

*Ανάλυση Διασποράς με δύο παράγοντες
(μία παρατήρηση ανά συνδυασμό αγωγών)*

```
> blend_rep(paste("Blend",1:5),4)
```

```
> treatment_rep(LETTERS[1:4],rep(5,4))
```

```
> yield_scan()
```

```
1: 89 84 81 87 79
```

```
6: 88 77 87 92 81
```

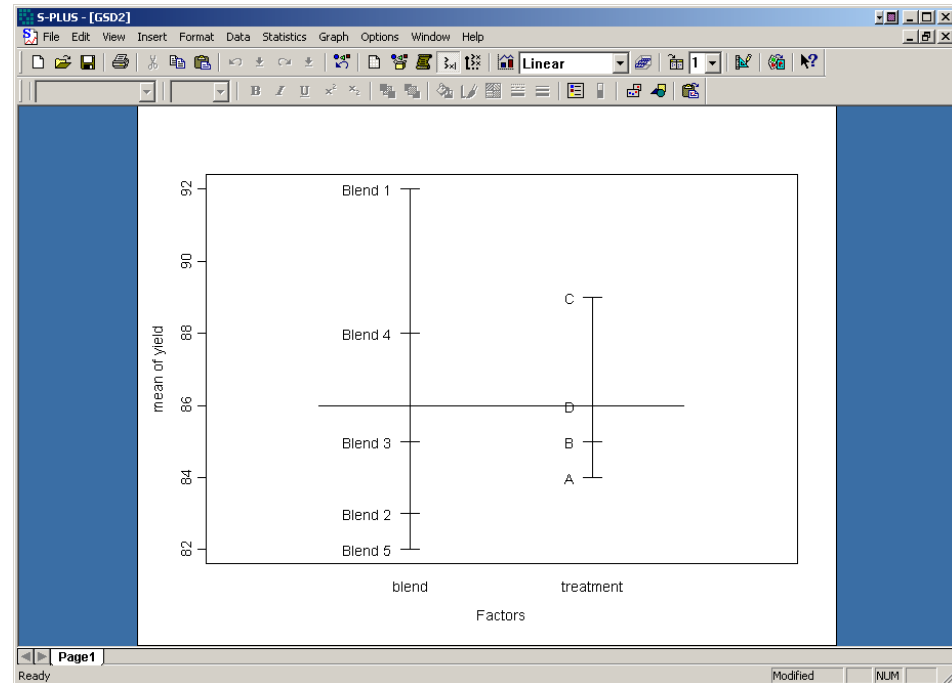
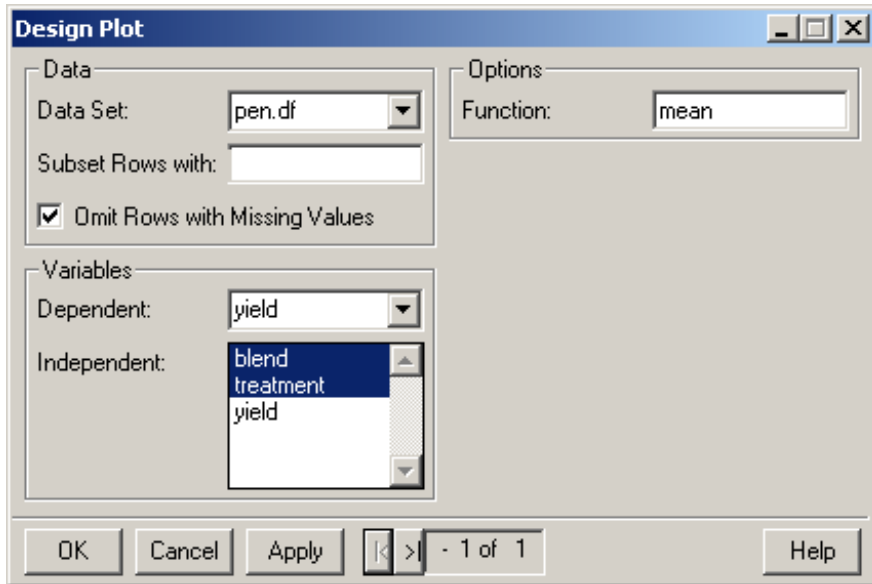
```
11: 97 92 87 89 80
```

```
16: 94 79 85 84 88
```

```
21:
```

```
> pen.df_data.frame(blend,treatment,yield)
```

