Βιομετρία

Ενότητα 1η: ANOVA Tables for Various Experiments

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Ευρωπαϊκή Ένωση
Ευρωπαϊκό Κοινωνικό Ταμείο
ΕΠΙΧΕΙΡΗΣΙΑΚΟ ΠΡΟΓΡΑΜΜΑ
ΕΚΠΑΙΔΕΥΣΗ ΚΑΙ ΔΙΑ ΒΙΟΥ ΜΑΘΗΣΗ
επένδυση στην κοινωνία της γνώσης
ΥΠΟΥΡΓΕΙΟ ΠΑΙΔΕΙΑΣ & ΘΡΗΣΚΕΥΜΑΤΩΝ, ΠΟΛΙΤΙΣΜΟΥ & ΑΘΛΗΤΙΣΜΟΥ
ΕΙΔΙΚΗ ΥΠΗΡΕΣΙΑ ΔΙΑΧΕΙΡΙΣΗΣ
ΕΣΠΑ 2007-2013
πρόγραμμα για την ανάπτυξη
ΕΥΡΩΠΑΪΚΟ ΚΟΙΝΩΝΙΚΟ ΤΑΜΕΙΟ
Με τη συγχρηματοδότηση της Ελλάδας και της Ευρωπαϊκής Ένωσης

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- Το έργο υλοποιείται στο πλαίσιο του Επιχειρησιακού Προγράμματος «Εκπαίδευση και Δια Βίου Μάθηση» και συγχρηματοδοτείται από την Ευρωπαϊκή Ένωση (Ευρωπαϊκό Κοινωνικό Ταμείο) και από εθνικούς πόρους.

ANOVA Tables for Various Experiments

Ενότητα 1η

Βιομετρία
Τμήμα Γεωπονίας

Factor Structures

Crossed and Nested Factors (1)

- Two factors are **crossed** if every level of one factor is combined with every level of the other factor. The individual factors are called **main effects**, while the crossed factors form an **interaction effect**.

Crossed and Nested Factors (2)

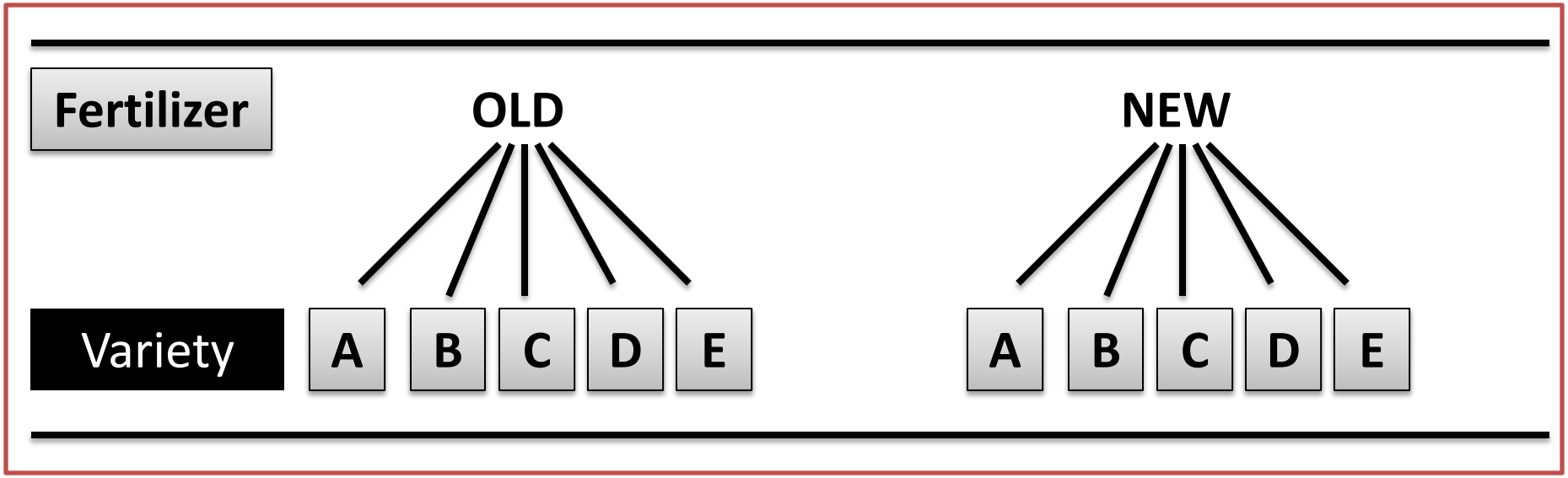


Figure 1.
Design structure of an experiment with two factors crossed with one other

Figure 1 is called a stick diagram. The lines, or sticks, indicate the relationships between the levels of the two factors

Crossed and Nested Factors (3)

