

Organisms of the Soil.

Plant Breeding and Mendel's Law.

No. 4.

The discovery and isolation of the various forms of bacteria of the soils forms a fascinating contribution to agricultural science, the significance of which has probably not yet been fully appreciated. Pasteur laid the real foundations of modern microbiology by his classical researches on fermentation. He expressed the opinion that nitrification—the curious change of ammonia to nitrates known to take place in the soil was a bacterial process. Schloesing and Muntz in 1877 first showed that nitrification was due to micro-organisms. Warington, of Rothamsted, confirmed this discovery, and showed that ammonium salts could be nitrified by adding a trace of soil. Winogradsky, in 1890, succeeded in isolating the organisms and growing them in pure culture, and showed that three distinct types of bacteria were necessary to convert organic matter into nitrates. He also formulated the soil conditions necessary for their maximum activity. In 1887 Hellriegel and Wilfarth, after much painstaking research, first demonstrated to the world that leguminous plants—the members of the pea family, were able to obtain the nitrogen they need for growth from its inexhaustible supplies of this element in the atmosphere through the activity of bacteria which lived symbiotically on their roots. Thus was solved a problem which had puzzled agriculturists from the earliest times—the renovating effect of leguminous plants on soil fertility. In Columella's treatise on agriculture, he stated that lucerne, vetches, beans, peas, and lentils enriched the soil, while all other crops exhausted it. Subsequent research has shown that there exist a certain group of organisms in the soil known as azoto-bacter, which can actually live on decaying organic matter, and fix free nitrogen from the atmosphere independently of any leguminous crops, and that these organisms have been found from the windswept summits of the Pyrenees to the sandy dunes that skirt our coasts. The soil is no longer regarded as a mere mass of finely pulverized rock, but as a living laboratory swarming with millions of microscopic bacteria, and these bacteria are the real makers of plant food in the soil, and are, therefore, essential to the nutrition and growth of all forms of plants.

Plant Breeding.

The work of the plant breeder has been of incalculable value to the agriculturist in providing him with varieties of farm crops that are more prolific, of better quality, and more resistant to the attack of fungoid diseases. Very valuable help has been placed in the hands of the plant breeder by the scientific work of Gregor Mendel, a monk of the Monastery of Brunn, in Austrian Silesia. Mendel experimented with the hybridization of peas in the monastery garden, and discovered what is now regarded as the greatest of all biological discoveries, and a knowledge of the law is of invaluable aid to the plant breeder. With a knowledge of Mendel's law and its various applications, the plant breeder may breed plants to order. He can create new varieties of farm crops and garden plants with the same certainty that an architect can conceive a new type of house, draw plans of it, and reproduce it faithfully in wood, stone, or brick. The great value of Mendel's law to the plant breeder is that it enables him to forecast what will happen when two dissimilar plants of the same species are hybridized together. A plant may be regarded from the point of view of inheritance as a composite of unit characters. When two plants, differing in a number of unit characters are hybridized, the hybrid plant contains the unit characters of both parents. When this hybrid plant is self-fertilized, a segregation of characters of the two parents are to be found among the second generation progeny, and in numbers and in proportions which may be predicted beforehand. This may be illustrated by reference to the hybrids between Skinless and Gatum, and Gatum and Duckbill barley, shown on the accompanying sheets. In the former cross all plants in the first generation are alike—black and beardless. Barley is normally self-fertilized. In the second generation, four distinct types are met with—Beardless Black, Beardless White, Bearded Black, Bearded White. The four classes were found by actual experiment to be present in the following proportions:—Nine Beardless Black, 3 Beardless White, 3 Bearded Black, 1 Bearded White, which are the proportions which would be expected from Mendel's law. Similarly with the hybrid between Skinless and Duckbill barley. Skinless barley is six-rowed and beardless. Duckbill is two-rowed and bearded. In the first generation all plants were two-rowed and beard-

less. In the second generation four only types were found.—Beardless two-rowed, Bearded two-rowed, Beardless six-rowed, Bearded six-rowed, and these four types were found by experimental trial to be present in the proportion of 9, 3, 3, 1—the proportions expected from Mendel's law. Sir Robert Biffon, of Cambridge, has observed a very important application of Mendel's law. He found that some varieties of wheat were very susceptible to yellow rust in England, while other varieties are practically immune from attack. Hybrids made between immune and susceptible varieties were found to be all susceptible to rust in the first generation, while in the second generation the susceptible and immune forms segregated in the proportion of 3 to 1—showing that susceptibility and immunity were Mendelian characters. Pole Evans, of South Africa, has recently shown that the same holds true of red rust, the fungus disease which causes so much damage in Australia. This discovery of the inheritance of susceptibility and immunity marks a definite step forward in the breeding of disease-resistant plants.

Farrer's Work.

