

rous as that proceeding from a plumper seed. As, however, the germ must be nourished from the substance of the seed until its roots can draw nutriment from the soil, it is reasonable to suppose that very poor seed would have a better chance in good than in exhausted soils. Your commissioners, therefore, consider that their inquiries on this particular question terminated alike in an undeniable and satisfactory conclusion. Much valuable information on that subject, including Dr. Schomburgk's report, is appended. It having been thought by some persons that the rust may partly be accounted for by the continued use for many years of the progeny of the same crop, and that a change of seed, brought from distant localities, would shut out the disease, your commissioners report that this idea is not supported by the evidence. On the contrary, crops raised from seed brought from distant places have been affected with rust equally with those raised from seed grown on the same sections. No doubt, for other reasons unconnected with rust, change of seed is often desirable; and the evidence of witnesses on this point shows that new seed should be procured as nearly as possible from a latitude similar to that where it is intended to plant it, and also from a poorer soil to a richer one, and *vice versa*, otherwise time will be lost in the acclimatization of the new arrival. Fine specimens of South Australian seed-wheat have produced soft and diseased crops in England, in fields where seed grown in the same neighborhood produced healthy and fruitful plants. The colonial seed had not become acclimatized, and the plant suffered accordingly. But although the red rust is shown to be dependent upon atmospheric conditions, and to commence its ravages upon the stem and leaf of the plant, and not to ascend from the root, it is nevertheless desirable to pickle the seed for the purpose not only of killing the spores of black rust or smut, but also in order to destroy spores of the red rust which may happen to attach to it. On the subject of the composition of pickles for wheat, a few words will presently be added.

IV. BLACK RUST AND SMUT.—Smut being effectually destroyed by a proper preparation of the seed, it has not been thought necessary to inquire particularly into a disease within the knowledge of all practical farmers. With reference to black rust, late sowing is recommended as a preventive, unless the ground should previously be thoroughly saturated. Dry plowing, by turning up the land in clods, and leaving open cavities beneath the surface, which harrowing does not fill up, is considered by several practical agriculturists as strongly favoring the development of black rust. One witness says, "The remedy I always adopt is, never to work my land unless it is sufficiently saturated with a certain depth of rainfall, so that the soil is sufficiently moist throughout, and then working the land when it is mellow. I have always found I have avoided black rust. I was led to conclude that black rust came from the roughly-broken state of the soil; as the harrows only penetrate an inch or two—the black rust always made its appearance when the roots got down that far—the bottom being hollow as a honeycomb." Others, in like manner, recommend the thorough working and pulverization of the land, combined with proper pickling, as a sufficient antidote to this form of cereal disease.

V. TAKEALL.—This disease, so destructive in many districts of South Australia, is

not so well understood as rust. Farmers and chemists are alike at sea—ploughmen and microscopical observers differ *in toto* as to its nature and causes. It is said to result from an exhausted soil, from the presence of too much salt in the soil, from the deficiency of some constituent element essential to the maturing of cereal crops. It is declared to be want of drainage, and it is said to be want of manure. It is affirmed to be caused by a vegetable fungus, and to be a disease analogous to the potato disease. It is also said to be the result of insect ravages. Scarcely any two witnesses agree on this point, whether farmer or chemist. But the subject is of far too great moment to be passed over indifferently. In some respects, takeall is more to be dreaded than red rust. The latter cannot commit wholesale destruction, unless in connection with a description of weather such as we rarely have in this colony; but takeall appears altogether independently of the weather. And as its ravages are irrespective of climatic influences, so are its movements inexplicable by reference to locality or soil. It is, like last season's rust, to be found everywhere, and the richest soils often suffer the most. It attacks newly-broken or fallowed land as well as land frequently cropped. It especially attacks the slopes of hills—not so often the table land on the top, nor the flats in the valley, as the slopes and sides. All cereals fall before it; even native grass disappears. It works in patches, selecting certain spots or centres—thence radiating, often succeeded by cocksfoot or Grant's thistle, the takeall in following seasons reappearing in other spots. Its movements being so little reducible to rule, experience and observation are at fault in endeavoring to explain it, and hence conflicting ideas. This difference perplexes the inquiry, whilst the rapid spread of the pest, and the fear that it will every year encroach upon wider tracts of country, render close observation and study a duty of the utmost importance. The appearance of the cereal, above ground, as it fades away and perishes under the influence of this insidious invader, needs no description, being but too well known.—The root has been examined, and appearances detected, leading some observers to conclude that the disease is caused by a vegetable, and others by an animal parasite. Dr. Muecke has magnified and photographed fibres of the roots of wheat plants suffering from takeall, exhibiting a number of minute white threads of a woolly appearance, which he considers to be the mycelia of a fungus causing the disease. Mr. Ey, who has also examined it microscopically, says that it is not a fungus, and that the supposed fungoid may be found attached to all roots, healthy or unhealthy. He considers that the disease is caused either by animalcule attacking the plant in the first instance, or by the growth of a sort of a lichen at the bottom of the stalk, which serves as a nest for animalcule. He says: "What I recognise under the name 'takeall,' is the *Vibrio tritici*, or eel of wheat. A plant taken from a diseased spot will be found black on the stem, from the roots to the first internode; and on pressing, a thin film of lichen or moss will come off. In this will be found a number of animalcule coiled up, apparently dead; but on being moistened with a drop of water, on a glass slide under the microscope will come to life in an hour, moving about with great rapidity. They are like eels of wheat, which, as yet, have only been found in the grain. I have not yet satisfied myself

