects of the subject were admirably dealt with by Prof. F. L. Engledow in the Jubilee Memorial Lecture delivered at Birmingham. This lecture, published in Chemistry and Industry of 30th May, 1942, is well worth the attention of all interested in the applications of science to agriculture and serves to indicate the complexity of the many problems involved. The dominant factor in the scientific investigation of farming is the capricious nature of the various factors concerned, such as weather, soil conditions which may exhibit great diversity over an area of a few square yards, the severity of attack by pests and diseases and the slow cumulative changes which may occur when similar crops or stock are raised continuously on the same land. These not infrequently wreck the most carefully designed experiments and introduce enormous difficulties in arriving at the exact knowledge so necessary for future developments. The use of mechanical power for cultivation, artificial fertilisers, irrigation and drainage have reduced the importance of the type of soil during the last few decades, but in view of the difficulties involved in discovering new territory for exploitation the steadily increasing population will still make agriculture one of the most important problems of the world.

Man has long been familiar with the wholesale removal of surface soil by natural agencies, but it has been recognised only during the last few years that human activity has lead to disastrous results by clearing forests and other vegetation, thus exposing the soil to the erosive action of rain and wind. A notable example of this is the wide expanse of Dartmoor, which since the removal of its trees to smelt the Cornish tin ore has remained a barren waste. Suitable irrigation has rendered many formerly barren areas fertile, but in some cases the disturbance in the distribution of soluble salts in the soil caused by this operation has inhibited cultivation entirely. The physical properties of the soil are controlled to some extent by farming operations, but the scientific explanations underlying the results obtained and their effect upon cultivation are very limited owing to their complexity. The use of artificial fertilisers is dependent upon past scientific investigations and much success has been achieved by their application although our knowledge is still very limited with
regard to the essential "traces" elements such as boron, copper, etc. The heterogenous nature of the soil introduces enormous difficulties in the endeavour to assess the value of such elements and considerable improvement is needed in the technique of sampling and the statistical analysis of the results obtained. The organic matter varies greatly in quantity in different soils and widely varying opinions are held with regard to the value of the humus present. Owing to its complex nature this constituent is not readily defined and its effect is so varied on different soils and crops that much more work will be necessary before our knowledge of the subject is clearly defined. For many centuries the prevailing farming systems of the world have been adapted as far as possible to the local weather conditions, but owing to the inconstant nature of the latter much uncertainty must exist even when science and practical ingenuity have been applied to the fullest extent. Thus the agriculturist must be prepared to take unavoidable risks imposed upon him by climatic conditions such as variation in air temperature, wind and rainfall. A factor of considerable importance to which scientific investigation has contributed much success is the control of weeds, and the introduction of new kinds of crops from other countries as well as the breeding of new and more useful varieties of plants owe much to the application of scientific method. Owing to the gradual change in habits and taste of consumers the problems connected with the quality of plant and animal products are in a continuous state of flux and scientific progress is compelled to keep pace with these changes. In the breeding and feeding of animals a wide field of investigation lies open and much progress has already been made, but until commercial quality can be defined and measured many problems must remain unsolved. Little or no scientific knowledge exists relating to the housing of livestock and regulations made by local authorities are often based upon ignorance. The diseases and insect pests of plants and animals receive the attention of an army of workers in all parts of the world and much has been achieved in their suppression, but new problems continually arise from a variety of causes and need increasing attention with the passage of time. The many considerations indicated above are by no means individual subjects for one may have to deal with in its relation to several others, and an investigator in one branch may find himself drawn far away from his original objective during the progress of his work. However, by the patient progress of the scientific worker an adequate food supply for the nations of the world will be attained without which a lasting peace and a comfortable world would be impossible.

