Experiments in empire-building: Mendelian genetics as a global agricultural enterprise

Berris Charnley (University of Leeds)

ipbio.org

- In consequence of the re-discovery of Mendel's Laws of Inheritance ... Attention has been called to the scientific study of breeding problems ... The extraordinary certainty with which the complex problems of heredity can be unravelled has shown that the hopes of a few years ago, that breeding would become a precise subject, are rapidly being realised.
- JRASE 'The Application of Mendel's Laws of Inheritance to Breeding Problems', 67 (1906) p.46

- [I]mmunity and susceptibility to the attacks of yellow rust form as sharply a differentiated pair of characters as Mendel himself would have wished for.
- Biffen, *Science Progress,* 1907

Cutting from Daily Mail

OCTOBER 28, 1921.

WHEAT WIZARD.

CURING CRIMINAL PLANTS.

What is probably the finest wheat in the world has been created at Cambridge, and this season it has been yet further improved. The maker is Professor Biffen and his staff, who have quite surpassed all the "plant wizards" of the age in this or any other country. Perhaps the strangest part of the improved "Yeoman" wheat, as it is called, is its parentage. Professor Biffen has performed the miracle of getting good offspring from a bad parent. For example, he found in America a most cantankerous and repulsive wheat. It had a little head and a stiff beard, but through these deficiencies a heart of gold was detected. By help of that astonishing law of heredity known as the law of Mendel the bearded wheat of criminal type was enabled to hand on to his grandchildren his strength and hardihood and golden heart without the beard and the small head. "Improved Yeoman," his lustiest descendant, has a huge ear of 80 grains or more and a "strong" transparent kernel.

POULTRY AND MIRACLES

CHELMSFORD PREPARES FOR CHRISTMAS.—A typical Essex farmer admiring at Chelmsford market yesterday one of the beasts destined to provide joints for the Christmas dinner-table. [Daily Mail.

CUP FOR ORIGINATOR OF "LITTLE JOSS" WHEAT.—The Hon. E. G. Strutt (left) presenting at the Shire Hall, Chelmsford, yesterday, an 84-oz. cup to Professor Biffen, of Cambridge, as an acknowledgment by Essex farmers of his signal services to agriculture in producing "Little Joss" wheat. [Daily Mail.

Daily Mail Jan 2-25

WHEAT WIZARD.

SIR R. H. BIFFEN'S NEW GRAIN.

By THE AGRICULTURAL CORRESPONDENT.

When the home-grown loaf is made again in this country on a large and useful scale (as hopeful agriculturists believe it will be made) it will be due in a great measure to the work of Professor R. H. Biffen, head of the School of Agricultural Botany at Cambridge, whose knighthood was announced in *The Daily Mail* yesterday. Farmers everywhere, particularly corn-growers, were pleased to see Professor Biffen's name in the honours list. He has worked for many years in his researches in seed corn without any financial gain, but has put a lot of money into farmers' pockets.

Sir R. H. Biffen.

He has been called the "Wheat Wizard" and is known to cereal-growers chiefly as the creator of the two wheats "Little Joss" and "Yeoman," the former a very prolific yielder and the latter a wheat with the free-milling qualities of the Manitoban wheats, making the home-grown loaf a possibility. "Yeoman" was produced about 15 years ago, and, meanwhile, Professor Biffen has continued his researches to improve it.

His most recent success came last autumn, when 2,500 quarters of the improved variety, "Yeoman II.," were sold for sowing for this year's harvest.

It is believed that, despite the adverse season, practically the whole of this

WHEAT WIZARD.

HONOURED BY FARMERS.

GRATEFUL FOR FINE HARVESTS.

FROM OUR SPECIAL CORRESPONDENT.

CHELMSFORD, Friday.

Christmas Market Day of 1921 will be remembered by the farmers of Essex when the singularly fine array of beasts and birds sold on the market stones has been long forgotten.

They came in from all parts of the country with two main objects—one the normal round of buying and selling; the other to do honour to two of their greatest benefactors.

Essex acres are devoted to cereals on an extensive scale, and there are two wheats—Yeoman and Little Joss—and a barley—Plumage Archer—whose introduction has done much to ensure fine harvests on the county's heavy land. The farmers wished to recognise the great services done them by the scientists who bred these cereals.

So down to the old town amid the exhilarating bustle of the Christmas market they invited Professor Biffen, of Cambridge, the "father" of Yeoman and Little Joss, and Mr. E. S. Beaven, of Warminster, Wiltshire, "the "father" of Plumage Archer.

With happy speeches they gave them each a massive silver bowl weighing 9oz., and as their chairman, Mr. George Raby, of Fillingham Hall, Southminster, said: "We are only too proud to think that Essex has led the way in practical appreciation of the work of these two men, whose great research has been without any financial gain to themselves."

This ceremony took place in the Shire Hall. When the bowls had been handed to them, Professor Biffen said: "I may, perhaps, in the near future, be in a position to supply you with an even better

ES AND INDEPENDENT

BEDFORDSHIRE CHAMBER OF AGRICULTURE

IMPORTANT LECTURE BY PROF. BIFFEN ON THE FUTURE OF WHEAT GROWING

On Saturday afternoon a visit was paid to the Bedfordshire Chamber of Agriculture, meeting at the Swan Hotel, Bedford, by Mr. R. H. Biffen, M.A., Professor of Agriculture at Cambridge University, the eminent hybridiser of cereals and producer of improved varieties of of wheat. Considering the busy season and the brilliant weather out of doors, the attendance was very large—exceeding, indeed, the seating accommodation, and the interest in the proceedings was maintained to the end of a meeting which was protracted by the annual business on the agenda. As Professor Biffen had given a course of lectures to the school-teachers of the county some years ago, an invitation was given to the Teachers' Association, and a number attended. The President, Mr. J. Arnold Whitchurch, was in the chair, and among those present were Mr. and Mrs. B. Howkins, Messrs. C. P. Hall, H. Trustram Eve, R. Long, G. E. Brown, C. King, W. G. Hatfeild Harter, T. Handley, F. Brown, S. Street, D. Price (Secretary to the Teachers' Association), A. Howard, B. E. L. Perryman, F. Turner, H. J. Peacock, E. Laxton, E. Ransom, W. Hartop (Oakley), W. Ell, J. Fairbank, W. Hipwell, T. E. Davies, R. Whitworth, J. Day, A. Brittain, I. Godber, Mrs. Kendall, Messrs. H. E. Perks, C. Tacchi, A. Laird, W. W. Low, J. Matthews, H. J. Humphreys, S. Vincent, E. Abbiss, A. Syratt, J. H. Thomson, J. Maddison, J. H. Brown, F. C. Atkinson, J. Hamson, S. D. Handley, M. F. Bliss, A. A. Chibnall, with the Hon. Secretary, Mr. W. M. Peacock.

PRESENT AND FUTURE OF WHEAT-GROWING.

Prof. Biffen, who was received with applause, said he had selected this subject in view of the general awakening of the public to the fact that we were not growing anything like the quantity of food-stuffs, and particularly wheat, that we ought to grow. In the five-year period 1866-70 we grew 2¾ million quarters of wheat which made 64/5 per quarter in the best years, and 46/11 in the worst. From 1860 onward prices tended to fall. In the period 1881-5 the highest was 45/4 and the lowest 32/10, but the acreage kept up. In the next period, 1886-90 the highest average price was 32/5, and the lowest 29/9, and the acreage fell to 2½ millions. In the next five years the prices were 37/- and 22/10, and the wheat area steadily diminished. In the next five years it dropped to 1.9 million acres: in the next five to 1.6 millions, and now it was about 1¼ millions. During the last 15 years there had been a fairly steady rise in price. In the period 1906-10 the highest average was 36/11 and the lowest 28/3, but in the war years the prices were of course abnormal. The present yield was about one-fifth of the quantity consumed, and 80 per cent. of the wheat supply had to be imported.

