

whereas when kept moist the spores were found to remain viable for a considerable period. This would tend to explain, in part, why the disease is more prevalent in wet seasons.

(c) *Fusarium Root-rot* (*Fusarium elegans* var.).—Laboratory tests have demonstrated that a *Fusarium* isolated from roots of soft turnips is responsible for considerable losses in the field, since it attacks and destroys the tap root of this plant. Hitherto this disease has been attributed to grass-grub.

#### CEREAL DISEASES.

(a) *Loose Smut of Wheat* (*Ustilago tritici*).—Numerous pedigree lines of wheat have been treated by the hot-water method, with a view to distributing smut-free nucleus lines for future certification. Experiments run to test the alleged immunity of Hunter's wheat to loose smut resulted in a small percentage infection being secured, principally in plants "breaking" from the original type. Artificial inoculation experiments demonstrated the presence of more than one biotype of this smut to be present in the Dominion.

(b) *Stinking Smut of Wheat* (*Tilletia tritici* and *T. levis*).—Field reports of continued success of the copper-carbonate-dust treatment, introduced by the laboratory some years ago, have shown further experiments on the control of this smut to be unnecessary at present.

(c) *Wheat Rusts and Mildew* (*Puccinia elymi*, *P. graminis*, and *Erysiphe graminis*).—Tests were made with sulphur dusts to determine whether under our conditions these diseases could be combated, and to ascertain if possible the probable losses they cause. Twelve applications were made on eight wheat varieties. In the untreated check plots appeared heavy infections of leaf-rust, moderately heavy infection of stem-rust, and in the centre of the plots, moderate infections of mildew; whereas in the treated plots a scant trace of these diseases was apparent. The difference in weight of grain between treated and untreated plots showed an increase in yield of 100 per cent. in most varieties. These results show that were it not for these rusts, wheat-growing could be made profitable in the North Island even in unfavourable seasons, but indicate quite clearly that rust-resistant varieties would be essential. As a preliminary to this work the rust biotypes present in New Zealand are being studied.

(d) *Black End*.—Seed showing 9 per cent. of this condition was sown at the area, but infection was not obtained. Heads apparently free from this disease were sprayed with spore suspensions of the fungus, but no increase in percentage infection was obtained over normal check lines. These results would tend to demonstrate that the fungus isolated is probably not responsible for the black-end disease.

(e) *Stripe Disease of Barley* (*Helminthosporium sativum*).—Twelve plots of various infected lines of malting and feed barleys were sown at the area, after treatment with hot water or various organic mercury preparations. But little stripe developed in the check plots, and merely a trace in all treated lines. The disease is apparently controlled by the hot-water process, since in the malting-barley crops of the Dominion, grown principally from seed treated by this process, but a trace is to be found, whereas it is prevalent in crops of green-feed barleys grown from untreated seed, and is common in barley imported from overseas.

#### POTATO DISEASES.

(a) *Corticium Disease* (*Corticium solani*).—Definite evidence has been secured showing that this disease spreads in the rows through the soil from diseased to healthy plants. Likewise it has been found in the persistence experiments that the disease may remain in the soil from one infected crop, to infect a second planted twelve months later. Rotation appears to have no effect upon the time over which the fungus remains in the soil, heavy infections being secured following swedes, peas, or cereals. On the other hand, grass appears to have a slight depressing effect on the persistence of the disease.

Attempts to increase the penetration of the acidulated mercuric chloride dip by the addition of alcohol failed when tested under laboratory conditions. A series of tests run with a view to lessening the injury caused by the dip if used late in the season failed owing to damage caused to the sprouts, late dipping killing these, and thus causing the crop to develop more slowly than the normal. In a series of yield-trial experiments, designed to ascertain the effects of different treatments on yield, significant increases were secured with a modified formula, both with seed and cut table tubers. Increased strengths of solution failed to give increased yields, possibly because of the damage caused to the tubers.

(b) *Wilt Diseases*.—A special investigation has been conducted in order to determine the causes of wilts so prevalent in our New Zealand potato crops. Isolations made from a considerable number of tubers, from different localities and from different varieties, yielded about twenty-one species of fungi. Inoculations showed that of these only species of *Vorticillium* produced typical wilt symptoms. Seed similar to that from which these fungi were isolated was planted in the field and yielded 29 per cent. wilted plants.

(c) *Potato Dry-rot* (*Fusarium* spp.). A study was made of the organisms causing dry-rot. Four species of *Fusarium* were isolated from numerous tubers. Inoculations showed that of these three species were responsible, and *F. ceruleum* proving to be the species mainly concerned. Negative results were secured with numerous other fungi isolated from decaying tubers.

(d) *Black-dot* (*Colletotrichum atramentarium*).—This has proved to be a common disease of the potato in the Dominion, upwards of 30 per cent. infection being noted in certain lines. Inoculation experiments showed the fungus to be parasitic, twenty-one out of forty plants being infected in one test. Experiments conducted with mercuric chloride have failed to control this disease.

(e) *Silver Scurf* (*Spondylocladium atrovirens*).—This disease has proved to be very common on tubers throughout the Dominion, in one line 98 per cent. being observed. Treatment with mercuric chloride failed to reduce infection in the line tested.

(f) *Virus Diseases*.—All plants from supposed virus-free potatoes produced last season have been indexed, and all diseased ones discarded. Clean seed thus secured has been planted in isolated areas at Tangimoana, Marton, and Waituna West, and the crops rogued from time to time.

Certain lines of the variety Dakota show a curly-top condition. Investigation of this has shown it to be due to a virus disease, and this has been verified by graft inoculations.

The connection between net necrosis and spindle sprout has been confirmed. Experiments with grafts and needle inoculations have been undertaken, but results are not available as the crops are not harvested. These diseases are responsible for a considerable lowering of yield, as upwards of a 50-per-cent. decrease has been recorded in trials undertaken at the Area.

Numerous transmission experiments have been conducted in the glasshouse with the various virus diseases of potato (in collaboration with the Entomological Section); several hundreds of tubers have been indexed during the winter months, for freedom from virus. In the course of this work it was found that certain potatoes carried a masked virus, for the juice of certain apparently healthy plants, when inoculated into *Datura* and Tobacco seedlings produced definite mosaic symptoms in these hosts.