sustAffor

Bridging effectiveness and sustainability in afforestation

CAPACITIES

Sustaffor Project – 1st Training for SMEs

27th February 2015, Poznan

3. Economic issues in reforestation: from plant quality to planting

Francisco José Lario, TRAGSA

GrupoTragsa

Garantía Profesional. Servicio Público

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3. Economic issues in reforestation: from plant quality to planting

3.1. Presentation

3.2. Delivering genetic high quality plants in post fired areas

3.3. Review of silvicultural schemes

3.4. Cost facts on planting

3.1. Presentation

Grupo Tragsa at the service of society

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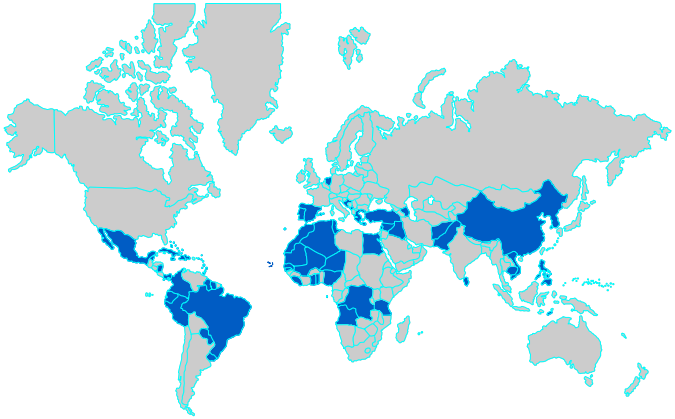
SEPI

Grupo Tragsa is a Spanish state-owned company belonging to the **Sociedad Estatal de Participaciones Industriales (SEPI),** which controls 51% of its capital. The **Sociedad Estatal de Participaciones Industriales** is a public-law entity, whose activities take place in accordance with private-law regulation, and which is attached to the **Ministry of Finance and Public Administrations.**

It consists of Tragsa, the parent company founded in 1977 for the execution of works and services, and Tragsatec, an engineering and consultancy subsidiary set up in 1990.

Grupo Tragsa´s turnover is EUR 943,8 M in 2011.

Geographical Distribution



Grupo Tragsa has strong presence nationwide, with offices in **17 regions and 52 provinces,** providing added value in terms of quick and effective implementation and execution of entrusted projects.

The **international presence of Grupo Tragsa**, with more than **120 projects in 35 countries** in Africa, Latin America and the Caribbean, Asia, Europe and the Middle East, provides the company with:

- Excellent knowledge transfer
- Extensive experience
- Application of the latest technology in its main areas of expertise

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Grupo Tragsa's Activities

1. Environment.
2. Infrastructures.
3. Building and Architecture.
4. Water.
5. Public health and Sanitary services.
6. Services.
7. Studies, technical support and consultancy.
8. Emergency management.

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1. Environment

The vocation of Grupo Tragsa for social environmental performances is innate to its own origin and corporate purpose. Our interventions additionaly cover:

- Biodiversity.
- Conservation, improvement and recovery of spaces.
- Silviculture and forest management.
- Hydrologic and forest recovery and erosion control.
- Prevention, monitoring and control of forest fires.

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1.1 MACEDA NURSERY

PLANT PRODUCTION

LOCATION AND CHARACTERISTICS

- Plant production is done in Maceda (Ourense).
- Nursery facilities are located within a property of 9,8 has, from which 60 % is devoted to production and the 40 % left is devoted to field trials.
- There are four areas of production well defined:

  Working area (2.000 m^2), greenhouse with heating system (6.000 m^2), shadowed area (6.000 m^2) y hardening area (12.000 m^2). There are also two more greenhouses devoted to rooting and hybrid chestnut mother plant culture, as well as office area, warehouse and seed chambers.

MACEDA NURSERY

1.2 PLANT PRODUCTION

PRODUCTION CAPACITY

- Annual production capacity of the nursery is 4 million plants, ranging almost any forest species of Iberian Peninsula, some ornamental species, dune restoration plants and grafted chestnut for fruit production. Shortly, we will produce grafted plant of stone pine and walnuts.

1.3.1

MACEDA NURSERY

PLANT PRODUCTION

PLANT PRODUCTION MEANS

- Personnel in the nursery is highly specialized in plant production with more than 15 years of experience.
- Electronic and mechanical equipment are leading in the sector:

Automatic climatic control

Two semi automatic seeding lines.

Potting machine

Fertigation system

MACEDA NURSERY

PLANT PRODUCTION

PLANT PRODUCTION MEANS

1.3.1

Bed transport system

Two seed and propagative plant material chambers.

Cutting rooting system: temperature and air humidity control with cooling and fog system, heating beds and rooting tunnels

MACEDA NURSERY

1.3.1 PLANT PRODUCTION

PLANT PRODUCTION MEANS

Mother plants fields of hybrid chestnut and maritime pine of high genetic value

Grafting infrastructure: green and wooden vine grafting machines, and special for grafted plants area drop-watered . Highly specialized personnel.

MACEDA NURSERY

PLANT PRODUCTION

SPECIAL PRODUCTION MEANS

1.3.2

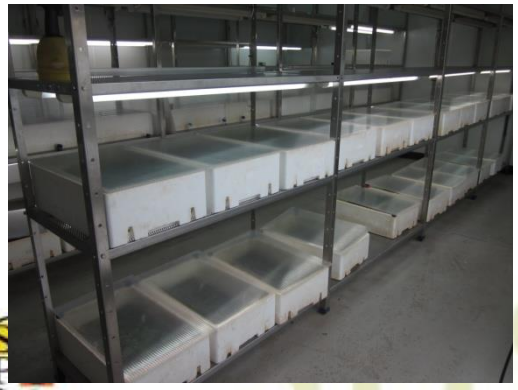
In vitro culture laboratory and acclimation facilities

Two laminar flow cabinet

Two growing chambers

Liquid Temporary Immersion System (TIS)

Photo Autotrophic Micro propagation System (PAM)



Acclimation chamber

Acclimation greenhouse

LINES OF WORK AND COFINANCED PROJECTS IN PUBLIC COMPETITIVE CALLS 2006-2014

DEFINED BY THE MAIN FOREST AND AGROFOREST SPECIES IN OUR INFLUENCE AREA :

Castanea sp

Chestnut Base Materials resistant to *Phytophthora cinnamomi*. **RECATI2 0609**

Large scale production of new and improved Forest Reproductive Materials. **BIOFRON 1012**

Forest plant quality protocols for predicting field performance. **PROVIFOR 0608**

Protection, production, innovation and appreciation of chestnut as center of Rural Development. **INNOVACASTANIA 1315**

Pinus pinaster Ait

Early Growth Form Selection in *Pinus pinaster* in Galicia-NW Iberian Penin. **SELPREFTER 0610**

Strategic Singular Project. Forest Restoration and Management **INITRAGSA 0910**

Genomics tools in *Pinus pinaster* for biomass production and Forest Sustainable Management. **SUSTAINPINE 1012**

Network for innovation in silviculture and integrated systems for forest risk management. **FORRISK 1314**

DEFINED BY THE MAIN AGROFOREST AND AGRICULTURAL SPECIES IN OUR INFLUENCE AREA :

Quercus suber

Cork oak selection on production and cork quality bases; micro propagation and acclimation of selected clones.
SEFEALI 0004

Obtaining Forest Reproductive Materials of cork oak of high quality and cork productivity.
SEFEALII 0609

Vitis vinifera

Micro propagation of vine. Indexing by green grafting for free virus material certification. PGIDT00 AGR11E

Indexing by green grafting of vine varieties. Varietal identification system by molecular markers, and the relationship between micropropagation and rejuvenation of the plants produced.PXIDIT03RAG07E

