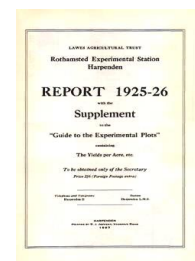


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Report 1925-26 With the Supplement to the Guide to the Experimental Plots



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Production of Manure from Waste Cellulose Materials

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guaranteed cultures issued under adequately controlled conditions without diverting the scientific staff from their proper function of carrying out research work.

PARTIAL STERILISATION.

The practice of partially sterilising soil by steam or anti-septics, advocated as a result of investigations at Rothamsted some years ago, is now extensively used in the glasshouse tomato and cucumber growing industry, and has played an important part in raising yields to the levels commonly attained to-day. " Sick " soils, such as those previously dealt with, are now rare: before this stage is reached, the soil is steamed or treated with carbolic acid. They can still be found, however: one studied in 1925 by the Lea Valley Research Station, yielded only 28 tons per acre: a portion that was steamed, yielded 50 tons per acre, while a part treated with carbolic acid yielded 43 tons per acre. The practical problem has now shifted and sterilisation is adopted rather as a preventive than as a cure.

Unfortunately, steaming is costly and the carbolic acid treatment, while cheaper, is rarely as effective. Search has, therefore, been made for more potent chemicals. A heavy oil produced as a by-product from the Mond Gas process was better, giving 6.25 lb. per plant, when applied at only half the usual rate, as against only 5.5 lb. for the full carbolic treatment, and 5.25 on the untreated soil: Steam, however, raised the yield to 7 lb. per plant. This particular oil is not easy to apply, and persists long in the soil. In another nursery it was less effective: the untreated plots yielding 4.8 lb., while the oil gave 5.4 lb., and the carbolic acid 4.3 lb. per plant.

Two organic substances, possible intermediates in the dye industry, have been studied; chlor-di-nitrobenzene and 3.5 dinitro-o-cresol: the former was more effective than carbolic acid even when used in only one-seventh the amount (0.02 per cent. of the weight of the soil instead of 0.15 per cent.), giving an additional 2 tons of tomatoes per acre, as against 1 ton given by carbolic. In these trials the soil was initially good, the yields on the control plots being 44 tons per acre, beyond which it is difficult to go.

In view of the change in the nature of the practical problem, the scientific investigation has been reopened jointly by the Insecticides and Microbiological Departments.

PRODUCTION OF MANURE FROM WASTE CELLULOSE MATERIALS, STRAW, ETC.

This process was worked out at Rothamsted by Dr. H. B. Hutchinson and Mr. E. H. Richards in 1920, and has been steadily improved. The exploitation, being unsuitable for an experiment station, is carried out by the non-profit-making syndicate, Adco. The process is now at work in over 30 countries, and thousands of tons of material are treated each year.

The scientific work is being continued in these laboratories. The decomposition proceeds when sufficient moisture and nitrogenous and other nutrients are present, but different waste substances

behave very differently under the same conditions. Dr. Rege finds that two factors determine whether a given waste material will decompose quickly to make a good manure: the amount of food or energy material (usually pentosans), this being beneficial, and the amount of lignin, which is detrimental. The relatively high proportion of lignin to pentosan accounts for the unsuitability of certain substances for conversion into manure, but it also suggests that they might become suitable if mixed with other waste material rich in pentosans.

Certain species of thermophilic fungi appear to be the chief agents affecting the decomposition. Dr. Rege has shown that strains of *Coprinus sp.* (*fimetarius?*), *Aspergillus sp.* (*fumigatus?*) and *Acremoniella sp.* (*velutina?*), all common soil forms, can act at temperatures exceeding 50°C, a degree of heat not infrequently attained in manure heaps. Thermophilic bacteria are known, but so far as is ascertained at present, the bacterial decomposition of cellulose does not rest at the humus stage, but runs right down to the final products, carbon dioxide and water.

MICROBIOLOGY AND TREATMENT OF SEWAGE AND OTHER EFFLUENTS.

It has long been a reproach to science that, of the 230,000 tons of nitrogen consumed annually by the inhabitants of these islands in their food, only a small part ever returns to the land, the rest being lost or dissipated at great expense. Various sewage sludges have from time to time been tested at Rothamsted, but the only one of promise as a fertiliser (we express no opinion as to any other property), is the Activated Sludge, made by blowing air through the sewage. This contains, when dry, some 6 per cent. of nitrogen in an easily available form, and is worth on the farm up to £4 per ton. Since ordinary sludges contain only 1 or 2 per cent., it was at first thought that the richness of activated sludge was the result of some fixation of gaseous nitrogen, but experiments at Rothamsted (1921-22 Report, p. 50) showed that it came from a better recovery in the sludge of the nitrogen of the sewage, the proportion being 15 per cent. or more (rising in favourable conditions to 27 per cent.), as compared with 10 per cent. by precipitation and 4 per cent. by septic tank methods. Further work has shown that this higher efficiency of recovery is due to a great absorption of ammonia from the sewage.

This absorption is largely due to microorganisms, which assimilate the ammonia and convert it into protein and protoplasm. Bacteria and protozoa both take part, the bacteria assimilating the ammonia and the protozoa assimilating the bacteria; finally, the protozoa are entangled in the sludge and, when dry and dead, contribute largely to its fertilising value. The smooth working of the process depends on maintaining the proper balance between the numbers of protozoa and bacteria. A remarkable instance of failure at one large town studied this year was traced to the introduction of yeast from a brewery into the effluent; this yeast had stimulated the development of the protozoa, which, in turn, had reduced the bacterial population so much that they could not adequately purify the sewage. As soon as the discharge of yeast was stopped, more active purification was resumed.