



Instituto de Investigación y Formación Agraria y Pesquera
CONSEJERÍA DE AGRICULTURA, PESCA Y DESARROLLO RURAL



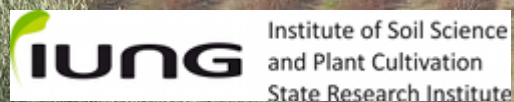
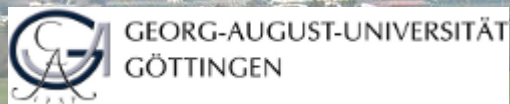
A meta-analysis of the effects of agricultural management on soil physical quality for different farm typologies across Europe

Gema Guzmán, Marta Sáenz de Rodrigáñez, Ana Laguna, Juan Vicente Giráldez,
Karl Vanderlinden, and Hein ten Berge

SSS10.8 How scientific results can improve sustainable agriculture

European Geosciences Union-General Assembly 2014

Partners



Objetives



Is a “best management practice” (BMP) always best?

Is there a set of BMPs to enhance soil physical quality across the European Union?

Overview: why SPQ is a major concern?



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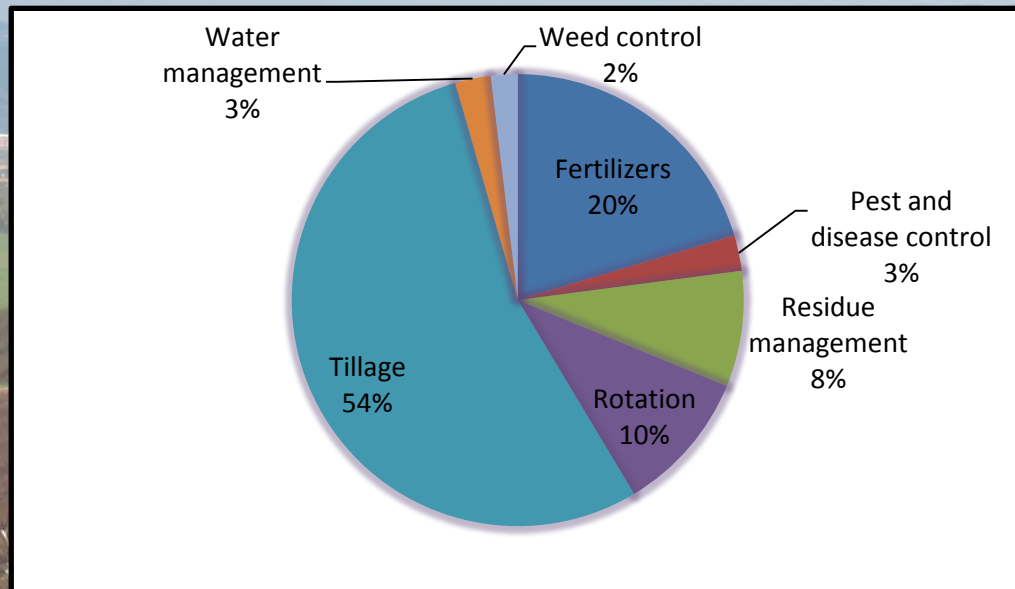
Materials and methods: dataset

3059 records with data on physical soil quality

Long term experiments (LTEs) (n=66)

Indicators	Acronyms	No. of records	No. of LTEs
Bulk density	bd	930	44
Penetration resistance	pr	978	20
Permeability	pe	209	24
Aggregates stability	as	356	26
Runoff yield	ry	198	23
Sediment yield	sy	191	24

Materials and methods: dataset



Distribution of the bibliography search regarding **soil physical quality**

Base line treatment	BMPs
Monoculture	Crop rotation
Chemical control	Mechanical control
Residue removal	Residue incorporation
Conventional tillage	Minimum tillage
	Cover crops
	Deep ploughing
	Direct drilling

