

European Innovation Partnership (EIP) Wales

Sustainable intensification in upland grazing production systems

Interim Report

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Project description

Evidence from Finland shows that Finnish farmers had doubled their grassland production in seven years as a result of changing the type of seed used on the grassland. They now depend on timothy and tall fescue, amongst other grass and clover species, to sustain their herds and flocks. The inspiration for this EIP project comes from Finland, where work carried out utilising timothy as a mainstay of grass leys and gypsum as a fertiliser, has proved very successful in grazing regimes.

The EIP project is based at Llwyn Y Brain, Adfa, which is run by John and Sarah Yeomans, north of Newtown, Powys. The land rises up to 1,400 feet above sea level. Richard Tudor, a renowned grassland farmer from Llysun, Llanerfyl was also involved in the project with his father, Tom and son, Morgan.

The project will examine the success of leys with various percentages (by weight) of timothy with a view to improving the efficiency of upland intensive grazing systems. Different establishment methods, namely scratching and slot seeding, will be utilised. The 3 year project will look at the quality, quantity and persistence of these leys as compared to an existing upland ley.

Project aims

The long term strategy of this project is to examine and highlight the benefit of alternative species, namely plantain and timothy, within grassland leys, and the potential for those to improve farm viability.

The aims of the project are detailed below.

- Improving the financial return and viability of upland units via improved carrying capacity and output of the grassland.
- To establish a timothy dominant sward to support and sustain upland flocks.
- To determine if there is a best technique for the establishment and production of timothy.
- To encourage and foster the development of knowledge throughout the agricultural community, and strengthen the links between research /innovation and the rural community
- Are there any biodiversity benefits of timothy and fescues e.g. insects and small mammals?

Important additional information

Tragically, in spring 2020, Richard Tudor died suddenly in an accident. However, Tom and Morgan Tudor have maintained contact with the members of the project operational group and continue to be involved with the project.

The project has also been affected by COVID lockdowns which have limited the amount of meetings, site visits and knowledge transfer activity that could take place. The project was paused for 3 months in spring 2020 and the project will now be extended to June 2022.

Experimental design

This project strives to establish a timothy dominant sward on the uplands of mid Wales in an attempt to improve grassland production and utilisation. Different techniques have been used to establish whether sowing methods influence the adoption of the timothy seed. The soil status of each plot site – P, K, Mg and pH, was established and corrected before any seed was sown to ensure the soil was balanced before any seeding took place.

Establishment of initial plots

Eight trial plots were selected at random along with two 'no input' control blocks, on land at Llwyn Y Brain, Adfa. Two plots had a control 'off the shelf' ley, while the remaining six had ryegrass and white

clover as a base with increasing levels of timothy and varying amounts of fescue and plantain. For the duration of the project the quality and volume of grass produced was closely measured. This included monitoring persistence and comparing trial plots to establish which variant succeeded on the specific ground type.

To encourage the development of knowledge throughout the agricultural community, and strengthen the links between research, innovation and the rural community, students from IBERS will take part in the project, and there will also be the opportunity for ongoing knowledge transfer between all members and the Finnish farming community.

Project activity in 2020

Monitoring of timothy plots

Following the establishment of plots, with different levels of timothy inclusion in May 2019 (0, 10, 25 and 40% of seed mixture by weight), it was planned to assess the resultant swards for yield and quality and to monitor animal performance through 2020.

There were already concerns in 2019 that the timothy component of the swards had failed to establish as hoped. Sward assessments in the autumn of 2019 revealed no significant differences between many of the plots in terms of timothy plants – and that even in the 40% inclusion plots, less than 12% timothy survived in the actual sward.

It was hoped that by 2020, a development of the timothy plants through spring and early summer would happen, with several people suggesting that timothy was a slow starter and may well show improvement in the year following establishment.

