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The impact of herbal leys on the health and performance of grazing lambs

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Executive summary

Much has been talked and written about the use of herbal leys in livestock production historically.

There are benefits in using herbal leys in conventional sheep farms.

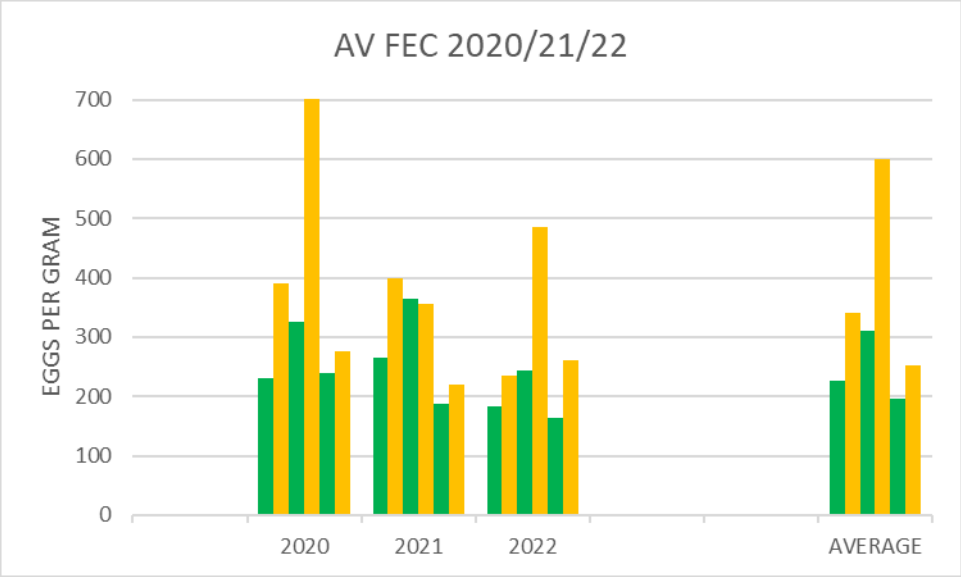
Herbal leys have the potential to reduce worm burden within grazing lambs whilst maintaining / improving liveweight gain, whilst this pasture needs very little fertiliser in a commercially stocked setting.

Reducing inputs whilst maintaining productivity is key to improving the sustainability of farming in the future. Reducing the reliance on bought in farm inputs will improve business resilience.

Previous trials have shown positive response to using herbal mix leys to grow lambs compared to conventional mixes (Grace et al, 2018). This project tested this out on 3 farms in West Wales

See below the average FEC levels on each plot on each site:

	AVERAGE FEC (2020)		**AVERAGE FEC (2021)**		**AVERAGE FEC (2022)**	
	Conv	***Herbal***	***Conv***	***Herbal***	***Conv***	***Herbal***
Site 1	391	230	445	323	234	183
Site 2	962	326	355	365	485	243
Site 3	276	240	218	187	260	164



The above graph shows the average FEC on each site over the 3 years with the green bars being the Herbal plots and the orange bars being the conventional pasture.

The following data was collected on each plot:

- Samples from Sentinel lambs where collected every 2 weeks to be analysed for level 2of worm burden FEC.
- *Dry matter Yield* (t/ha) using a rising plate meter was collected fortnightly during the data collection period (late June to Late October) with the plate meter being calibrated regularly when used on the herbal pasture
- The Sentinel lambs where weighed every 2 weeks to record the daily liveweight gain over that period
- Drenching frequency was recorded on various protocols
- Grass quality analysis on fresh grass samples was done in year 1+2 to evaluate any differences in energy, protein etc.
- Soil analysis which includes trace element levels were taken to evaluate any potential differences, at the start and at the end of the project

Key findings were:

- On average across all farms the lambs grazing the herbal ley had a lower level of FEC than the lambs on the conventional ley
- In the first two years where drenching was triggered according to individual plot FEC, the lambs grazing the herbal plots had longer drenching intervals compared to the lambs grazing the conventional plots
- In year 3 it was decided to drench the two lamb groups, grazing the herbal and conventional plots, at the same time
- The average daily liveweight gain of the sentinel lambs on both the herbal and conventional plots where similar in years 1+2, and in year 3 the lambs on the herbal plots had a slightly better daily liveweight gain

- The dry matter yield of both leys where similar over year 1+2, but during the drought in year 3 the herbal pasture plots exceeded the conventional plots
- Grass quality was only measured on all sites for year 1+2. It suggests that digestibility (D) values and metabolisable energy (ME) are similar between herbal and conventional pasture. In this project the protein level of the herbal ley fluctuated compared to conventional, but tended to be lower. Lower protein levels can be a positive, as sheep and cattle use more energy to deal with excessive levels of protein (above 17%), and therefore have less available to facilitate daily liveweight growth.
- The level of sugars where similar or higher in the herbal ley compared to the conventional ley

Contents

1. Introduction

There is a growing need to reduce the use of worm drenches in modern sheep production systems, due to:

- the increasing level of drench resistance, (WAARD et al. 2015) due to over use of anthelmintics, building up on some farms
- the negative effect anthelmintics can have on soil and plant health
- Previous trials have shown positive response to using herbal mix leys to grow lambs compared to conventional mixes (Grace et al, 2018). This project tested this out on 3 farms in West Wales.

The Herbal ley used was a mix of 50% perennial ryegrass varieties and also different herbal species such as chicory, plantain, yarrow, timothy and white clover.

These variety of species (also referred to as Multi Species Sward) bring a variety of traits to the pasture including varying root depths, differing nutrient and mineral availability, and resilience to challenging weather events (such as drought)

The conventional grass mix used was a more common perennial ryegrass, timothy and white clover mix.

Both mixes used in the project where standard mixes from the same company

As previously suggested, the Herbal mix ley had the potential to reduce the worm burden on lambs, with the anthelmintic properties within the chicory plant.

This project looked at the effects on worm burden, of the differing pasture mixes in a commercial setting on three farms on west Wales

2. Methodology

The trials were carried out on 3 sheep farms in Mid and Southwest Wales (Table 1). The plots were established in May 2020

The plots were then grazed by large groups of ewes and lambs to ‘Create a Worm Burden’ in the new pasture, before the mobs were set up and data collection was started.

On each farm, one field (approximately 3Ha) was split in half of equal size, then sub divided by temporary electric fencing into 4 paddocks and rotationally grazed. There was

In each year, a total of 20 ‘sentinel’ lambs were chosen and tagged on each farm, where 10 lambs grazed the herbal ley and 10 lambs grazed the conventional ley. These lambs would then be the basis of the data collection as far as FEC (Faecal Eggs Counts) and daily liveweight gain. The sentinels would remain on the plots until the end of the data collection for that year. With 6 different lamb groups over 3 farms, there were 60 sentinel lambs to compile the data set from.

The other lambs from the flock were used to make up the mobs and achieve the desired stocking rate of between 1500-2200 kg liveweight per Ha (kgLW/Ha). This stocking rate was flexible and adjusted to balance the grass demand with the grass growth.

The following data was gathered:

- Sentinel lambs in each group were sampled for FEC analysis fortnightly from late June to late October
- The sentinel lambs were weighed fortnightly
- Each separate paddock had the pasture measured fortnightly
- Soil samples from each plot were analysed at the start and at the end of the project
- Grass samples were taken from all plots mid-season for year 1 and 2
- Pasture Larval Counts were taken once in year 1 (year of establishment) then twice a year in years 2+3

- Therefore, we effectively had 8 paddocks on each farm (4x Herbal, 4x Conventional)
- 10 Sentinel lambs in each group on each grass mix
- Group would rotate around paddocks in 28day rotation
- Stocking rate would vary with grass growth rate, range from 2100kg/Ha-1500kg/Ha

Plots were grazed from late June to late October, and stocking rate was adjusted according to pasture available/grass growth rate

- Samples from sentinel lambs were taken every two weeks
- Dosing was done when FEC (Faecal Egg Count) was near or at 400 EPG (Eggs per Gram)

2.1 Site locations

Details of the farms involved in the project:

Farm	**Location**	**Description**
1	Hebron, Whitland	1000 breeding ewes & 150 replacements ewe lambs run on 300 acres on land running from 500 to 950 feet altitude
2	Login, Whitland	670 breeding ewes & 19 suckler cows, run on 200 acres on land running to 500 feet
3	Aberystwyth, Ceredigion	750 breeding ewes & replacement ewe lambs run on 200 acres on land running from 100 feet to 900 feet

2.2 Plot management

Plots were grazed on a 28-day cycle. Within each farm grazing was identical on the plots in terms of timing and stocking rate.

During the establishment of the pasture in 2020 we had issues on 2 sites with Fat Hen in the paddocks, although the new seeds had germinated. It was then decided to mechanically top the weeds to allow the sown seeds to establish.

Once this operation was done the weeds did not return the following year.

Due to dry conditions at site 3, establishment of the plots were delayed, and resulted in less data collected in year 1.

Before data collection started, a large mob of ewes and lambs were grazed on the plots to establish a 'Worm Burden'

The stocking rate was adjusted during the season according the grass growth, in order to maintain the desired rotation.

At any point in the season, if needed, quality was reset with mechanical topping

2.3 Data collection and analysis

The following data was collected and analysed to compare the performance of the herbal pasture to the conventional pasture for both plots on each of the three sites:

- FEC SAMPLES. Sentinel lambs in each group were sampled for FEC testing fortnightly from late June to late October. This allowed for the comparison of any effects of the differing pasture on FEC and worm burden within the livestock.

- LIVEWEIGHT. The Sentinel lambs were weighed at the same time as FEC sampling to compare any effects on the performance of lambs grazing each pasture

- DRY MATTER YIELD. Each separate paddock had the pasture measured fortnightly with a rising plate meter. As plate meters are designed for measuring ryegrass/clover swards a re-calibration was made to the plate meter to account for the variance of herbage in the herbal plots

- SOIL SAMPLES. Soil samples of each plot were taken at the start and at the end of the project, to assess any effect of the different pasture on the soils.