Materials and methods: data treatment

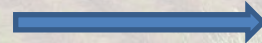
$$RR = \frac{I_{mp}}{I_{bt}}$$

$$\text{Log}RR = \text{Log} \left(\frac{I_{mp}}{I_{bt}} \right)$$

If $RR > 1$

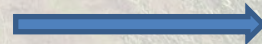


Negative effect



bd pr
ry sy

Positive effect



pe as

If $RR < 1$



Negative effect



pe as

Positive effect



bd pr
ry sy

Materials and methods: data treatment

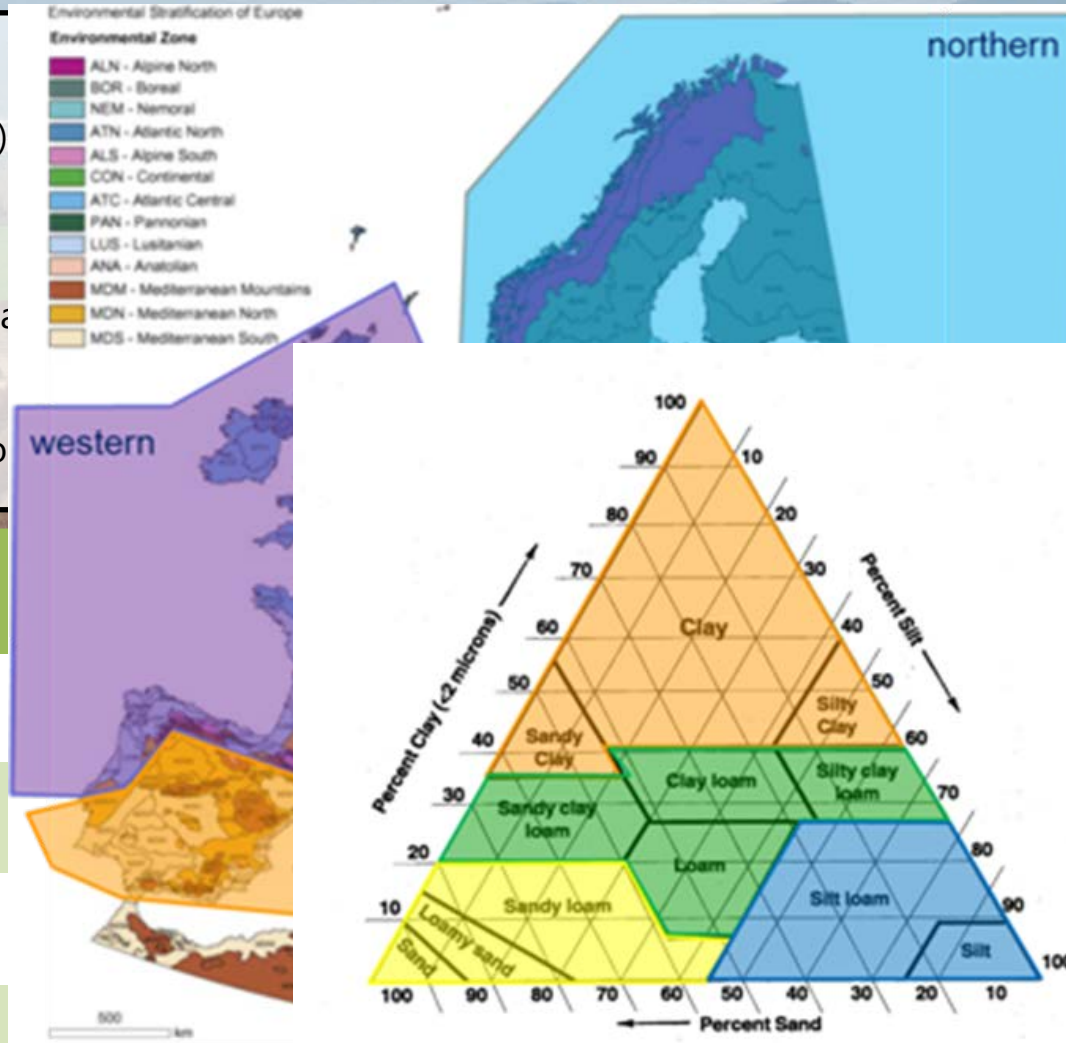
Descriptive statistics

One-sample t-test ($p < 0.05$)

Histograms

Analysis of variance to evaluate practice, separately.