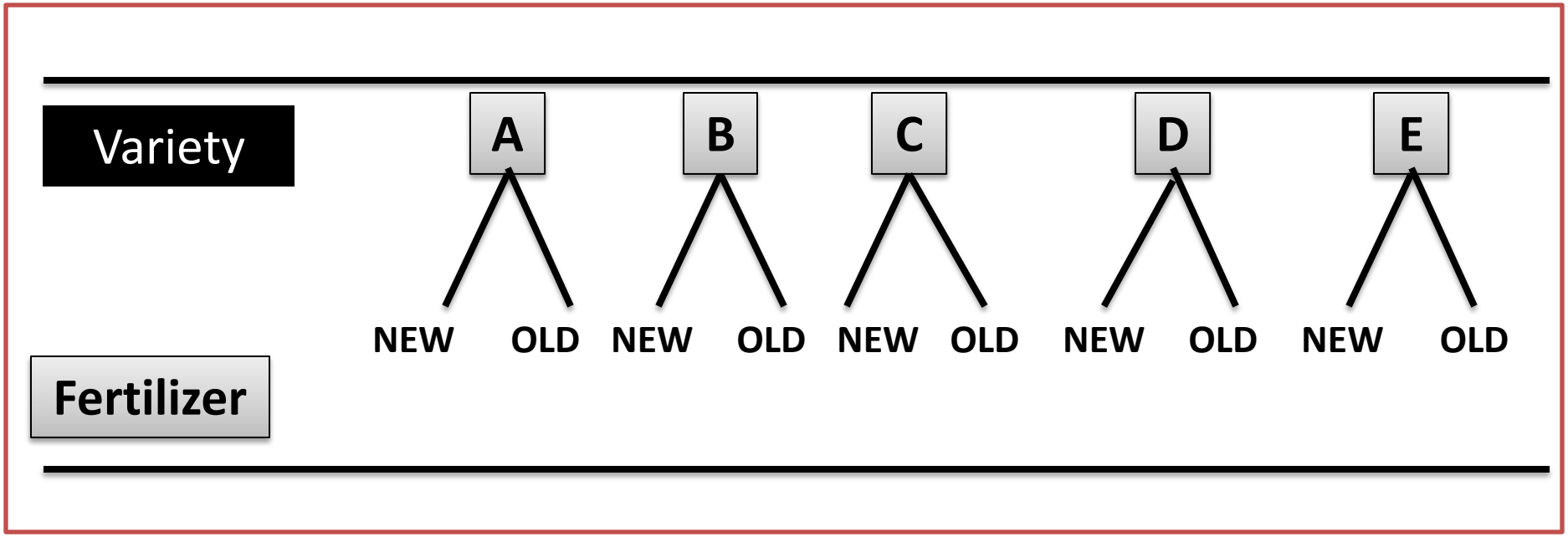


Figure 1.
Alternative stick diagram for the two-factor crossed experiment

Crossed and Nested Factors (4)

- A factor is **nested** when each level of the nested factor occurs with only one or a combination of levels of the other factor or factors.

Crossed and Nested Factors (5)

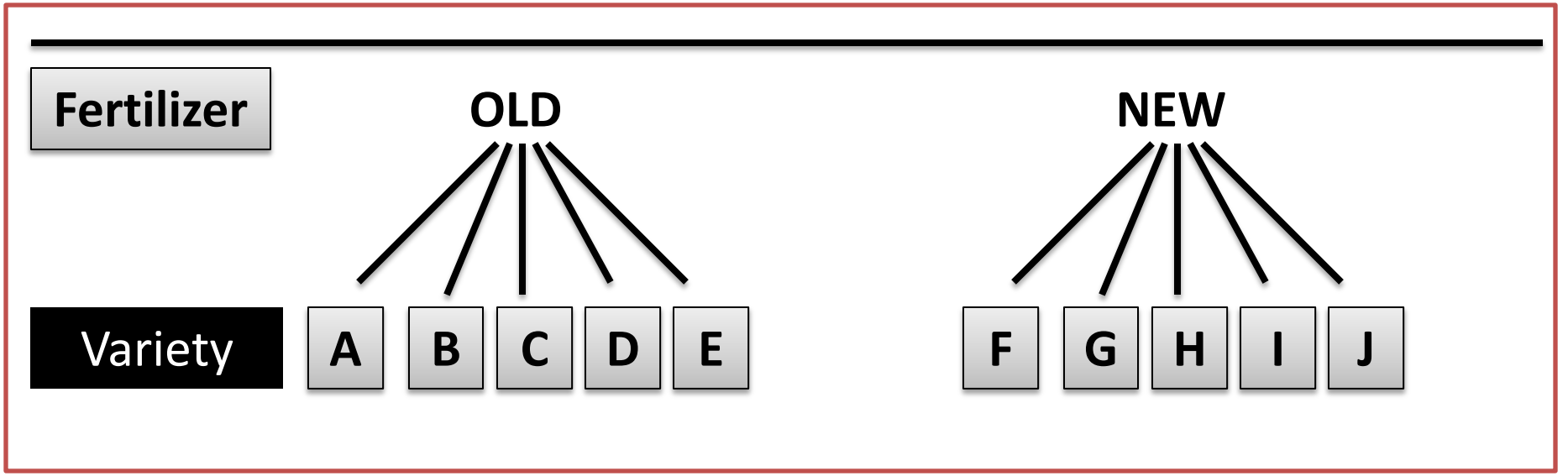


Figure 3.