> **plot.design(pen.df,fun=median)**



```
> par(mfrow=c(1,2))
> plot.factor(pen.df)
```

Factor Plot

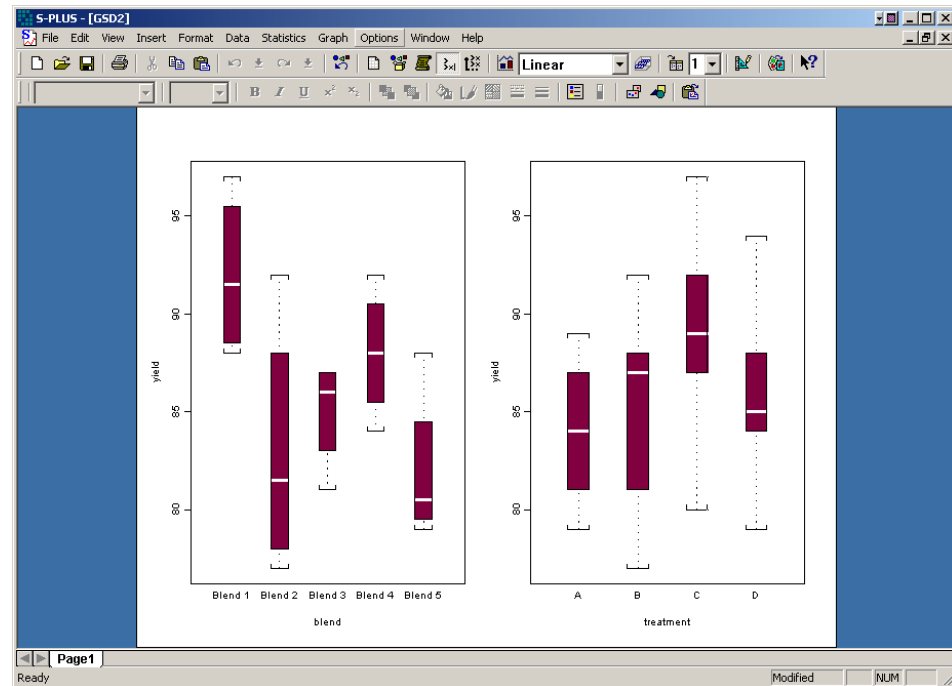
Data
Data Set: pen.df
Subset Rows with:
 Omit Rows with Missing Values

