



Research and Development Protocol for Silvoarable Agroforestry in the UK (part 2)

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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 protocols ([Milestone 16; \(4.3\)](#)) for the participative research and development network focused on agroforestry for arable farmers. It forms a second protocol which should be read alongside Smith (2015).

2 Background

Modern agroforestry systems with high value trees (for timber or fruit) are currently rare in the UK, although in recent years, a small but growing number of adventurous farmers have been planting new alley cropping systems. The tree component consists either of top fruit trees (apples, pears and plums), and/or timber trees, with arable or vegetable crops in the alleys.

The management of the tree understorey was identified by the UK silvoarable stakeholder group as an innovation for further development at the workshop held on 18 November 2014 (Smith et al. 2014). There are two main issues with the understorey – first, with regards to weed control, and second, the area between the trees is unproductive.

Weeds can impact tree establishment and growth, and there are concerns that weeds growing in the tree row may spread into the adjacent crop. In conventional systems, weed control in the tree row is often achieved through the use of herbicides. Weed control in organic systems must be achieved through cultivations or by the use of mulches including sheet mulches (e.g. mipmaplex, jute) and woodchip. Another option is to establish a vegetated ground-cover that can out-compete weeds but does not compete with the trees. Using a floral-rich mixture can provide additional benefits by attracting pollinators and natural enemies as well as other biodiversity.

The economic returns from high value trees, especially timber trees, are not realised for many years after planting. With fruit trees this may be after 5 years (e.g. semi-dwarf apple trees), but with timber trees this may not be for several decades. Planting trees on arable land can sometimes therefore be viewed as ‘locking’ away productive land. Development of the understorey into an additional productive element provides an opportunity for growing new crops and increasing overall productivity, although it must be offset against an increase in management complexity.

This protocol describes a series of on-farm trials/demonstrations that assess the impacts of a range of approaches to understorey management of high-value trees within arable systems in England.

3 Objective of trial/demonstration

To compare the impact of different approaches to understorey management in terms of economics, (including labour costs), productivity and biodiversity (plants (including weeds) and invertebrates) and potentially tree pests and diseases.

4 Description of site

The trial will take place at two sites where trees have been incorporated into arable systems in South East and Eastern England (Table 1). Tolhurst Organics is in Berkshire (Figure 1) and Whitehall Farm is in Cambridgeshire (Figure 2 and 3).



Figure 1. Establishment of trees at Tolhurst Organics in Berkshire, England



Figure 2. View across a silvoarable at Whitehall Farm, Cambridgeshire

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

Site characteristics		
Farm name:	Tolhurst Organics	Whitehall Farm
County:	Berkshire	Cambridgeshire
Area (ha):	9	120
Co-ordinates	51.50°N 1.06°W	52.53°N 0.18°W
Site contact:	Iain Tolhurst	Stephen Briggs
Site contact email	tolhurstorganic@yahoo.co.uk	stephen.briggs@abacusorganic.co.uk

Soil characteristics		
Soil type		
Soil depth		
Soil texture		Organic sandy clay loam
Other characteristics		pH 6.4-7.2 OM 23.8%

Tree characteristics		
Tree species	Apples (18 varieties); field maple (<i>Acer campestre</i>); Whitebeam (<i>Sorbus aria</i>); Italian alder (<i>Alnus cordata</i>); oak (<i>Quercus robur</i>); black birch (<i>Betula lenta</i>); hornbeam (<i>Carpinus betulus</i>); Myrobalan/cherry plum (<i>Prunus cerasifera</i>)	Apples
Variety/ rootstock	18 varieties of apples	13 varieties of apples
Tree density (spacing)	1.5 m between trees, except apples with 3 m to adjacent tree	3 m between trees
Tree protection	Tree guards and woodchip mulch	Wire mesh and mipmap fabric mulch
Additional details	Planted spring 2015. Trees will be thinned to leave only oaks	Planted autumn 2009

Crop characteristics		
System	Silvoarable system	Silvoarable system
Species	Vegetables	Cereals
Coverage	alleys 20m wide	alleys 24m wide
Additional details	Organic stockless	Organic

Climate data		
Mean min temp	5.9°C	5.9°C
Mean max temp	14.4°C (mean for 1981-2010)	14.4°C (mean for 1981-2010)
Annual rainfall	612 mm	586 mm
Details of weather station (and data)	Benson 51.620, -1.097, 57 m amsl http://www.metoffice.gov.uk/public/weather/climate/gcpjx1hq	Monks Wood 52.400, -0.233, 41m amsl http://www.metoffice.gov.uk/public/weather/climate/gcrf4enk4