Design structure of a one-factor nested experiment

Crossed and Nested Factors (6)

- The nested factor ‘‘variety’’ would never occur by itself in an ANOVA table; rather it would always be denoted in the nested notation **variety(fertilizer)**.
- The nested factor is usually random, but unlike the crossed relationship, the nested relationship is not symmetrical. In a stick diagram, the nested factor is always drawn below the main factor.
- A nested factor never forms an interaction effect with the main factor(s) within which it is nested.

Crossed and Nested Factors (7)

- It can, however, be crossed with other factors. For example, the factor relationship: **temperature*variety (fertilizer)** is **valid**.
- It indicates that each level of the temperature factor combines with each level of the variety factor which is nested within the fertilizer factor.

Crossed and Nested Factors (8)

- If the temperature factor has three levels (e.g., high, medium, and low), then there are thirty ($3 \times 10 = 30$) combinations of temperature, variety, and fertilizer.
- On the other hand, the factor relationship **fertilizer*variety (fertilizer)** is **not valid** because the variety factor cannot be nested with, and crossed with, the fertilizer factor at the same time.

Degrees of Freedom (1)

- A source containing **a single factor** has degrees of freedom **one less than its number of levels**.
- A source containing **nested factors** has degrees of freedom **equal to the product of the number of levels of each factor inside the parentheses**, and the number of levels minus one of each factor outside the parentheses.
- .

Degrees of Freedom (2)

- A source containing **crossed factors** has degrees of freedom **equal to the product of the number of levels minus one of each factor in the source**.
- The **total degrees of freedom** in a model is **one less than the total number of observations**.

Some Examples

Table 1.

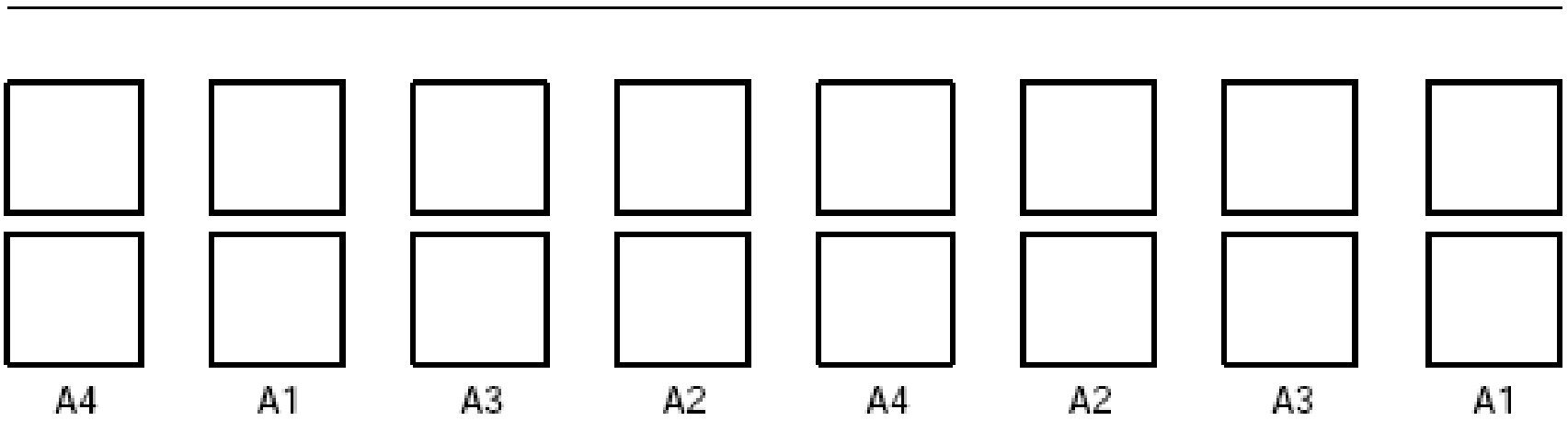
Hypothetical sources of variation and their degrees of freedom

Source	df	Comments
A	a-1	Single factor
B (A)	(b-1) (a)	B nested within A
A* B	(a-1) (b-1)	A crossed with B
D*B (A)	(d-1) (b-1) (a)	D crossed with B nested within A
B (AD)	(b-1) (a) (d)	B nested within A and D