A pairwise Bonferroni test to



Climate

Northern

Western

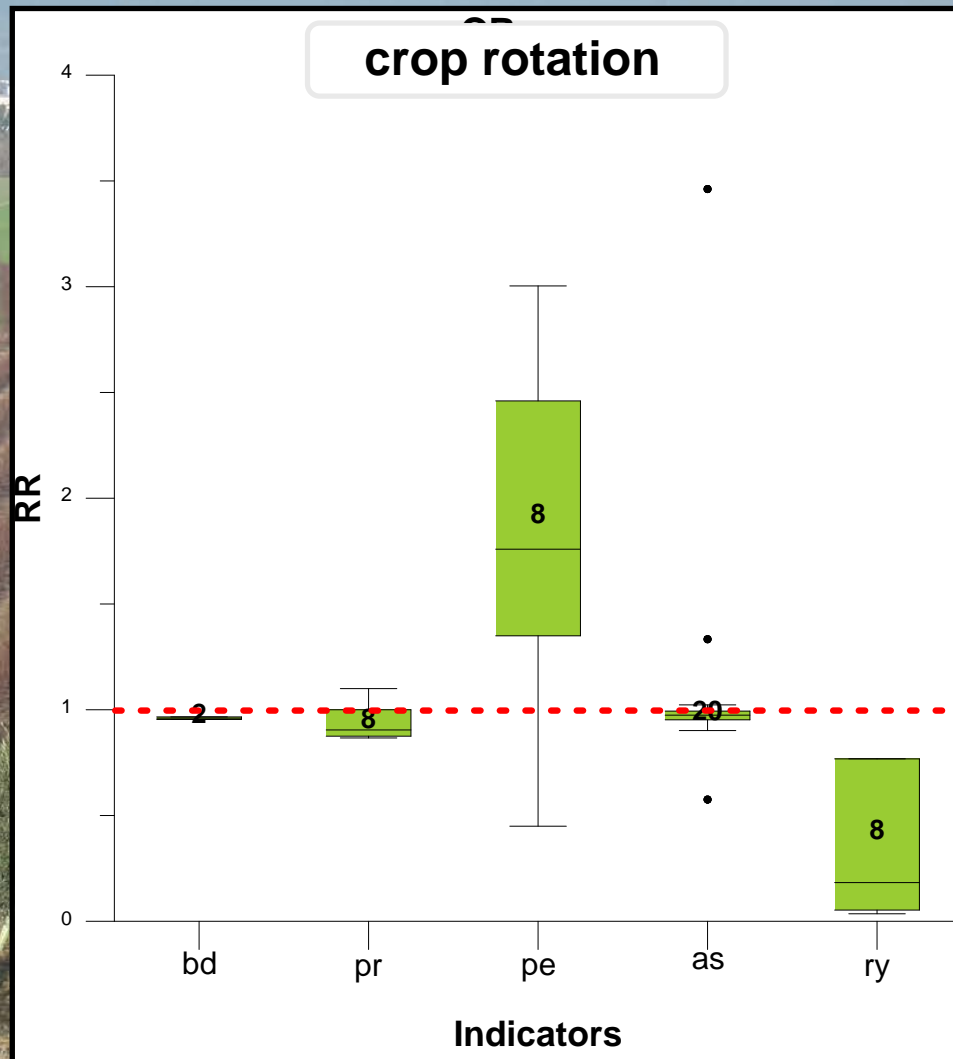
Eastern

Southern

Other
(non-European LTEs)

