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## Agroforestry for the Green Deal transition. Research and innovation towards the sustainable development of agriculture and forestry

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Agroforestry for the Green Deal transition. Research and innovation towards the sustainable development of agriculture and forestry  
Abstract

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### Abstract

Trees could help to reduce livestock production vulnerability to climate change by providing a fodder resource during periods of drought. Fodder trees are commonly used in tropical and Mediterranean areas, but they remain poorly studied in temperate regions. Previous studies highlighted that leaves of some tree fodder species have nutritive values close to those of herbaceous forages in summer (e.g. Mahieu et al. 2021). However, little is known about the variation in nutritive value of fodder trees throughout their growing period, from early summer to autumn.

This study focused on 16 tree species sampled in June, August and October, from 2014 to 2017, in 22 French locations (*Acer pseudoplatanus*, *Alnus cordata*, *Castanea sativa*, *Corylus avellana*, *Fagus sylvatica*, *Fraxinus americana*, *Fraxinus excelsior*, *Gleditsia triacanthos*, *Juglans x intermedia*, *Morus alba*, *Paulownia tomentosa*, *Prunus avium*, *Robinia pseudoacacia*, *Sorbus domestica*, *Ulmus minor*, *Ulmus* 'Nanguen'; n = 292). Leaf samples were analysed to determine their *in vitro* dry matter digestibility (IVDMD) and their contents in dry matter (DM), ash, crude protein (CP), neutral detergent fibre (NDF), acid detergent fibre (ADF) and acid detergent lignin (ADL). The seasonal variation of these variables was analysed using a linear mixed model and estimated marginal means. Sampling location and year were used as random factors.

Our results highlighted divergent seasonal dynamics depending on the nutritive values (Figure 1). Only leaf CP decreased from June to August and from August to October ( $P \leq 0.001$ ). DM, ash content and IVDMD decreased from June to August ( $P \leq 0.001$ ), but had weak evidence to evolve from August to October ( $P > 0.05$ ). We found no evidence of seasonal variation for NDF, ADF and ADL ( $P > 0.1$ ). The dynamics of IVDMD, CP, NDF, ADF and ADL were similar of those observed by Vandermeulen et al. (2018), who focused on different temperate tree species.

*Castanea sativa* was the only species to strongly improve CP (from 140 g/kg in June to 172 g/kg in August). *Robinia pseudoacacia* increased NDF, ADF and ADL from June to August and *Fraxinus americana* decreased mineral content from August to October, while other species mainly remained constant. *Robinia pseudoacacia* behaviour was similar to the results of Papachristou et al. (1999), but few studies focused on the seasonal variability of the studied species. However, the effects of species could be higher than those of season, as previously showed (Wood et al. 1994; Ravetto Enri et al. 2020).

Our results as well as bibliography references highlighted specific dynamics between the different components of the nutritive value, as well as diversity among species in the seasonal variability. More studies are now required to better characterise the variation in nutritive value of tree fodder species across seasons, their biomass production and palatability.

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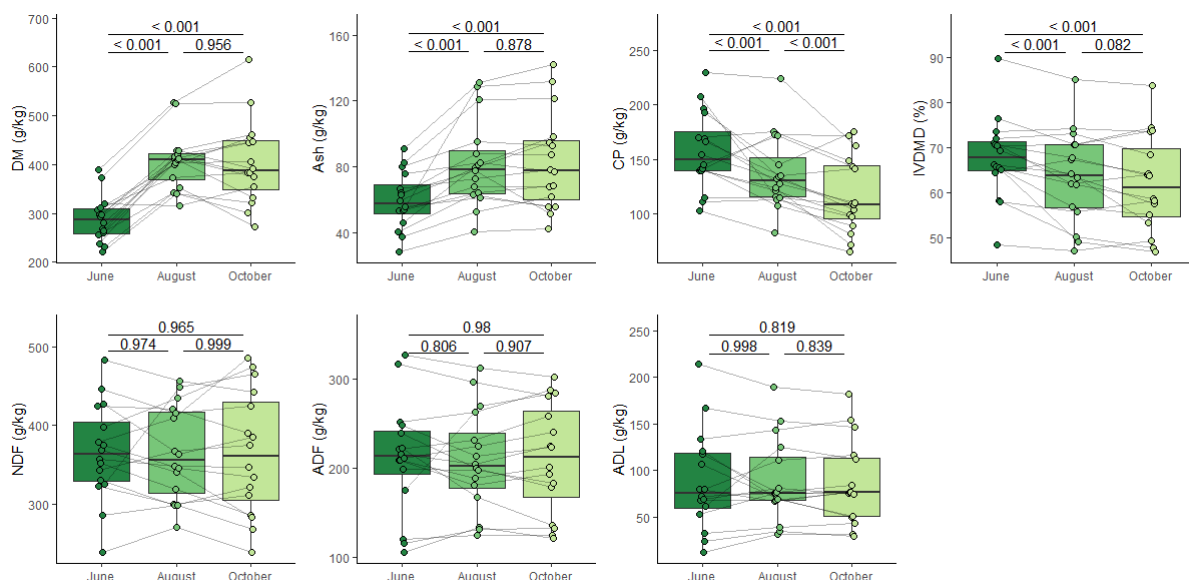
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**Figure 1.** Chemical composition (g/kg) and IVDMD (%) of the leaves of 16 tree species across seasons. P-values evaluate seasonal effect on nutritive values. Dots represent monthly mean values of the 16 studied species.