However, sward assessments in late May 2020 still found the swards to be ryegrass dominant, with timothy plants averaging less than 10% across all the different timothy plots. The table below summarises the findings;-

% timothy inclusion	establishment method	%Ryegrass	%Timothy	%Plantain	%Wclover	% Meadow grass	Average % Timothy
0	drill	76	0	1	2	20	0
	broadcast	47	0	0	4	37	
10	drill	36	9	2	4	47	7.5
	broadcast	60	6	2	1	28	
25	drill	57	12	3	2	17	8
	broadcast	63	4	3	0	28	
40	drill	68	2	2	3	23	9.5
	broadcast	70	17	3	1	8	

Figure 1. Sward composition of plots May 2020 (visual assessment)

There were isolated areas within each of the plots with a greater timothy presence, but on a plot scale there was little to differentiate the plots.

Throughout 2020 the 9 plots (8 treatments and a control) were assessed for grass dry matter production (monthly cuts from under grazing cages). See Figure 2.

The new leys (although short of timothy) performed incredibly well – providing a hugely valuable supply of forage - particularly through the dry period of May/June when the plots (10ha in total) carried over 600 ewes plus lambs. This extra forage supply gained from reseeding is particularly valuable to an upland farm, allowing more stock to be sent to the hill and lowland silage fields closed out earlier, offering opportunity to increase silage quality and reduce purchased feeds.

The average first year yield from the reseeds of 10.6tDM/ha compares closely to the results from another EIP project ([Alternative forage systems for marginal land](#)) where the reseeded upland pastures grew 10.2tDM/ha in their first full year of production.

The yields are a massive contrast to the 3.2tDM/ha grown on the older permanent pasture that neighbours the plot area.

Plot	Treatment	kgDM/ha/yr
1	Nil Timothy rake	11980
2	10%Timothy drill	10430
3	10%Timothy rake	10730
4	Nil Timothy drill	8960
5	40%Timothy drill	11412
6	25%Timothy rake	7480*
7	25%Timothy Drill	8755*
8	40%Timothy rake	10110
Control	Old pasture	3192

Figure 2. Dry matter production from the plots (March-October 2020)

* incomplete data sets due to animals disturbing grazing cages.



Plate 1. With delayed spring grazing due to wet conditions, high covers developed on the plots – requiring high stocking rates.

By May 2020 it was felt there was little value to be gained from detailed monitoring of sward quality and animal productivity with such small differences in timothy contents on the different plots. It was decided that the project would have another attempt at establishing a timothy sward in 2020.

Discussions were had about the possible oversowing of timothy into the existing plots, but this was rejected due to concerns that the very small seed size of timothy would limit its establishment and competitive ability in a young, ryegrass dominant ley.

The possible reasons behind the failure of the timothy to establish successfully were debated. It was deemed likely a combination of:

- 1) Very wet soil conditions post-establishment may have led to the small seeds rotting at the base.
- 2) Ryegrass competition shading out the young timothy plants.
- 3) High organic matter content soils slowing the liming effect of the ground lime applied at establishment.

There was no real distinction between the raking and drilling options in terms of establishment success. Plant populations and sward production showed neither being the clearly better option.

New plot establishment in 2020

Two new plot areas (below the original plots) were burnt off with glyphosate in July 2020 then scratched and seeded with a grass harrow.



Plate 2. Seed bed conditions in August 2020

Prilled lime was applied to the seed bed to hopefully raise pH quickly and assist with the rapid breakdown of the desiccated sward. The soils were analysed at 5.5 and 5.7pH on the two new plots – and prilled lime applied at 300kg/acre.

The two new seed mixtures were formulated – with the emphasis on trying to establish non-ryegrass dominant swards with significant timothy component.

On one plot the ryegrass component was scaled back to just 3kg of AberGain tetraploid, with timothy raised to 8kg, plus 1kg of white clover. This compares to 7kg ryegrass and 5.5kg timothy in the original 40% timothy mix sown in 2019. It is hoped that this will allow more opportunity for the timothy to dominate the sward.

The seed mixture for the second plot included a broader mix of grasses – with 2kg ryegrass, 3kg meadow fescue, 2kg festulolium, 1kg cocksfoot and 4kg timothy. The principle is again to see if the mixture of different grasses allows more opportunity for the timothy to establish in a less competitive environment.