CAUSES OF THE DEPRESSION.

The reasons for the fall of prices and the wheat going out of cultivation were fairly clear. A generation ago great wheat-growing areas were opened up in Canada, the States, and the Argentine. Wheat grew very well on virgin soil, and could be stored up almost indefinitely without deteriorating. It was also a time when shipping freights were falling rapidly. Wheat was brought here at a far cheaper rate than it could be grown in this country. Another result was that a large part of the milling trade gradually concentrated at the ports.

HOW TO MAKE WHEAT-GROWING PROFITABLE.

Politicians were now saying that we ought to grow every bit of grain we can, and that it should not be difficult to get back to 2¾

THE POSSIBILITIES.

Some people were optimistic enough to see the time when we should grow 50 per cent. better crops, but he was afraid they were mistaken and thought we should be lucky to add 20 per cent. on the average to the crops. He thought they might in time pull up to 38 or 40 bushels by a more generous use of artificial manures. Unfortunately that could not be pushed very far without running up against a limit, for if they overdosed it, they got a lodged crop, difficult to handle and costly to gather. Breeders, however, were gradually overcoming that difficulty by building up a straw of remarkable standing capacity, that would carry a greatly increased crop without lodging. They were also building up wheats which were less susceptible to some of the commoner diseases. On an average the crops were depreciated 5 or 10 per cent. by attacks of disease, but the plant-breeder was producing varieties which did not catch these diseases.

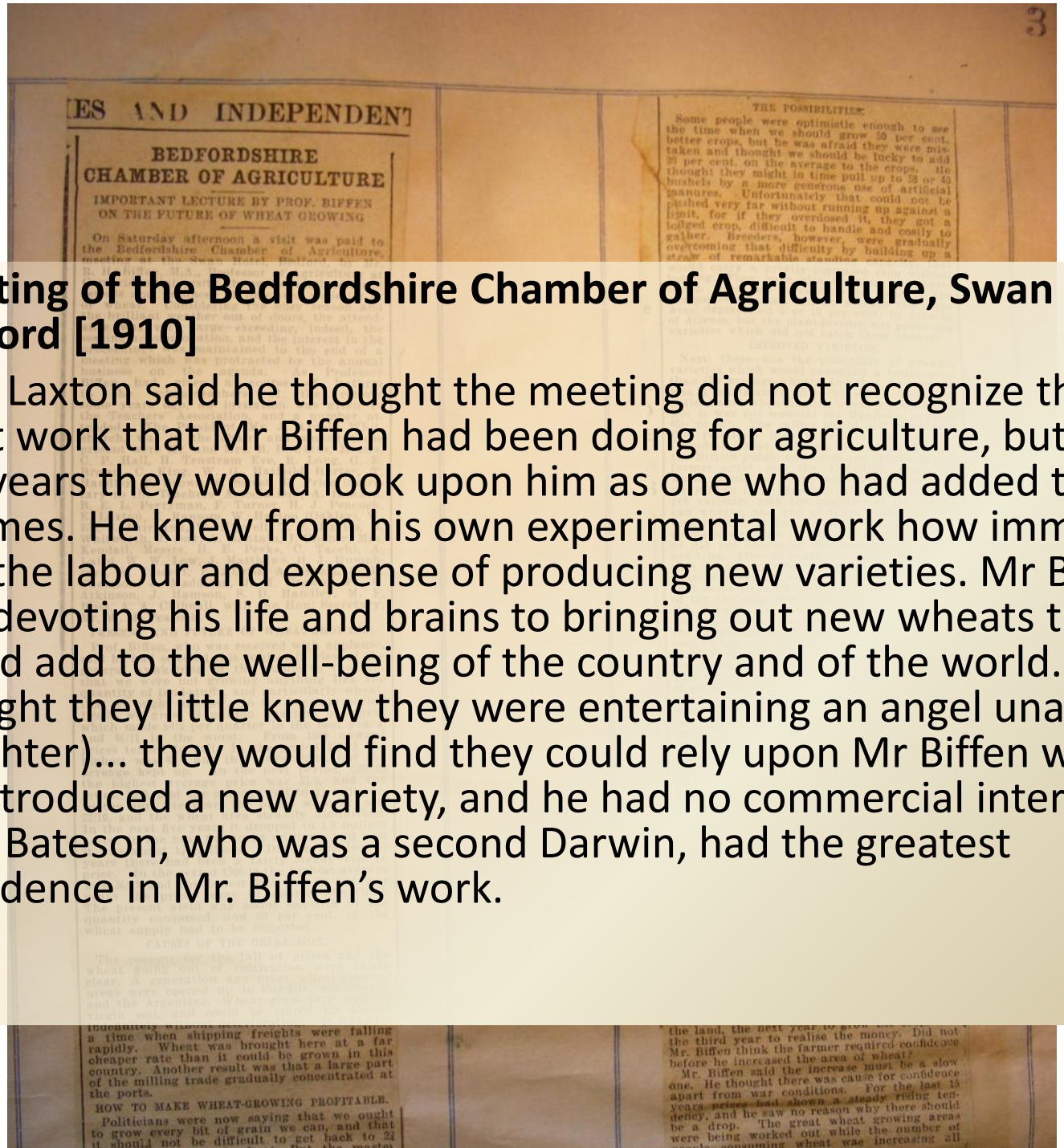
IMPROVED VARIETIES.

Next, there was the possibility of growing varieties which would command a better price than the average wheats, and that, he thought, was a particularly hopeful side. They had noticed that when English wheat was selling at 35/-, it was not unusual for Manitoba to fetch 40/- or 42/-. The miller would tell them that this relatively high price was due to the Canadian wheat making a type of bread which the British public now demands. If the British farmer could get the Canadian price his wheat would be worth well over 20/- an acre more than it is. Breeders were now trying to get varieties with the qualities of the American wheats, and one of those qualities was "strength." It was a popular notion that this strength was due to climatic conditions such as did not obtain in this country. That was not true. After 20 years' experience they knew that it was possible to grow wheat in this country every bit as strong as the best wheat that came from Canada, but in nine cases out of ten the crop was hardly big enough to pay the farmer, in spite of the high price it fetched. One of the best was Red Fife, but on the experimental farm at Cambridge, he could grow only 18 bushels of it where he could grow 40 bushels of the ordinary English type. Yet there were other English farms where Red Fife suited the land, and really good crops of it could be grown. Although they had hundreds of returns, they could not yet say just what soil and climate would suit that particular variety, and they could only find out by trying it. The problem on which the breeders were working was that of taking the good quality out of the Canadian wheat and putting it into some of our good heavy yielding English varieties, and the difficulty was increased by the necessity of producing a sufficient quantity to test in the mill and the bakehouse to see if it really is a strong wheat. A number of varieties which combined the heavy yield and the good qualities were being tried, and, though the trials showed that the new sorts yielded every bit as well as Square Heads Master or Wilhelmina, he would not say too much about them until they had passed the mill and the bakehouse. If the results were satisfactory, they ought to add another 10 or 15 per cent. to the value of the crop. Putting together the various points he had discussed, he thought they would increase the value by 20, possibly 25 per cent. Then if the acreage were to swing up to 2½ millions they would be approaching half of the wheat supply which this country needed (applause).

AN INTERESTING DISCUSSION.

Mr. Hartop said it took one year to prepare the land, the next year to grow the crop, and the third year to realise the money. Did not Mr. Biffen think the farmer required confidence before he increased the area of wheat?

