GOOD CROPS FROM POOR LAND

TREATMENT OF SEED INSTEAD OF SOIL

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LARGE increases in yield, as a result of soaking cereal seed in suitable nutrient solution before sowing in nutrient deficient soil, were obtained on the experimental scale by Mrs. W. O. Roberts, a member of a team set up by Britain's Agricultural Research Council to work on the diagnosis and cure of mineral deficiencies in plants.

The work had two objects. First, to find out whether it was possible to introduce into the seed enough of the major nutrients, phosphorous and potassium, in a readily available form to carry the young plant through its early stage before its root system was sufficiently developed to make full use of available supplies of these nutrients in the soil, and secondly to discover whether the same would apply to trace element on soils known to produce trace element deficiencies.

The most important result was obtained by soaking oats in about one third of their weight of 21 per cent. tribasic potassium phosphate ($K_3 PO_4$) solution, and sowing in soil known to be deficient in phosphate. The yield from untreated seed was 17, from water-soaked 20, and from phosphate soaked, seed 25 bushels to the acre; and there were correspondingly large increases in straw. This was equivalent to using 3·4 pounds $P_2 O_5$ per acre, of which no less than 73 per cent. was recovered in the harvested grain, suggesting a high degree of efficiency of utilization of phosphate. In another experiment on oats, phosphate was found to be more than seven times as efficient when soaked as when sown with the seed, and in an experiment on wheat it was 60 times as efficient. Large increases in yield were also obtained in barley.

A WARNING

It must be emphasized that these hopeful results were on an experimental scale and that the process has not yet been applied on the large scale. There are certain conditions that have been found to be essential for success, and a warning must be given that unless these conditions are satisfied the grain may easily be damaged or killed.

* From *The Planters' Journal*—Vol. XLI, No. 1, January, 1949.

The volume of solution must be so chosen that all of it is absorbed within 24 hours. When grains are soaked valuable substances are extracted by the water or solution and unless the solution is absorbed completely they are lost and the grain is consequently damaged. Cereal grains absorb about one-quarter of their weight of water or nutrient solution.

The soaked seed may be sown broadcast by hand without drying, but if this procedure is adopted the wet grain must be sown immediately because it soon " heats " when stored in a heap when moist.

If the seed cannot be broadcast immediately after soaking, or if it is to be sown by drill, it must be dried. The safest drying method is to expose the grain in a thin layer to a current of dry air at normal temperature with frequent turning. If artificial heat is used it is most important that the temperature must not rise above 22° Centrigrade in the early stages because grains are particularly susceptible to heat injury when moist. The grain should be dried to its original weight; excessive drying is to be avoided.

When soaked grain is dried to its original weight it will be found that it has increased in volume by about one-third. Allowance must be made for this when adjusting seeding rates.

THREE CEREALS

The choice of the most suitable compound of the nutrient element to be used in solutions for soaking seeds is important and it was found that some compounds are to be avoided. For example, all ammonium salts which tend to be poisonous—while there appears to be a particular compound which is the best for each of the cereals. In the case of phosphates, the best form for oats is tripotassium phosphate (trisodium phosphate seemed equally good when there was no soil deficiency of potassium). For wheat, potassium dihydrogen phosphate seems best, used at a concentration of five per cent., and for barley, dipotassium hydrogen phosphate at 17 per cent. Large increases in yield were obtained by soaking the three cereals in the three solutions mentioned, but it will be noted that all three contain potassium, to which part of the increases may have been due. If phosphate alone is required, the obvious choice, as being easily obtainable, would be triple superphosphate, but unfortunately an experiment with this form of phosphate became waterlogged, and its suitability was not established.

The " soaked " nutrient is held in the outer layers of the seed, where it is readily available to the rootlets of the developing seedlings, but it is readily dissolved out again if the grain is subjected to excessively wet conditions, consequently soaked seed is likely to give better results on well drained, than on poorly drained, soils, and may be inffective on a waterlogged soil.

The greatest future for seed-soaking may well be on soils that are not only deficient of phosphate but also fix any phosphate added to them in a form that is unavailable to the plant. Phosphate soaked into the outer layers of the seed is largely protected from this soil fixation and, as already stated, is readily available to the rootlets of the developing plant. There are vast areas of such phosphate deficient soils that also fix phosphate added to them. The extremely efficient uptake of soaked phosphate into the plant

leading to large increases in yields in relation to the phosphate used, already mentioned, suggests that the method is well worth trying in the many areas of the world where phosphate has to be transported over great distances.

