

ALLEY COPPICE: AN ALTERNATIVE LAND USE SYSTEM

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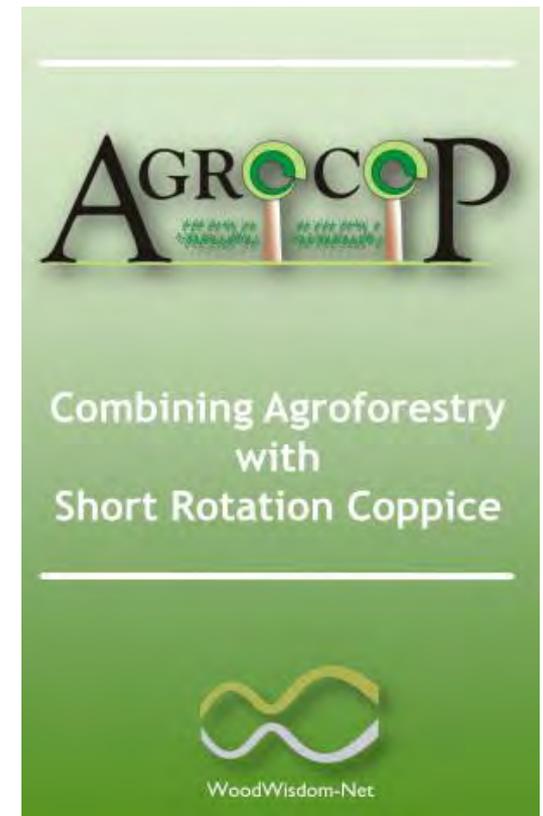
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FARM WOODLAND FORUM MAY 2015. ORGANIC RESEARCH CENTRE

Contents

- -The AGROCOP project
- -Work on this project in Ireland (N&S)

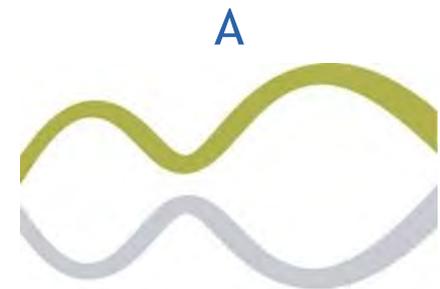


AgroCop

Maximizing Timber and Energy Wood Production by Innovative **Agroforestry** Systems with Short Rotation **Coppice** as Intercrop

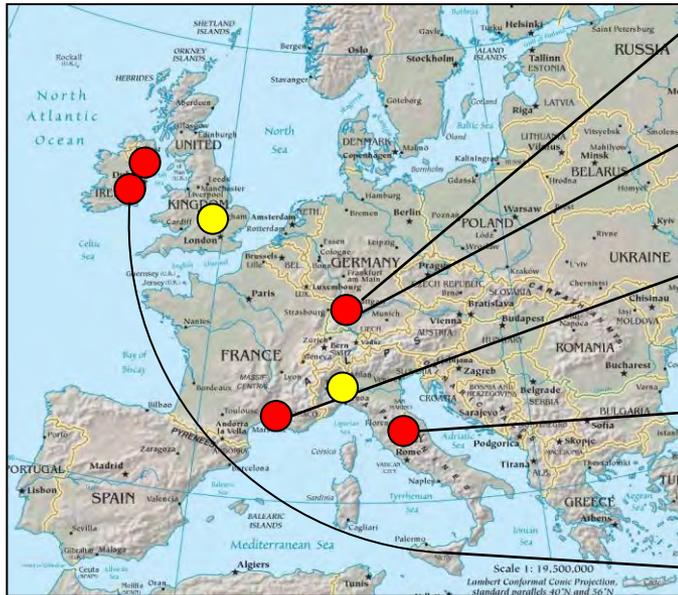


M Nahm, J André, G Douglas,
C Dupraz, G Facciotto,
A Graves, R Lunny, J McAdam, C
Morhart, P Paris, A Pisanelli, H
Spiecker, L Tosi, UH Sauter



WoodWisdom-Net
Project

Who?



1. Forest Research Institute Baden-Württemberg (FVA), Freiburg
2. Chair of Forest Growth (IWW), University of Freiburg
3. Institut National de la Recherche Agronomique (INRA), Montpellier
4. CNR-Istituto di Biologia Agroambientale e Forestale (IBAF), Porano
5. Teagasc - Agriculture and Food Development Authority, Dublin & Agri-Food and Biosciences Institute (AFBI), Belfast

Project Associates:

- Centre for Environmental Risks and Futures, Cranfield University (UK)
- Research Unit for Intensive Wood Production, Casale Monferrato (IT)
- **+ Farmers!**

Background

Europe: Demand for woody biomass will exceed the availability of the raw material in future



Timber



Energy wood



Increase the production of feedstock for both product lines in a sustainable and economically viable way



New land use concepts needed

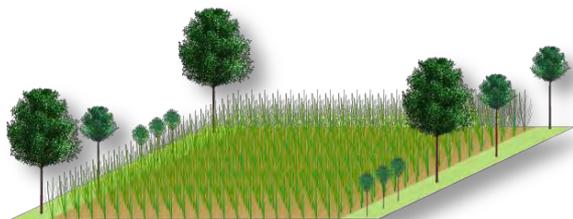
Chosen Approach

Combination of

- 1) Agroforestry-Systems (AFS) for timber production
- 2) Short-Rotation-Coppice (SRC) for energy wood production

on agricultural fields

→ „Alley Coppice“



Morhart C, Douglas G, Dupraz C, Graves A, Nahm M, Paris P, Sauter UH, Sheppard J, Spiecker H. (2014). Alley Coppice – a new system with ancient roots. *Annals of Forest Science*, 71, 527-542.

Objectives

- Establish and monitor experimental Alley Coppice plots in Europe
- Model their biophysical and economic behaviour
- Provide
 - information material,
 - management guidelines,
 - a tool for practitioners to estimate the profitability of an Alley Coppice system on a given field

Major achievements

Milestones:

- Established experimental plots in all involved countries
- Collected data from already existing and the newly established experimental plots
- Collected data (costs / workload) on establishment operations
- Economic and biophysical modelling

Output:

- Four master theses
- One bachelor thesis
- One (three) PhD thesis
- Five published papers, more to come



Selected Results

- Second harvest of SRC
- Modelling trees
- Results from the field trials in AgroCop countries
- Models / Tools
- AF at field edges

Germany

SRC: Harvest of the 2cnd Rotation (CREFF + AgroCop)