3.2. Delivering high quality plant in forest burned areas

01 Precedents

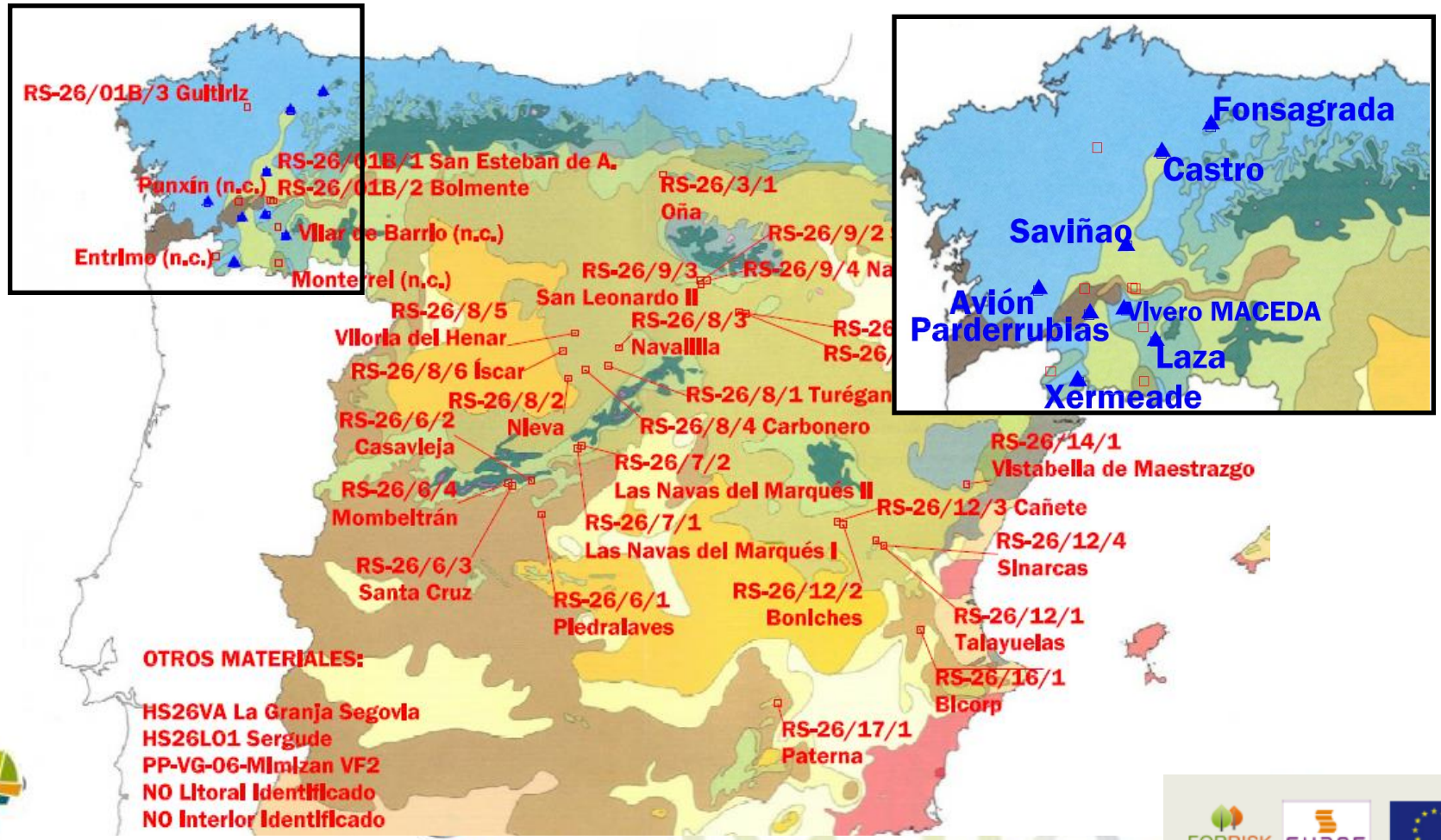
- High risk of summer fire in Galicia
- Around 15.000 ha/year of forest fires in Northwestern Spain
- Sooner restoration the better for preventing soil losses
- Cell forest seedlings are seeded in spring and early summer to achieve appropriated hardening before planting
- Time can be save by delivering already hardened cuttings cultivated in trays of small-sized cells from the end of the summer to the end of the winter
- Because of the more expensive costs in cultivating cuttings, added value of the genetic material should be a prerequisite

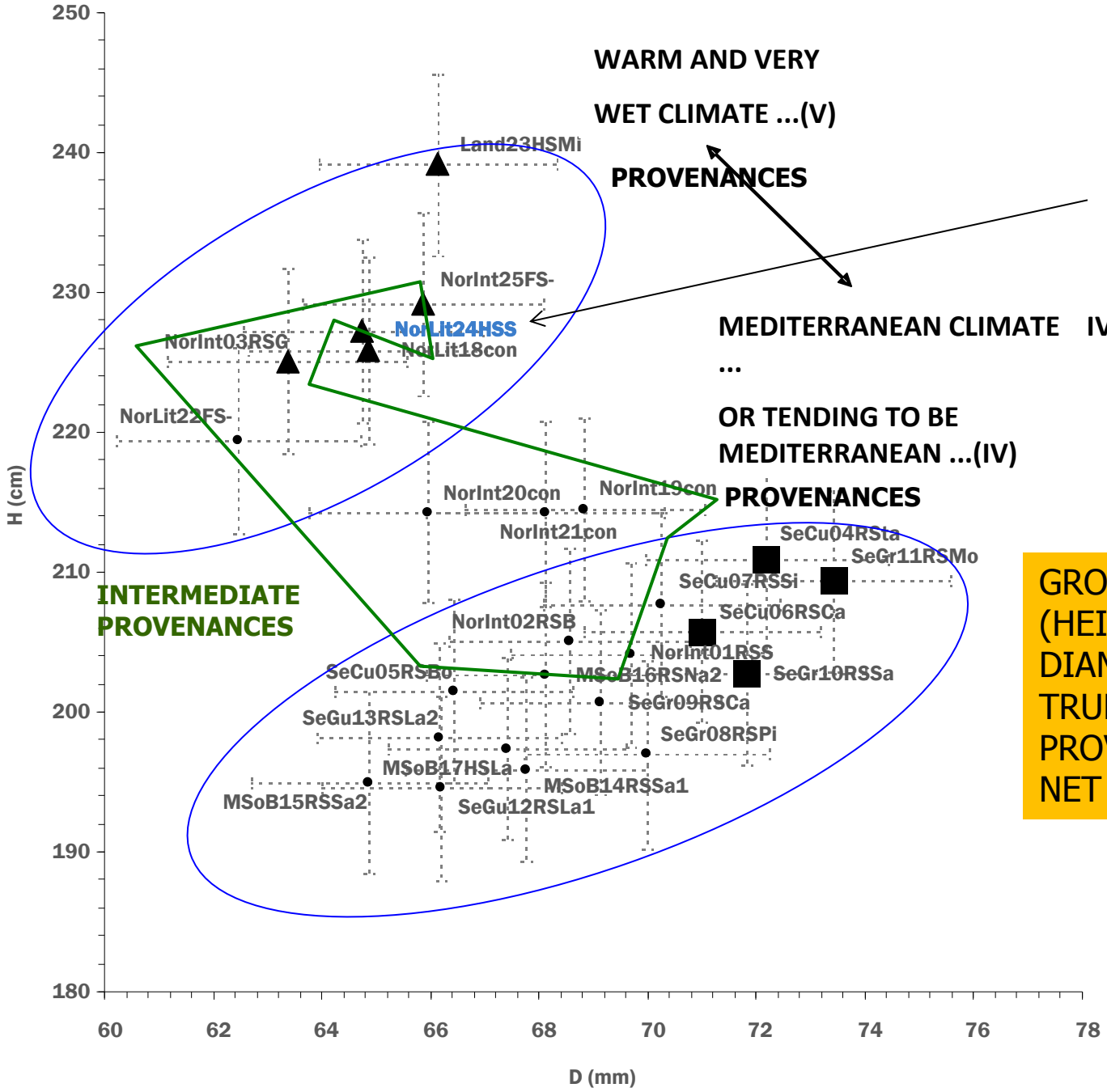
02 Objectives

- REFORESTATION WITH 2 TO 4 MONTHS CULTURE CUTTINGS FROM ALREADY EXISTING MOTHER PLANTS BY MEANS OF USING SMALL CELLTRAYS (MINIPLUGS) INDICATED IN BURNED FOREST AREAS IN GALICIA (NORTHWESTERN SPAIN)