Split Plot Designs

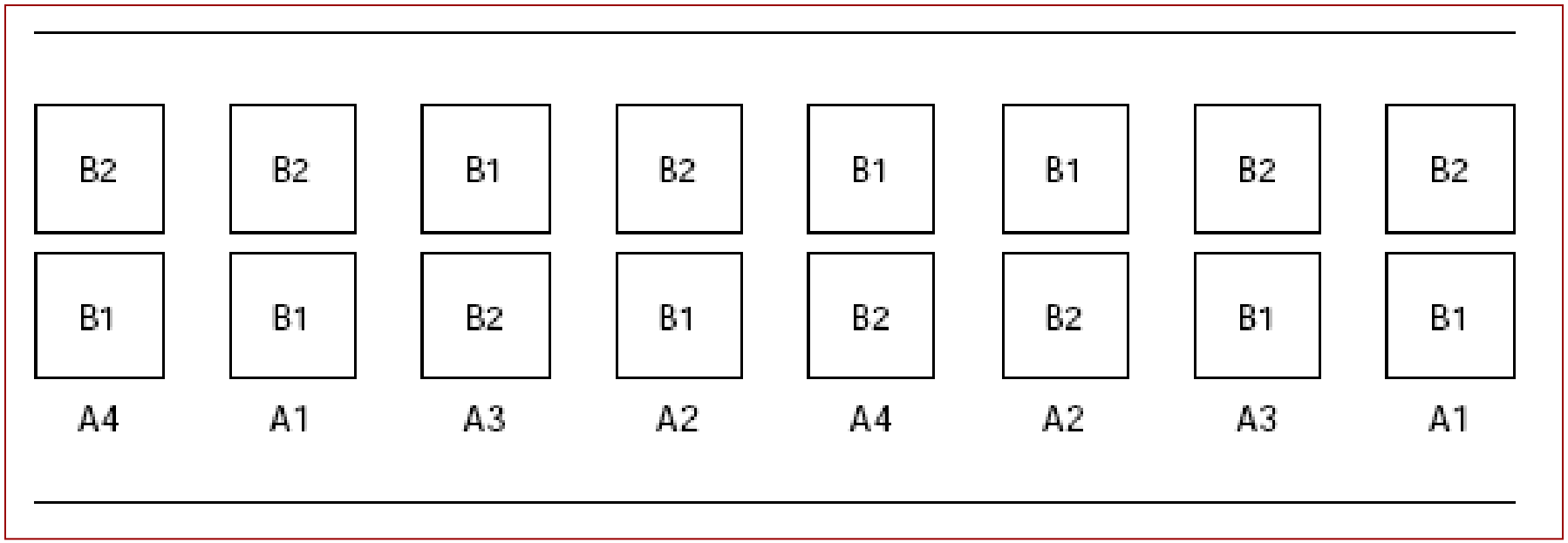
Main Plots for Factor A

- Main-plots of a completely randomized split-plot design.
- Each pair of squares is an experimental unit for factor A



Factor B is a Split on Factor A

- A completely randomized split-plot layout



ANOVA Tables

Two Factor Completely Randomized Design

FACTOR: ANOVA Table for this model

K Value	Source	Degrees of Freedom
2	Factor A	a-1
4	Factor B	b-1
6	AB	(a-1)(b-1)
-7	Error	ab(r-1)

Completely Randomized Design for Factor A…

…Factor B is a Split Plot

FACTOR: ANOVA Table for this model

K Value	Source	Degrees of Freedom
2	Factor A	a-1
-3	Error	a(r-1)
4	Factor B	b-1
6	AB	(a-1)(b-1)
-7	Error	a(r-1)(b-1)

Three Factor Completely Randomized Design

FACTOR: ANOVA Table for this model

K Value	Source	Degrees of Freedom
2	Factor A	a-1
4	Factor B	b-1
6	AB	(a-1)(b-1)
8	Factor C	c-1
10	AC	(a-1)(c-1)
12	BC	(b-1)(c-1)
14	ABC	(a-1)(b-1)(c-1)
-15	Error	abc(r-1)

Completely Randomized Design for Factor A…

…Factors B and C are Split Plots on A

FACTOR: ANOVA Table for this model

K Value	Source	Degrees of Freedom
2	Factor A	a-1
-3	Error	a(r-1)
4	Factor B	b-1
6	AB	(a-1)(b-1)
8	Factor C	c-1
10	AC	(a-1)(c-1)
12	BC	(b-1)(c-1)
14	ABC	(a-1)(b-1)(c-1)
-15	Error	a(r-1)(bc-1)

