Package ‘soiltestcorr’

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Title Soil Test Correlation and Calibration
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Description A compilation of functions designed to assist users on the correlation analysis of crop yield and soil test values. Functions to estimate crop response patterns to soil nutrient availability and critical soil test values using various approaches such as: 1) the modified arcsine-log calibration curve (Correndo et al. (2017) <doi:10.1071/CP16444>); 2) the graphical Cate-Nelson quadrants analysis (Cate & Nelson (1965)), 3) the statistical Cate-Nelson quadrants analysis (Cate & Nelson (1971) <doi:10.2136/sssaj1971.03615995003500040048x>), 4) the linear-plateau regression (Anderson & Nelson (1975) <doi:10.2307/2529422>), 5) the quadratic-plateau regression (Bullock & Bullock (1994) <doi:10.2134/agronj1994.00021962008600010033x>), and 6) the Mitscherlich-type exponential regression (Melsted & Peck (1977) <doi:10.2134/asaspectpub29.c1>). The package development stemmed from ongoing work with the Fertilizer Recommendation Support Tool (FRST) and Feed the Future Innovation Lab for Collaborative Research on Sustainable Intensification (SIIL) projects.
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Description

This function runs the quadrants analysis suggested by Cate and Nelson (1965)

Usage

cate_nelson_1965(data = NULL, stv, ry, target, tidy = FALSE, plot = FALSE)

Arguments

data
argument to call a data.frame or data.table containing the data
stv
argument to call the vector or column containing the soil test value (stv) data
ry
argument to call the vector or column containing the relative yield (ry) data
target
argument to specify the ry target (numeric) to estimate the critical stv for
tidy
logical operator (TRUE/FALSE) to decide the type of return. TRUE returns a data.frame, FALSE returns a list (default).
plot
logical operator (TRUE/FALSE) to decide the type of return. TRUE returns a ggplot, FALSE returns either a list (tidy == FALSE) or a data.frame (tidy == TRUE).

Details

See online-documentation for additional details.
Value
returns an object of type ggplot if plot = TRUE.
returns an object of class data.frame if tidy = TRUE,
returns an object of class list if tidy = FALSE.

Note
This code was adapted from Mangiafico, S. S. (2013). Cate-Nelson Analysis for Bivariate Data Using R-project. The Journal of Extension, 51(5), Article 33. https://tigerprints.clemson.edu/joe/vol51/iss5/33/

References

See Also
eval_tidy, defusing-advanced lm, anova ggplot, aes, geom_point, labs, geom_abline, annotate, theme

Examples

# Example 1 dataset
dat <- data.frame("ry" = c(65,80,85,88,90,94,96,97,95,98,100,99,99,100),
    "stv" = c(1,2,3,4,5,6,7,8,9,10,11,12,13,14,15))

# Run
fit_example_cn_1965 <- cate_nelson_1965(data = dat, ry = ry, stv = stv, target = 90, tidy=FALSE, plot=FALSE)
fit_example_cn_1965
Arguments

data argument to call a data.frame or data.table containing the data
stv argument to call the vector or column containing the soil test value (stv) data
ry argument to call the vector or column containing the relative yield (ry) data
tidy logical operator (TRUE/FALSE) to decide the type of return. TRUE returns a
data.frame, FALSE returns a list (default).
plot logical operator (TRUE/FALSE) to decide the type of return. TRUE returns a
ggplot, FALSE returns either a list (tidy == FALSE) or a data.frame (tidy ==
TRUE).

Details

See online-documentation for additional details.

Value

returns an object of type ggplot if plot = TRUE.
returns an object of class data.frame if tidy = TRUE,
returns an object of class list if tidy = FALSE.