03 Genetic Material

SEED SOURCE PROVENANCE (text in red)
FIELD TRIALS (text in blue)

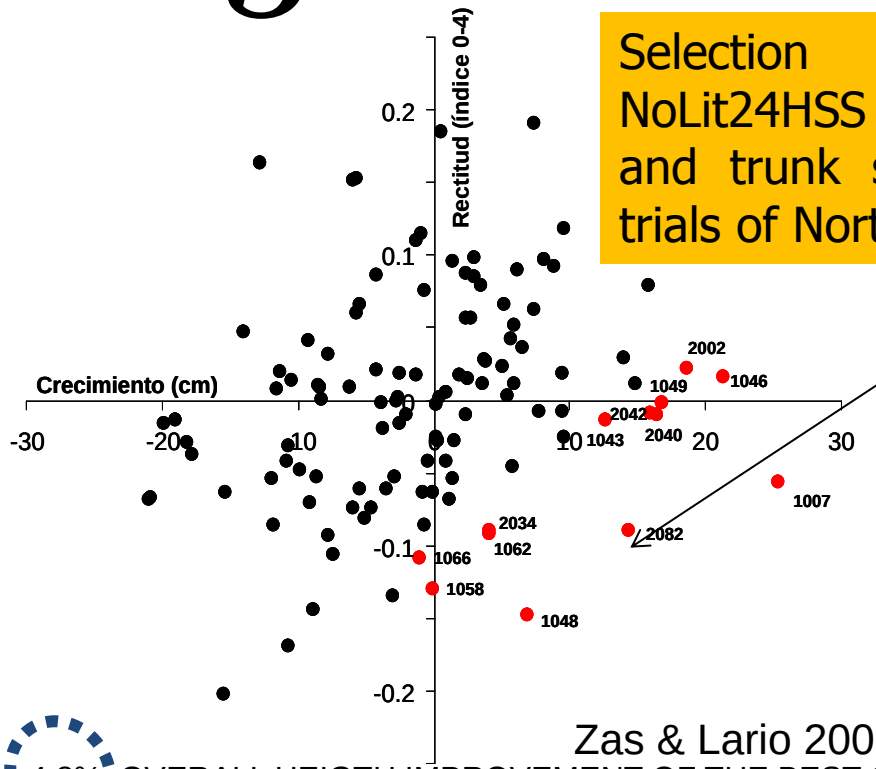




NoLit24HSS provenance compound by 116 families

GROWTH PERFORMANCE (HEIGH AND NORMAL DIAMETER OF THE TRUNK) OF THE TESTED PROVENANCE IN THE NET OF FIELD TRIALS

03 Genetic Material



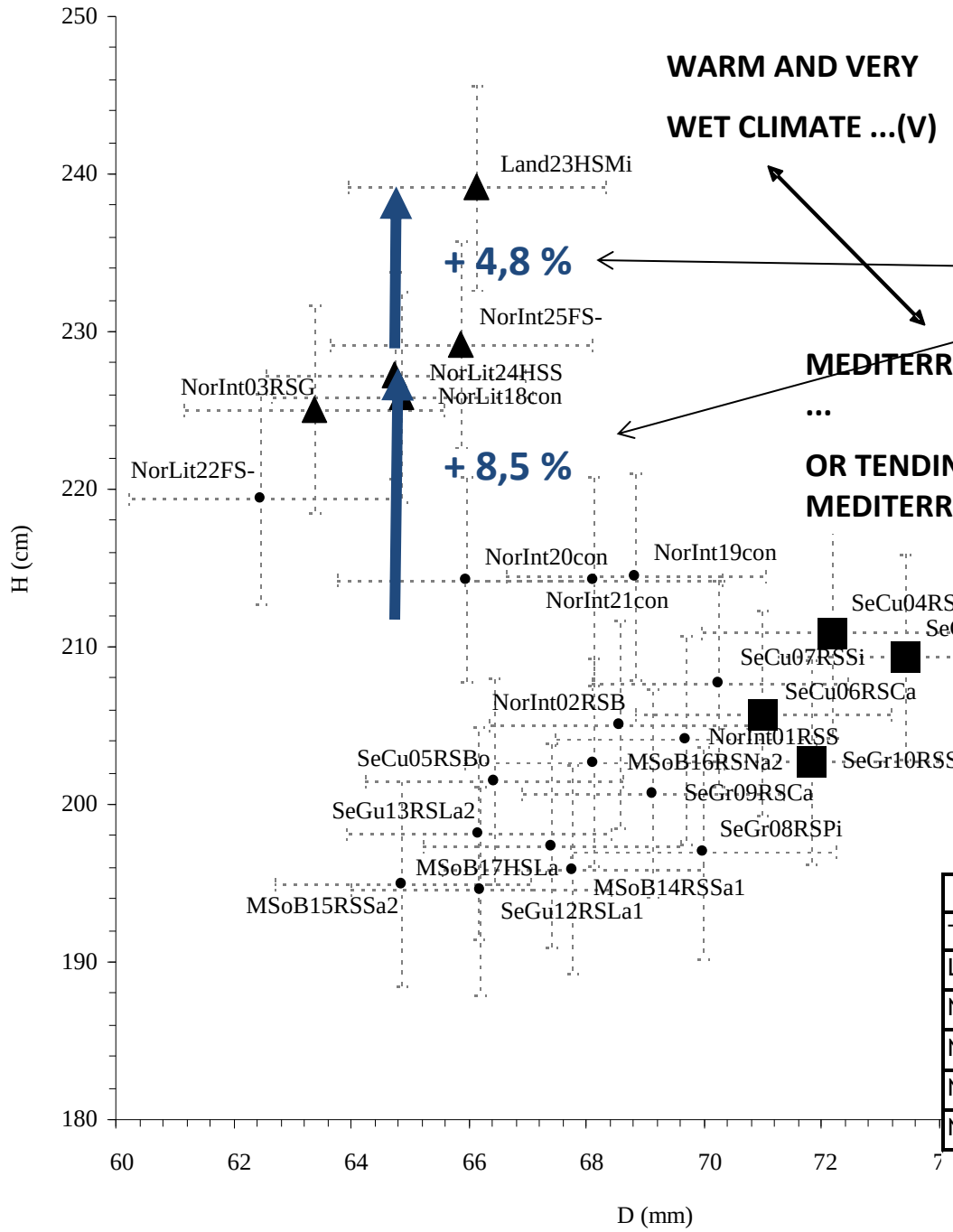
Selection of 12 families within NoLit24HSS provenance by height growth and trunk straightness in four families trials of Northwestern Spain (red pots)

Family improvement respect to the overall performance of all the families of NoLit24HSS provenance

Families	Heigth %	Straigthness %
1007	10.1	5.7
1046	7.5	-1.1
2002	7.2	-3.4
2040	7.2	0.9
1049	7.0	-0.4
2082	6.2	7.6
2042	5.4	0.8
1043	5.1	0.4
2034	1.6	8.5
1062	1.5	7.2
1058	0.0	12.3
1066	-1.1	8.2

Zas & Lario 2008

4,8% OVERALL HEIGTH IMPROVEMENT OF THE BEST 12 FAMILIES RESPECT TO THE OVERALL PERFORMANCE OF ALL THE FAMILIES OF NoLit24HSS PROVENANCE



FINAL IMPROVEMENT OF USING 12 CLONED SELECTED FAMILIES RESPECT TO A MEAN PERFORMING PROVENANCE OF THE SPECIES COULD EQUALS IMPROVEMENT OF NorLit24HSS RESPECT TO THE MEAN PERFORMING PROVENANCE PLUS IMPROVEMENT OF THE 12 CLONED SELECED FAMILIES RESPECT TO THE OVERALL NorLit24HSS PROVENANCE

Height improvement of the best provenance respect to a mean performing provenance of the species

	H Media MC	H Sigma	Mejora (%)
Total	209,50	1,13	-
Land23HSMi	239,14	6,54	14,2
NorInt25FS-	229,19	6,60	9,4
NorLit24HSS	227,22	6,55	8,5
NorLit18con	225,87	6,63	7,8
NorInt03RSG	225,11	6,57	7,5

