### Sir John Russell's Lecture.

### A Great Experimental Station.

was also present.

Discovery of Artificial Manures.

Sir John said that the Rothamsted exnitrogen, could advantageously be given them, yet so small that they could be lower. to crops in the form of sulphate of am seen only imperfectly. Gradually they Discoverer of Artificial Manure. monia, a by-product in the manufacture of were being picked out from the soil and more expensive bones. So he patented and other leguminous plants. and made artificial manures for the first ments on his home farm and secured for upon smaller organisms. All those were Rothamsted a young chemist, Joseph being studied. Henry Gilbert. The two worked together for 60 years-all their lives, in halk wheat field, which was perhaps the making manure from sewage. never had a complete fallow all thatknowledge was really true. experiment had shown that wheat could agriculturist began to use them first manure since 1839 still yielded about 10 high standard of farm production. bushels to the acre.

### Far-reaching Experiments.

ordinary farm crops, and they had shown and so add further to the achievement that artificial manures-sulphate of am-of science in agriculture. monia, nitrate of soda, superphosphate. sulphate and muriate of potash-not only increased the growth of crops, but altered them in composition and habit of growth. Thus superphosphate increased root development and maturation, and hastened ripening-a great advantage in helping the plant to avoid certain pests and diseases. Turther, some of the changes in growth enabled the plant to stand up better against the effects of bad seasons, especially lack of sunshine and temporary drought. The science of manuring was now so far advanced at Rothamsted that if the general nature of the season could be predicted, it would be possible to draw up fertilizer mixtures for the different crops that would make the best use of the sunshine and the rain. Many experiments were now being made on this subject, and it had been found necessary to set up a statistical department so as to control the accuracy of the work, and to trace the relationship between soil and weather conditions and the efficiency of the different fertilizers. New methods of field experiments had been devised, and it was now possible to estimate quite small differences in value between different fertilizers and to say under what conditions any one of them was likely to be better than any other. The advantage of the work was that they could now advise farmers how to choose, with considerable certainty, between the eight different nitrogenous fertilizers now on

CE IN AGRICULTURE the market: and also the five phosphatic fertilizers, and the four potassic fertilizers, according to the soil and weather conditions in which they were farming.

Artificial Manure from Straw.

Artificial fertilizers, however, had not quite the same action as farmyard manure. Indeed, so far science had failed to provide any concentrated fertilizer that would act as well, particularly in a dry season. Farmyard manure was becoming costly on English and European farms. At Rothamsted, however, a method had been devised for making it from waste straw or other vegetable matter, without the use of animals at all. It was found that farmyard, manure owed its value not the animals. Sir John Russell gave a lecture in but to the great crowd of minute living Brookman Hall, Adelaide School of Mines organisms always present in it, and so the wasted could not be changed to good Ruthven were interested listeners. manure.

Wonderful Micro-organisms in Soil.

homes of England. The times were bad isms in the soil. Its interest arose out for farmers, and Lawes depended on farm- of the fact that farmyard manure and at Sir John Russell's disposal. ing: his hope was to get more out of the green manure were not themselves plant Sir John Russell, who illustrated his Farmyard Manure From Waste Straw.

### The Part of the Scientists.

fact. A barn was converted into a As yet, the knowledge gained had not laboratory, and the field experiments found much practical application but were made year after year on the same beginnings had been made in: -(1) Making land, and always with the same crops; artificial farmyard manure; (2) innoculaso as to be quite certain that the result tion for the growth of leguminous crops; was not a trick of the season. The Broad-(3) the treatment of sick soils; and (4) best known part of Rothamsted, was perience showed that the really important put into wheat in 1843 and had been kept thing was to be quite sure about the in wheat every year since. It hadfacts; to be certain that the supposed time. though on three occasions half the business of the universities and the the field was fallowed one year and the experimental stations. Once the fact other half fallowed the next season. The were definitely established, the ingeniou be grown year after year without diffi-one direction, and then in another, unti culty, except that weeds became trouble-finally some really great advance was fiell off only slowly if fertilizer were of no practical value; but they were now withheld. The plot that had had no the basis of a great industry and of a the laboratory experiments of to-day made in the universities and experimental farm:

might, in their turn, develop into me The experiments had made on all the thods of great practical value to-morrow

# EXPERIMENTS WITH FERTILISERS.

# What Rothamsted Has Done.

Lecture By Sir John Russell.