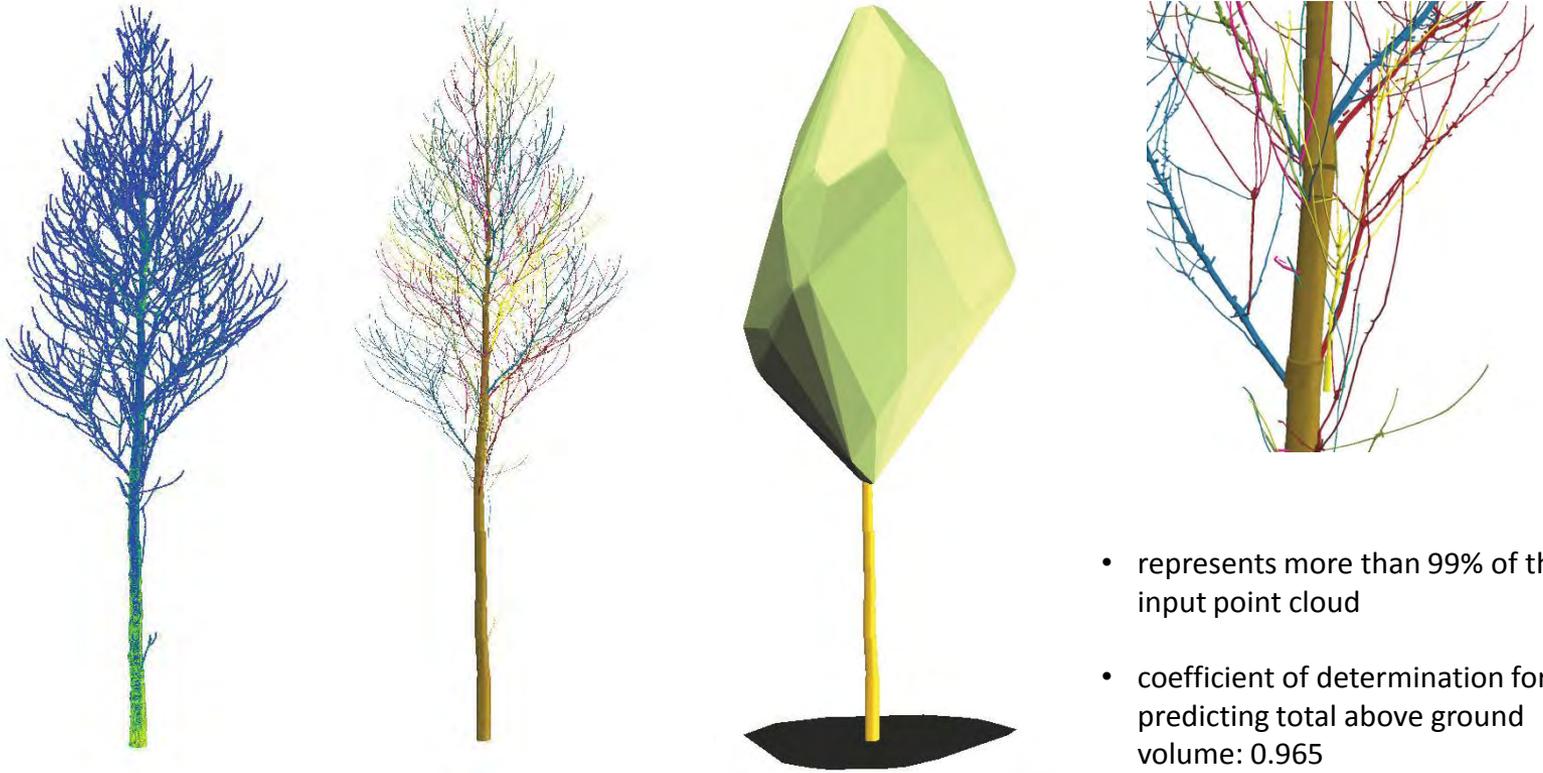
Field	Year	Work productivity [ha / h]
		RWT
Kraichtal 1	2011	0.7
	2013	0.8
Kraichtal 2	2011	1.1
	2013	1.1

→ Second harvest comparable to first

→ CREFF - Tool applicable to 2nd harvest

Germany

Tree Models Derived from Terrestrial Laser Scan Data (Lin2Value + AgroCop)



- represents more than 99% of the input point cloud
- coefficient of determination for predicting total above ground volume: 0.965

Hackenberg J, Morhart C, Sheppard J, Spiecker H, Disney M. (2014). Highly Accurate Tree Models Derived from Terrestrial Laser Scan Data: A Method Description. *Forests*, 5, 1069-1105.

Germany

SRC Biomass Distribution and Nutrient Content

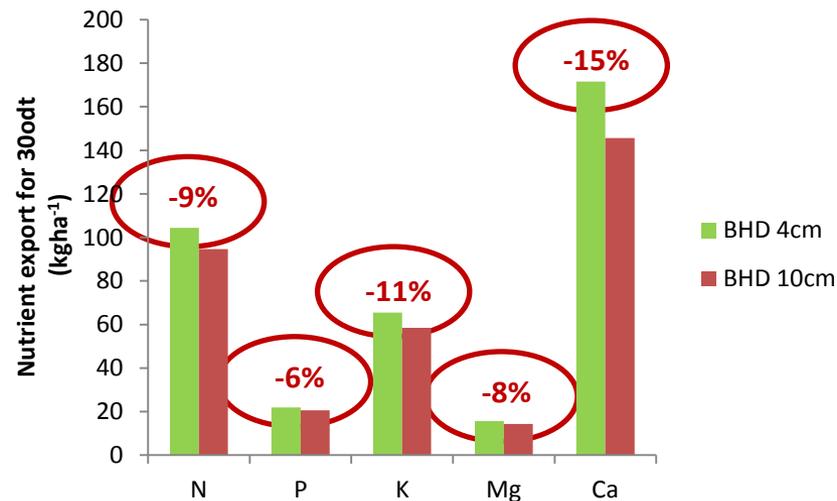
Theoretical scenario:

3-year rotation / 30 odt ha⁻¹

Green: DBH 4cm, 11.143 trees ha⁻¹

Blue: DBH 10cm, 1.461 trees ha⁻¹

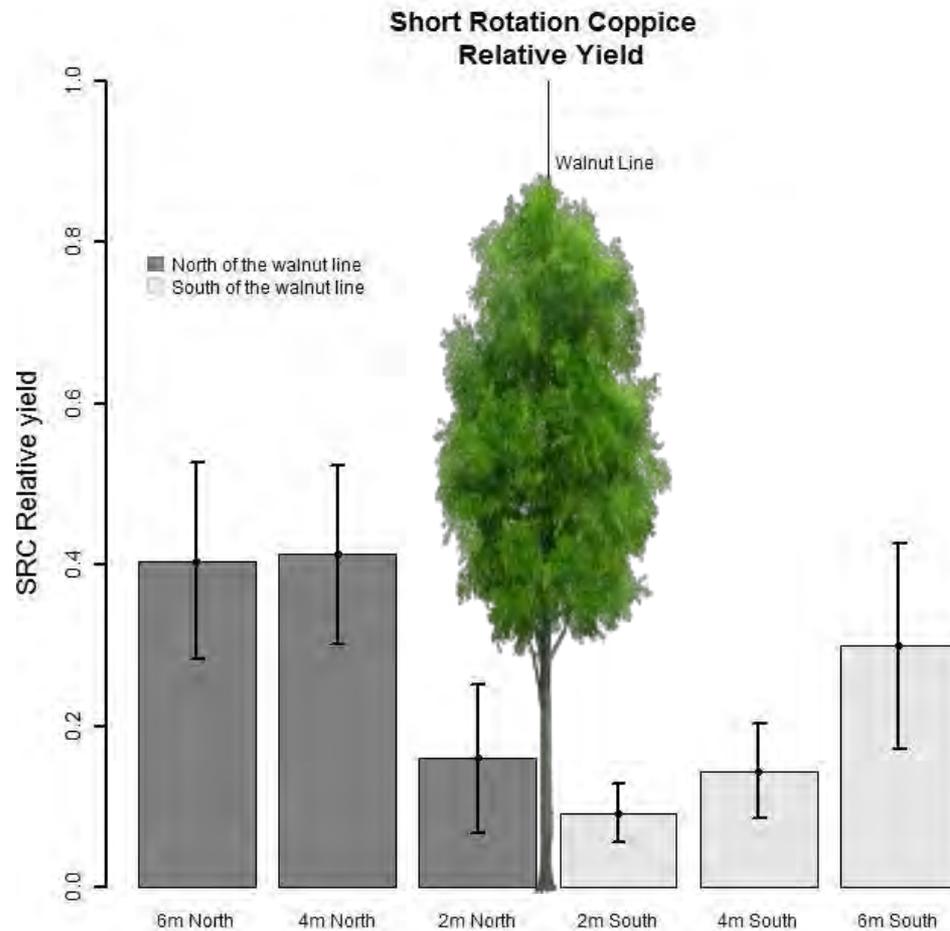
→ Bark percentage of total biomass drops from 25% to 19% (difference of 1.7 odt ha⁻¹)



