UMR1213 Herbivores

Animal plant relationships and feeds Team (Rapa)

Links between vegetation traits and forage value to assess production services provided by permanent grasslands

To upgrade the use of permanent grasslands in livestock farming systems for their economic and environmental utility, their value needs better assessment in terms of both quantity (biomass production) and quality (nutritive value). The wide variability in permanent grassland botanical composition makes it important to understand the links between vegetation characteristics and permanent grassland value. Observed over a wide range of environmental and management conditions, vegetation characteristics and climatic data explain almost half of the variance of forage quality and 20–40% of the variance of biomass production.

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Data and grass samples collected in an original set of a wide range of permanent grasslands in France were analysed, taking into account management variability and environmental conditions.
Two models were used to determine the best vegetation characteristics for the prediction of production and nutritive value: (i) plant functional types, proportions of grasses, legumes and forbs, and weather, and (ii) two proxies for plant functional types (dry matter content and phenological development at medium plant stage), proportion of grasses, legumes and forbs, and weather. The study was conducted on a set of 190 permanent grasslands distributed over a wide range of soil, climatic and management conditions, and lasted 2 years. For each of the permanent grasslands, climatic data, values of vegetation characteristics, biomass production and nutritive value were collected at the beginning and end of spring, and during summer and autumn regrowths.
Contribution of weather was important and particularly for regrowths. Composition in terms of botanical families, medium plant stage and sward dry matter content were the common variables that explained both biomass production and nutritive value during the growing season. Biomass production was mainly explained by the proportion of legumes and forbs, medium plant stage and dry matter content. Grass nutritive value was linked to the same factors, including plant functional types. However, the contribution of grass plant functional types was lower. Both models could be used to predict biomass production and nutritive value: R2 of the two models are quite similar.
Over a wide range of environmental and management conditions, vegetation characteristics and climatic data explained almost half of the variance of forage quality and 20–40% of the variance of biomass production. It shows that simple criteria can be used to account for the complexity of permanent grassland botanical composition. In addition, the survey of this set of 190 permanent grasslands allowed the publication of a typology of permanent grasslands in France based on the links between vegetation characteristics and forage production and quality described here, and on the botanical composition).

These results may help those seeking to develop models predicting biomass production or nutritive value of permanent grasslands that can be used for the evaluation of ecosystem services provided by permanent grasslands at the farm and landscape scales.

Publication/patent:

Michaud A., Plantureux S., Pottier E. and Baumont R., 2014. Links between functional composition, biomass production and forage quality in permanent grasslands over a broad gradient of conditions Journal of Agricultural Science, doi:10.1017/S0021859614000653
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