EUROLEGUME 2014-2017

Enhancing of legumes growing in Europe through sustainable cropping for protein supply for food and feed

FP7 Research Project Nº 61378

Fijación biológica de nitrógeno

Juan A. Fernández

Universidad Politécnica de Cartagena

ETSIa Cartagena

EUROLEGUME 2014-2017

Enhancing of legumes growing in Europe through sustainable cropping for protein supply for food and feed

FP7 Research Project Nº 61378

- Introducción
- Proyecto Eurolegume
  - Fijación biológica del N
  - Disponibilidad N en cultivos posteriores
  - Emisión de gases invernadero (N_2O)

Universidad Politécnica de Cartagena

ETSIa Cartagena

EUROLEGUME 2014-2017

Enhancing of legumes growing in Europe through sustainable cropping for protein supply for food and feed

FP7 Research Project Nº 61378

¿Qué proporcionan a los humanos?

Alimentos ricos en proteínas

Reducen los aportes de N en agricultura

Mejoran propiedades del suelo

Reducen plagas y enfermedades

Universidad Politécnica de Cartagena

ETSIa Cartagena

EUROLEGUME 2014-2017

Enhancing of legumes growing in Europe through sustainable cropping for protein supply for food and feed

FP7 Research Project Nº 61378

Papel en la sustentabilidad ambiental

Reducen las emisiones de los gases de invernadero

Contribuyen al secuestro de C en los suelos

Reducen la energía fósil usada en la producción de alimentos

Universidad Politécnica de Cartagena

ETSIa Cartagena

EUROLEGUME 2014-2017

Enhancing of legumes growing in Europe through sustainable cropping for protein supply for food and feed

FP7 Research Project Nº 61378

Reducción de los aportes de N

Contribuyen a la fertilidad del suelo

Captan N atmosférico a través de una simbiosis con bacterias y dejan N para los cultivos

Reducen la contaminación de agua

Universidad Politécnica de Cartagena

ETSIa Cartagena

EUROLEGUME 2014-2017

Enhancing of legumes growing in Europe through sustainable cropping for protein supply for food and feed

FP7 Research Project Nº 61378

Reducen las emisiones de los gases de invernadero (CO_2, N_2O y CH_4)

Directamente

Indirectamente (producción y transporte)

Universidad Politécnica de Cartagena

ETSIa Cartagena

EUROLEGUME 2014-2017

Enhancing of legumes growing in Europe through sustainable cropping for protein supply for food and feed

FP7 Research Project Nº 61378

Contribuyen al secuestro de C

Residuos de las plantas son emitidos como CO_2 por los microbios

Acumulan C orgánico en formas estables

Reducen emisiones de CO_2

Universidad Politécnica de Cartagena

ETSIa Cartagena

EUROLEGUME
2014-2017

Enhancing of legumes growing in Europe through sustainable cropping for protein supply for food and feed

FP7 Research Project № 61378






Funded by the 7th Research Framework Programme of the European Union

EUROLEGUME 2014-2017

Enhancing of legumes growing in Europe through sustainable cropping for protein supply for food and feed

FP7 Research Project Nº 61378

- 12 Research Institutions
- 6 SME (5 SME and 1 SME performing RTD)
- UTAD for Project management and coordination
- ECRI for Communication an Dissemination

