

JMSC 2019

Towards a Cost Assessment of Soil Erosion

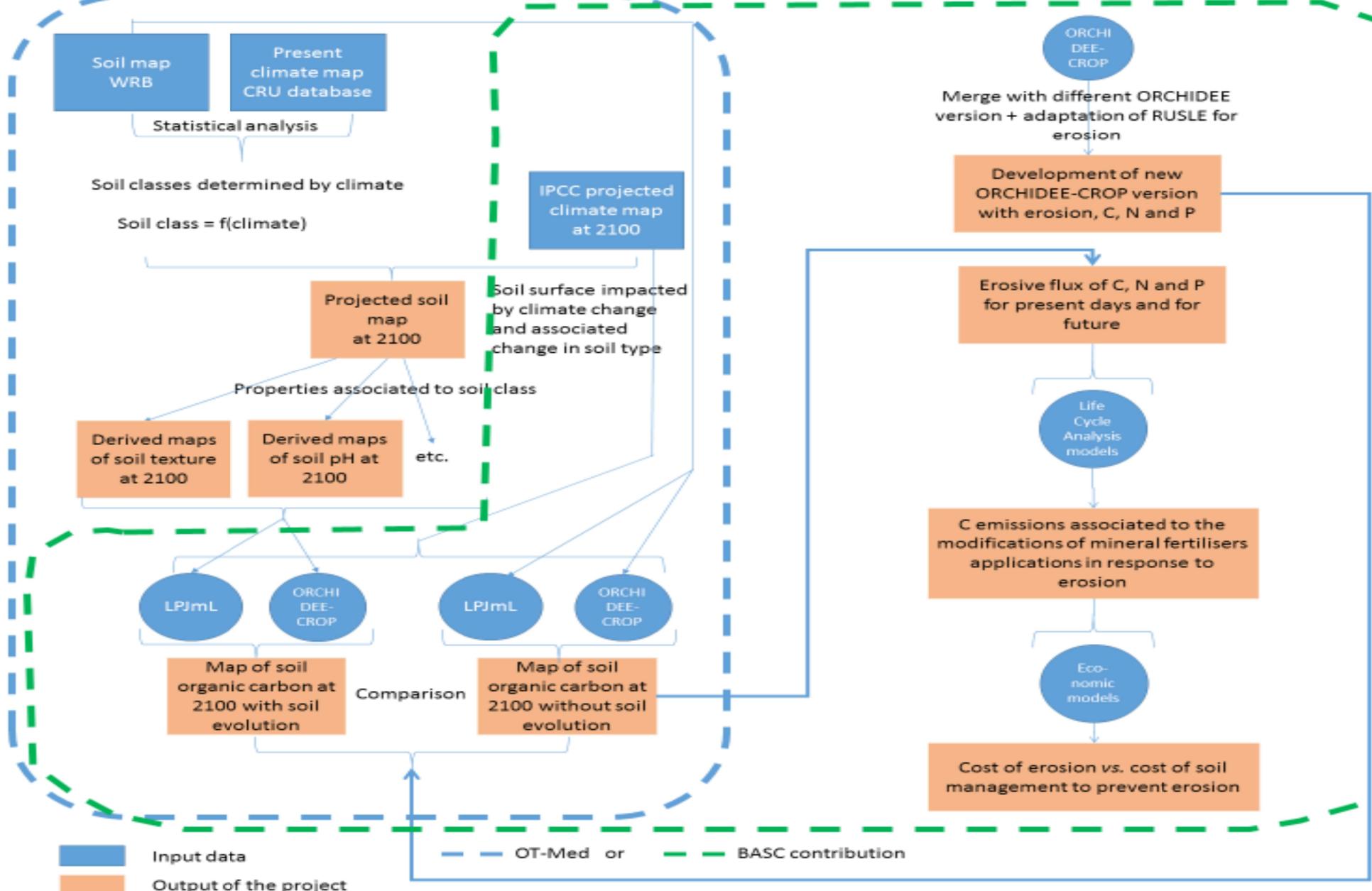
- I) The economic assessment of soil erosion costs
(on site/off site) ;
- II) The estimates of replacement costs (fertilizers);
- III) The prospects for an economic estimate database

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ASSESS Eranet OTE-Med (coord. B.Guenet)



ASSESS Project : Economic Assessment WP5



The economic assessment of erosion cost (on site/off site)

I) on-site costs :

Loss of soil;

Loss of nutrients

Loss of organic matter;

Decreased chemical, physical and biological fertility;

Damage to plantations and amendments;

Falling yields;

Production losses;

Decrease of the cultivated area;

II) off site costs;

Sedimentation

Sedimentation of lakes and rivers;

Decreased water retention capacity;

floods;

Flash floods;

Landslides ;

Destruction of transport infrastructure;

Obstruction of waterways;

eutrophication;

Loss of biodiversity;

Unsafe water quality;

Negative effects on water treatment;

Negative effects on the production of electrical energy;

Decrease in food production;

Restrictions on recreational uses of water;

Estimates of erosion cost, a short review

a) On-site cost Estimates :

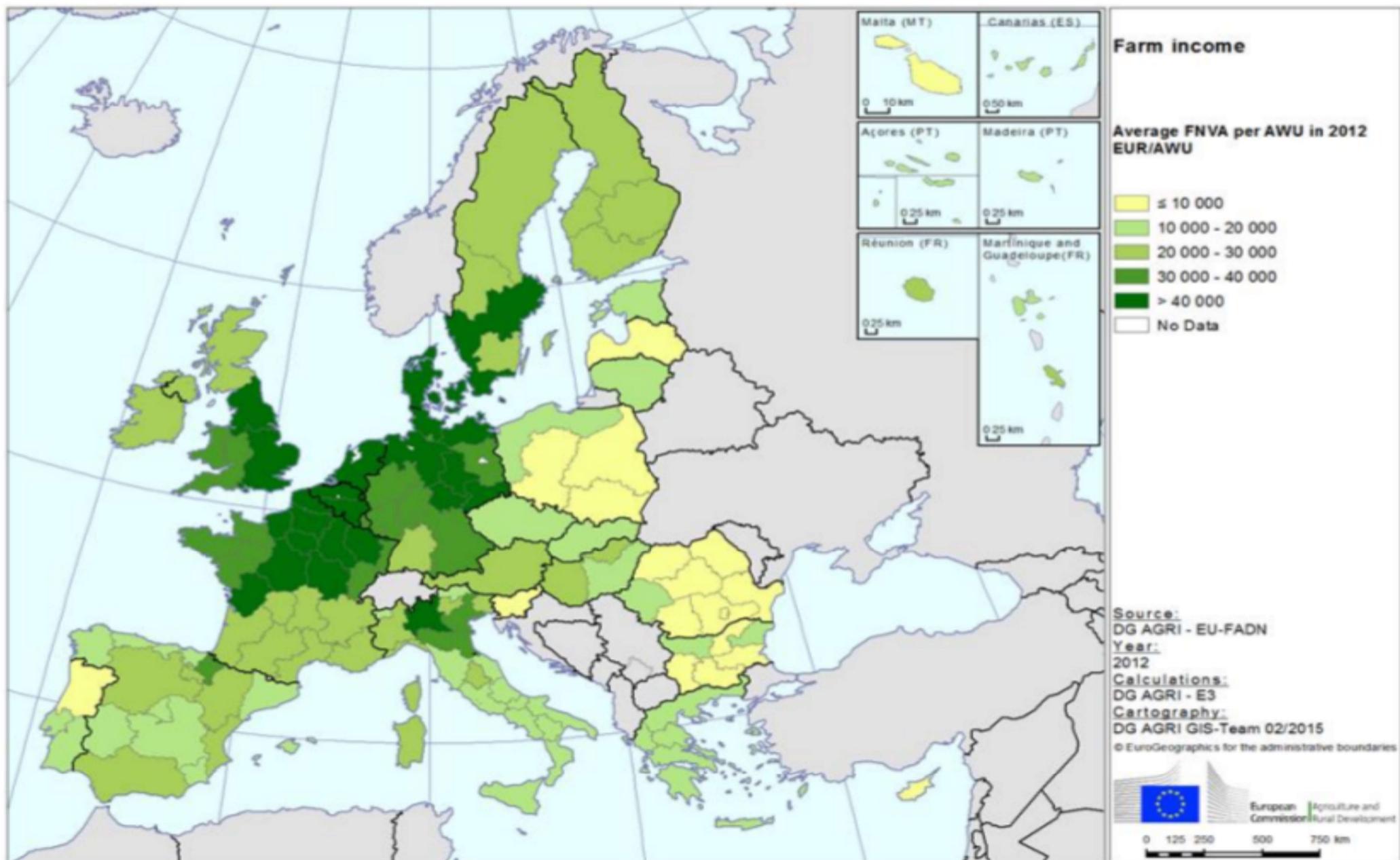
- Nutrients and soil (t/y 3 billions), USA, 1933 : **\$/y 400 millions** ;
- Nutrients (N, P & K), productivity & soil (0,9 - 26,6 t/y, Brasil, Sao Paulo, 1961 : **\$/ha/y 27 - 1500** ;
- Organic material & nutrients (N,P et K), USA, 1983 : **0,5 - 1 billion \$/y** ;
- Nutrients, productivity & erosion control , USA, 1986 : **1,7 à 1,8 billion \$/y** ;
- Soil (50 t/ha/y), Zimbabwe, 1986 : **\$/y117 million** ;
- Nutrients (N & P), Zimbabwe, 1988 : **\$/y 1,5 billions** ;
- Soil (t/ha/y 6,5), Mali, 1989 : **\$/ha/y 29,1 - 112,1** ;
- Organic material, nutrients (N& P), productivity, soil (t/y 3,2 - 12,9 millions), USA, 1989:**\$/y 5,2 millions - 1,2 billions** ;
- Productivity, Java , 1989 : **\$/y 340 - 406 millions** ;
- Nutrients (N, P, K, Ca & Mg) & soil (20 t/ha/y), Brazil Parana, 1989: **242 millions à 30 billions \$/y** ;
- Nutrients (N, P, K, Ca & Mg), Brazil Sao Paulo, 1991 : **212 millions \$/y** ;
- Nutrients (N, P, K), USA, 1991: **20 billions \$/y** ;
- Productivity (corn, soy, & wheat) & soil (t/y 10 - 15), Mexico : **\$/y 500 000** ;
- Soil (t/ha/y 42), Ethiopia, 1995: **\$/y 130 millions** ;
- Organic material, nutrients, soil (t/ha/y 0,5 - 10) & sediments, EU (25), 2007: **\$/y 45,4 billions** ;
- Nutrients (N, P, K, Ca & Mg) & soil (t/ha/y 1,04 - 8,9), Brazil, S. Catarina, 2007: **14,83 - 24,94 \$/ha/y** ;
- Nutrients (N, P, K), & soil (t/ha/y 7,1 - 206,9), Spain, Puentes, 2007 : **\$/ha/y 5,12 - 66,54** ;
- Nutrients (N, P, K, Ca & Mg), Brazil, Sao Paulo, 2009 : **\$/ha/y 28,32 à 72,65** ;
- Soil (t/ha/y 0,5 - 10), EU (2010) : **\$/ha /y 165,85 - 409,10** ;

Agricultural Economic Data by Regions (NUTS 2)

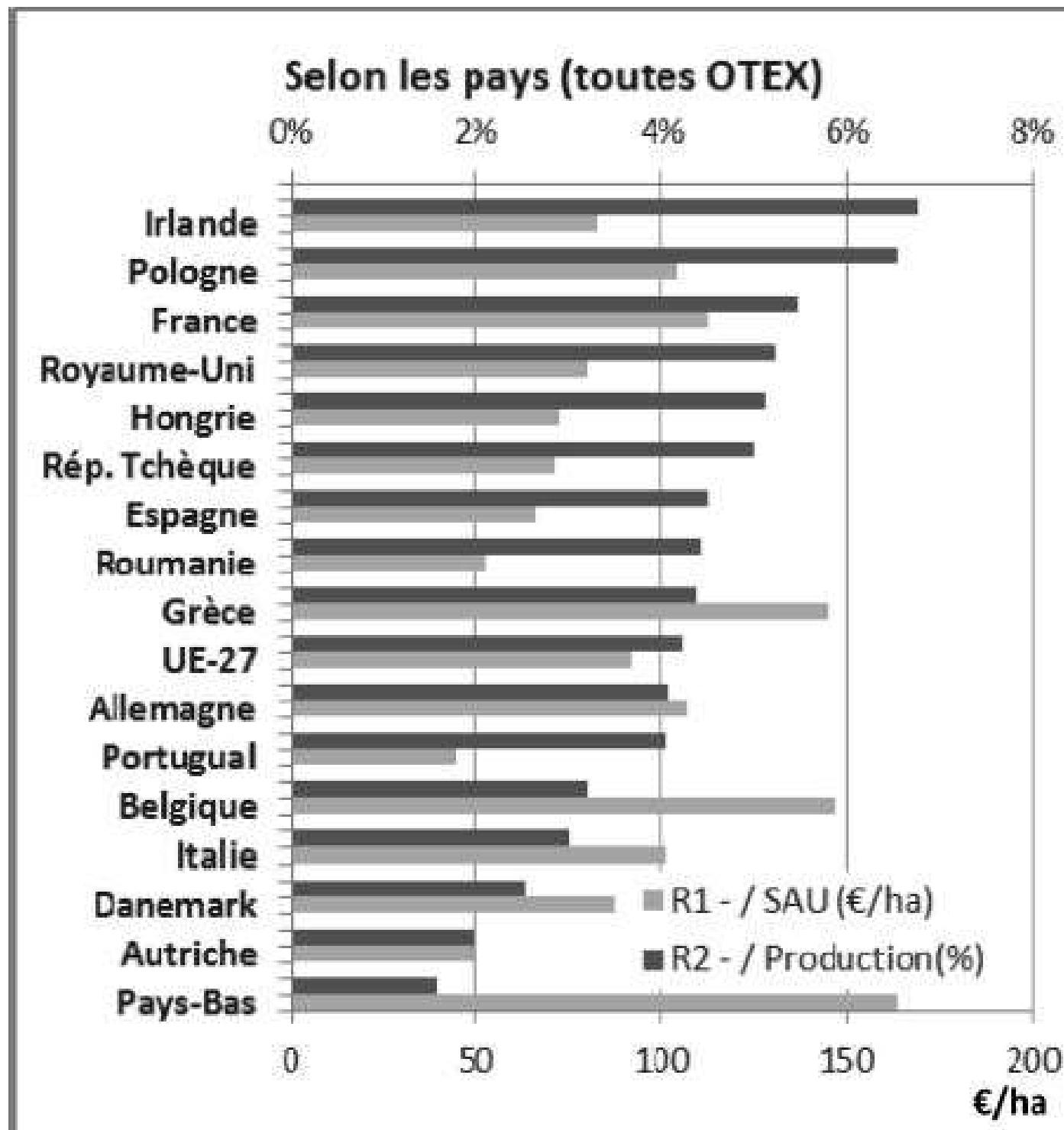
source : EU-FADN, 2013

FNVA per AWU by FADN region in 2012

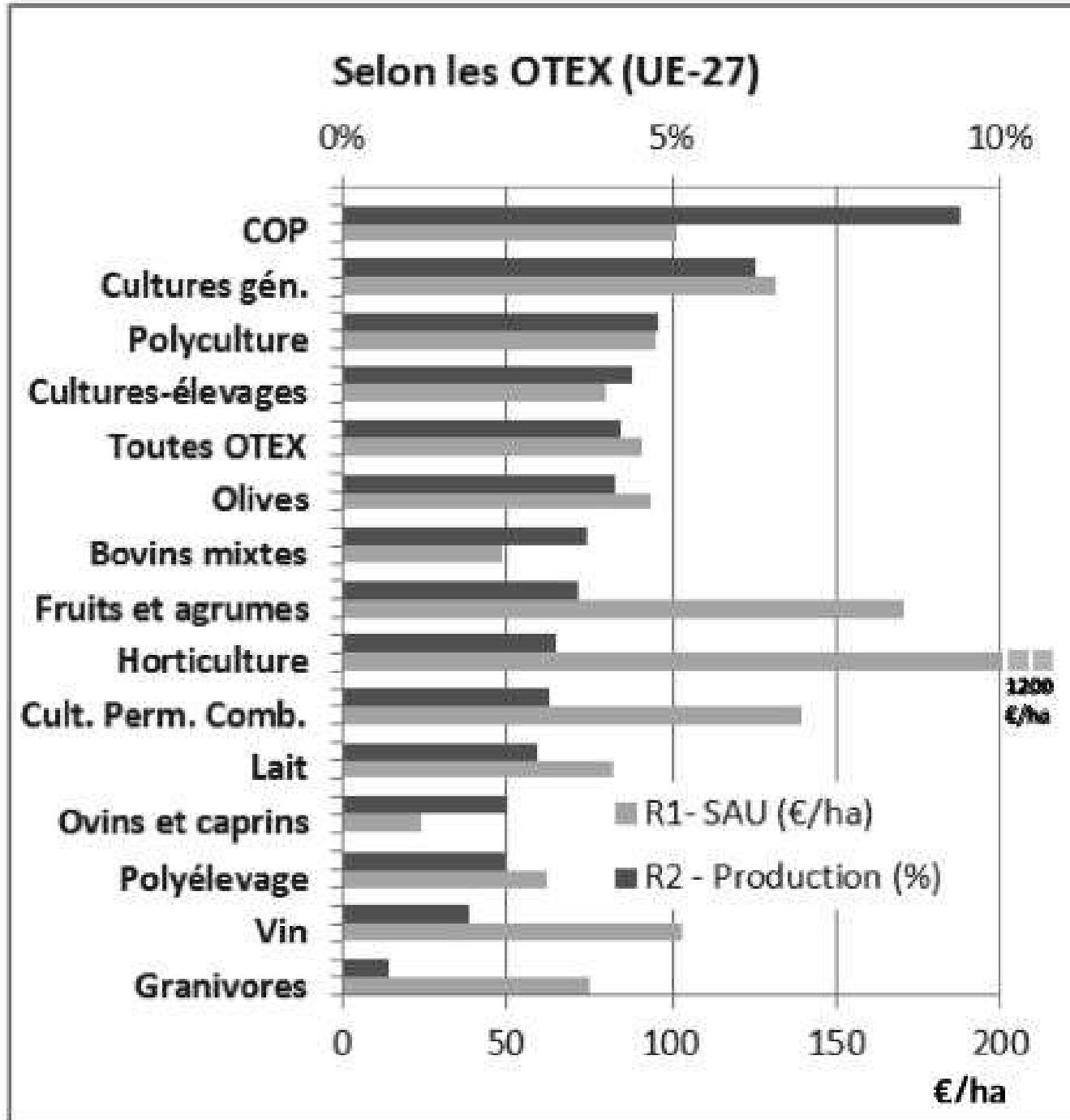
(average per farm, in EUR)



Fertilizer inputs, UE (RICA 2000-2009) by State Member



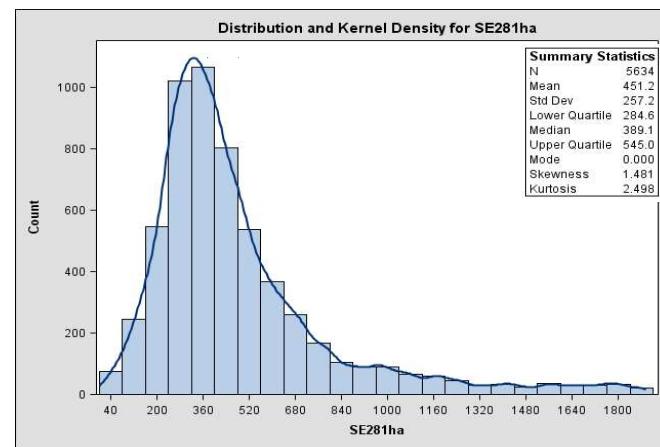
Fertilizer inputs in the UE (2000-2009) by ToF



FACEPA : Micro-Econometric Modeling of Agricultural Production Costs

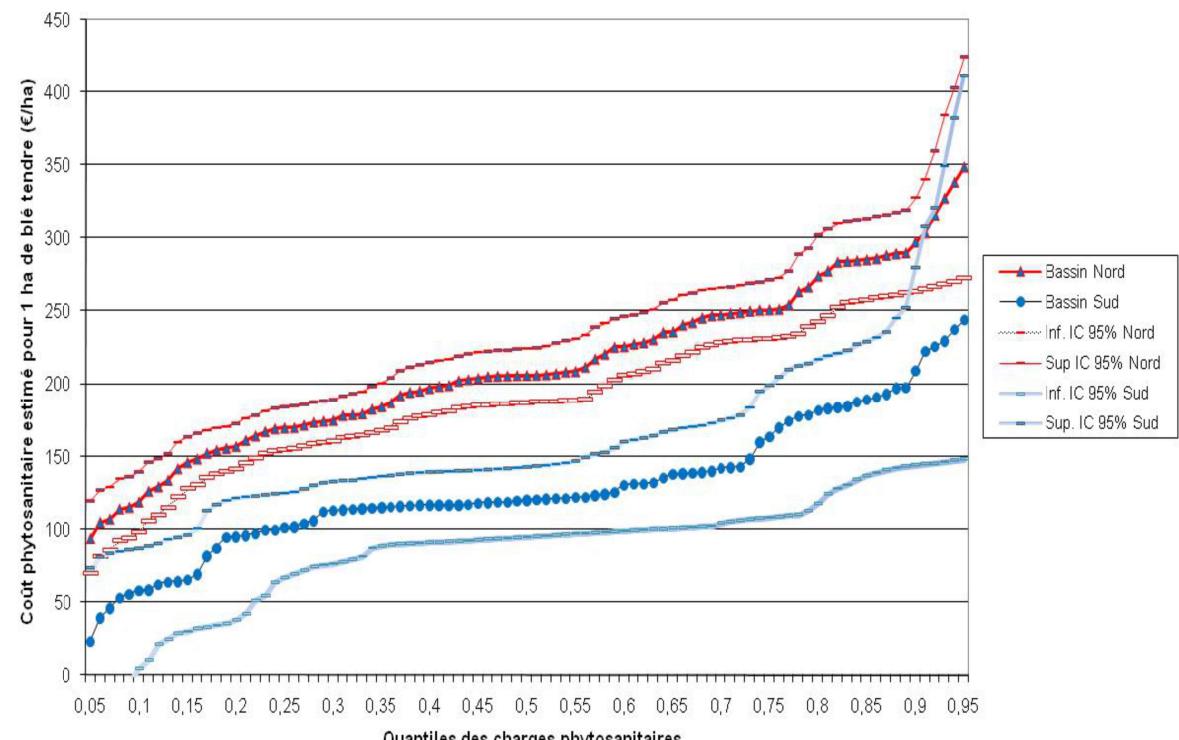
PRODUITS CHARGES	Y_{1h}	...	Y_{kh}	...	Y_{Kh}	<i>TOTAL CHARGE</i>
X_{1h}	a_{1h}^1	...	a_{1h}^k	...	a_{1h}^K	$\sum X_{1h}$
\vdots	\vdots		\vdots		\vdots	\vdots
X_{ih}	a_{ih}^1	...	a_{ih}^k	...	a_{ih}^K	$\sum X_{ih}$
\vdots	\vdots		\vdots		\vdots	\vdots
X_{Ih}	a_{Ih}^1	...	a_{Ih}^k	...	a_{Ih}^K	$\sum X_{Ih}$
<i>TOTAL PRODUCT</i>	$\sum Y_{1h}$...	$\sum Y_{kh}$...	$\sum Y_{Kh}$	$\sum_k Y_{kh} = \sum_i X_{ih}$

FACEPA : Conditional Quantile Estimation of Agricultural Production Cost



$$\sum_{i; y_i \geq x_i' \beta} q |x_i - y_i' \beta| + \sum_{i; y_i < x_i' \beta} (1 - q) |x_i - y_i' \beta|$$

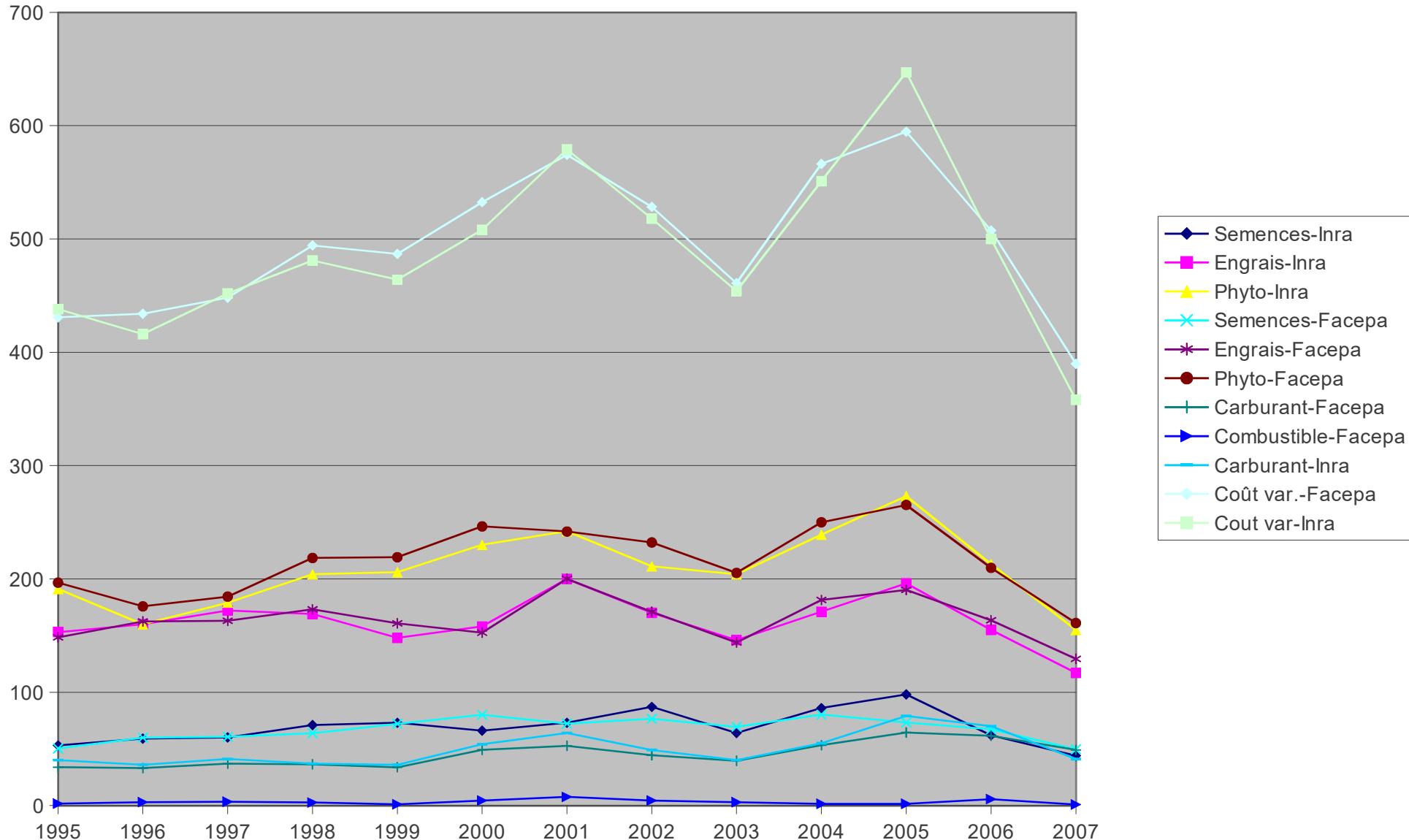
Blé tendre : processus quantile du coût phytosanitaire, bassins Nord et Sud
(RICA 2006, grandes cultures, estimations basées sur les surfaces)



FACEPA : Estimates of Agricultural Production Costs



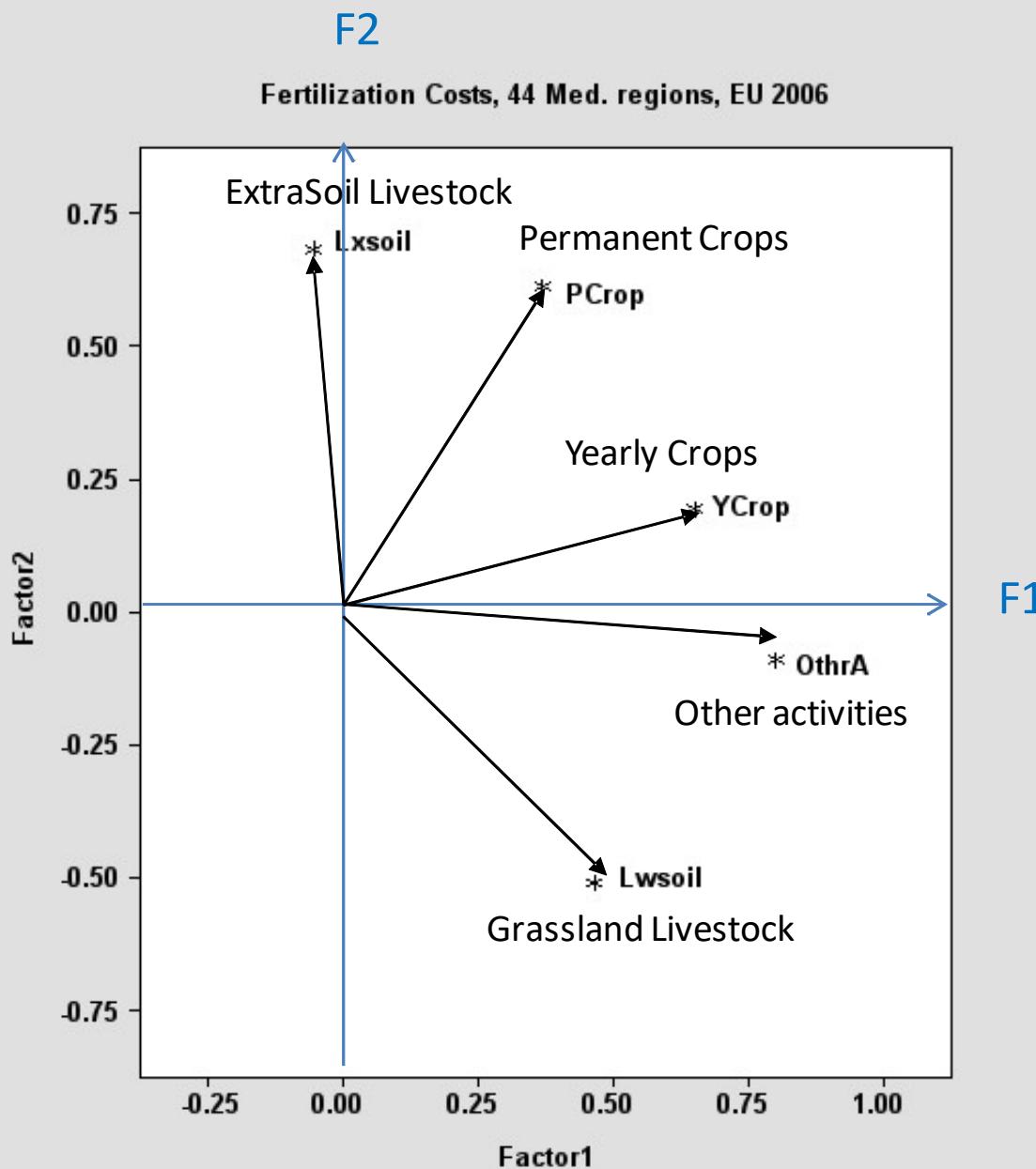
Blé tendre, coûts variables



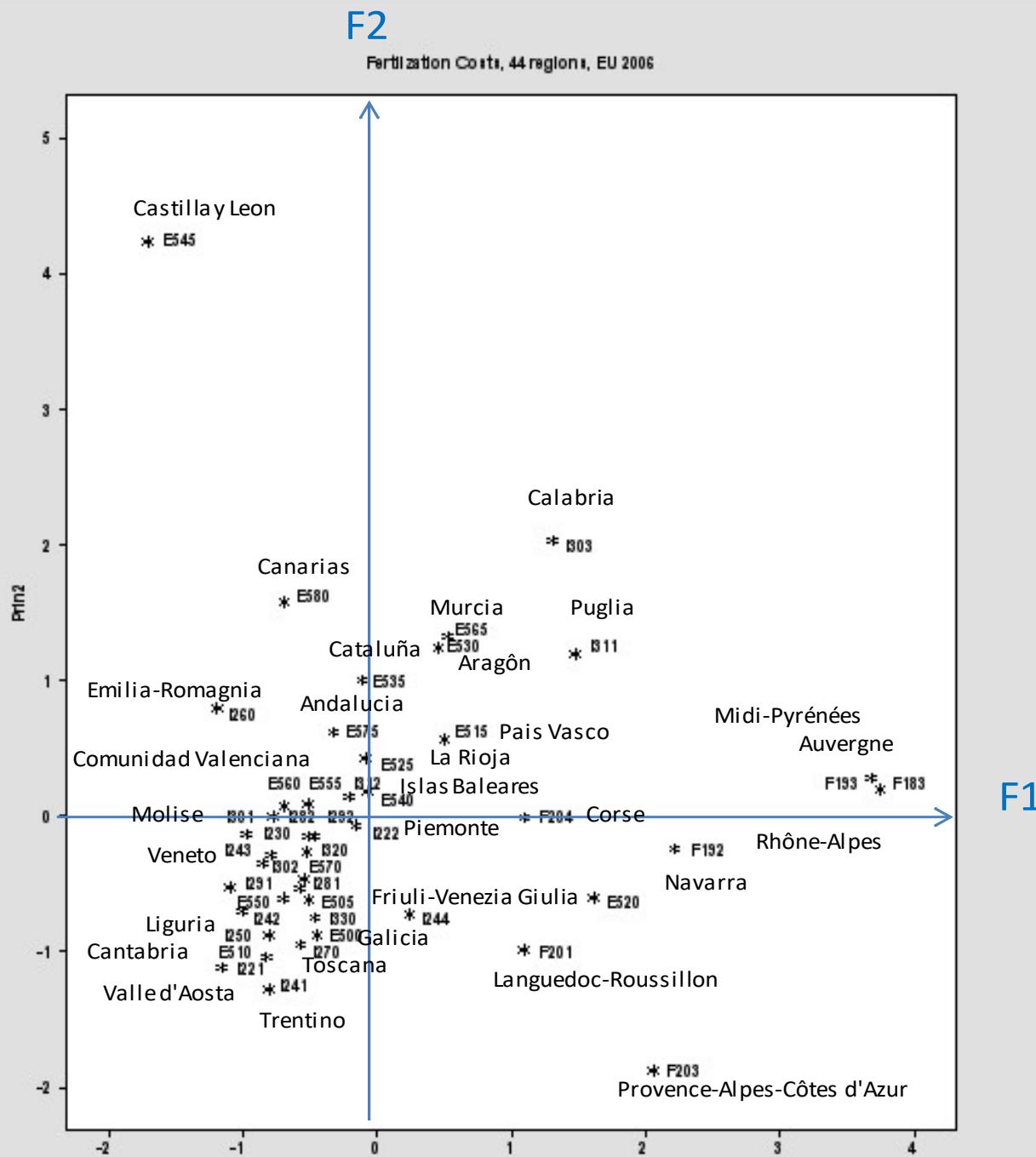
ASSESS : Conditional Median Estimates of Fertilization Cost, EU Southern Regions

reg	Year	Crop	PermCrop	Livsxsoil	Livswssoil	OthrActi	region
F183	0,116	0,014	0,000	0,067	0,138		Midi-Pyrénées
F192	0,083	0,012	0,000	0,051	0,087		Rhône-Alpes
F193	0,170	0,000	0,000	0,059	0,113		Auvergne
F201	0,069	0,014	0,000	0,075	0,000		Languedoc-Roussillon
F203	0,036	0,017	0,000	0,139	0,000		Provence-Alpes-Côte d'Azur
F204	0,054	0,008	0,000	0,000	0,100		Corse
I221	0,000	0,003	0,000	0,000	0,000		Valle d'Aosta
I222	0,096	0,010	0,000	0,000	0,000		Piemonte
I230	0,042	0,000	0,003	0,008	0,000		Lombardia
I241	0,007	0,000	0,000	0,014	0,000		Trentino
I242	0,012	0,015	0,000	0,000	0,000		Alto Adige
I243	0,028	0,012	0,002	0,016	0,000		Veneto
I244	0,039	0,008	0,000	0,023	0,031		Friuli-Venezia Giulia
I250	0,035	0,000	0,000	0,000	0,000		Liguria
I260	0,031	0,029	0,004	0,006	0,000		Emilia-Romagna
I270	0,029	0,005	0,000	0,014	0,000		Toscana
I281	0,056	0,006	0,000	0,000	0,000		Marche
I282	0,044	0,009	0,002	0,000	0,011		Umbria
I291	0,023	0,000	0,002	0,005	0,000		Lazio
I292	0,022	0,031	0,000	0,004	0,019		Abruzzo
I301	0,070	0,014	0,000	-0,005	0,000		Molise
I302	0,027	0,023	0,000	-0,001	0,000		Campania
I303	0,021	0,107	0,000	0,019	0,096		Calabria
I311	0,044	0,054	0,000	0,000	0,122		Puglia
I312	0,022	0,037	0,000	0,000	0,038		Basilicata
I320	0,041	0,025	0,000	0,008	0,000		Sicilia
I330	0,030	0,014	0,000	0,018	0,000		Sardegna
E500	0,048	0,000	0,000	0,011	0,000		Galicia
E505	0,064	0,000	0,000	0,000	0,000		Asturias
E510	0,023	0,000	0,000	0,005	0,000		Castilla y León
E515	0,160	0,012	0,000	0,000	0,000		País Vasco
E520	0,132	0,013	-0,004	0,010	0,039		Navarra
E525	0,099	0,028	0,000	0,000	0,000		La Rioja
E530	0,149	0,042	0,000	0,000	0,000		Aragón
E535	0,118	0,039	0,000	-0,012	0,000		Cataluña
E540	0,045	0,048	0,000	0,026	0,000		Islas Baleares
E545	0,120	0,037	0,013	-0,006	0,000		Castilla y León
E550	0,039	0,010	0,000	0,002	0,000		Madrid
E555	0,043	0,037	0,000	0,006	0,000		Castilla-La Mancha
E560	0,038	0,036	0,000	0,000	0,000		Comunidad Valenciana
E565	0,084	0,081	0,000	0,032	0,000		Murcia
E570	0,045	0,015	0,000	0,006	0,000		Extremadura
E575	0,072	0,045	0,000	0,000	0,000		Andalucía
E580	0,024	0,099	0,000	0,000	0,000		Canarias

Fertilisation Cost: PCA 44 regions, Southern Europe

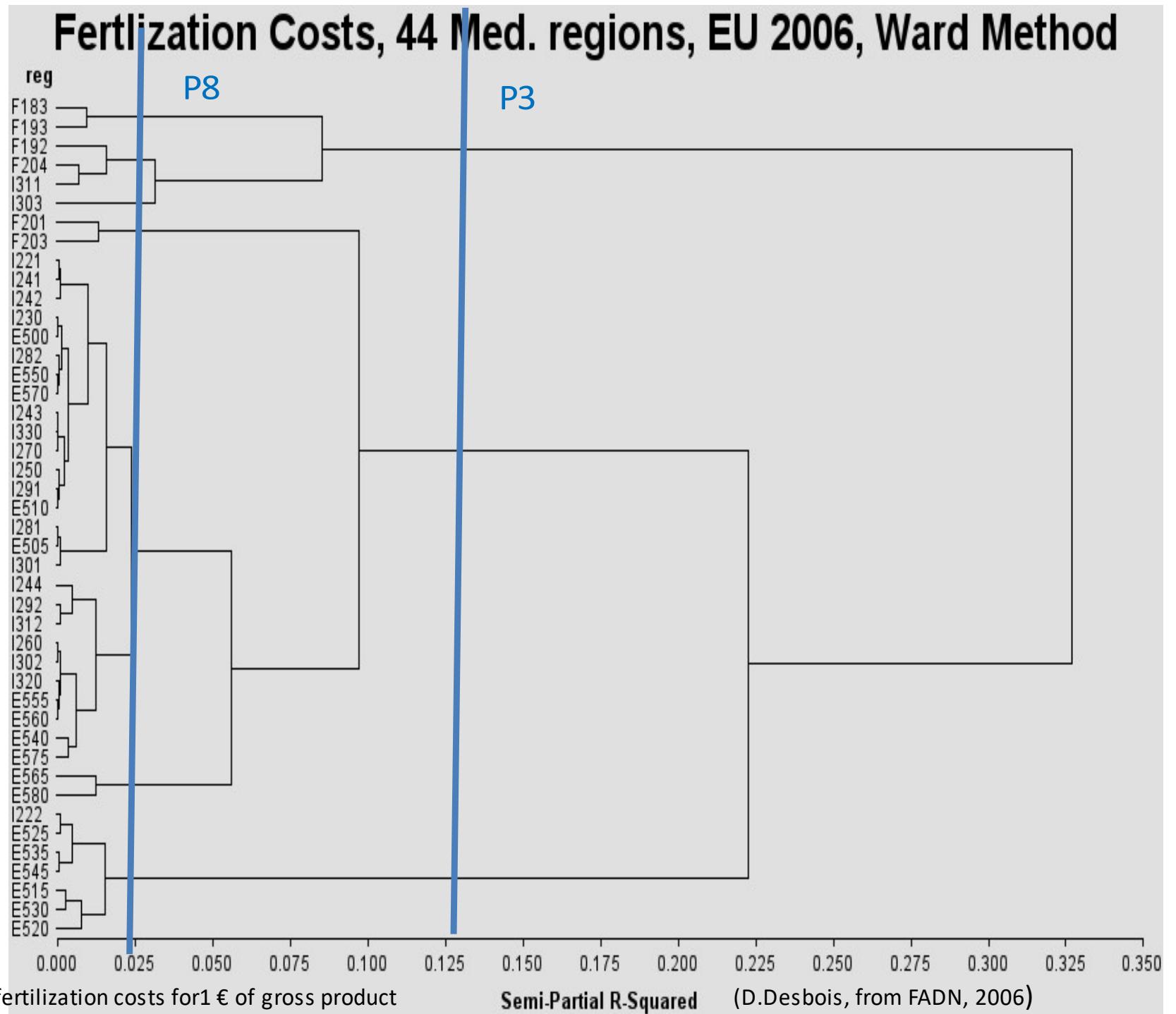


Fertilization costs are different at the regional level



Some meaningful clusters of fertilisation cost can be found at regional level

Midi-Pyrénées
Auvergne
Rhône-Alpes
Corse
Puglia
Calabria
Languedoc-Roussillon
Provence-Alpes-Côtes d'Azur
Trentino
Valle d'Aosta
Lombardia
Alto Adige
Umbria
Galicia
Madrid
Extremadura
Veneto
Sardegna
Toscana
Liguria
Lazio
Cantabria
Marche
Asturias
Molise
Friuli-Venezia Giulia
Abruzzo
Emilia-Romagna
Basilicata
Campania
Sicilia
Castilla-La Mancha
Comunidad Valenciana
Islas Baleares
Andalucia
Murcia
Canarias
Piemonte
La Rioja
Cataluña
Castilla y Leon
Pais Vasco
Aragón
Navarra



Economic Estimates : Work in Progress

- Currently, setting an OTE-Med NUTS II Database of Conditional Quantile Estimates, on 1995-2007 ;
- Comparables estimates are being envisioned for a more precise set of 15 types of products and/or at NUTS III level for some watershed (Rhône, Ebro) with unit costs per hectare ;
- Conventions are being in progress with local, national & european economic institutes to update dataset ;

References

- Desbois D. (2017) Displaying empirical distributions of conditional quantile estimates: an application of symbolic data analysis to the cost allocation problem in agriculture », *Proceedings of the 17th Conference of the Applied Stochastic Models and Data Analysis International Society*, Londres, pp. 189-202.
- Desbois D., Butault JP., Surry Y. (2017) Distribution des coûts spécifiques de production dans l'agriculture de l'Union européenne : une approche reposant sur la régression quantile, *Économie rurale*, vol. 361, n°5, pp. 3-22.
- Desbois D. (2015) Estimation des coûts de production agricoles : approches économétriques. *PhD Thesis*, ABIES-AgroParisTech, dirigé par J.C. Bureau et Y.Surry, 249 p.
- Desbois D., Butault J.-P., et Surry Y. (2013) Estimation des coûts de production en phytosanitaires pour les grandes cultures. Une approche par la régression quantile. *Economie Rurale*, n° 333, 27-49.
- Surry Y., Desbois D., et Butault J.-P. (2012) Quantile Estimation of Specific Costs of Production. *FACEPA*, D8.2, 49 p.

JMSC 2019: Thank you for your attention