- GRASS SAMPLES. Grass samples were taken from all plots mid-season to assess and compare the differing plots against each other in terms of grass quality.

- TIMING of DRENCHING. The timing of administrating a drench to the lamb groups on each plot was recorded. In year 1+2 the lambs where drenched on separate

occasions, whenever FEC levels rose, e.g. the herbal plots where drenched at different times to the conventional plots.
After a discussion with vets and Techion, the company doing FEC analysis work, it was decided to drench both mobs at one site at the same time when one or both mobs reached the FEC threshold. The reason for this was to make it more practical for the farmers as well as improving the statistical robustness of the data.

2.4 Grass + herbal species

See below the mixes of pasture used in the project.

Both where 'off the shelf' and commercially available to all farmers.

HERBAL LEY

VARIETY	**KGS**	
Chicory	1.5	
Plantain	2	
Yarrow	0.5	
Birdsfoot Trefoil	0.5	
Timothy	1.0	
Alsike Clover	0.5	
White Clover	2.5	
Perennial Ryegrass	8.4	
TOTAL	16.9	Kg/Ha

CONVENTIONAL LEY

VARIETY	**KGS**
Perennial Ryegrass	23
Timothy	2
White Clover	2
TOTAL	27kg/Ha

Results

2.3 FEC Data

The data collection period was shorter in year 1 because before the lambs could graze, the new pasture on the different plots needed to be established, grazed with a large volume of ewes and lambs to introduce a worm burden, before fencing the rotational plots. Also, due to dry conditions, site 3 where later establishing the pasture.

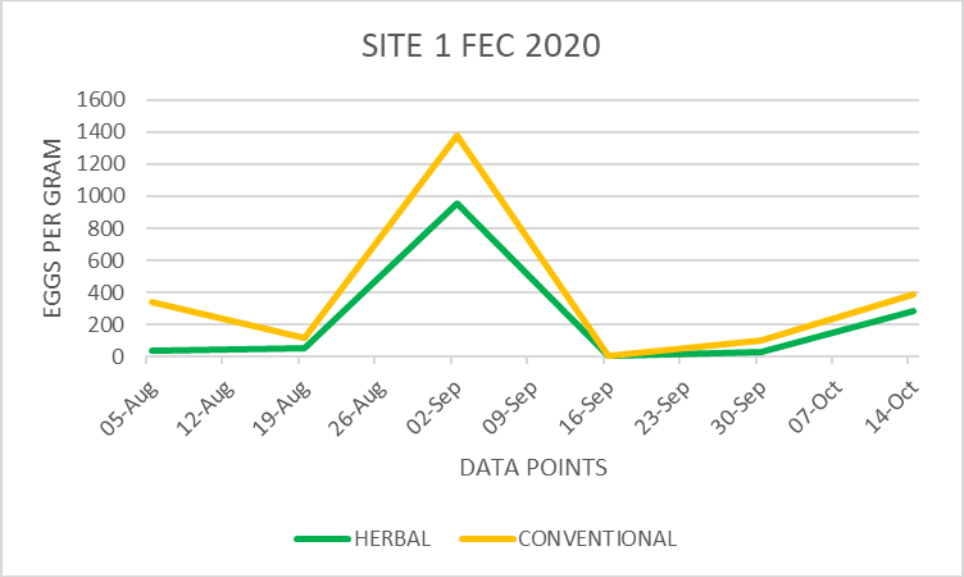
- At a stocking rate of 2000 kgLW/Ha lambs were rotationally grazing the plots from August to mid October, grazing from 2800-3200 kgDm/Ha down to 1500-1600 kgDm/Ha.
- On average, the faecal egg count (FEC) of the sentinel lambs and mob group sample on the herbal ley was between 30-65% lower compared to lambs on the conventional ley.

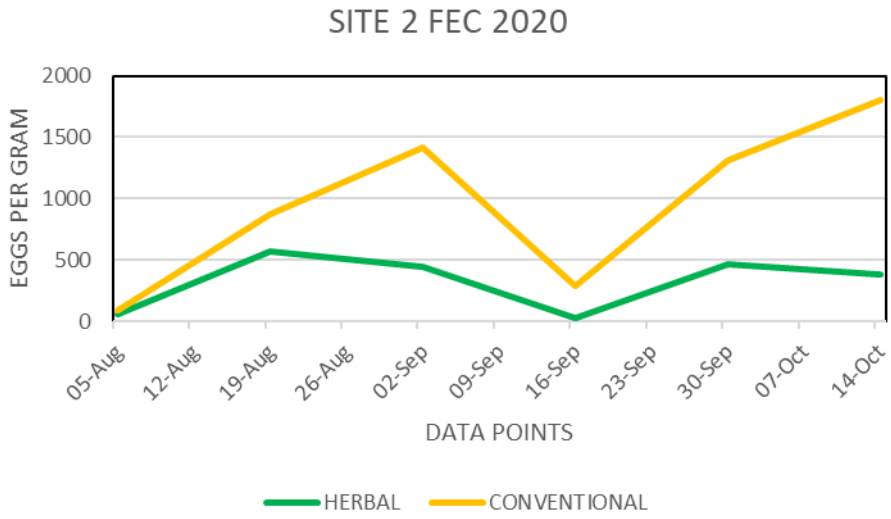
The graphs below show the FEC levels of the sentinel lambs sampled over the data collection period in year 1 for all three sites.

They clearly show where FEC levels rose to a peak, where the stock were drenched, and the resulting drop post drenching.

Site 1+2 drenched both groups once in this data collection.

Due to lower worm burden on site 3 (<700 eggs/gm), the lambs did not need drenching.


SITE 1 FEC 2020
EGGS PER GRAM
1600
1400
1200
1000
800
600
400
200
0
05-Aug
12-Aug
19-Aug
26-Aug
02-Sep
09-Sep
16-Sep
23-Sep
30-Sep
07-Oct
14-Oct
DATA POINTS
HERBAL
CONVENTIONAL


SITE 2 FEC 2020
EGGS PER GRAM
2000
1500
1000
500
0
05-Aug
12-Aug
19-Aug
26-Aug
02-Sep
09-Sep
16-Sep
23-Sep
30-Sep
07-Oct
14-Oct
DATA POINTS
HERBAL
CONVENTIONAL

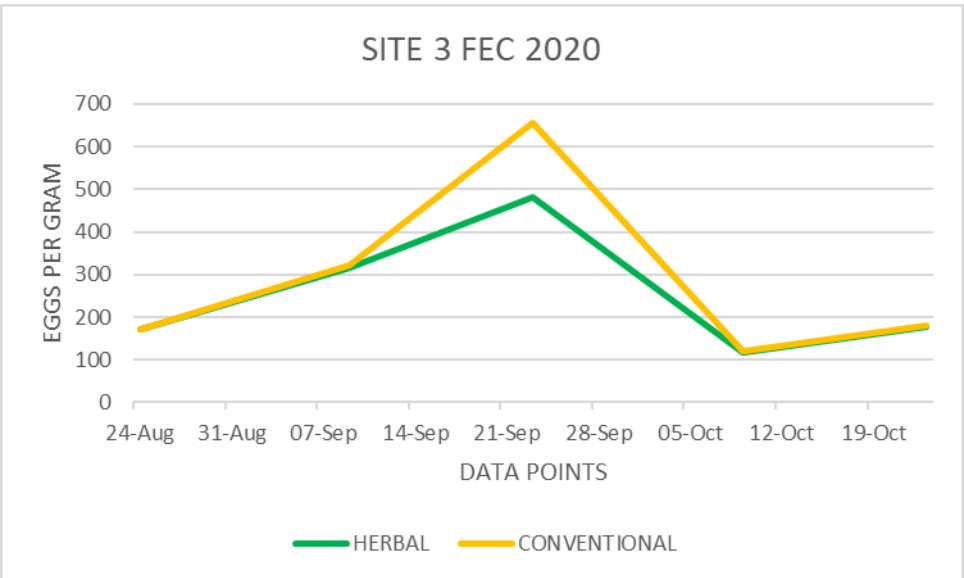

SITE 3 FEC 2020
EGGS PER GRAM
700
600
500
400
300
200
100
0
24-Aug
31-Aug
07-Sep
14-Sep
21-Sep
28-Sep
05-Oct
12-Oct
19-Oct
DATA POINTS
HERBAL
CONVENTIONAL

Table showing the individual FEC sample results (Eggs/gm), as an average per collection point, for the above graphs.

	05-Aug		19-Aug		02-Sep		16-Sep		30-Sep
SITE 1									
HERBAL	39		59		959		4		32
CONVENTIONAL	345		123		1376		7		102
SITE 2									
HERBAL	55		574		448		28		469
CONVENTIONAL	87		868		1419		286		1312
SITE 3									
HERBL	171		315		482		180		116
CONVENTIONAL	171		321		656		210		120

On site 2 in year 1 it can be seen, before drench was administered the average FEC on the herbal ley rose then reduced slightly by the next sampling, in comparison to the conventional group which saw the FEC levels continually rise.

This suggests a positive effect on the levels of FEC from the pasture.