Budget Breakdown

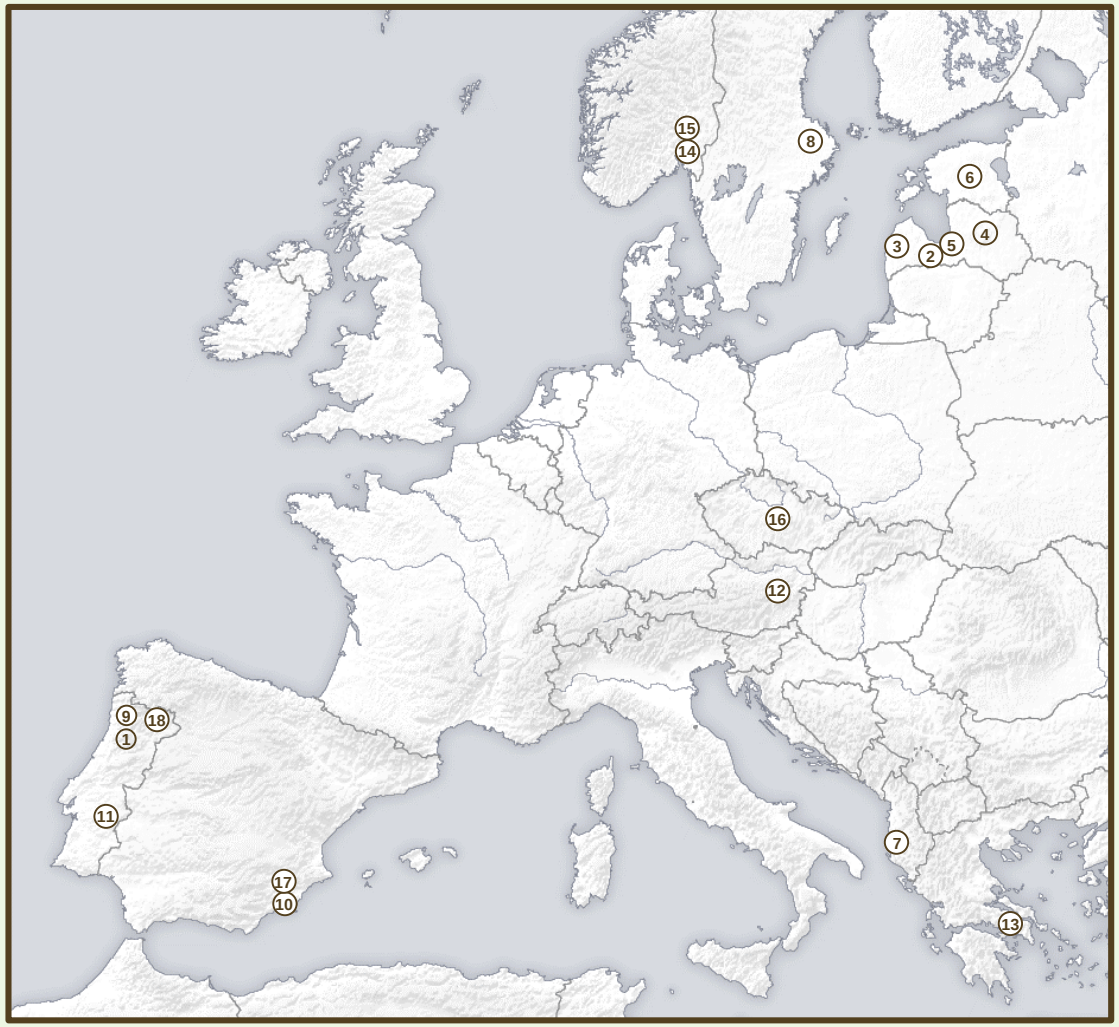
- Total investment of 6,5M€
- Requested EU contribution of 5M€
- 4-year project starting January, 1st, 2014.

Funded by the 7th Research Framework Programme of the European Union

EUROLEGUME
2014-2017

Enhancing of legumes growing in Europe through sustainable cropping for protein supply for food and feed

FP7 Research Project Nº 61378



Location of the 18 EUROLEGUME partners

1. UTAD
2. LLU
3. PHRC
4. SPPBY
5. BIOEFEKTS
6. ECRI
7. AUT
8. JTI
9. FRESCURA SUBLIME
10. UPCT
11. INIAV
12. BOKU
13. AUA
14. BIOFORSK
15. UMB
16. SYMBION
17. KPRA
18. ESTIRPE

Funded by the 7th Research Framework Programme of the European Union

EUROLEGUME
2014-2017

Enhancing of legumes growing in Europe through sustainable cropping for protein supply for food and feed

FP7 Research Project Nº 61378

Funded by the 7th Research Framework Programme of the European Union

EUROLEGUME 2014-2017

Enhancing of legumes growing in Europe through sustainable cropping for protein supply for food and feed

FP7 Research Project Nº 61378

WP 1 – Project Management & Coordination

WP Leader: Prof. Dr. Eduardo Rosa | UTAD

T1.1 Planning and Scheduling

T1.2 Progress monitoring, control & quality management

T1.3 Implementing the structure for communication, management & administration

T1.4 Funding distribution for EC payments

T1.5 Project quality plan

Funded by the 7th Research Framework Programme of the European Union

EUROLEGUME 2014-2017

Enhancing of legumes growing in Europe through sustainable cropping for protein supply for food and feed

FP7 Research Project № 61378

WP 2 – Broading of genetic diversity in breeding through evaluation of genetic resources

Description of Biochemical/morphological features of pea, faba bean, and cowpea/black-eyed bean genotypes to develop varieties for food/feed and use in breeding

