



## Research and Development Protocol for Agroforestry for Ruminants in the Netherlands

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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,
4. and 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 22 \(5.3\)](#)) for the participative research and development network focused on the use of agroforestry in free-range pig production systems.

## 2 Background: trees for ruminants

Integration of trees with crops and/or livestock production (agroforestry) can be a more sustainable way to increase the productivity of land and to provide a greater number of ecosystem services and environmental benefits than disaggregated agricultural and woodland systems (Rigueiro-Rodríguez et al. 2009). Integrating trees and livestock is expected to improve animal welfare because the trees provide shelter against heat and wind, and tree fodder can be a natural source of minerals for ruminants (Luske & Van Eekeren 2014, Rahmann 2004, Smith 2012). Although silvopastoral systems used to be common in the Netherlands, at present only a few modern farms implement agroforestry for ruminants. Although dairy goats are intermediate feeders (Avondo et al., 2008), browse material from trees and shrubs is often not included in their diet.

Since 2012 several dairy and goat farmers in the 'Noord-Brabant' province of the Netherlands have implemented agroforestry on their farms (Van Eekeren et al. 2012). "Fodder trees" for cows and goats such as willow, elder and hazel have been planted. In addition, an online database has been established with over 600 records of tree species and the nutritional values of tree leaves ([www.voederbomen.nl/nutritionalvalues](http://www.voederbomen.nl/nutritionalvalues)). Furthermore, two goat farmers are working together with the owners of an adjacent natural area where their goats are allowed to browse the trees.

The objectives of this part of the AGFORWARD project are:

- To investigate and communicate 'best practices' in relation to agroforestry systems with livestock in the Netherlands. As the project uses a participatory research method, and agroforestry practices are not widely used in the Netherlands, we will focus on cases of individual farms that embrace agroforestry, to describe 'best practices'.
- to develop further the database with nutritional value of fodder trees (with other WP5 partners) and write regional fact sheets to make the data available for farmers. Scientific literature will be used to further develop knowledge about the value of trees for livestock as a food source. In addition, a preference test with dairy cows will give information about which species dairy cows prefer.
- To model the costs and benefits of fodder trees on cases of cow and goat farms in order to optimize the system design.

### 3 Synthesise existing knowledge of ‘best practice’

#### 3.1 Objectives

The objective of this study is to make available the existing knowledge and practical experiences of using fodder trees with dairy cows and goats in The Netherlands. This includes the use of goats in nature conservation.

#### 3.2 Methods

Literature and interviews with a variety of farmers and experts will be used to describe existing knowledge and best practices in The Netherlands. Table 1 presents the activities planned to perform this study.

Table 1. Activities planned for synthesis of best practices

Step	Activity	Time
Data collection	Description of examples of silvopastoral systems in the Netherlands. Interviews with relevant farmers and other experts (e.g. zoos, contractors, nature organisations) about practical issues, costs and benefits (yields or losses of biomass and mineral production) and effects on animal welfare, animal behavior and biodiversity	April 2015 –April 2016
WP5 skype meeting	Meeting with partners from INRA, AFBI and ORC	May 2016
WP 5 workshop	Workshop with partners from INRA, AFBI and ORC to compile collected knowledge from United Kingdom, Netherlands and France	May 2016 (General Assembly)
Publication	Production of report	August 2016

### 4 Database of nutritional values of fodder trees

If available, ruminants use tree leaves as a fodder source (Becker & Nehring 1965). Leaves of tree species have different nutritional values as the level of proteins and minerals differ with species, soil type and season (Luske & Van Eekeren 2104). Several stakeholders suggested a further development of the online database of nutritional values of fodder trees. Most temperate tree species are already present in the database ([www.voederbomen.nl/nutritionalvalues](http://www.voederbomen.nl/nutritionalvalues)), but some Mediterranean species are missing although data might be available in the literature. Therefore we will seek further information from other project partners to deliver more data for the database.

The current online database is interesting for researchers, but difficult for farmers to use. Together with the other WP5 partners, we want to develop regional factsheets for farmers with tree species, specifications and their suitability as a fodder crop. The objectives of the factsheets are 1) to make the data more available for farmers and 2) make the database more suitable for Mediterranean countries. Furthermore there appears to be minimal literature about the palatability of tree leaves as a fodder for dairy cows. Therefore we propose to undertake a preference test of the update of selected fodder (from trees) by dairy cows.

#### 4.1 Objective

The objectives of this study are bringing together results of nutritional value of tree leaves for ruminants and to test the preference of dairy cows of two planted tree species in a trial.

#### 4.2 Methods

Tree leaf composition will be examined by literature study and data analyses of tree leaf samples. New data for the online database will be collected from other WP5 partners. A preference test will be completed on a commercial organic farm. Table 2 presents the activities planned to perform this study.

Table 2. Activities planned for database of nutritional values of fodder trees for ruminants

Step	Activity	Time
Data collection	<ul style="list-style-type: none"> <li>Investigate tree leaf composition of willow and alder</li> <li>Inform project partners about methods for tree leaf analyses to further develop the online database with nutritional values of tree leaves and collection of the data.</li> </ul>	June 2015 –Aug 2017
On farm test	<ul style="list-style-type: none"> <li>Preference test with two tree species on a dairy farm with fodder trees</li> </ul>	June 2015-Sept 2015
Publication	<ul style="list-style-type: none"> <li>Report with the results of the preference test with dairy cows and estimation of mineral intake by eating tree leaves</li> <li>Farmer-friendly factsheet with information about nutritional value of tree leaf species in (Dutch and English which can be translated and customized by project partners)</li> <li>Incorporation of new data in the online database</li> </ul>	August 2016  August 2017  June 2015 – Aug 2017

### 5 Modelling costs and benefits of fodder trees

A key question asked by dairy and goat farmers working with fodder trees is how they can optimize a system of fodder trees on their farm. This optimization includes practical issues and financial consequences of, for example, the choice of trees, the planting schedule, tree protection, the quantity of fodder production, and how to harvest and feed the browse.

#### 5.1 Objective

The objective of this study is to describe case studies of fodder trees on ruminant farms in terms of financial and economic costs and benefits.

#### 5.2 Methods

We will work with selected farmers using a participatory approach. We will support farmers in the further improvement of their fodder tree systems by providing them with practical information. At the same time we monitor their inputs (such as trees, protection, and labour) and results (such as fodder tree growth and feeding system). Where possible we estimate financial and economic costs and benefits of the issues involved. Table 3 describes the planned activities to perform this study.

Table 3: Activities planned for the modelling of costs and benefits of fodder trees on cow and goat farms

Step	Activity	Time
Farm selection	<ul style="list-style-type: none"> <li>Select farmers that do have fodder trees already and are willing to further optimize their system</li> <li>Discuss aims and questions with selected farmers</li> </ul>	June 2015
Data collection using participative methods	<ul style="list-style-type: none"> <li>Support 'test farms' with information on which they can base their choices</li> <li>Monitor inputs and results of the fodder tree systems on the test farms</li> </ul>	June 2015 – Aug 2017
Publication	<ul style="list-style-type: none"> <li>Report with the results</li> </ul>	August 2017

## 6 Acknowledgements

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