Lucerne as an alternative protein source in southwest England: a Demo Farm perspective

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Abstract

Lucerne (*Medicago sativa*) remains a widely grown forage crop globally. In Great Britain however, its use has been restricted by crop establishment challenges. With global demand for protein continuing to rise, the European dairy sector is tasked with increasing the use of home-grown protein forages. In 2013 the British Grassland Society and DairyCo embarked on the three-year-long Demo Farms project, whereby selected findings from the DairyCo-funded Grass, Forage and Soils research partnership involving a number of UK universities could be transferred to farmers via a network of trials and events on commercial farms. In 2014 a high-output dairy farm in southwest England in its second year of growing lucerne joined the project, providing knowledge exchange opportunities around the use of home-grown lucerne to reduce purchased protein costs and improve farm business scale efficiency. This paper explores the strategies employed at the demo farm growing and feeding the crop to date, and the farm's use as a knowledge exchange mechanism.

Keywords: knowledge transfer, lucerne, on-farm practice

Introduction

Lucerne (*Medicago sativa*) remains a minority crop in Great Britain despite its proven high yields, protein content, palatability and zero nitrogen fertiliser requirement. It is estimated that as much as 404,680 hectares (ha) are suitable for growing lucerne in Great Britain. The main barrier has been the establishment phase. A number of trials undertaken at universities within the Grass, Forage and Soils research partnership (RP) have provided insight into strategies to maximise establishment, including investigations into the potential of a cover crop (spring barley) to reduce weed burden and whether spring or autumn sowing is preferential for lucerne production in Great Britain.

Additionally, there is a knowledge gap regarding optimum strategies to maximise the value of lucerne in dairy cow diets. Alternative feeding strategies are also being explored, including: the optimum rate of inclusion of lucerne in dairy cow diets when combined with maize and/or grass silage, the effect of plant maturity at harvest for silage on forage quality and cow performance, and the effect of chop length of lucerne on ensilability, digestibility and cow performance.

The aim of the demo farm is to provide a suitable context in which to relay relevant messages from the RP to farmers.

The demo farm case study

The farm is located in mid-Cornwall, southwest Great Britain. The soil type is a clay loam to loam over slaty mudstones, with naturally high groundwater in places. Average rainfall is 1000 mm per annum and the farm is at an altitude of 100 m. The herd comprises 230 Holstein cows, one third of which are milked by robot. Average production is 10,000 litres with an all year-round calving pattern. Grass (61 ha), forage maize (44 ha) and lucerne (24 ha) are now the predominant crops grown on the farm. Winter wheat (15 ha) is also produced.

Lucerne was established for the first time in May 2013 when 17 ha (cv. Marshall) was sown as a pure stand at a seed rate of 25 kg ha^{-1} (seed costs £170 ha^{-1}). The land was previously used for wheat, grass and potato production, and the soil nutrient status was good (Table 1).

The crop was harvested twice in 2013 with an estimated yield of 17.5 Mg ha^{-1} (fresh weight, cut), equating to dry matter (DM) yield of 4.25 Mg DM ha^{-1}. Slurry was applied after each cut with a dribble bar at a rate of 27.5 Mg ha^{-1}. A further 7 ha of the crop were sown in April 2014. Weed burden in the newly sown crop was controlled early in the growing season with a weed wiper.

The first harvest of 2014 (11 June) was taken from the 17 ha in second-year production only, again followed by 27.5 m^3 ha^{-1} slurry. Yields were estimated from quadrat clips, projecting a yield difference of more than 3.29 Mg ha^{-1} between north- and south-facing fields (Table 2). The yield at second harvest was estimated by the farmer to be 7.59 Mg ha^{-1} fresh weight, based on the weight capacity and number of trailer loads carried off the fields (transportation to the nearest weigh bridge was not feasible as contractors were used for silaging).

