

# Package ‘AgroTech’

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**Type** Package

**Title** Data Analysis of Pesticide Application Technology

**Version** 1.0.2

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**Description** In total it has 7 functions, three for calculating machine calibration, which determine application rate (L/ha), nozzle flow (L/min) and amount of product (L or kg) to be added. to the tank with each sprayer filling. Two functions for graphs of the flow distribution of the nozzles (L/min) in the application bar and, of the temporal variability of the meteorological conditions (air temperature, relative humidity of the air and wind speed). Two functions to determine the spray deposit (uL/cm<sup>2</sup>), through the methodology called spectrophotometry, with the aid of bright blue (Palladini, L.A., Raitano, C.G., Velini, E.D. (2005), <doi:10.1590/S0103-90162005000500005>) or metallic markers (Chaim, A., Castro, V.L.S.S., Correles, F.M., Galvão, J.A.H., Cabral, O.M.R., Nicolella, G. (1999), <doi:10.1590/S0100-204X1999000500003>). The package supports the analysis and representation of information, using a single free software that meets the most diverse areas of activity in application technology.

**Encoding** UTF-8

**RoxygenNote** 7.2.1

**Imports** ggplot2, gridExtra, xlsx, readxl, ggrepel, stats, nortest, lmtest, crayon, utils

**License** GPL (>= 2)

**Depends** R (>= 3.6)

**NeedsCompilation** no

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example_markblue	<i>Dataset: Example markblue</i>
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---

**Description**

The data are part of an experiment that studied the spray deposit

**Usage**

```
data(example_markblue)
```

**Format**

data.frame containing data set

curva Vector with curves

TRATAMENTO Numeric vector with treatment

repe Numeric vector with repetition

Abs Numeric vector with absorbance

area Numeric vector with area

**Author(s)**

Rodrigo Yudi Palhaci Marubayashi, <marubayashi@uel.br>  
 Gabriel Danilo Shimizu  
 Otavio Jorge Grigoli Abi Saab

**Examples**

```
data(example_markblue)
```

---

example\_markbluecurve *Dataset: Example markbluecurve*

---

**Description**

The data are part of an experiment that studied the spray deposit

**Usage**

```
data(example_markbluecurve)
```

**Format**

data.frame containing data set

curva Vector with curve

Amostra Numeric vector with sample

Abs Numeric vector with absorbance

ppm Numeric vector with concentration

**Author(s)**

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Gabriel Danilo Shimizu

Otavio Jorge Grigoli Abi Saab

**Examples**

```
data(example_markbluecurve)
```

---

example\_markmet *Dataset: Example markmet*

---

**Description**

The data are part of an experiment that studied the spray deposit

**Usage**

```
data(example_markmet)
```

**Format**

data.frame containing data set  
trat Vector with treatment  
repe Numeric vector with repetition  
ppm Numeric vector with concentration

**Author(s)**

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Gabriel Danilo Shimizu  
Otavio Jorge Grigoli Abi Saab

**Examples**

```
data(example_markmet)
```

---

```
example_meteorological
```

*Dataset: Example meteorological*

---

**Description**

The data come from a meteorological station on a rural property in the city of Rolandia/PR

**Usage**

```
data("example_meteorological")
```

**Format**

data.frame containing data set  
tempo Numeric vector with time  
temp Numeric vector with air temperature  
ur Numeric vector with relative humidity  
vento Numeric vector with wind speed

**Author(s)**

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Otavio Jorge Grigoli Abi Saab

**Examples**

```
data(example_meteorological)
```

---

`flowgrap`*Flow graphic of nozzles on spray bar*

---

**Description**

This is a function to check the conditions of the spray nozzles

**Usage**

```
flowgrap(  
  file,  
  pointsize = 3.5,  
  xsup = 1.1,  
  xinf = 0.9,  
  pointcolor = "red",  
  xlab = "Nozzle number",  
  ylab = NA  
)
```

**Arguments**

<code>file</code>	Numerical vector with the flows
<code>pointsize</code>	Point size ( <i>default 3.5</i> )
<code>xsup</code>	Upper limit
<code>xinf</code>	Bottom limit
<code>pointcolor</code>	Point color (red)
<code>xlab</code>	x axis legend
<code>ylab</code>	y axis legend

**Value**

Returns graph of ggplot2

**Author(s)**

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Gabriel Danilo Shimizu

Otavio Jorge Grigoli Abi Saab

## References

ANDEF Associação Nacional de Defesa Vegetal. Manual de tecnologia de aplicação de produtos fitossanitários. Campinas: Linea Creativa, 2004. 50p.

BOLLER, W.; RAETANO, C. G. Bicos e pontas de pulverização de energia hidráulica, regulagens e calibração de pulverizadores de barras. In: ANTUNIASI, U. R.; BOLLER, W. (Organizadores). Tecnologia de aplicação para culturas anuais. Passo Fundo: Aldeia Norte; Botucatu: FEPAF, 2011. p.51-82.

SPRAYING SYSTEMS CO. Catálogo 51A-PT - Produtos de pulverização para agricultura. Wheaton: Spraying Systems Co., 2014. 160p.

## Examples

```
resp=c(881,854,865,876,906.3,
874.7,868.3,878.7,872.7,901.7,
823.3,889.7,861.3,900.3,890.3,
886.7,916.7,872,912.7,894)
flowgrap(resp)
# flowgrap("file.xlsx")
```

---

flowpres

*Flow calculation as a function of working pressure*

---

## Description

This is a function to determine the flow rate of a spray nozzle as a function of the working pressure

## Usage

```
flowpres(q1, q2, p1, p2)
```

## Arguments

q1	Nozzle flow 1 (L/min)
q2	Nozzle flow 2 (L/min)
p1	Nozzle pressure 1 (bar)
p2	Nozzle pressure 2 (bar)

## Details

Nozzle flow 1:

$$q1 = \frac{\sqrt{p1}}{\sqrt{p2}} * q2$$

Nozzle flow 2:

$$q2 = \frac{q1}{\frac{\sqrt{p1}}{\sqrt{p2}}}$$

Nozzle pressure 1:

$$p1 = (\sqrt{p2} * \frac{q1}{q2})^2$$

Nozzle pressure 2:

$$p2 = (\frac{\sqrt{p1}}{\frac{q1}{q2}})^2$$

### Value

Returns values of flow (L/min) or pressure (bar)

### Author(s)

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Gabriel Danilo Shimizu

Otavio Jorge Grigoli Abi Saab

### References

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BOLLER, W.; RAETANO, C. G. Bicos e pontas de pulverizacao de energia hidraulica, regulagens e calibracao de pulverizadores de barras. In: ANTUNIASSI, U. R.; BOLLER, W. (Organizadores). Tecnologia de aplicacao para culturas anuais. Passo Fundo: Aldeia Norte; Botucatu: FEPAF, 2011. p.51-82.

SPRAYING SYSTEMS CO. Catalogo 51A-PT - Produtos de pulverizacao para agricultura. Wheaton: Spraying Systems Co., 2014. 160p.

### See Also

[flowrat product](#)

### Examples

```
flowpres(q1=NA, q2=0.80, p1=1.00, p2=2.80)
```

```
flowpres(q1=0.48, q2=0.80, p1=1.00, p2=NA)
```

---

flowrat

*Calculation of required spray nozzle flow*

---

### Description

This is a function to determine the required flow rate of a spray nozzle

### Usage

```
flowrat(Q, q, V, W = 50)
```

**Arguments**

Q	Application rate (L/ha)
q	Nozzle flow (L/min)
V	Sprayer speed (km/h)
W	Spacing between spray nozzles (cm)

**Details**

Application rate (L/ha):

$$Q = \frac{60000 * q}{V * W}$$

Nozzle flow (L/min):

$$q = \frac{Q * (V * W)}{60000}$$

Sprayer speed (km/h):

$$V = \frac{60000 * q}{Q * W}$$

Spacing between spray nozzles (m):

$$W = \frac{60000 * q}{Q * V}$$

**Value**

Returns values for flow, application rate, sprayer speed, spacing between spray tips

**Note**

60000 Units conversion factor

**Author(s)**

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**References**

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BOLLER, W.; RAETANO, C. G. Bicos e pontas de pulverização de energia hidráulica, regulagens e calibração de pulverizadores de barras. In: ANTUNIASSI, U. R.; BOLLER, W. (Organizadores). Tecnologia de aplicação para culturas anuais. Passo Fundo: Aldeia Norte; Botucatu: FEPAF, 2011. p.51-82.

SPRAYING SYSTEMS CO. Catalogo 51A-PT - Produtos de pulverização para agricultura. Wheaton: Spraying Systems Co., 2014. 160p.



**See Also**[flowpres product](#)**Examples**

```
flowrat(Q = 190,q = NA,V = 10,W = 50)
```

---

markblue

*Spray deposit (glowing blue marker)*

---

**Description**

This is a function to determine spray deposit using bright blue marker and then after performing tests of assumptions, analysis of variance and comparison of means

**Usage**

```
markblue(  
  d1,  
  d2,  
  v1,  
  ci,  
  ncu2 = 1,  
  ntrat2 = 2,  
  nrep2 = 3,  
  nresp2 = 5,  
  naf2 = 6,  
  analysis = TRUE,  
  design = "DIC",  
  transf = 1,  
  quali = TRUE,  
  grau = 1,  
  test = "parametric",  
  mcomp = "tukey",  
  ylab = expression(mu ~ cm^2),  
  save.xlsx = FALSE  
)
```

**Arguments**

d1	Curved worksheet
d2	Experiment worksheet
v1	Wash volume (mL)
ci	Initial marker concentration
ncu2	Column referring to the curve ( <i>default</i> is 1)

ntrat2	Column referring to treatment
nrep2	Column referring to repetition
nresp2	Column referring to absorbance
naf2	Sheet area (cm <sup>2</sup> )
analysis	Perform statistical analysis
design	Experiment design
transf	Data transformation
quali	Qualitative or quantitative treatment ( <i>default</i> is TRUE)
grau	degree of the polynomial (when treatment is quantitative)
test	Parametric or Nonparametric ( <i>default</i> is "parametric")
mcomp	Mean comparison test ( <i>default</i> is "tukey")
ylab	y axis name ( <i>default</i> is expression( $\mu \sim \text{cm}^2$ ))
save.xlsx	Want to export in excel format ( <i>default</i> is FALSE)