New mixture Plot A

AberGain	Late Tet	3 kg/acre
Dolina	Timothy	8 kg/acre
Rivendel	Medium white clover	1 kg/acre

New mixture Plot B

AberGain	Late Tet	2 kg/acre
Laura	Meadow Fescue	3 kg/acre
Donata	Cocksfoot	1 kg/acre
Lofa	Festulolium	2 kg/acre
Dolina	Timothy	4 kg/acre
Rivendel	Medium white clover	1 kg/acre

The plots were sown on 25th August in a narrow window of dry weather, before the ground became very wet. There was no opportunity for an autumn graze to encourage tillering or exert some pressure on any establishing weeds. Initial germination was good, and although there were early signs of chickweed, the numbers of grass seedlings was good.



Plate 3. Establishment was hampered by cool wet conditions in September (26/09/20)

In mid-October (50 days post sowing) multiple 0.1m² quadrat assessments were made in each of the two plots to record plant numbers of the sown grasses and clover – as well as weed grasses and broad-leaved weeds.

The very high numbers and brittle nature of the chickweed plants (*Stellaria media*) made it almost impossible to count individual plants so a visual % ground cover assessment was made. There was very few other weed species present – occasional plants of mouse ear chickweed (*Cerastium* species) and marsh thistle (*Cirsium palustre*).

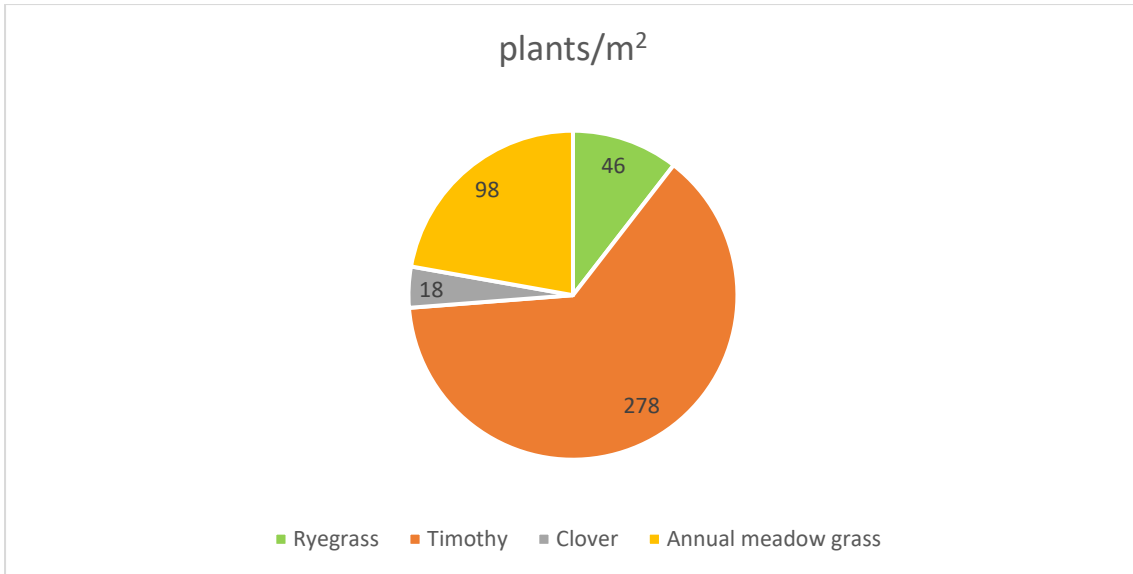


Figure 3. Plant numbers in Plot A – Oct 2020

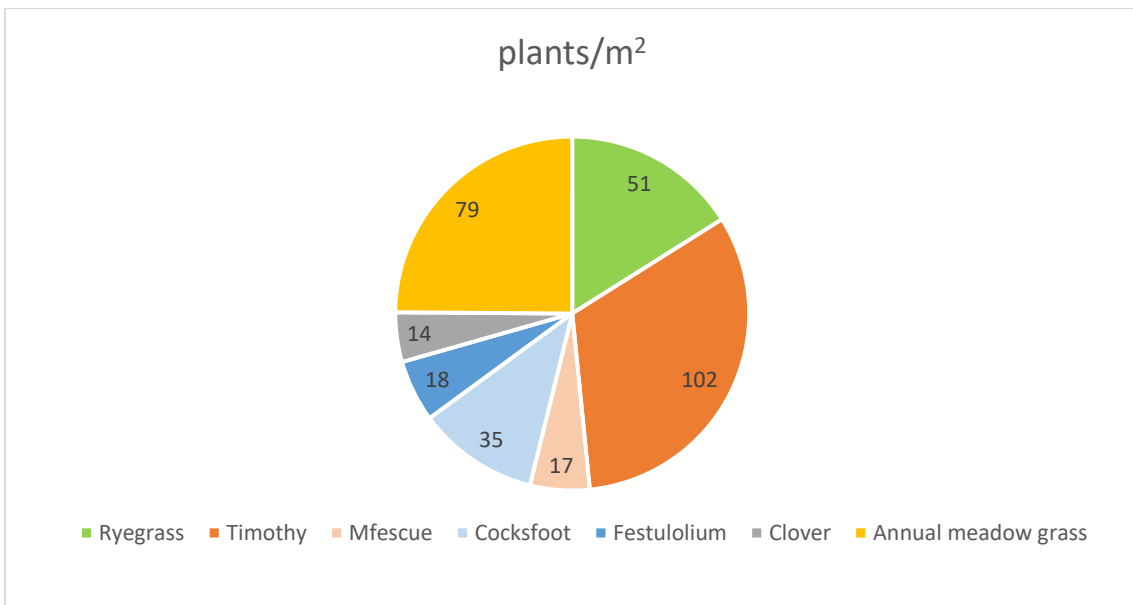


Figure 4. Plant numbers in Plot B – Oct 2020

Chickweed cover ranged from 15 to 80% in the quadrats assessed but overall average at 45% in plot A and 30% in plot B (see Plate 3). Ground conditions prevented any grazing or intervention with sprays. It is hoped that spring fertiliser and tight grazing and possible use of grass harrows may be sufficient to deal with the chickweed – spraying will be a last resort.

Past experience with reseeds on the plots have found the chickweed to remain fairly static over winter (staying as small plants and not being too aggressive).



Plate 4. Example quadrats from Plot A (left) and Plot B (right)



Plate 5. Poor ground conditions in autumn restricted any grazing or mechanical/chemical control of chickweed.

The initial plant counts do show that two high timothy content swards have at least been established – and the project team is hopeful that the project can now investigate the yields, quality and animal production of swards with contrasting grass species.

Summary of main findings from the project in 2020

It has been difficult to establish a timothy dominant sward and none of the plots sown in 2019 have more than 10% timothy, despite including over 5kg in some of the seed mixtures.

It is thought the lack of success with timothy has been mainly due to poor establishment conditions (wet soils, small seeds) along with strong competition from the companion ryegrass and a possible negative impact of low soil pH.

There appears to be no difference in establishment success with either raking and broadcasting or direct drilling.

The reseeded plots have been successful in creating highly productive swards that have produced over 10tDM/ha in their first full year; over 3 times the production of neighbouring old permanent pasture.

Without major differences in sward composition on the plots the plans to assess sward quality and animal performance were abandoned for 2020.

New plots were established in August 2020 with seed mixtures that included less ryegrass and a higher timothy component. Prilled lime was applied to try and improve establishment conditions.

Early indications are that the timothy has established successfully and forms a strong component of the new swards. Weed ingress (chickweed and meadow grass) may present issues for the sward in 2021 but hopefully careful grazing management will help the timothy and other sown grasses to outcompete these weeds.

Plans for the project in 2021

Going forward the project will now have four different sward types to evaluate:-

ryegrass/clover - established 2019

ryegrass/clover/timothy – established 2019

ryegrass/high timothy/clover – established 2020

mixed grass species/low ryegrass/clover – established 2020

These four swards will continue to be monitored for yield and quality in 2021, along with assessment of animal performance at key stages through the grazing season.

It is also planned to look at the soil carbon regime of the plots and compare their soil carbon levels with neighbouring fields that have been less improved over the last 50 years.