



The role of legumes in sustainable crop rotation

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Monoculture presents long-term problems, higher nitrogen consumption, greater risk of pests and diseases, especially weeds, and higher consumption of plant protection products.

The inclusion of legumes in rotations has a positive effect on the environment, which is further enhanced when the rotation consists of crops whose production requires high levels of inputs. With the introduction of protein crops economic profitability is maintained due to savings in inputs such as nitrogen fertilisers, both in legume cultivation and in subsequent crops, generally wheat, whose yield increases.

The advantages of alternative crops in terms of diversification of work dates, diversification of risks, and greater ability to combat weeds, pests, and diseases make them attractive when considering the farm as a whole.

Legumes are suitable for all European regions, and there are many possible outlets for these crops, as their protein- and energy-rich grains can be used for the animal and human food market.

1.

Effect of legumes on production

Experiments conducted in long-term trials show benefits in different areas, such as increased production in successive crops (See Table 1).

The graph shows that the first wheat sown after alternative crops can provide a yield increase of more than 10% compared to yields on plots where a second wheat crop is repeated (dark green columns). If the previous crop is a legume, in this case peas, there is a 17% increase in wheat yield compared to the previous wheat crop. In addition, the second cereal sown after alternative crops can produce between 5% and 10% more than the resown cereal. (Light green columns). The second wheat crop sown after legumes, specifically peas, produced around 9% more than the resown wheat.

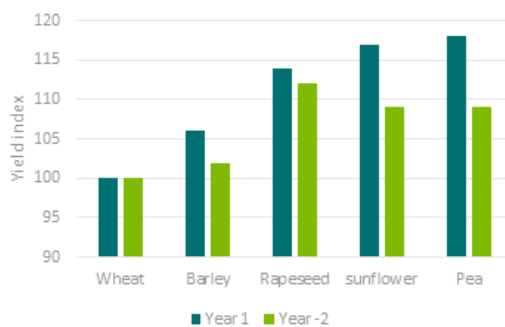


Table 1.
Yield index according to previous crop.

2.

Interaction between nitrogen fertilisation and crop rotation

Legumes, due to their ability to fix atmospheric nitrogen through symbiosis with rhizobium bacteria present in the soil, do not require nitrogen inputs during cultivation and allow for a reduction in nitrogen fertiliser inputs in the following crop (Table 2).

The following table shows three response curves to different incremental nitrogen inputs. All lines show how wheat crop productivity responds to increasing doses of nitrogen applied to the trial, for each of the previous crops. The differences are noticeable. While previous crops such as legumes show more linear-plateau curves in which maximum yield is reached quickly, in the case of wheat, there is a continuous response of the crop to increasing doses, but sowing with a potential below that of other previous crops.

The introduction of peas into the rotation has enabled an average saving of 40 kg of nitrogen per hectare in the following wheat crop thanks to the nitrogen-fixing effect of the legume.

It has also increased the efficiency of this fertiliser's use by wheat, which required 26 kg/N per tonne of grain when sown after wheat and only 17.5 kg/N per tonne of grain when sown after peas.

