Focus Farm Review

The Potential for Balansa Clover in Wales

The Llyn Rhys experience

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1 Summary

Mr Pearce Hughes runs a flock of 1,250 Lleyn, AberField, AberMax and AberVale ewes (i.e. is an Innovis 'multiplier' farmer), at Llyn Rhys, Llandegla, Wrexham. The farm has participated in the Farming Connect Focus Farm initiative, with a specific focus on assessing the viability of balansa clover, it's suitability to the Welsh climate, and its forage and grazing capability compared to other forage crops.

What is Balansa Clover?

'Fixation' balansa clover is an annual legume, native to the north-eastern Mediterranean region. This clover can tolerate a variety of soils and due to its deep tap rooting (of up to 45cm), it can help soil drainage and water infiltration.

Balansa clover is capable of producing large amount of biomass and due to its rosette growth patterns it allows it to be persistent for intensive grazing or cutting. Balansa clover is versatile, i.e. it is resilient to cold and dry conditions, as well as waterlogged soils. In terms of feed value, it can produce up to 5,882 kg/ha DM and 28% crude protein on a dry matter basis.

(Further information can be found here http://www.fixationclover.com/forage.html and http://www.grasslandoregon.com/assets/fixation_brochure_v1.15.pdf)

1.1 Conclusions/Take Home Points for the Industry

1.1.1 High quality clover based silage results in reduced input costs

For every 10% increase of clover in a sward crude protein can increase by 1% [4]. Farming for feed efficiency and greater use of forage can offset rising purchased feed costs. Clovers play a vital part of this improving silage quality, and therefore feed utilisation.

The aim at Llyn Rhys is 'to try and produce rocket fuel silage to feed the ewes before lambing, to minimise the amount of concentrate we need to put into them', says Mr Hughes. Maximising the sugar content of grass silages will improve microbial protein synthesis in the rumen, therefore increasing the efficiency of meat and milk production.

The Balansa silage analysed at 14.5% crude protein, 11.5MJ/kg ME, a D-value of 72 and 46% dry matter (DM).

In comparison, conventional haylage harvested at Llyn Rhys achieved 11.7% crude protein, 11.6 MJ/kg ME, a D-value of 72, and 81.9% DM.

He fed the Balansa silage to his twin and triplet-bearing ewes in late February, five weeks pre-lambing. The flock started lambing on March 25th and an 18% protein concentrate is normally introduced five weeks before lambing. However, the performance of the ewes on the balansa silage was so good that Mr Hughes was able to delay feeding by two weeks.

He estimates that this resulted in savings of £1.68 a head in his twin bearing ewes. 'The quality of the silage was so good that it essentially replaced the cake. We probably could have held off feeding for another week or so but we didn't want to risk it'.

'We had been hoping the balansa silage would have achieved a protein level of 16% instead of 14.5% but with a slightly earlier cutting date I am sure we could have achieved this'.

1.1.2 Balansa Clover performed under poor conditions, with potential climate change benefits.

Mr Hughes doesn't view balansa only as a means of reducing his purchased feed costs. He says its nitrogen-fixing properties are improving soil fertility and reducing inputs of chemical fertiliser – a 5:24:24 fertiliser was applied at 246kg/ha at sowing followed by 123kg/ha of urea four weeks later.

Balansa is also an aggressive weed suppressant. "Nothing stood a chance against it, even the Italian ryegrass was struggling to keep up. With the likelihood of some weed killers being withdrawn in the future this is definitely a consideration,'' says Mr Hughes.

Unlike some forages, balansa will do well in less than ideal soil pH conditions. "It will grow well at a pH of 5.7 to 5.8 and there are reports of farmers growing it successfully at pH levels as low as 4.8 in America'' says Charlie Morgan, Mr Hughes' grassland adviser.

He believes farmers must look at the options for growing novel plants if the UK is to experience drier conditions going forward. Although this does not feel like an issue currently, with very wet summers and winters prevailing in Wales, conditions can change rapidly. Versatile clover varieties (e.g. balansa, being both drought and waterlogging resistant) may need to be part of the livestock producers' forage system, in order to respond to increasingly variable weather patterns.

Annual clovers are very high yielding and they have drought tolerant characteristics; they can be considered among a range of options farmers have at their disposal if the UK is to experience a change in climatic conditions. With such dry conditions in parts of America, a multitude of species are sown into one mix and grown to maximise biomass. These crops can stand five to six-foot-high and after they have been cut they are grazed to optimise livestock potential under difficult conditions.

They also provide organic matter to soils, improving soil structure, aiding water retention and nutrient availability. Some of these species have significantly different rooting capabilities, and the multi species seed mix can help ensure the forage crop serves a range of requirements.

1.1.3 Clover can reduce pollution and help mitigate climate change impacts

The incorporation of clover into grassland mixtures is a way to reduce both fertiliser applications and diffuse water pollution risks[1].