Note

This code was adapted from Mangiafico, S. S. (2013). Cate-Nelson Analysis for
edu/joe/vol51/iss5/33/

References

Cate & Nelson (1971). A simple statistical procedure for partitioning soil test correlation data into

See Also

eval_tidy,defusing-advanced lm,anova ggplot,aes,geom_point,labs,geom_abline,annotate.theme

Examples

# Example 1 dataset
dat <- data.frame("ry" = c(65,80,85,88,90,94,93,96,97,95,98,100,99,99,100),
"stv" = c(1,2,3,4,5,6,7,8,9,10,11,12,13,14,15))

# Run
fit_example_cn_1971 <- cate_nelson_1971(data = dat,
ry = ry, stv = stv, tidy=FALSE, plot=FALSE)

fit_example_cn_1971
**data_test**  

**Dataset 1**

**Description**
Example dataset containing hypothetical pairs of soil test value (STV) and relative yield (RY).

**Usage**
data_test

**Format**
this data frame has 137 rows and the following 2 columns:

- **STV** soil test value
- **RY** relative yield, %

**Source**
doi:10.7910/DVN/NABA57

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**freitas1966**  

**Dataset 2**

**Description**
Example dataset containing real data reported by Cate & Nelson (1971) from Freitas et al. (1966). Soil test potassium values (STK) and relative yield as percentage (RY).

**Usage**
freitas1966

**Format**
this data frame has 24 rows and the following 2 columns:

- **RY** relative yield, %
- **STK** soil test potassium, ppm

**Source**
**linear_plateau**

*Linear-plateau response function*

**Description**

This function helps to fit a linear-plateau model in order to estimate critical soil test values (CSTV) above which yield response becomes flat.

**Usage**

\[ LP_f(x, \text{intercept}, \text{slope}, \text{cx}) \]

\[ SS_LP(x, \text{intercept}, \text{slope}, \text{cx}) \]

\[
\text{linear_plateau(}
  \text{data = NULL,}
  \text{stv,}
  \text{ry,}
  \text{target = NULL,}
  \text{tidy = FALSE,}
  \text{plot = FALSE,}
  \text{resid = FALSE}
\text{)}
\]

**Arguments**

- **x**: selfstart vector for independent variable, Default: NULL
- **intercept**: selfstart arg. for intercept Default: NULL
- **slope**: selfstart arg. for slope Default: NULL
- **cx**: selfstart arg. for critical X (cx) value Default: NULL
- **data**: Optional argument to call and object of type data.frame or data.table containing the soil test value (STV) and relative yield (RY) data, Default: NULL
- **stv**: name of the vector containing soil test values (-) of type numeric.
- **ry**: name of the vector containing relative yield values (%) of type numeric.
- **target**: numeric value of relative yield target (e.g. 90 for 90%) to estimate the CSTV. The target needs to be < plateau, otherwise, target = plateau.
- **tidy**: logical operator (TRUE/FALSE) to decide the type of return. TRUE returns a data.frame, FALSE returns a list (default).
- **plot**: logical operator (TRUE/FALSE) to plot the linear-plateau model, Default: FALSE
- **resid**: logical operator (TRUE/FALSE) to plot residuals analysis, Default: FALSE

**Details**

See [online-documentation](#) for additional details.
Value

returns an object of type ggplot if plot = TRUE.
returns a residuals plot if resid = TRUE.
returns an object of class data.frame if tidy = TRUE,
returns an object of class list if tidy = FALSE.

LP_f: vector of the same length as x using the linear-plateau function
SS_LP: selfStart object to pass into the linear_plateau fit

linear_plateau: function

Note

For extended reference, we recommend to visit: https://gradcylinder.org/linear-plateau/ & https://github.com/austinwpearce/SoilTestCocaCola
by Austin Pearce. Self-start function code adapted from nlraa package by F. Miguez

References


See Also

eval_tidy, defusing-advanced nlsLM, AIC, lm, optim, coef, predict, AICc, model-quality nlsResiduals

Examples

```r
# Example dataset
dat <- data.frame("ry" = c(65,80,85,88,90,94,96,97,95,98,99,100),
                  "stv" = c(1,2,3,4,5,6,7,8,9,10,11,12,13,14,15))

# Run
fit_example_lp <- linear_plateau(data = dat,
                      ry = ry, stv = stv, resid = TRUE, plot = FALSE)
fit_example_lp
```

mitscherlich

*Mitscherlich response function*

Description

This function helps to fit a Mitscherlich response model for relative yield (ry) as a function of soil test values (stv).
Usage

mits_formula_1(x, a, b, c)

mits_formula_2(x, b, c)

mits_formula_3(x, c)

mitscherlich(
  data = NULL,
  stv,
  ry,
  type,
  target = NULL,
  tidy = FALSE,
  plot = FALSE,
  resid = FALSE
)