Mr. Biffen said the increase must be a slow one. He thought there was cause for confidence apart from war conditions. For the last 15 years prices had shown a steady rising tendency, and he saw no reason why there should be a drop. The great wheat growing areas were being worked out while the number of



- **Meeting of the Bedfordshire Chamber of Agriculture, Swan Hotel Bedford [1910]**
- Mr E Laxton said he thought the meeting did not recognize the great work that Mr Biffen had been doing for agriculture, but in a few years they would look upon him as one who had added to their incomes. He knew from his own experimental work how immense was the labour and expense of producing new varieties. Mr Biffen was devoting his life and brains to bringing out new wheats that would add to the well-being of the country and of the world. He thought they little knew they were entertaining an angel unawares (laughter)... they would find they could rely upon Mr Biffen when he introduced a new variety, and he had no commercial interest. Prof. Bateson, who was a second Darwin, had the greatest confidence in Mr. Biffen's work.

Telegraph 1920 (3)

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OUR FOOD PROBLEM.

SCIENTIFIC SOLUTION OF A LEGACY OF THE WAR.

By ARCHIBALD HURD.

One of the national weaknesses which the late war, marked by the intensive submarine campaign, brought home to us is the provision of adequate food supplies for 47,000,000 people, in peace as in war conditions, living in islands which normally grow only about sufficient for one-third of that population. Our memories are short, or it would be at once recognised by everyone that that represents a question of the utmost urgency, since it is evident that the last war has not been fought. Fortunately for the nation, the matter has not been neglected, as I learnt in casual conversation a few days ago, with satisfaction, for the nearer we come to a solution of the food problem the simpler will become the problem of naval defence. The position is enheartening and interesting from the point of view of the layman unversed in agricultural science.

The best brains of the agricultural world and groups of scientists set to work many months ago, and next summer the new National Institute of Agricultural Botany will be housed in a fine range of buildings at Cambridge which are now nearing completion. The project represents a happy combination of Government officials and the leaders of our greatest industry. All the interests concerned have united to make the institute a success. The movement is already assured of a capital sum of £93,836. The scheme originated with Sir Lawrence [illegible] who gave £10,000 and a five-year guarantee of £1,000; Mr. Frederick Hiam, who presented [illegible]

these lines, Germany, Holland, and Sweden having proved, as the saying goes, that "there is money in Mendelism." The corn production of Southern Sweden, for instance, has been increased by 30 per cent. as a result of an institute similar to the one which is about to be established at Cambridge. So far as this country is concerned, the pioneer work in Mendelism has been carried on under financial and other disadvantages principally by Professor Rowland Biffen, Professor of Agricultural Botany at Cambridge University. Apart from his "making" of a new wheat, which combines the "rust" resistance of the Russian Ghirka wheat with the yielding capacity of the English variety, he is now about to give us for the first time in modern years a loaf which will be "quite English." This is what Mr. Bruce says of the new wheat which Professor Biffen has grown:

"It is well known to every miller that certain of the Canadian wheats produce a flour which is much superior for baking purposes to the flour of English wheat. So much is this the case that no bread is made nowadays solely from English flour. A considerable proportion of Canadian flour is always present in modern bread. This superior quality is most marked in a wheat known as 'Red Fife.' Professor Biffen made 'Yeoman' by taking the superior quality only out of 'Red Fife' and combining it with the high-yielding character of certain English wheats. The economic value of this achievement is obviously very great. Canadian wheat, in pre-war days, commanded in the market about 5s more per quarter than the best English wheat, so that if we multiply the total yield of English wheat in quarters by 5s we can form some conception of the value which could be added to the produce of English wheat fields if the varieties at present used by farmers were replaced by wheats similar to 'Yeoman.'"

Nor is that all. He has produced a wheat suitable for the Fen country, and working on similar lines Mr. E. S. Beaven, of Warminster, has also done notable work. New barleys are now available which give an increased yield of 10 per cent. over the old varieties. Professor Biffen hopes to produce shortly a spring wheat [illegible] will give a higher yield than any known [illegible]ty. The results obtained at Cambridge [illegible] been the work of Professor Biffen and two or three assistants, but it is said that there is sufficient research in sight to occupy the time of twenty assistants, who, in combination

Here is a pressing problem which demands attention in order that immune varieties of potatoes may be produced to suit the tastes and needs of the domestic circle, the hotel keeper, the baked-potato man, and those who make their living by selling "fish and chips." Everyone has his own penchant in the matter of potatoes, some preferring them mealy and some otherwise, some one colour and some another; the hotel keeper, never certain of the day to day demand, wants a kind that can be cooked twice over; in the fish and chips shop a potato is required which will not absorb too much fat, for fat is expensive; the potato merchant who perambulates the streets demands a potato which is large and mealy, has a thick skin, and can be baked. What the scientist has to do is to breed immune varieties which will meet all these needs.

The new institute has had no more convinced supporter than Sir Daniel Hall, who has devoted his life to agriculture. He was for a long time associated with the Rothamsted Laboratory. He has come to the conclusion that owing to the work done there "the yield of British crops and the permanent fertility of the land were raised from the level indicated by an average wheat of about 20 bushels an acre to one of over 30 bushels." He has stated that the position now is one that calls for further effort.

Already on many of the more highly-cultivated farms the limits of commercial success as regards manuring are almost reached, the plant itself either does not utilise the food at its disposal, or by increased susceptibility to disease, or, as in the case of cereals, by its incapacity to sustain its own weight, cannot be further fed without risk of disaster. We want new races of plants adapted to intensive cultivation, and it is my deliberate opinion that an increase in the production of our land is much more easily obtainable in that direction than in any other. By research and by the due dissemination of the results of that research it is certain that the yield of our crops could be raised by ten per cent. within the next twenty years.

That benefit could be cumulative because it would bring much land now carrying unprofitable grass into cultivation and render farming possible on areas that are now waste. When I say unprofitable grass I mean unprofitable in the national sense, though it may pay the farmer. Land that will not carry paying crops has to be farmed cheaply with a minimum of labour, and must be left in grass,