03 Genetic Material

PLANTED FOREST OPERATIONAL BALANCE USING NOT IMPROVED GENETIC PLANT MATERIAL OF *Pinus pinaster*

YEAR	CONCEPT	INVERSIÓN (€/ha)	RETORNO (€/ha)	RESULTS (€/ha)
0	PLANT	231.83	-	- 231.83
0	PLANTATION	2.767,77	-	- 2.767,77
2	CLEARING 1	368.90	-	- 368.90
4	CLEARING 2	387.57	-	- 387.57
10	THINNING 1	562.48	573.48	11.00
20	THINNING 2	1.981,66	3.170,40	1.188,74
30	FINAL CUT	8.202,60	18.383,08	10.180,48
		14.502,80	**22.126,96**	**7.624,15**

254 €/Ha year

PLANTED FOREST OPERATIONAL BALANCE USING IMPROVED GENETIC PLANT MATER OF *Pinus pinaster*

YEAR	CONCEPT	INVERSIÓN (€/ha)	RETORNO (€/ha)	RESULTS (€/ha)
0	BRED PLANT	811,39	-	- 811,39
0	PLANTATION	2.767,77	-	- 2.767,77
2	CLEARING 1	368,90	-	- 368,90
4	CLEARING 2	387,57	-	- 387,57
10	THINNING 1	774,57	788,53	13,96
20	THINNING 2	2.499,67	3.991,67	1.492,00
30	FINAL CUT	9.852,06	22.083,19	12.231,14
		17.461,93	**26.863,39**	**9.401,46**

CPI %	2,5	INTER -ANNUAL VARIATION OF PRICES %	2,5	

313 €/Ha year

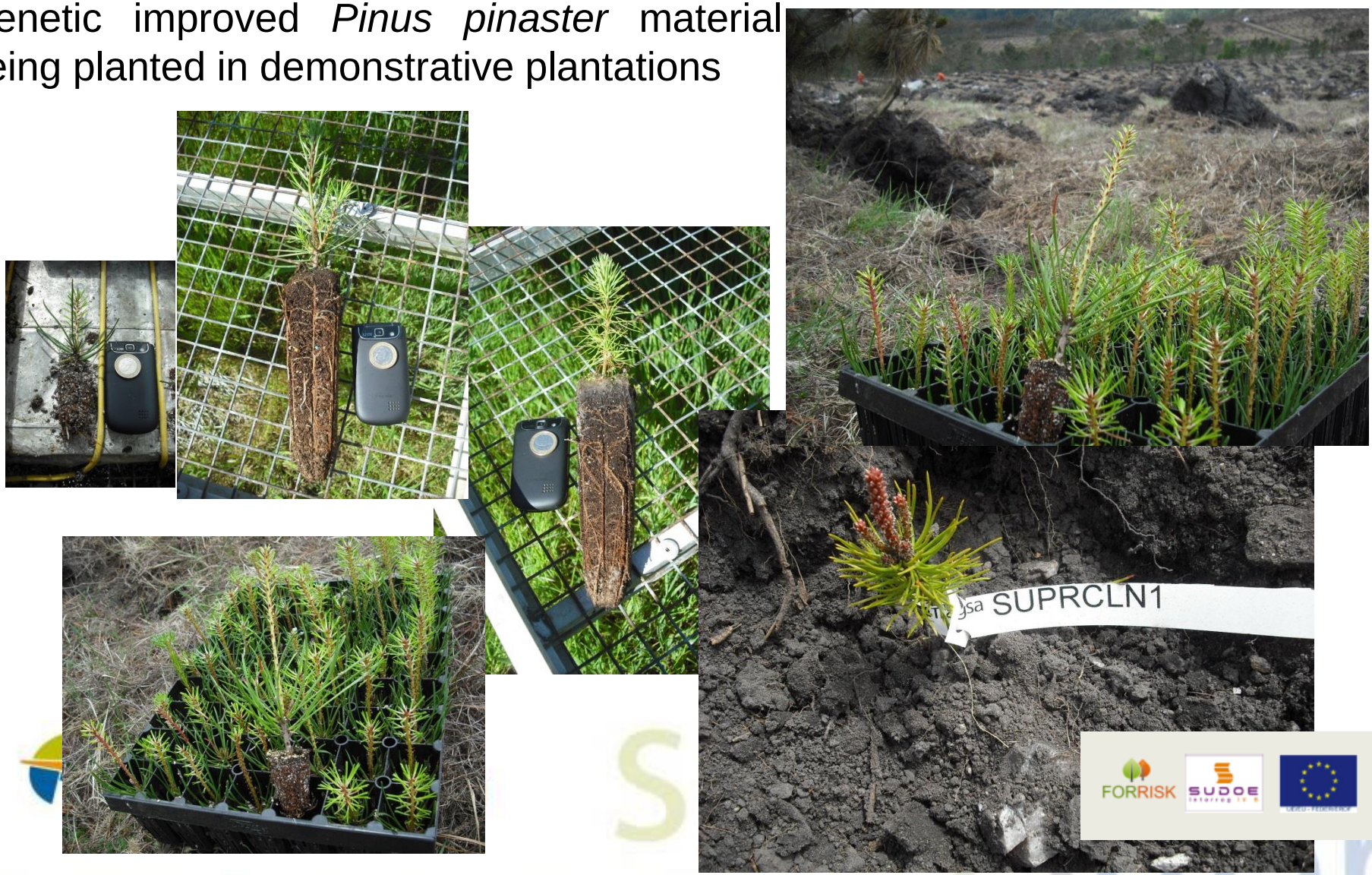
Growths modelled by GesMO 2009 Diéguez-Aranda et al 2009

03 Genetic Material

In Site Index 14 sites of coastal areas….growth would change from 13,26 m3/ha&year to 16,17 m3/ha&year (GesMO© 2009) that would lead to the following economics improvement:

- IRR % from 4,02 to 4,18 if for particle industry
- IRR % from 5,25 to 5,72 for more added value destinies (sawmills,etc.)

Genetic improved *Pinus pinaster* material being planted in demonstrative plantations



QUALITY PLANT MESSAGE

- BETTER GENETICS PLANT INCREASE FOREST PLANTATIONS PROFITABILITY

3.3. Review of some silvicultural itineraries

EUROPEAN FOREST INSTITUTE
ATLANTIC EUROPEAN REGIONAL OFFICE – EFIATLANTIC

FORRISK

SUDOE Interreg IV B

UE/EU - FEDER/ERDF

Multi-criteria risk analysis: comparing different types of forest management in terms of related multiple risks on key-species of the SUDOE area

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Partners : EFI, ISA, CETEMAS, NEIKER, HAZI, INRA, CRPF, CNPF/IDF, FCBA, TRAGSA

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Multi-criteria risk analysis

Method

→ Full risk analysis

→ On main productive species of the regions

Hazard x Vulnerability x Impact

Contrasted forest management scenarios

- To compare several regions

	Portugal	Basque-Country	Galicia	Asturias	Aquitaine	Midi-Pyrénées
Radiata pine		X	X	X		
Eucalypts	X	X	X	X	X	
Maritime pine	X		X	X	X	
Douglas		X				X
Laricio pine		X				
Poplar						X

Multi-criteria risk analysis

Method

→ Full risk analysis

→ On main productive species of the regions

Hazard x Vulnerability x Impact

Contrasted forest management scenarios

- To compare several regions
- To go further than what is usually done

Radiata pine	R1-Classic	R2-Short term	R3-Mid term	R4-High quality	R5-Sophisticated	R6-Biomass		
Eucalypts	E1-Standard	E2- Low investment	E3-Intensive	E4-Short rotation	E5-High quality	E6-Nitens plantation	E7-Lack of active management	*E8-France Standard*
Maritime pine	M1-High quality	M2-Standard classic	M3-Low investement	M4-Short-term with subsidies	M5-Low density without thinning	M6-Half-dedicated to biomass	M7- Biomass	M8- No management
Douglas	D1- Intensive big wood	D2-Standard	D3-Uneven-aged	D4-Intensive thinnings	D5- Mixed	D6-France standard	D7-France short	
Laricio pine	L1- Intensive big wood	L2-Standard	L3-Uneven-aged	L4- Mixed				
Poplar	P1-Standard	P2-Low investment	P3-Intensive	P4-Short rotation		P5- Very short rotation		

