

Package ‘TCpRepDesigns’

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Type Package

Title Partially Replicated Test-Control Designs for Early Generation Varietal Trials

Version 0.0.1

Description Provides functions for generating partially replicated (p-rep) test-control designs for early generation varietal trials conducted across multiple environments. The package implements three construction methods for obtaining efficient p-rep test-control designs with one or more control treatments. The package extends the partially replicated design framework of Vinaykumar et al. (2026) <[doi:10.1007/s12355-025-01684-1](https://doi.org/10.1007/s12355-025-01684-1)> to accommodate test-control comparisons in breeding trials. Functions are also provided for generating randomized and non-randomized layouts and for evaluating designs using average variance measures for test-versus-test and test-versus-control comparisons, together with canonical efficiency factors. The proposed designs are useful for large-scale varietal evaluation trials where a large number of test lines are assessed under limited experimental resources.

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print.pRep3	<i>Print p-Rep Test-Control Design</i>
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Description

Print p-Rep Test-Control Design

Usage

```
## S3 method for class 'pRep3'
print(x, ...)
```

Arguments

x	An object of class "pRep3".
...	Further arguments.

Value

The input object invisibly.

print.TCpRep	<i>Print p-Rep Test-Control Design</i>
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Description

Prints the design parameters together with the non-randomized and randomized layouts.

Usage

```
## S3 method for class 'TCpRep'
print(x, ...)
```

Arguments

x An object of class "TCpRep".
... Further arguments.

Value

The input object invisibly.

print.TCpRep2 Print p-Rep Test-Control Design

Description

Print p-Rep Test-Control Design

Usage

```
## S3 method for class 'TCpRep2'  
print(x, ...)
```

Arguments

x An object of class "TCpRep2".
... Further arguments.

Value

The input object invisibly.

TCpRep1 Generate p-Rep Test-Control Designs: Method I

Description

Constructs a family of partially replicated (p-rep) test-control designs for early generation varietal trials conducted across multiple environments. The method is based on mutually orthogonal Latin squares (MOLS) and permits the inclusion of one or more control treatments with higher replication than the test treatments.

Usage

```
TCpRep1(s, control)
```

Arguments

s An integer ($s \geq 3$) specifying the order of the construction.
 control Number of control treatments.

Value

A list containing design parameters, non-randomized layouts, and randomized layouts.

 TCpRep2

Generate p-Rep Test-Control Designs: Method II

Description

Constructs partially replicated (p-rep) test-control designs for multiple environments using an affine resolvable partially balanced incomplete block design framework. The method accommodates several admissible numbers of environments and introduces one control treatment per environment.

Usage

TCpRep2(p)

Arguments

p An integer ($p \geq 3$).

Value

A list of p-rep test-control designs for all admissible values of the number of environments. Each design contains design parameters, non-randomized layouts, and randomized layouts.

 TCpRep3

Generate p-Rep Test-Control Designs: Method III

Description

Constructs partially replicated (p-rep) test-control designs for multiple environments using arrays derived from mutually orthogonal Latin squares. The design is obtained by deleting selected rows from the generated arrays and assigning pairs of arrays to environments. The highest-numbered test treatments are merged into a control treatment with higher replication than the remaining test treatments.

Usage

TCpRep3(s)

Arguments

`s` An odd prime or prime power ($s \geq 5$).

Value

A list containing design parameters, non-randomized layouts, and randomized layouts.

TCpRepEfficiency *Efficiency Measures for p-Rep Test-Control Designs*

Description

Computes efficiency measures for partially replicated (p-rep) test-control designs. The function calculates average variances for test-versus-test and test-versus-control comparisons, together with the canonical efficiency factor.

Usage

```
TCpRepEfficiency(design, test)
```

Arguments

`design` A design matrix containing test and control treatments.
`test` Number of test treatments in the design.

Value

A data frame containing average variance measures and the canonical efficiency factor.

Examples

```
design <- matrix(c(
  1,6,11,"C1",
  2,5,12,"C1",
  3,8,9,"C1",
  4,7,10,"C1",
  1,7,12,"C1",
  2,8,11,"C1",
  1,8,10,"C1",
  2,7,9,"C1",
  3,6,12,"C1",
  4,5,11,"C1",
  3,5,10,"C1",
  4,6,9,"C1"
), byrow = TRUE, ncol = 4)

TCpRepEfficiency(design, test = 12)
```

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