Completely Randomized Design for Factors A and B…

…Factor C is a Split Plot on A and B

FACTOR: ANOVA Table for this model

K Value	Source	Degrees of Freedom
2	Factor A	a-1
4	Factor B	b-1
6	AB	(a-1)(b-1)
-7	Error	ab(r-1)
8	Factor C	c-1
10	AC	(a-1)(c-1)
12	BC	(b-1)(c-1)
14	ABC	(a-1)(b-1)(c-1)
-15	Error	ab(r-1)(c-1)

Four Factor Completely Randomized Design

FACTOR: ANOVA Table for this model

K Value	Source	Degrees of Freedom
2	Factor A	a-1
4	Factor B	b-1
6	AB	(a-1)(b-1)
8	Factor C	c-1
10	AC	(a-1)(c-1)
12	BC	(b-1)(c-1)
14	ABC	(a-1)(b-1)(c-1)
16	Factor D	d-1
18	AD	(a-1)(d-1)
20	BD	(b-1)(d-1)
22	ABD	(a-1)(b-1)(d-1)
24	CD	(c-1)(d-1)
26	ACD	(a-1)(c-1)(d-1)
28	BCD	(b-1)(c-1)(d-1)
30	ABCD	(a-1)(b-1)(c-1)(d-1)
-31	Error	abcd(r-1)

One Factor Randomized Complete Block Design

FACTOR: ANOVA Table for this model

K Value	Source	Degrees of Freedom
1	Replication	r-1
2	Factor A	a-1
-3	Error	(r-1)(a-1)

Two Factor Randomized Complete Block Design

FACTOR: ANOVA Table for this model

K Value	Source	Degrees of Freedom
1	Replication	r-1
2	Factor A	a-1
4	Factor B	b-1
6	AB	(a-1)(b-1)
-7	Error	(ab-1)(r-1)

Randomized Complete Block Design for Factor A…

…with Factor B a Split Plot on A

FACTOR: ANOVA Table for this model

K Value	Source	Degrees of Freedom
1	Replication	r-1
2	Factor A	a-1
-3	Error	(r-1)(a-1)
4	Factor B	b-1
6	AB	(a-1)(b-1)
-7	Error	a(r-1)(b-1)

Three Factor Randomized Complete Block Design

FACTOR: ANOVA Table for this model

K Value	Source	Degrees of Freedom
1	Replication	r-1
2	Factor A	a-1
4	Factor B	b-1
6	AB	(a-1)(b-1)
8	Factor C	c-1
10	AC	(a-1)(c-1)
12	BC	(b-1)(c-1)
14	ABC	(a-1)(b-1)(c-1)
-15	Error	(r-1)(abc-1)

Randomized Complete Block Design for Factor A…

… with Factors B and C as Split Plots on A

FACTOR: ANOVA Table for this model

K Value	Source	Degrees of Freedom
1	Replication	r-1
2	Factor A	a-1
-3	Error	(r-1)(a-1)
4	Factor B	b-1
6	AB	(a-1)(b-1)
8	Factor C	c-1
10	AC	(a-1)(c-1)
12	BC	(b-1)(c-1)
14	ABC	(a-1)(b-1)(c-1)
-15	Error	a(r-1)(bc-1)

Randomized Complete Block Design for Factors A and B…

… with Factor C as a Split Plot on A and B

FACTOR: ANOVA Table for this model

K Value	Source	Degrees of Freedom
1	Replication	r-1
2	Factor A	a-1
4	Factor B	b-1
6	AB	(a-1)(b-1)
-7	Error	(ab-1)(r-1)
8	Factor C	c-1
10	AC	(a-1)(c-1)
12	BC	(b-1)(c-1)
14	ABC	(a-1)(b-1)(c-1)
-15	Error	ab(r-1)(c-1)

Randomized Complete Block Design for Factor A…

… with Factor B as a Split Plot on A and Factor C as a Split Plot on B

FACTOR: ANOVA Table for this model

K Value	Source	Degrees of Freedom
1	Replication	r-1
2	Factor A	a-1
-3	Error	(r-1)(a-1)
4	Factor B	b-1
6	AB	(a-1)(b-1)
-7	Error	a(r-1)(b-1)
8	Factor C	c-1
10	AC	(a-1)(c-1)
12	BC	(b-1)(c-1)
14	ABC	(a-1)(b-1)(c-1)
-15	Error	ab(r-1)(c-1)

Four Factor Randomized Complete Block Design

FACTOR: ANOVA Table for this model

K Value	Source	Degrees of Freedom
1	Replication	r-1
2	Factor A	a-1
4	Factor B	b-1
6	AB	(a-1)(b-1)
8	Factor C	c-1
10	AC	(a-1)(c-1)
12	BC	(b-1)(c-1)
14	ABC	(a-1)(b-1)(c-1)
16	Factor D	d-1
18	AD	(a-1)(d-1)
20	BD	(b-1)(d-1)
22	ABD	(a-1)(b-1)(d-1)
24	CD	(c-1)(d-1)
26	ACD	(a-1)(c-1)(d-1)
28	BCD	(b-1)(c-1)(d-1)
30	ABCD	(a-1)(b-1)(c-1)(d-1)
-31	Error	By Subtraction