Effective use of the balansa clover species will not only improve soil fertility, reducing the requirement for artificial nitrogen inputs; it is also an aggressive weed suppressant, all of which will reduce inputs of fertiliser and weed killer. Introducing balansa clover can also lead to improved mineralisation of soil, with 37 – 55% of total N applied to clover sown soils being mineralised as appose to 13 – 21% to grassland[2]. With the increase in soil organic matter from the clover crop, nutrients are held in the soil for use by

[1] Wilson, B. 2017. *Practical Measures to Reduce Greenhouse Gas Emissions from Grassland Systems.* Cotswold Grass Seed Direct. Available from: https://www.cotswoldseeds.com/updates/practical-measures-reduce- greenhouse-gas-emissions-grassland-systems. (Accessed 2nd January 2018).

[2] Perdigao, A. Pereira, J. Moreira, N. Trindade, H. Coutinho, J. 2017. Carbon and nitrogen mineralisation from green manures as alternative nitrogen sources in Mediterranean farming. *Archives of Agronomy and Soil Science.* 63. 11. (1546 – 1555).

future crops, providing excellent establishment conditions for future cropping whilst minimising applications of nitrogen at sowing, all of which will decrease run off/pollution risks.

1.1.4 Balansa clover has the potential to overcome soil degradation

Implementing a grassland programme that incorporates balansa clover should lead to reduced soil degradation, and is likely to help remedy problems associated with poor soil conditions. On fields which have suffered soil erosion and nutrient leaching, incorporating a clover will alleviate such problems through increasing the water retention capacity of the soil. Clover's thick growth and vast root system will also greatly reduce both erosion and leaching[3]. In fields with high erosion risk and poor nutrient retention, opting for an annual clover of this type will not only improve conditions through holding soils over winter, but will provide a more nutritious and desired bedding for future cropping.

To fulfil the potential that clover has to offer grassland systems in Wales, there is the need for the implementation of an effective rotation which ensures future crops will benefit from any clover residue. Annual clovers -such as balansa have green manure credentials which again can aid erosion and therefore reduce soil degradation.

2 Business Review

Mr Pearce Hughes runs a flock of 1,250 Lleyn, AberField, AberMax and AberVale ewes (i.e. is an Innovis 'multiplier' farmer), at Llyn Rhys, Llandegla, Wrexham.

Farming in the drier north east area of Wales, Mr Hughes is interested in growing high quality multi-purpose forage crops. He has an interest in improving soil condition, hence trialling the use of a deep rooting clover (the balansa), as well as trying out a range of seed mixes with deeper rooting species (such as Daikon Tillage Radish, rooting to 30-40cm).

This focus on soil condition is evident as a business strategy, with the planting of a 12 variety seed mix in a field badly compacted by electricity pylon contractors, including balansa and berseem clover[4]. Mr Hughes considers that this has resulted in a much improved soil structure, as well as the decaying clover providing nitrogen for the next season's crop.

Aside from improving livestock production (i.e. kg meat produced), business priorities include minimising soil erosion over winter, and nutrient retention for future crops –hence the interest in annual clovers as green manures.

[3] Soil First. 2014. *Cover Crop of the Month: Balansa Clover.* Soil First. Available from: http://www.soil1st.com/cover-crop-month-balansa-clover/. (Accessed 2nd January 2017).

[4] AHDB – Managing clover for better returns.

[4] http://www.cpm-magazine.co.uk/2016/06/20/companion-cropping-berseem-clover-improves-soils/

3 Project review

3.1 Aim of the project.

The main aim of the project was a viability study on balansa clovers' suitability to Welsh climate and conditions for forage and grazing compared to other forage crops.

This project evaluated how well such a crop could grow in Wales (specifically at Llyn Rhys, in 2016/2017). There is the potential to undertake further trials on other sites to monitor its benefits if any in more detail.

3.2 Details of the project:

3.2.1 Trial 1

A 6 acre block was sown with 9kg Italian Rye Grass and 2kg Balansa Clover per acre. Italian Ryegrass was used as it has a similar lifespan to Balansa Clover so would be complementary as regards growth and reaching optimum yield.

The field was ploughed and then power harrowed to prepare the seedbed. Fertiliser was applied at 100kg of 5/24/24 per acre.

Yields were calculated by weighing a sample of the big bales then converting this to the DM yield in accordance with the silage analysis.

3.2.2 Trial 2

A field with an open Italian sward was divided in two to evaluate the performance of two clover varieties 'stitch' seeded in autumn. Both varieties are claimed to be winter hardy and were well established by spring, competing with the grass and providing additional nitrogen to the sward.

