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ACTIVITIES OF WAITE RESEARCH INSTITUTE

Review Of Investigations And Experiments

AERIAL SURVEYS ASSISTS SOILS DIVISION

Preparing For Field Work; Wheat Breeding; And Pasture Development

By R. M. M.

Overlooking acres of ploughed fields, vast areas of experimental plots, and an arboretenm of more than a thousand trees of various species, stands the Waite Agricultural Research Institute, which lies on the scarp of the Adelaide foothills within four miles of the city. Coupled with this countryfield vista, the Institute, encompassed with its 300 acres, and an additional 140 acres which have been leased, commands a panoramic view of St. Vincent's Gulf from Brighton to the Outer Harbor, and of the Adelaide plains as far as the eye can vision.

With its world-wide reputation in agricultural research the main objective of the institute is to enlarge the stock of knowledge relating to agriculture in the widest sense and to pass it on to those actively engaged in production, as farmers or pastoralists. Expressed in more precise terms, the aim is to conduct researches on plant and soil problems relating to agriculture, and on the insect and fungus pests which affect production. Though extension work in agriculture is not a function of the institute, a considerable amount of educational work in agriculture is effected through visits of agricultural bureaux, parties of farmers, and other visitors, to the experimental fields and laboratories of the institute. It was on one of these visits, and through the courtesy of the Director of the Waite Agricultural Research Institute (Dr. A. E. V. Richardson) and several members of the institute staff, that I was able to spend an interesting day in the fields and laboratories, where experiments were being carried out for the benefit of agriculture in Australia.

Pasture Experiments

The first member of the staff to whom the Director introduced me was the agronomist, who took me across to the fields of the institute, where in common with many areas of this State at the present time, are in a thoroughly dry parched condition. Here, seeding operations have been suspended pending a definite break in the weather. It was rather surprising therefore, to find dotted about the fields, collections of plants and patches of pasture that were quite green and growing comparatively vigorously. These, I found out were composed largely of Phalaris tuberosa, a perennial grass of high drought resistance, which is now being increasingly sown, as a result of work at the institute. The areas of this grass have been established for periods ranging from 7 years to 12 months, and although only 4½ inches of rain have fallen in the last 8½ months and no rain has been recorded for five weeks, practically all the established plants are alive and showing green. In contrast to the Phalaris plants, a large proportion of some thousands of perennial rye-grass plants, established in the experimental field, have failed to persist. From the surviving plants it is intended to breed a South Australian strain of rye-grass, with high powers of persistency and drought resistance. Two other pasture plants of interest pointed out to me were lucern, which like Phalaris tuberosa is green and producing feed at the present time, and the Dwalganup early variety of subterranean clover, the presence of which is indicated by liberal quantities of seed on the soil surface, where it has previously been sown. Following success with Phalaris tuberosa and early subterranean clover on cultivated land, the agronomist remarked that attempts were being made this year to introduce those plants into the natural pastures by surface harrowing.

Experiments On Plant Diseases

It was with the chemist in the agricultural chemistry department that I was able to learn something of the diseases that affected plants—mainly those of the tomato and tobacco. The causal agents of a number of diseases of both plants and animals have been grouped together as "viruses," on account of certain similarities possessed by them, but very little is known about their real nature. It is not even known whether viruses in general are living organisms or highly complex non-living chemical systems. The chemist in this department said that a series of investigations was being carried out, having as its main object the determination, as far as possible, of the nature and properties of several plant viruses, it being realised that such knowledge was essential to a proper understanning of the diseases and might assist in ameliorating or preventing them. The results obtained so far were very interesting, but it would not be wise to arrive at any sweeping conclusions at this stage. However, the trend of developments might be gathered from the following summary. One virus studied—that responsible for tobacco mosaic disease—is very resistant and will remain active for years under normal conditions of storage. Another virus—the causal agent of tomato spotted wilt and other diseases—will remain active for only a few hours when removed from the plant by expressing the juice and storing it in the laboratory. The difficulty, in fact, is to keep this virus active long enough to do anything with it. By suitably altering the conditions of storage and by the addition of certain chemicals, a suspension of this virus has been prepared which is at least as active after two days as when first prepared.