THE CHEMISTRY OF SOILS

Many of our readers would no doubt be puzzled if asked to define the term "Pedology" and those with higher erudition would probably suggest that it bore some relation to children or the feet of men and animals. Neither proposal would, however, be correct as this word has been given to the science devoted to the study of the soil, a subject of extraordinary complexity embracing the work of chemists, physicists, geologists and micro-biologists. In our attempts to systematise knowledge we endeavour to draw sharp lines of demarcation between different classes of natural substances or organisms, but Nature favours intricacy in everything and thus continues to foil our efforts to a very large extent. This is particularly evident in the subject of this review, and many of the difficulties encountered were dealt with in a lecture by L. T. Lowe, a report of which is published in Chemistry and Industry for 23rd May, 1942. After dealing with the formation of soils by the hydrolytic disintegration of hard igneous rocks the author refers to the influence of climatic phenomena such as temperature and rainfall upon the breakdown products. It will be evident that in wet regions the soluble constituents such as salts of sodium and calcium will tend to be washed out and lead to the formation of impervious "pans" by deposition of iron oxide above layers in which excess of aluminium and silicon compounds are congested. In dry countries the weathering of rocks is due to the action of frost and wind and owing to the absence of moisture the soluble salts remain in the soil, rendering it alkaline and thus incapable of supporting vegetation. Such soils may become highly fertile if well irrigated when the growth of trees and other plants will tend to increase the humidity still further and eventually convert a once arid region into one showing a high degree of productiveness. The probable reactions occurring in the formation of various types of soil are expressed in the form of chemical equations but it is very doubtful whether these represent the true course of events since many other substances liable to interact are present. To the agriculturist, "clay" is the inorganic portion of the soil with particles less than 0-002 mm. in diameter and this constituent may vary in amount from nil to 70 per cent. in different soils. Clay is crystalline in structure and owing to its origin from different kinds of rock containing different elements, the chief of which are silicon, aluminium and iron. The flocculation of clay is of outstanding importance in agriculture as upon it depends the ease with which the soil can be worked and drained whilst its capacity for base exchange with soluble salts favours the retention of potassium and ammonium compounds and phosphates which thus remain available for plant nutrition. The acidity of soils is difficult to determine owing to their buffering action and the weakness and polybasicity of the organic acids present, but the use of the electrometric method for determining the pH value has enabled workers to ascertain the "lime requirement" with a fair degree of accuracy and thus adapt the soil to particular crops. The organic matter in the soil is gradually broken down to form a complex blackish substance known as "humus," which generally varies in amount from 3 to 10 per cent. This material is much finer than clay but behaves similarly with regard to flocculation and base exchange although its buffering effect is much greater. Partial sterilisation of the soil either by heat or the use of disinfectants has been shown to increase fertility and several suggestions have been made to explain this action, each of which is probably true in some degree although direct evidence indicates that the effect is partly chemical and partly biological. Many complex problems are...
involved in the investigation of soil chemistry and although much has already been achieved the field awaiting further development is a very extensive one.

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**FIFTEENTH ANNUAL REPORT, 1941, OF THE GRAIN RESEARCH LABORATORY, WINNIPEG, MANITOBA**

One of the more important duties of this Laboratory is to make annual studies of the quality characteristics of the principal Western Canadian grain crops. The Annual Report, drawn up by the chief chemist, Dr. J. A. Anderson, is devoted for the most part to recording the results of these studies, and a section is given to barley of the 1940-41 season in this, the Fifteenth Report.

Average samples of each of the grades 2 and 3 C.W. Six-Row, from each of two soil zones, and from the three provinces of Manitoba, Saskatchewan and Alberta, have been analysed and submitted to malting tests in the same way as the 1939-40 crop, which was dealt with in the Fourteenth Report (see this Journal, 1941, 261). The soil zones were the black earth and the grey-black transition, on which the bulk of Western Canadian malting barley is grown, samples from other soil zones, and of first grade C.W. Six-Row barley were too few to be properly representative. The data listed in the Report show that grade 2 barley was superior to grade 3 in most properties, although the differences are small, and that the best barley came from Alberta and the poorest from Manitoba. The former contained an average of 2.06 per cent. of nitrogen (expressed on the dry barley) compared with the latter’s 2.30 per cent., and the difference was reflected in the superior qualities of the malt from the Alberta barley. Barley from the grey-black soil contained more heavy-grade grain and yielded less nitrogen, wort nitrogen and diastase than barley from the black soil, but there was little to choose between them in respect of bushel weight or extract given by the malt.

A survey of the protein content shows that only small amounts of low-protein malting barley were shipped from Manitoba, whilst only insignificant amounts of high-protein barley were shipped from Alberta. Although this is only the second year in which these data have been collected, it can be seen by comparing the information contained in the two Reports that there are already signs of regularity in barley qualities according to district of growth, and it is interesting to note from maps given in the Report that three of the five areas showing high barley production in 1939 also show high production in 1940. In most grades the 1940 barley was slightly lower in protein than the 1939 crop.

