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Work at Waite Research Institute →

IMPROVED WHEAT VARIETIES

Farm Crop Diseases Investigated

TESTS WITH NITROGENOUS FERTILISERS

(By Prof. A. E. V. Richardson, M.A., D.Sc.)

In this article, which Dr. Richardson (Director of the Waite Agricultural Research Institute) has written specially for "The News," a survey is made of the far-reaching tests which are being conducted at Urrbrae Estate.

Wheat varieties for semi-arid areas, the effect of treating pasture land with soluble phosphates, plant diseases, classification of soils —these are some of the many problems which Dr. Richardson discusses.

The institute was established as a result of the bequests of the late Mr. Peter Waite to the University of Adelaide for the purpose of furthering the cause of education in agriculture and allied subjects.

The University Council decided that the best means of giving effect to the wishes of the donor would be to establish an agricultural research institute and endeavor to enlarge the stock of knowledge relating to agriculture in its widest sense, and pass it on to those actively engaged in production as farmers or pastoralists. For the present the investigational work is confined to plant and soil problems and to the diseases of farm crops.

The active work of the institute began in March, 1925, when the members of the staff took up their duties. The initial tasks confronting the staff were the improvising of laboratories in the existing buildings pending the erection of suitable permanent laboratories, and the preparation of the arable area for field investigations.

Through the generosity of Sir John Melrose, who in 1927 donated £10,000 for the building of a chemical laboratory, and assistance from the Empire Marketing Board and the Council for Scientific and Industrial Research, each of which has contributed £3,000 toward a laboratory for the investigation of the mineral content of pastures and of the soil problems associated with the Murray River settlements, the University was able to construct the first group of permanent laboratories for the institute. These are now approaching completion, and the laboratory work will be greatly facilitated when they are ready for use.

The scientific work in progress comprises the following:—

(1) The investigation of problems affecting the production of farm crops, the improvement of pastures, and the breeding of improved varieties of cereals.

(2) The classification of soils, the survey of the soil types, and the investigation of the soil fertility problems in the irrigation districts along the Murray River Valley.

(3) The investigation of the diseases of farm crops.

FARM CROPS PROBLEMS

One of the important limiting factors to crop production in Australia is the rainfall. Investigations are in progress to determine how much rainfall is required by various farm crops, pasture plants, and fodder crops to produce a given yield, and the influence of soil type, fertilisers, time of sowing, variety, and season, on the water requirement of the crop.

The permanent experimental fields are devoted to the study of field problems concerned in the growing of cereal crops and the effect of fertilisers, time and rate of seeding, choice of variety, methods of cultivation and rotation on the yield of these crops.

An outstanding feature of the fertiliser tests has been the marked response of all crops and pastures to dressings of soluble phosphate. The highest yields of wheat, barley, and oats have been obtained where applications of 300 lb. of soluble phosphates have been applied.

The effect of soluble phosphates has been equally marked in stimulating the growth of natural pastures, and in increasing the proportion of leguminous plants in the pasture.

Although some years must elapse before definite conclusions can be drawn from the investigations on crop rotation, it would appear that where the winter rainfall is from 15-20 in. the yields of wheat after peas are likely to be as heavy as wheat after the conventional bare fallow. Evidence is accumulating to show that nitrogenous fertilisers may prove profitable supplements to soluble phosphates, not only for wheat, but also for pastures, where the winter rainfall (April to October) exceeds 15 inches, especially where the crops are grown continuously. An effort is being made to determine the precise effect of varying quantities and forms of nitrogenous fertilisers on wheat sown on fallowed, stubble, and virgin land. No fewer than 144 field plots are being sown to determine the effect of nitrogenous fertilisers, and each manurial treatment is replicated at least six times.

An important problem to be faced in field experimental work is the variation in the soil from one part of the field to another.

Modern methods of plot arrangement and technique seek to reduce the errors of an experiment to a minimum, and what is especially important, to evaluate them. Investigations are in progress to determine the most suitable arrangement, size, and number of plot replications to overcome soil heterogeneity, and to enable the investigator to assess the significance of his results.

The improvement of pastures has formed a prominent feature of the investigations from the inception of the institute. Top-dressing of grassland with superphosphate is becoming more important every year, and at the Waite Institute the carrying capacity of the pasture has been doubled by treatment with soluble phosphates.

A close study is being made of the effects of soluble phosphates on the yield, botanical composition, and nutritive value of the pasture, the chemical composition of the individual species in the pasture, the effect of the pasture on the grazing animal, and finally the effect of grazing on varying intensities on the pasture itself.

