

BOOK REVIEWS

INTRODUCTION TO QUANTITATIVE GENETICS. By D. S. Falconer, A.R.C.
Unit of Animal Genetics, Edinburgh. Oliver and Boyd, Edinburgh
and London, 1960, pp. 365.

FEW books on population genetics have appeared since 1920 when the foundations of the subject were laid by Fisher, Haldane and Wright. The present publication is a welcome addition covering the whole field of the subject. The book is primarily meant for biologists with ordinary mathematical ability. It is, however, also useful to statisticians interested in quantitative inheritance especially in relation to animal breeding.

The book is apparently divided into two parts. In the first part covered under Chapters 1-5, the genetic properties of populations and the changes therein, constituting 'population genetics' are described. These include the basic concept of gene frequency, the forces of migration, mutation and selection to which the gene frequency is subject and further complexities introduced by random changes in small populations. Effects of inbreeding by regular and irregular systems have also been dealt with in this section.

The second part is devoted to the inheritance of characters showing continuous variation, the so-called quantitative characters. Chapters 6-8 describe the notions of continuous variation and the parameters determining the mean and variance in a continuously varying character. The covariance between different sorts of relatives and the heritability of characters are dealt with in Chapters 9-10. Of interest to the animal breeders are the three Chapters 11-13 on effects of selection and the Chapters 14-16 on inbreeding and cross-breeding. While the former include the properties of response to selection, its long-term effects and the relative merits of different methods of selection, the latter discuss the general principles under headings (i) changes of mean value, (ii) changes of variance and (iii) the utilisation of heterosis. After clearing up a few complexities such as problems of scaling and threshold characters in Chapters 17-18, the author discusses correlated characters in Chapter 19. The book concludes with a discussion on current ideas on the effects of natural selection on metric characters in Chapter 20.

On the whole the exposition of the subject-matter is commendable in two respects. Firstly the principles of the subject have been introduced without the aid of path coefficients or matrix algebra. This enables a reader with elementary mathematical background to digest the material. In fact, in this respect, the author has done an admirable service to those biologists who complain that this subject is very difficult. Secondly the experimental results—many of them from the work of the author and his colleagues in Edinburgh—have been used in the form of illustrative examples. This helps the reader to appreciate the applicability of the theory to practical cases.

The author has, however, skillfully avoided the controversial topics of the subject for want of which a research worker can hardly support or modify his ideas while going through the book. Nevertheless, the book does serve the purpose of clarifying many notions in the field of quantitative genetics, which, though not controversial, sometimes confuse workers in this field.

P. NARAIN.

AN INTRODUCTION TO SAMPLING THEORY WITH APPLICATIONS TO AGRICULTURE. By M. R. Sampford, Agricultural Research Council Unit of Statistics, University of Aberdeen, Oliver & Boyd, Edinburgh and London, Net Price 30 s.

This book gives an elementary development of the statistical theory underlying the design and analysis of sample surveys and is primarily meant for agricultural workers. No previous knowledge of statistical theory is assumed. The book gives numerous applications of sampling theory to agricultural surveys of special interest to students of African agriculture.

The first two chapters stress the role of sampling in agricultural science and various organizational aspects involved in the planning of sample surveys. After introducing certain basic statistical ideas essential for the understanding of the subject, the author covers the following topics in the next five chapters:

- (a) Method of Random Sampling.
- (b) Systematic Sampling.
- (c) Stratification.
- (d) The Ratio and Regression Methods.
- (e) Cluster Sampling and Multi-stage Sampling.

Chapter 9 summarizes the various sampling techniques described earlier and gives some discussion of their relative merits. This chapter also discusses briefly the topics on the choice of sampling units and non-sampling errors. The next three chapters deal with the determination of the sample size, the problems arising in the case of repeated sampling from the same population and the estimation of proportions and numbers respectively. In the Appendix at the end, the author has proved some fundamental results in sampling.

The author describes in great detail the method of selecting at random three quadrats in a field and then claims (page 46) that "the quantity

$$\frac{\text{total yield of all quadrats}}{\text{total area of quadrats within the field}}$$

will provide an unbiased estimate of the yield per unit area of the whole field". It is not clearly stated whether the method of simple random sampling or varying probability is adopted in the selection of the quadrats but from the details given, it seems that the method of simple random sampling has been used for selection of the quadrats. Since all the quadrats are not of the same size, it is clear that both the numerator and the denominator of the estimate are random variables. Consequently, the estimate of the yield per unit area is obviously biased.

Occasionally, the author makes statements which are not quite rigorous and need justification. Thus, on page 24, the author says "Of possible non-random methods, systematic and 'representative' sampling deserve mention, etc." Again, on page 74, line 23, the author says "In general, a systematic sample can be expected to give a more precise estimate than a stratified sample of the same size, etc." On page 121, line 10, another statement is made that "The selection of units with unequal probabilities is not extensively practised, except when the results are to be analysed by the ratio method, etc." Again on page 23, line 24, the author seems to convey the impression that selection of units in a haphazard manner is equivalent to simple random sampling. The reviewer is of the considered view that it is in the highest degree important that in any elementary exposition of the sampling theory, the basic concepts must be clearly and rigorously put forth in order that these are not liable to misinterpretation. The statements like ones mentioned above are not uncommon.

The author has preferred to use his own notation for summation instead of the standard notation used in almost all the text-books. To the reviewer, this seems to be rather unfortunate since readers,

used to the standard notation, are likely to experience difficulty in following the development of the subject. The reviewer is also of the opinion that the proofs given in the Appendix are somewhat too cumbersome to be of material assistance to the readers to whom the book is primarily addressed. There are also a few misprints in the book.

These criticisms do not, however, in any way detract from the value of the book which, in our view, is lucid in its exposition, handy and likely to prove particularly useful to agricultural workers for whom it is primarily designed. The numerous illustrations and the exercises at the end of each chapter and their solutions should especially help the reader in obtaining an insight into the application of the sampling methods described in the book. It is a book which, we think, ought to be on the shelf of every agricultural statistics worker.

B. V. SUKHATME.