As in this country, and especially since the war started, much care is being taken to guard against the outbreak of serious insect infestations in stored grain, and a section of the Report dealing with entomological investigations is contributed by Dr. B. N. Smallman, who has been doing work of this nature in the Laboratory. Five species of mites have been found in stored grain in Western Canada. For the convenience of the grain trade these species have been roughly described and grouped as:—common mite, Cheyletus eruditus Latr., Parasitus sp. Only the common mite is capable of physically damaging the grain. Heavy infestation with mites adds considerably to the moisture in stored grain, and it has been found that there is a regular relationship between the number of mites present and the moisture content. In this respect the common mite constitutes a greater threat to the condition of stored grain than other species since it multiplies the most rapidly. Mites are seldom found in grain with a moisture content of less than 13 per cent., and the unexplained tendency for moisture in stored grain to accumulate at or near the surface often favours mite infestations which could not have started if the grain had maintained its original uniform moisture content. For this reason, one of the control measures advocated is to rake the surface of the stored grain periodically with a long-tined fork. Improved ventilation is an additional aid in preventing the formation of this crust of moisture. Of the fumigants that have been tested, chloropicrin remains the simplest, most effective and most economical.

The flat grain beetle (Laemophloeus) was found in large numbers in a few temporary stores in January this year, and other potentially serious pests are the meal moths (Plodia and Ephestia) and the spider beetles (Ptinus). Up to the present these insects have caused little damage, but the spider in particular needs watching, for it is a most persistent pest, able to survive low temperatures and low moisture conditions.

The Canadian grain trade has been kept informed of these facts by circulars, and by substituting common names for the entomological ones exchange of information has been made easier among its members. By these means, says Dr. Smallman, they have become thoroughly "insect conscious," and the fact that serious losses have been avoided is largely due to their vigilance and intelligent use of control measures.

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**THE CONTROL OF INSECT PESTS**

The close relationship which should exist between pure and applied research is not always given the recognition which it deserves. The man who studies the behaviour of insects—the way in which they live, where they live, their habits of breeding, and so on—will probably find the value of his work doubted by many. Some words of J. H. Fabre, the celebrated French entomologist, are not without interest in this respect:—"Yet who has told you, O man of little faith that what (knowledge) is useless to-day will not be useful to-morrow? If we learn the customs of insects or animals we shall understand better how to protect our goods. Do not despise disinterested knowledge, or you may rue the day." The importance of the control of insect pests needs little emphasis. Our crops are attacked, whether we are commercial growers or humble allotmenteers, and the harvest itself is not safe even when gathered into store. Some of the problems encountered when it is attempted to control infestation of stores have recently been discussed by Prof. J. W. Munro (Cereal, 1942, 67, 155-168). Five hundred tons of produce in one warehouse were calculated to harbour 5,400,000 caterpillars of the moth Ephestia cautella.
From a knowledge of its breeding habits, it appears that this enormous population might well be the progeny developed from one or two pairs of parents who had entered the store three years earlier! Cleanliness is an important control measure, but cooperation on the part of growers of imported materials is not always easy to obtain. Physical methods of control—heating and freezing—offer some promise, and the development of rapid freezing methods may lead to useful advances. Of chemical methods, there are the use of insecticidal dusts such as act by desiccation of the insect’s body fluids, the use of fumigants of which prussic acid, ethylene oxide, and chlorinated hydrocarbons are examples—though these have obvious disadvantages including the problem of residual fumigant, and the use of insecticidal sprays. An interesting example is given of the successful use of a mist spray of pyrethrum in kerosene against both caterpillars and moths of the genus Plodia in a dried fruits warehouse. It should be noted that different insects require for their destruction different concentrations of insecticides, and evaluation of the worth of a given preparation is more complex than will allow random selection of a test organism. Some advance is being made in our knowledge of the mode of action of insecticides; the absorption which is a necessary preliminary to toxic action is dependent on the properties of the outer body tissue, and particularly on the lipoids present in this tissue. Substances which have been empirically found to increase toxicity are now known to act by increasing the absorption. Thus, a study of the biochemistry and anatomy of insects may provide a means of enhancing insecticidal properties. As Prof. Munro states in his concluding sentence, “the practical and the theoretical are so intimately interwoven that we cannot separate them, and he will work best who makes no distinction but views the work as an integral whole.” Such sentiments need not be confined to the realm of applied entomology.

**RUBBER AND TYRE MILEAGE**

It is not only in this country that the loss to the Japanese of the territories in which rubber is cultivated is felt, for our allies were also dependent on these sources and in view of the serious shortage of this useful material economy in its use is imposed upon us all. Perhaps the most extensive use of rubber is in the manufacture of tyres for all kinds of vehicles, and some useful points on economy in this direction are embodied in a paper by F. E. Kunkel, which appeared in *The American Brewer* for April, 1942. Formerly the average user of tyres considered merely the question of cost but to-day the sole problem is the saving of rubber by increasing mileage to the greatest possible extent. It is highly important that the correct type of tyre should be used for any particular purpose since overloading causes excessive internal heat and this is the commonest cause of premature failure. In addition overloading causes uneven and excessive wear of the treads and also tends to produce blowouts. Similar results are produced by running at high speeds and the modern tendency to travel as fast as possible should be suppressed. There is only one degree of inflation which is correct, anything over or under the recommended pressure being deleterious to tyre life, and for this reason frequent check should be made of the air pressure in the tyre. Improper inflation is responsible for about 75 per cent. of tyre troubles.