T2.1 Sourcing and characterization of genetic diversity

T2.2 Phenotyping selected accessions for site specific biotic and abiotic stress

T2.3 Creating of Near Infrared Reflectance (NIR) spectroscopy calibration for selected quality parameters of peas

T2.4 Evaluation of genetic diversity by molecular methods

Funded by the 7th Research Framework Programme of the European Union

WP Leader: Dr. Arta Kronberga| SPPBI

EUROLEGUME
2014-2017

Evaluation of genetic resources

Funded by the 7th Research Framework Programme of the European Union

EUROLEGUME
2014-2017

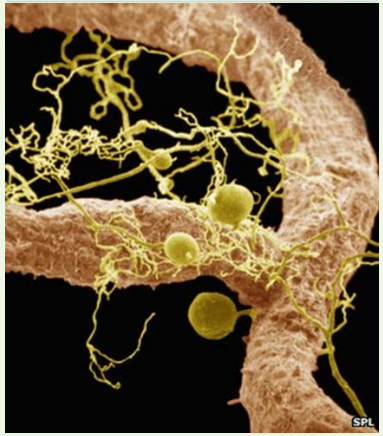
Evaluation of genetic resources

Funded by the 7th Research Framework Programme of the European Union

EUROLEGUME 2014-2017

Enhancing of legumes growing in Europe through sustainable cropping for protein supply for food and feed

FP7 Research Project Nº 61378



WP 3 – Selection of appropriate rhizobium strains to support nitrogen fixation and development of inoculants

Selection of the most appropriate *Rhizobium* and arbuscular *mycorrhizae fungi* to support nitrogen fixation. Development of new commercial inoculants

T3.1 Selection of rhizobial strains and arbuscular mycorrhizal fungi (AMF) for enhanced BNF and legume growth

T3.2 Phenotypic and genotypic characterization of *Rhizobium leguminosarum* and *Bradyrrhizobium* spp. Strains

T3.3 Development of new commercial products

- **Formulation for pea and fava bean**
- **Formulation for cowpea**

WP Leader: Dr. Guilhermina Marques| UTAD

Funded by the 7th Research Framework Programme of the European Union

EUROLEGUME 2014-2017

Enhancing of legumes growing in Europe through sustainable cropping for protein supply for food and feed

FP7 Research Project № 61378

WP 4 – Nutritional value and innovative food and feed

Develop foods and feeds based on the nutritive value from European varieties of pea, faba bean, and cowpea

T4.1 Evaluation of the quality of new feed and food

T4.2 Multiuse of all three species in development of innovative foods/feeds

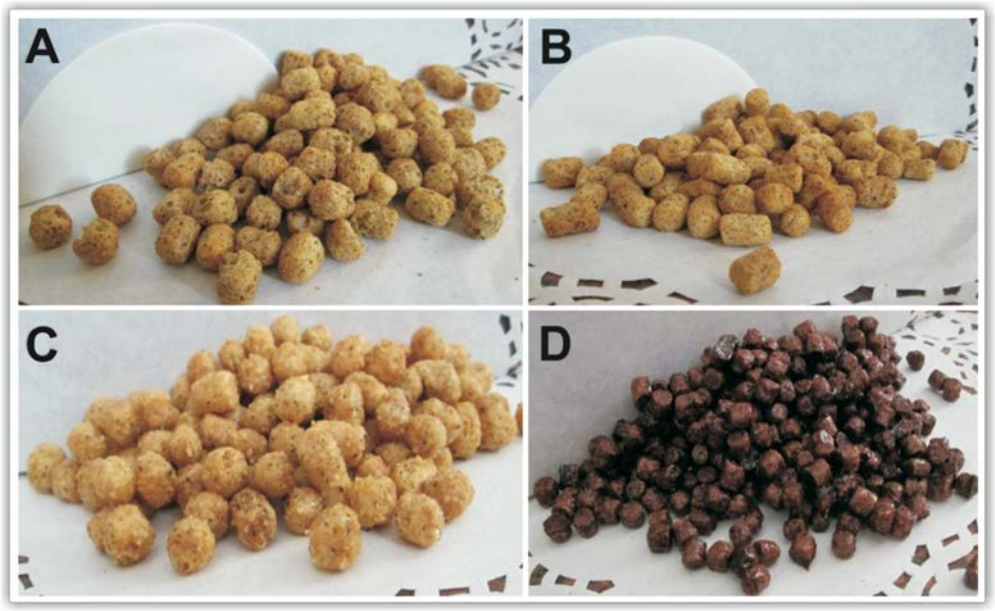
T4.3 Development of new processing and packing techniques

