**An example of a Latin Square Design**

Example: A 4 x 4 Latin-square experiment was conducted to compare the effects of four spacings A, B, C and D on the yield of millet. The plan and yields are given below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Row | Column | | | |
| 1 | 2 | 3 | 4 |
| 1 | A  231 | B  280 | C  285 | D  284 |
| 2 | B  284 | A  246 | D  283 | C  271 |
| 3 | C  275 | D  282 | A  258 | B  258 |
| 4 | D  259 | C  271 | B  289 | A  275 |

**Table 1: Raw data**

We have to test whether the different spacings are equally effective, and in case they are not so, to compare the spacings pairwise.

Model: We shall denote by *yijk* the observation on the treatment combination where the factor A is at the *ith* level (*ith* row), *B* is at the *jth* level (*jth* column) and C is at the *kth* level (*kth* treatment). The triplets *(i,j,k)* take only *m2* (*m* being the number of treatments as well as the number of replications per treatment, here *m*=5) of the possible *m3* values that are dictated by the particular *LSD* used. If we denote this set of *m2* possible values by , then *(i,j,k)* takes values from or, symbolically, *(i,j,k)∈* . Then our linear model is

, *(i,j,k)∈*

with , *eijk~NID(0,σe2)*

The symbols *α, β* and *τ*  stand for the effects due to the factors A, B and C.

The 4 row totals are: 1080, 1084, 1073, 1094.

The 4 column totals are: 1049, 1079, 1115, 1088

The 4 treatment totals are: 1010, 1111,1102, 1108

The grand total is 4331.

The correction factor=

Raw total SS=1,176,289

Total SS=1,176,289- 1,172,347.5625=3941.4375

Row SS=

Column SS=555.1875

Treatment SS=

Error SS=Total SS-Row SS-Column SS-Treatment SS=1553.925

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Source of variation | d.f. | SS | MS | *Fo* |
| Rows | 3 | 57.6375 | 19.2125 | 2.2841 |
| Columns | 3 | 555.1875 | 185.0625 |
| Treatment | 3 | 1774.6875 | 591.5611 |
| Error | 6 | 1553.925 | 258.9875 |
| Total | 24 | 3941.4375 |  |

**Table 2: Analysis of variance table for the Latin Square Design**

*F0.05;3,6*=4.76 , *F0.01;3,6*= 9.78. So, the hypothesis of equal effect of the four spacings is accepted both at the 1% level and the 5% level. The p-value of the above test comes as 0.179. Since the four spacings are equally effective, there is no need to compare them pairwise.