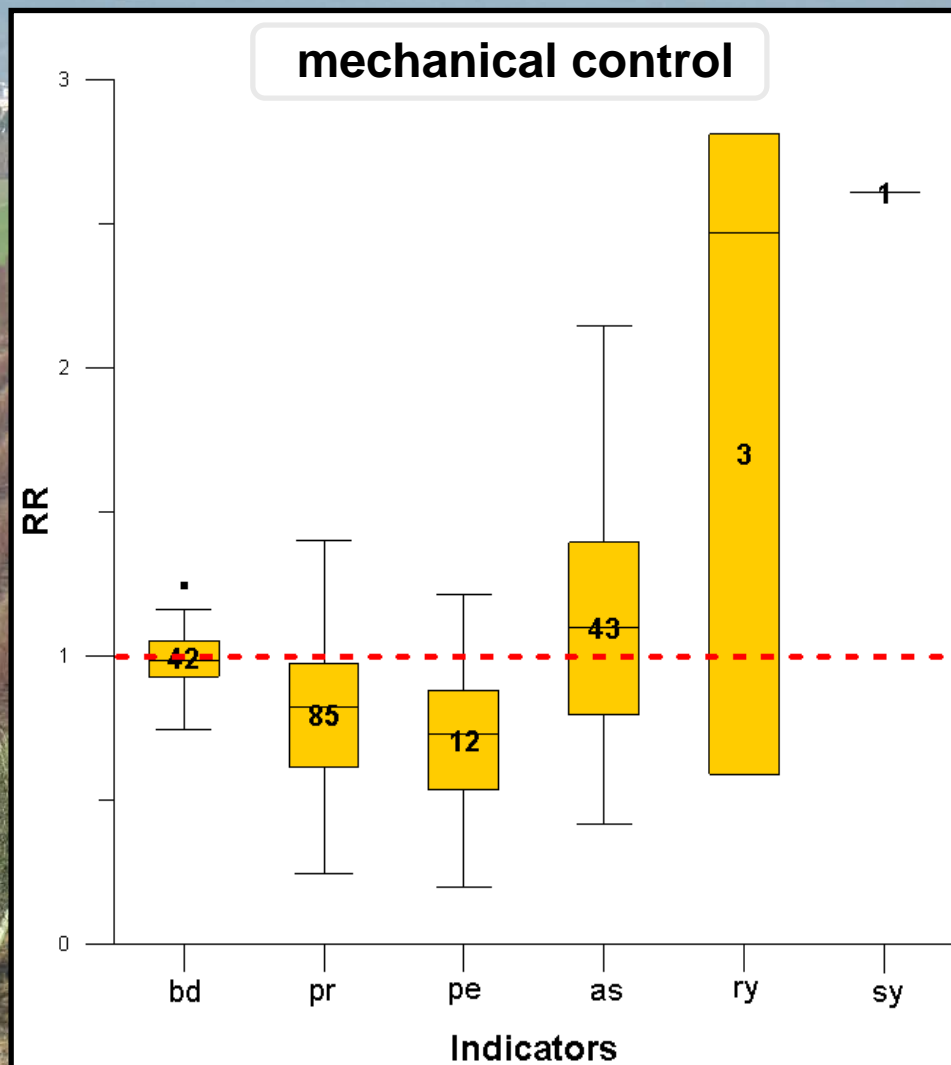
Adapted from Metzger et al. 2005

Results: rotation



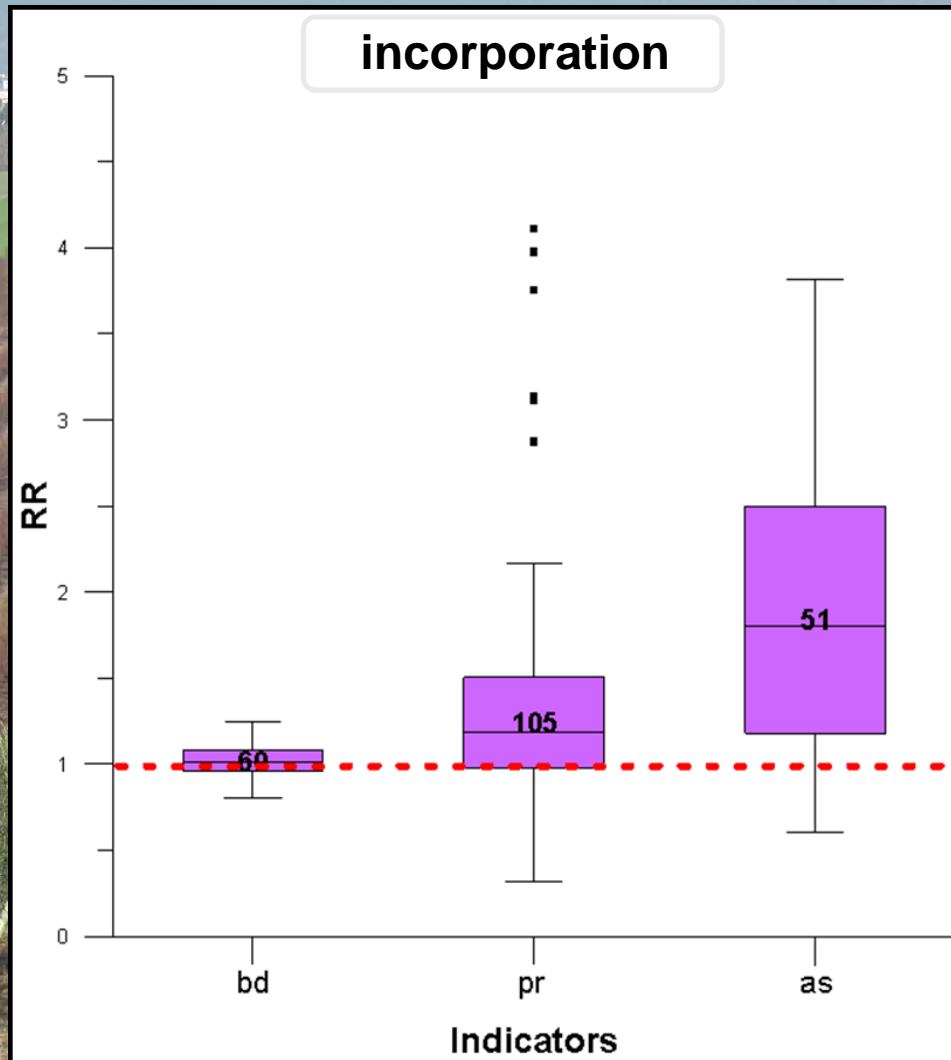
monoculture

Results: weeds control



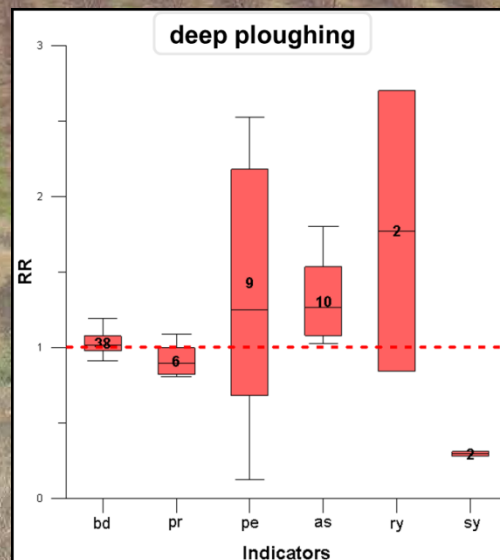