The two viruses mentioned above differ greatly in their behaviour to chemicals. Many substances which inactivate wilt virus readily, have scarcely any effect on the activity of mosaic virus. But, it was noticed, that by suitable chemical treatment both viruses could be rendered inactive in a few seconds. The chemist hoped that knowledge gained along those lines would assist in combating the activity of those viruses, and that it would also throw light on the nature of viruses in general.

A glimpse of the interior of the modern and well equipped glasshouses which are used for water requirement investigations of field crops and pasture plants, and where various kinds of plants are reared and grown for experimental purposes, was made before spending an interesting period in the Department of Entomology. The investigations in progress in this department are concerned with certain major insect problems of agriculture and horticulture.

Investigations Of Pests

Research extending over the past three years concerning the lucern flea has enabled a clear understanding of the reasons for the occurrence of the insect in large numbers during particular months of the year. The entomologist told me that those causes were intimately associated with the influence of climate and the development of improved clover pastures. Spraying with lime sulphur had been shown to be efficient in restricted areas; pasture management and investigation of the influence of insect and allied predotors were the lines upon which future investigations must be centred in relation to the more extensive pasture areas.

A detailed investigation of the apple thrips is also being carried out in this department. In one of the laboratories an assistant was busy counting the thrips which were crawling out of rose buds seen inside a glass container. A strong light placed near the container attracted the thrips, the thrips then being caught were counted. This process goes on daily, and by means of an accurate chart, the department is able to see when these insects are more prevalent at certain times during the year. Referring to the apple thrips the entomologist stated that they occur in plague numbers in certain years in spring in the southern States of Australia, and caused serious losses to the apple crop. It had been shown that those plague outbreaks were associated with particular weather conditions during the year of the outbreak. The species of thrip was found in flowers and blossom throughout the year in the neighborhood of Adelaide, and investigations had shown that the numbers increased in autumn and spring. The numbers present in early spring depended upon the number present in the previous autumn and the survival during the winter, while the second spring rise in numbers might be large when the weather was favorable; and if those numbers occurred during October, serious damage might be done to apple blossom. The aim of the control of the pest was to protect the apple blossom during those critical periods (until the fruit was set) by dusting or spraying with insecticides which kept the thrips away. The entomologist then showed me two species of insects—the red legged earth mites, which are troublesome in certain areas of the State during the wet season, and he remarked that the area of distribution was increasing, and where soil and rainfall were favorable they were destructive to peas, clovers, garden plants, &c. Soil type had an important influence on the numbers which developed in any situation. The eggs were susceptible to excessive wetness, and the lighter, porous soils were more favorable for its increase, when rainfall was suitable.

In listening to the investigations made in connection with the green peach aphis, I learnt that the climate of this State did not normally favor the dormant eggs on the peach trees, where they hatch before spring before the buds burst. The occurrence of plague numbers in certain years was definitely due to the character of the autumn, winter, and spring months.

This department is now working on investigations concerning the scareb beetle grub, which mainly affects pastures in the South-East. Chermes, a little insect now affecting the growth of pines, also in the South-East, are now claiming the attention of the entomologist.

Pasture Experimental Plots

In the Department of Plant Physiology the physiologist explained that the investigations of the department were mianly directed towards the elucidation of the relations of the supply of nitrogen and phosphorus to plant growth. Although increasing supply of both those nutrients increased the final size of the plant, the manner in which that increase was effected was strikingly different in two cases. In the case of nitrogen, during the early part of the growing period, increased supply had little or no increase in growth rate, and in fact, the growth rate might be actually depressed, and the high nitrogen plants might be smaller than the low nitrogen plants. Later, however, the growth rate of the low nitrogen plant fell off rapidly, and became less than that of the high nitrogen plants, so that the latter finished up by being larger. The reason for those phenomena was at present under investigation. Increased phosphorus increased the growth rate during the early part of the growing period, and the whole effect on the final size was due to that early increase in growth rate. In later life the high phosphorus plants grew less rapidly than the low phosphorous plants; that had been found to be, because the high phosphorus plants being larger, ran short of nitrogen earlier than the low phosphorus plants. The plant pathologist added that interaction of those two nutrients at various stages of the growth of the plants presented a number of interesting problems, the elucidation of which was adding considerably to our knowledge of the effect of those two important nutrients on the plants and its yield.

