January 24th., 192 7.

Dear Sir,

I am much obliged for your letter of December 10th., on the preparation of Latin Squares.   I mentioned in the paper you referred to that somewhat different methods are used for 5 x 5 and for 6 x 6 squares.

First, if larger squares are in contemplation I should be content to write down any arrangement (7 x 7 or more as the case may be) fulfilling the primary conditions, having the first row and the left hand column in the prescribed order A B C D E F G; and then to stir it up by the following three processes.

(α) Intramutation.

Omitting A, the remaining letters are permuted at random, (this may be quickly done by drawing numbered cards from a pack).   The per-mutation obtained produces a change in the configuration in the following way.   Suppose E comes in the place of B, than (i) E has to be written for B wherever it occurs, (ii) the columns are permuted so that the 2nd column (originally headed by B) is moved to fifth place (iii) the rows are likewise permuted so that the second row is moved to the fifth place, the other columns and rows being in the same way shifted round in accordance with the permutation obtained

(β) all rows, but the first, which are now again led by B C D .... in this order, are permuted according to a new permutation obtained at random

(γ) The letters A B..... which still head the columns are assigned

at random to the treatments or varieties to be tested.

For 6 x 6 squares I have prepared key cards which, with the above treatment will yield all possible squares.   Since they are rather numerous I should advise starting with any one of them such as

```
A B C D E F
B A D F C E
C F B E A D
D C E A F B
E D F C B A
F E A B D C
```

and using the above processes to obtain fresh arrangements as required. For 5 x 5 the intrasmutation may be omitted, for there are only 56 arrangements in all with the leading rows and columns in order, and processes β and γ will give all possible arrangements; the 56 arrangements may be written on cards and one chosen at random.

For 4 x 4, which is the smallest usable size, there are only 4 such arrangements

```
A B C D        A B C D        A B C D        A B C D
B A D C        B A D C        B C D A        B D A C
C D A B        C D B A        C D A B        C A D B
D C B A        D C A B        D A B C        D C B A
```

From these (β) and (γ) give 576 arrangements of 4 varieties on a given set of plots.

As you evidently have the J.M.A. paper, I enclose an old one from the J.A.S.   It is the earliest explanation of the analysis of variance in its modern form.   My book on Statistical Methods gives the applications to the Latin Square in detail, with some discussion of the principles of plot experimentation.

Yours   sincerely,