ANOTHER SUCCESS

In the time available only a few experiments could be carried out to see how far micro-nutrient deficiency could be prevented by seed-soaking. One experiment proved quite clearly that soaking seed in manganese sulphate before sowing in manganese-deficient soil, resulted in the seedling remaining green and healthy some weeks after those from untreated seed had died. Some soils are so deficient of manganese that seedlings die soon after the first leaf appears above the surface and before spraying can be effective. The results of the experiment just mentioned suggested that on such soils seed-soaking might well carry the seedling through this early critical stage until there was enough leaf development for manganese spraying to be effective.

Mrs. Roberts has written a more detailed account of her work for a number of Britain's *Journal of Agricultural Science.* It is to be regretted that circumstances made it impossible to continue the work beyond the experimental stage to full scale field trials, especially as it suggested the possibility of very large economies in the use of phosphates and, perhaps, also potash, together with increases in yield, and pointed to a possible new way of dealing with trace element deficiency problems.

T. PETCH

TOM PETCH, B.A., B.Sc., died at his home at Wootton in England on Christmas Eve, at the age of 79. His passing will be felt as a great loss to British and Tropical Mycology.

He came to Ceylon in 1905 as Mycologist to the Royal Botanic Gardens. On the retirement of Dr. J. C. Willis in 1912, he assumed responsibility for systematic botany as well as mycology in the newly constituted Department of Agriculture. He relinquished that post in 1925 to become the first Director of the Tea Research Institute of Ceylon. He retired in 1928 to rejoin his family in England after spending twenty-three arduous years in Ceylon.

On arrival his attention was immediately directed towards the disease problems of plantation crops, cacao, coconut, tea and rubber. At that time the planting of rubber trees was booming and he devoted much time to the study of the problems of that expanding industry. In 1911 he published "The Physiology and Diseases of Hevea brasiliensis", and in 1921 a revised and more complete account of the diseases of that tree under the title "Diseases and Pests of the Rubber Tree". His tea book "The Diseases of the Tea Bush" was not published till 1923, but meanwhile numerous articles on the diseases of many economic crop plants appeared in the pages of the *Tropical Agriculturist*. As his work became known to agriculturists in the tropics and to scientific institutes, Peradeniya became a recognized centre of mycological knowledge, and requests for advice and assistance were received from many parts of the world.

Although Petch will be best remembered by the planting community for his work on the diseases of plantation crops his interests extended far beyond pathology. He was a born naturalist with interests in all living things but with a special liking for fungi. His first paper on New Ceylon Fungi appeared in 1906 and his revisions of Ceylon fungi started in 1907. Since then there has been a long succession of papers, his object being to describe accurately all known fungi of Ceylon. It was a large undertaking, but with it he established Ceylon mycology on a sound foundation. Later he became especially interested in entomogenous fungi and his work in that sphere established his reputation as a world authority.

Petch's knowledge of the Ceylon flora was very extensive. Although mycology was his main study he yet found time to devote to systematic botany. His papers on Aristolochia, Cryptogyne, Gregarious flowering, Buttress roots, &c., indicate his diversity of interests.

Mycology was originally Petch's hobby, and after it became his profession it still remained his hobby. His outturn of scientific papers was prolific, and the question was sometimes asked how he found time to do it all. He spent his short leaves in Ceylon at his cottage near Hakgala Gardens, taking with him his notes so that he might write undisturbed by official correspondence, and returning with new collections for further study. Much of his home leave was spent in Herbaria in Paris, London and elsewhere comparing his Ceylon specimens with the original types. He always seemed to be at work—or was he pursuing his hobby ? His interests never dimmed and papers for publication continued to flow from his pen till death intervened. Whatever he wrote, whether in official correspondence or for publication was precise and clear, occasionally trenchant.

He was essentially a field man and always maintained that the proper place to study fungi was in their natural habitat and not in test-tubes. Of course he recognized the value of laboratory studies but there was nothing he detested more than what he termed a "test-tube

species". He was a keen observer and little missed his observation. It was once said of him that he wore spectacles not to enable him to see, but to ensure that he saw better than anyone else.

The Tea Research Institute was fortunate in having Petch as its first Director. Though he held the post for but a few years his able advice and thorough knowledge of the industry and its requirements were invaluable during its establishment and early years. He laid the excellent foundation on which others have built.

Petch was of a quiet, retiring disposition, hating publicity. He always preferred to work quietly and unobtrusively in the background. He was never very prominent in Committees, having little to say, but that little was always to the point and full of sound advice. Although of a naturally reserved character those who knew him best will remember his kindly manner and droll humour.

C. H. GADD.