Options
Type: Boxplot
 Rotate X-Axis Labels
 Include Boxplot Means

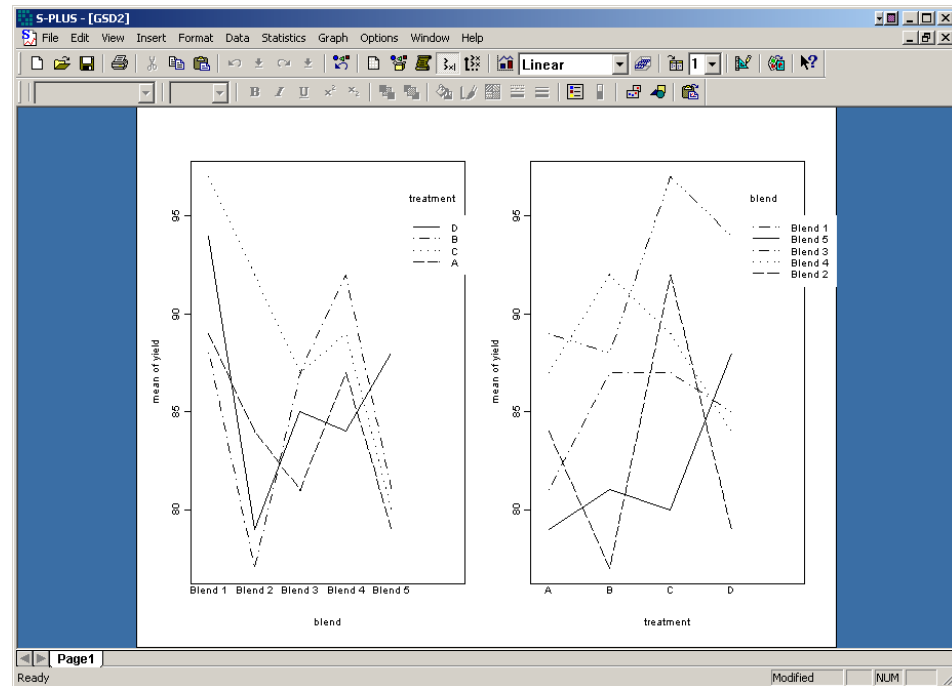
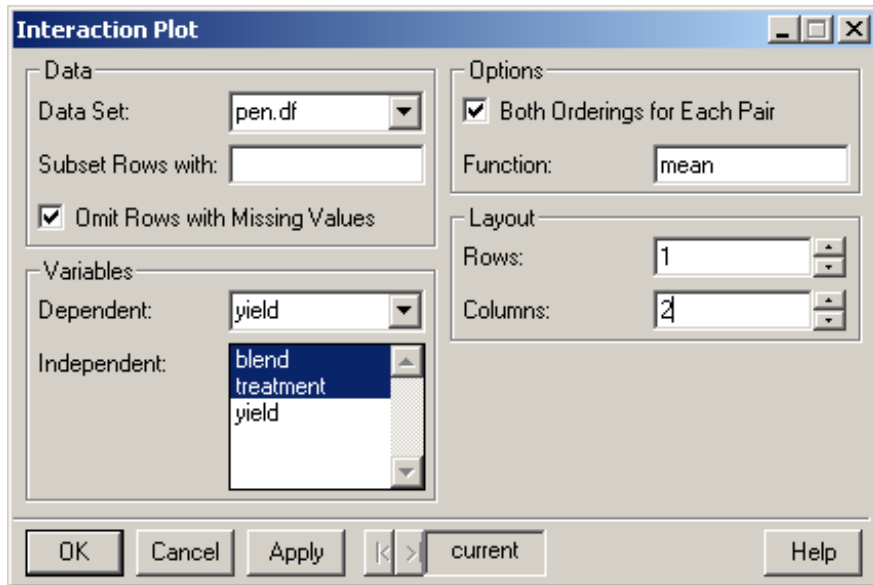
Variables
Dependent: yield
Independent: blend, treatment, yield

Layout
Rows: 1
Columns: 2

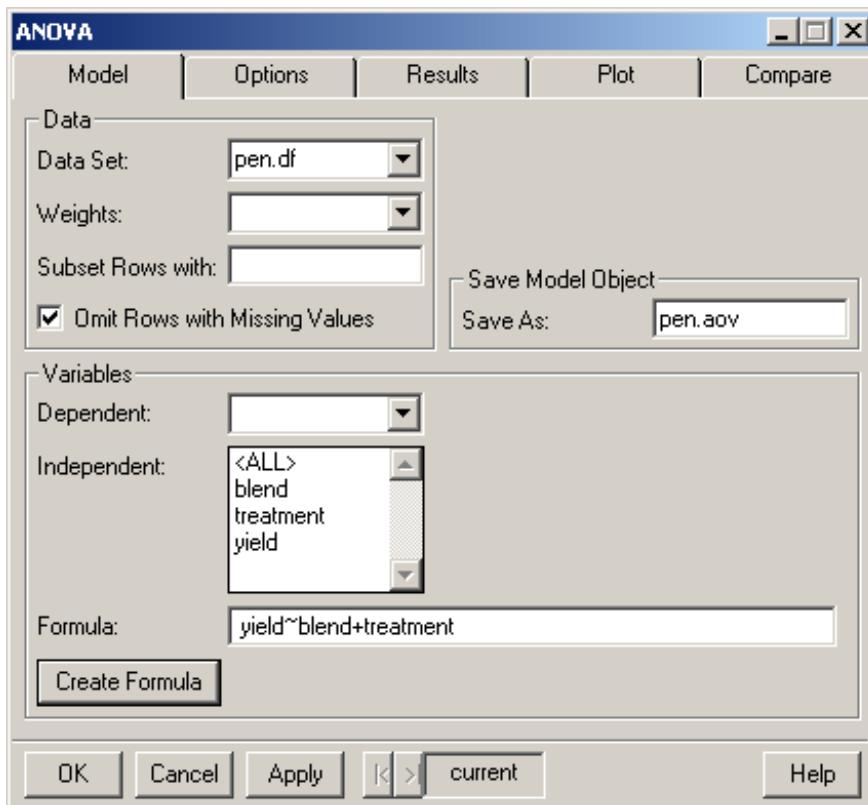
OK Cancel Apply < > current Help



- > **attach(pen.df)**
- > **interaction.plot(treatment, blend, yield)**
- > **interaction.plot(blend, treatment, yield)**
- > **detach()**