Archibald Hurd *Telegraph 1920*

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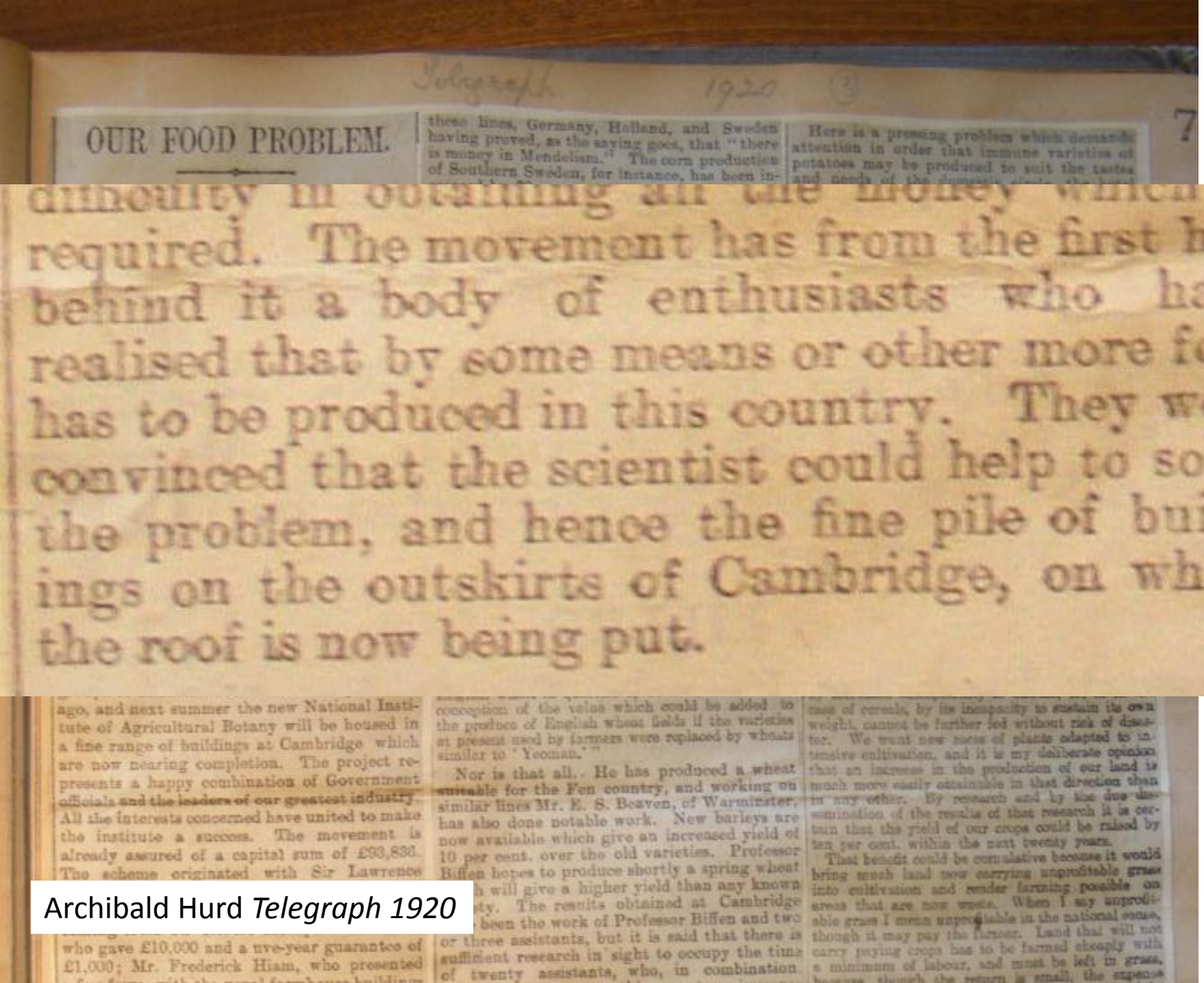

OUR FOOD PROBLEM.

difficulty in obtaining all the money which is required. The movement has from the first had behind it a body of enthusiasts who have realised that by some means or other more food has to be produced in this country. They were convinced that the scientist could help to solve the problem, and hence the fine pile of buildings on the outskirts of Cambridge, on which the roof is now being put.

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Archibald Hurd *Telegraph 1920*

- Conclusions of the Departmental Committee on Distribution and Prices of Agricultural Produce (Linthglow) Report:

"As a result of careful scientific research, Professor Biffen, of Cambridge University has succeeded in breeding a wheat, namely, "Yeoman," which crops heavily ... And above all possess strength" p.85

- [T]he National Farmers' Union, should recommend its members to produce "Yeoman" ... Millers ... Should concentrate on the production, advertisement and sale of all-Yeoman flour, while bakers should make enlightened use of its proved and recognised qualities. p.86

SCIENCE TO THE RESCUE OF AGRICULTURE: WHEAT-BREEDING MIRACLES

PHOTOGRAPHS SUPPLIED BY C. E. BRAND. DESCRIPTIVE ARTICLE BY DAVID MASTERS.

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"FEW people," writes Mr. David Masters, in an article accompanying these photographs, "have any idea of the wonderful work going on at the Cambridge Experimental Farm, where Professor H. R. Biffen is working for our future daily bread, and quietly and unobtrusively breeding new wheats that are the finest in existence—wheats of better quality and higher yield than any hitherto grown by man, wheats that may prove the very salvation of agriculture in this country. The average yield of English wheat is the highest in the world, being 31½ bushels to the acre, while the wonder lands of Canada do not produce more than 17 bushels to the acre. But the English yield, though high, is of poor quality, while the Canadian yield, although lower, is of very fine quality. A loaf made with English flour is so heavy that millers are compelled to mix the inferior English grain with the hard Canadian wheat, in order that the bakers may supply the large, light loaf that people desire. It is obvious that, if our farmers could produce twice as much wheat from the same lands, the benefit to the people would be incalculable. Professor Biffen realised that this result could not be obtained by selection; he knew that the only way to

[Continued in Box 2.

THE WORST GRAIN DISEASE CONQUERED: THE SECOND GENERATION OF RUST-RESISTING WHEAT BRED AT CAMBRIDGE.

Top row—(1) Duluth, the father plant; (2.) Ear of rust-resisting wheat; (3.) Red Fife, the mother plant. Below, variations of parental characters—(4) Beardless Red Fife; (5.) Intermediate bearded type; (6.) Rust-resisting type; (7) Bearded type not immune from rust; (8.) Improved beardless Duluth; (9.) Bearded Duluth.

Continued.] 2

improve the yield and the quality was to breed entirely new varieties of wheat. At Cambridge the amazing sight may be seen of wheat being grown in giant cages made of small-mesh wire, in order to keep the birds away from the grain. These cages are used for comparative yield trials, the land being divided like a chessboard into squares of four feet. Generally four varieties of wheat are sown, so arranged that each variety is grown in about fifty different places, to allow of any variation in the soil. The grain is planted at intervals of 2 in. in rows 6 in. apart, and at the time of harvesting the square yard in the centre of each plot is carefully measured, the crop cut, and the yield discovered with absolute accuracy. Wheats from all parts of the world are collected and used for breeding purposes, but in every case a variety called Red Fife is made to serve as the mother plant. Red Fife is of fine quality, hard in the grain, and it ripens well; moreover, it may be grown year after year without losing quality, whereas all other foreign wheats deteriorate after being grown a season or two in England. Having a low yield of high quality, Red Fife is cross-fertilised with wheat having a high yield of a poorer quality with the result that among the new wheats

[Continued in Box 3

HEAVY AND NOT WELL RISEN OWING TO THE POOR QUALITY OF THE WHEAT: A LOAF MADE FROM ENGLISH FLOUR.

Continued.] 3

bred will be one or two with the best qualities of both parents: a yield much better than that of Red Fife, and a quality better than that of the other parent. Occasionally a wheat is produced with a higher yield than the high-yielding parent, and this is the wheat that the scientist seeks, the wheat that is to provide the daily bread of the future. In due course the ripe grain is gathered and labelled. The next season it is carefully planted, and the eighty or so plants from the ear will be found very much alike in character. This grain is then planted, and big variations begin to appear. The finest ears are selected, and the rest thrown away, and by the third or fourth generation the type becomes fixed and breeds true. Then comes the task of growing the wheat for seed, which is saved and planted again and again until stocks are ready for one or two favoured farmers, who in turn grow solely for seed purposes. It is half a lifetime before there is enough seed for even a few farmers. One of the finest wheats in the world is Yeoman, which was bred by Professor Biffen about seventeen years ago, and the stocks are still comparatively small. Farmers and others will open their eyes in amazement when they know that Yeoman has yielded, when grown in a field by the ordinary methods of cultivation, the phenomenal crop of 96 bushels to the acre, or three times the

[Continued below.

SHOWING THE SUPERIOR QUALITY OF CANADIAN WHEAT: A LARGER LOAF MADE FROM THE SAME QUANTITY OF RED FIFE FLOUR.

Received 12th. June 1925.

East Kent Gazette 6/6/25

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HOME-GROWN WHEAT.

In the course of a reply to a question asked in the House of Commons, the Minister of Agriculture has given an account of the action being taken to improve the quality of home-grown wheat. The Ministry assists by grants-in-aid the Plant Breeding Institute of the University of Cambridge and the National Institute of Agricultural Botany, whose work in evolving improved strains of wheat, especially Yeoman II., is well known. The Ministry has also established and proposes to extend, a system of crop variety stations where new and standard varieties of crops are tested. The Royal Commission on Food Prices received evidence recently that an improvement in the quality of home-grown wheat had been effected without sacrifice of yield.