The work of William Farrer, Australia's pioneer wheatbreeder, is a remarkable example of what one man can do to stimulate wheat production by the creation of improved varieties. Farrer was a graduate of Cambridge, who settled at Lambing, near Canberra, and established a private wheatbreeding station. He devoted himself to the production of new varieties of wheat by selection and hybridization. He produced in 1901 his famous Federation wheat, a variety which is very popular in New South Wales, Victoria, and in portions of South Australia, on account of its high-yielding capacity. In many

parts of Victoria, particularly in the Wimmera, probably the premier wheat-producing district of the Commonwealth, 90 per cent. of the wheat grown is Federation. Its introduction into Victoria has meant at least £500,000 per annum to the Victorian wheatfarmers for the past 15 years. So popular has this variety become that Farrer may be said to have changed the colour of the harvest fields of Victoria from golden yellow to dull bronze—the colour of his own Federation wheat. Thirty-three new varieties of wheat were produced by Farrer in his 20 years of work. Fifteen of these varieties are widely cultivated in New South Wales and Victoria. He not only produced prolific varieties, but varieties equal in milling quality, e.g., Bobs, Comeback, and Cedar, with the best in the world, and varieties, too, which were immune to rust. A perusal of his paper "The making and improvement of wheats for Australian conditions," read before the Australian Association for the Advancement of Science, will show that he had been working on strict Mendelian lines; and that he had observed the principle of segregation among second-generation hybrids, although Mendel's work was not known to the scientific world until De Vries, Tschermak, and Correns re-discovered it in 1900. He never obtained, nor did he ever seek, the slightest monetary advantage from his labours. The single object which actuated him during the 20 years he devoted himself to his self-imposed task was the improvement of wheatfarming. With this object he set himself the task of creating improved varieties which would give higher yields per acre and better quality of grain. He was eminently successful in this task. Previous wheatbreeders had succeeded in producing a few varieties of outstanding excellence in some particular characteristics. Farrer produced a large number of varieties of the most varied characteristics from which the cereal grower could select with confidence one or more varieties pre-eminently suited to his climatic conditions. This success was rendered possible by the peculiar equipment of Farrer's genius—his scientifically methodical brain, his untiring energy, his minute and conscientious attention to detail, and, above all, to his singleness of purpose, and the lofty ideals which he set before himself. It is true that his monument is to be seen in nearly every ripening wheatfield in Victoria and New South Wales, but it would be a thousand pities if we allowed the memory of this great Australian to perish for want of proper recognition.

REGISTER 27.7.25

ELDER CONSERVATORIUM.

The eighth concert for this session will be held in the Elder Hall to-night. A capital programme, given by students of the Conservatorium, has been arranged. It includes an excellent variety of vocal and instrumental works by masters of both the old and modern schools. Miss Alice Meegan, A.M.U.A., and Miss Muriel Prince will be the accompanists. Plan at S. Marshall & Son's, Gawler place.

NEWS. 27.7.25

Mr. G. C. Ligertwood, who has been assistant lecturer in botany at the Adelaide University, and who will leave for Great Britain on Thursday to pursue his studies at Cambridge, will give a small dinner party at the South Australia Hotel tonight to a few of his friends. Subsequently Mr. Leslie Napier will be host at an informal dance at the Piccadilly, North terrace, given as a farewell to Mr. Wood.

Distinguished Ex-soldiers Admitted.

A special sitting of the Full Court, presided over by the Acting Chief Justice (Mr. Justice Poole) and Mr. Acting Justice Richards, was held on Saturday morning to admit new barristers to the Supreme Court of South Australia.

A representative assembly of the legal profession witnessed the ceremony, and included in the spectators were a number of ladies, who took seats in the jury benches.

A Legal Family.

Mr. L. von Doussa, in moving upon the report of the board of examiners for the admission of William Louis von Doussa, said it gave him great pleasure, after a record of 53 years of service as a practitioner of the Court, to move for the accession to the Bar of that Court of the third generation of the family.

The Acting Chief Justice—I congratulate you upon that. Mr. von Doussa is admitted.

Mr. von Doussa is a son of Mr. Frank von Doussa, manager of Elder, Smith, and Co., Strathalbyn. His mother was a member of the Egerton-Warburton family, well known in connection with Australian exploration. He was born in 1901, and educated at St. Peter's College. Graduating at the Adelaide University, he served his articles with his grandfather, Mr. Louis von Doussa, who has practised at Mount Barker for more than 50 years. Mr. Stanley von Doussa, uncle of Mr. W. L. von Doussa, is in practice at Mannum.

Journalist, Soldier, Lawyer.

Mr. G. C. Ligertwood, in formally seeking admission on behalf of Frederick Morley Cutlack, said that that gentleman had a most distinguished and honourable career, both as a soldier and as a journalist. At the outbreak of the war he joined the King Edward Horse, and later transferred to the Royal Field Artillery in France. In 1918 he secured the position of official war correspondent to the A.I.F., and fulfilled that position with distinction. He was the author of two histories of the war, and had done much of his law study while at the front. He had already practised as a barrister of Lincoln's Inn, London.