Year 2 Results

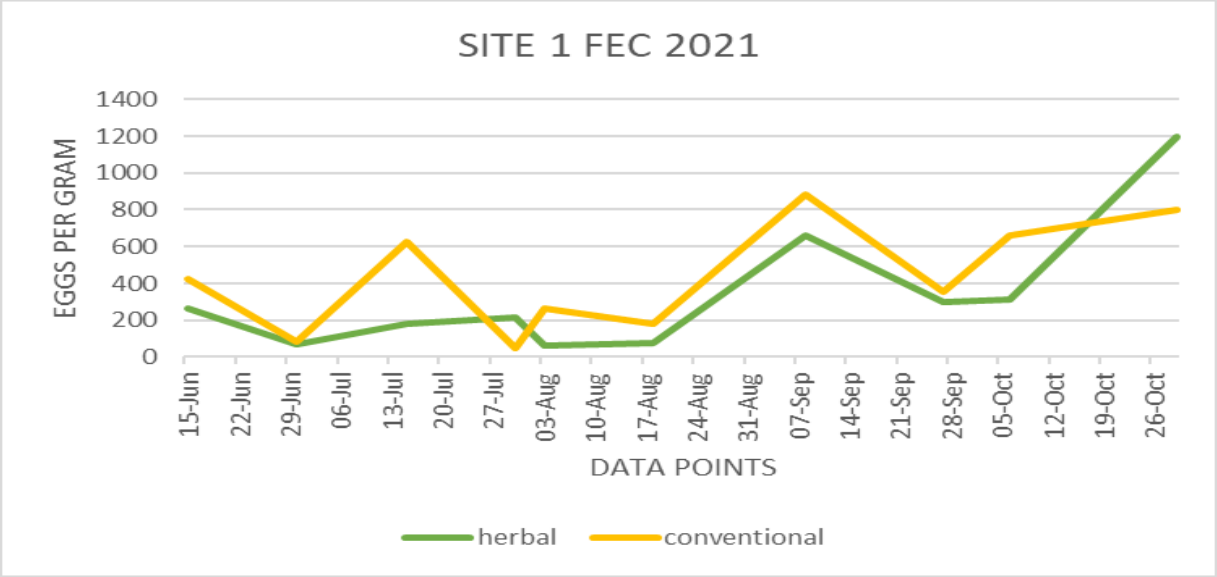
Weather conditions during 2021 made it challenging to manage grass cover, and the availability of grass differed substantially between the three sites throughout the season.

On the whole, stocking rate was at the upper end of the scale at 2000 kgLW/Ha for most of the post weaning grazing season, with a drop down to 1000 kgLW/Ha towards the end, with just the 10 sentinel lambs on their own grazing the plots for the final 2-4 weeks/last of the data collection period.

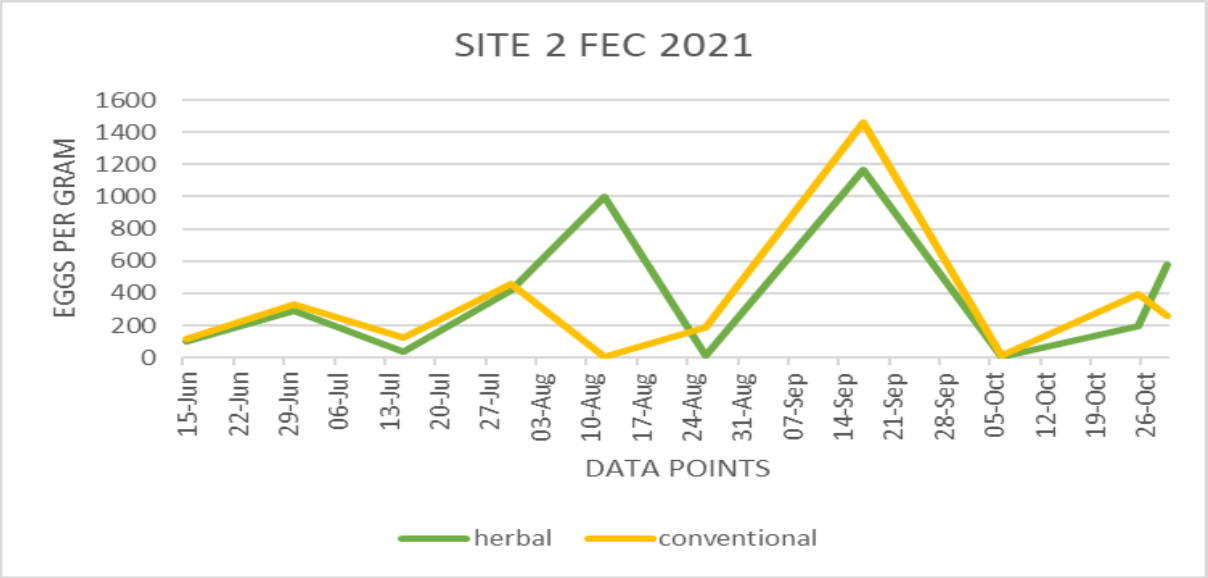
Graphs for site 1-3 below, show that on average FEC of the lambs on the herbal ley plots where lower than the stock on the conventional plots.

The graph for site 2 shows that FEC levels spiked substantially higher in the lambs on the herbal plots compared to the conventional plots on the 3rd August.

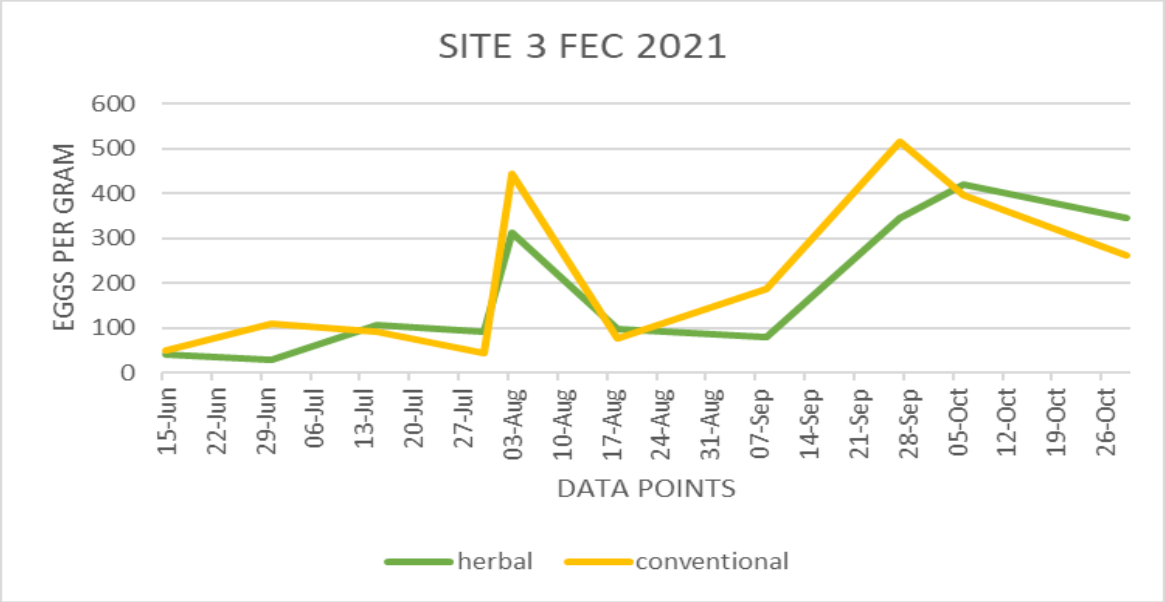
This was due to the conventional plots receiving a worm drench 2 weeks before the herbal plot received a worm drench, as the stock on the herbal plots had slightly lower FEC at the point of drenching for the conventional run lambs and did not warrant treatment as per protocol. Although the numbers were similar on average, the conventional had individually higher FEC than the herbal, which explains the decision taken.



	15-Jun	30-Jun	15-Jul	30-Jul	03-Aug	18-Aug	08-Sep	27-Sep	06-Oct	29-Oct
SITE 1										
herbal	266	66	178	213	59	73	661	298	314	1200
conventio	423	80	623	47	266	182	885	354	663	800



	15-Jun	30-Jun	15-Jul	30-Jul	12-Aug	26-Aug	17-Sep	06-Oct	25-Oct	29-Oct
herbal	100	292	38	420	1000	10	1169	7	200	581
conventio	120	332	126	462	7	189	1459	17	395	262



	15-Jun	30-Jun	15-Jul	30-Jul	03-Aug	18-Aug	08-Sep	27-Sep	06-Oct	29-Oct
SITE 3										
herbal	42	28	105	91	311	98	80	346	421	345
conventio	49	108	93	45	444	77	188	514	395	262

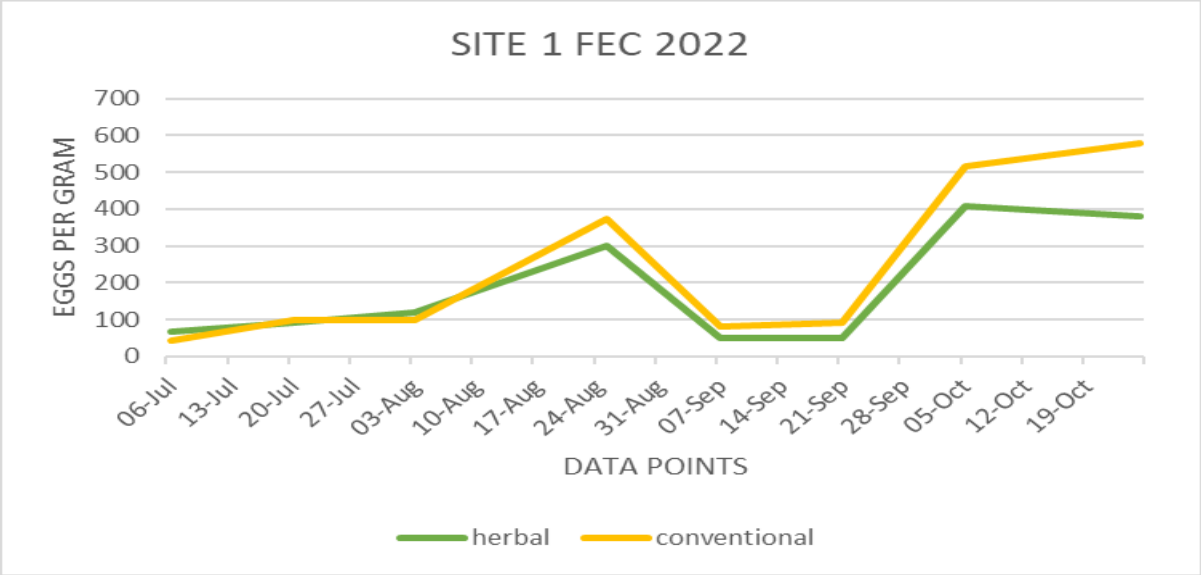
Year 3 Results

Graphs for site 1+2 show that the drought during late summer of 2022 had a big effect on the worm burden, with both plots on both sites having low FEC levels until the drought had been broken with a lot of rainfall.

