PLANT BREEDING IN THE LIGHT OF GENETICS

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THE following conclusions may be drawn from the section of plant breeding in the light of genetics: first, that genetics and cytology can afford valuable assistance to the plant breeder, and secondly, that the geneticist needs a better understanding of the problems of plant breeding, and the breeder of the possibilities of genetical research, before really fruitful collaboration will be achieved.

The breeder requires, for example, detailed information about the mode of reproduction and the cytological behaviour of his material. Cytology and genetics can and do give him such information. But he also needs very detailed knowledge of the inheritance of quantitative characters, and this the geneticist cannot at present supply. It is highly significant that in horticultural breeding, where genetics and cytology have most fully proved their value to breeding programmes, the geneticist is also frequently a breeder. The breeding problems can in such cases be attacked immediately with the full resources of the genetics, and on the other hand, the value of any new genetical technique for breeding work is immediately appreciated. As a case in point, Crane and Thomas have encountered the necessity for determining the mode of reproduction of *Rubus* species, and have been able to obtain the necessary information by a series of simple genetical and cytological observations. There is also collaboration between breeders and geneticists interested in maize, and for the past fifteen years maize breeding methods have been developed at a rate far exceeding that found in any other cereal crop, as described by Lindstrom, Singleton and Jenkins. The problems of the root-crop breeder closely parallel those encountered in the case of maize, and in overcoming them Rasmusson adopts a similar technique based on like genetical experience.

It is in the field of self-fertilizing cereals that there has been least collaboration, and it is here that opinion is most sharply divided on the question of the practical value of genetical work. Cytology

has provided essential information about the causes of sterility in wheat species crosses and in *Triticum-Agropyron* crosses, but it is clear that the real need of the cereal breeder is guidance in his varietal crossing and selection programmes. This guidance can only be given when more genetical research has been done on inheritance in quantitative characters.

Perhaps the most difficult and least developed aspect of plant breeding is the production of what are essentially new species of crop plants by hybridization and polyploidy. The discovery of the action of colchicine in bringing about chromosome doubling has given a stimulus to research in this field, as shown by the number of papers on the subject. It is, however, too early to assess accurately the practical possibilities of colchicine treatment. In this connexion, also, the study of the origin of our present cultivated plants is of prime importance in indicating how such new forms might be made. Mangelsdorf's analysis of the origin of maize materially adds to our knowledge in this direction, besides affording another example of how genetical analysis can be used in the solution of an evolutionary problem.

All breeding work involves variety trials, and both these and the development and use of the theory of quantitative characters will require rather complex statistical analysis. The use of statistics in plant breeding was the subject of a joint meeting of this and the statistics section opened by Yates. It was apparent that the full benefit of statistics, as of genetics, has not yet been realized in plant breeding.

Though the task of organizing genetics, cytology and statistics in the service of plant breeding is unquestionably difficult, the Edinburgh meetings, especially that of Frankel's committee of plant breeders, have been of service in showing not only what has been done but also where the difficulties are to be found. Further meetings of the same kind should be of even greater value.