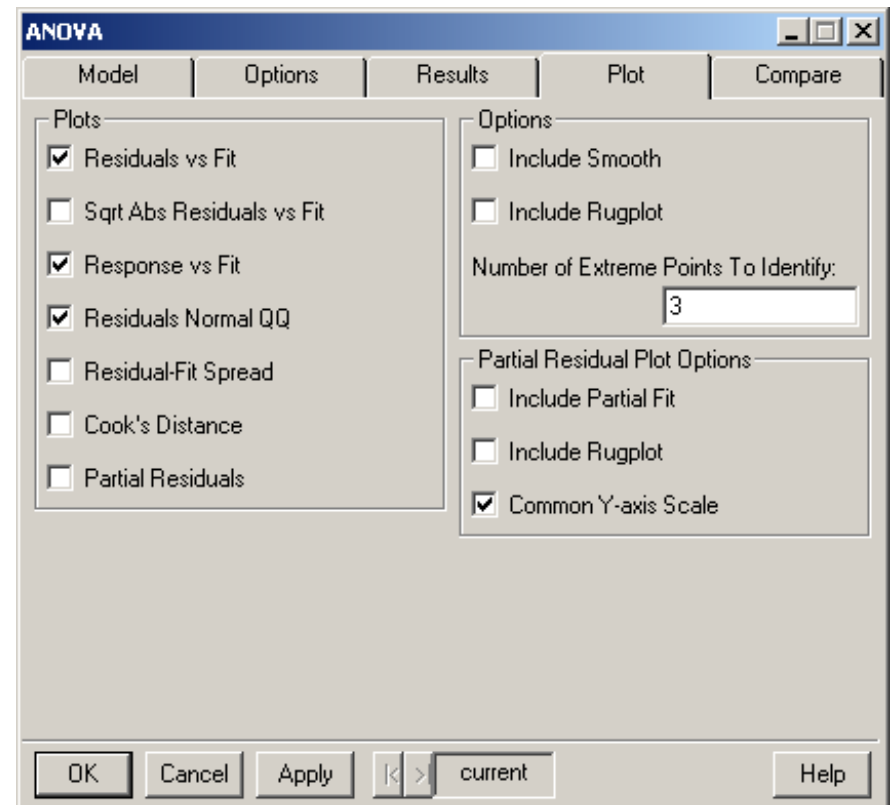
- > `pen.aov_aov(yield~blend+treatment,pen.df)`
- > `qqnorm(resid(pen.aov))`
- > `plot(fitted(pen.aov),resid(pen.aov))`



The ANOVA dialog box is shown with the 'Model' tab selected. It contains the following fields and options:

- Data:** Data Set: pen.df; Weights: (empty); Subset Rows with: (empty); Omit Rows with Missing Values; Save Model Object: Save As: pen.aov
- Variables:** Dependent: (empty); Independent: <ALL>, blend, treatment, yield; Formula: yield~blend+treatment; Create Formula button

Buttons at the bottom: OK, Cancel, Apply, < >, current, Help



The ANOVA dialog box is shown with the 'Plots' and 'Options' tabs selected. It contains the following fields and options:

- Plots:** Residuals vs Fit; Sqrt Abs Residuals vs Fit; Response vs Fit; Residuals Normal QQ; Residual-Fit Spread; Cook's Distance; Partial Residuals
- Options:** Include Smooth; Include Rugplot; Number of Extreme Points To Identify: 3; **Partial Residual Plot Options:** Include Partial Fit; Include Rugplot; Common Y-axis Scale

Buttons at the bottom: OK, Cancel, Apply, < >, current, Help

> summary(pen.aov)

	Df	Sum of Sq	Mean Sq	F Value	Pr (F)
blend	4	264	66.00000	3.504425	0.0407462
treatment	3	70	23.33333	1.238938	0.3386581
Residuals	12	226	18.83333		

Multiple Comparisons

Model Selection
Model Object: pen.aov
Name String Match:

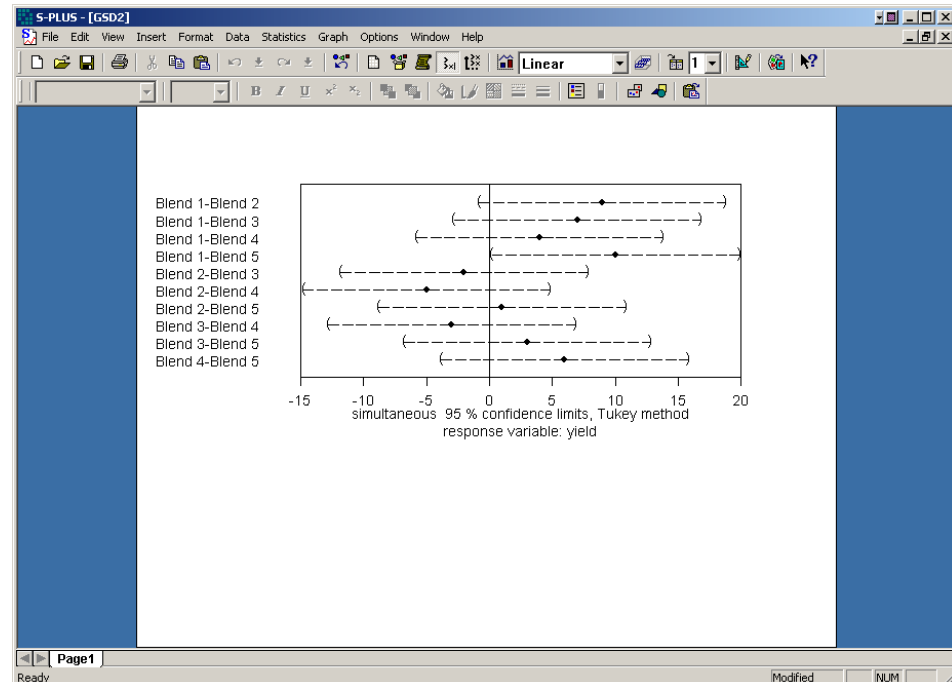
Variable
Levels Of: blend
Comparison Type: mca
Compare To Level:

Options
Method: best.fast
Confidence Level: 0.95
Bounds: upper.and.lower
Error Type: family-wise
Adjust For:
Contrast Matrix:
Critical Point:
Simulation Size:
Scheffe Rank:

Results
Save As:
 Print Results
 Plot Intervals

Validity Check
 Estimability Check

OK Cancel Apply - 1 of 1 Help



```
> tukey.1(pen.aov,pen.df)
```

```
$p.value:
```

```
[1] 0.7597822
```

```
> comp.plot(pen.aov,pen.df)
```

```
$theta.hat:
```

```
[1] 4.002165
```