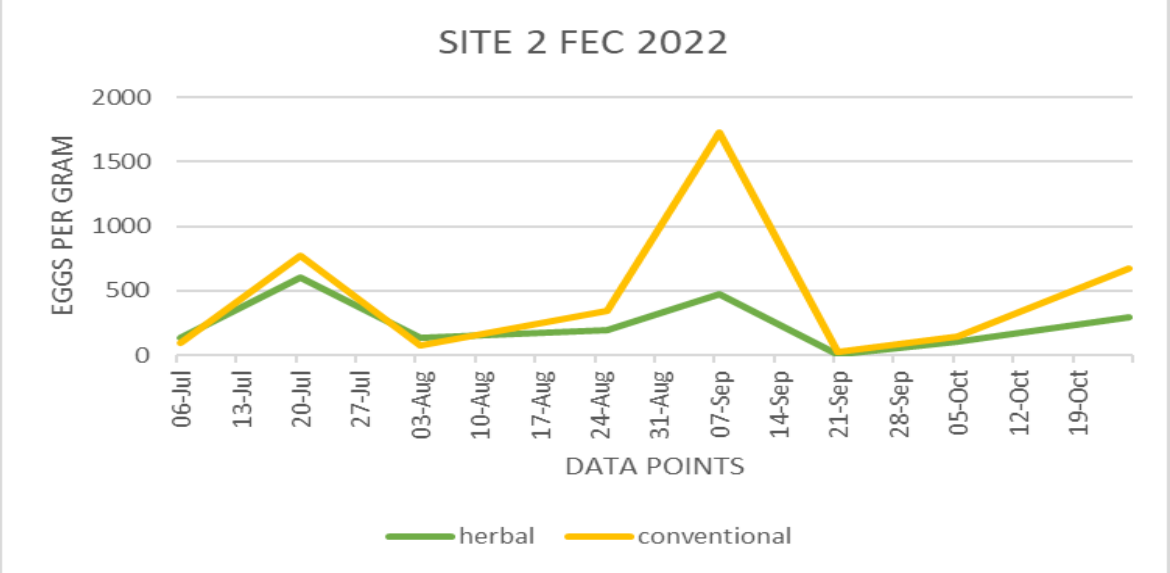
Then it can be observed that the FEC levels increased, with a higher level on the conventional sites than the herbal plots.

Site 3 did not suffer as badly with the dry weather as the other two sites. The graph shows a similar trend to year 1, with the FEC being higher on the conventional pasture in comparison to the herbal pasture

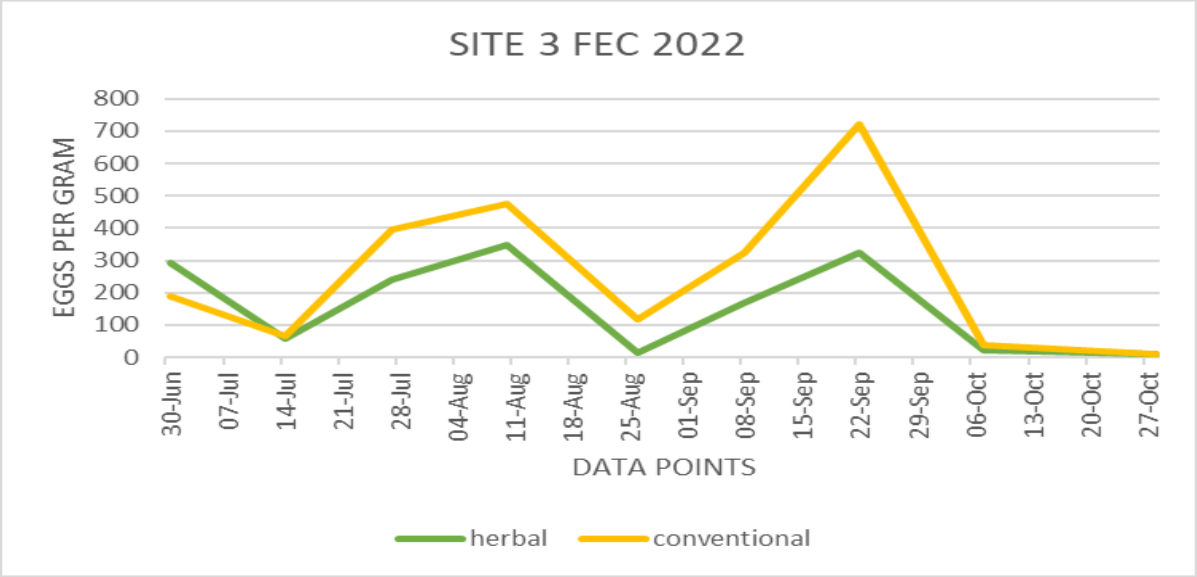
In year 3, it was decided to drench both sets of lambs at the same time on each site, instead of drenching the different mobs when they had high FEC levels.



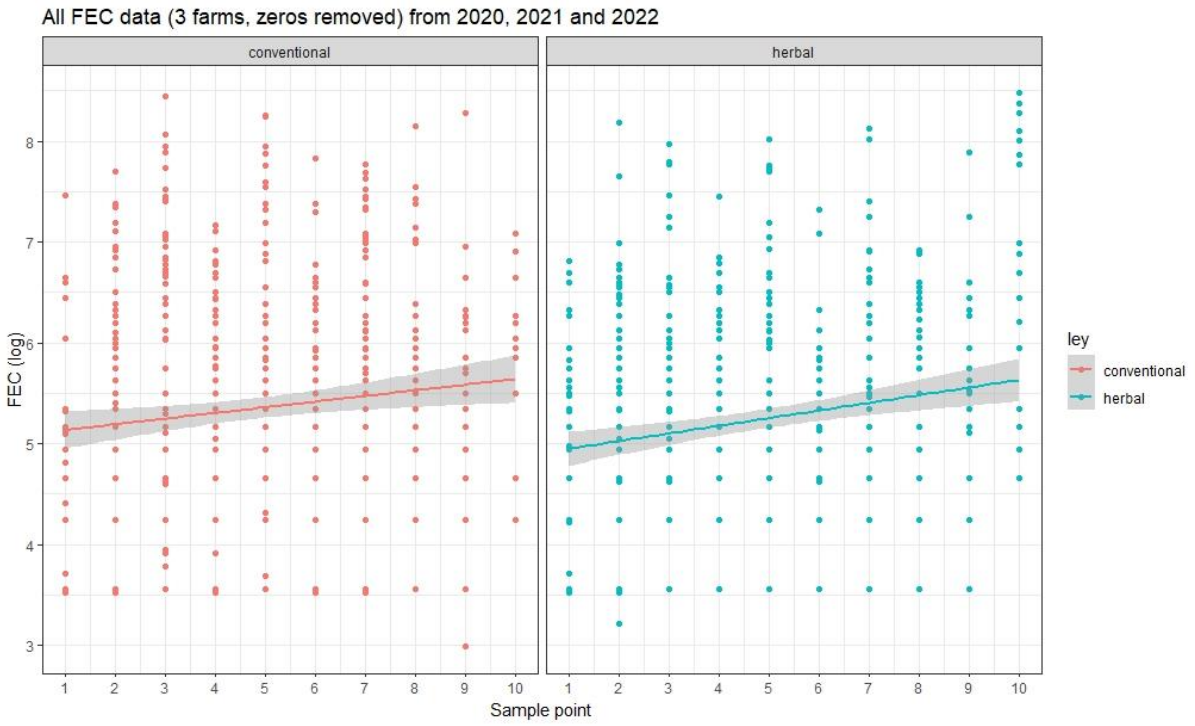
	06-Jul	20-Jul	03-Aug	25-Aug	07-Sep	21-Sep	05-Oct	25-Oct
SITE 1								
herbal	66	90	119	300	50	50	432	420
conventio	41	98	98	372	80	90	498	578



	06-Jul	20-Jul	03-Aug	25-Aug	07-Sep	21-Sep	05-Oct	25-Oct
SITE 2								
herbal	136	603	136	192	470	7	104	296
conventio	94	776	80	343	1729	30	150	675



	30-Jun	14-Jul	27-Jul	10-Aug	26-Aug	08-Sep	22-Sep	07-Oct	28-Oct
SITE 3									
herbal	291	57	239	346	14	168	325	21	11
conventio	189	66	396	476	119	322	723	38	11



