

# Package: safuzzy (via r-universe)

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**Type** Package

**Title** Stability Analysis with Fuzzy Logic

**Version** 0.1.1

**Description** It integrates 'fuzzy logic' into the analysis of genotype adaptability and stability. By classifying genotypes based on degrees of belonging, the package provides a detailed assessment of their behavior in different environmental groups.

**License** MIT + file LICENSE

**Encoding** UTF-8

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## Contents

annicchiarico . . . . .	2
cruz_torres_vencovsky . . . . .	3
eberhart_russell . . . . .	4
ge_data . . . . .	5
hybrid . . . . .	6
lin_binns . . . . .	8

**Index****10**


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annicchiarico                      *Annicchiarico (1992) method*

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**Description**

Adaptability and Stability Analysis based on the interpretation of the Annicchiarico 1992 methodology, developed by Carneiro et al. 2019.

**Usage**

```
annicchiarico(data, env, gen, rep, var)
```

**Arguments**

data	Data file (data.frame) with variables.
env	Column with environment information.
gen	Coluna contendo informações de genótipo.
rep	Column containing genotype information.
var	Variable to be analyzed.

**Value**

A data frame containing the following estimates:

Gen Genotype.

Wg General recommendation index for environments.

Wd Recommendation index for unfavorable environments.

Wf Recommendation index for favorable environments.

GE Membership (%) to the general stability genotypes group.

PA Membership (%) to the poorly adapted genotypes group.

FAV Membership (%) to the favorable adapted genotypes group.

UNF Membership (%) to the unfavorable adapted genotypes group.

**Author(s)**

Douglas de Oliveira Maciel <douglasmaciel@discente.ufg.br>

**References**

Carneiro, A. R. T., Sanglard, D. A., Azevedo, A. M., Souza, T. L. P. O. D., Pereira, H. S., & Melo, L. C. (2019). Fuzzy logic in automation for interpretation of adaptability and stability in plant breeding studies. *Scientia Agricola*, 76(2), 123-129.

**See Also**

[hybrid](#)  
[lin\\_binns](#)

**Examples**

```
data(ge_data)
annicchiarico(data = ge_data, env = environment, gen = genotype, rep = block, var = gy)
```

---

cruz\_torres\_vencovsky *Cruz, Torres & Vencovsky (1989) method*

---

**Description**

Adaptability and Stability Analysis based on the interpretation of the Cruz, Torres & Vencovsky (1989), developed by Carneiro et al. 2019.

**Usage**

```
cruz_torres_vencovsky(data, env, gen, rep, var)
```

**Arguments**

data	Data file (data.frame) with variables.
env	Column with environment information.
gen	Coluna contendo informações de genótipo.
rep	Column containing genotype information.
var	Variable to be analyzed.

**Value**

A data frame containing the following estimates:

Gen Genotype.  
 B\_0 Mean of the variable for each genotype.  
 B\_1 Regression coefficient ( $B_1$ ) for each genotype.  
 B1\_B2 Regression coefficient ( $B_1 + B_2$ ) for each genotype.  
 R2 Coefficient of determination ( $R^2$ ) for each genotype.  
 MdAF Membership (%) to the average adaptability to favorable environments genotypes group.  
 Nda Membership (%) to the poorly adapted genotypes group.  
 MdAG Membership (%) to the general adaptability to favorable environments genotypes group.  
 MaxGF Membership (%) to the maximum adaptability to favorable environments genotypes group.  
 MaxDes Membership (%) to the maximum adaptability to unfavorable environments environments group.  
 BE Membership (%) to the low stability genotypes group.  
 BP Membership (%) to the low yield genotypes group.

**Author(s)**

Douglas de Oliveira Maciel <douglasmaciel@discente.ufg.br>

**References**

Carneiro, A. R. T., Sanglard, D. A., Azevedo, A. M., Souza, T. L. P. O. D., Pereira, H. S., & Melo, L. C. (2019). Fuzzy logic in automation for interpretation of adaptability and stability in plant breeding studies. *Scientia Agricola*, 76(2), 123-129.

**See Also**

[hybrid](#)

[lin\\_binns](#)

[eberhart\\_russell](#)

**Examples**

```
data(ge_data)
```

```
cruz_torres_vencovsky(data = ge_data, env = environment, gen = genotype, rep = block, var = gy)
```

---

eberhart\_russell

*Eberhart & Russel (1966) method*

---

**Description**

Adaptability and Stability Analysis based on the interpretation of the Eberhart & Russel 1966 methodology, developed by Carneiro et al. 2018.

**Usage**

```
eberhart_russell(data, env, gen, rep, var)
```

**Arguments**

data	Data file (data.frame) with variables.
env	Column with environment information.
gen	Coluna contendo informações de genótipo.
rep	Column containing genotype information.
var	Variable to be analyzed.

**Value**

A data frame containing the following estimates:

Gen Genotype.

B\_0 Mean of the variable for each genotype.

B\_1 Regression coefficient ( $B_1$ ) for each genotype.

R2 Coefficient of determination ( $R^2$ ) for each genotype.

GE Membership (%) to the general stability genotypes group.

PA Membership (%) to the poorly adapted genotypes group.

FAV Membership (%) to the favorable adapted genotypes group.

UNF Membership (%) to the unfavorable adapted genotypes group.