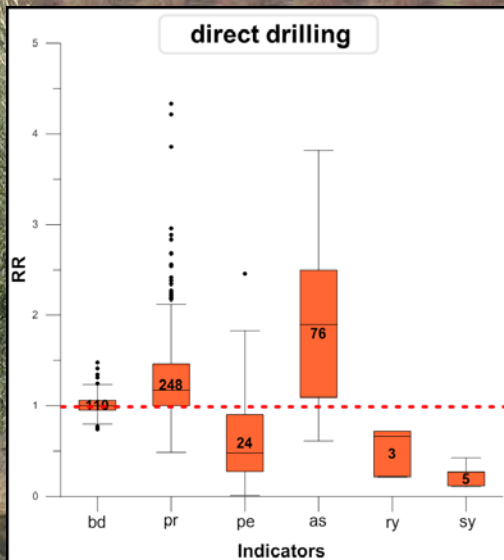
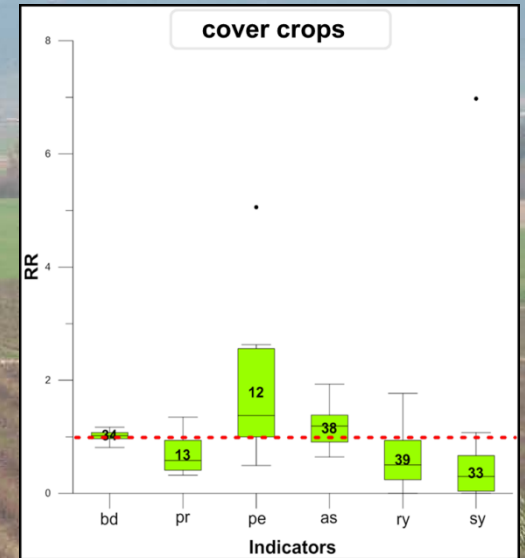
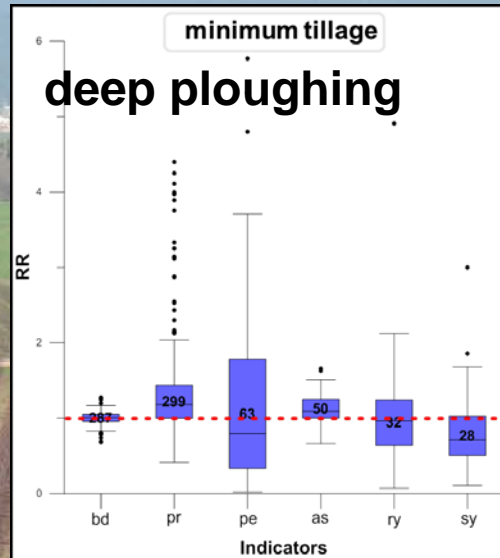
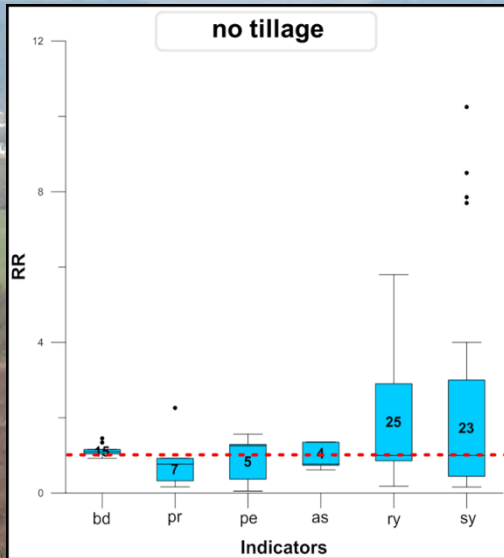
chemical control

