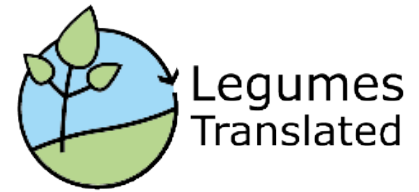


Lucerne in north-western Europe

Paul Hargreaves, Lorna L. MacPherson and Jennifer Flockhart



Lucerne (*Medicago sativa* L.) can be fed to dairy, beef cattle and sheep as part of the protein forage component of their ration. Based on Scottish research, this note provides guidance on identifying site and climate combinations where the production of lucerne can be viable in north-western Europe. The experience from research on lucerne gained in these marginal conditions provides a useful guide to production more generally.

Outcome

Lucerne is a high protein forage legume that has great potential as a forage feed for dairy and beef cattle and sheep. However, the combination of cool conditions and naturally acidic soils in the wetter parts of the British Isles is generally not favourable to the growth of lucerne. But with careful site selection and soil management, the potential benefits from this persistent, high yielding and high-protein forage crop can be exploited in north-western Europe.

The positive outcomes:

- Biological nitrogen fixation so no nitrogen fertiliser is required.
- Excellent break-crop effect with up to 70%

Applicability

Theme: How to create optimal conditions for growing lucerne

For: Dairy, beef and sheep farmers

Where: Cool, temperate climate i.e., Scotland

Timing: Under the right conditions, lucerne can be grown as a protein crop

Impact: Better legume crops

less nitrogen required for the subsequent cereal.

- High yields with up to 12 tonnes dry matter/ha/year from multiple cuts for about five years.
- High voluntary intake due to good palatability.
- Reduced need for additional protein feeding due to high protein content (18-22% of the dry matter).
- High fibre content that enhances rumen health and reduces the risk of acidosis.
- Improved soil structure.
- Drought tolerance.
- Stable yield from established crops.



A mature crop of lucerne ready for harvest. Photograph: Bernadette Julier (INRAE)

Matching site, climate, cultivar and management

Climate

Like most other temperate crops, lucerne germinates when soil temperature rises above 2°C but a soil temperature of at least 8°C is required for effective establishment.



Grazing lucerne. Photograph: Bernadette Julier (INRAE)

The optimum temperature for establishment is about 12°C, reached in late spring in north-western Europe. The young plants grow slowly. The main aim of crop establishment is to build up biomass in the first year so that the crop goes into its first winter with good root reserves. This means balancing waiting for warm conditions that will support rapid germination with sowing early enough to escape summer droughts affecting germination. This gives a sufficiently long first-year growing season so that plants are robust going into the first winter.

Site

The roots of young lucerne plants are sensitive to waterlogging and only well-drained soils are suitable. Once established, lucerne is more drought tolerant than most forage grasses giving high yields of high-protein forage for about five years. This drought tolerance reduces the effects of drought on total farm-level forage yields on drought-prone sites. Lucerne is an option particularly as part of a whole-farm strategy for increasing the resilience of forage and protein production against drought.

Cultivars and sowing

Lucerne is outcrossing and so cultivars are populations of genetically related but different individuals. A diverse range of cultivars enables adaptation to a wide range of environments. This means attention to cultivar selection is required so that the chosen cultivar has a good combination of traits suited to the site. Dormancy is an important trait for matching the site and cultivar.

Lucerne has developed to grow in a variety of different climates, with varying levels of winter activity or dormancy. Some winter dormancy is needed to survive cold winters in north-western Europe. There is a trade-off between the level of winter dormancy and the length of the growing season and yield potential. Lucerne seed is very small and a fine seedbed is required for the shallow drilling (1.0–2.5 cm) of 20–25 kg seed/ha. Consolidation of the seedbed after sowing helps give good contact between seed and soil. Most weed species found in Scotland are better adapted to cool wet conditions than young lucerne plants. Therefore, cool wet conditions during the early establishment phase favours the growth of weeds more than lucerne resulting in increased and potentially damaging weed competition.



Lucerne growing at Crichton Royal Farm in Dumfries, Scotland in 2015. Photograph: Jennifer Flockhart

The first cuts may be weedy but then the weed disappears and established lucerne crop is usually very competitive against new weed establishment. Weed competition can also be reduced by sowing a low-growing grass with the lucerne.