MINERALS IN PASTURES

Particular attention is being devoted to the mineral content of pastures, and the influence of soil, fertilisers, and the stage of growth of the grass on the mineral constituents of the pastures. Recent research has drawn attention to the very important part which the mineral constituents of a food play in animal nutrition.

The further extension of wheat-growing is intimately associated with the breeding of wheats suited to the semi-arid areas. It has been shown that the wheat plant requires a maximum amount of water at or about the time of flowering, but in the semi-arid areas of the State this period frequently coincides with hot drying winds which result in such heavy losses by transpiration that the supply of soil moisture fails to keep pace with the needs of the crop.

One method of combating such adverse conditions which has been used with success in other countries, is the production of varieties which escape the dry scorching winds and deficient water supply by earliness of maturity. Time of maturity is a definitely inherited character, and is directly related to yield in the semi-arid areas.

Hence hybridisation can proceed on definitely constructive lines with the object of producing a high yielding early maturing strain. Earliness of maturity and high yielding capacity are, however, to some extent incompatible, hence the wheat breeders object must be to produce a strain with as long a period of growth as the average climate of the locality will permit.

The first step is to obtain the best varieties from the arid regions of the world where wheat has been grown for centuries. The next is systematically to hybridise the most promising early maturing varieties with the best local varieties, and to select from the new combinations that inevitably arise, those types which possess the most desirable combination of characters. The final step is to test the new types, when fixed, for yielding ability under adverse climatic conditions.

The breeding of early maturing varieties of wheat is part of the plant breeding programme of the Waite Institute, and for this purpose early maturing Indian and Egyptian varieties have been used extensively in crossing with the best local varieties. The work is being undertaken by Dr. I. F. Phipps, who recently returned from a three years' intensive study of plant genetics at Cornell University.

PLANT DISEASE INVESTIGATIONS

Research work on plant diseases has been conducted by Mr. G. Samuel (plant pathologist) on two main problems, the spotted wilt of tomatoes and grey speck or manganese deficiency disease of oats. Besides this, however, numerous specimens of plant diseases have been identified from many parts of the country, most of them having been sent through the Department of Agriculture, or gathered by the district agricultural instructors.

These serve to bring to notice the main diseases which are prevalent, and in need of investigation. In this way, for instance, it has been found that two stunting diseases of wheat and oats have been more than usually prevalent during the season. Investigation has shown these to be due probably to eelworms in one case and to a fungus called rhizoctonia in the other.

A description of the stunted plants, with photographs, was published in the August number of the "Journal of Agriculture," and farmers were asked to send a few specimens of diseased plants from any stunted patches they had in their crops. Further specimens will be welcomed from any who did not notice the previous request.

TOMATO WILT

The investigation on tomato wilt is being made with facilities provided by the Commonwealth Council for Scientific and Industrial Research. An insect-proof glasshouse was erected last year for the special experimental work which was needed.

The first studies were upon the method of spread of this serious disease, and it was shown by experiments in the glasshouse that the wilt was not carried in the seed from diseased plants, or in the soil in which they had grown. Neither could it be given to a healthy plant by touching it with a diseased plant, or even by injecting some of its sap into it. Then numbers of insects were tried as possible carriers of the disease, including aphis, leaf-hoppers, white fly, and others, but without success.

Finally, one kind of insect was found which would carry the virus of the disease and inject it into healthy plants and cause the disease. This insect was a species of thrips. It is closely related to the very small thrips which live in flowers, such as apples and roses. It obtains the virus of the tomato wilt when it feeds on a diseased plant, and can then transmit it to any healthy plan it feeds upon. However, there is an incubation period of two to three weeks, while the virus is gradually spreading through the bitten plant, and during which time it may appear perfectly healthy. Then suddenly the bronze discoloration appears on the young leaves, the plant is diseased, and will not grow further.

The investigations are still being continued with a view to finding the best method of control. We have to discover how the insects last over the winter, whether the disease can be in weeds round the tomato field, what sprays are most effective in killing the insects, and also to try to find a variety of tomato more resistant to the disease than those we now grow.

MANGANESE DEFICIENCY

Mr. Samuel and Mr. C. S. Piper (chemist), have shown that on certain soils oats will not grow successfully because they cannot obtain sufficient manganese. Manganese is a metal which is often found in small quantities in association with iron ores. Most soils in South Australia are well supplied with this element, but on certain light calcareous soils, and on certain black swamp soils, and also on the rich volcanic soil round Mount Gambier, there often does not seem to be sufficient manganese for a good crop of oats.