whether the eel or the lichen is the primary cause; but one of the two is takeall. The animalcules might be sown with the seed; it is sometimes the case that one grain of wheat will contain 4,000 to 5,000 eels of wheat."

The witnesses, however, whilst giving expression to their opinions, or their conjectures, were all (with the exception of Dr. Muecke, who strongly adheres to the fungoid origin of takeall) very careful to avoid any final or positive avowal. It is scarcely probable that the takeall results from the development of *vibriones* sown in the seed wheat, because the disease has been just as bad in crops from seed pickled in strong dilutions of sulphuric acid and other mixtures fatal to insect life, as in crops not pickled at all. The Victorian Committee make no reference to takeall—the very name in fact being an admission that the nature and cause of the malady are not as yet found out. The use of sulphur has been found beneficial, and land rendered barren by takeall has been recovered where the ashes of a bush fence have been scattered; but it is doubtful whether the sulphur acted specifically upon the supposed spore or egg of the takeall, or chemically upon the soil, nor is it certain whether the ashes of the bush fence destroyed the takeall by acting chemically upon the soil, or whether the change noticed where the hedge was consumed might be attributable to the heat of the fire. It is exceedingly desirable that this most vital question should be thoroughly sifted, as there is imminent danger of our wheat lands succumbing section by section to this mysterious visitor, and the Commission are, therefore, of opinion that a series of experiments in the application of diluted sulphuric acid, and also of sulphur in its various combinations, both as a pickle for the seed and as a top dressing for the diseased spots in the land, might be of great use, inasmuch as the only generally available remedies for takeall described in the evidence as having been successfully used are diluted sulphuric acid, applied by Mr. Ey as a top dressing, and sulphur and lime, used by Mr. Martin as a pickle for the seed.

VI. PICKLING SEED WHEAT.—Although experience shows that pickling seed wheat is no security against red rust, it does not follow that it has no effect at all upon that disease. Apart, however, from this formidable enemy to cereals there are other foes to be met and vanquished only by a proper system of pickling the seed, and hence the inquiries made and evidence taken by the Commission on the subject. It is not necessary to dwell upon a practice so well known and generally observed; but it may be remarked that the evidence taken discloses great difference of usage in this particular. Whilst some farmers only let their wheat remain in pickle for a few minutes; others allow it to be in the solution for hours. The chemical witnesses recommend six or eight hours' steeping; Dr. Muecke says eight if the weather be wet, and twelve if it be dry, giving four ounces of bluestone to the bushel. Some farmers do not soak the wheat at all; but merely sprinkle it with the liquid solution, turn the heap over a few times, and dust it with dry lime. It is doubtful, however, whether the fungus spores adhering to the grain are effectually destroyed in this manner, and as the power of wheat to retain its vitality under certain conditions of pickling can easily be ascertained by experiments, it would be worth while for agriculturists to make a set of trials. There is much