ROOTROTS OF CEREALS. II

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INTRODUCTION

In the original review (45) an attempt was made to cover most of the pertinent literature, from which was drawn information concerning the major types of root diseases in cereals. These types were then discussed in regard to their economic importance and the main research trends pertaining to each. Perhaps the most impressive feature brought out in the review was the close association between soil conditions and cropping practices and the incidence of root maladies. Subsequent reports in the literature on rootrots reveals, as might be expected, a considerable concentration by workers upon various aspects of the relationship between soil factors and root diseases. An overall view of the literature for the past ten years shows that root maladies have received considerable attention. In Europe and the British Isles, take-all, a serious root disease of wheat and barley, continues to receive much attention. In North America research on take-all continues, but the common rootrots that attack all cereals appear to be emerging as a major challenge. There are large cereal-growing areas where, no doubt, researches on diseases are being conducted but from which, because of the late war and the unsettled period following, few reports are received. A perusal of the literature on rootrots of cereals, appearing through the period under review, shows no important new development in research trends but a considerable exploration of problems opened up earlier. However, there has appeared one new disease of oats, Helminthosporium blight, that should be included in any discussion on rootrots. For a comprehensive survey of root disease fungi in general, the reader is referred to the treatise by Garrett (17) published in 1944.

In the present discussion of rootrots of cereals, the arrangement will be, for the most part, in accordance with types of disease, followed by brief concluding remarks.

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Take-all, caused by *Ophiobolus graminis*, must be classed as a major rootrot of cereals. Under some conditions it is extremely destructive, but it can be effectively controlled in most cases. It will always receive much attention because of its occasional sudden appearance and extensive damage in wheat and barley crops. Winter (69), following a period of rather intensive investigation on the influence of soil structure, temperature and moisture on the infection of wheat by *O. graminis*, published the results of some work on biotic factors. He concluded that accumulation of carbon dioxide, as originally suggested by Garrett (10), is not a limiting factor in the growth of the hyphae of this fungus in natural soils. On the other hand, his work indicated the presence of inhibiting substances in the soil which are partly destroyed by heat. Destruction of these substances would explain the better growth of *O. graminis* in partially sterilized soils. A comprehensive piece of work on partial sterilization of soil and its influence on *O. graminis* was later reported by Winter (70). From this investigation the activity of soil micro-organisms antagonistic to *O. graminis* was well established as the principal inhibitory source, although complicating factors may arise from various soil types. In applying these findings for the control of take-all under field conditions, it was suggested that the best approach is to modify the soil by addition of organic materials; these materials favour growth and multiplication of the antagonists. Winter (71, 72) further investigated the part played by soil micro-organisms as antagonists of *O. graminis*. He observed the presence of a great abundance of actinomycetes after a period of two weeks in partially sterilized soil, a phenomenon that did not occur in natural soil. These actinomycetes destroyed the hyphae of *O. graminis* by direct parasitism or by secretion of toxins. In natural soils, bacteria, actinomycetes and fungi react to the presence of the hyphae of *O. graminis*, resulting occasionally in a beneficial as well as a harmful influence on the pathogen. *O. graminis* responded favorably to the addition of nutrients, such as peptone, glucose and biomalt, under sterile conditions, but under non-sterile conditions the influence of antibiosis produced variable results. Some studies were made also on the influence of the rhizosphere of different plants on the growth of *O. graminis*. Slagg and Fellows (49) contributed to the study of