Faba bean in cropping systems

The grain legume (pulse) faba bean (Vicia faba L.) is grown world-wide as a protein source for food and feed. At the same time faba bean offers ecosystem services such as renewable inputs of nitrogen (N) into crops and soil via biological N\textsubscript{2} fixation, and a diversification of cropping systems. Even though the global average grain yield has almost doubled during the past 50 years the total area sown to faba beans has declined by 56\% over the same period. The season-to-season fluctuations in grain yield of faba bean and the progressive replacement of traditional farming systems, which utilized legumes to provide N to maintain soil N fertility, with industrialized, largely cereal-based systems that are heavily reliant upon fossil fuels (=N fertilizers, heavy mechanization) are some of the explanations for this decline in importance. Past studies of faba bean in cropping systems have tended to focus on the effect of faba bean as a pre-crop in mainly cereal intensive rotations, whereas similar information on the effect of preceding crops on faba bean is lacking. Faba bean has the highest average reliance on N\textsubscript{2} fixation for growth of the major cool season grain legumes. As a consequence the N benefit for following crops is often high, and several studies have demonstrated substantial savings (up to 100–200 kg N ha\textsuperscript{-1}) in the amount of N fertilizer required to maximize the yield of crops grown after faba bean. There is, however, a requirement to evaluate the potential risks of losses of N from the plant–soil system associated with faba bean cropping via nitrate leaching or emissions of N\textsubscript{2}O to the atmosphere as a consequence of the rapid mineralization of N from its N-rich residues. It is important to develop improved preventive measures, such as catch crops, intercropping, or no-till technologies, in order to provide farmers with strategies to minimize any possible undesirable effects on the environment that might result from their inclusion of faba bean in cropping system. This needs to be combined with research that can lead to a reduction in the current extent of yield variability, so that faba bean may prove to be a key component of future arable cropping systems where declining supplies and high prices of fossil energy are likely to constrain the affordability and use of fertilizers. This will help address the increasing demand by consumers and governments for agriculture to reduce its impact on the environment and climate through new, more sustainable approaches to food production. The aims of this paper are to review the role of faba bean in global plant production systems, the requirements for optimal faba bean production and to highlight the beneficial effects of faba bean in cropping systems.

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