Received 22nd June 1925.

...mer 20/6/25

Daily Mail 15/6/25

D Macclesfield Courier 23/5/25.

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16

June 1923.
Times THE TIM

THE ALL-ENGLISH LOAF.

BEST VARIETIES OF WHEAT.

MILLING VALUES.

(By Our Agricultural Correspondent.)

The references in the latest interim report of the industrious and competent Departmental Committee, presided over by Lord Linlithgow, to bread made with all-English flour are interesting for several reasons, but especially for what they reveal regarding past and present efforts to make it feasible to produce a loaf from home-grown wheat that will be acceptable to consumers.

The pioneer movement organized by the North Bucks branch of the National Farmers' Union, for supplying to the public bread made exclusively of flour milled from English wheat, is deserving of recognition, as it has been largely due to this enterprising scheme that definite evidence on the point is available. Newport Pagnell has given a lead in a departure of wide significance. The loaf put on the market under the N.F.U. movement has the defects of its qualities; as "an electioneering loaf" it is wanting in bulk, and in respect to colour also it may be at a disadvantage in appealing to customers; but there has to be set against its somewhat small and solid appearance the claim that in nutritive merit it will compare favourably with its larger and whiter rival of composite origin. The all-English loaf—grown, milled, and baked in this country—is free from any of the mixing, colouring, and "bleaching"—a process that calls for careful investigation—devices of which, it is understood, the common loaf of the day is suspected. The householder is safeguarded against deception in weight by the law, but size may be an unsafe guide to the value of the article supplied. The Newport Pagnell loaf, obtainable, we believe, from any baker in that town, is both palatable and wholesome, and disproves the supposition that good bread cannot be made from unmixed English flour.

The appeal to farmers to help forward the demand for all-English bread by growing varieties of wheat known to have high milling qualities is worthy of respectful attention. Professor Biffen's Yeoman wheat is especially recommended. The exceptional milling value of this wheat has never been questioned, and the fact that it is, perhaps, the most widely-grown variety to-day is proof that its merits have been recognized by both millers and farmers. The few shillings more per quarter which the farmer readily give for it have naturally influenced its place on the farm.

There are, however, difficulties in the way of the general adoption of this or any other single variety, which may be known in full measure only to the growers. Excellent wheat as Yeoman is, it is somewhat fastidious in its preferences as to environment. It is essentially a plant for the best soils, or soils in a high state of fertility, and because of this predilection for the richer lands it has to be cultivated with exacting discrimination. Failure to observe in practice this aspect of the question might more than discount, in the financial result, the benefit gained by the higher value of the grain per given unit. A comparison with the Swedish Iron wheat, as it is known up till now—it is stated that the defect has been corrected in the seed sent out from Svalof this year—is noteworthy on this point. Of these extremes in milling value the Iron variety has sometimes been chosen, and the choice justified on economic grounds, because of the larger return in bulk and weight. A similar example of quality being bought at too great a sacrifice in quantity is furnished by our old Squarehead wheats and Canadian Red Fife. [illegible]

Professor Biffen's Work.

Professor Biffen's work in the raising of new varieties of cereals deserves the prominence assigned to it in this valuable report. Yeoman wheat is only one of several varieties that have been sent out from the Cambridge station. Of its predecessors, Little Joss is the best known, and it is curious that this earlier product of Mr. Biffen's researches still retains precedence in some of the Fen areas, the very districts in which, in the nature of things, Yeoman should surpass all rival sorts. Among the varieties that are in process of development at Cambridge there appear to be several of promise. Professor Biffen would be the last to inspire hopes that may not be fulfilled, and if he can be induced to speak confidently of the prospects of the newer sorts it may be assumed that Yeoman will soon be in competition with rival varieties from the same source.

The breeding of cereals, potatoes, and farm and garden plants in general is a delicate and difficult process, making severe demands on knowledge, skill, and patience, and growers are under deep obligations to those who undertake the work successfully.

In evolving a new breed of wheat, for instance, milling quality is only one of many points to be considered. The possession of that quality alone would be of little value. Professor Biffen and others are seeking to combine in the one variety heavy yielding properties, high milling quality, rust-resisting powers, and straw that will withstand rain and wind storms. It is a lofty ambition, but that is what our scientists are striving to achieve, and as only one crop a year can be grown progress must be slow. But such is the eagerness of farmers to sow the best varieties procurable that a brisk market is assured for the wheat or other plant that is proved to be an improvement on the older types.

While consideration of varieties of crops and selections suitable to local conditions is opportune both in the Linlithgow Report and in everyday practice, it would be a mistake to assume that a remedy for the existing crisis in arable farming can be found along these lines. The combined effect of palliative measures is not to be despised; in the best of circumstances it will be required to render other schemes operative and effective. Whatever form Government action may take, it is safe to assume that it will not be designed to relieve farmers of the necessity of keeping in line with the most enlightened procedure in the management of their holdings. The aid given would be justified only if it were made to supplement and to supplant private initiative, enterprise, and resource in the management of land and livestock. This is all that is asked for by farmers versed and experienced in their calling.

THE COUNCIL OF AGRICULTURE.

MR. NOEL BUXTON ON BRITISH FOOD.

A meeting of the Council of Agriculture for England was held yesterday at the Middlesex Guildhall. Mr. G. Edwards, M.P., presided.

Mr. W. McCracken proposed a resolution recommending the Ministry to consider the desirability of acquiring powers to enable them to supplement the compensation paid to farmers for cattle destroyed under Foot-and-Mouth Disease Orders by grants to meet at least a portion of the loss due to the suspension of production and earnings, and to the increase in the cost of replenishing stocks, and to meet the claims of farm labourers for loss of employment and wages due to the slaughter of herds.

The resolution was defeated.

Mr. Spragoon proposed that in view of the urgent need of land drainage for the reclamation and improvement of agricultural land, the Government should be requested to bring in legislation giving county councils the necessary powers to deal with the matter. He said that several million acres of grass and arable land were only giving a tithe of the return which they should. The chief reason was the lack of proper drainage.

The resolution was carried.

Mr. Noel Buxton, Minister of Agriculture, said it fell to him to give certain facts of interest to the Council in regard to what had happened since their last meeting. With regard to foot-and-mouth disease, the number of outbreaks had declined almost regularly from 99 in the week ending March 2 to nine in the week ending April 27. The weekly totals since then had been nine, 11, and 13. Attention had been given to the disinfection of railways, and they were convinced that good results would follow. A move had been made in regard to reclamation. There had been exhaustive inquiries as to the possibilities of the margin of the Wash, and a scheme was to be carried out a few miles from King's Lynn, where, fortunately, the land was under the control of the Crown. About 400 acres would be dealt with. They were waiting to see the result of the King's Lynn scheme before bringing forward others.

Referring to types of British wheat, he said he did not think the progress that had been made was realized. Research had acted in direct relation to economic improvement, and a name that ought to be held in honour in this country was that of Professor Biffen. He emphasized the value of "Yeoman" wheat, and said he was not ashamed to confess a sentimental preference for British food, which almost all of them, even ardent free-traders, could hope to have, and it was rather interesting, with the progress made in regard to British wheat, that it was now possible for a voluntary preferentialist, such as he was, to consume nothing but British food.

Times July 23 – 24.

NEW ENGLISH WHEAT.

YEOMAN II. AVAILABLE FOR SOWING.

(By Our Agricultural Correspondent.)

As the result of Professor Biffen's work at the Cambridge University Plant Breeding Institute, a new type of Yeoman wheat will be available for sowing in the coming autumn. Of this new variety, Yeoman II., about 2,500qr. will be sold by tender through the Agricultural Seed Trade Association, the National Association of Corn and Agricultural Merchants, the National Association of British and Irish Millers, and other established dealers in seed corn. The price is £6 6s. per 4½ cwt., subject to 5 per cent. discount for cash, free on rail at cleaner's station.

