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Data gaps on small-seeded forage legumes in Germany and Europe

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Introduction

European agriculture faces the challenge of reducing the existing protein gap and decreasing its dependence on imported soy as animal feed (Freund et al. 2025; Hristov et al. 2024). Forage legumes such as lucerne, red clover, white clover or incarnate clover offer considerable potential in this regard. They provide local, farm-based sources of protein and are also suitable for locations where intensive crop production is only possible to a limited extent. Various studies show that forage legume-based cropping systems can make an important contribution to increasing European protein self-sufficiency and transforming land use towards sustainability and resilience (Tomic et al. 2023). Beyond their role as a source of protein, forage legumes provide a range of desirable ecosystem services. Against this backdrop, forage legumes are increasingly being discussed as a key component in the European debate on more sustainable feed bases and more resilient production systems (Notz et al. 2023; Panagea et al. 2025).

At the same time it is difficult to assess the actual relevance of forage legumes in European agriculture today. Neither the extent of cultivation nor the regional distribution of individual species can be reliably quantified on the basis of available statistical data. In many databases, forage legumes are either not recorded at all or are grouped together in collective categories such as 'fodder plants', 'clover and other fodder plants' or with grassland, so that the range of species and the acreage disappear in the statistical data maze (Lampach et al. 2025). This means there is a lack of transparency regarding the extent to which small-seeded forage legumes actually contribute to closing the protein gap and in which areas targeted support measures would be particularly effective.

Against this background, an exploratory qualitative expert survey was conducted to specifically examine whether there is as little reliable knowledge about the numerical situation of forage legumes in Germany and the European Union as a look at the current statistical databases would suggest. This article reports on the key findings of this study, with a focus on data availability: the central question is to what extent experts can provide reliable information on the regional distribution of these crops, or whether they are just as much in the dark as the official statistics.

Data and Methods

For this study, five guided, qualitative expert interviews were conducted. The interviewees were individuals who work in various segments of the forage legume value chain: A product manager from the upstream agricultural sector with responsibility for seed production and animal feed, a project scientist from applied legume research, a cultivation advisor from an agricultural association, the managing director of a company in the downstream sector focusing on the processing of forage legumes, and a cultivation advisor from an institution supporting and promoting organic farming. The interviews were conducted using a semi-structured guideline, recorded, transcribed and then analysed using a structured qualitative content analysis according to Mayring. The focus was particularly on expert estimates and information on acreage, cultivation fluctuations, regional distribution and data bases for forage legumes in Germany and Europe.

Results and Discussion

The evaluation of the expert interviews initially confirms the picture described in the literature regarding the species mix of forage legumes. Lucerne, red clover and white clover are cited as by far the most important crops. Lucerne plays a key role, particularly in the downstream sector of processing of forage legumes, while red clover is of central importance in forage production and white clover in permanent grassland. Other small-seeded forage legumes such as incarnate clover, Alexandrian clover, Persian clover, Swedish clover and vetch play a significantly smaller role and are mainly used in mixtures, catch crop mixtures or special applications.

Regionally, the interviews suggest that cultivation in Germany is concentrated primarily in the southern federal states. Bavaria is particularly noteworthy, where a comparatively high proportion of farmland is cultivated with clover grass. Baden-Württemberg is also mentioned as an important location for forage legumes. At European level, the picture is similar to that found in the literature: France and Italy are cited as the main producing countries for lucerne, while Spain and various Eastern European countries, such as Romania, Hungary and parts of the Baltic states, are highlighted as important production regions (Julier et al. 2017). Nevertheless, this information remains largely uncertain in nature. It was hardly possible to obtain precise information during the interviews.

The interviews clearly show that even within the industry, there is hardly any reliable information available on acreage and the geographical location of cultivation areas. The interviewees limited themselves to rough estimates or general assessments of large areas, and even the main growing countries were only classified approximately by individual experts. Several interviewees explicitly emphasised that there are no specific statistics or databases on forage legumes. Overall, the data collection was therefore unable to generate representative and reliable results on the importance of lucerne, red clover and white clover in Germany and Europe in terms of area. In order to create a more reliable data basis, a much broader survey approach with a very high number of interviews, especially with seed producers, multiplication companies and grassland advisors in various European countries, would be necessary.

At the same time, the interviews allow conclusions to be drawn about the future importance of forage legumes. Several experts point out that increasing weather extremes tend to favour the cultivation of forage legumes. Forage legumes are seen both as a building block for closing the protein gap and as a component of more climate-resilient crop rotations. Accordingly, a moderate increase in acreage is expected, which is reflected in a slight increase in sales of forage legume seeds. In addition, new uses are emerging, such as the use of forage legumes for insect farming or the extraction of 'green protein' for monogastric feed or potentially human

nutrition. These prospects underscore that these crops may gain structural importance, even if their current acreage is insufficiently recorded statistically.

However, the interviews also highlight problems with seed availability, the difficulty of finding sufficient seed multiplication sites, and a partial lack of immediate economic benefits for conventional farms. Against this backdrop, seed producers and distribution organisations play a key role: they not only decide which seeds are available and in what quantities, but also indirectly influence the speed at which forage legumes can expand on the market.

Overall, the study thus paints an ambivalent picture: forage legumes are highly rated by experts in agronomic, ecological and strategic terms, but remain largely 'invisible' in statistical terms. It is precisely this discrepancy between perceived importance and a lack of data transparency that should make the further expansion of a systematic database a long-term goal for research, industry and politics.

Implications

The results of the qualitative expert survey clearly show that there is a considerable need for research in the field of forage legumes with regard to the collection and processing of reliable data. As long as the acreage, regional concentration and utilisation pathways of small-seeded forage legumes are hardly visible in statistics or only visible in collective categories, their actual importance for protein supply, climate-adapted crop rotations and the provision of agroecological services remains largely a 'black box'. Improving the data basis is therefore not only a technical requirement, but also a central requirement for adequately considering the importance of these crops in policy advice, breeding strategies and operational decisions.

One possible starting point for a more detailed analysis of potential lies in combining different spatial data sets. This would allow a model-based investigation of the regions of Europe where forage legumes are likely to already play a role today or could become more established in the future. One possibility would be to overlay a map of cattle density with soil and land use data in order to identify areas where high demand for fodder meets comparatively low grassland availability, but where there are also light soils with limited suitability for intensive crop farming. Such a spatial perspective could help to identify 'blind spots' and develop targeted strategies for advisory services, variety development and support instruments.

At the same time, the question must be asked whether forage legumes could be included as standard in official statistics and categorised by species. A separate, disaggregated list of the most important forage legume species at EU level would perhaps be an effective first step towards creating transparency about the current situation and developments over time. In this regard, it will be necessary in future to evaluate the effort that an extended statistical recording would entail and the administrative actions that would need to be organised in this regard.

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