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RELATIVE TO

BLIGHT IN WHEAT

AT

KORONG VALE.

PRESENTED TO BOTH HOUSES OF PARLIAMENT BY HIS EXCELLENCY'S COMMAND.

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BLIGHT IN WHEAT.

Department of Agriculture,
Melbourne, 2nd February, 1888.

The Honorable the Minister of Agriculture.

SIR,

On the 15th December last, a question having been asked in Parliament, by Mr. Langdon, as to whether a report had been obtained upon the cause of the blight in wheat at Korong Vale, I was instructed by you to have the matter inquired into; and I have the honour to report that, with a view to as complete a report as possible being obtained, Messrs. T. K. Dow, R. Dodd, and A. McNaughton, who were then acting for the Department as farm judges, were requested to visit Korong Vale, in order to ascertain, if possible, the cause of the disease. The report of those gentlemen is attached, and it is stated therein that, in their opinion, the absence of some constituents in the soil necessary for the support of the plants is the cause of the failure of the crops.

Samples of the wheat-plants and of the soil were submitted to Mr. Pearson, the Agricultural Chemist attached to the department, and in his report, which is appended, insufficient nourishment is given as a reason for the disease.

A report on analysis of the soil, by Mr. Pearson, is also attached, and the report is to the effect that the soil is poor in all respects. Mr. Pearson's report contains a description of manures which he recommends for application to the soil.

I have the honour to be, Sir,
Your most obedient servant,
D. MARTIN,
Secretary for Agriculture.

The Honorable the Minister of Agriculture.

SIR,

Having been requested by the Department of Agriculture to report upon a disease alleged to be affecting the wheat crops in the Korong Vale district, we have the honour to lay before you the result of our investigations.

On the 7th December, 1887, we proceeded to Mr. Daniel King's Kent Farm, six miles east of the Korong Vale railway station, in the shire of Korong; a letter from Mr. King having called attention to the existence of the disease in his own and his neighbour's crops. In Mr. King's case, the disease was confined to one portion of his farm, about 40 acres in extent, and we found that a wheat crop growing on this land was badly affected with a disease having a resemblance to "Take-all" (*Zenodochius cerealium*). Many other farms were found to be similarly affected in the same district, and in some cases more extensively than in that of Mr. King's property. The disease has been observed in the district for several years, and it is found to be spreading, the area affected this season being much larger than in previous years.

Proceeding to examine Mr. King's crop, we found that there were patches of from one-tenth of an acre to an acre in extent upon which the wheat had entirely failed, the surface being covered with sow thistles and other weeds. Adjoining these patches the wheat crop had a healthy appearance, promising a yield of from 15 to 18 bushels per acre. But the bare spaces were so numerous that the yield of the field would probably be reduced to 6 bushels per acre. The effects observable were similar to those resulting from "Take-all," and the history of the crop, as related by Mr. King, also revealed a general resemblance to the course of the same disease. The crop, which was sown in May, is said to have come up evenly, and to have looked well until the 20th of October, when the wheat was out in ear. At this period the plants on the affected patches ceased to develop, and began to wither and decay. While the remainder of the crop continued to grow, and finally to ripen, the process of decay was going on upon the affected portions, with the result that just before harvest these patches presented the appearance which was observed.

Many of the wheat-plants had evidently entirely disappeared, while in a few cases there remained some inches of dead straw.

Such, we learned, had been the general course of the disease upon other farms in the district. In Mr. King's case, the land had only been three seasons under crop. The new land was broken up three years' ago, and sown with wheat. A good crop was obtained, but in the succeeding wheat crop patches of "Take-all" appeared. Next season, Mr. King dressed the land with bone dust, at the rate of 2 cwt. per acre, when sowing the wheat, but the disease, instead of being checked, spread to a greater extent, presenting the appearance which we have described.

Examining the soil on the diseased patches, we found the surface to consist of a reddish friable loam to a depth of about four (4) inches, and the subsoil a mixture of granitic sand and clay. The subsoil was hard, although moist from recent rains. Proceeding to examine the adjacent soil, which was supporting healthy wheat-plants, we discovered a marked difference. In this case the soil was somewhat deeper, and the subsoil, while containing some granitic sand, was softer, and incorporated with it was a much larger proportion of clay. On the remaining portions of the farm, where there were crops promising a yield of from 20 to 24 bushels per acre, the surface was a stronger loam, with a good subsoil of red clay. Upon visiting other farms in the district, we found that the disease was worse where the soil was most granitic. A granitic range traverses the southern portion of the district, and apparently it was only in the vicinity of the range that the disease had spread to any great extent.

We are of opinion that the causes of the failure upon the patches of land referred to will probably be found in the composition of the soil, some constituents necessary for the support of the wheat-plant being absent. The disease known as "Take-all," which exhibits similar effects, is usually met with in soils which have been exhaustively cultivated for a number of years, and is, no doubt, to be attributed to such cultivation having robbed the land of elements necessary for the support of cereals. In this section of the Korong Vale district, the disease has appeared in new land, but, as the soil is not naturally rich and the subsoil is decidedly poor, the failure is nevertheless likely to be caused by a deficiency of some necessary elements of fertility.