Work in the glasshouses of the Waite Institute has given very interesting proofs that a small trace of magnesium is necessary for the growth of many, if not all plants. Much of this work has been done in water cultures, where the plants grow only in a bottle with their roots dipping in a watery solution of pure chemical salts. In this way it has been shown that as small a quantity as one part of manganese in ten million parts of solution is sufficient for the needs of most plants, while in the complete absence of manganese they die at a very early stage.

Experimental plots have now been laid down with the co-operation of the Department of Agriculture on soils where there is a deficiency of available manganese, and these are designed to find the best and cheapest source of manganese for applying to prevent disease. It seems quite probable that this problem may be satisfactorily solved on a field scale within the next year or two. This will enable attention to be turned to some other disease at present on the "waiting list."

REG. 12·9·28

WHOSE ACRE?

A Waymouth Street Property.

By his will, dated December 7, 1916, Ronald Lindsay Johnson, of Woodleigh, Altrincham, Cheshire, who died on May 29, 1917, stipulated that, as regarded his property in Australia, the trustees should consult Messrs. Lisle G. Johnson and Herbert A. Parsons, both of Adelaide, about the disposal of his Adelaide property, which testator bequeathed upon trust to any one, or if more than one, to each equally, to his brothers and sisters and cousin (Howard Fife Johnson), who should within five years after his death settle in Australia; or, in lieu of settlement, be employed by the Australian Government on Government service outside Australia. If after five years no one was qualified to receive the property, his trustees might extend the time limit for a further three years or might at once and in any case after the additional three years should (if the property had not meanwhile been disposed of) hand it over to the University of Adelaide or to the City of Adelaide, or to the Government of the Commonwealth, stipulating if they thought fit the terms on which it was to be hande dover. From his death until disposal of the property the trustees were to hand over any balance of income after paying ordinary and special taxation, reasonable expenditure on upkeep and legal expenses, to any approved object or objects or person or persons either locally in Adelaide or in Australia, or to a purely Imperial object.

In the Civil Court (No. 3.), on Tuesday, Mr. Justice Napier was asked for the determination of the following questions: —(a) Whether upon the true construction of the will the bequest of the property in Adelaide is valid and subsisting; (b) whether if the bequest is valid, plaintiffs are at liberty to transfer the property to such one of defendants as they may think fit, and to attach any conditions to such transfer, or in what manner plaintiffs should dispose of the property; (c) whether, if the bequest is not valid, the property falls into the residue; and (d) who is entitled to the income from the Adelaide property pending the decision of the trustees.

Plaintiffs were the Rev. Alan Douglas Johnson, of Ashton-under-Lyne, Lancashire, and Arthur Lawrence Johnson, of Lindfield, Wilmslow, Cheshire, business manager, trustees, and brothers of deceased, who were represented by Mr. G. C. Ligehtwood. Defendants were the University of Adelaide, the Corporation of the City of Adelaide, the Commonwealth of Australia, and three sisters of testator. For the first-named defendant Mr. J. F. Astley appeared, for the second Mr. P. Ohlstrom, but the Commonwealth of Australia was not represented. Mr. A. B. Moulden appeared for Gladys Morton Johnson, Lorna Angas Johnson, and Enid Mary Bagley, sisters of testator.

His Honor drew the attention of counsel to the fact that he was a member of the Senate of the Adelaide University and also of the Faculty of Law. Moreover, he was a taxpayer of the Commonwealth. "Perhaps," he added, "you can get a more indifferent Judge to try your case. If you can, you should. I do not know whether or not there is any Judge who is not in some way or other connected with the University.

Mr. Ligertwood—We are quite content for your Honor to try the case.

His Honor—Then the parties being aware of the circumstances desire me to go on. Very well. I am afraid you will have to have me.

Mr. Ligertwood explained that the property in question was town acre 200, in Waymouth street, immediately west of the South Australian Gas Company. In February, 1920, it was valued at £6,000, but it was now worth considerably more. None of the parties mentioned under the will had complied with the stipulations regarding settlement in Australia.

Judgment was reserved.

ADV. 12·9·28

Dr. R. W. Cilento, formerly of Adelaide, was recently appointed in succession to Dr. Elkington, Director of Tropical Hygiene, Commonwealth Department of Health, with headquarters at Brisbane. Next month Dr. Cilento will leave, in company with a French colleague, to undertake a medical survey of Melanesia.