Yeoman II. is introduced to take the place of the older Yeoman wheat, a memorandum published from the National Institute of Agricultural Botany, Huntingdon-road, Cambridge, states that there are two substantial reasons for adding yet another sort to the list of those now grown in this country. One of these is that pure stocks of the older Yeoman, owing to admixture with other wheats, are getting difficult to obtain; the other that

WHEAT RESEARCH IN BRITAIN.

THE FIGHT AGAINST DISEASE.

SIR ROWLAND BIFFIN'S SUCCESS.

CAMBRIDGE WORK.

(By Our Agricultural Correspondent.)

For twenty years Sir Rowland Biffen, working in the seclusion of his Cambridge fields, has been seeking to produce wheats that shall be disease resisting, carry a straw that will not lodge under the influence of wind and water, and be capable of producing abundant hard grain of the best quality. To-day the breeding technique has been mastered, but the time required for production of a new variety varies from six to seven years. No less a period is required for testing, and finally the large-scale distribution problem arises. It follows that even if the scientists could be satisfied with progress, farmers must find it slow until they realise that the work is being done, not for one generation, but for many.

To-day Sir Rowland Biffen can claim to

disaster upon us, because we were so very short of food just then. Our Empire lay at the mercy of rust spores!

From the Cambridge station widespread research is directed. One research worker is testing rust-proof varieties from Canada in order to see whether they will be susceptible to the yellow form. In the Argentine, in Australia, in Kenya Colony, and in Germany Cambridge students are conducting experiments for the man who guided their studies in the earlier days; indeed, there is no part of the world in which people anxious to carry out research cannot receive direction and inquiry from the Experimental Station.

ANOTHER DISEASE.

Although we have named the worst of wheat troubles, there is another disease with an unpleasant name of Ophiobolus, a foot rot, that is also to be dreaded. It attacks wheat in areas of continuous growth and threatens all the countries that produce in bulk for export. Though its forms and developments are studied continuously, no cure has yet been forthcoming.

As most people know, one of the English farmer's troubles has been the reluctance of the miller to buy his wheat for bread making. It is the best in the world for biscuits, it is bought by the thousands of tons for poultry, but the miller eyes it askance, because in a wet year it may carry 20 per cent. or more of moisture that he must dry at his own expense, while the baker finds all-English flour difficult to handle. Sir Rowland claims that the wheat to be put on the market in bulk in 1938 should be strong enough to yield a first-class loaf without any blending, and this will put the British

mercy of rust spores!

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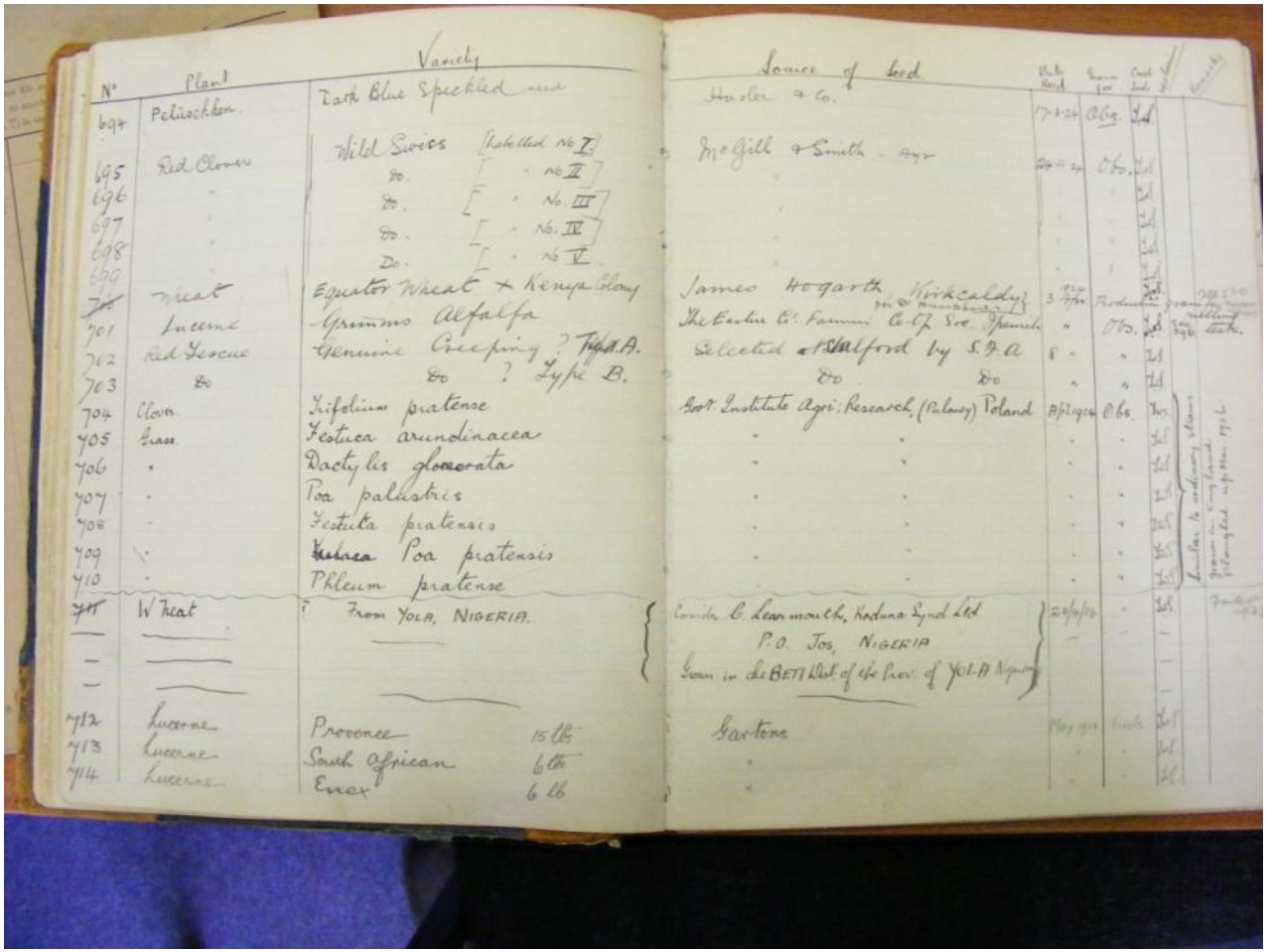
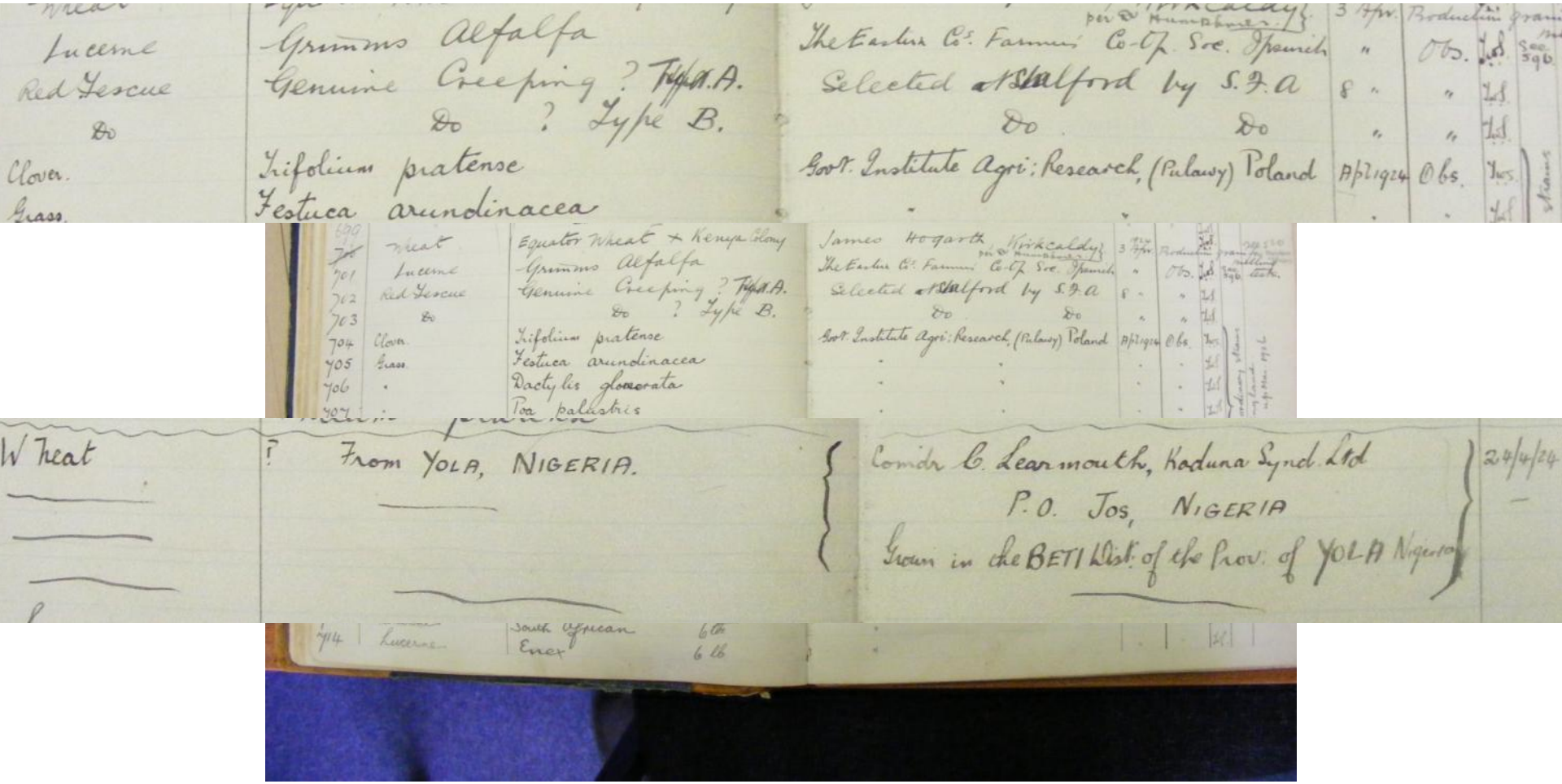
Plot records at the National Institute of Agricultural Botany