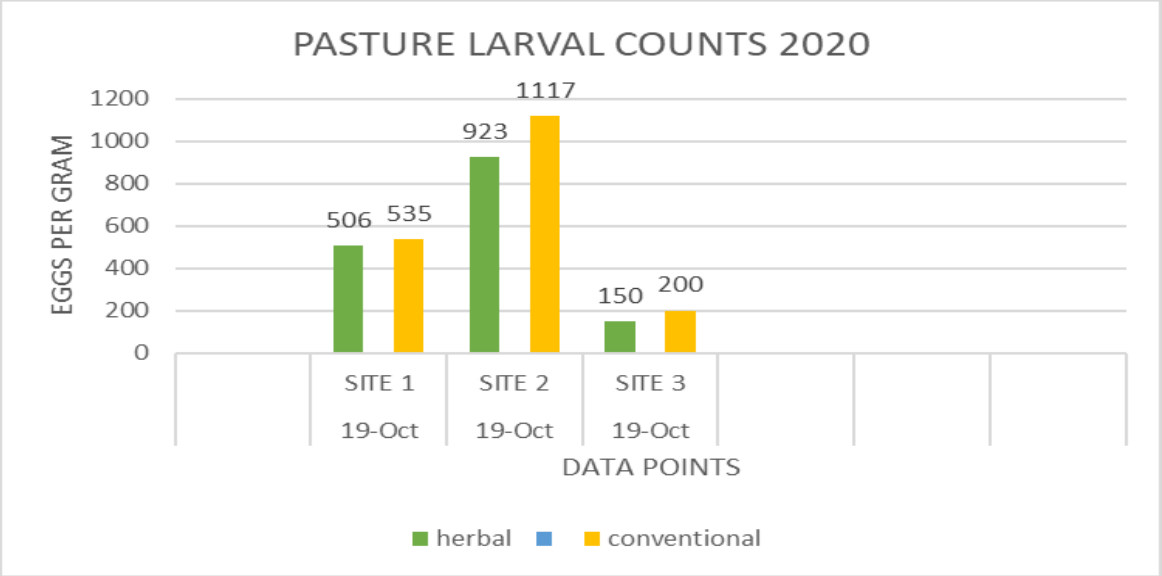
The above statistical graph, shows the variety in the FEC levels on both herbal and conventional plots. With both having a similar trajectory throughout the project duration.

The data shows that herbal pasture has generally lower FEC level in comparison to the conventional protocol.

2.4 Pasture Larval Count

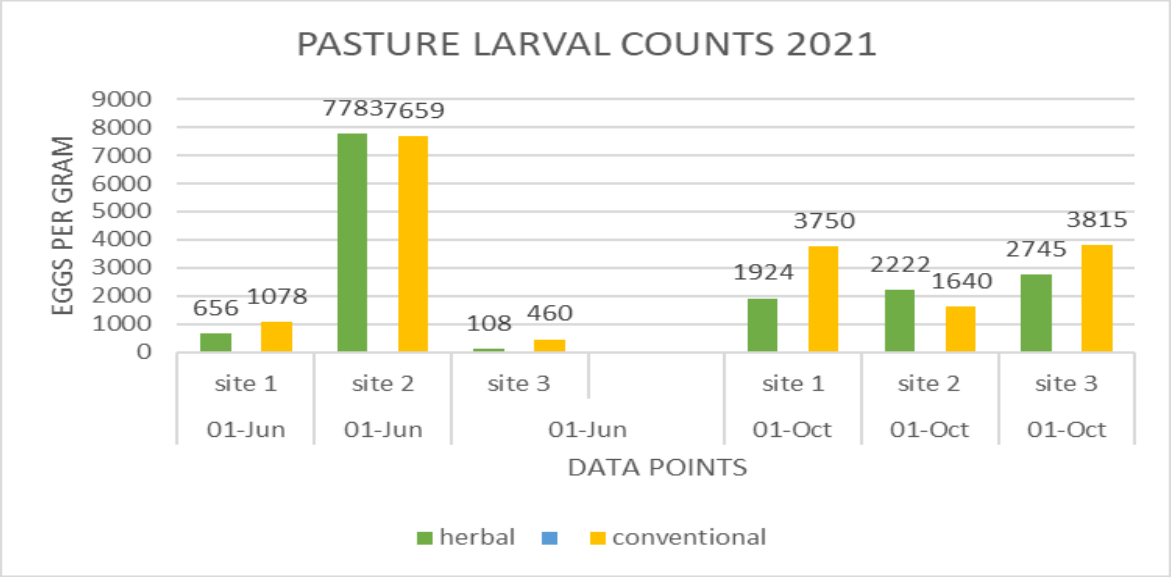
Collecting data on pasture larval counts (PLC) allowed us to see whether it correlated with the FEC counts, on each plot and site.

Although we tried to create a ‘worm burden’ in the first year of establishment, by grazing the new leys with large numbers of ewes and lambs, we saw a moderate to low level of PLC in the autumn.



By year 2, site 2 had a relatively high level of PLC on both plots, which dropped to a more acceptable level by the autumn.

Site 1 and 3 showed low to moderate levels of PLC, with the levels being lower on the herbal pasture in comparison to the conventional plots.

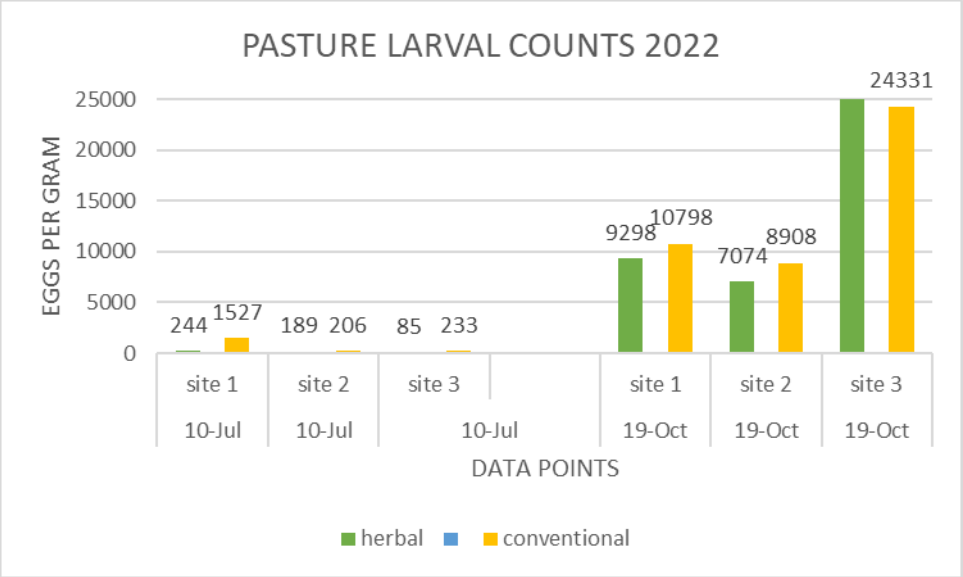


By year 3, the first sampling for PLC saw low levels across all sites.

The effects of the weather can clearly by seen here. The dry summer resulted in low PLC, and the heavy rain which led to a flush of grass growth to the end of the season led to high PLC.

Site 3 which historically had low PLC counts, recorded very high PLC count in the Autumn of 2022.

Apart from the final PLC on site 3, the PLC on the herbal pasture was lower than on the conventional pasture.



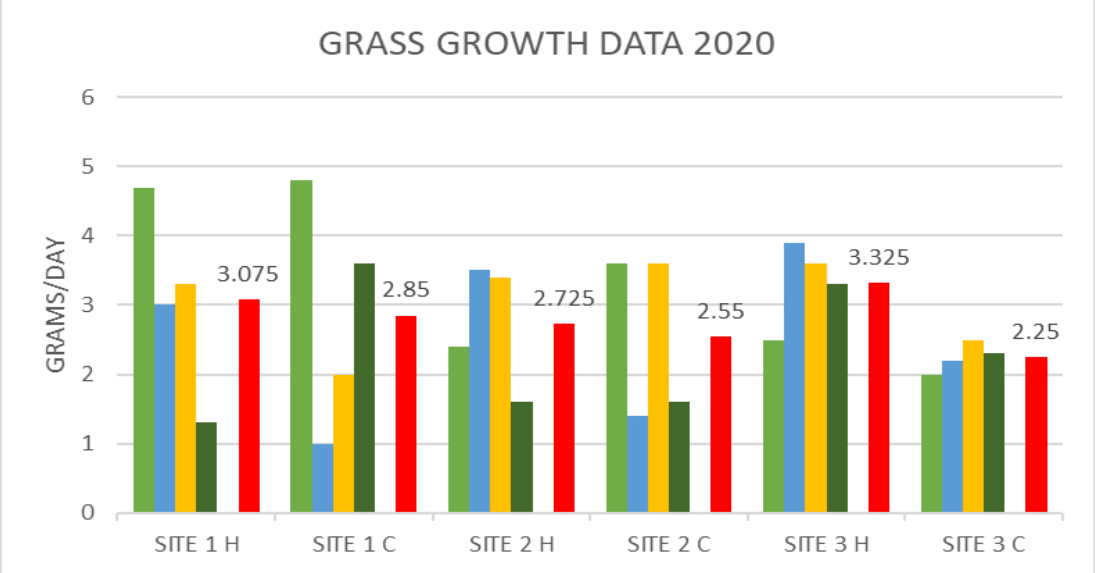
2.5 Pasture dry matter yields

As the plots on each site where split into paddocks and rotationally grazed, we took the opportunity to monitor the amount of herbage grown on each individual paddock. The grass growth data was taken over the data collection period of the start of July to the end of October.