Arguments

x selfstart vector. for model fit Default: NULL
a selfstart arg. for asymptote, Default: NULL
b selfstart arg. for xintercept Default: NULL
c selfstart arg. for curvature Default: NULL
data Optional argument to call and object of type data.frame or data.table containing
  the stv and ry data, Default: NULL
stv name of the vector containing soil test values (-) of type numeric.
ry name of the vector containing relative yield values (%) of type numeric.
type string or number that indicates the type of Mitscherlich model to fit. Default: 1
  type = "no restrictions" or type = 1 for model with 'no restrictions';
type = "asymptote 100" or type = 2 for model with 'asymptote = 100';
type = "asymptote 100 from 0" or type = 3 for model with 'asymptote = 100 and xintercept = 0"
target numeric value of relative yield target (e.g. 90 for 90%) to estimate the CSTV.
  Default: NULL
tidy logical operator (TRUE/FALSE) to decide the type of return. TRUE returns a
  data.frame, FALSE returns a list (default).
plot logical operator (TRUE/FALSE) to plot the Mitscherlich model, Default: FALSE
resid logical operator (TRUE/FALSE) to plot residuals analysis, Default: FALSE

Details

See online-documentation for additional details.
mod_alcc

Value
returns an object of type ggplot if plot = TRUE.
returns a residuals plot if resid = TRUE.
returns an object of class data.frame if tidy = TRUE,
returns an object of class list if tidy = FALSE.
Mitscherlich type 1 formula
Mitscherlich type 2 formula
Mitscherlich type 3 formula
mitscherlich: function

Note
For extended reference, we recommend to visit: https://github.com/austinwpearce/SoilTestCocaCola by Austin Pearce.

References

See Also
eval_tidy,defusing-advanced nlsLM,AIC lm,optim,coefficient,predict AICc model-quality nlsResiduals, bind ggplot,aes,geom_rug,geom_point,geom_abline,geom_path,annotate,labs,theme

Examples

# Example dataset
dat <- data.frame("ry" = c(65,80,85,88,90,94,93,96,95,98,100,99,99,100),
  "stv" = c(1,2,3,4,5,6,7,8,9,10,11,12,13,14,15))

# Run
fit_example_mits <- mitscherlich(data = dat, type = 1,
  ry = ry, stv = stv, resid = TRUE, plot = FALSE)

fit_example_mits

mod_alcc

Modified Arcsine-Log Calibration Curve

Description
This function runs the modified arcsine-log calibration curve to estimate critical soil test values (CSTV) following Correndo et al. (2017)
Usage

mod_alcc(
    data = NULL,
    ry,
    stv,
    target,
    confidence = 0.95,
    tidy = FALSE,
    plot = FALSE
)

Arguments

data: Optional argument to call and object of type data.frame or data.table containing the stv and ry data. Default: NULL
ry: name of the vector containing relative yield values (%) of type numeric.
stv: name of the vector containing soil test values of type numeric.
target: numeric value of relative yield target (e.g. 90 for 90%) to estimate the CSTV.
confidence: numeric value of confidence level (e.g. 0.95 for significance = 0.05)
tidy: logical operator (TRUE/FALSE) to decide the type of return. TRUE returns a data.frame, FALSE returns a list (default).
plot: logical operator (TRUE/FALSE) to decide the type of return. TRUE returns a ggplot, FALSE returns either a list (tidy == FALSE) or a data.frame (tidy == TRUE).

Details

See online-documentation for additional details.

Value

returns an object of type ggplot if plot = TRUE.
returns an object of class data.frame if tidy = TRUE,
returns an object of class list if tidy = FALSE.

Note

For extended reference, we recommend to visit doi:10.7910/DVN/NABA57 and https://github.com/adriancorrendo/modified-ALCC by Adrian Correndo.

References

### quadratic_plateau

**Quadratic-plateau response function**

This function helps to fit a quadratic-plateau response model and to estimate a critical soil test values (CSTV) above which yield response becomes flat.