Multi-criteria risk analysis — Method

Economic assessment of scenarios

→ Different methods : mainly standing value + different possibilities for costs integration or not (can be compared)

- Regional models to determine yield for all scenarios
- Regional wood prices to determine standing values
- Regional costs for silvicultural practices
- Average value per year

GesMO

Capsis
Computer-aided projection of strategies in silviculture

PBRAVO

Multi-criteria risk analysis

Maritime Pine

Scenario name	Maritime Pine **M1- High quality**	**M2- Standard classic**	**M3- Low investement**	**M4- Short-term**	**M5- Low density without thinning**	**M6- Half-dedicated to biomass**	**M7- Biomass**	**M8- No management**
Objective	High quality timber >1,5m3	Timber 1 to 1,2 m3	Timber 1 to 1,2 m3	Small timber 0,3 to 0,4 m3	Small timber0,3 to 0,4 m3	9 years-biomass (30t/ha) 35 years timber BO (1 m3)	Biomass70 t/ha	Timber 1 to 1,2 m3
Site preparation	No ploughing. Round up. Broadleaf trees preservation	Full ploughing. Fertilization	Smashing roll, strip ploughing, crumbling, seed furrow preparation, no fertilization	Full ploughing. fertilization	Full ploughing. fertilization	Full ploughing. fertilization	Stump removal, full ploughing,. fertilization, drainage	Full ploughing. Fertilization
Stand composition	Maritime pine, broadleaves preservation, diversified wooded undergrowth	Even-aged single species forests	Even-aged single species forests	Even-aged single species forests	Even-aged single species forests	Even-aged single species forests	Even-aged single species	Even-aged single species forests
Genetic material	No	Genetically improved plants	Seeds from graded stands	Genetically improved plants	Genetically improved plants	Genetically improved plants	Genetically improved plants	Genetically improved plants
Regeneration type	Natural regeneration-1400 stems/ha after clearing	Plantation 1250 stems/ha	Sowing-1600 stems after clearing	1250 stems/ha	800 stems/ha	2500 stems/ha (2*2m, 1 row biomass, 1 row timber)	3000 stems/ha	Plantation 1250 stems/ha
Cleaning/ **Clearing/** **Weed control**	Rack creation. Cleaning 1 row /2, with diversified undergrowth, 1 time every 3 to 5 years after rack creation. 2 clearings	Full cleaning once a year during 5 years (every 5 years)	No cleaning before thinning 1 intermediate, then a first economical thinning	2 cleanings	2 cleanings	Silvicultural maintenances between 9 and 30 years	No practices	First cleaning
Thinnings/ **Pruning**	4-5 thinnings- pruning	3-4 thinnings	No pruning/ 4-5 thinnings	1 thinning/ no pruning	No thinning/ no pruning	1 biomass thinning, then 3-4 thinnings	No thinning	No thinnings, no pruning
Harvest	50-60 years ; 300 stems/ha	35-45 years; 300 stems/ha	50-60 years ; 300 stems/ha	25 years ; 700 stems/ha	25years; 700 stems/ha	9 years-biomass 35 years-300 stems/ha	8-12 years	Erratic

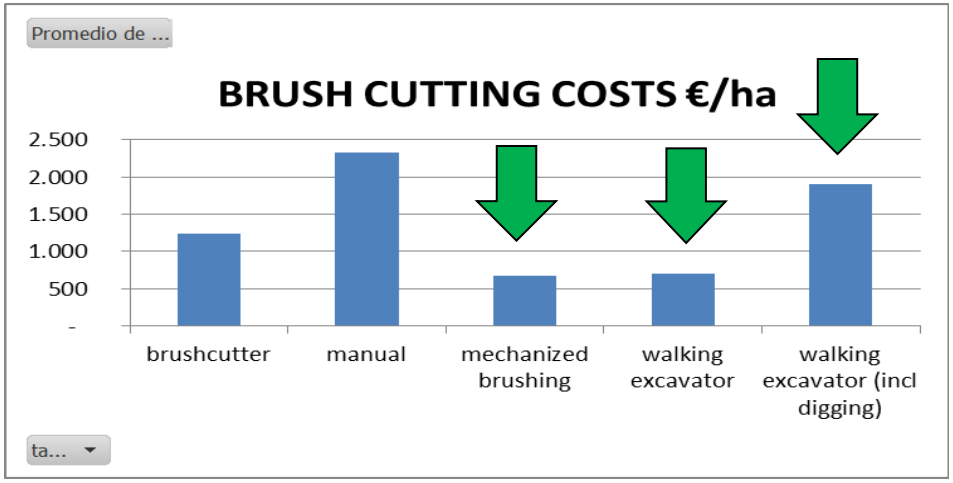
Multi-criteria risk analysis

Poplar

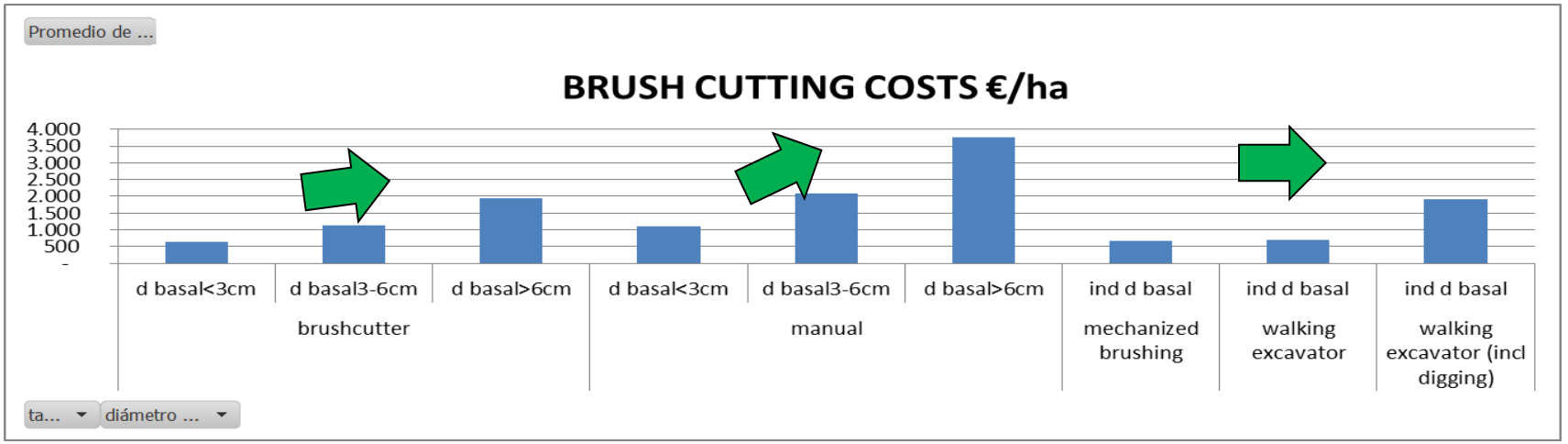
Scenario name	P1- Standard	P2- Low investment	P3- Intensive	P4- Short-rotation	P5- Very short rotation
Objective	Timber	Timber	Timber	Biomass	Biomass
Site preparation	Full ploughing. .Fertilization. Game protection	No game protection. No fertilization.. Localised tillage in « potet »	Full ploughing. .Fertilization. Game protection	Full ploughing. .Fertilization. No game protection	Full ploughing. .Fertilization. No game protection Pre-germination treatment
Stand composition	2 cultivars, optimized on growth	Several clones and diversified undergrowth	Only 1 clone	Multiclonal	Only 1 clone
Genetic material	Multiclonal limited and focused on performance criteria	Multiclonal constant values, quite resistant : blanc du poitou, I45 51 …	Monoclonal on the one with the highest performance at that moment	Multiclonal : clones most secured in a health point of view	Monoclonal : the best initial growth
Rgeneration type	Cutting plantation 7*7 m (204 stems/ha)	Small cuttings plantation 7*7 m. (204 stems/ha)	Cutting plantation 7*7 m (204 stems/ha)	Small cuttings plantation: 3000 stems/ha	Small cuttings plantation: 8000 stems/ha
Cleaning/ Clearing/ Weed control	1 discing per year during 3 years for 2 interlines.	1 discing per year for 3 years.	Discing every year. Tree-health control.	1 discing per year for 3 years.	No control
Prunings	2-3 pruning 6m	Pruning 4 m with a pole	Pruning 8 m	No pruning	No pruning
Harvest	15-18 years	18-22 years	12-15 years	7-10 years	3-5 years