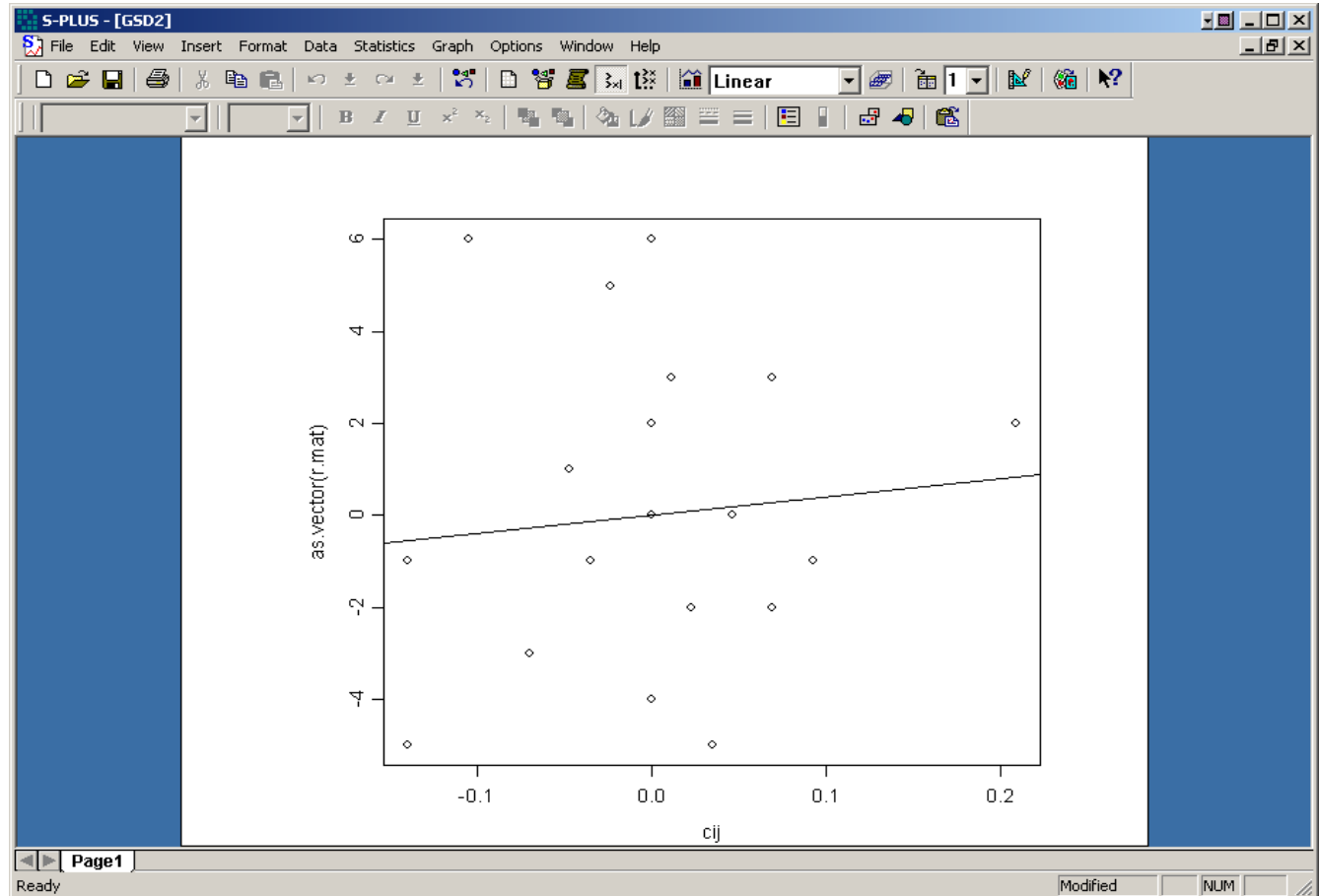
```
$std.error:
```

```
[1] 9.980428
```

```
$R.squared:
```

```
R2
```

```
0.008854346
```



$$y_{ij} = u + a_i + b_j + \Theta a_i b_j + e_{ij}$$

$$T_{1df} = (IJ - I - J) \frac{SS_{\Theta}}{SS_{res.1}}$$

$$SS_{\Theta} = \frac{\left(\sum_{i=1}^I \sum_{j=1}^J \hat{\alpha}_i^A \hat{\alpha}_j^B y_{ij} \right)^2}{\sum_{i=1}^I (\hat{\alpha}_i^A)^2 \sum_{j=1}^J (\hat{\alpha}_j^B)^2}$$

$$SS_{res.1} = SS_{res} - SS_{\Theta}$$

$$SS_{res} = \sum_{i=1}^I \sum_{j=1}^J r_{ij}^2$$

$$Y_{ij} = \mu + t_i + e_{ij}$$

df EMS

Αγωγές $p - 1$ $\rho^2_e + n \sigma^2_t$

Σφάλμα $p(n-1)$ ρ^2_e

- Υπόθεση: $H_0: t_j = 0$ (για όλα τα j)

t_j τυχαίο δείγμα από $N(0, \rho^2_t)$

df EMS

Αγωγές $p - 1$ $\rho^2_e + n \rho^2_t$

Σφάλμα $p(n-1)$ ρ^2_e

- Υπόθεση: $H_0: \rho^2_t = 0$

```
> is.random(pen.df$blend)_T
```

```
> is.random(pen.df)
```

```
blend treatment
```

```
  T    F
```

```
> pen.vc_varcomp(yield~blend,pen.df)
```

```
> summary(pen.vc)
```

```
Call:
```

```
varcomp(formula = yield ~ blend, data = pen.df)
```

```
Variance Estimates:
```

```
      Variance
```

```
blend 11.56667
```

```
Residuals 19.73333
```

```
Method: minque0
```

```
Coefficients:
```

```
(Intercept)
```

```
      86
```

```
Approximate Covariance Matrix of Coefficients:
```

```
[1] 3.3
```

```
>
```

$$Y_{ijk} = \mu + a_i + b_j + (ab)_{ij} + e_{ijk}$$