Results: residues management



removal

Results: tillage



conventional

Results: quantitative matrix

MPs/indicators	bd	pr	pe	as	ry	sy
Monoculture	1.00	1.00	1.00	1.00	1.00	-
Crop rotation	0.96	0.93	1.41	1.09	0.29	-
Chemical control	1.00	1.00	1.00	1.00	-	-
Mechanical control	0.99	0.79	0.65	1.15	-	-
Residue removal	1.00	1.00	-	1.00	-	-
Residue incorporation	1.01	1.36	-	1.86	-	-
Conventional tillage	1.00	1.00	1.00	1.00	1.00	1.00
No tillage	1.11	0.84	0.55	0.87	1.93	2.46
Minimum tillage	1.00	1.35	0.72	1.12	4.86	3.59
Cover crops	1.02	0.68	1.45	1.18	0.60	0.56
Deep ploughing	1.03	0.92	1.26	1.32	1.77	0.30
Direct drilling	1.02	1.32	0.38	1.88	0.53	0.24

Results: qualitative matrix

MPs/indicators	bd	pr	pe	as	ry	sy	Overall SPQ
Monoculture							
Crop rotation	+	++	+	+	++	NA	++
Chemical control							
Mechanical control	+	++	-	++	NA	NA	+
Residue removal							
Residue incorporation	-	--	NA	++	NA	NA	0
Conventional tillage							
No tillage	-	+	-	--	--	--	--
Minimum tillage	0	--	--	++	-	-	-
Cover crops	--	+	+	++	++	++	++
Deep ploughing	--	+	+	++	-	++	+
Direct drilling	-	--	--	++	+	++	++

Conclusions

Is a “best management practice” (BMP) always best? **No**

There is a strong influence of environmental conditions, time scale and crop type on physical quality

Not enough data for further evaluations

Soil conservation strategies could be formulated combining different MPs to enhance soil quality

Is there a set of BMPs to enhance soil physical quality across the European Union? **Yes**

Crop rotation

Direct drilling

Cover crops

Mechanical control

Deep ploughing

Minimum tillage

No tillage



Residue incorporation?



Institute for Sustainable Agriculture



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Thank you for your attention

<http://www.catch-c.eu/>

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