**Value**

Returns the comparison between the treatments of the experiment

**Note**

Curve name on the curve worksheet (d1) must be the same as the curve name on the experiment worksheet (d2)

**Author(s)**

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**References**

No reference

**See Also**

[markmet](#)

**Examples**

```
data("example_markbluecurve")
data("example_markblue")
markblue(d1=example_markbluecurve,
         d2=example_markblue,
         v1=20,
         ci=1500,
         ncu2 = 1,
```

```

ntrat2 = 2,
nrep2 = 3,
nresp2 = 4,
naf2 = 5)

```

---

markmet

*Spray deposit (metallic marker)*


---

### Description

This is a function to determine spray deposit using metallic markers and then after performing tests of assumptions, analysis of variance and comparison of means

### Usage

```

markmet(
  ppm,
  white,
  VL,
  AL,
  analysis = TRUE,
  trat,
  block,
  design = "DIC",
  transf = 1,
  quali = TRUE,
  grau = 1,
  test = "parametric",
  mcomp = "tukey",
  ylab = expression(mu ~ cm^2),
  save.xlsx = FALSE
)

```

### Arguments

ppm	Concentração
white	White reading
VL	Wah volume (mL)
AL	blade area (cm2)
analysis	Perform statistical analysis
trat	Vector with treatment
block	Vector with block (if design = "DBC")
design	Experiment design
transf	Data transformation
quali	Qualitative or quantitative treatment ( <i>default</i> is TRUE)

grau	degree of the polynomial (when treatment is quantitative)
test	Parametric or Nonparametric ( <i>default</i> is "parametric")
mcomp	Mean comparison test ( <i>default</i> is "tukey")
y1ab	y axis name ( <i>default</i> is expression( $\mu \sim cm^2$ ))
save.xlsx	Want to export in excel format ( <i>default</i> is FALSE)

**Value**

Returns the comparison between the treatments of the experiment

**Author(s)**

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Gabriel Danilo Shimizu

Otavio Jorge Grigoli Abi Saab

**References**

No reference

**See Also**

[markblue](#)

**Examples**

```
library(AgroTech)
data("example_markmet")
with(example_markmet,
      markmet(ppm = ppm,
             white = 0.02,
             VL = 35,
             AL = 63.61,
             analysis = TRUE,
             trat=trat))
```

---

product

*Amount of phytosanitary product per spray tank*

---

**Description**

This is a function to determine the amount of commercial product to be placed in the sprayer tank at each fill

**Usage**

```
product(Ct, Dose, Q)
```

**Arguments**

Ct	Spray tank volumetric capacity (L)
Dose	Product dose to be applied (L/ha, mL/ha, kg/ha, g/ha)
Q	Application rate (L/ha)

**Value**

Returns values for amount of product (L or kg)

**Author(s)**

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Gabriel Danilo Shimizu  
Otavio Jorge Grigoli Abi Saab

**References**

ANDEF Associacao Nacional de Defesa Vegetal. Manual de tecnologia de aplicacao de produtos fitossanitarios. Campinas: Linea Creativa, 2004. 50p.

BOLLER, W.; RAETANO, C. G. Bicos e pontas de pulverizacao de energia hidraulica, regulagens e calibracao de pulverizadores de barras. In: ANTUNIASSI, U. R.; BOLLER, W. (Organizadores). Tecnologia de aplicacao para culturas anuais. Passo Fundo: Aldeia Norte; Botucatu: FEPAF, 2011. p.51-82.

SPRAYING SYSTEMS CO. Catalogo 51A-PT - Produtos de pulverizacao para agricultura. Wheaton: Spraying Systems Co., 2014. 160p.

**See Also**

[flowpres](#) [flowrat](#)

**Examples**

```
product(Ct = 800,Dose = 200,Q = 100)
```

---

vartemp

*Temporal variability graph of weather conditions*

---

**Description**

This is a function to check weather conditions in agricultural spraying

**Usage**

```
vartemp(  
  file,  
  nx = 1,  
  ny = 2,  
  variable = NA,  
  ylab = "Dependent",  
  xlab = "Independent",  
  size.text = 12,  
  size.title = 12,  
  size.strip = 12,  
  size.lty = 0.7  
)
```

**Arguments**

file	Excel file (xlsx)
nx	Time
ny	Weather conditions
variable	Variable name
ylab	y axis (Dependent)
xlab	x axis (Independent)
size.text	Size text ( <i>default</i> is 12)
size.title	Size title ( <i>default</i> is 12)
size.strip	Size strip ( <i>default</i> is 12)
size.lty	Size line ( <i>default</i> is 0.7)

**Value**

Returns graph of ggplot2

**Author(s)**

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Gabriel Danilo Shimizu

Otavio Jorge Grigoli Abi Saab

**References**

No reference

**Examples**

```
data("example_meteorological")  
vartemp(example_meteorological)
```

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