Morhart C, Sheppard J, Spiecker H. (2013). Above Ground Leafless Woody Biomass and Nutrient Content within Different Compartments of a *P. maximowiczii* × *P. trichocarpa* Poplar Clone. *Forests*, 4(2), 471-487.

France

Delayed planting of SRC in the Mediterranean zone



Hybrid Walnut (18 years), 100 trees/ha
Poplar SRC, var. Monviso, 10.000 cuttings/ha

- SRC yield at 6m > 2m from timber tree line ($p=0.00002$)
- Higher yields on the north side of timber trees line ($p=0.01$)
- Very low growth increment

France

Silvoarable Agroforestry with pollards



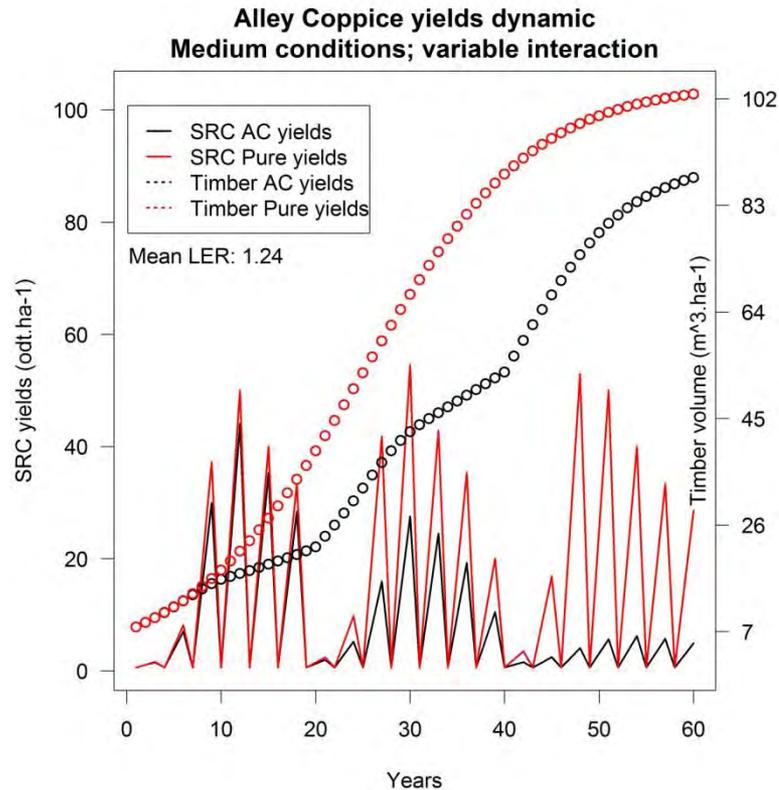
- < competition for light and/or water?
- > biomass productivity of the intercrop?
- Biomass production from pollards

Walnut trees	non-pollarded	pollarded
Stem water potential	9.7 bar	7.1 bar
DBH increment	100%	47%

Intercrop (wheat)	non-pollarded	pollarded
PAR	65%	91%
Relative yield	70%	80%

France

Biophysical Modelling: Example



3 rotation cycles of ~ 20 years

Rotation period = 3 year

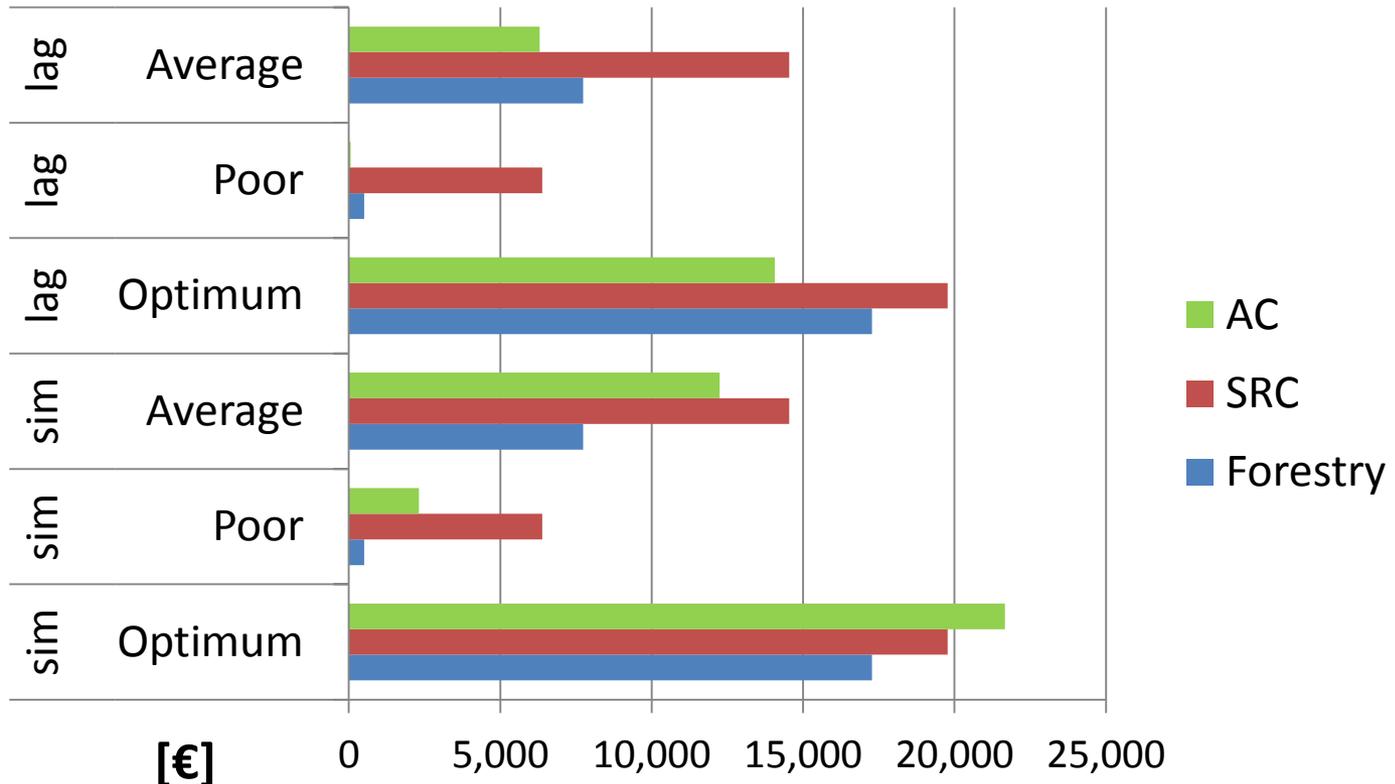
Distance between timber tree rows: 15m

- Timber volume: Moderate decline
- SRC yield: Strong decline

...but: depending on plant design etc.