Lucerne flower. Photograph: Cotswold Seeds

Rotation

Lucerne crops can yield well for up to 10 years, but most stands are kept for about five years. Lucerne is auto-toxic in that established plants suppress the establishment of young lucerne plants in the same place. This means that an interval of about six years between crops is required to prevent the residue of the previous crop impacting on the new crop and to prevent the buildup of diseases and pests specific to lucerne. Autotoxicity also means that stitched in/over-seeding of a sparse crop is not an effective option.

Fertilisation

Lucerne does not need fertiliser nitrogen but there are high off-takes of phosphorus (P) and potassium (K) in the forage. The crop is particularly responsive in the juvenile stage so applications to the seedbed are relevant. Slurry can suppress biological nitrogen fixation and is therefore not good for this crop. This presents a challenge on farms with high overall-stocking rates. Managing P and K therefore needs to be part of a whole-farm approach to these nutrients.

Lucerne is sensitive to low soil pH (acidity) and attention to liming is required, especially in north-western Europe. The target pH for a mineral soil is between 6.2 and 7.0. In moderately acidic soils or in soils where no lucerne has been grown for many years, seed inoculation is highly recommended. Lucerne is also sensitive to deficiencies of boron (B), molybdenum (Mo) and zinc (Zn) in the soil.

Sources

Autret, B., Mary, B., Chenu, C., Balabane, M., Girardin, C., Bertrand, M., Grandeau, G. and Beaudoin, N., 2016. Alternative arable cropping systems: A key to increase soil organic carbon storage? Results from a 16 year field experiment. *Agriculture Ecosystems & Environment* 232, 150–164. www.doi.org/10.1016/j.agee.2016.07.008

Irving, L. J., Sheng, Y.-B., Woolley, D. and Matthew, C., 2007. Physiological effects of waterlogging on two lucerne varieties grown under glasshouse conditions. *Journal of Agronomy & Crop Science*, 193, 345–356. www.doi.org/10.1111/j.1439-037X.2007.00277.x

Julier, B., Gastal, F., Louarn, G., Badenhauer, I., Annicchiarico, P., Crocq, G., Le Chatelier, D., Guillemot, E., Emile, J.-C., 2017. Lucerne (Alfalfa) in European cropping systems. In: Murphy-Bokern, D., Stoddard, F. L., and Watson, C. *Legumes in cropping systems*. CABI, 168–192.

Julier Latta, R. A., Cocks, P. S. and Matthews, C., 2002. Lucerne pastures to sustain agricultural production in southwestern Australia. *Agricultural Water Management*, 53, 99–109. [www.doi.org/10.1016/S0378-3774\(01\)00158-5](http://www.doi.org/10.1016/S0378-3774(01)00158-5)

McConnell, D. and Genever, L., 2014. Growing and feeding lucerne. AHDB Dairy, Stoneleigh, UK. media.ahdb.org.uk/media/Default/Imported%20Publication%20Docs/Growing%20and%20feeding%20lucerne.pdf

Sherrell, C. G., 1983. Effect of boron application on seed production of New Zealand herbage legumes. *New Zealand Journal of Experimental Agriculture*, 11, 113–117. www.tandfonline.com/doi/pdf/10.1080/03015521.1983.10427739

Smethurst, C. F., Garnett, T. and Shabala, S., 2005. Nutritional and chlorophyll fluorescence responses of lucerne (*Medicago sativa*) to waterlogging and subsequent recovery. *Plant and Soil*, 270, 31–45. link.springer.com/article/10.1007/s11104-004-1082-x

Stout, D. G., Broersma, K. and Acharya, S. N., 1997. Seed pre-inoculation and soil liming for growth of forage legumes on acidic clay soils. *The Journal of Agricultural Science*, 128, 51–57. www.doi.org/10.1017/S0021859696003905

About this practice note and Legumes Translated

Authors: Paul Hargreaves, Lorna L. MacPherson and Jennifer Flockhart

Publisher: Scotland's Rural College (SRUC)

Production: Donau Soja

Permalink: www.zenodo.org/record/4438042

Copyright: © The Authors, 2021. Reproduction and dissemination is permitted for non-commercial purposes provided the authors and source are fully acknowledged.

This practice note was prepared within the Legumes Translated project funded by the European Union through Horizon 2020, Project Grant Number 817634.

Citation: Hargreaves, P. R., MacPherson, L. L., and Flockhart, J., 2021. Lucerne in north-western Europe. Legumes Translated Practice Note 12. Scotland's Rural College (SRUC). www.legumestranslated.eu

The content is solely the responsibility of the authors. No warranties, expressed or implied, are made with respect to the information provided. Information relating to the use of plant protection products (pesticides) must be checked against the product label or other sources of product registration information.