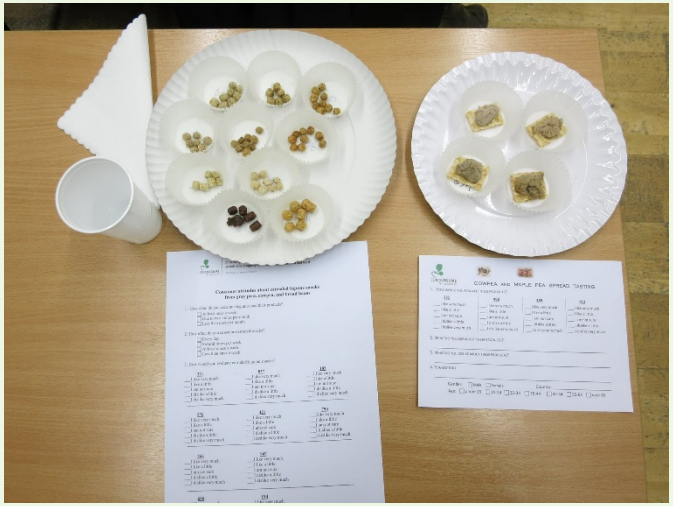
T4.4 Economic assessment of new products

WP Leader: Dr. Ruta Galoburda| LLU

Funded by the 7th Research Framework Programme of the European Union

Nutritional value and innovate food and feed





Funded by the 7th Research Framework Programme of the European Union

Nutritional value and innovate food and feed

10 days at 1ºC

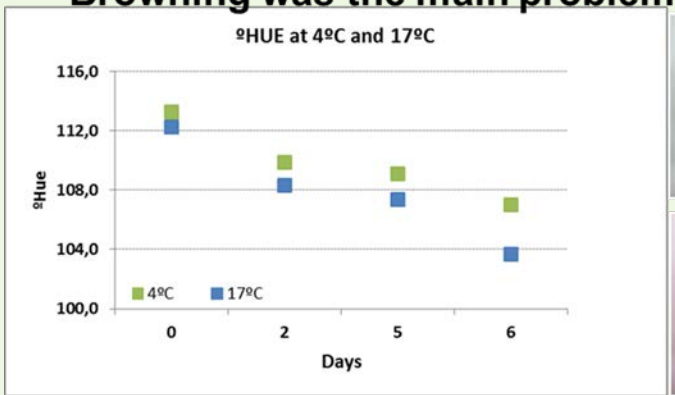
Sodium hypochlorite 10 d, 1ºC

Initial

Sodium hypochlorite 10 d, 15ºC

Ascorbic acid 10 d, 1ºC

Browning was the main problem



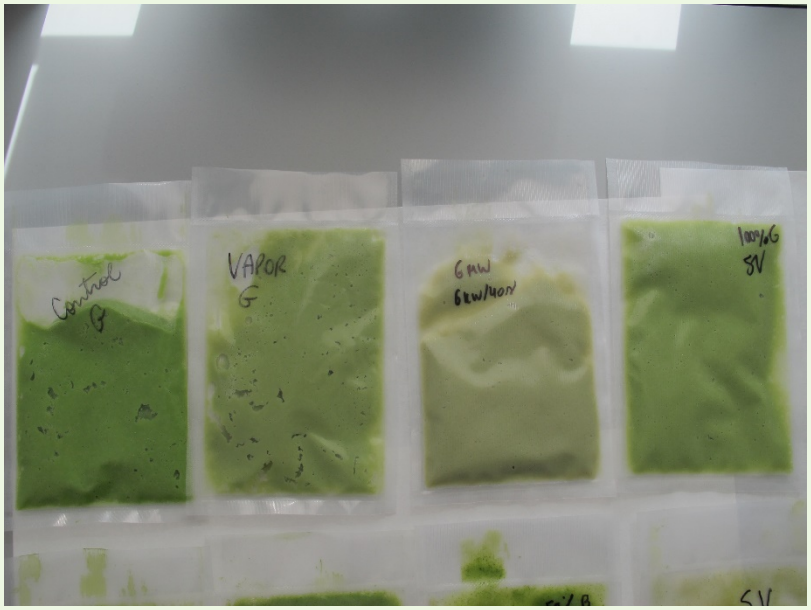
Funded by the 7th Research Framework Programme of the European Union

