

Plant and animal proteins: an equation with numerous parameters. Consequences for research agenda on alfalfa.

Christian HUYGHE, Directeur Scientifique Adjoint Agriculture, Inra, 147 rue de l'Université, 75338 Paris 07

Abstract

In a context of huge worldwide increase of protein demand, the supply chain of plant proteins for human nutrition, either through during consumption or after animal production is often analysed as a linear value chain relying upon an increasing production of high-quality plant protein, an improved protein efficiency in animal production and the implementation of industrial processes to increase functional and nutritional properties of proteins.

This vision must be completed by taking into account environmental impact, for which nitrogen plays a key role. This atom is central for the value of protein, and is also a potential source of water pollution (nitrate), emission of GHG (N₂O) and its industrial fixation as ammonitrate is consuming a lot of fossil energy. Legumes and especially alfalfa make it possible to benefit from protein production without most environmental impact as thanks to symbiotic fixation there is no energy consumption and no nitrous oxide emission. If alfalfa is correctly inserted in crop rotations, there is no risk of nitrate leaching and the nitrogen in the plant residues may be used by the following crops.

It is compulsory to take into account the impossibility to increase the acreage of arable land worldwide, this leading to the need to reconsider the cropping systems and the various sources of proteins in these cropping systems. Imports of protein-rich raw material must be regarded as an increase of virtual size of European farms.

More degrees of freedom exist through a systemic approach of cropping systems at low environmental impact including intercropping, an improvement of animal production systems to increase protein efficiency, even though the possibilities seem limited, a better use of the by-products through a cascading approach in bio-based industries. Because of the contrasting protein content of alfalfa leaves and stems, partitioning of biomass may be reconsidered.

Other sources of proteins such as insects and algae are often suggested as alternatives and their value must be considered through their consequences on production efficiency and environmental impact.

In this very broad frame, it is then possible to re-investigate the role of alfalfa, the possible changes in cultivation and the gaps of progress that are offered through plant breeding.