Week-05-L-02

Agricultural Statistics in Practice

Stability & Sustainability Analysis

Models Assessing Stability – Wricke Model

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Wricke Model

R B D Randomized Block Designs

- According to this model, the mean of performance of the genotypes/varieties are important and from these mean performances an estimate of the stability, is known as '**ecovalence**' is worked out. The stability estimate ecovalence is given as follows:

G×E

$$\boldsymbol{\varepsilon_i = \sum_{j=1}^{e} (\bar{y}_{ij} - \bar{y}_i - \bar{y}_j + \bar{y})^2}$$

where,

$\boldsymbol{\varepsilon_i}$	= *Ecovalence for the* i^{th} *variety/genotype*
$\boldsymbol{\bar{y}_{ij}}$	= *Average performance of the* i^{th} *genotype/variety in the* j^{th} *environment*
$\boldsymbol{\bar{y}_i}$	= *Average performance of the* i^{th} *genotype/variety*
$\boldsymbol{\bar{y}_j}$	= *Average performance of the* j^{th} *environment*
$\boldsymbol{\bar{y}}$	= *Average performance of all the genotypes over all the environments* i.E. *Total mean*

Wricke Model

- From the relation, it's evident that ecovalence for any variety or genotypes is the sum of the squares of deviation of its mean performances over the locations or situation.
- Being the sum of squared quantities it can have range from zero to infinity.

  0 → ∞

- Thus, the variety or genotype having lowest value of ecovalence (or the lowest percentage ecovalence value) is the most famous and stable among the genotypes or variety.

Example

- Following table gives the average performance of six different varieties of paddy, under five different situations. Work out the ecovalence values of the variables and comment which variety is most stable one.

E

G

Variety	S_1	S_2	S_3	S_4	S_5
V_1	11.1	12.33	12.17	13.13	9.77
V_2	13.43	11.33	13.83	12.83	9.00
V_3	7.77	8.67	8.17	8.67	7.67
V_4	10.50	9.00	10.00	9.67	9.83
V_5	10.23	10.30	9.67	9.37	8.60
V_6	7.40	8.00	7.77	7.73	9.67

Solution

- The ecovalence values corresponding to different varieties are calculate along the following formula:

$$\boldsymbol{\varepsilon_i} = \sum_{j=1}^{e} (\overline{\boldsymbol{y}}_{ij} - \overline{\boldsymbol{y}}_i - \overline{\boldsymbol{y}}_j + \overline{\boldsymbol{y}})^2$$

Here, i = 6 and j = 5

And, $\boldsymbol{\varepsilon_i}$ = *ecovalence for the i^{th} variety/genotype*

$\overline{\boldsymbol{y}}_{ij}$ = *Average performance of the i^{th} genotype/variety in the j^{th} environment*

$\overline{\boldsymbol{y}}_i$ = *Average performance of the i^{th} genotype/variety*

$\overline{\boldsymbol{y}}_j$ = *Average performance of the j^{th} environment*

$\overline{\boldsymbol{y}}$ = *Average performance of all the varieties over all the five situation i.E. Grand mean*

Solution

Variety	S_1	S_2	S_3	S_4	S_5	*Average*
V_1	11.1	12.33	12.17	13.13	9.77	**11.71**
V_2	13.43	11.33	13.83	12.83	9.00	**12.09**
V_3	7.77	8.67	8.17	8.67	7.67	**8.19**
V_4	10.50	9.00	10.00	9.67	9.83	**9.80**
V_5	10.23	10.30	9.67	9.37	8.60	**9.63**
V_6	7.40	8.00	7.77	7.73	9.67	**8.11**
Average	**10.08**	**9.94**	**10.27**	**10.23**	**9.09**	**9.92**

- $\boldsymbol{\varepsilon_1} = ((11.17 - 11.71 - 10.08 + 9.92)^2 + (12.33 - 11.71 - 9.94 + 9.92)^2 + (12.17 - 11.71 - 10.27 + 9.92)^2 + (13.13 - 10.23 - 11.71 + 9.92)^2 + (9.77 - 11.71 - 9.09 + 9.92)^2 = \mathbf{0.887}$

$\bar{y}_{ij} - \bar{y}_{i.} - \bar{y}_{.j} - \bar{y}$

- $\boldsymbol{\varepsilon_2} = ((13.43 - 12.09 - 10.08 + 9.92)^2 + (11.33 - 12.09 - 9.94 + 9.92)^2 + (13.83 - 12.09 - 10.27 + 9.92)^2 + (12.83 - 10.23 - 12.09 + 9.92)^2 + (9.00 - 12.09 - 9.09 + 9.92)^2 = \mathbf{8.852}$

Solution

- $\boldsymbol{\varepsilon_3} = ((7.77\ - 8.19 - 10.08 + 9.92)^2 + (8.67\ - 8.19 - 9.94 + 9.92)^2 + (8.17\ - 8.19 - 10.27 + 9.92)^2 + (8.67\ - 10.23 - 8.19 + 9.92)^2 + (7.67\ - 8.19 - 9.09 + 9.92)^2 = \mathbf{0.755}$
- $\boldsymbol{\varepsilon_4} = ((10.50\ - 9.80 - 10.08 + 9.92)^2 + (9.00\ - 9.80 - 9.94 + 9.92)^2 + (10.00\ - 9.80 - 10.27 + 9.92)^2 + (9.67\ - 10.23 - 9.80 + 9.92)^2 + (9.83\ - 9.80 - 9.09 + 9.92)^2 = \mathbf{1.532}$
- $\boldsymbol{\varepsilon_5} = ((10.23\ - 9.63 - 10.08 + 9.92)^2 + (10.30\ - 9.63 - 9.94 + 9.92)^2 + (9.67\ - 9.63 - 10.27 + 9.92)^2 + (9.37\ - 10.23 - 9.63 + 9.92)^2 + (8.60\ - 9.63 - 9.09 + 9.92)^2 = \mathbf{0.418}$
- $\boldsymbol{\varepsilon_6} = ((7.40\ - 8.11 - 10.08 + 9.92)^2 + (8.00\ - 8.11 - 9.94 + 9.92)^2 + (7.77\ - 8.11 - 10.27 + 9.92)^2 + (7.73\ - 10.23 - 8.11 + 9.92)^2 + (9.67\ - 8.11 - 9.09 + 9.92)^2 = \mathbf{6.478}$

Conclusion

Variety	V_5	V_3	V_1	V_4	V_6	V_2
Ecovalence	0.418	0.755	0.887	1.532	6.478	8.852

- Thus, the variety 5 is the most stable variety followed by variety 3, variety 1 and so on.
- Interesting point to note that though variety 2 is providing maximum average yield it ranks lowest among the varieties with respect to stability.
- Variety 2 may be recommended for situation three and four.

Thank You


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