3.4 Costs facts on planting

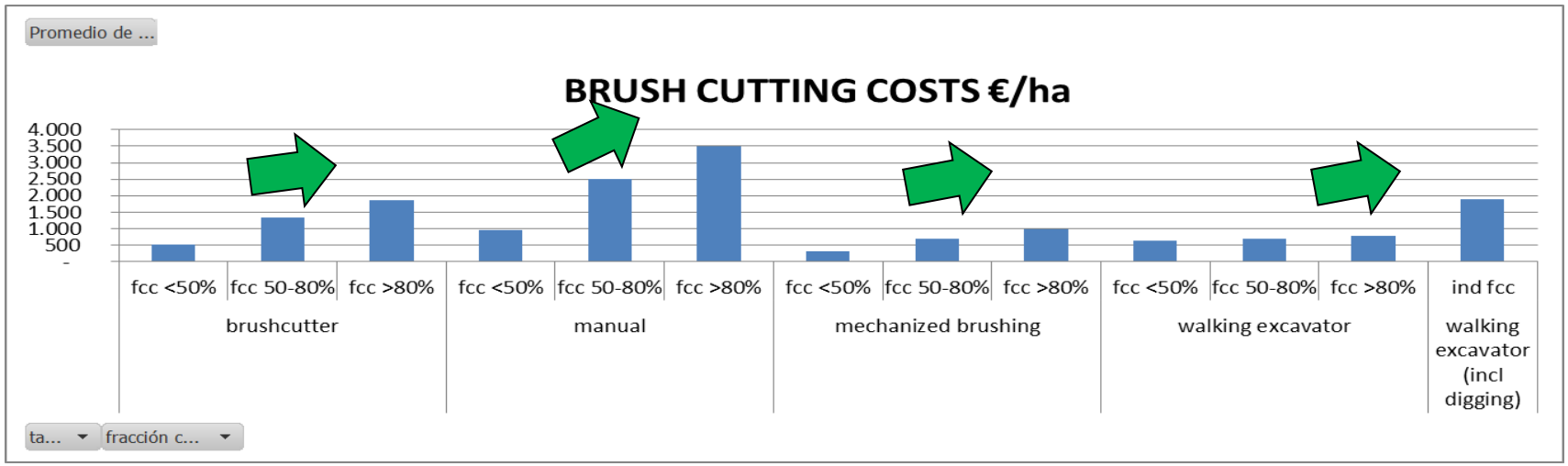
- **BRUSH CUTTING** MEANS



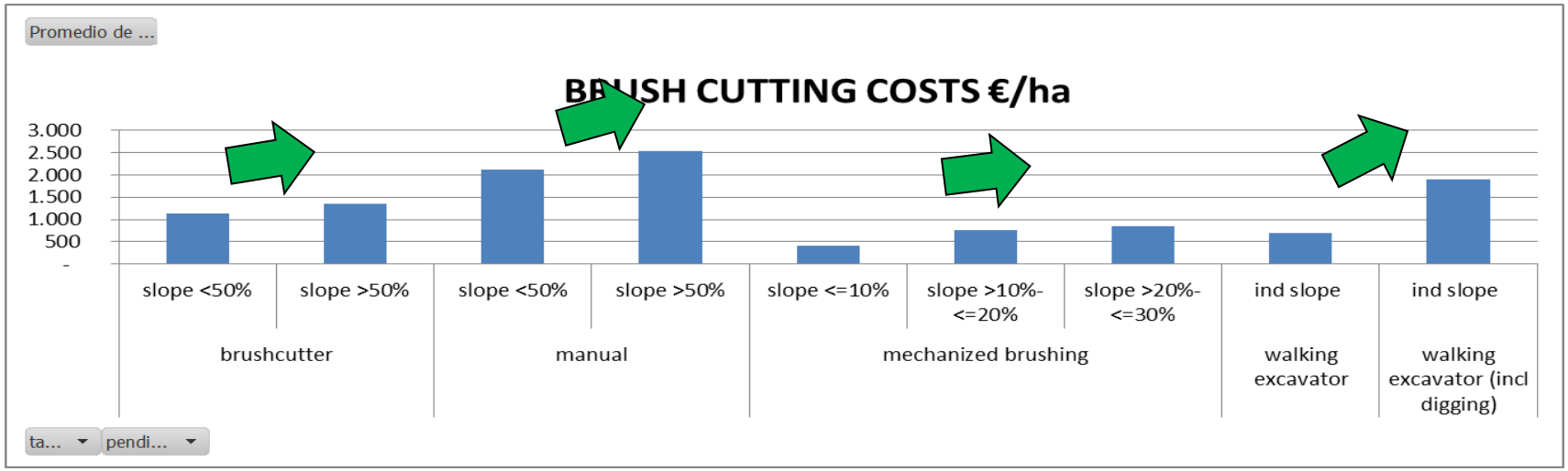
- BY BASAL DIAMETRE WITHIN MEAN OF **BRUSH CUTTING**



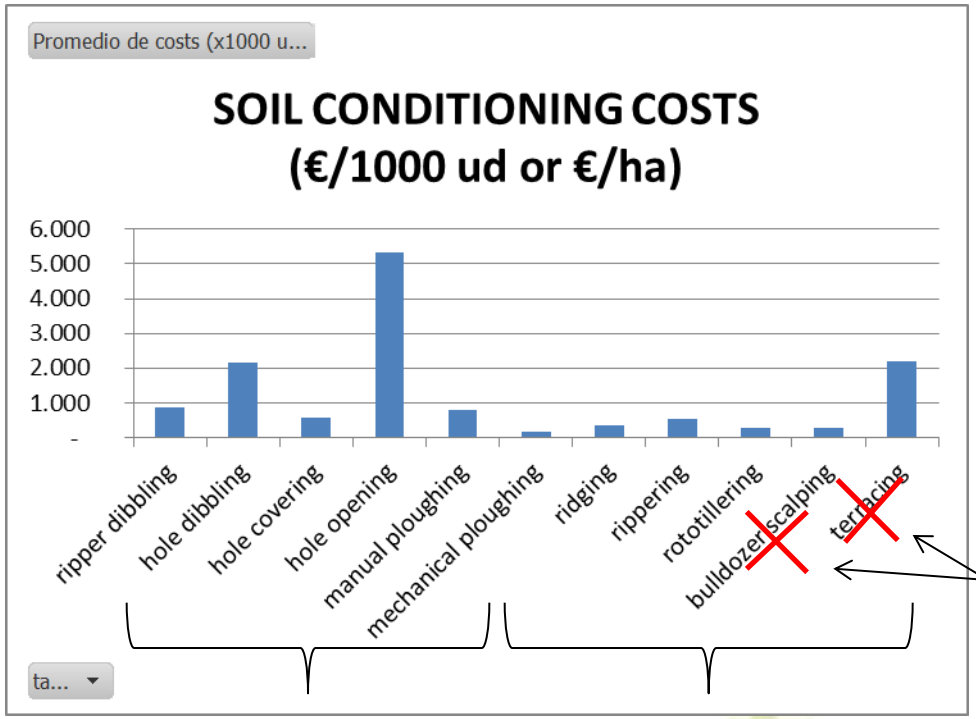
- BRUSH COVERING (fcc) WITHIN MEAN OF **BRUSH CUTTING**