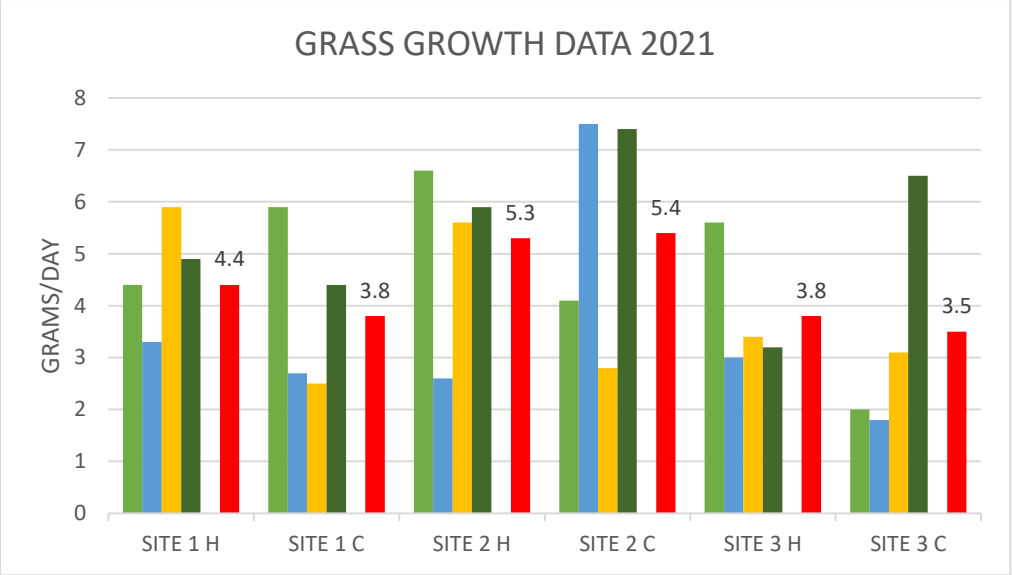
This was done with a rising plate meter. The herbal plots measurements where adjusted, by calibration, to account for the higher growing nature of the species that were used.

It can be seen from data below that the herbal pasture compares well with a more conventional pasture.

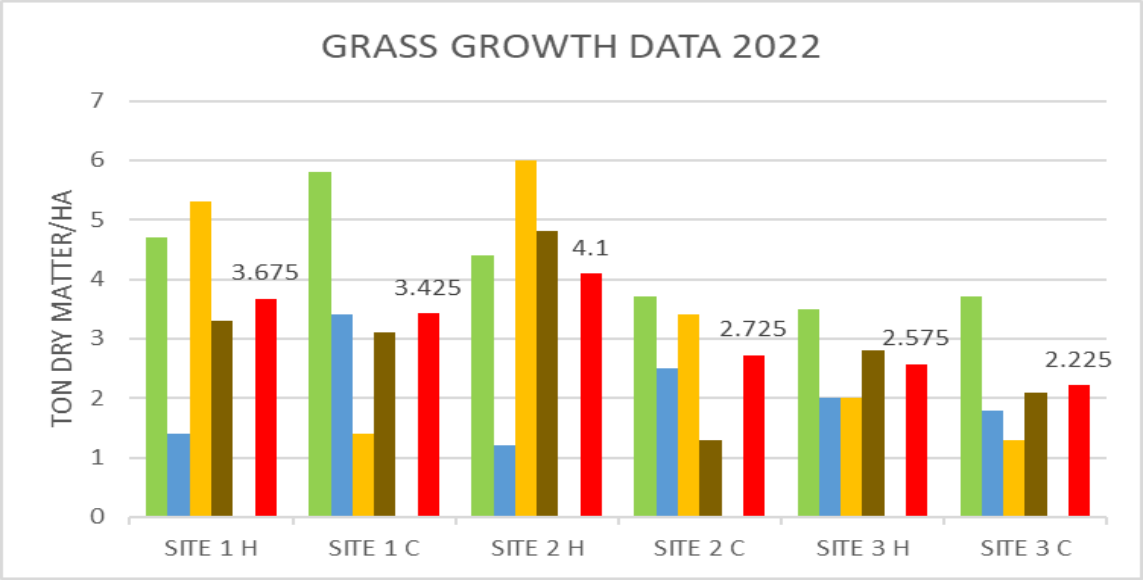
During the dry summer of 2022, the herbal pasture showed a positive effect on dry matter yield, due to the plant species having deeper rooting system, thus coping with the dry conditions better than the shallower rooting system of the conventional perennial ryegrass based pasture



	SITE 1 H	SITE 1 C	SITE 2 H	SITE 2 C	SITE 3 H	SITE 3 C
PLOT 1	4.7	4.8	2.4	3.6	2.5	2
PLOT 2	3	1	3.5	1.4	3.9	2.2
PLOT 3	3.3	2	3.4	3.6	3.6	2.5
PLOT 4	1.3	3.6	1.6	1.6	3.3	2.3
AVERAGE	3.075	2.85	2.725	2.55	3.325	2.25



		TOTAL DM GRASS GROWN			2021	
	SITE 1 H	SITE 1 C	SITE 2 H	SITE 2 C	SITE 3 H	SITE 3 C
PLOT 1	4.4	5.9	6.6	4.1	5.6	2
PLOT 2	3.3	2.7	2.6	7.5	3	1.8
PLOT 3	5.9	2.5	5.6	2.8	3.4	3.1
PLOT 4	4.9	4.4	5.9	7.4	3.2	6.5
AVERAGE	4.4	3.8	5.3	5.4	3.8	3.5



	TOTAL DM GROWN 2022					
	SITE 1 H	SITE 1 C	SITE 2 H	SITE 2 C	SITE 3 H	SITE 3 C
PLOT 1	4.7	5.8	4.4	3.7	3.5	3.7
PLOT 2	1.4	3.4	1.2	2.5	2	1.8
PLOT 3	5.3	1.4	6	3.4	2	1.3
PLOT 4	3.3	3.1	4.8	1.3	2.8	2.1
AVERAGE	3.675	3.425	4.1	2.725	2.575	2.225

2.6 *Lamb growth data*

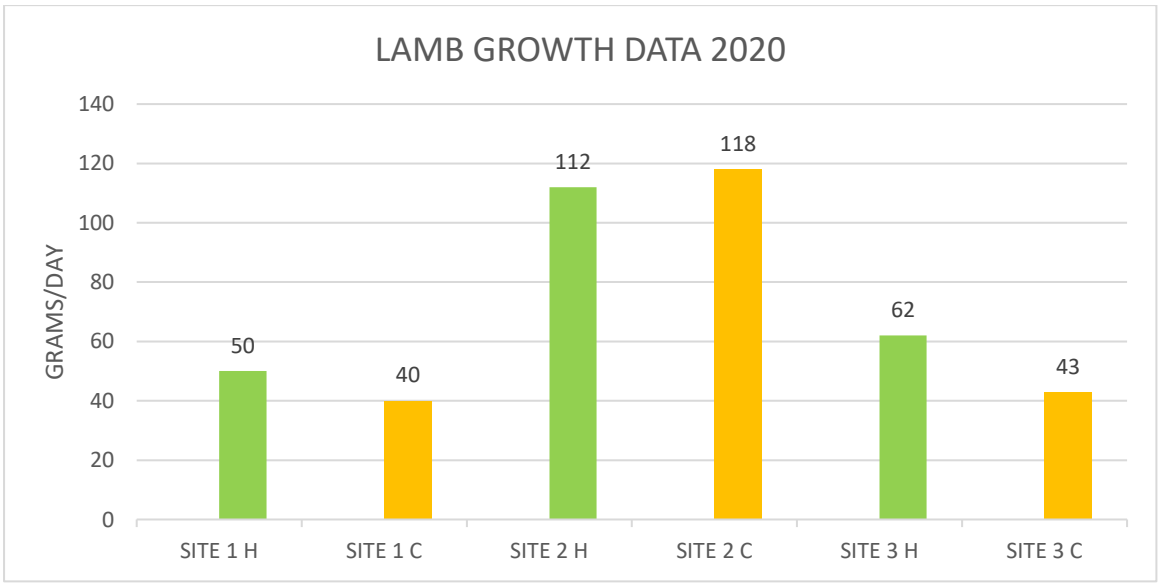
The 10 sentinel lambs on each site were weighed fortnightly to monitor any differences in liveweight gains.

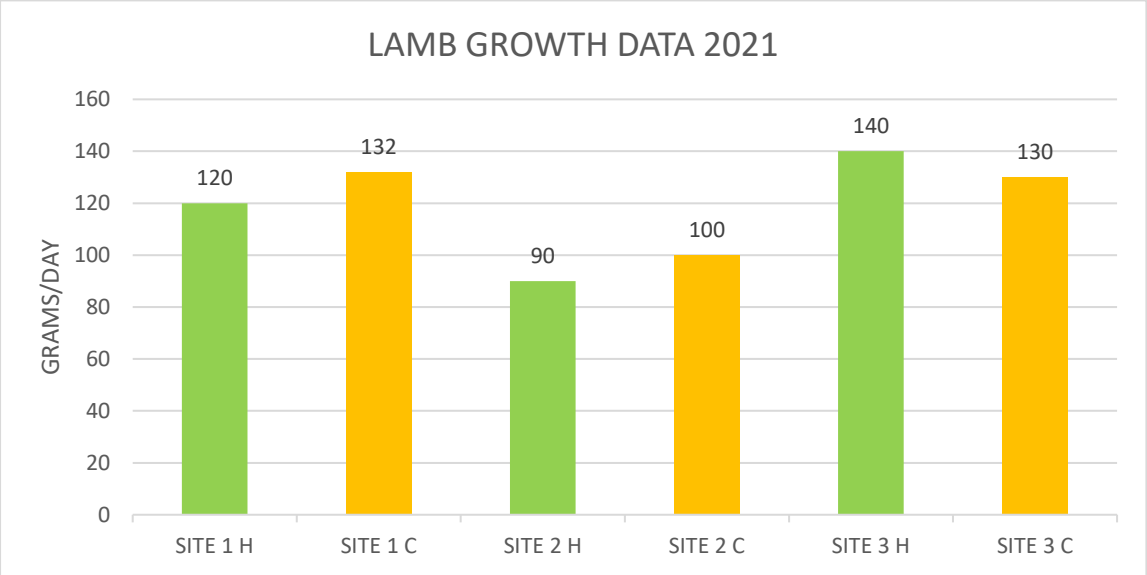
Looking at the data over the 3 years, the growth would be viewed as poor in a commercial setting, where the project saw the average daily liveweight gain vary from 40-160 grams/day.

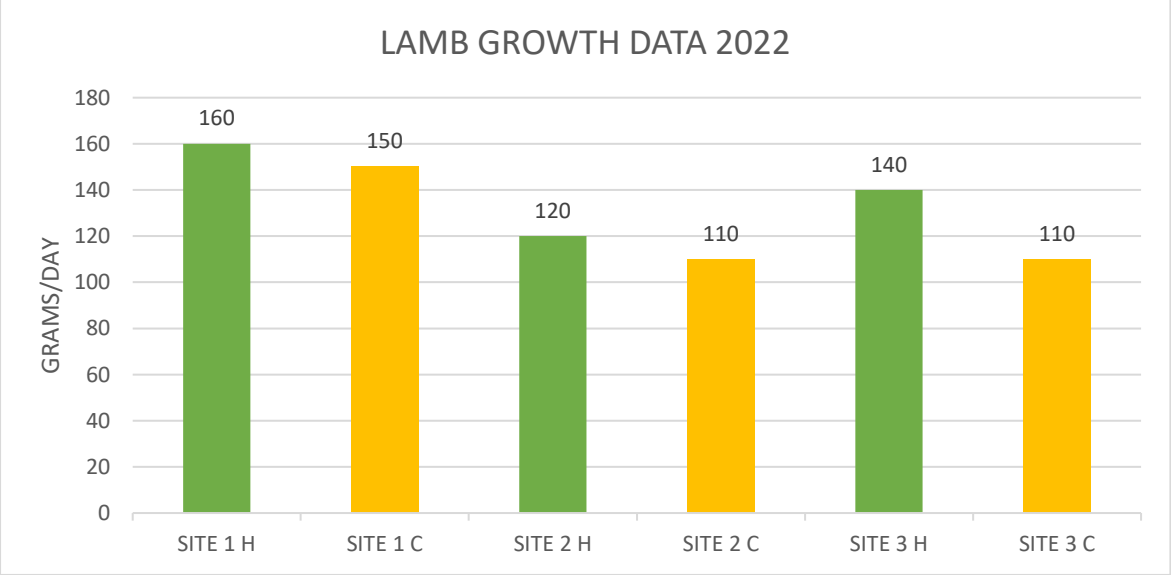
In comparison on conventional farms a more realistic average daily liveweight gain aimed for would be anywhere from 160-250 grams/day.

The following graphs show that both herbal and conventional plots maintained similar lamb growth rates on each site.

The slightly higher growth rates within the lambs grazing the herbal pasture during 2022 could potentially be down to the more drought tolerant species providing good quality and quantity of pasture.



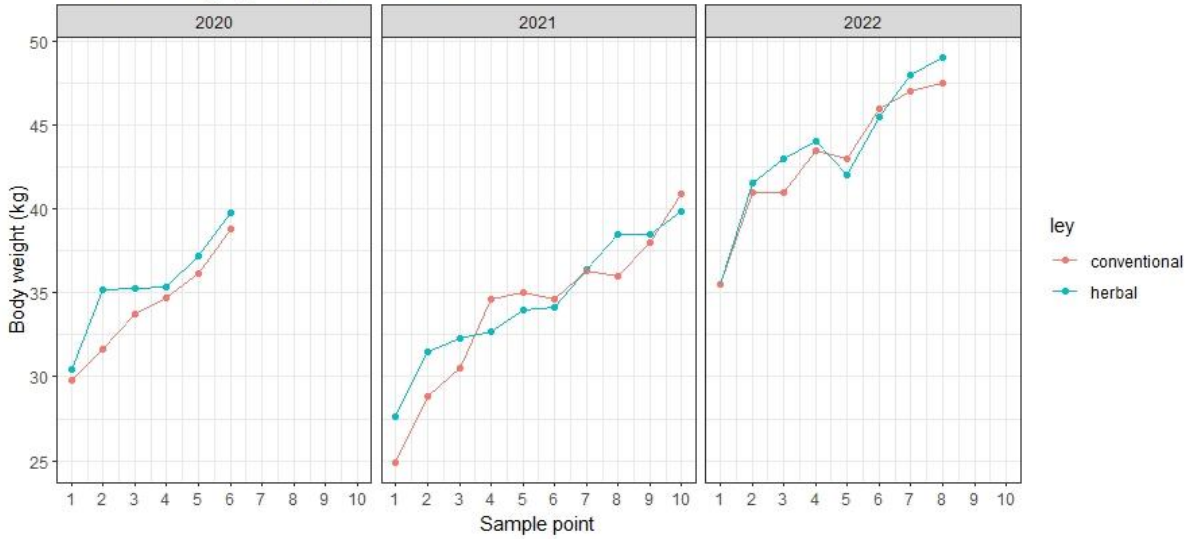




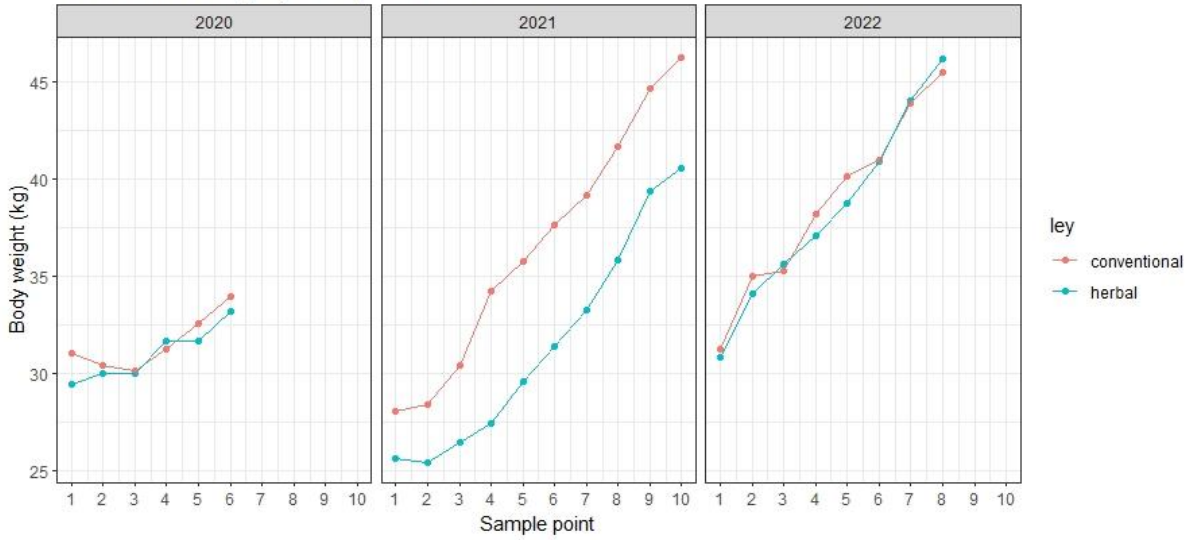
The graphs below show the variety of lamb growth weights on different sites in different years.

There is no definitive difference between the conventional and herbal pasture in this particular project. On the whole, there seems to be similar performance on herbal leys in this situation compared to conventional pasture

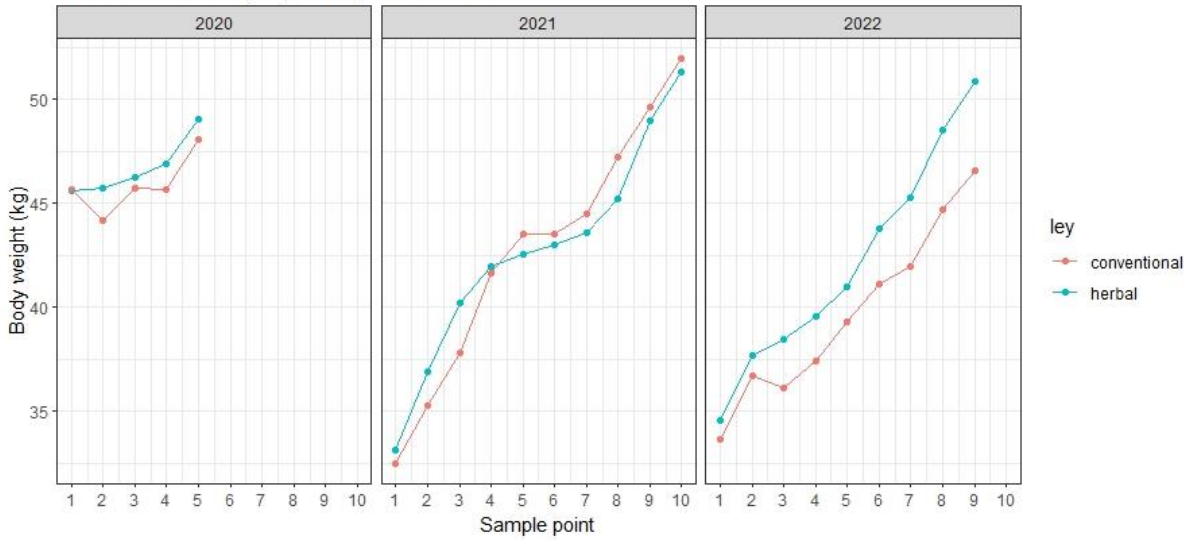
Frowen average growth performance



Maes Felin average growth performance



Trawscoed average growth performance



3.5 Soil analysis

Soil samples were taken at the start of the project, and again at the end of the project, to assess if there was any effect on soil available nutrients and soil health between the herbal and conventional pasture.