When I met the Agrostologist in his department, where the pasture research work is carried out, he told me that a typical autumn day's work consisted of designing an experiment to elucidate a specific problem arising out of the needs of the grazier. As an example, the agrostologist spoke of the seed rate of the grass phalaris tuberosa, when grown in conjunction with subterranean clover. A designed experiment, he explained, might call for the use of 108 small plots, each one-hundredth of an acre in area, and an appropriate field section of slightly over an acre in area was accurately subdivided into 108 plots in accordance with a scale plan which had been made. One plot might require the seed rate of 10 lb. per acre; that plot then actually required one-tenth of a pound of seed. That quantity was actually weighed and thoroughly mixed with two or three times its weight of sawdust. The seed and sawdust were placed in small linen or paper bags and labelled appropriately to its plot. This was done for each of the 108 plots on which 18 different seed rates of the grass were to be sown, each seed rate being put down six times.

The agrostologist is then ready to sow his experiment on the following day, but he has to await for appropriate seeding weather. May is the month in which the Institute normally expects to sow pasture seed, but this year the dry weather prevented this.

Wheat Breeding

From the Plant Geneticist's department, I gathered that the present need for efficiency and economy in wheat growing emphasised the importance of variety to the farmer. No additional cost of production was incurred by growing varieties which gave the maximum yield per acre. One objective of the wheat breeder was to create varieties of high yielding ability associated with such characters as ease of harvesting, drought resistance, disease resistance, baking quality, and adaptability to climatic and soil conditions. While the production of a new variety was a very simple procedure, the creation of a variety superior to existing varieties in yielding ability and the characters listed above, was as different, as the production of a new variety, was easy.

Three methods are usually adopted in the production of improved varieties, namely, introduction of varieties from other countries, selection from within varieties, and hybridisation or cross-breeding followed by selection. The latter method is the most valuable, for it creates endless variation and permits the breeder to combine the desirable characters of two or more varieties in one new variety. A new variety produced as the result of crossing two varieties is only one of hundreds of varieties which may have been obtained from that cross. It is in selecting the one or possibly more varieties possessing high yielding ability associated with other desirable characters, out of the hundreds of possible varieties, that the technique, judgment, and experience of the wheat breeder is exercised. From the initial cross, to the distribution of the seed to farmers occupies a period of approximately 10 years. This long period, occupied in selecting, purifying, and testing for yielding ability is necessary, for a new variety is of no value unless it is superior to existing varieties.

A number of promising new varieties are now under test at the Waite Institute.

Soil Investigations

In the soils division of the institute, it was pointed out by the soil survey officer that the main sections of the chemical work at that institute dealt with the (a) soil investigations, (b) analyses of pasture and crop plants.

The first section is the joint concern of the Waite Institute, and the Division of Soils of the Council for Scientific and Industrial Research, which has its headquarters also at the institute. The Division of Soils is busy mainly on soil surveys and problems which arise from the field study of soil types defined in the surveys. At the present time the data on the soils of the Berri and Cobdogla irrigation areas (S.A.) is being put together for publication, the soil maps and analyses having just been completed. Preparations are now being made to begin field work on the Mildura (Victoria) settlements in the near future, and a set of aerial photographs have been made by the R.A.A.F. of this area to assist in the survey. Mapping is proceeding in the drawing office on the data for soils of the Murrumbidgee area (N.S.W.) covered by surveys during the past eight months. An examination of soil samples from Gin Gin (W.A.) is under way, with a view to throwing some light on the complaint in stock pastured in that district suffering from enzootic ataxia or Gin Gin disease. Some work has recently been done on the possibility of reclaiming tidal flats north of Port Adelaide. The specific chemical characteristics of a range of samples of soil belonging to the important group of Red Brown Earths in South Australia and of the Murray Valley are being studied.

The effect of nitrogenous and phosphatic manuring on the composition of two pastures at the Waite Institute, consisting of Phalaris and subterranean clover is being worked out at the present time.