- SLOPE WITHIN MEAN OF **BRUSH CUTTING**



- **SOIL CONDITIONG MEANS**



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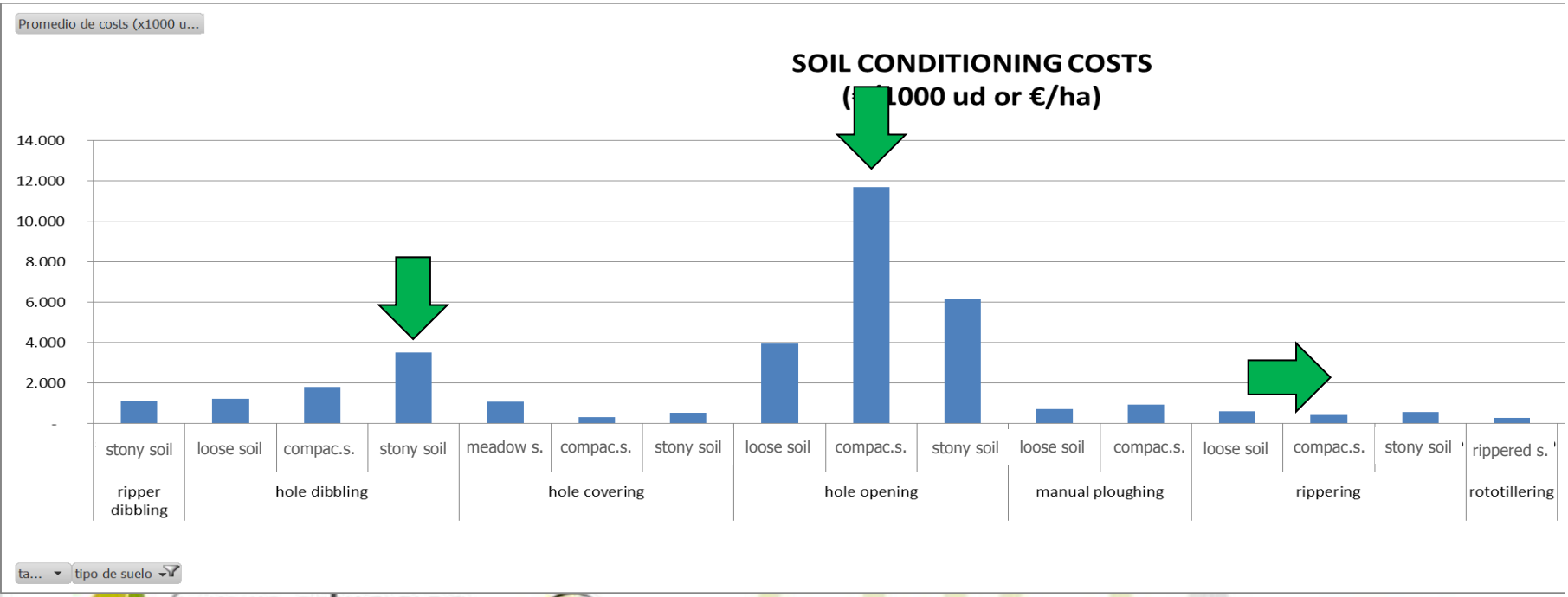
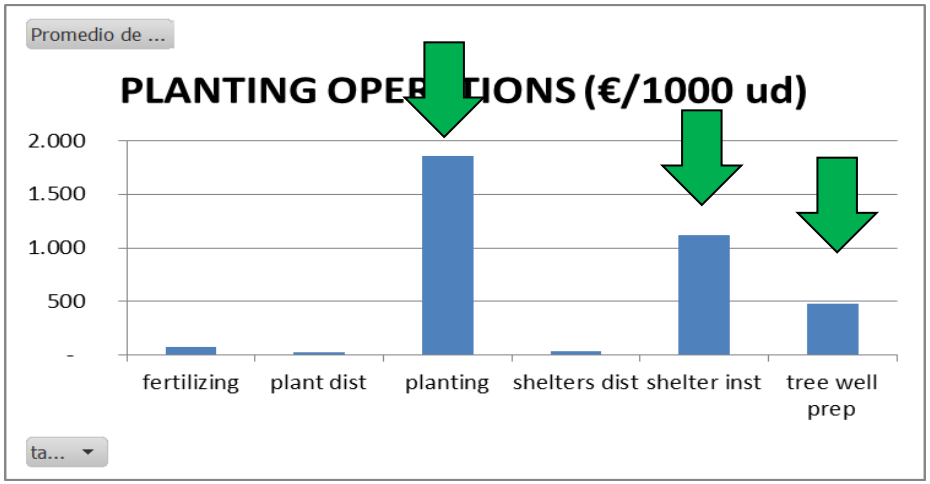
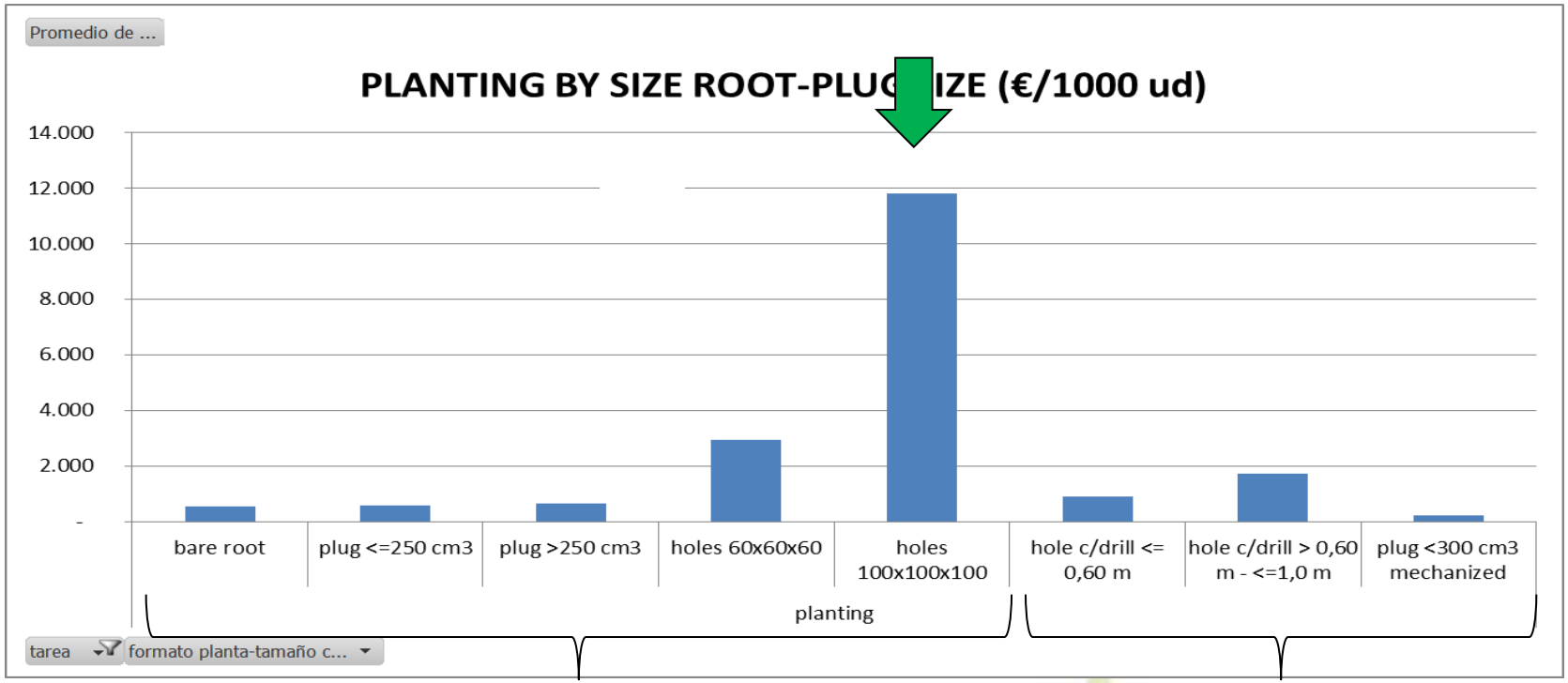
- SOIL TYPE WITHIN **SOIL CONDITIONING MEANS**



