



The Field.

The Potato Disease.

The current part of the *Journal of the Royal Agricultural Society of England* contains a paper from the pen of William Carruthers, F. R. S., consulting Botanist to the Society, on the potato disease, abounding in facts, and the results of experiments that throw much interesting light on the nature of this destructive, and hitherto, but little understood malady.

According to this writer the potato disease has been known for ages in the western countries of South America, and just thirty years ago, it made its appearance in a malignant form, and considerably injured the crops, both in the United States and Canada, where it re-appeared the following year. It was first detected in Europe during the latter part of July, 1845, in Belgium; and within two months appeared in the British Islands, Denmark, France, Germany and Russia, and it has continued with more or less intensity ever since. Last year it was again particularly destructive in several places in the United Kingdom, so that the price of potatoes in the British markets has risen to an unprecedented mark. The Earl Cathcart, President of the Royal Agricultural Society, has offered a prize of £100, for the best report, founded on scientific investigation and experience, on the nature of this insidious disease, and the most practicable and efficient methods of arresting its progress.

The following quotations, giving the author's views on the present state of knowledge regarding the potato disease will be found interesting:—

"There is no longer any dispute as to its real cause. All the notions which supposed it to be produced by physical agencies, or to be the indication of a defective method of cultivation, or of a deterioration of the plant, have been conclusively set aside. Nor can it be held that the microscopic fungus, which is known to be invariably found in diseased potatoes, is the result of the disease and not its cause. Since De Bary has produced the disease by placing the spores of the fungus on the leaves and tubers of healthy potatoes.

"Beginning this narration with De Bary's experiment we may trace intelligently the history of this baneful parasite, and notice the nature and progress of the injury it produces in the potato. The spores, or more properly spores of the fungus are minute and void bodies, so small that the greatest diameter is not more than the eight-hundredth of an inch long. When a spore rests on the under surface of a leaf, and there is sufficient moisture, it pushes out a slender tube, though a ruptured opening in its coat. This tube penetrates the epidermis on the spot where germination takes place, or finds its way to one of the

innumerable openings or stomates which abound on the lower surface of the leaf, and passing through the opening enters the tissues. The slender tubular root called the mycelium rapidly grows, pushing its way everywhere through the substance of the leaf. It branches and rebranches freely; the brown coloring matter contained in it gives the spotted appearance to the leaves, which indicates to the eye the existence of the disease. The mycelium sends out, through the stomates, branches into the air that give a mouldy aspect to the under surface of the leaf. The ultimate branches of this external growth are somewhat interruptedly swollen, and many of them bear minute oval bodies at their extremities. These are the spores. The mycelium passes down the leaf-stalk into the stem; through this it obtains access to the other leaves as well as to the underground branches, and through them to the potatoes themselves, which are indeed only enlarged and shortened portions of the underground stem. De Bary placed some spores on the leaves of a healthy potato, on February 4th; the day following the tubes of the mycelium had penetrated the leaves; on the 8th the mould appeared on the under surface covered with fruit, and on the 9th the whole plant was diseased.

"The individual cells which are pierced by the mycelium are destroyed, and the starch granules contained in the cells are attacked and consumed. Putrefaction soon begins, affecting first the cell-walls and then the starch. Payen has put it beyond doubt that the mycelium consumes the starch, for in his investigations he detected the granules attacked by the mycelium threads, and he made the injury more apparent by using iodine, the action of which on coloring starch granules is well known. By the ordinary processes all the starch can be separated from diseased potatoes, not only that contained in cells yet untouched by the mycelium, but even the granules that remain uninjured by the mycelium or the surrounding putrefaction.

"The mycelium does not naturally fruit on the upper surface of the leaf, on the stem, or on the tuber of the potato, as these parts are either destitute of stomates or but partially furnished with them, and the mycelium does not send its fruiting branches through continuous epidermal structures, but when any of these parts of the potato, attacked by the invisible fungus, is cut and placed in a moist atmosphere, the fruiting branches speedily appear. Some of the oval heads also contained in the branches are larger than the others, and contain within them from six to sixteen minute bodies. When water is applied either artificially or naturally, the outer covering bursts and the contents are liberated. Each of the male spores thus set free moves about in the water by the aid of two cilia. In a short time the motion ceases, and if a proper nidus exists, the spore germinates."

This minute fungus belongs to the genus *Pero-*

pora, and has received the name *Perozo-spora infestans*, Mont. In order to destroy effectually the parasitic fungus, it is recommended that diseased plants whether leaves, stems, or tubers, should be destroyed by fire. If they are left to decay or become incorporated with the manure these rest-spores and mycelium will most probably germinate as soon as placed under favorable conditions.

"De Bary has shown by experiment that there is nothing in the potato plant more than in any other to predispose it to the attack of the fungus. It is not weak or unhealthy plants that are attacked, but wherever the spores rest and finding the suitable moisture germinate, there the disease will appear. When only the fungus has got a footing in a crop of potatoes, its rapid growth, the little time required to develop fruiting branches, and the innumerable number of spores produced make its progress very rapid. Even when the disease is first noticed by the cultivator, it has taken such a hold of the crop that its perfect cure is, I believe, impossible. As moisture is so necessary to the development of the spores, every means should be adopted to prevent undue moisture. No soil is exempt; but there is less danger of an attack and less injury when the disease makes its appearance in thoroughly drained soils.

As it amounts almost to a moral certainty that the approaching season will witness in some parts of this Province the re-appearance of this destructive pest, in an intensive degree, cultivators of potatoes should keep a timely look out, and as soon as signs of the enemy are manifest, every effort that is practicable should be made at once, to arrest its progress. Notwithstanding our author speaks pretty positively that when the disease has obtained a strong hold of the crop its entire removal in the present state of knowledge, is impossible; yet we know that in moderately sized patches careful hand-picking has been found effectual; and in the great majority of cases the timely application of *Paris Green*, as recommended by the Entomological Society in a report to the commissioner of agriculture for this Province, has been attended with more or less success, in mitigating the evil and arresting its further advancement.

As a general rule, manure does best on heavy soils applied as a broadcast top-dressing; on light soils it is better to plough it in with shallow furrows. There have not been a sufficient number of accurately conducted experiments with top-dressing in summer, to determine satisfactorily what amount of manure would be thus wasted by exposure. We suspect, however, that this great loss is commonly over-estimated. Manure spread on grass land early in autumn, or even in August, has not only proved of great value to the grass, but has had a marked effect on the following corn crop, planted on spring-ploughed soil. We should prefer spreading to leaving in heaps, although the latter is most common. When spread evenly every shower of rain washes the soluble and enriching parts into the soil; but if in heaps, it would be more likely to lose by fermenting, and rain would be no benefit to it. Without knowing anything of the nature or condition of the soil, we should be inclined to recommend, as the safest course, to plough in the manure as shallow as practicable after being thoroughly spread and broken by a surface harrow, leaving, however, a portion of the field with the manure exposed, by way of experiment.—*Cultivator.*