DUAL HARVESTING AND PROCESSING OF FORAGE LEGUMES

JOHANN BACHINGER, KLAUS GUTSER

Material samples for demonstration purposes and stability tests made of alfalfa stems and linseed oil-based epoxy resin, manufactured by Bio-Composites and More GmbH (B. A. M.).

In addition to its traditional use as a forage crop, alfalfa is also interesting as a renewable raw material for natural fibre-reinforced plastics. Because of its high drought tolerance and – in light of the recent surge of soybean and mineral fertiliser prices – its ability to fix nitrogen, alfalfa should be given greater attention in crop production. Compared to soybean, alfalfa has a high proportion of fibrous stem tissue, which is difficult to digest. To date, this has prevented its use in animal husbandry, despite the fact that alfalfa has the highest protein productivity of all crops. Therefore, the FUFAPRO project now aims to specifically optimise the separation of alfalfa leaves and stems.

In order to generate a higher added value in alfalfa cultivation through the utilisation as protein-rich forage as well as the material utilisation of the stem biomass, leaves and stems must be separated. Preliminary studies show that cutting of the top 30 cm results in a higher forage value, while the lower stem biomass has a significantly higher content of crude fibre depending on the growth stage. This high-cutting method is a promising technique for selectively harvesting leaf and stem biomass. The multitude of research questions is addressed by different project partners. For example, IAP and B. A. M. GmbH are testing the suitability of the stem tissue for various natural fibre-reinforced plastics or building materials. Jointly, the Bauern AG Neißetal, INDITRAC and Dr.-Ing. Jürgen Paulitz are further developing the harvesting methods and testing them in practice. For better modelling of the forage value and the crude fibre content during crop growth, ZALF is conducting trials regarding different cutting times, cutting heights and alfalfa cultivars along with the determination of the respective proportion of stem and leaf biomass, as well as corresponding economic and ecological evaluations.

The results of the forage analyses show the great potential of alfalfa leaves and the high-cut biomass for use in animal husbandry as an alternative to soybean. The samples analysed so far showed a mean crude protein content of 25.9 % and an energy content of 7.8 MJ NEL per kg DM. In spring, leaves before budding featured peak values of up to 36 % crude protein and 8.5 MJ NEL per kg DM. In comparison, soybean and rapeseed extraction meal have a crude protein content of 50 % and 39 % as well as an energy content of 8.4 and 7.1 MJ NEL per kg DM, respectively.

Without major alterations, disc mowers proved to be well suited for cutting at 30 cm height. Sample preparation showed that the separation of stems and leaves after threshing can be done with an air separator for seed cleaning. Based on this principle, a combination of a bale breaker with a cyclone separator for leaf-stem separation is now to be developed to practice readiness. Tests regarding the suitability of alfalfa stem biomass for producing building materials also delivered promising results (see photo). The FUFAPRO project is part of the initiative »Land-Innovation-Lausitz« within the framework of the BMBF programme »Innovation and Structural change (WIR!)«.

Project: Development and regional establishment of climate-resilient, resource-efficient farming systems for cultivation, dual harvesting and processing of forage legumes into selected, fibrous stem material for natural fibre-reinforced plastics with improved properties and leaf mass for high-quality protein utilisation (FUFAPRO) **Term:** 2020–2023 **Funding agency:** BMBF **Lead at ZALF:** Bachinger (jbachinger@zalf.de) **Partners:** IAP, INDITRAC, Unterauftragsnehmer: Bauern AG Neißetal, Bio-Composites and More GmbH (B. A. M.), Ingenieurbüro für Naturfasertechnologien, Dr.-Ing. Jürgen Paulitz