Italy

Economic Modelling: Example



- In „sharp“ calculations, AC is usually less competitive than pure SRC - except for simultaneous planting under optimal conditions

Germany

Agroforestry at field edges



Proceeds from timber (1.4 m ³ and 400 € / m ³)	560.00 €
Proceeds from fire wood (4.4 m ³ and 30 € / m ³)	132.00 €
Total proceeds (timber + fire wood)	692.00 €
Total production costs	355.60 €
Net profit per tree	336.40 €

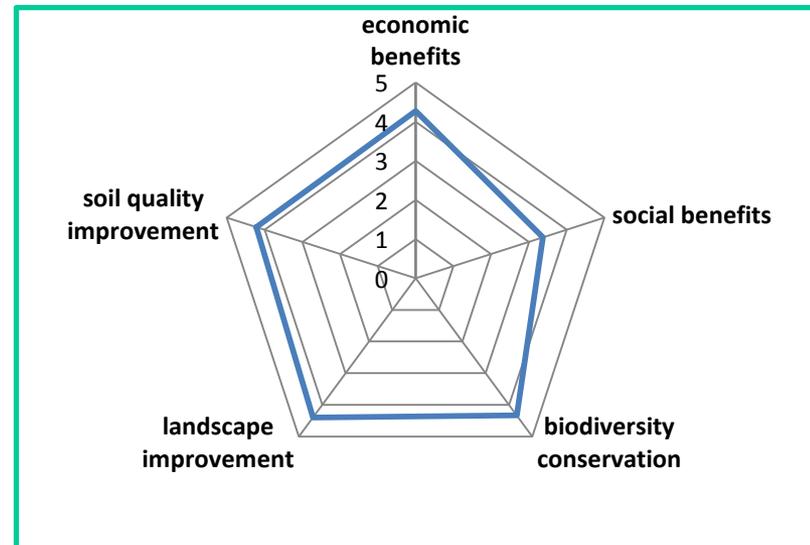
Nahm M, Morhart C, Spiecker H, Sauter UH (2015). Agroforst ganz am Rande: Böschungen und Feldraine für die Wertholzproduktion nutzen. Naturschutz- und Landschaftsplanung, submitted.

Italy

Alley Coppice Questionnaire, Italy

Results

- predominantly planted on plain land with good soil fertility
- weed control: most frequent management constraint
- all farmers satisfied with tree growth
- environmental benefits (biodiversity conservation, landscape, soil quality improvement) rated equally important as economic benefits
- **main concern: Where / how to sell the biomass / the timber?**