Clover 1 – Balansa clover. Seeded at 2kg an acre

Clover 2 – 'Frosty' Berseem clover. Seeded at 6kg an acre

3.3 Project results

- The trial 1 crop was cut on August 10th, yielding 33 bales at 630kg/bale – **the equivalent of 4 tonnes/hectare**. "It was at waist-level when we cut it,'' says Mr Hughes.

- The silage analysed at 14.5% crude protein, 11.5MJ/kg ME, a D-value of 72 and 46% dry matter (DM). In comparison, haylage harvested at Llyn Rhys achieved a crude protein of 11.7%, 11.6 MJ/kg ME and 81.9%. **The performance of the ewes on the balansa silage was so good that Mr Hughes delayed feeding by two weeks**.

Silage Quality Comparison Table –comparing result from 3 forage crops at Llyn Rhys in 2016.

	Balansa Clover Italian Ryegrass	Grass Big Bale Haylage	Conventional Grass Silage
D Value	72	72	59
ME	11.5	11.6	9.5
FME	9.4	10.5	7.5
DM %	45.8	81.9	42.7
Crude Protein	14.5	11.7	9.2
pH	4.8	5.7	4.5
Sugars g/kg	98	78	62

- Mr Hughes estimates that this resulted in **savings of £1.68 a head in his twin bearing ewes**. "The quality of the silage was so good that it essentially replaced the cake. We probably could have held off feeding for another week or so but we didn't want to risk it. We had been hoping the balansa silage would have achieved a protein level of 16% instead of 14.5% but with a slightly earlier cutting date I am sure we could have achieved this target DM."

- He says its **nitrogen-fixing properties are improving soil fertility and reducing inputs of artificial N fertiliser** – a 5:24:24 fertiliser was applied at 246kg/ha at sowing followed by 123kg/ha of urea four weeks later.

- The project showed how **balansa is also an aggressive weed suppressant**. Mr Hughes commented that "nothing stood a chance against it, even the Italian ryegrass was struggling to keep up". With the likelihood of some weedkillers being withdrawn in the future this is definitely worth the industry reflecting on.

- As a spring-sown annual, the balansa didn't grow back after cutting in 2016. Independent grassland and forage specialist Charlie Morgan indicated that with **an autumn sowing it should to be capable of producing three cuts of silage and grazing for fattening lambs**.

- To bridge the gap left by the balansa, more balansa clover seed was stitched into the ley in half the field shortly after the silage was cut and berseem clover was stitched into the other half. **The yield of perennial Italian ryegrass was boosted by the decaying annual clover**, releasing nitrogen into the soil.

- **The berseem was well established by the spring with very little inputs – it grew at an average of 31kg/DM/ha/day from March 20th**. No fertiliser was applied last autumn and Mr Hughes only applied a single dressing of 23:4:13 fertiliser at a rate of 187kg/ha (75kg/acre) in early April.

- **The berseem performed well even in the wet winter conditions experienced at Llyn Rhys**. It appeared to have not put its roots down too deep because it had an adequate water supply. However, berseem does have the capacity to go deep if needed, indicating it's adaptability to circumstance.

- The decaying clovers provide nitrogen for the next crop. Mr Morgan indicated that **it is important to plan crop rotations, to work out which crop should benefit next from these clover supplied nitrogen levels.**

- The **soil conditioning properties of the multi-species cover crops** were evident at Llyn Rhys. Mr Hughes tried this system on another very compacted field, with a mix incorporating 12 different species, one of which was Daikon Tillage radish, which rooted to 30-40cm. The grassland specialist commented how this type of crop was a feed source for the flora and fauna in the soil. He reflected that the inclusion of a deep rooting radish had improved the soil conditions of the field.

3.4 SWOT project analysis

STRENGTHS	• Improve overall performance of flock. • More production from grazed grass • Higher protein levels in grazing • Clover has a positive effect on worm burden in sheep • Would expect it to improve soil structure and compaction issues? • High Yielding • Weed Suppressant • Grows in wet and acidic conditions • Winter Hardy
WEAKNESSES	• Balansa is only an annual legume • Therefore potential for Balansa to leave open swards towards end of season. • Little known variety at moment so slow take up in agri community. • Single cut of silage appeared to weaken clover regrowth significantly
OPPORTUNITIES	• Develop the longevity of Balansa • Increased use of legume varieties could further increase a farms stocking and fields carrying capacity • Further work into the worm limiting effect of Balansa Clover • Break crop – Breaking weed cycles – prevents weeds growing.
THREATS	• If looking to use clover as part of a worm burden management regime, farmer capabilities with regards to faecal egg counting is important. • Increased poaching associated with higher rainfall influenced by climate change • Farmer engagement with novel clovers requires a level of management that is over and above the requirements of a conventional grazing system – requires an investment in time and farmer upskilling.

3.4.1 Farmer perspective of the project

The primary objective of the trial was to see if the Balansa would actually grow at Llyn Rhys. Mr Hughes indicated that for this short trial, the balansa was only able to be cut once, and produced a reasonable yield, but the protein levels of what was produced was very good.

The Balansa effectively disappeared after cutting therefore there was no aftermath grazing to speak of, and therefore no monitoring of its effect for grazing ewes or finishing lambs. It was used purely as a silage based feed for in lamb ewes. It would be interesting for another project to consider balansa/berseem effect on improved worm control or improved killing out percentage/daily live weight gain.

As regards the Balansa specifically, Mr Hughes was not able to note any impact on soil structure, as the crop was not present for long enough to make any significant difference. This was affected also by it being a very wet year, so the crop did not need to send down particularly deep tap roots.

Mr Hughes concludes that the balansa was a good weed suppressant, it did make good quality silage, but that it had poor longevity and is probably only any good as a minor part of a multi variety sward for silage first cut, based on this short trial at Llyn Rhys.

4 Impact on the industry

4.1 Impact on individual business

Please refer to Section 3 of the report

4.2 Impact on wider industry

4.2.1 The potential benefits of Balansa Clover

More ewes per ha

Higher Clover content improves protein levels in forage and may also improve soil structure. Incorporating clover into the forage regime can increase the amount of sheep that can be carried on a per hectare basis. Improving forage quality can reduce time for finishing lambs and therefore provide an option to increase stocking rates, and increasing output. Improvements to top soil structure from deep rooting cops such as the clover can allow the grazing season to be extended further and increase the holding capacity of the farm further increasing the efficiency of the enterprise.

Higher lamb weight per ha and a reduction in worm burdens

Generally, clover leys provide a high-quality leafy diet that contributes to increasing lamb liveweight gains and reducing faecal egg counts[5].

Improvements in soil fertility and structure

Soil structure – the root system of clovers can help tackle soil compaction. This results in more spaces between soil particles, which enhances movement of nutrients and water and improves crop yields. IBERS research shows that soils with better structure as a result of using clover also enable the crop to use fertiliser more efficiently[6].

High Quality Silage

The Balansa Clover resulted in high quality silage with a high crude protein of 14.5% and high sugars resulting in better fermentation and ensiling of the feed.

This should result in better ewe enterprise performance however a feed trial could be run to properly ascertain the benefits of this clover.

4.3 Impact on Welsh Government's cross cutting and priority themes

4.3.1 Climate change

The incorporation of clovers into the grass mix, including annual clovers helps ensure adequate vegetation cover is present, which protects against erosion. This improved grass mix should have the ability to withstand frequent grazing and will further sequester atmospheric CO^2 as roots will act as a carbon store.

Clover rich swards help ensure continuous soil cover throughout the season. This will reduce likely pollution issues from agriculture such as loss of soil/sediment, agro chemicals and fertilisers.

[5]Worm Control in Sheep -QMS Scotland
http://www.qmscotland.co.uk/sites/default/files/qm2895_worm_guide_final_040917.pdf
[6] – Managing Clover for Better returns. AHDB Clovers in improve both soil fertility and soil structure - Hybu Cig Cymru
http://www.hccmpw.org.uk/medialibrary/publications/HCC_Grassland_Management_ENG.pdf

The incorporation of a versatile (drought and waterlogging resistant) clover variety into forage seed mixes in Wales has the potential to help the industry be more resilient to year on year fluctuations in climate conditions.

If the principles of this project are adopted more widely, they should contribute to a reduction in emissions from feed production and transportation. Ensuring standards of animal welfare are high will improve feed efficiency and reduce inputs. This will help reduce nitrogen use per unit of meat produced across the sector as a whole. Grazing high quality grassland or silage with a clover mix can also be associated with reduced greenhouse gas emissions[7].

4.3.2 Animal Health and Welfare (AHW)

Although not a primary focus of this project, there is further scope to assess the value of a range of clovers in forage mixes to help reduce worm burden in the Welsh flock. With increased resistance to anthelmintics throughout the UK and particularly Wales, there is an increasing demand for alternative methods such as management and prevention, rather than reliance on chemical treatment alone.

4.3.3 Future Generations

The project encourages young farmers who are working or looking to work in the sheep industry to be forward thinking and to grasp opportunities to run a business more efficiently. This includes reducing cost, labour and time; whilst making full use of what lower cost alternatives such as a clover/grass based diet can provide. All of which are increasingly important post Brexit in such a volatile industry.

4.3.4 Tackling Poverty

Running flocks more efficiently will allow businesses to use time more wisely and to be able to focus on elements such as improved grazing management resulting in increased productivity and reduced costs. More cost efficient business practices result in the potential for increased returns, whether that be from on or off farm income.

[7] http://www.nutrientmanagement.org/what-we-do/tools/feed-planning-for-sheep-and-cattle/