Plot records at the National Institute of Agricultural Botany



- By the time this has been accomplished perhaps the League of Nations will be able to turn its attention to deciding what nationality the new wheat is.

- Biffen, *Cambridge University Agricultural Society Magazine,*1925

PROFESSOR BIFFEN.

THE IDEA OF A RURAL CIVILISATION.

By H. S.

In appearance, this Cambridge professor suggests a philosopher. He has a large, meditative, and sometimes humorous eye, very dark in colour, the forehead above possessing a white wall of good, solid brain power, and the black moustache under the nose, solemn as a curtain over a vestry door, hiding a mouth which to stove [illegible] as a pipe than to speech.

This interesting, silent, and romantic person spends his life in a kingdom of interesting mystery, groping his way among invisible horses, and listening for the least sound of God's footfall in the dark. He lives in the underworld of nature, in the darkness that lies a ploughshare's depth beneath the visible surface, where seeds peel and spin, where little threads of roots break forth and feel their way down and down into the darkness, and where the living corn inside lifts up its tiny blade and pierces the furrow and greets the sun.

To this happy and reflecting man there is no science in the world to be compared with the science of agricultural botany, which pursues Nature to her greatest darkness in quest of her greatest mystery—life and growth.

IN SEARCH OF THE SUPER-SEED.

His idea is this: We are only at the beginning of English agriculture. During the last 60 years, thanks very largely to the work of the Rothamsted Experimental Station under Sir Daniel Hall, we have been enormously improving our soil; indeed, we have improved it so much that it is often too rich for the seed we put into it. Where progress lies in the future is in finding a seed worthy of this rich soil, a seed that will not send up great rickety stalks of corn with thin and feeble ears filled for the most part with water, but a corn strong in the leg and with ears as tight packed with solid flour as breeding can make them. How tight that packing

How is this to be done?

As the director of the Cambridge Plant Breeding Institute, Professor Biffen has done great services to agriculture; but a bigger instrument is needed if the pace is to be forced and if England is to lead the world in this great matter. It is hoped that a National Institute of Agricultural Botany may be started by a few patriotic and far-seeing men, to which Professor Biffen, with a staff of trained workers, will be able to conduct the most daring experiments and act as Chief of the General Staff to the whole world of British agriculture. This is the ideal for which some competent men are now working industriously.

A GREAT DISCOVERY.

A pupil of Professor Biffen has just made a discovery which is of almost as great an importance as a victory in battle. He is at work in the Argentine (largely because there is no place for him in England), and he has there produced a wheat which resists rust, and which will therefore increase prodigiously the wheat crop of that great Republic. This most important event has not yet been [illegible] in the newspapers. England has need of this young gentleman, and Professor Biffen, as the head of a National Institute, would have room for him on his staff. The professor would no longer lose his pupils year after year.

No seed merchant can do what this National Institute would undertake. It is unreasonable to expect the seed merchant to conduct experiments over eight or ten years, subjecting each step in his process to calling and baking tests, corresponding with men of science all over the world, even in Tibet, as Professor Biffen does, when at the end of it all there is nothing patentable. A seed once on the market is everybody's property. The gentleman has done good and patriotic work, but we must not expect too much of him.

"London," says our professor, "is still the world's chief emporium of the seed trade; very few people know that fact, an important fact; and yet nothing is done on a scale commensurate with this position to improve the quality of our seed. Sweden is far more go-ahead than we are. We ought to wake up to the duty laid upon us by our position as the center of the greatest agricultural empire in the world. We can give a new impetus to the

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"We have got to tune up farming," he says. "The farmer is now alert and receptive. The Board of Agriculture is alive to the possibilities of the future. If only the national spirit gets roused we may accomplish great things. It is not at all impossible that we may create in England a great rural civilisation. That would be a most beneficent revolution."

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SUDAN
ETHIOPIA
KENYA
UGANDA
SOMALI REPUBLIC
UPPER JUBA
LOWER JUBA
NORTH EASTERN
EASTERN
WESTERN
NYANZA
CENTRAL
RIFT VALLEY
COAST
MARA
MWANZA
Lake Turkana
L. Stefanie
Lake Victoria
1133 metres
Lake Kyoga
Lake Baringo
Lake Natron
Lake Eyasi
Lake Manyara
Speke Gulf
Winam Gulf
Sese Islands
Detailed map see pp. 24—25
Lodwar
Lokitaung
Moroto
Gulu
Lira
Soroti
Masindi
Mbale
Tororo
Jinja
Kampala
Entebbe
Masaka
Bukoba
Musoma
Mwanza
Shinyanga
Kitale
Eldoret
Kakamega
Kisumu
Kisii
Kericho
Nakuru
Naivasha
Narok
Nairobi
Machakos
Konza
Nyeri
Murang'a
Thika
Embu
Meru
Nanyuki
Nyahururu
Isiolo
Maralal
Marsabit
Moyale
Mandera
El Wak
Wajir
Garissa
Kismayu
Hola
Lamu
Malindi
Mombasa
Kilifi
Voi
Tsavo
Moshi
Arusha
Kitui
Kikuyu
MT. ELGON 4321
MOUNT KENYA 5199
KILIMANJARO 5895
MT. KULAL
Mega
Maikona
Dukana
Kakuma
Nimule
Buna
Habaswein
Merti
Mado Gashi
Koreh
Kongoni
Kindaruma Dam
R. Tana
R. Athi
R. Galana
R. Juba
INDIAN
Metres
5000
3000
2000
1000
500
300
200
100
Sea Level
Spot heights in metres

Varieties of wheat worth growing in Kenya.