One Factor Randomized Complete Block Design…

…Combined over Locations

(or Combined over Years)

FACTOR: ANOVA Table for this model

K Value	Source	Degrees of Freedom
1	Location	l-1
-3	Error	l(r-1)
4	Factor A	a-1
5	LA	(l-1)(a-1)
-7	Error	l(r-1)(a-1)

One Factor Randomized Complete Block Design…

… Combined over Locations and Years, with new Locations each Year

FACTOR: ANOVA Table for this model

K Value	Source	Degrees of Freedom
1	Year	y-1
3	L(Y)	y(l-1)
7	R(LY)	yl(r-1)
8	Factor A	a-1
9	YA	(y-1)(a-1)
11	LA(Y)	y(l-1)(a-1)
-15	Error	y(r-1)(a-1)

Randomized Complete Block Design Combined over Locations and Years…

…with the same Locations each Year

but Randomized

FACTOR: ANOVA Table for this model

K Value	Source	Degrees of Freedom
1	Year	y-1
2	Location	l-1
3	YL	(y-1)(l-1)
7	R(LY)	yl(r-1)
8	Factor A	a-1
9	YA	(y-1)(a-1)
10	LA	(l-1)(a-1)
11	YLA	(y-1)(l-1)(a-1)
-15	Error	yl(r-1)(a-1)

Randomized Complete Block Design Combined over Locations and Years…

… same Locations and Randomization each Year (Perennial Crops)

FACTOR: ANOVA Table for this model

K Value	Source	Degrees of Freedom
1	Location	l-1
3	R(L)	l(r-1)
4	Year	y-1
5	LY	(l-1)(y-1)
7	RY(L)	l(r-1)(y-1)
8	Factor A	a-1
9	LA	(l-1)(a-1)
12	YA	(y-1)(a-1)
13	LYA	(l-1)(y-1)(a-1)
-15	Error	ly(r-1)(a-1)

Two Factor Randomized Complete Block Design…

…Combined over Locations (or Combined over Years)

FACTOR: ANOVA Table for this model

K Value	Source	Degrees of Freedom
1	Location	l-1
3	R(L)	l(r-1)
4	Factor A	a-1
5	LA	(l-1)(a-1)
8	Factor B	b-1
9	LB	(l-1)(b-1)
12	AB	(a-1)(b-1)
13	LAB	(l-1)(a-1)(b-1)
-15	Error	l(r-1)(a-1)(b-1)

Two Factor Randomized Complete Block Design with Split Plot…

…Combined over Locations

FACTOR: ANOVA Table for this model

K Value	Source	Degrees of Freedom
1	Location	l-1
3	R(L)	l(r-1)
4	Factor A	a-1
5	LA	(l-1)(a-1)
-7	Error	l(r-1)(a-1)
8	Factor B	b-1
9	LB	(l-1)(b-1)
12	AB	(a-1)(b-1)
13	LAB	(l-1)(a-1)(b-1)
-15	Error	la(r-1)(b-1)

Two Factor Randomized Complete Block Design…

… Combined over Locations and Years, New Location each Year

FACTOR: ANOVA Table for this model

K Value	Source	Degrees of Freedom
1	Year	y-1
3	L(Y)	y(l-1)
7	R(LY)	yl(r-1)
8	Factor A	a-1
9	YA	(y-1)(a-1)
11	LA(Y)	y(l-1)(a-1)
16	Factor B	b-1
17	YB	(y-1)(b-1)
19	LB(Y)	y(l-1)(b-1)
24	AB	(a-1)(b-1)
25	YAB	(y-1)(a-1)(b-1)
27	LAB(Y)	y(l-1)(a-1)(b-1)
-31	Error	yl(r-1)(ab-1)

Two Factor Randomized Complete Block Design…

… Combined over Locations and Years, same Location but Randomized each Year

FACTOR: ANOVA Table for this model

K Value	Source	Degrees of Freedom
1	Year	y-1
2	Location	l-1
3	YL	(y-1)(l-1)
7	R(LY)	yl(r-1)
8	Factor A	a-1
9	YA	(y-1)(a-1)
10	LA	(l-1)(a-1)
11	YLA	(y-1)(l-1)(a-1)
16	Factor B	b-1
17	YB	(y-1)(b-1)
18	LB	(l-1)(b-1)
19	YLB	(y-1)(l-1)(b-1)
24	AB	(a-1)(b-1)
25	YAB	(y-1)(a-1)(b-1)
26	LAB	(l-1)(a-1)(b-1)
27	YLAB	(y-1)(l-1)(a-1)(b-1)
-31	Error	yl(r-1)(ab-1)