## The Value of Farmyard Manure.

There was a large attendance at the and to trace the relationship between soil before a large and representative audience manure was made by encouraging those Brookman hall, School of Mines, on Friday and weather conditions and the efficiency on Friday evening on "The Rothamsted organisms to act. The process was not evening, when Sir John Russell lectured of the different fertilisers. New methods Experimental Station, England," of which perfect, but it had already given valuable to the is director. The Chancellor of the results in Great Britain, the United Rothamsted, England, explaining how it differences in value between different ferpresided. His Excellency the Governor- where, and it was continually being im- began, and what it had done. His Ex-tilisers and to say under what conditions nor (Sir Alexander Hore-Ruthven, V.C.) proved. Straw which formally had to be cellency the Governor and Lady Hore- any one was likely to be better than any were welcomed by the Chancellor of the that they could now advise farmers how University (Sir George Murray), who exto choose with considerable certainty between the eight different nitrogenous periments were started in 1843 by John Some of the most interesting of the plained that the lecture was really in fertilisers on the market; also the Bennet Lawes, an English country squire, recent work-and it might in future turn association with the University, which five phosphatic fertilisers, and the four who lived in the beautiful old manor out to be some of the most useful-had appreciated the School of potassic fertilisers, according to the soil house of Rothamsted-one of the stately been in connection with the micro-organ- Mines in placing the larger Brookman hall and weather conditions in which they

land. At that time the yield of wheat foods: indeed, in themselves they were lecture with many lantern slides, explained Artificial fertilisers, however, had not was about 20 bushels to the acre, but in harmful to plants. But, once in the soil, that the Rothamsted experiments were quite the same action as farmyard Lawes they went through a remarkable series of started in 1843 by John Bennet Lawes, an manure; indeed, so far science had failed had a taste for making agricultural experi- changes, to end up by being of great English country squire, who lived in the to provide any concentrater fertiliser ments, and great luck in that his experi-value to soil fertility. For 40 years scien- beautiful old manor house of Rothamsted, that would act as well; particularly in a ments nearly always succeeded. He knew tific workers had tried to discover how one of England. The dry season. Farmyard manure was a little chemistry and something about the those changes came about, but always un-times were bad for farmers and Lawes de- becoming costly on English and European composition of farmyard manure—then the successfully. Then it was shown that pended on farming. His hope was to get farms. At Rothamsted, however. regular manure on all farms and still one they were effected by myriads of minute more out of the land. At that time the method had been devised for making it of the best-and he had found by ex-living organisms, so numerous that a salt-yield of wheat was about 20 bushels an from waste straw or other vegetable matperiment that one of its constituents, spoonful of soil might contain millions of acre, but in some seasons it fell much ter, without the use of animals at all. It