Distinguished Military Career.

Mr. A. S. Blackburn, in moving for the admission of William Francis James McCann, said that Mr. McCann had to his credit a distinguished military career. He enlisted as a private in the 10th Battalion in 1914, and, remaining with that battalion right throughout the war, rose to be its commanding officer in 1919. That was an achievement probably unique in the annals of the A.I.F.

Mr. McCann is President of the Returned Soldiers' and Sailors' Imperial League of Australia, and is a hard worker in the interests of returned soldiers. He was Vice-President of the organization from 1921 to 1924. He is also Vice-President of the British Empire Service League, a trustee of the South Australian branch of the R.S.S.I.L.A., the British Imperial Services Fund, and Poppy Day Fund, and a member of the Soldiers' Children's Education Board. Mr. McCann's war service record reveals a career of rapid progress. Enlisting in August, 1914, he became a sergeant the following month. In October he embarked for Gallipoli. In April, 1915, he was promoted to company sergeant-major at Gallipoli, in August to second lieutenant, in November to lieutenant, and in April, 1916, to captain. In July, 1916, he was wounded in the skull at Pozieres, and was awarded the military Cross. He was the first officer to be decorated in France and the first officer in the 10th Battalion to receive an immediate award. After having rejoined his unit in November, 1916, he was wounded in the neck at Longueval in April, 1917. A month later he was back in active service, and in July, 1918, was awarded a bar to his military cross. In 1918, at Crepey Wood, he was presented with the distinguished service order medal, and the following month became a major. From October to December, 1918, he attended the staff college at Camberley, and was appointed to the command of the 10th Battalion in 1919. For valiant conduct at the landing of Gallipoli he was twice mentioned in despatches and army corps orders, and received congratulatory messages from Gen. Plumer, Rawlinson, and Birdwood. On his return to Australia, in 1919, he qualified for assistance in mixed farming under the soldier settlement scheme, but was classified medically unfit on account of war injuries. He began his law course in 1921.

After the candidates had been sworn in, Mr. Justice Poole, on behalf of the Bench, congratulated them on their admission, and expressed the hope that they would win success and esteem in their profession. After referring to the careers of each man, he said that years ago a learned Judge of that Court had said that they had to administer justice according to law, not abstract justice. He hoped they would learn to know the law and administer justice to their clients in accordance with it. Then he had no doubt that they would gain full respect and confidence.

With the spread of learning, the fear of overcrowding in the learned professions seems reasonable enough; and, as each fresh batch of graduates issues from the University, its absorption in the life of the community excites renewed wonder. How can room be made for so many young lawyers and budding doctors? And yet, so far as may be observed, there is no unemployment in the legal or medical professions; and some of the recently established practitioners appear to be very far removed from indigence. If the population of the country were rapidly increasing, the phenomenon would be uninteresting. If doctors and lawyers retired from practice, or from life, a score at a time, there would be obvious vacancies to be filled. If the community grew palpably more litigious, or less healthy, the mystery would be satisfactorily explained. All these factors may be at work; but, so far as the medical profession is concerned, the demand for graduates is being amply met, as is evident from statistics compiled for, and published in, *The Medical Journal of Australia*. There is definite evidence of a gradual reduction of the number of potential patients to each medical practitioner; or, in other words, doctors are increasing more rapidly than the population.

Last year, there were resident in the Commonwealth 4,502 medical practitioners; this year, the number is 4,773, a 6 per cent. increase, which is most striking when compared with the 3 per cent. increase noted for the previous four years. As *The Medical Journal* observes, however, "the crucial test of the presence or absence of overcrowding is the numerical relation of the practitioners to the general population." On the first day of the present year, the approximate number of people to each doctor in Australia was 1,223. In 1918, the average Australian doctor's share of potential patients was 1,355, and, by 1921, the number had fallen only to 1,307. In the more populous States, the numerical scope of the ordinary medical practice would appear to be more limited still. The following are the figures:—New South Wales, 1,920 doctors (1 to every 1,166 people); Victoria, 1,571 (1 to 1,050); Queensland, 501 (1 to 1,664); South Australia, 394 (1 to 1,347); Western Australia, 230 (1 to 1,584); Tasmania 157 (1 to 1,400). These statistics may be deceptive, for the reason that in Melbourne and Sydney the number of specialists and whole-time medical officers employed by public and industrial bodies is proportionately greater than in the other capitals. It would be unwise to assume too confidently, therefore, that in the most sparsely populated areas of the continent each doctor has to look after a disproportionate number of people. "If it were possible," says *The Medical Journal*, "to ascertain the number of general practitioners, it would probably be found that the average number of persons in the community corresponding to each one would be about 2,000, and that, outside the large metropolitan and suburban areas, the figures would not vary to a great extent."

ADV. 27.7.25

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NEWS. 26.7.25

Professor T. G. B. Osborn, D.Sc., Professor of Botany, University of Adelaide, returned to Adelaide from Melbourne by the express the morning.