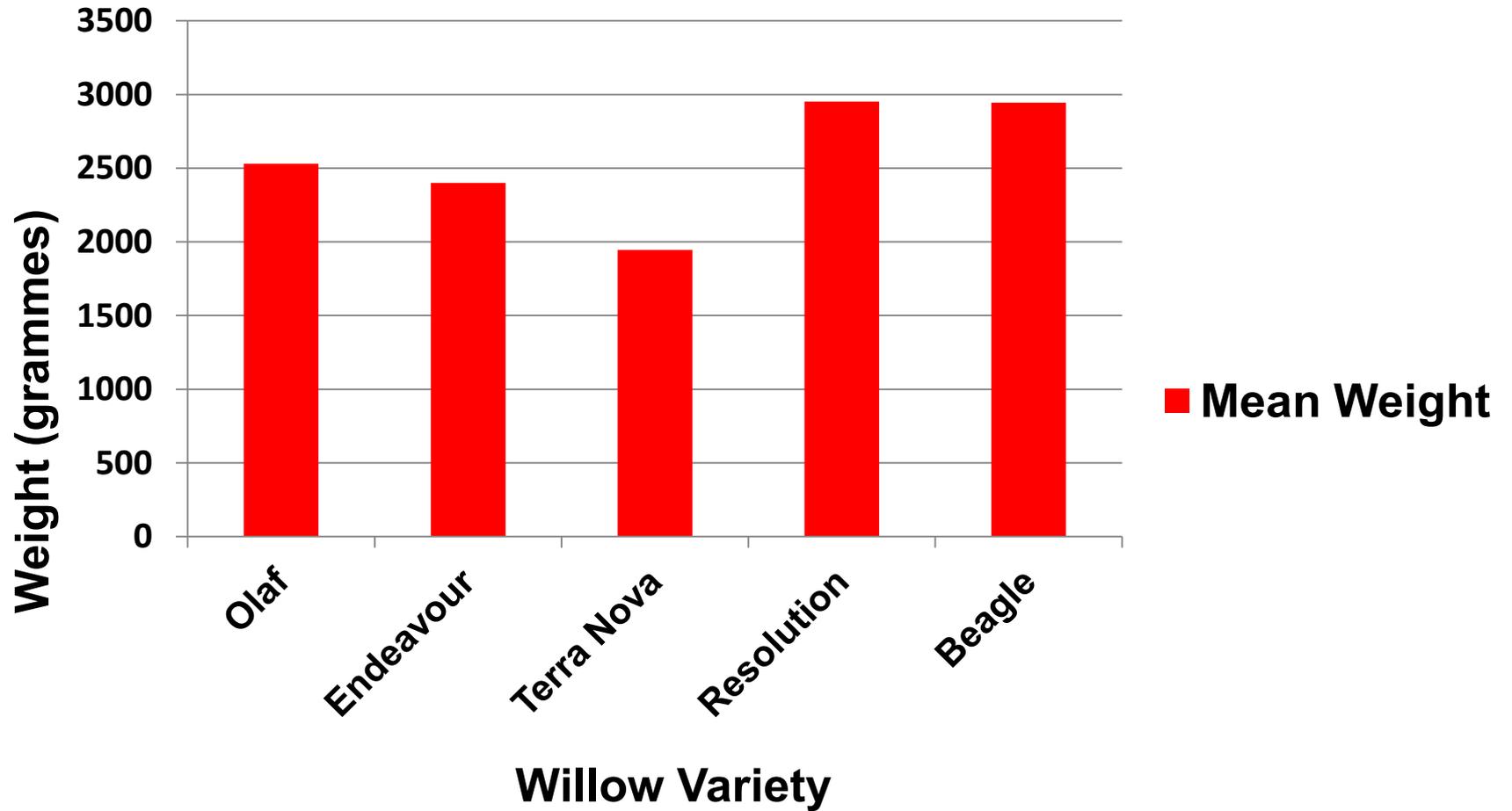


Ireland

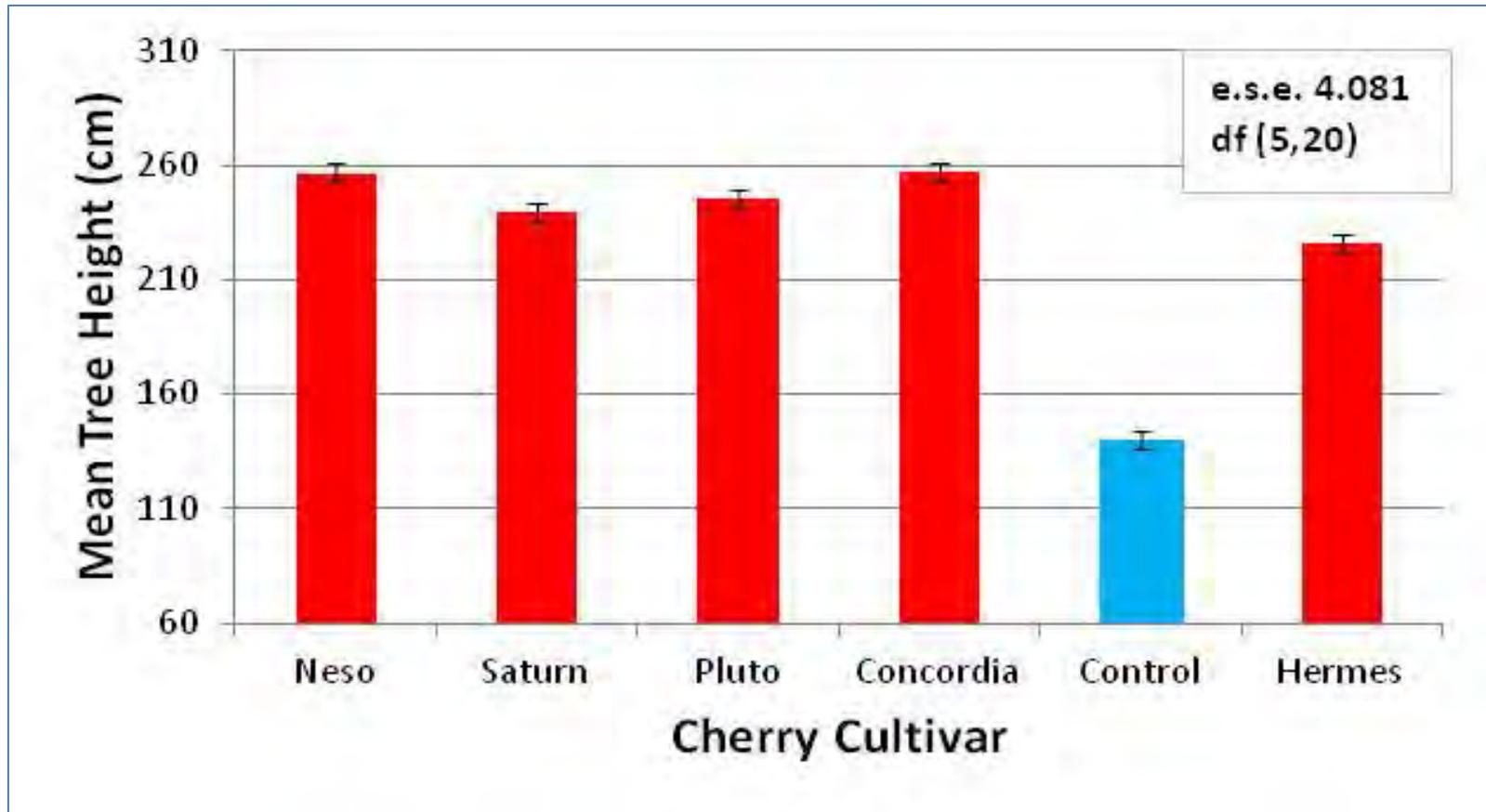
- **Experimental Sites**
- In May 2013 three experimental sites were established, two in the North of Ireland at the Agri-Food and Biosciences Institute Research Station in Loughgall, Co. Armagh and one at Gurteen College Roscrea, Co. Tipperary, Ireland.