coal gas. He further experimented with their habits studied: and methods had also Lawes had a taste for making agricultural always present in it; and so the manure bones, which had worked marvels on been devised for estimating their numbers, experiments, and great luck in that his was made by encouraging these minute some of the English pastures but had Every month, however, new ones were experiments nearly always succeeded. He organisms to act. The process was not failed at Rothamsted. He found that discovered, and no one would venture to knew a little chemistry and something perfect, but it had already given valuif they were treated with sulphuric acid say what that great soil population was about the composition of farmyard manure able results in Great Britain, the United they became instantly effective, being con- really like. Some of them changed the -then the regular manure on all farms States, Canada, South Africa, and elseverted into the substance then called useless residues of dead plants into and still one of the best. He had found where and it was continually being imsuperphosphate of lime. At that time humus and valuable food for the next by experiment that one of its constituents, proved. Straw. which formerly had bones were dear; but rock phosphate generation of plants. Others fixed the nitrogen, could advantageously be given to be wasted, could now be which had only just been discovered, was nitrogen from the air and built it up to crops in the form of sulphate of am- changed to good manure. cheap, and Lawes found that if it were into complex preteins by a process that monia, a by-product in the manufacture of of the most interesting of the recent treated with sulphuric acid it produced no chemist could imitate or even under- coal gas. He further experimented with work, and it might turn out to be some the same superphosphate of lime as did the stand. Others fed the valuable clovers bones, which had worked marvels on some of the most useful, had been in connec Some of the English pastures, but had failed at tion with the micro-organisms in the soil, the process, set up a factory near London, were like plants in that they simply took Rothamsted. He found that if they were Its interest arose out of the fact that time in history. For many years he had ing and green manure were hands, and he made a considerable for washed out by the rain. Others fed of lime. At that time bones were dear the whole superphosphate industry in his any; yet those also were useful, be instantly effective, being converted into not themselves plant foods. In thembeen discovered was cheap, and Lawes to end up by being of great value to soil found that if it was treated with sul- fertility. phuric acid it produced the same superphosphate of lime as did the more expensive bones. So he patented the process, For 40 years scientific workers tried to set up a factory near London, and made discover how these changes came about, artificial manures for the first time in but always unsuccessfully. Then it was whole superphosphate industry in his of minute living organisms, so numerous hands, and he made a considerable for- that a salt-spoonful of soil might contain tune. But he continued the field experi- many millions of them, yet so small that ments on his home farm and brought to they could be seen only imperfectly. Rothamsted a young chemist, Joseph Gradually they were being picked out Henry Gilbert. The two men worked to- from the soil, and their habits studied. gether for 60 years, all their lives in fact. Methods had also been devised for esti-A barn was converted into a laboratory, mating their numbers. The field experiments were made year after however, new ones were discovered, and year on the same land and always with no one would venture to say what this the same crops, so as to be quite certain great soil population was really like. that the result was not a trick of the Some of them changed the useless resig The Broadbalk wheat field was dues some and that the yield was maintained achieved. Artificial fertilization began perhaps the best known of Rothamsted. It and so long as fertilizer was given; and it at Rothamsted as laboratory experiment; was put into wheat in 1843, and had been generation of plants. Others fixed nitrokept in wheat every year since. It had gen from the air, and built it up into never had a complete fallow all the time, complex proteins by a process that no though on three occasions half the field chemist could imitate or even underwas fallowed one year and the other half stand. Others fed the valuable clovers fallowed the next. The experiment had and other leguminous plants. Some were shown that wheat could be grown year like plants in that they simply took after year without difficulty except that up plant food without themselves mak. weeds became troublesome. The yield ing any: yet these also were useful, was maintained so long as fertiliser was because they protected the food from given; and it fell off only slowly if fertiliser being washed out by the rain. Others fed was withheld. A plot that had had no upon smaller organisms. All these were manure since 1839 still yielded about 10 being studied. bushels per acre.

### Habits of Growth Altered.

The experiments were made on all the ordinary farm crops, and they had shown that artificial manures—sulphate of am- for the growth of leguminous crops, the monia, nitrate of soda, superphosphate, sul- treatment of sick soils, and making phate and muriate of potash-not only in- manure from sewage. All experience creased the growth of crops, but altered showed that the really important thing them in composition and habit of growth. was to be quite sure about the facts: Thus superphosphate increased root deve- to be certain that the supposed knowlopment and naturation. It hastened ledge was really true. This was the busiripening, which was a great advantage in ness of the universities and the experihelping the plant to avoid certain pests ment stations. Once the facts were deand diseases. Further, some of the finitely established the ingenious agrichanges in growth enabled the plant to culturist began to use them, first in one stand up better against the effects of bad direction, then in another, till finally seasons, especially lack of sunshine and a really great advance in practice was temporary drought. The science of manur- achieved. Artificial fertilisation began at ing was now so far advanced at Rotham- Rothamsted as laboratory experiments sted that, if the general nature of the of no practical value. They were now the season could be predicted, it would be pos- basis of a great industry, and of a high sible to draw up fertiliser mixtures for standard of farm production. So the the different crops that would make the laboratory experiments of to-day made best use of the sunshine and the rain, in the universities and experiment farm; Many experiments were now being made might in their turn develop into methods on this subject, and it had been found of great practical value to-morrow and necessary to set up a statistical depart- add further to the achievements of ment to control the accuracy of the work, science in agriculture.

They other. The advantage of the work was were farming,

was found that farmyard manure owed its value not to the animals, but to the great crowd of minute living organisms

### What Minute Organisms Do.

For many years he had the shown that they were effected by myriads of dead plants into humus food for valuable

Applying the Knowledge Gained.

As yet the knowledge gained had not found much practical application, but beginnings had been made in making artificial farm-yard manure, inoculation