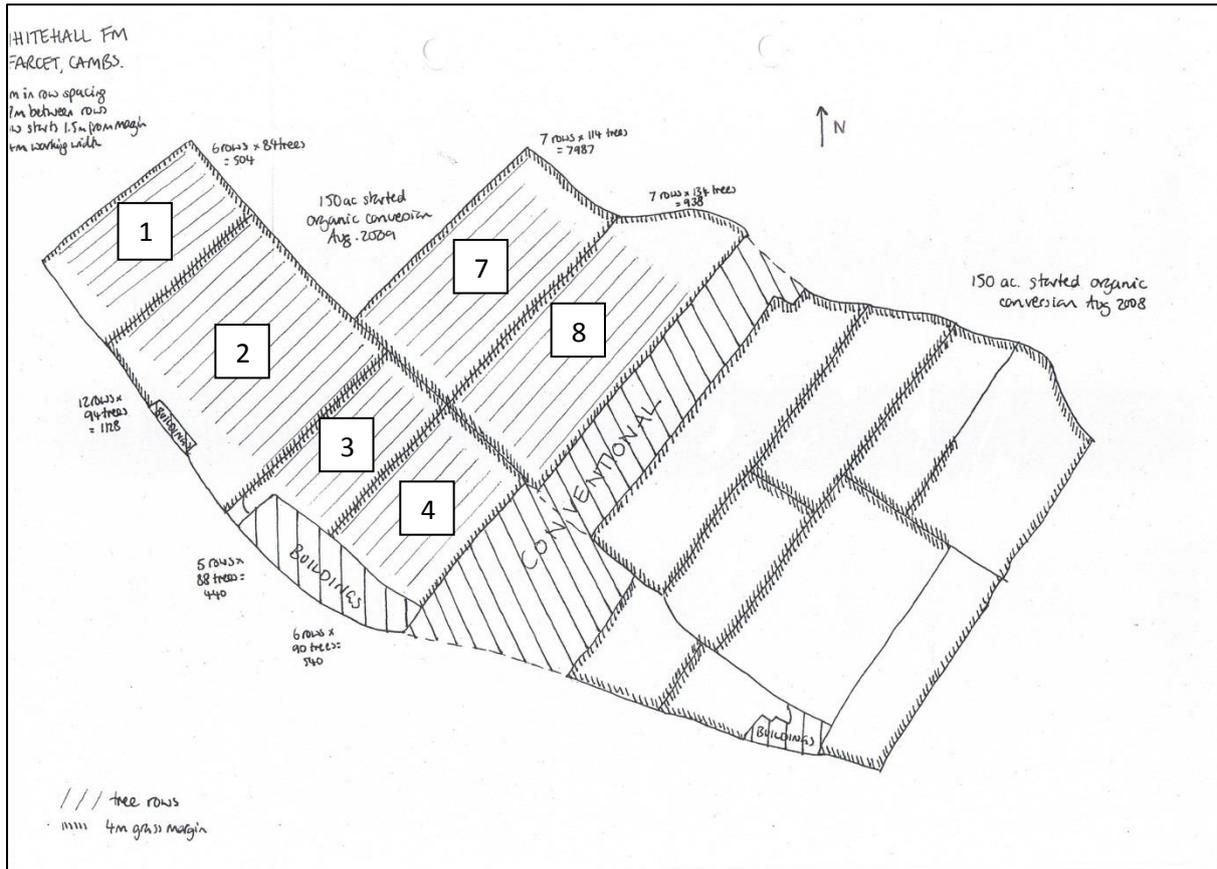


Figure 3. Map of Whitehall Farm (showing field numbers)

5 Design

5.1 Conceptual design

The design at Tolhurst involves six understorey management practices (Table 2), and two understorey treatments were sown in October 2009 (Table 3).

Table 2. Description of understorey treatments at Tolhurst Organics

Tree row (from field entrance)	Understorey species (March 2015)	Understorey species (planned)	Management
1	Legume and herb mix planted July 2012	Keep as same	Possible cut every 2-3 years Trees woodchip mulch 2 years
2	Legume and herb mix planted July 2012	Interplant with flower bulbs and perennial flowers Oct 2015	Woodchip mulch for 2 years
3	Veg in 2014 (sweet corn)	Rhubarb Oct 2015	Woodchip mulch crowns 2 years
4	Veg in 2014 (potato) Followed Grass/vetch /red clover gm	Natural regeneration	Possible cut every 2-3 years
5	Long term beetle bank	Keep as same	No management except remove rogue trees.
6	Legume and herb mix planted July 2013	Keep as same	Possible cut every 2-3 years Trees woodchip mulch 2 years

Table 3. Description of understorey treatments at Whitehall Farm

Field	Understorey species (sown Oct 2009)
1, 2, 3, 4	Birds foot trefoil 20%; Alsike clover 20%; Red clover 15%; Small-med white clover 25%; Ox-eye daisy 5%; Sanfoin 15%
7,8	Birds foot trefoil 20%; Alsike clover 22%; Red clover 13%; Small-med white clover 25%; Ox-eye daisy 5%; Red campion 10%; Common knapweed 5%

6 Measurements

The planned measurements at each site are described in Tables 4 and 5.

Table 4. Measurements to be taken at Tolhurst Organics

Parameters	Method	When
Tree establishment	Assess dead/alive	April 2016
Tree growth	Tree height	June 2015 and April 2016
	Canopy diameter	June and Aug 2015 and Aug 2016
Understorey plant diversity	Quadrats	June 2015 and 2016
Invertebrate diversity	Pitfalls	June 2015 and 2016
	Soil cores	Oct 2015
	Sweep netting/transects	June 2015 and 2016
Economics	Establishment costs	Oct 2015
	Management costs incl labour	Oct 2015
	Product outputs	Oct 2015

Table 5. Measurements to be taken at Whitehall Farm

Parameters	Method	When
Understorey plant diversity	Quadrats	June 2015 and 2016
Invertebrate diversity	Pan-traps	May-Sept 2015 and 2016
Economics	Establishment costs	Oct 2015 and 2016
	Management costs including labour	Oct 2015 and 2016
	Product outputs (apples)	Oct 2015 and 2016

7 Acknowledgements

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8 References

Smith J, Wolfe M, Crossland M, Howlett S (2014). Initial Stakeholder Meeting Report: Silvoarable Agroforestry in the UK. 21 November 2014. 8 pp. Available online:

<http://www.agforward.eu/index.php/en/silvoarable-agroforestry-in-the-uk.html>

Smith, J. (2015). Research and Development Protocol for Silvoarable Agroforestry in the UK. 28 April 2015.