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### Integrating multipurpose trees in a paddock grazed by cattle: first results of the co-designed layouts

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#### Introduction

Despite the multiple functions offered by trees to livestock farmers (e.g. source of forage, animal welfare, litter, fuel wood, timber), agroforestry systems constitute a minor part of ruminant husbandry in Northern Europe. Before adopting agroforestry, farmers need more information on the methods to protect young trees from ruminants, and on the spatial organization of trees to address multiple purposes.

To answer these demands, an agroforestry paddock was co-designed with farmers, researchers, technical institute engineers and extension agents in 2014. This paper presents the agroforestry paddock and gives its first results.

#### Materials and methods

The agroforestry paddock (3 ha) was implemented in February 2015 on the innovative mixed crop – dairy cattle system of INRA in Lusignan (Vienne, France), which integrates also other agroforestry practices (Novak et al., 2016). To save fossil energy and water, forage resources are preferentially grazed.

Fodder trees were planted to be browsed by cattle but also to provide wood chips. Two types of pruning techniques will be tested: pollards of *Morus alba* and *Alnus cordata*, and coppices of *Salix caprea*, *Ulmus minor*, *Robinia pseudoacacia* and *Alnus incana*. High stem trees (*Pyrus communis*, *Gleditsia triacanthos*, *Sorbus domestica*) were also planted, mixed in various layouts with pollards and coppices. Three spatial organizations of trees are tested with single, double or triple-row sets, with an inter-row spacing of 20 m. To restrict the browsing of the young trees by cattle, seven types of tree protections were compared: single or double line of electric fence, electric fencing tape, metal or plastic fences, olfactory repellents and a barrier tape. Another option was to exclude the paddock from grazing and to mow the grassland during the first years.

#### Major results

After two years, the most efficient protections were the following: electric fence, electric fencing tape and metal fence. Electric fence and electric fencing tape are quickly installed and facilitate the mechanical control of the vegetation although they are relatively expensive. Metal fence is cheaper and offers the opportunity to be used as trellis for climbing fodder plants. However, it needs more time to be installed and it complicates the control of the vegetation on the tree rows. The olfactory repellents did not work.

When considered relative to the number of tree seedlings, double and triple row sets are more economical and time saving for their implementation and maintenance. They also open more opportunities for different tree uses compared to single rows. However, the available grazing area is more reduced, and will only be recovered when the trees will be browsed.

#### Conclusion

The collaborative design gave promising layouts for integrating multipurpose trees in a paddock grazed by cattle, and for using them as an aerial browsed fodder.

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**Keywords:** tree fodder; cattle; collaborative design; silvopastoral system; multipurpose trees.

#### References:

1. Novak S., et al., 2016, 3rd European Agroforestry Conference, Montpellier, 396-398.