Serial Experiments.

THE review of ' A Hand-Book of Statistics for use in Plant Breeding and Agricultural Problems ', by F. J. Shaw appears in the March issue of *Current Science*. About the illustration* in the section of Serial Experiments the reviewer (D. S. R.) writes, "The sum of squares due to blocks is taken as though there are 5 blocks, whereas there are actually 30 blocks. Because a block in Table XLVI is not identical in all the seasons and in the two localities in the sense that a variety is, the necessary correction should be made when using the book."

By suggesting a correction to write the S. S. for blocks as

		d. f.	S.S.
	Blocks ..	24	5120·831
instead of as			
	Blocks ..	4	197·774
Blocks × Localities	.. ..	4	735·224
Blocks × Seasons	.. ..	8	3175·232
Blocks × Seasons × Localities	..	8	1012·601

the reviewer only partially gets over the unreal difficulty of attaching meaning to such items in the analysis of variance table as depend for their meaning on the arbitrary numbering of blocks in different years and localities. There are four other items which depend for their meaning on the arbitrary numbering of blocks, namely

		d. f.	S.S.
Blocks × Varieties	.. ..	48	1112·562
Blocks × Varieties × Seasons	..	96	2231·135
Blocks × Varieties × Localities	..	48	897·245
Blocks × Varieties × Seasons × Localities	..	96	1979·310

and if the correction is to be complete it is necessary to replace the four items by one single item, namely

		d. f.	S.S.
Error	.. ..	288	6220·252

Although it is unnecessary to split the block S.S. (24 *d.f.*) and the error S.S. (288 *d.f.*) it is not incorrect to divide them in the way done by Shaw. The use of the word

'correction' by the reviewer is in this sense misleading.

A mistake has been made not in the analyses of Variance Table but in its interpretation in tests of significance. In an experiment in randomised blocks in which varieties are assigned wholly at random within each block, the degrees of freedom corresponding to the interaction between blocks and varieties are due to the differences in fertility between different plots within the same block and are therefore wholly available for providing the estimate of error. In the present illustration there will be 48 *d.f.* available for estimating the error in each of the six single experiments, and 288 (48 × 6) for estimating the error in the aggregate as against only 96 allotted by the author. By assigning only the third order interaction to the residual error, Shaw fell into the error of basing the error-proper on only a partial number of *d.f.* As a consequence of this the level of significance was much too raised and the tests were made more stringent than were originally intended.

In the example under discussion, the number of *d.f.* for error as shown in Shaw's book is already sufficiently large and there is no likelihood that any of his conclusions will be materially altered due to the rise in the significance level. But nevertheless it is of real value to guard against this mistake which may seriously affect interpretation in other serial trials where the *d.f.* for error are relatively few.

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* The illustration is taken from an actual experiment conducted by Mr. R. D. Bose, Pusa, and had originally appeared in the *Journal of Agriculture and Live-Stock of India*, **5**, Part VI.