Two Factor Randomized Complete Block Design…

… Combined over Locations and Years, same Location and Randomization each Year

FACTOR: ANOVA Table for this model

K Value	Source	Degrees of Freedom
1	Location	l-1
3	R(L)	l(r-1)
4	Year	y-1
5	LY	(l-1)(y-1)
7	RY(L)	l(r-1)(y-1)
8	Factor A	a-1
9	LA	(l-1)(a-1)
12	YA	(y-1)(a-1)
13	LYA	(l-1)(y-1)(a-1)
16	Factor B	b-1
17	LB	(l-1)(b-1)
20	YB	(y-1)(b-1)
21	LYB	(l-1)(y-1)(b-1)
24	AB	(a-1)(b-1)
25	LAB	(l-1)(a-1)(b-1)
28	YAB	(y-1)(a-1)(b-1)
29	LYAB	(l-1)(y-1)(a-1)(b-1)
-31	Error	By Subtraction

Two Factor Randomized Complete Block Design with Split…

… Combined over Locations and Years, New Location each Year

FACTOR: ANOVA Table for this model

K Value	Source	Degrees of Freedom
1	Year	y-1
3	L(Y)	y(l-1)
7	R(LY)	yl(r-1)
8	Factor A	a-1
9	YA	(y-1)(a-1)
11	LA(Y)	y(l-1)(a-1)
-15	Error	y(r-1)(a-1)
16	Factor B	b-1
17	YB	(y-1)(b-1)
19	LB(Y)	y(l-1)(b-1)
24	AB	(a-1)(b-1)
25	YAB	(y-1)(a-1)(b-1)
27	LAB(Y)	y(l-1)(a-1)(b-1)
-31	Error	y(r-1)(lab-a-1)

Two Factor Randomized Complete Block Design with Split…

… Combined over Locations and Years, same Location but Randomized each Year

FACTOR: ANOVA Table for this model

K Value	Source	Degrees of Freedom
1	Year	y-1
2	Location	l-1
3	YL	(y-1)(l-1)
7	R(LY)	yl(r-1)
8	Factor A	a-1
9	YA	(y-1)(a-1)
10	LA	(l-1)(a-1)
11	YLA	(y-1)(l-1)(a-1)
-15	Error	yl(r-1)(a-1)
16	Factor B	b-1
17	YB	(y-1)(b-1)
18	LB	(l-1)(b-1)
19	YLB	(y-1)(l-1)(b-1)
24	AB	(a-1)(b-1)
25	YAB	(y-1)(a-1)(b-1)
26	LAB	(l-1)(a-1)(b-1)
27	YLAB	(y-1)(l-1)(a-1)(b-1)
-31	Error	yl(ra-1)(b-1)

Two Factor Randomized Complete Block Design with Split…

…Combined over Locations and Years, same Location and Randomization each Year

FACTOR: ANOVA Table for this model

K Value	Source	Degrees of Freedom
1	Location	l-1
3	R(L)	l(r-1)
4	Year	y-1
5	LY	(l-1)(y-1)
7	RY(L)	l(r-1)(y-1)
8	Factor A	a-1
9	LA	(l-1)(a-1)
12	YA	(y-1)(a-1)
13	LYA	(l-1)(y-1)(a-1)
-15	Error	ly(r-1)(a-1)
16	Factor B	b-1
17	LB	(l-1)(b-1)
20	YB	(y-1)(b-1)
21	LYB	(l-1)(y-1)(b-1)
24	AB	(a-1)(b-1)
25	LAB	(l-1)(a-1)(b-1)
28	YAB	(y-1)(a-1)(b-1)
29	LYAB	(l-1)(y-1)(a-1)(b-1)
-31	Error	By Subtraction

Two Factor Randomized Complete Block Design using Strip Plots

FACTOR: ANOVA Table for this model

K Value	Source	Degrees of Freedom
1	Replication	r-1
2	Horizontal Factor A	a-1
-3	Error (a)	(r-1)(a-1)
4	Vertical Factor B	b-1
-5	Error (b)	(r-1)(b-1)
6	AB	(a-1)(b-1)
-7	Error (c)	(r-1)(a-1)(b-1)

Three Factor Randomized Complete Block Design...

… with the Treatments Arranged in Strips

FACTOR: ANOVA Table for this model

K Value	Source	Degrees of Freedom
1	Replication	r-1
2	Horizontal Factor A	a-1
-3	Error (a)	(r-1)(a-1)
4	Vertical Factor B	b-1
-5	Error (b)	(r-1)(b-1)
6	AB	(a-1)(b-1)
-7	Error (c)	(r-1)(a-1)(b-1)
8	Subplot Factor C	c-1
10	AC	(a-1)(c-1)
12	BC	(b-1)(c-1)
14	ABC	(a-1)(b-1)(c-1)
-15	Error (d)	ab(r-1)(c-1)

Four Factor Randomized Complete Block Design...