Clamp silage was made, with fructan biological additive at a rate of 2 l Mg^{-1} (Table 3). The growing season was generally drier in 2014 than the previous year, receiving an average 59 mm rainfall per month between March and September compared to an average 66.4 mm in 2013 (Camborne Weather Station, Met Office 2015).

Table 1. Soil nutrient status prior to lucerne cultivation.

pH	7.25
Phosphorous mg l^{-1}(index)	34 (3)
Potassium mg l^{-1}(index)	283.5 (3)
Magnesium mg l^{-1}(index)	98 (2)
Organic matter % loss on ignition	8.5

Table 2. Difference in crop performance in adjacent north- and south-facing fields prior to the first cut of second-year lucerne in June 2014.

	North-facing	**South-facing**
Plant size (mean g plant^{-1})	326.4	490.8
Plant density (number of plants m^{-2})	50	67
Estimated yield (fresh weight Mg ha^{-1})	6.53	9.82

Table 3. First and second harvest lucerne silage analysis from the demo farm, 2013 and 2014.

	First harvest		**Second harvest**	
	2013	**2014**	**2013**	**2014**
Dry matter (DM) (g kg^{-1})	243	409	255	52.6
Crude protein (g kg^{-1} DM)	168	166.5	168	201.5
D-value (digestible organic matter g kg^{-1} DM)	640	665	630	-
Metabolisable energy (MJ kg DM^{-1})	10.2	10.6	10.1	-
pH	4.7	4.05*	4.7	4.79

* Value significantly different.

Lucerne is provided in the diet of both the robotically milked and conventionally milked cows at a rate of approximately 1.5 kg dry matter per cow per day (5-6 kg fresh weight per cow per day). This equates to 15% of the dry matter intake from forage. It is fed as part of a total mixed ration which includes (amongst other ingredients): chopped fodder beet, whole crop wheat, haylage and first cut silage. The lucerne is chopped to approximately 5 cm.

This commercial farm, and the story of its experience with this little-used crop, provides a platform for knowledge exchange activity that breaks down barriers around learning styles and the perceived impractical nature of university-based trials. Farmer-facing events were held at the farm in July and November 2014. The first focused on growing and feeding lucerne, whilst the second related to the use of lucerne in potential lower crude protein diets for dairy cows. Researchers from the RP led presentations at each event, providing a rare opportunity for direct interaction with farmers in a farmer-centric setting. Through the data generated from the demo farm, researchers were able to compare and contrast their findings with on-farm practice, providing stimulus for comment at the events. Attendance figures at each event were encouraging, with a total number of 90 participants. Attendance was dominated by, but not restricted to farmers, and included representatives from associated trades such as farm advisers, agronomists and merchants.

Both the popularity of the events and feedback collected indicate that the target audience is engaged with the topic area and that the demo farm is a suitably located and a credible host. The demo farmers view their involvement in the project as a new and valuable learning experience and particularly welcome the opportunity to hear from primary researchers.

The demo farm project is ongoing until 2016, allowing further data collection and evaluation during 2015. Existing issues remain with the quality of data collected, which can also be addressed as the project progresses. A cost-benefit analysis (planned to take place in 2015) may help elucidate the influence of including lucerne in the dairy ration compared to other simultaneous on-farm actions in this commercial farming situation. A further 10 ha lucerne will be sown in 2010, reflecting the farmers' satisfaction with its performance and the impact of greening requirements under the 2015 Common Agricultural Policy reforms.

Conclusions

Conducting demonstrational investigations within the context of a commercial farm presents challenges in terms of collecting significant sample sizes of comparable data, applying controls and obtaining precise data without overtly impacting on farming activities. Accounting for other influencing factors is problematic as the project is not research led in the same way as trials at university-based sites. Nevertheless, the demo-farm format for knowledge exchange presents enhanced opportunities for researchers and intermediaries such as the British Grassland Society and DairyCo to work with active farmers to address practical challenges collaboratively.

References

Met Office (2015) Camborne meteorological data set. Available at: http://tinyurl.com/p9ktzct.