Exp. 1 Cherry interplanted with willow variables-row width vs willow variety

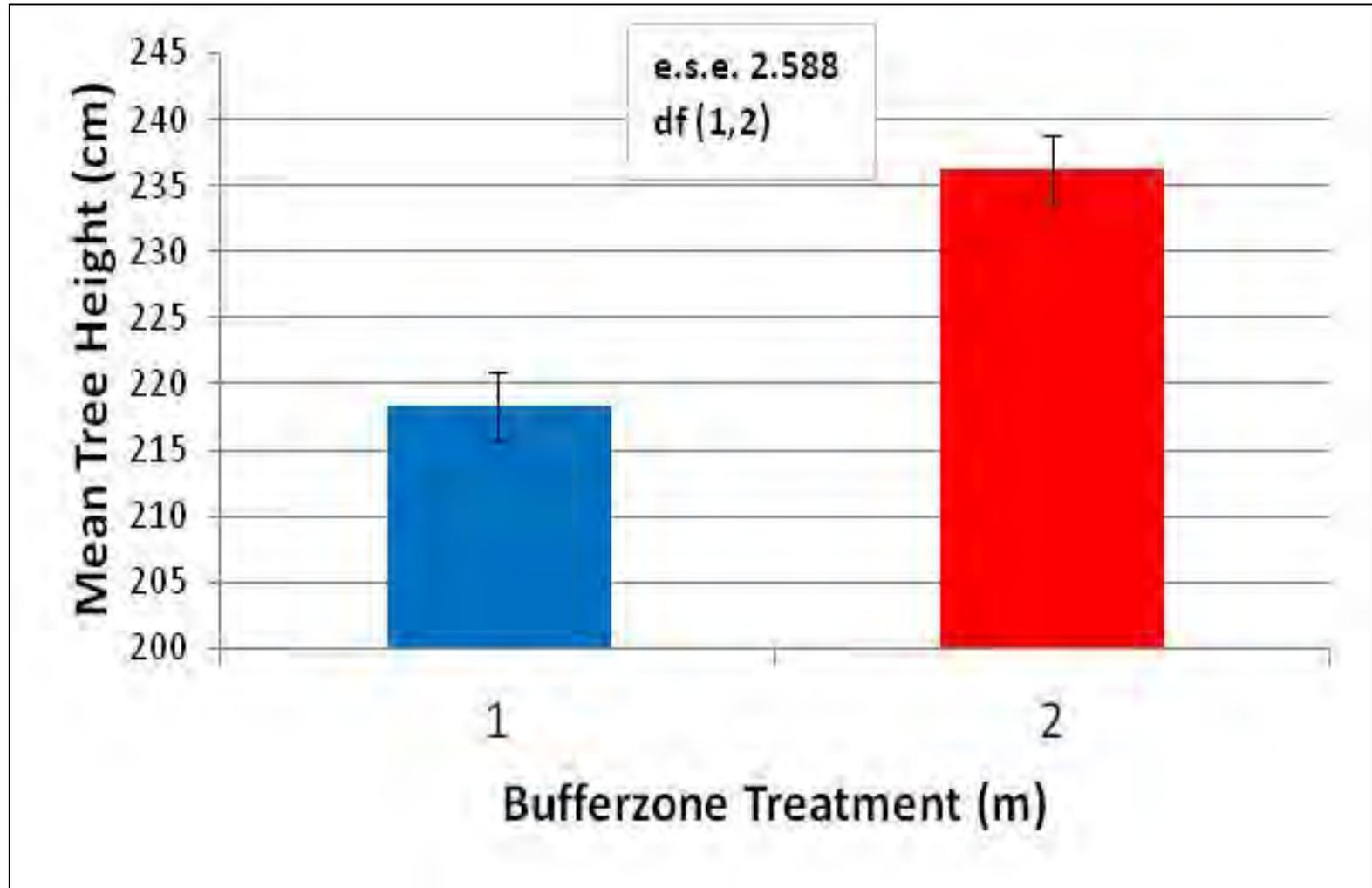




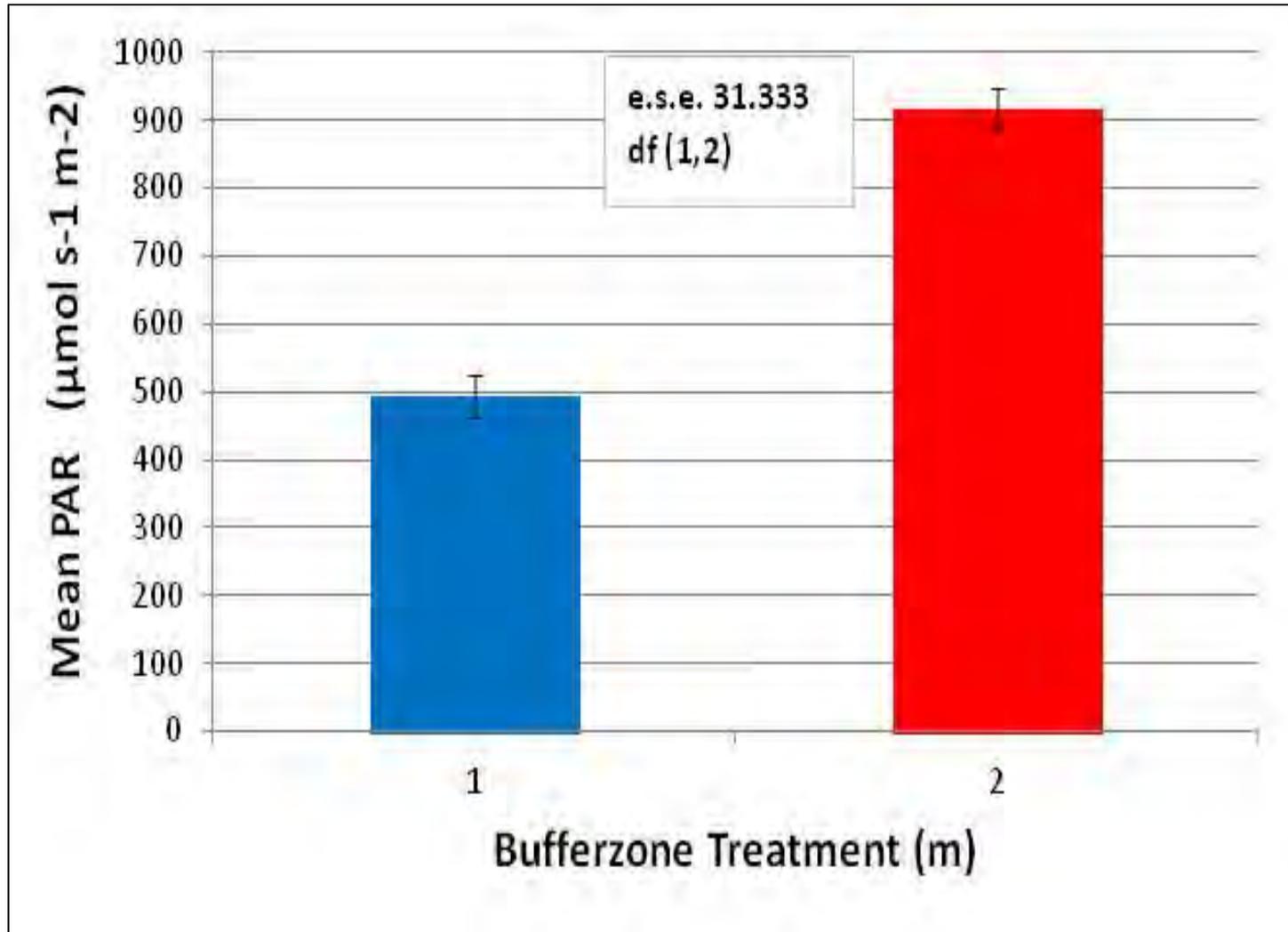
Mean ht of cherry –yr2



Effect of buffer width on tree ht.



PAR



Experiment 2 – Poplar – willow trial at AFBI, Loughgall, Co. Armagh, N. Ireland.