… with Factors B, C, and D as Split Plots on Factor A

FACTOR: ANOVA Table for this model

K Value	Source	Degrees of Freedom
1	Replication	r-1
2	Factor A	a-1
-3	Error	(r-1)(a-1)
4	Factor B	b-1
6	AB	(a-1)(b-1)
8	Factor C	c-1
10	AC	(a-1)(c-1)
12	BC	(b-1)(c-1)
14	ABC	(a-1)(b-1)(c-1)
16	Factor D	d-1
18	AD	(a-1)(d-1)
20	BD	(b-1)(d-1)
22	ABD	(a-1)(b-1)(d-1)
24	CD	(c-1)(d-1)
26	ACD	(a-1)(c-1)(d-1)
28	BCD	(b-1)(c-1)(d-1)
30	ABCD	(a-1)(b-1)(c-1)(d-1)
-31	Error	By Subtraction

Four Factor Randomized Complete Block Design...

… with Factor B as a Split Plot on Factor A and Factors C and D as Split Plots on Factor B

FACTOR: ANOVA Table for this model

K Value	Source	Degrees of Freedom
1	Replication	r-1
2	Factor A	a-1
-3	Error	(r-1)(a-1)
4	Factor B	b-1
6	AB	(a-1)(b-1)
-7	Error	a(r-1)(b-1)
8	Factor C	c-1
10	AC	(a-1)(c-1)
12	BC	(b-1)(c-1)
14	ABC	(a-1)(b-1)(c-1)
16	Factor D	d-1
18	AD	(a-1)(d-1)
20	BD	(b-1)(d-1)
22	ABD	(a-1)(b-1)(d-1)
24	CD	(c-1)(d-1)
26	ACD	(a-1)(c-1)(d-1)
28	BCD	(b-1)(c-1)(d-1)
30	ABCD	(a-1)(b-1)(c-1)(d-1)
-31	Error	By Subtraction

Βιβλιογραφία (1)

- **Φασούλας, Α. Κ. (ανατ. 2008).** *Στοιχεία Πειραματικής Στατιστικής*. Θεσσαλονίκη: Άγις-Σάββας Δ. Γαρταγάνης.
- **Καλτσίκης, Π. Ι. (1997).** *Απλά Πειραματικά Σχέδια*. Αθήνα: Εκδόσεις Α. Σταμούλη.
- **Μιχαηλίδης, Ζ. (2005).** *Βιομετρία-Γεωργικός Πειραματισμός*. ΑΤΕΙ Θεσσαλονίκης.
- **Steel, R. & Torrie, J. (1986).** *Principles and Procedures of Statistics: A Biometrical Approach*. Singapore: McGraw-Hill Book Company.
- **Gomez, K. & Gomez, A. (1984).** *Statistical Procedures for Agricultural Research*. Singapore: John Willey & Sons, Inc.
- **Kuehl, R. (2000).** *Designs of Experiments: Statistical Principles of Research Design and Analysis*. Pacific Grove: Duxbury Thomson Learning.

Βιβλιογραφία (2)

- **Cochran, W. & Cox, G. (1953).** *Experimental Designs*. New York: John Willey & Sons, Inc.
- **Cox, D. R. (1958).** *Planning of Experiments*. New York: John Willey & Sons, Inc.
- **Λογισμικό MSTATC**
- **Zar, J. (1996).** *Biostatistical Analysis*. New Jersey: Prentice-Hall International, Inc.
- **Kirk, R. (1995).** *Experimental Design: Procedures for the Behavioral Sciences*. Pacific Grove: Brooks/Cole Publishing Company.
- **Girden, E. (1992).** *ANOVA: Repeated Measures*. Newbury Park: Sage Publications.

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Θεσσαλονίκη, Φεβρουάριος 2014

Ευρωπαϊκή Ένωση
Ευρωπαϊκό Κοινωνικό Ταμείο

ΕΠΙΧΕΙΡΗΣΙΑΚΟ ΠΡΟΓΡΑΜΜΑ
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επένδυση στην κοινωνία της γνώσης
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ΕΙΔΙΚΗ ΥΠΗΡΕΣΙΑ ΔΙΑΧΕΙΡΙΣΗΣ

ΕΣΠΑ 2007-2013
πρόγραμμα για την ανάπτυξη
ΕΥΡΩΠΑΪΚΟ ΚΟΙΝΩΝΙΚΟ ΤΑΜΕΙΟ

Με τη συγχρηματοδότηση της Ελλάδας και της Ευρωπαϊκής Ένωσης