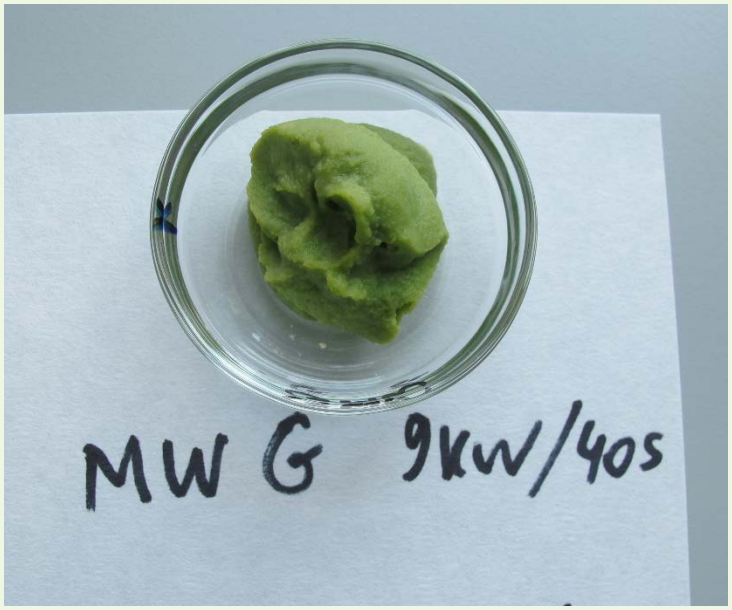
EUROLEGUME
2014-2017

Nutritional value and innovate food and feed

Funded by the 7th Research Framework
Programme of the European Union

Nutritional value and innovate food and feed





Funded by the 7th Research Framework Programme of the European Union

EUROLEGUME 2014-2017

Enhancing of legumes growing in Europe through sustainable cropping for protein supply for food and feed

FP7 Research Project Nº 61378

WP 5 – Legume supported cropping system in sustainable agriculture

Introducing of pea, faba bean, and cowpea in production schemes to enhance the sustainability of agricultural systems and improve the yield and economical benefit

T5.1 High protein outcome-focused field investigations

T5.2 Biological nitrogen fixation focused investigations

T5.3 Transcriptomic characterization in drought stress

WP Leader: Prof. Dr. Dimitrios Savvas| AUA

Funded by the 7th Research Framework Programme of the European Union

EUROLEGUME 2014-2017

Enhancing of legumes growing in Europe through sustainable cropping for protein supply for food and feed

FP7 Research Project Nº 61378

WP 5 – Legume supported cropping system in sustainable agriculture

T5.2 Biological nitrogen fixation focused investigations

- Sub-Task 5.2.1. Detection of genotypes & cropping system influence on soil properties
- Sub-Task 5.2.2. Evaluation of the BNF efficiency of different Rhizobia & AMF strains under field conditions
- Sub-Task 5.2.3. Evaluation of commercially produced Rhizobia & AMF strains in pot trials and under field conditions

WP Leader: Prof. Dr. Dimitrios Savvas| AUA

Funded by the 7th Research Framework Programme of the European Union

WP 5 – Legume supported cropping system in sustainable agriculture

T5.2 Biological nitrogen fixation focused investigations

^{15}N natural abundance method

$$\delta^{15}N = \frac{Sample\ atom\%^{15}N - 0.3663}{0.3663} \times 1000$$

$$\%Ndfa = \frac{\delta^{15}N\ of\ reference\ plant - \delta^{15}N\ of\ N_2\text{-}fixing\ legume}{\delta^{15}N\ of\ reference\ plant - B} \times 100$$

$$BNF_{hb} = \frac{DMY \times NL \times \%Ndfa}{10000}$$

Funded by the 7th Research Framework Programme of the European Union

EUROLEGUME 2014-2017

Enhancing of legumes growing in Europe through sustainable cropping for protein supply for food and feed

FP7 Research Project Nº 61378

WP 5 – Legume supported cropping system in sustainable agriculture

Sub-Task 5.2.2. Evaluation of the BNF efficiency of different Rhizobia & AMF strains under field conditions

- 2014-2015. Haba: *Burkholderia* sp. + *Glomus intraradices, G. etunicatum, G. claroideum* y *G.mosseae* (AMF)
- 2015. Caupi: R32 *Rhizobium* sp., R63 *Bradyrhizobium japonicum*, R57 *Bradyrhizobium* sp. + AMF
- 2015-2016. Haba: F11.1 *Rhizobium leguminosarum* bv. *viciae*, F33.3- *Burkholderia cenocepacia*, R46- *B. vietnamiensis* + AMF