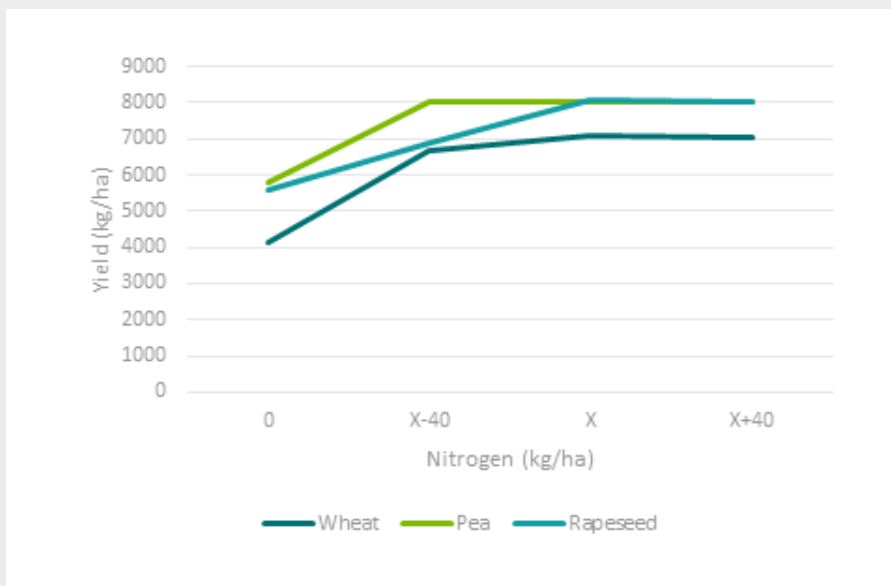


Table 2.

Wheat yield depending on the preceding crop and nitrogen input.

3.

Crop rotation and weeds

One of the best ways to combat weeds is to rotate crops on the same plot of land.

This allows us to: - Alternate species with different sowing times (autumn, winter, spring). - Alternate dense crops with crops in wide rows that allow for weeding between rows. Introducing legumes into crop rotation allows other active ingredients in plant protection products to be used, reducing the risk of resistance developing (Table 3).

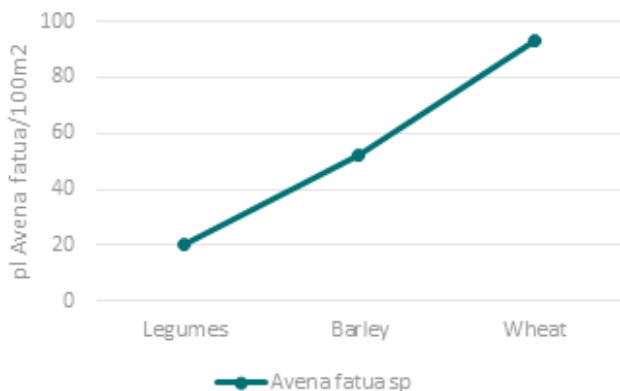


Table 3.
Avena fatua plants in cereal crops depending on the preceding crop

4.

Effect of crop rotation on pests and diseases

In addition to influencing factors such as production and fertilisation, including legumes in crop rotation helps to control pests and diseases in cereals by breaking their life cycle.

An example of this can be seen with the cereal pest *Zabrus tenebroides*, where it has been proven that its population decreases when other crops are included in the rotation, but the best precedent for its control is legumes (Table 4). Evaluations carried out on cereal crops show that legume preceding crops significantly reduce pest damage to crops.

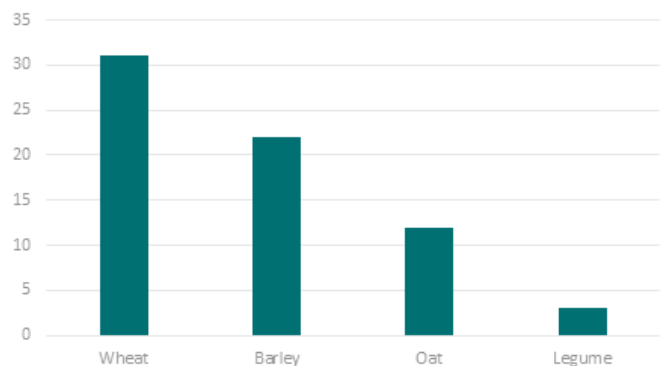


Table 4.
Plants/m² of wheat affected by *zabrus tenebroides* depending on the previous crop

Conclusion

The inclusion of leguminous crops in crop rotation provides agronomic and environmental benefits due to their ecosystem services. In addition to reducing inputs in their own cultivation and in subsequent crops, such as the use of nitrogen fertilisers, they contribute to more sustainable and resilient agricultural systems.





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