*Week-05-L-03*

# Agricultural Statistics in Practice

## Stability & Sustainability Analysis

## Models Assessing Stability – Perkins and Jinks Model

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# *Perkins and Jinks Model*

- Perkins and Jinks (1968) in an attempt to improve the stability model of Eberhart and Russell opined that genotype-environment interaction is more important from stability point of view.
- As such they proposed to regress genotype-environmental interaction on environmental indices, rather than the mean performances of genotypes over the environment ($Y_{ij}$). They proposed the following model:

$$Y_{ij} = \mu + a_i + e_j + g_{ij} + \varepsilon_{ij}, \qquad i = 1,2,\ldots..t \text{ and } j = 1,2,3 \ldots \ldots .l$$

*where* $Y_{ij}$ = *Mean effect of* $i^{th}$ *genotype in* $j^{th}$ *situation*

$$\mu = \frac{1}{s \times t}\sum_{i,j} Y_{ij}\ ;\ Mean\ of\ all\ the\ genotypes\ over\ the\ sitations$$

$$a_i = \bar{Y}_i - \mu;\ Additive\ effect\ due\ to\ i^{th}\ genotype$$

$$e_j = \bar{Y}_j - \mu;\ Additive\ effect\ due\ to\ j^{th}\ situation$$

$$g_{ij} = Y_{ij} - \mu - a_i - e_j;\ Interaction\ effect\ of\ i^{th}\ genotype\ in\ j^{th}\ situation$$

$$\varepsilon_{ij};\ Error\ associated\ with\ i^{th}\ genotype\ in\ j^{th}\ situation$$

# *Perkins and Jinks Model*

*Again,*

$$g_{ij} = \beta_i e_j + \delta_{ij}$$

Where, $\beta_i$ *is the regression coefficient, and*
$\delta_{ij}$ *is he deviation from regression*

*Thus, the Perkins-Jink model turns out to be:*

$$\begin{aligned} Y_{ij} &= \mu + a_i + e_j + g_{ij} + \varepsilon_{ij} \\ &= \mu + a_i + e_j + \beta_i e_j + \delta_{ij} + \varepsilon_{ij} \\ &= \mu + a_i + e_j(1 + \beta_i) + \delta_{ij} + \varepsilon_{ij} \end{aligned}$$

*So the basic structure of the model remains the same, even the deviation from regression.*

*But the regession coefficient* $b_i$ *, in Eberhart – Russell model becomes* $b_i = (1 + \beta_i)$

# *Solution*

- Perkins-Jinks ANOVA
- Consider the following given stability table except the column of regression coefficient

| *SOV* | *D.F.* | *SS* | *MS* |
|---|---|---|---|
| *Genotypes* | 5 | 71.377 | 14.275 |
| *Environment/join regression* | 4 | 5.617 | 1.404 |
| *Genotype x Environment* | 20 | 23.835 | 1.192 |
| *Heterogenity between regression* | 5 | 17.272 | 3.454 |
| *Remainder* | 15 | 6.564 | 0.438 |

# *Conclusion*

| *Variety* | $V_i - \bar{V}$ | $b_i - 1 = \beta_i$ | $\bar{S}^2_{d_i}$ | *Inference* |
|---|---|---|---|---|
| $V_1$ | 1.791 | 1.289 | 0.527 | Low stability, good for rich environment |
| $V_2$ | 2.164 | 2.857 | 0.460 | Low stability, good for rich environment |
| $V_3$ | – 1.736 | – 0.449 | 0.138 | Low performance, less sensitive to environment |
| $V_4$ | – 0.122 | – 0.894 | 0.323 | Slightly low performance, less sensitive to environment |
| $V_5$ | – 0.289 | – 0.041 | 0.291 | Slightly low performance, comparatively stable, good for average environment |
| $V_6$ | – 1.809 | – 2.761 | 0.028 | Low performance, good for poor environment |

Thus, the relative ranking of the genotypes remains the same as it is in case of Eberhart – Russell Model

# Thank You