**Author(s)**

Douglas de Oliveira Maciel <douglasmaciel@discente.ufg.br>

**References**

Carneiro, V. Q., Prado, A. L. D., Cruz, C. D., Carneiro, P. C. S., Nascimento, M., & Carneiro, J. E. D. S. (2018). Fuzzy control systems for decision-making in cultivars recommendation. *Acta Scientiarum. Agronomy*, 40, e39314.

**See Also**

[hybrid](#)

[lin\\_binns](#)

**Examples**

```
data(ge_data)
```

```
eberhart_russell(data = ge_data, env = environment, gen = genotype, rep = block, var = gy)
```

---

ge\_data

*Rice Lines Adaptability and Stability Data Using Fuzzy Logic*

---

**Description**

A real dataset containing the grain yield and plant height performance of upland rice lines evaluated across multiple environments. This dataset is used to demonstrate the application of the fuzzy logic methodology for adaptability and stability analysis implemented in the safuzzy package.

**Usage**

```
ge_data
```

**Format**

A data frame (or tibble) with columns representing the experimental factors:

genotype Factor representing the evaluated upland rice lines/genotypes.

environment Factor representing the test environments (combinations of locations and crop years).

block Factor representing the local control.

gy Numeric variable containing the grain yield performance (e.g., kg/ha).

ph Numeric variable containing the plant height performance (e.g., cm).

**Details**

The data consists of phenotypic evaluations of elite lines and commercial cultivars of upland rice. The analysis provides membership degrees that assist breeders in selecting stable and high-yielding genotypes for target environments.

**Source**

Data obtained from the breeding trials conducted and published by Maciel et al. (2025).

**References**

Maciel, D. D. O., Guimarães, P. H. R., & Melo, P. G. S. (2025). Harnessing fuzzy logic for adaptive and stable selection of upland rice lines. *Crop Breeding and Applied Biotechnology*, 25(2), e527425213. doi:10.1590/198470332025v25n2a28

**Examples**

```
data(ge_data)
head(ge_data)
```

---

 hybrid

*Hybrid method*


---

**Description**

Stability and Adaptability Analysis based on the interpretation of the Eberhart & Russel 1966 methodology, associated with the modified Lins & Bins (1988) methodology, developed by Carneiro et al. (2020).

**Usage**

```
hybrid(data, env, gen, rep, var)
```

**Arguments**

data	Data file (data.frame) with variables.
env	Column with environment information.
gen	Coluna contendo informações de genótipo.
rep	Column containing genotype information.
var	Variable to be analyzed.

**Value**

Um data frame contendo as seguintes estimativas:

Gen Genotype.

PIF Performance index in favorable environments.

PID Performance index in unfavorable environments.

B\_1 Regression coefficient ( $B_1$ ) for each genotype.

R2 Standardized coefficient of determination ( $R^2$ ) for each genotype.

GE Membership (%) to the general stability genotypes group.

PA Membership (%) to the poorly adapted genotypes group.

FAV Membership (%) to the favorable adapted genotypes group.

UNF Membership (%) to the unfavorable adapted genotypes group.

**Author(s)**

Douglas de Oliveira Maciel <douglasmaciel@discente.ufg.br>

**References**

Carneiro, A. R. T., Sanglard, D. A., Azevedo, A. M., Souza, T. L. P. O. D., Pereira, H. S., Melo, L. C., & Carneiro, P. C. S. (2020). Fuzzy logic applied to different adaptability and stability methods in common bean. *Pesquisa agropecuária brasileira*, 55, e01609.

**See Also**

[eberhart\\_russell](#)

[lin\\_binns](#)

[annicchiarico](#)

**Examples**

```
data(ge_data)
```

```
hybrid(data = ge_data, env = environment, gen = genotype, rep = block, var = gy)
```

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`lin_binns`*Modified method of Lin & Binns (1988)*

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**Description**

Stability and Adaptability Analysis based on the interpretation of the modified Lins and Bins (1988) methodology.

**Usage**

```
lin_binns(data, env, gen, rep, var)
```

**Arguments**

<code>data</code>	Data file (data.frame) with variables.
<code>env</code>	Column with environment information.
<code>gen</code>	Coluna contendo informações de genótipo.
<code>rep</code>	Column containing genotype information.
<code>var</code>	Variable to be analyzed.

**Value**

A data frame containing the following estimates:

Gen Genotype.

PIF Performance index in favorable environments.

PID Performance index in unfavorable environments.

GE Membership (%) to the general stability genotypes group.

PA Membership (%) to the poorly adapted genotypes group.

FAV Membership (%) to the favorable adapted genotypes group.

UNF Membership (%) to the unfavorable adapted genotypes group.

**Author(s)**

Douglas de Oliveira Maciel <douglasmaciel@discente.ufg.br>

**References**

Carneiro, P. C. S. (1998). Novas metodologias de análise da adaptabilidade e estabilidade de comportamento (Doctoral dissertation, Universidade Federal de Viçosa.).

**See Also**

[eberhart\\_russell](#)

[hybrid](#)

**Examples**

```
data(ge_data)
```

```
lin_binns(data = ge_data, env = environment, gen = genotype, rep = block, var = gy)
```

# Index

## \* datasets

ge\_data, 5

annicchiarico, 2, 7

cruz\_torres\_vencovsky, 3

eberhart\_russell, 4, 4, 7, 8

ge\_data, 5

hybrid, 3–5, 6, 8

lin\_binns, 3–5, 7, 8