Equator - To grow extensively above the 7500 foot level. Its most useful features are to be found in its freedom of shedding. The toughness of its ears & chaff which prevent the shedding of its grain even when over ripe - and a degree of yellow rust resistance sufficient to ensure a fairly reliable cropping capacity. The grain is of fair quality & useful for blending but milled alone does not produce a very satisfactory flour for breadmaking.

The wheat known as K.T., resembles Equator so closely that it cannot be distinguished from it.

Marquis under Kenya conditions is a free shedding wheat which produces an over abundance of straw & lodges badly in unfavourable weather conditions. The samples of grain

Reprinted from the "East African Farm & Home Journal." December, 1926.

WHEAT GROWING IN KENYA.

ADDRESS BY SIR ROWLAND BIFFEN, F.R.S.

Professor Sir Rowland Biffen addressed a large gathering of farmers in the Lecture Hall on the Nakuru Show ground during the show week. Great interest was displayed in his address because of the fact that Professor Biffen had just completed the main part of his tour of the wheat growing areas of the Highlands and this was the first occasion on which he had had an opportunity of giving his general impressions of the prospects of the industry in the Colony.

Captain H. Sayer presided and in a few appropriate sentences introduced Professor Biffen to his audience, which included His Excellency the Governor, Sir Edward Grigg, the Director of Agriculture and Mr. Burton, the Government Plant Breeder who had accompanied Sir Rowland Biffen during his tour.

Professor Biffen said he spoke on the problems of wheat growing in Kenya with some hesitation because he gathered from many people with whom he had discussed the subject that the season had been somewhat abnormal and had been characterised by excessive rainfall and an excessive amount of rust. Perhaps, however, from his point of view, the excessive amount of rust which seemed to have existed at different altitudes was really a satisfactory feature because it gave him an idea of what Kenya conditions could be at their worst; and it was perhaps not altogether a disadvantage to visit the country under such conditions.

The present position of Kenya as a wheat growing country was a peculiarly interesting one. To begin with, it was a brand new country in which wheat growing had only been carried out for a comparatively short period. The farmers started with the disadvantage that there were no indigenous wheats in the country. Before the white man came wheat was completely unknown and he thought that fact rather significant because of the neighbouring country of Abyssinia where wheat growing was a very old and very well established industry going back over 5,000 years. They had to remember the fact that wheat had not come across the Abyssinian boundary and into cultivation in what he believed to be very similar conditions in Kenya.

"You have had to find wheats" he continued, "capable of being grown here, and settlers, farmers and the Agricultural Department have been more or less searching the world for varieties of wheat which you can grow in this country. I think that search has been a very intensive one. The Agricultural Department here has got together 300 wheats and tested them out. They have found in the majority of cases that those wheats would not succeed under Kenya conditions. On coming out to this country I have been surprised by the extraordinary small number of the wheats that seem to be capable of growing in Kenya. I am surprised because I happen to know that up and down the wheat countries of the world there are growing something like 5,000 different types of wheat; and yet you have only managed to find a few you can grow here. One naturally asks oneself why this should be and I think a good deal turns on the reasons why so few wheats have been found capable of growing in this country.

CLIMATIC CONDITIONS AND SOILS.

"You have to think first of all of your own local conditions and I think I may say that, at all events from a wheat growing point of view, those conditions are unique. I do not think I will qualify that at all: they are absolutely unique. In the first place you have a continuous growing period. In this strangely equable climate you are growing wheat at practically any time of the year. You have no seasons whatever and nothing to check its growth. Only four days ago on a farm 30 miles from here I had the extraordinary experience of seeing a field being prepared for sowing, a new area in which the crop was just coming above the ground, a quarter of a mile further on another crop coming into ear, and almost alongside they were reaping ripe wheat. It is a state of affairs which, to put it mildly, is altogether unusual. Not only can you grow wheat the whole year round, but there are actually districts in which it is quite possible to pull off two crops in a single season—again rather an unusual state of affairs.

"This continuous growing period of your wheat is further characterised by the fact that at night, particularly in the higher altitudes, you have somewhat low temperatures for plant growth, and, at the high altitudes, the wheat plant is somewhat checked I believe during the night period. Your wheat is also being grown under peculiarly intensive illumination. We know that all plants want some light but we do not know how much they want, and it is just a question in my mind whether wheat in Kenya is getting more sunshine than it actually wants. But that is a matter that plant physiologists will have to investigate.

"The rainfall conditions, taken all round, appear to be satisfactory. Although the rainfall is high for wheat—I place it somewhere about 45 inches and wheat generally succeeds best with a rainfall between 20 and 30 inches—this apparently excessive rainfall is compensated for by very rapid evaporation through the soils and I imagine the roots of the plants do not get much more moisture than they do in most wheat growing countries.

"So much for the climate; now for the soils. Those in some respects are peculiar. They are mostly volcanic soils. Very little is known about growing wheat in them and so far as I know they are characterised by the fact that they are more or less lacking in phosphates. I am making that generalisation on the strength of 20 or 30 soil analyses which I have had an opportunity of seeing. You have got on the whole a fertile soil—in some cases a very fertile soil indeed—but it is a soil which contains comparatively small quantities of phosphates which are more or less essential to wheat growth. Wheat grown under those conditions is in some respects a very different plant from wheat such as we grow in England or such as we see in the United States or Canada or India or in any of the great wheat producing countries, and I think it is well that we should try to realise that fact.

"Kenya wheat differs from all the other types of wheat which I have seen in the course of 20 years in producing many stems per plant; that is one of the facts that strikes me most. Wheat is producing in Kenya six, seven or more tillers per stool and gives the promise of an abundant crop. At home the English wheats are putting out two per plant—the actual number is two and one-third per plant. If you compare such a state of affairs with Canada or the United States, you will find that each wheat plant consists of a single stem with a single ear on top of it. In fact the greater part of the world's wheat is produced from this single stem plant. Here in Kenya you have a different type of plant which in some ways is of extraordinary promise. Another thing that strikes me in regard to Kenya wheat is that at times the grain finishes off badly. Generally speaking it finishes extraordinarily well and on the show ground you will find four or five bags which are as fine as anywhere in the world; but in other cases the grain finishes badly for a reason I cannot explain altogether at present.

FUNGOID PESTS.

"Another fact which strikes me, and the curious conditions are responsible is that the wheat grown here is, I think I may say, peculiarly susceptible to the attack of a number of fungoid pests. In fact I have never yet seen wheat so badly attacked by rusts as I have in this country. I have been very impressed by the variety of the rust attacks and it soon became quite clear to me that the incidence of the rusts on the wheats was going to determine straight away whether Kenya is ever to be a wheat producing country. The attacks of rust are so severe that there is always the risk of the crop being wiped out and even the most optimistic of farmers will not go on growing wheat if three out of four crops are wiped out by rust each year. Naturally I have devoted very considerable attention to the distribution of rusts about the coun-

- As a matter of fact you are producing more than in the Argentine ... Given proper cultivation ... I can see no great difficulty in Kenya producing not only enough to feed itself, but to feed its native population as well
- Biffen, *East African Farm and Home Journal,* 1926

Concluding thoughts

- A study of the rise of agricultural science,
  - Ag. Sc. As the intellectual territory/property of Mendelism.
- Mendelism as a subject best understood from a *global* perspective.