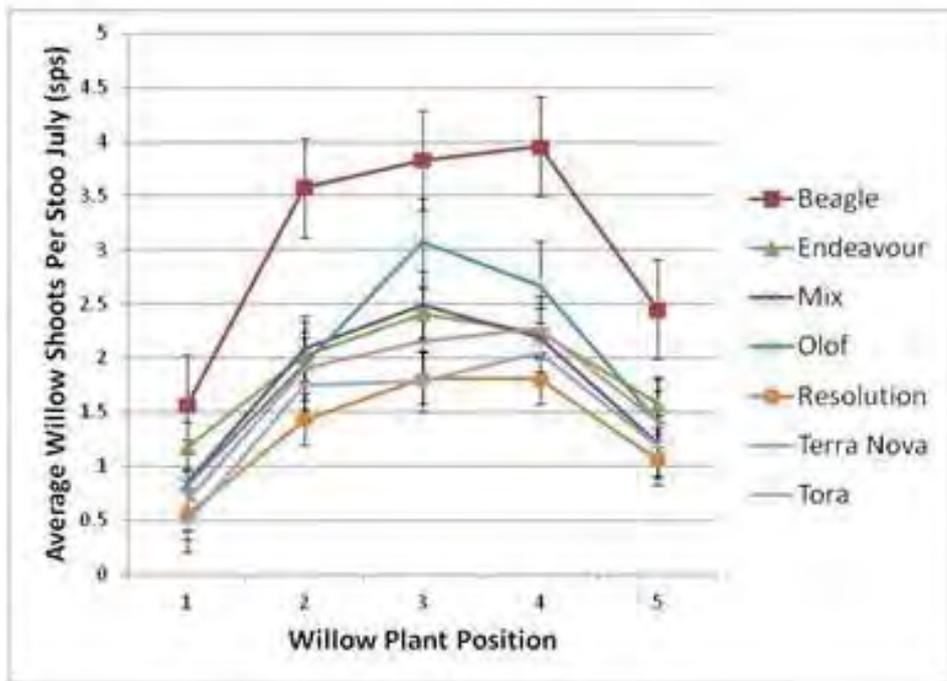
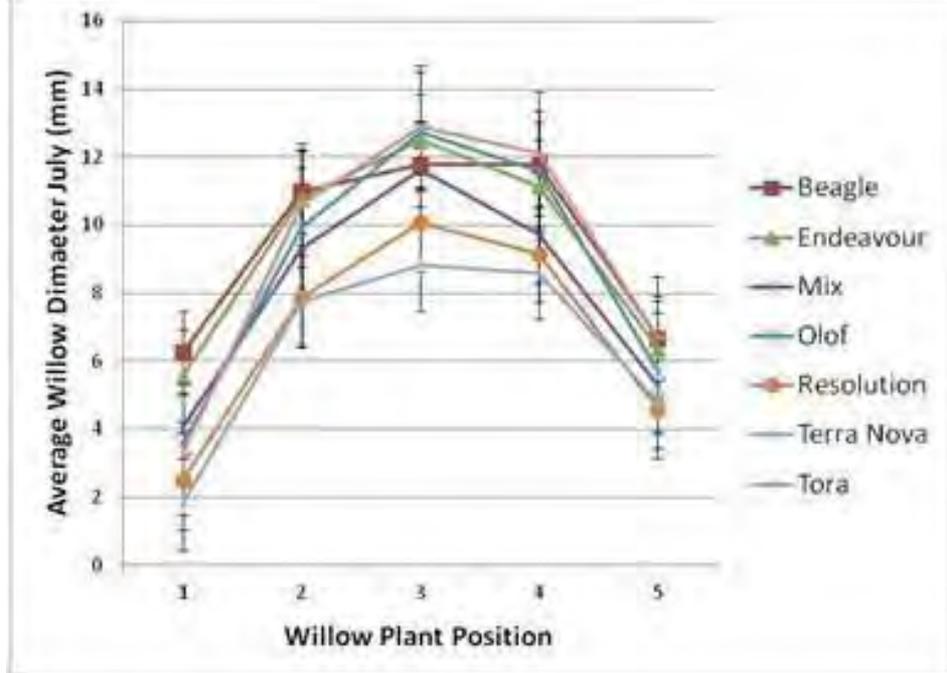
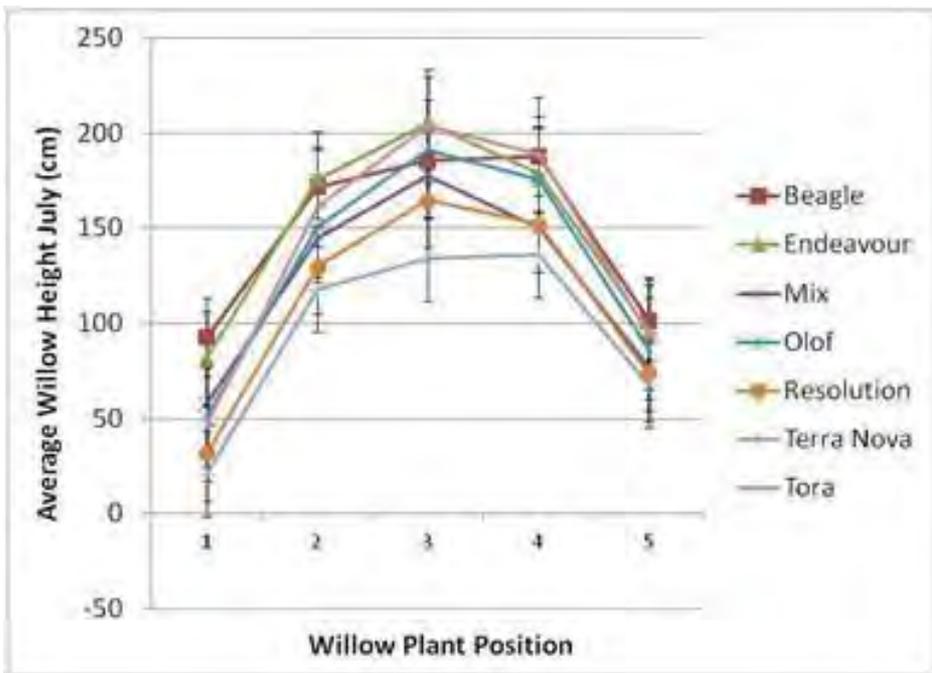
Poplar-Willow Alley Coppice System

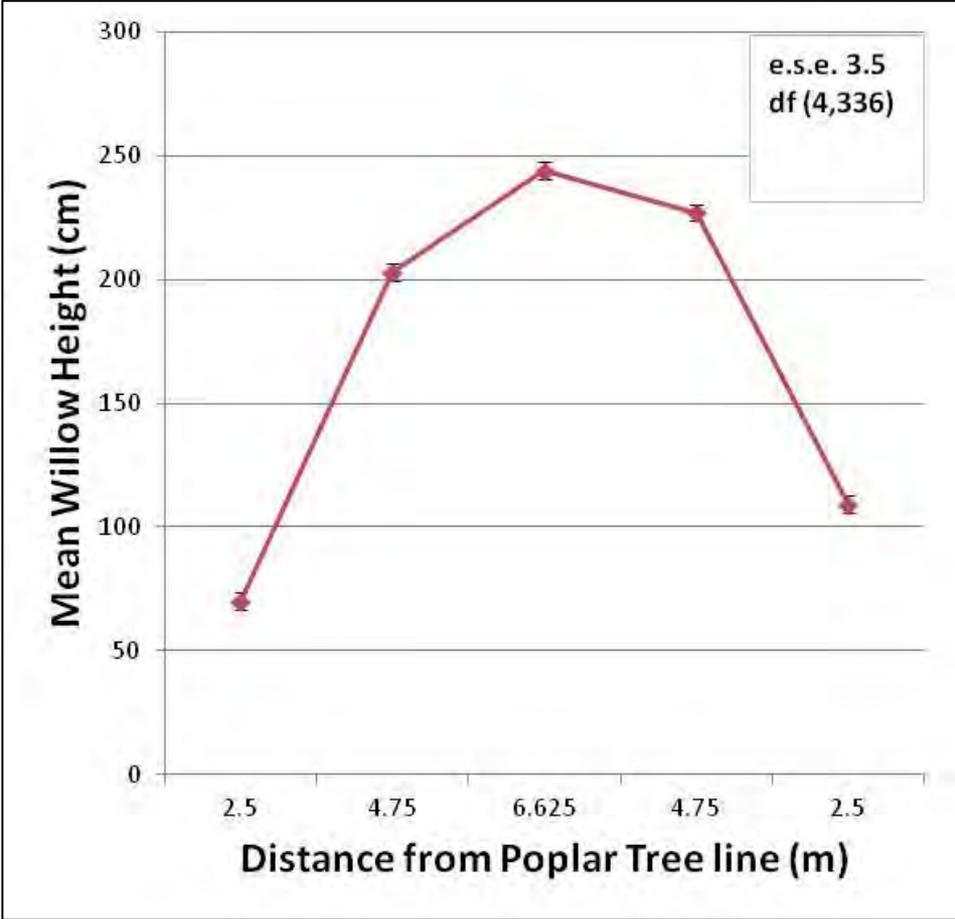


Alley Coppice (AC) system with Poplar trees intercropped with Willow near the Agri-Food & Biosciences Institute (AFBI) research station, Loughgall, Co. Armagh.