WP Leader: Prof. Dr. Dimitrios Savvas| AUA

Funded by the 7th Research Framework Programme of the European Union

EUROLEGUME 2014-2017

Enhancing of legumes growing in Europe through sustainable cropping for protein supply for food and feed

FP7 Research Project Nº 61378

WP 5 – Legume supported cropping system in sustainable agriculture

WP Leader: Prof. Dr. Dimitrios Savvas| AUA

Funded by the 7th Research Framework Programme of the European Union

Rendimiento de un cultivo de haba inoculado con bacterias fijadoras de nitrógeno y micorrizas

Rendimiento (kg/m^2)			
Muchamiel		**Palenca**	
control	inoculado	control	inoculado
1,2	1,9 (58%)	1,3	2,3 (77%)

Y	X	R^2	F value
% de micorrización	CE ($\mu S\ cm^{-1}$)	0.99	45***
	B-glucosaminidasa ($\mu mol\ PNP\ g^{-1}\ h^{-1}$)		
	Producción ($kg\ ha^{-1}$)	0.91	253***
Peso de 100 semillas	Nt suelo ($g\ kg^{-1}$) BNF nódulos ($kg\ N\ ha^{-1}$)	0.99	308***
Número de nódulos	Deshidrogenasa ($nmol\ INTF\ g^{-1}\ h^{-1}$)	0.81	19***
	BNF nódulos ($kg\ N\ ha^{-1}$)		
BNF raíz ($kg\ N\ ha^{-1}$)	P raíz ($mg\ kg^{-1}$) NO_3^- suelo ($mg\ kg^{-1}$)	0.76	15***

EUROLEGUME 2014-2017

Enhancing of legumes growing in Europe through sustainable cropping for protein supply for food and feed

FP7 Research Project Nº 61378

WP 5 – Legume supported cropping system in sustainable agriculture

Sub-Task 5.2.3. Evaluation of commercially produced Rhizobia & AMF strains in pot trials and under field conditions

Summer 2016

- 2 pea accessions
- different in root architecture and morphology
- 2 nitrogen fixing-bacteria + AMF
- Pots fill with field soil mixed with 30% sand

WP Leader: Prof. Dr. Dimitrios Savvas| AUA

Funded by the 7th Research Framework Programme of the European Union

EUROLEGUME 2014-2017

Enhancing of legumes growing in Europe through sustainable cropping for protein supply for food and feed

FP7 Research Project Nº 61378

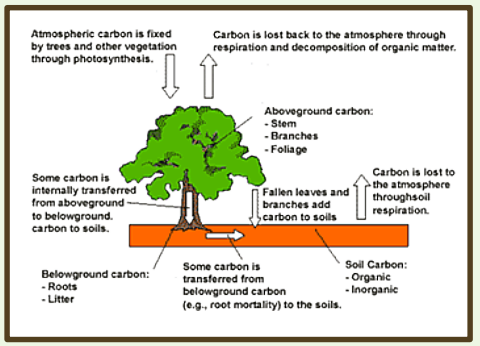
WP 6 – Management and valorisation of the residual biomass

To give an added-value to products from legume grain production

T6.1 Added value of crop residues

T6.2 N – availability to following crops

T6.3 Carbon sequestration and greenhouse gases balance



Funded by the 7th Research Framework Programme of the European Union

EUROLEGUME 2014-2017

Enhancing of legumes growing in Europe through sustainable cropping for protein supply for food and feed

FP7 Research Project Nº 61378

WP 6 – Management and valorisation of the residual biomass

T6.2 N – availability to following crops

Table 6. Soil analysis after a melon crop in rotation with faba bean crop.

Previous cultivar (PC)	Management practice (MP)	Total N in soil (g/kg)	Soil organic carbon (g/kg)	NH_4^+ in soil (mg/kg)
Muchamiel	Conventional	1.00±0.05	13.1±0.4	6.1±1.7
Palenca	Conventional	0.90±0.29	18.1±6.7	4.5±0.5
Fallow plot	Conventional	1.00±0.13	13.4±1.7	7.6±1.1
Muchamiel	Organic	0.98±0.11	11.9±1.1	7.7±2.0
Palenca	Organic	0.84±0.16	11.8±1.1	5.8±0.3
Fallow plot	Organic	0.98±0.06	12.5±0.5	5.7±0.6
Significance				
PC		$1.030^{N.s.}$	$0.318^{N.s.}$	$0.675^{N.s.}$
MP		$0.187^{N.s.}$	$3.926^{N.s.}$	$0.004^{N.s.}$
PC x MP		$0.024^{N.s.}$	$0.051^{N.s.}$	$2.711^{N.s.}$