Valve cores should be replaced as soon as they show signs of being defective or wearing out and should be kept free from dust, oil or grease by covering with the valve cap at all times. One factor which is too often neglected is the temperature attained by the tyre carcass due to atmospheric conditions and excessive speed or load. Since instruments for determining this factor accurately are on the market one of these should be obtained and used frequently. Should the temperature prove to be excessive the load or speed should be reduced or tyres of larger capacity installed if premature failure is to be avoided. In addition to the above other practical rules for ensuring longer tyre life are given in the form of a table and whilst perhaps appearing to be rather drastic are absolutely essential during the present emergency.

**THE SECTIONS**

**THE NORTH OF ENGLAND SECTION**

A joint meeting of this Section and the Incorporated Brewers’ Guild (Lancashire and Cheshire Section) was held on the subject of “Fuel Economy” in Manchester, on the 19th March, 1942, Mr. A. A. D. Comrie, B.Sc, F.I.C., was in the chair.

Mr. Kirkman, representing the Coal Utilisation Joint Council, and about 30 members were present. Several brewers had taken the opportunity of bringing members of their brewery engineering staff with them.

After some introductory remarks by the chairman, followed by Mr. Kirkman of the Coal Utilisation Joint Council, Mr. B. J. Herrod said that they had been called upon to exercise a good deal of ingenuity in maintaining output since the commencement of the war, but it was now obvious from recent Government statements, and what they had been told that day, that all their efforts in other directions were likely to be set at nought, unless great economies in fuel consumption could be effected. Mr. Kirkman had made it clear that all coal produced was being carefully directed by priority system to where it would be most effective in the national interest. He had given enough facts clearly to indicate that, as more and more coal was required for munition purposes the position of breweries was likely to become more and more difficult. Brewers must therefore regard the economical use of every ounce of their coal as of the utmost national importance.

He proposed to ask Mr. Kirkman the following questions, chosen with a view to stimulating discussion, although the ground in some cases had been covered by the memorandum on Fuel Economy recently issued to members by the Institute of Brewing.

1. What simple and easily obtainable recording apparatus is recommended for an ordinary boiler plant, and where should it be placed? 2. Having obtained the apparatus, what figures should be aimed
at? 3. Can the colour of smoke coming from a chimney be regarded as a good guide to successful combustion and what colour should be looked for? 4. What is the best way of testing walls, boiler seatings, etc., for air leakages? 5. What is the best way of catering for the very varying steam demand usual in breweries? 6. Is it advisable to lag flanges on steam pipes? 7. What is the best water level to work with? 8. Does it pay to shut down or bank at week-ends? 9. Are calorifiers more efficient than a suitable coil in a well lagged hot liquor tank? 10. Do the advertised attachments to fire doors effect economy and what is their principle? 11. What chance is there of our continuing to obtain coal from usual sources?

In his replies to the questions Mr. Kirkman embraced many others directly affecting breweries. Much interest was shown in a simple form of CO₂ indicator mentioned by Mr. Kirkman, and he suggested that brewers could best enlist the co-operation of their boiler-house firemen in the efficient use of fuel by introducing some form of bonus payment to them, based, for example, on the readings of some such instrument as the CO₂ indicator that had been described.

- OBITUARY

JOHN JAMES WHITLEY, J.P.
1868-1942

We regret to record the death on 30th May at Hatton, near Warrington, of Mr. J. J. Whitley, managing Director of Greenall Whitley & Co., Ltd., corporate members of our Institute.

In 1886 Mr. Whitley entered the service of the Wilderspool Brewery and in 1904 he was appointed Managing Director. He associated himself largely with the technical side of brewing, engineering claiming much of his attention, a factor which materially influenced the ordered development of his Company.

Mr. Whitley had many interests—he was a Trustee of the Savings Bank, and in 1935 became its Chairman. He was also a Director of the Guardian Press, and took an active part in the advance of education in his district.

A man of fine character, he was greatly admired by everyone with whom he came into contact, and his loss will be felt by a wide circle.