Photo credit: Rory Lunny







Expt 3. Co Tipperary , Ireland

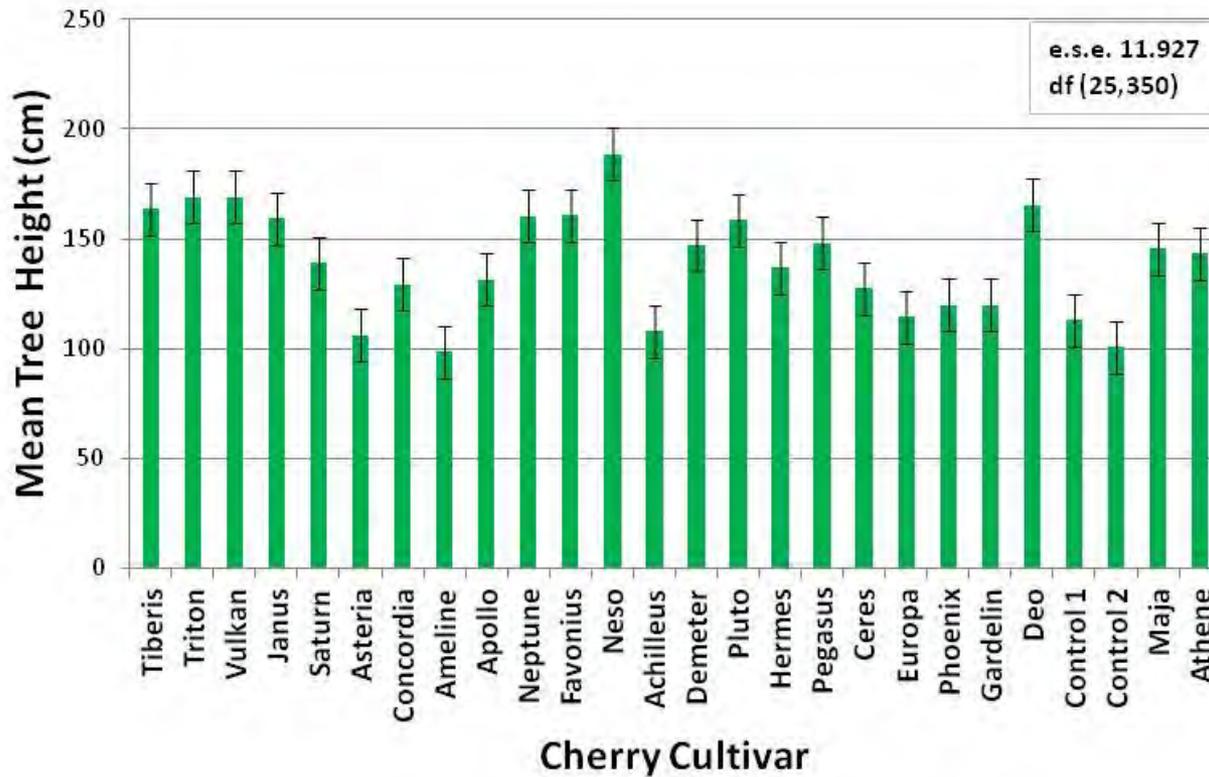


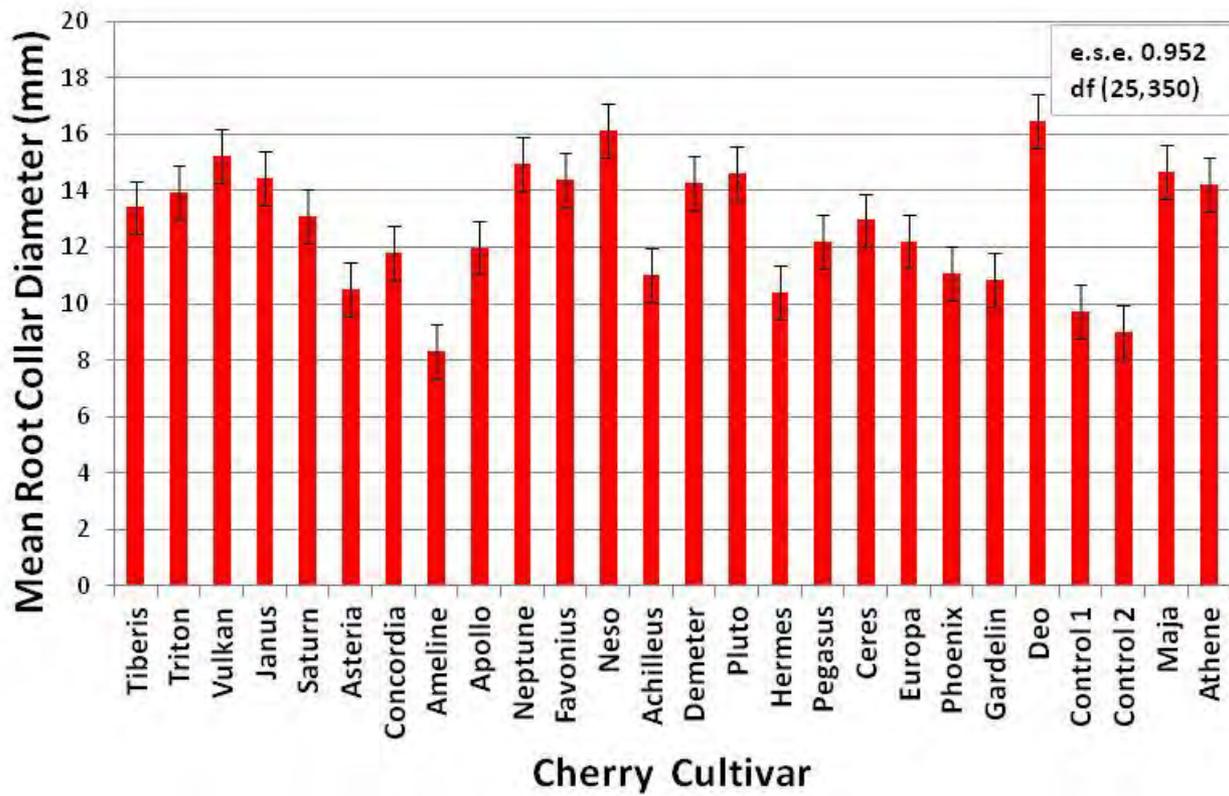
Experiment 3 (Gurteen)

Clonal Cherry Comparison.

- Randomised single tree linear plots.
- Measure cherry growth, soil water, light and leaf nutrients.

Expt 3-cherry variety







Information, publications:

→ www.agrocop.com

Thanks to:

