Research and Development Protocol for Grazed Orchards in France

Project name	AGFORWARD (613520)
Work-package	3: Agroforestry for High Value Trees
Specific group	Grazed orchards in France
Milestone	Milestone 10 (3.3) Part of experimental protocol for WP3
Date of report	26 February 2015
Authors	Nathalie Corroyer, Chambre d'agriculture de Normandie, France and Matthew Upson, Cranfield University, Bedfordshire, UK
Contact	nathalie.corroyer@normandie.chambagri.fr
Reviewed	Paul Burgess (14 May 2015)

Contents

AGFORWARD (Grant Agreement N° 613520) is co-funded by the European Commission, Directorate General for Research & Innovation, within the 7th Framework Programme of RTD. The views and opinions expressed in this report are purely those of the writers and may not in any circumstances be regarded as stating an official position of the European Commission.

1 Context

The AGFORWARD research project (January 2014-December 2017), funded by the European Commission, is promoting agroforestry practices in Europe that will advance sustainable rural development. The project has four objectives:

1. to understand the context and extent of agroforestry in Europe,
2. to identify, develop and field-test innovations (through participatory research) to improve the benefits and viability of agroforestry systems in Europe,
3. to evaluate innovative agroforestry designs and practices at a field-, farm- and landscape scale, and
4. to promote the wider adoption of appropriate agroforestry systems in Europe through policy development and dissemination.

This report contributes to the second objective. It contributes to the initial research and development protocol (Milestone 10 (3.3)) for the participative research and development network focused on the use of agroforestry with high value trees.

2 Background

Whilst grazing of traditional orchards has long been a common practice in France and continues to be practised on a considerable percentage of extant traditional orchards, it is uncommon for commercial cider 'bush' orchards to be grazed. Bush orchards are the dominant system used for cider apple production in France, with stocking density of about 600-1000 trees ha^{-1} with an inter-row spacing of about 5-5.5 m and an intra-row spacing of 2-2.5 m.

Livestock can incur costs and add additional complexity and administrative burdens to the management of commercial cider orchards (Burgess 2014; Durrant and Durrant 2009; Corroyer 2014). However, they can help reduce the cost of the mowing of grass in orchards, which can take place about eight times a year, and reduce the need for herbicides or mulches to control weeds (Durrant and Durrant 2009). Therefore, if the complexity and additional administrative burden can be overcome, there are opportunities to use grazing by sheep to increase revenue and to manage the grass understorey. It has also been postulated by farmers that better control of apple scab might be achieved by grazing, since sheep will eat apple leaves immediately as they fall to the ground, and help to decompose old leaves by trampling, thus reducing the refuge for the organism responsible (Corroyer 2014; McAdam 2014).

This trial is being conducted by the advisory service of Chambre d'Agriculture of Normany in France. The meeting of the 'Grazed Orchards in France' stakeholder group was held on 31 July 2014, at which it was decided that a key area of interest was the use of the Shropshire sheep breed to graze orchards, as they are considered to be 'tree-safe' (Corroyer 2014).

3 Objective of trial

The objective of the trial is to assess the effect of grazing Shropshire sheep in a bush orchard in terms of agronomic and economic impacts. The factors to be considered include:

- Financial and labour impacts of grazing
- Impact on apple scab (*Venturia inaequalis*)
- Impact on mineral nutrition of trees
- Impact on sawfly *(Hoplocampa testudinae*)
- Impact on the voles (*Microtus* species)

4 System description

The trial will take place in an organic bush orchard located in the Seine-Maritime region of Northern France (Table 1).

Table 1. Description of the site, with soil, tree, understorey, livestock, and climate characteristics.

Site characteristics	
Area (ha):	1.35
Co-ordinates:	49.515299°N; 1.59678°E
Site contact:	Nathalie Corroyer
Site contact email address	nathalie.corroyer@normandie.chambagri.fr

Soil characteristics	
Soil depth	>120 cm
Soil texture	24% clay; 70% silt
Additional soil characteristics	2.5% organic matter; C/N ratio = 8.9; pH = 6.5

Tree characteristics		
	Agroforestry system	Reference orchard system
Tree species	Apple (*Malus domestica*)	Apple (*Malus domestica*)
Varieties	Judor, Dabinett, Douce de l'Avent	Judor, Dabinett, Douce de l'Avent
Rootstock	MM 106	MM 106
Tree density (spacing)	550 trees ha^{-1}	790 trees ha^{-1}
Tree protection	Organic + low input	Organic

Understorey characteristics		
	Agroforestry system	Reference orchard system
Species	Grass	Grass
Additional details	Grass managed by grazing with Shropshire sheep.	Grass managed by mowing.

Livestock characteristics		
	Agroforestry system	Reference orchard system
Species	Shropshire sheep	none
Stocking density	Ewes (4 ha^{-1})	

Climate data	
Mean monthly temperature	10.9 (± 0.78.SD) °C
Mean annual precipitation	826 (± 230 SD) mm
Details of weather station	Data from a number of CRAN Meteorological Stations: Cimel.

5 Trial design and treatments

The trial comprises of a two treatment plots (Table 2). The mown orchard covers 0.665 ha and the area grazed by sheep cover 0.695 ha (Figure 1).

Table 2. Description of the two treatments

Mown orchard treatment	Grazed orchard treatment
Area A: organic orchard management with mowing to keep down the grass understory	Area B: grazed with Shropshire sheep

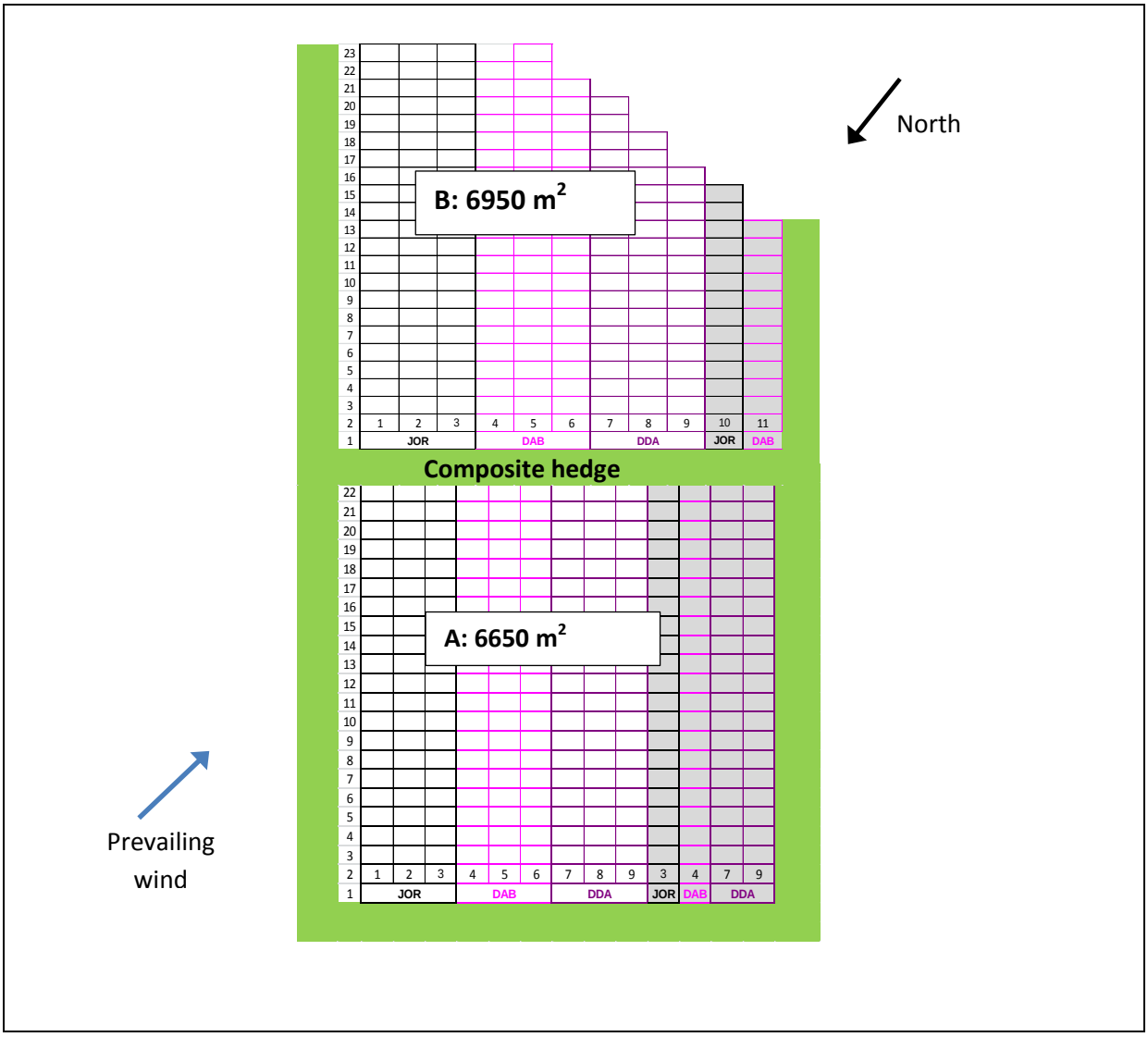

Figure 1. Schematic map showing the layout of the treatments

6 Measurements

The planned measurements to be taken in the two treatments are described in Table 3.

Table 3. List of measurements to be taken in the two treatments

Component	Mown orchard	Grazed orchard
Tree component	Apple scab damage on leaves and fruits Mineral composition of leaves Apple harvest: quantity and quality Litter degradation	Apple scab damage on leaves and fruits Mineral composition of leaves Apple harvest: quantity and quality Litter degradation
Pest and disease	Impact on sawfly (*Hoplocampa testudinae*): monitoring flight of sawfly and damage by sawfly on apple fruits	Impact on sawfly (*Hoplocampa testudinae*): monitoring flight of sawfly and damage by sawfly on apple fruits
Understorey component	Floral diversity Mineral composition of grass	Floral diversity Mineral composition of grass
Livestock component		Sheep liveweight gain is not important as the grazed orchard is primarily used to maintain adult ewes.
Management costs	Costs for mowing	Maintenance costs for sheep
Soil component	Residual nitrogen in the soil Physical and chemical analysis of soil (2015 and 2017) Analysis of the composition of organic matter (2015 and 2017)	Residual nitrogen in the soil Physical and chemical analysis of soil (2015 and 2017) Analysis of the composition of organic matter (2015 and 2017)
Flora	Impact on voles: presence and population levels and damage	Impact on voles: presence and population levels and damage

7 Acknowledgements

The AGFORWARD project (Grant Agreement N° 613520) is co-funded by the European Commission, Directorate General for Research & Innovation, within the 7th Framework Programme of RTD, Theme 2 - Biotechnologies, Agriculture & Food. The views and opinions expressed in this report are purely those of the writers and may not in any circumstances be regarded as stating an official position of the European Commission.

8 References

Burgess PJ (2014). Initial Stakeholder Meeting Report Grazed Orchards in the UK, Cranfield, Bedfordshire. Available at: http://www.agforward.eu/index.php/en/Grazed_Orchards.html

Corroyer N (2014). Initial Stakeholder Meeting Report: Grazed Orchards in France. 1 December 2014. 8 pp. Available online: http://www.agforward.eu/index.php/en/grazed-orchards-in-france.html

Durrant R, Durrant E (2009). The State of Apple Orcharding., Brecon, UK.

McAdam J (2014). Initial Stakeholder Meeting Report: Grazed orchards in Northern Ireland, UK. 4 December 2014. 9 pp. Available online: http://www.agforward.eu/index.php/en/grazed-orchards-in-northern-ireland-uk.html