We have forwarded, for minute examination, some specimens of the decayed wheat-plants, and samples of the soil and subsoil for analysis; and we respectfully recommend that the specimens be examined with a view of identifying the disease, and that the soil be analyzed for the purpose of ascertaining what constituents of plant-food are absent.

If the soil is found to be deficient in essential constituents, as we suppose, definite knowledge of that fact will enable farmers to supply the missing elements to their land in the shape of suitable manures.

We have the honour to be, Sir,

Your obedient servants,

(Signed) T. K. DOW.
R. DODD.
ANGUS McNAUGHTON.

Department of Agriculture, Agricultural Laboratory, 19 and 21 Queen-street,

No. 379/87. Melbourne, 15th December, 1887.

G. Martin, Esq., Secretary for Agriculture.

SIR,

I have examined the samples of wheat affected by "Take-all" which were left here by Mr. Angus McNaughton last Saturday, and find that they are attacked by two, three, and sometimes four different forms of fungoid growths.

One of these, which attacks the root and lower part of the stem, appears to the naked eye like a fine covering of white delicate wool, and under the microscope somewhat resembles the early (*oidium*) stage of grass mildew (*Erysiphæ graminis*).

Another, with which in almost every case the lower part of the stem was attacked, resembled very much the unnamed fungus which causes the "straw blight" of England. Like that fungus, it pierced the cells of the plant.

Another, also affecting the lower part of the stem in one instance, seemed like a "Fusisporium," and was olive-green in colour. Possibly it was a higher stage of the last-named fungi. The fourth, which was abundantly present on all the specimens of wheat, was a black mildew, growing in patches on the stem, leaves, and ears. These patches were of no definite shape, but gave to the wheat a mottled appearance. Under the microscope, they were seen to be made up of innumerable little tufts of dark-green colour, bearing spores. I have not yet met with any authorative account of these different forms of fungus growth. Possibly they have not all been yet described; for as new species of these low forms of life are being constantly discovered in older countries, it is likely that very much in this direction waits to be done in these colonies.

With regard, however, to the nature of the disease called "Take-all," I think it very likely that there are different specific diseases which are included in the broad general term of "Take-all," just as when speaking of human ailments one uses the term "fever" or "feverishness" to denote a general condition, without special reference to the specific cause of that condition. And as to remedial measures, there seems to be a general consensus of opinion that "Take-all" is a poverty disease, rarely affecting crops grown in land that is in good heart.

It is to be borne in mind that the spores of various microscopic fungi are always to be found in the soil or in the air, and these are ever ready to develop on suitable plants when the conditions are favorable to their doing so.

And the best way of coping with diseases of farm crops is, where practicable, to prevent those conditions from becoming favorable.

These fungus diseases are to plants what the so-called "germ" diseases are to animals, and the spores of the one are analagous to the germs of the other. And those principles of sanitation —sufficient food, ventilation, cleanliness, drainage, disinfection, and so forth—which have done so much to prevent the occurrence or the spread of epidemics amongst men would, if systematically adopted, without doubt very considerably decrease the frequency and severity of crop diseases.

Thus it appears, from general testimony, that the fungus which causes "Take-all" attacks mainly such crops as are insufficiently nourished.

The conclusion, then, is obvious—prevent the occurrence of this condition of insufficient nourishment, keep the soil in good heart, and the disease will not occur. And this is the plain and simple rule for the treatment of all poverty diseases.

With regard to other diseases which attack crops, growing indifferently in either rich or poor soils, attention should be paid to other points of sanitation. Thus, it may be that the spores have been conveyed to the soil in diseased straw from the previous year's crop, or that had been put in with the manures.

It should be a broad rule of what may be called crop-sanitation that all diseased crops should be burnt, or at least suitably disinfected, if this be practicable, as there is reason to believe it may be in many cases.

Diseased straw, unless it has been effectually disinfected, should not be used as litter.

Then, again, many disease-spores can germinate only in damp, stagnant air. This seems to be particularly the case with that serious scourge of the wheat crops, the "Summer Rust" (*Puccinia graminis*), which is generally said to break out in protected places, such as in corners of fields near hedges, or in hollows, and from these to spread to other parts.

It is clear, then, that a most important preventive measure against Rust and other diseases of similar habits is to afford to the crop a sufficient ventilation.

And this may be obtained by growing two crops in the same field, in alternate rows—say, one row or land of a root crop, then a row of wheat, then again a row of roots, and again a row of wheat, and so on throughout the field, the rows being made in the direction of the prevailing wind.

Of course, in many wheat-growing districts roots cannot be grown. But one of the practical problems of Victorian agriculture, which is now being worked out by several of the leading agriculturalists, is the finding out of suitable rotations for the different districts, and it is likely enough that before long practical discoveries of importance in this direction will be made.