- **PLANTING OPERATIONS**



- ROOT-PLUG SIZE WITHIN **PLANTING TYPE**



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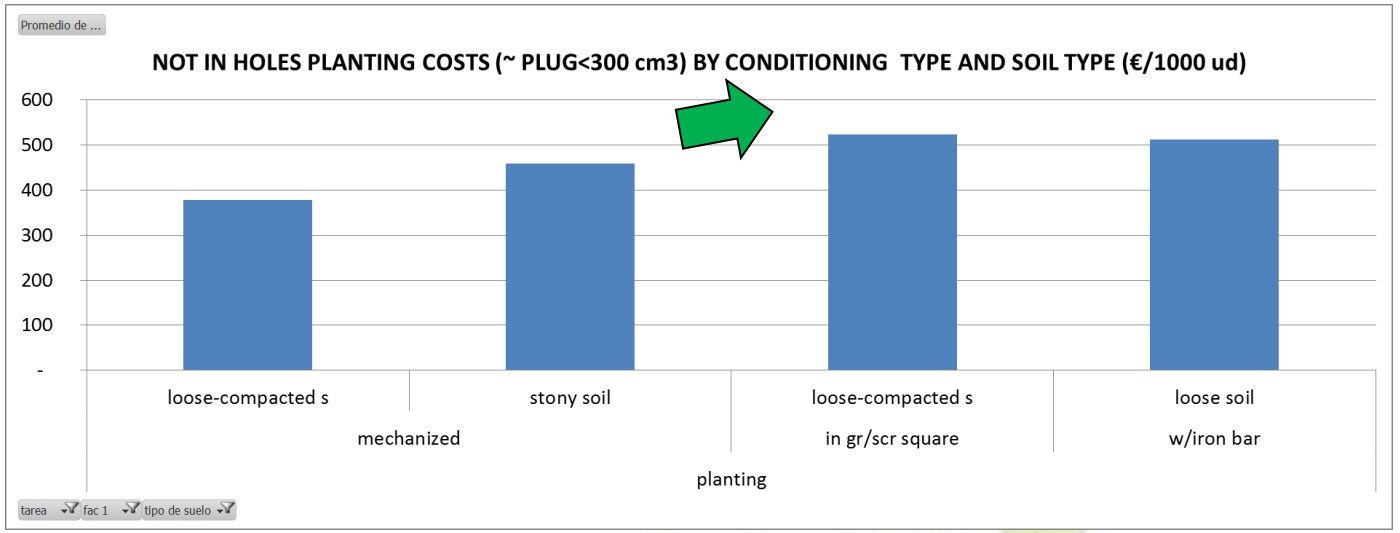
- PREVIOUS SOIL CONDITIONING OPERATION AND TYPE OF SOIL AFFECTING **PLANTING COSTS**



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FACTS ON PLANTING COSTS MESSAGES

- MECHANIZED BRUSH CUTTING IS CHEAPER
- THE HIGHER DIAMETER THE MORE EXPENSIVE BRUSH CUTTING
- THE HIGHER COVERING THE MORE EXPENSIVE BRUSH CUTTING SPECIALLY MANUAL ONE
- THE HIGHER SLOPES THE MORE EXPENSIVE BRUSH CUTTING SPECIALLY MANUAL ONE
- THE MANUAL HOLE DIBBLING AND OPENING ARE THE MORE EXPENSIVE SOIL CONDITIONING MEANS IN WHICH STONY AND COMPACTED SOIL INCREASE COSTS, SPECIALLY
- PLANTING IS THE MOST EXPENSIVE OPERATION IN THE PLANTING MOMENT, FOLLOWED BY TUBE SHELTER INSTALATION AND TREE WELL PREPARING
- IN MANUAL PLANTING THE BIGGER THE PLUG OF THE TREE THE MORE EXPENSIVE THE OPERATION, BUT IN MECHANIZED OPERATIONS PLANTING COSTS DECREASE FOR THE SAME PLUG SIZE
- PLANTING COSTS INCREASE WITH NOT MECHANIZED SOIL CONDITIONING
- PLANTING COSTS ARE BIGGER IN STONY SOILS FOLLOWED BY COMPACTED SOILS AND LOOSE SOILS.

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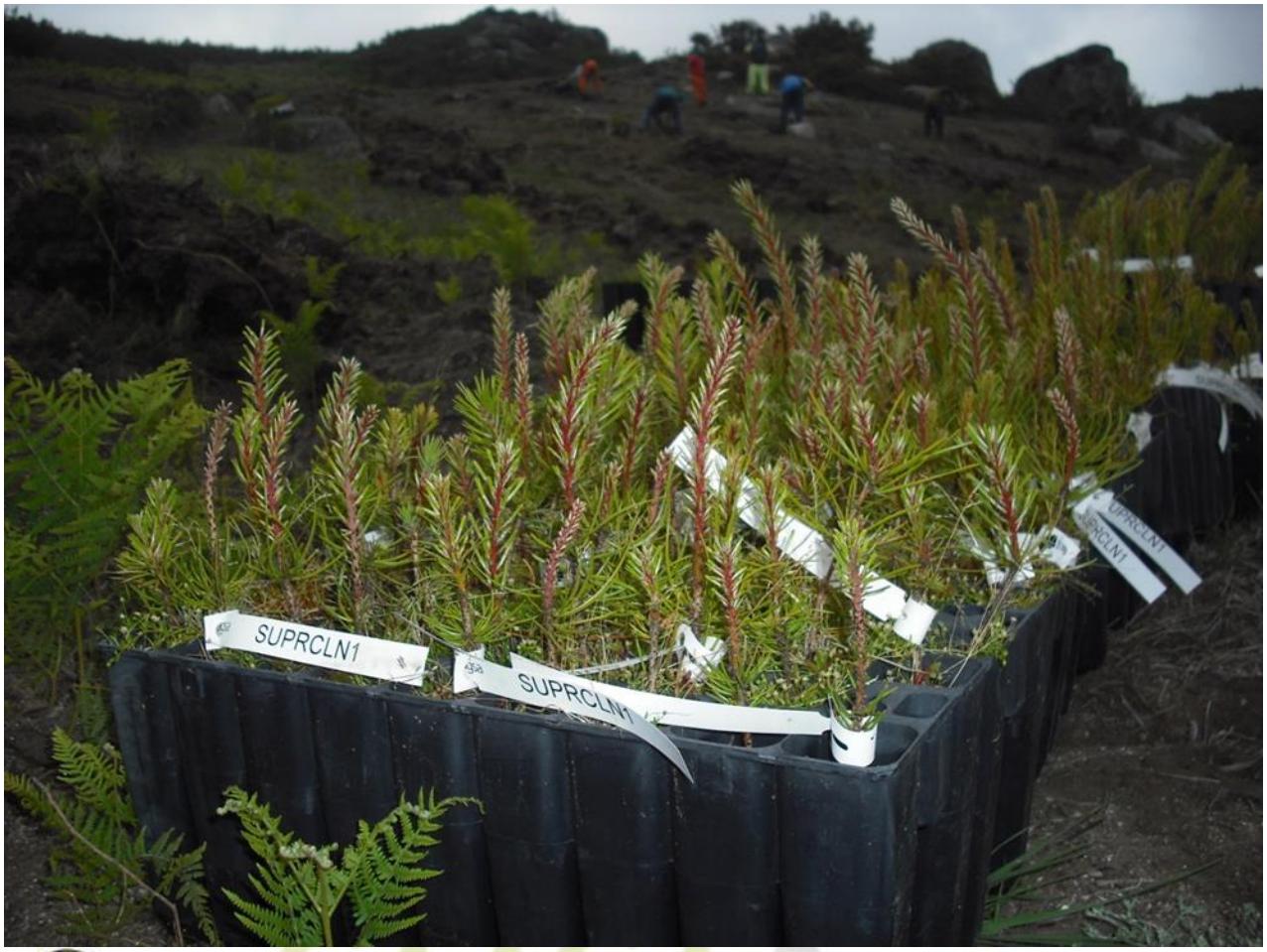
THANK YOU!!

flario@tragsa.es



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