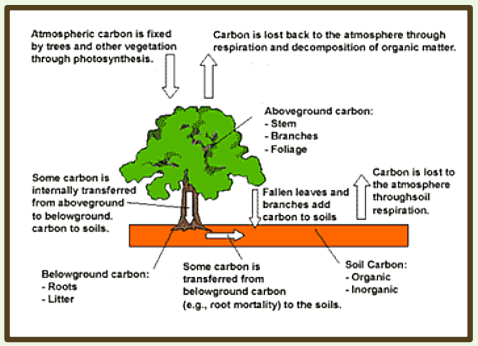


Table 7. Crop yield and fruit quality parameters in the melon crop in rotation with faba bean crop.

Previous cultivar (PC)	Management practice (MP)	Crop yield (kg/ha)	Fruit weight (kg)	Fruit length (cm)	Sugar content (%)
'Muchamiel'	Conventional	20060±9786	2.50±0.14	25.2±1.6	9.05±0.07
'Palenca'	Conventional	13000±6307	2.14±1.43	22.3±4.6	10.05±1.76
Fallow plot	Conventional	16667±7761	2.35±0.44	24.0±1.5	9.06±0.68
'Muchamiel'	Organic	15710±7877	2.10±0.70	21.3±3.8	9.45±0.21
'Palenca'	Organic	19540±735	2.10±1.10	18.2±5.8	8.30±0.90
Fallow plot	Organic	14486±5302	2.13±0.64	23.3±1.73	9.20±1.71
Significance					
PC		$0.143^{N.s.}$	$0.660^{N.s.}$	$1.491^{N.s.}$	$0.012^{N.s.}$
MP		$0.002^{N.s.}$	$1.242^{N.s.}$	$2.682^{N.s.}$	$0.407^{N.s.}$
PC x MP		$0.657^{N.s.}$	$0.173^{N.s.}$	$0.453^{N.s.}$	$1.052^{N.s.}$

Funded by the 7th Research Framework Programme of the European Union

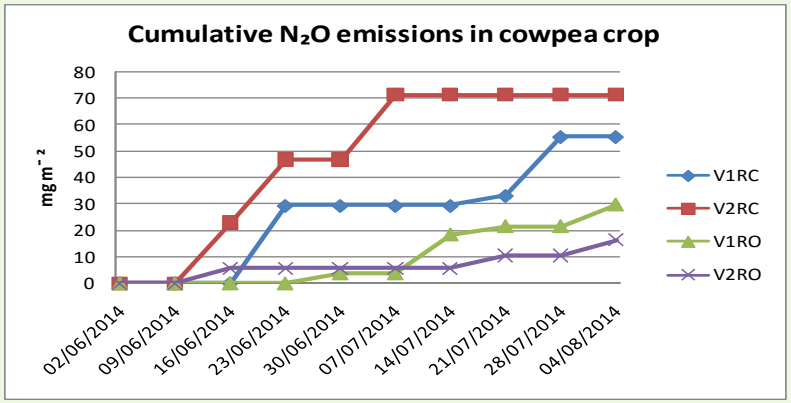
EUROLEGUME 2014-2017

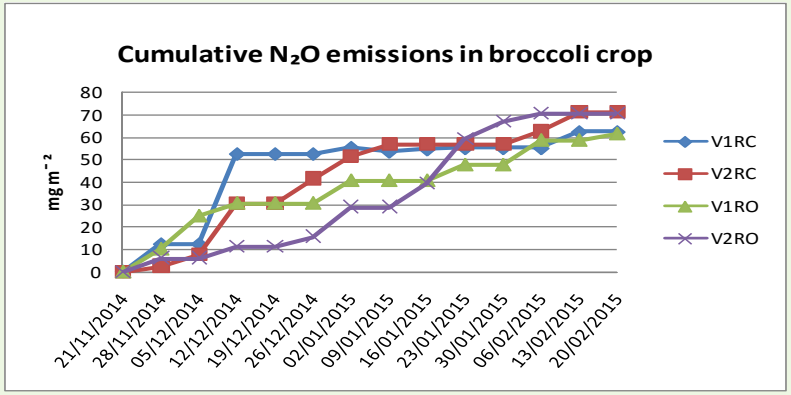
Enhancing of legumes growing in Europe through sustainable cropping for protein supply for food and feed

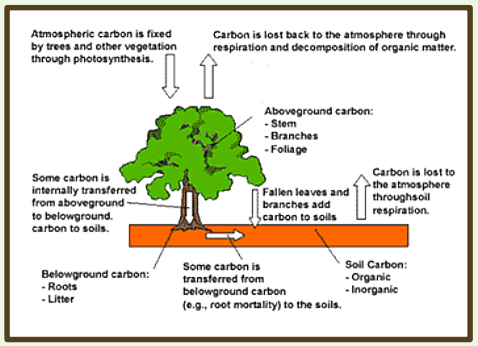
FP7 Research Project Nº 61378

WP 6 – Management and valorisation of the residual biomass

T6.3 Carbon sequestration and greenhouse gases balance



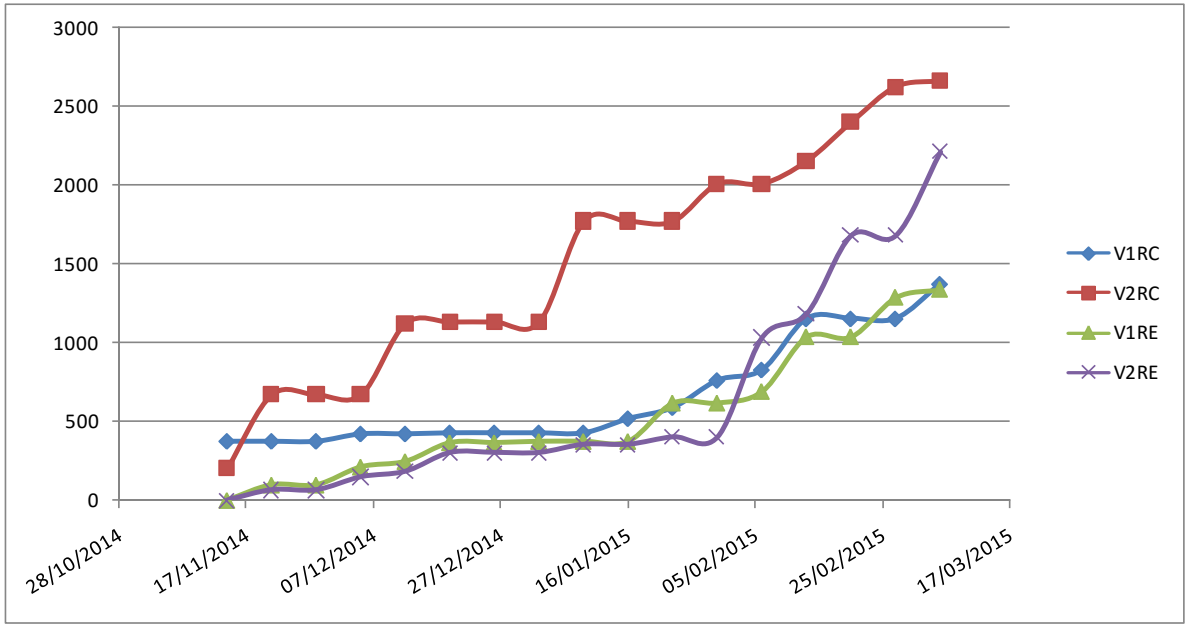




Funded by the 7th Research Framework Programme of the European Union

Emisión de gases de efecto invernadero – CH_4

CH_4 (mg/m²)	
Muchamiel (V1)	**Palenca (V2)**
Un incremento de **33,6** mg/m² en cultivo convencional (RC) frente al ecológico (RE)	Un incremento de **455** mg/m² en cultivo convencional (RC) frente al ecológico (RE)



EUROLEGUME 2014-2017

Enhancing of legumes growing in Europe through sustainable cropping for protein supply for food and feed

FP7 Research Project Nº 61378

www.eurolegume.com

WP Leader: Dr. Margit Olle| ECRI

WP 7 – Communication and Dissemination

T7.1 Development of website and its updating

T7.2 Planning and dissemination activities

T7.3 Implementation of dissemination activities

i) Publication of scientific papers

ii) Dissemination of activities throughout newletters and social networks

iii) Publication of EUROLEGUME results and outcomes

Funded by the 7th Research Framework Programme of the European Union

EUROLEGUME 2014-2017

Enhancing of legumes growing in Europe through sustainable cropping for protein supply for food and feed

FP7 Research Project Nº 61378

Thank you very much

Contact: Juan A. Fernández

E-mail: juan.fernandez@upct.es

Funded by the 7th Research Framework Programme of the European Union