It is very important, in connexion with the prevention of crop diseases, that farmers should recognise that they have common interests in these measures, and that combined action is required for the carrying out of preventive matters. I believe, eventually, it will be found that the prevention of these fungus epidemics is a matter to be dealt with by a service, to be placed on a similar footing to the weather service, and in which intercolonial action will be necessary.

With regard to "Take-all," from what I have heard and read, I am inclined to suppose that more diseases than one are referred to under the popular name "Take-all," and last year I proposed a short series of simple questions to be sent to different parts of the country with regard to this disease. The answers to these questions would have shown whether there was any diversity in the nature, occurrence, and symptoms of this affection. But there was no one to send these questions to, and no one to be on the look-out for the appearance of "Take-all" in his neighbourhood.

I have the honour to be, Sir,

Your most obedient servant,

A. N. PEARSON,

Agricultural Chemist.

Department of Agriculture, Agricultural Laboratory, 19 and 21 Queen-street,
No. 23/88. Melbourne, 25th January, 1888.

Analyses Nos. 155 and 156.

Report on analysis of soil and subsoil from patches of diseased wheat in Korong Vale, forwarded by Angus McNaughton, Esq., Melbourne.

The samples on analysis were found to contain, besides other substances, the following, viz.:—

SOIL.

Nitrogen	·060 per cent.
Phosphoric acid	·026 „ „
Potash	·138 „ „
Lime	·230 „ „

SUBSOIL.

Nitrogen	·027 per cent.
Phosphoric acid	·010 „ „
Potash	·189 „ „
Lime	·065 „ „

According to an English standard, a good soil should contain of—

Nitrogen	not less than ·160 per cent.
Phosphoric acid	„ „ „ ·200 „ „
Potash	„ „ „ ·200 „ „
Lime	„ „ „ ·500 „ „

Compared, then, with this standard, it will be seen that the above soil is poor in all respects more especially in respect of nitrogen and phosphoric acid, two constituents most essential for wheat growing.

The following are manures which may be recommended for application to this soil:—

FOR BARLEY, OATS, HAY.

Bone meal, or superphosphate of lime	2 cwt. per acre.
Potash salts	⅓ „ „ „
Ammonic sulphate	2 „ „ „

FOR PEAS AND BEANS.

Bone meal, or superphosphate of lime	3½ cwt. per acre.
Potash salts	½ „ „ „

FOR BEET-ROOT.

Bone meal, or superphosphate of lime	3½ cwt. per acre.
Potash nitrate	1½ „ „ „
Soda nitrate	1½ „ „ „

FOR POTATOES.

Bone meal, or superphosphate	3½ cwt. per acre.
Potash nitrate	1½ „ „ „

FOR SORGHUM.

Bone meal, or superphosphate	5 cwt. per acre.
Potash nitrate	1½ „ „ „
Sulph. ammonia	½ „ „ „

These manures may be obtained, ready mixed, by forwarding the above recipes to any of the following firms:—

Messrs. Cuming, Smith, and Co., 47 William-street, Melbourne.
Messrs. Blythe, Irving, and Binney, 22 King-street, Melbourne.
Messrs. James Fry and Co., Robb's Buildings, Collins-street.
Messrs. Grice, Sumner and Co., 24 Flinders-lane west, Melbourne.

For barley, oats, hay, and sorghum, the manure may be sown either broadcast or with a drill (it should in either case be spread as evenly as possible), and then harrowed in with the seed. For root crops and potatoes three-fourths of the manure should be ploughed in five inches deep, the remaining one-fourth being harrowed in with the seed.

I do not recommend a direct manuring for wheat, as the wheat crop is so liable to accident that a profit on the manure is not always certain, and the safe rule for manuring is to make sure of a profit the first year. It is better to grow wheat in a rotation, and let it use up the residual manure which has accumulated from the other crops. The following rotation may be recommended for trial:—

(1.) Barley or hay.
(2.) Peas or beans.
(3.) Wheat.
(4.) Sorghum or beet.
(5.) Peas or beans.
(6.) Wheat.

It is recommended, also, that before going to the expense of using the full quantity of manure above recommended, a preliminary trial on four plots should be first made, as follows:—

Four plots, each one-fortieth of an acre in extent, should be laid out adjoining each other. On No. 1, no manure should be applied; on No. 2, one-third of the above-mentioned quantity should be given; on No. 3, two-thirds; and on No. 4, the whole.

No. 1.—No manure.
No. 2.—One-third of the manure.
No. 3.—Two-thirds of the manure.
No. 4.—The whole of the manure.

The same quantity of seed should be sown on each plot. At harvest time, the crop on each plot should be harvested separately and weighed. It will then be seen what increase has been given for each dressing of manure, and what profit has resulted. On referring the results of the experiment to this Department, any further advice will be given that may be desired.

(Sgd.) A. N. PEARSON,
Agricultural Chemist.

By Authority: Robt. S. Brain, Government Printer, Melbourne.