

ON THE PROBABLE CAUSES OF THE FAILURE OF THE POTATO CROP.

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Mr. Milne briefly alluded to the various theories propounded, and gave reasons for thinking that the failure could not be ascribed to insects, parasitic fungi, or degeneracy in the plant. Insects of the description referred to did not generally prey upon healthy plants; and at all events they had not been seen on the potato plant till after it had shown symptoms of disease. The advocates of the fungus theory had never been able to decide whether the fungus was the cause of the disease, or whether the diseased plant produced the fungus; and the recent discovery, that in the diseased leaves and stem there are five or six different species of fungi, and nearly as many in the tainted tubers, renders it very improbable that the malady is caused by any one of them. As to the dying out of the potato, the majority of botanists deny that such an event has ever occurred in regard to any species of plants; and the notion that the potato may have degenerated from over cultivation, is contradicted by the fact that potatoes grown in this country from Chilian and Peruvian seed were affected last year like all others. The only alternative, therefore, is to suppose that there was something in the atmosphere which specially caused the disease in the potato crop. On examining the subject more narrowly, this supposition will be found to be confirmed by many circumstances, incapable of any other explanation. (1.) Thus it was well ascertained, that in 1845 and 1846, certain other plants and shrubs were affected simultaneously with the potato. This was the more remarkable in the year 1846, when, from the fineness of the season, vegetation generally was most luxuriant; and whilst these effects on particular shrubs, and even trees, were, in 1846, observable in the Highlands as well as Lowlands, they were, in 1845, not observable in the Highlands, in which part of the country the potato disease was, in 1845, also unknown. There can be little doubt, therefore, that those other plants which were injured simultaneously with the potato, were injured by the same agents, and this must have been atmospheric.

(2.) The parts of the potato and other plants which were first affected, were those exposed to the air. The disease in the potato was clearly ascertained to have commenced, not in the tubers, but in the upper parts of the plant—in the leaves of the finer varieties (which were the most common), in the stems of the coarser varieties.

(3.) The only cases in which the potato plants were generally saved, were either when the shaws had been cut over or pulled up, before the plants became diseased, or when they had been effectually screened from the blowing on them of the external air. Many cases were quoted in which potato plants well covered over with weeds, Savoy cabbages, Indian corn, and other tall plants, in garden and cucumber frames, and in out-houses, through which there was no draft of air, had been saved. In some of these cases it was mentioned that two or three plants, next the broken panes of a cucumber frame and the open door of an out-house, had become spotted, whilst the rest, which were not exposed to the blowing of the air, had been saved. Under this class of cases, it was mentioned that particular fields had been streaked with parallel bands of blight, which bands were found to have been coincident with the direction of the wind, and to have been produced by single hedge-row trees on the windward side of the fields.

Having, by these and other facts, established that the destroying agents had been in the atmosphere, the author proceeded next to inquire into the nature and properties of it.—

(1.) He showed, by elaborate meteorological tables, that it could not be ascribed to any of the ordinary elements of the weather. As to *humidity*, which was believed to be the cause by many persons, and in particular by Professor Harting, of Amsterdam, (who had published a memoir of a hundred quarto pages on the subject.) it was stated that in 1845, the quantity of rain which fell was, in England (where the disease was worst,) rather less than usual, and in the Highlands, (where the disease did not appear,) rather more than usual; and that the moisture suspended in the air was less than usual all over

Great Britain. There had also been many former years in which the rain and moisture had been much greater than in 1845. As to *temperature*, though it was true that in 1845 it had been in England 5 deg. to 7 deg. and in Scotland 2 deg. to 3 deg. less than the average, yet when it was considered that the potato grew equally well in Orkney with an average temperature of 46 deg., and in the south of England with an average temperature of 58 deg., it was evident that it could stand much greater variations of temperature than had occurred in 1845; and this theory was completely put at rest by the weather of 1846, which in Great Britain, during the summer months, was from 3 deg. to 4 deg. warmer than the average. If this atmospheric agent was not to be identified with any of the ordinary elements of the weather, the only alternative was, that it must be some foreign matter diffused through the atmosphere. This presumption was strengthened by several well-established facts.

(2.) It had been ascertained that, near the copper-works of Swansea, which gave out not only abundance of smoke, but copious fumes of sulphurous and arsenious acids (to such an extent as to blight the pastures), the potato crops of the miners had remained absolutely intact. The same exemption had been observed on a farm surrounded by lime-kilns; and it appeared that along the sea-shore the potatoes were less and later affected than elsewhere. Coal smoke contained much sulphurous acid, and the exhalations of the sea-air contained much chlorine. Now all gases, though themselves injurious to vegetation, had anti-septic properties, and some of them were commonly used to destroy or prevent contagion. From these facts it might be inferred that the atmospheric agent was some matter capable of being neutralized in the noxious effects by the gases above mentioned, and that it was probably some compound organic body, similar to what miasmatic exhalations are supposed to be.

(3.) Perhaps the farther properties of this deleterious matter might be inferred from the following circumstances:—A gentleman near Elgin stated that his field contained a number of basin-shaped hollows, which, though composed of the same soil as the rest of the field, were the most affected. Then it appeared that generally the low grounds were the first and most affected, the higher parts of the county the last and least affected. From these facts it might be inferred that the deleterious matter was heavier than atmospheric air. It could not be that the low grounds were most affected because wettest; for the evidence went rather to show that on the best drained soils the disease was worst. The other circumstance was the appearance of a fog or mist simultaneously with the appearance of the blight, which in some places gave out a sulphurous odour, and deposited a peculiar looking substance.

(4.) The inference from these facts is, that the atmosphere in 1845 and 1846 had been, over a large part of the earth's surface, impregnated with some subtle or highly comminuted matter, which was of such a nature as to be injurious to particular plants. It was shown from experiments by Dr. Christison, made some years ago, that sulphurous chlorine, and certain other gases, when mixed, even in so minute a quantity as not to be perceivable by the smell, would injure and ultimately kill plants; and it was interesting to observe, that the effects produced by these artificial means were precisely similar to what occurred in 1845 and 1846, the injury being shown first by spots in the leaves, and then descending by the footstalks. This coincidence is the more remarkable, as one of the gases operated with (the sulphurous) is heavier than atmospheric air, and might therefore have been expected to have attacked the stems before the leaves.

(5.) If the foregoing theory be correct, it might be presumed that the matter impregnating the atmosphere would be to some extent also injurious to animal life. This corollary is verified by the experience of the years 1845 and 1846. During both years there had prevailed pulmonary complaints among human beings, as well as among cattle and sheep, to a much greater extent than usual. The mortality of the population of England and Wales had for the three months ending September last, exceeded by 30 per cent. the average of the same