**Usage**

```r
QP_f(x, intercept, slope, Xc)
SS_QP(x, intercept, slope, Xc)
quadratic_plateau(
  data = NULL,
  stv,
  ry,
  target = NULL,
  tidy = FALSE,
  plot = FALSE,
  resid = FALSE
)
```

**Arguments**

- `x` : selfstart vector for independent variable, Default: NULL
- `intercept` : selfstart arg. for intercept Default: NULL
- `slope` : selfstart arg. for slope Default: NULL
- `Xc` : selfstart arg. for critical value Default: NULL
- `data` : Optional argument to call and object of type data.frame or data.table containing the stv and ry data, Default: NULL

**Examples**

```r
# Example 1 dataset
dat <- data.frame("ry" = c(65,80,85,90,94,93,96,97,95,98,100,99,99,100),
  "stv" = c(1,2,3,4,5,6,7,8,9,10,11,12,13,14,15))

# Run
fit_example <- mod_alcc(data = dat, ry = ry, stv = stv, target=90, confidence = 0.95)
fit_example
```

**See Also**

eval_tidy, defusing-advanced TDist, cor.test, sbind, filter, nest, ggplot, aes, geom_point, scale_manual, geom_abline, annotate
quadratic_plateau

stv  name of the vector containing soil test values (-) of type numeric.
ry   name of the vector containing relative yield values (%) of type numeric.
target numeric value of relative yield target (e.g. 90 for 90%) to estimate the CSTV. The target needs to be < plateau, otherwise, target = plateau.
tidy  logical operator (TRUE/FALSE) to decide the type of return. TRUE returns a data.frame, FALSE returns a list (default).
plot  logical operator (TRUE/FALSE) to plot the quadratic-plateau model, Default: FALSE
resid logical operator (TRUE/FALSE) to plot residuals analysis, Default: FALSE

Details

See online-documentation for additional details.

Value

returns an object of type ggplot if plot = TRUE.
returns a residuals plot if resid = TRUE.
returns an object of class data.frame if tidy = TRUE.
returns an object of class list if tidy = FALSE.

QP_f: vector of the same length as x using the quadratic-plateau function
SS_QP: selfStart object to pass into the quadratic_plateau fit

Note

For extended reference, we recommend to visit https://gradcylinder.org/quad-plateau/ & https://github.com/austinwpearce/SoilTestCocaCola by Austin Pearce. Self-start function code adapted from nlraa package by F. Miguez https://github.com/femiguez/nlraa

References


See Also
eval_tidy, defusing-advanced nlsLMAIC, lm, optim, coef, predict AICc model-quality nlsResiduals bind ggplot, aes, geom_rug, geom_point, geom_abline, geom_path, annotate, labs, theme annotate
Examples

# Example dataset
dat <- data.frame("ry" = c(65,80,85,90,94,96,97,98,100,99,99,100),
                  "stv" = c(1,2,3,4,5,6,7,8,9,10,11,12,13,14,15))

# Run
fit_example_qp <- quadratic_plateau(data = dat,
                                     ry = ry, stv = stv, resid = TRUE, plot = FALSE)
fit_example_qp
Index

* datasets
  data_test, 5
  freitas1966, 5
  freitas1966, 5
  cate_nelson_1965, 2
  cate_nelson_1971, 3
  coef, 7, 9, 12
  cor, 11
  cor.test, 11
  data_test, 5
  eval_tidy, 3, 4, 7, 9, 11, 12
  filter, 11
  freitas1966, 5
  geom_abline, 3, 4, 7, 9, 11, 12
  geom_path, 7, 9, 11, 12
  geom_point, 3, 4, 7, 9, 11, 12
  geom_rug, 7, 9, 11, 12
  ggplot, 3, 4, 7, 9, 11, 12
  labs, 3, 4, 7, 9, 11, 12
  linear_plateau, 6
  lm, 3, 4, 7, 9, 12
  LP_f(linear_plateau), 6
  mits_formula_1(mitscherlich), 7
  mits_formula_2(mitscherlich), 7
  mits_formula_3(mitscherlich), 7
  mitscherlich, 7
  mod_alcc, 9
  nest, 11
  nlsLM, 7, 9, 12
  nlsResiduals, 7, 9, 12
  optim, 7, 9, 12
  predict, 7, 9, 12
  QP_f(quadratic_plateau), 11
  quadratic_plateau, 11
  scale_manual, 11
  sd, 11
  SS_LP(linear_plateau), 6
  SS_QP(quadratic_plateau), 11
  TDist, 11
  theme, 3, 4, 7, 9, 11, 12