Symposium on Design of Long-time Experiments
(Joint Program with the Crops Science Division)

LONG-TIME CROP AND CULTURE ROTATIONS

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Almost 100 years have elapsed since crop rotation experiments were commenced at Rothamstead in 1848. Similar work was started in Illinois in 1876, in Missouri in 1888, and in Ohio in 1894. In Canada, rotation experiments on the Dominion Experimental Farms were begun in 1911. Present day agronomists owe much to the foresight of the early investigators who initiated and developed this field of investigational work. After this long period of years it would seem very fitting that some time might be devoted to a consideration of this work. What information have crop rotations supplied? What new problems have arisen? What weaknesses are inherent in existing techniques and how may these be corrected?

It is not to be expected that these discussions will relate primarily to the data which have been obtained from crop rotation experiments. Such results have special reference to various soil and climatic regions and would be of particular interest primarily to people from these regions. What is desired here, it may be assumed, is to consider the objectives and difficulties of crop rotation experiments, the problems which seem to be of greatest importance at the present time, and the procedures which should be followed to obtain reliable information.

PRINCIPAL OBJECTIVES OF CROP ROTATION EXPERIMENTS

Crop rotation experiments have been designed chiefly to learn the effects of various rotations upon the yields of crops, and upon the productivity of the soil after a long period of years. In different countries widely varying cropping or rotation practices are followed. In the dry regions of the prairie provinces of western Canada, small grain is produced often in a 2-year rotation of summer fallow and wheat. Where moisture conditions become more favorable, more grain and less summer fallow is used. On the other hand, in extremely dry areas, where it is too dry to grow grain successfully, the land is left in range. In the humid regions of eastern Canada and the northeastern United States, hay and pasture are included in the rotation and the summer fallow is omitted. In the corn belt of the United States corn is often grown for 2 years in succession and then followed by oats and clover.

In England, in recent years, the so-called short ley, is now being advocated in preference to permanent pasture. However, a few years ago well-managed, permanent pasture was also considered more productive and economical.

In parts of New Zealand, where ideal pasture conditions are said to prevail, all the land is devoted to pasture and hay. When well fertilized with about 12,000 pounds of superphosphate per acre per year, standing yields are being obtained, some data showing average yields from pasture clippings of over 12,000 pounds of dry matter per acre per year. Pasture yields are very much superior to what has been obtained in Canada. Besides, permanent pasture involves very little labor and expense. On the other hand, while legume hay and pasture are very satisfactory for the soil, they may not give in some localities very satisfactory economic returns. These necessitate livestock which may or may not be available.

In view of the widely varying cropping systems in various regions and in different countries, it is important to learn the most suitable system for local conditions. Long-time crop rotation experiments would seem to be the only means of providing reliable information to evaluate these different systems. This type of problem, however, cannot be solved in a few years and must continue until the various systems of cropping have had an opportunity either to improve or impair the productivity of the soil.

The principal objective should be to determine the maximum and optimum average yields of high-quality crops which may be obtained from rotations on the more important soil types under various climatic conditions. Usually this involves the application of different manure and fertilizer treatments on different types of rotations. Looking forward to the requirements of the future, crop rotations should be planned now to give information on what may be expected from different systems of crop rotation.

SPECIAL DIFFICULTIES WITH CROP ROTATION EXPERIMENTS

At first, crop rotation experiments were conducted without much consideration of the variability of the soil on which they were placed. In eastern Canada, some of these experiments were located on areas having widely different soil types. In some cases, only a few years of experience were obtained in Canada.