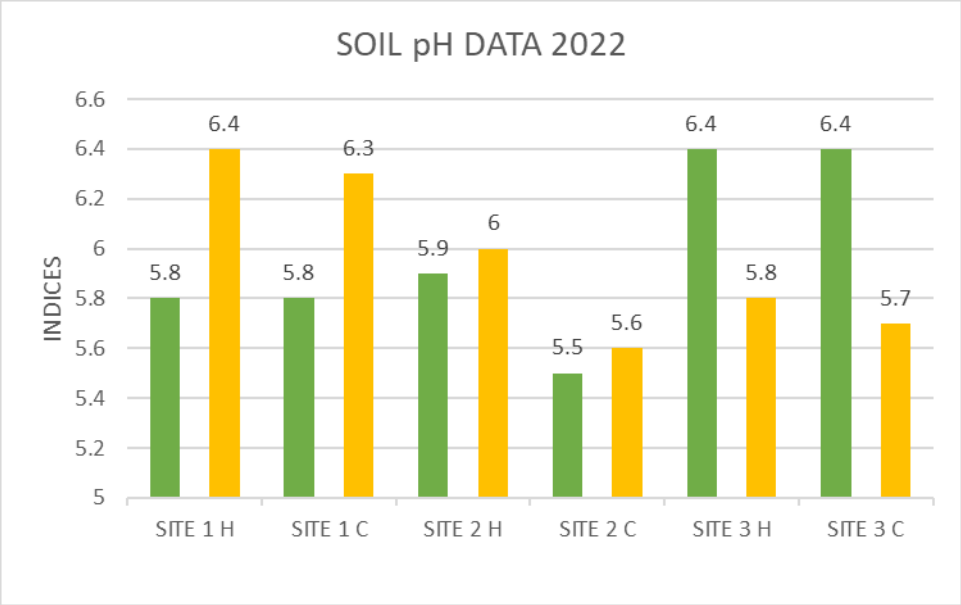
It can be seen from the bar chart on soil pH that due to differing on farm management practices, pH levels varied from site to site.

On average, the herbal plots had a higher pH level than the conventional plots at the end of the project.

This data comes on the back of low fertiliser usage on most of the sites, 30kgN/Ha in year 1, then no fertiliser in year 2+3.

Site 1 received 5 ton/Ha of lime in year 1 hence the significant rise in pH.

It is surprising how the pH levels in site 3 have been depleted so much on both the herbal and conventional plots. The plots had not been cut for silage at any time, and a low level of fertiliser at around 40kgN/Ha had been used.



In amongst varying management practices of the differing sites, on average, the pH level is slightly higher on the herbal plots in comparison to the conventional plots. This could possibly be explained by the deeper rooting structure of herbal plants and improved soil activity, resulting in less calcium being depleted.

Looking at other main nutrients in the soil, site 1 had lower levels of P+K at the end of the project, due to the decision to take a cut of silage in May 2022, and not feeding the crop with adequate nutrients.

Overall, in the post project soil analysis, which included trace elements, most levels where maintained.

One exception was the level of available Boron in the soil which increased up to 30% in some herbal plots. This may be linked to the deeper rooting species opening up the soil and making some nutrients and trace elements more available.

3.6 Grass analysis

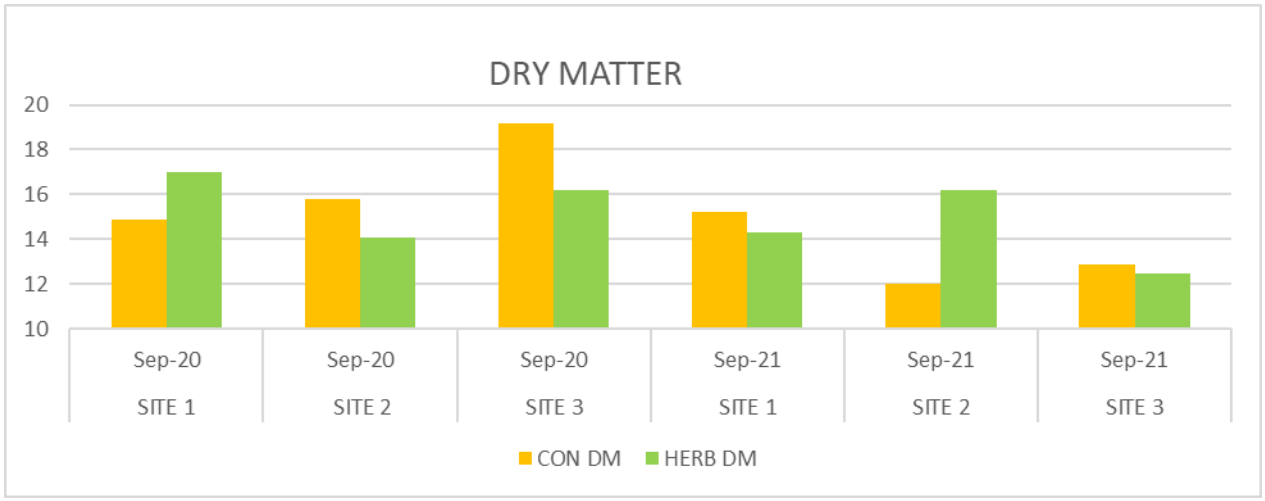
Grass samples were taken over 2 years to look at any differences in quality between the pastures.

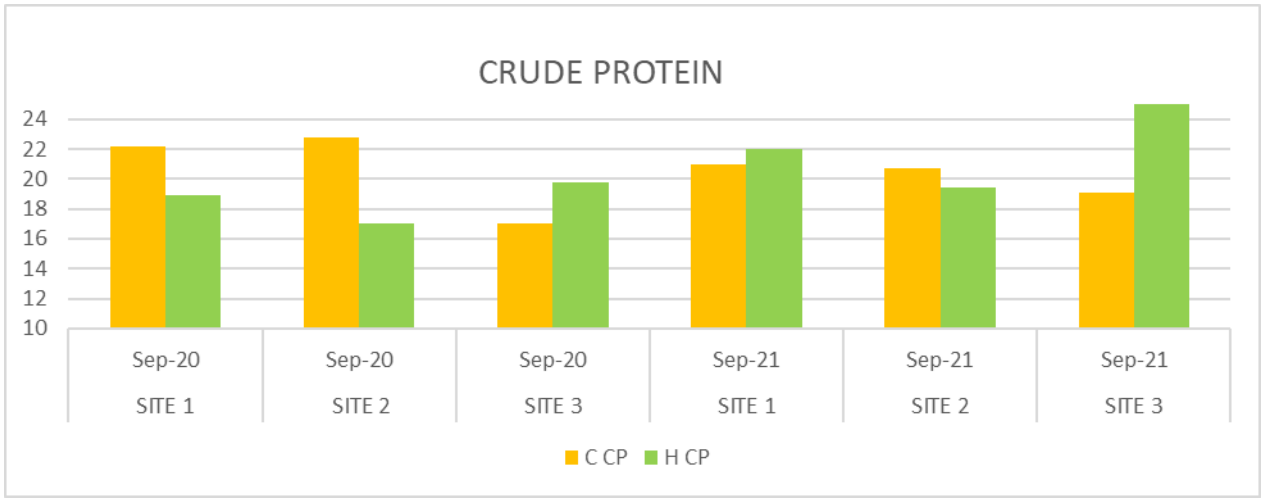
See below that the one noticeable difference is in the level of sugars, which was generally higher in the herbal pasture in comparison with the conventional pasture.

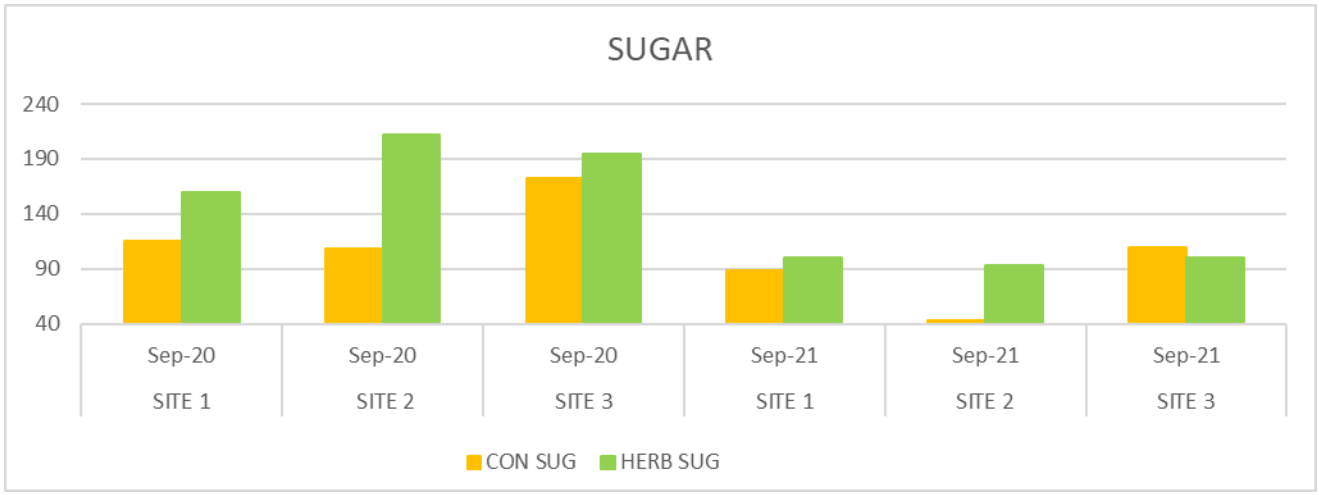
Crude Protein and Dry Matter levels were generally higher on the conventional plots.

With dry stock like ewes and lambs and young cattle, having elevated levels of protein, above 17%, can cause issues, as the stock need more energy to deal with the excess protein.

What can be seen in the sugars bar chart that the herbal pasture contains similar levels of sugar to the conventional pasture, with some sites having higher levels of sugar. This is a positive point which can provide stock with more energy to make best use of the nutrients made available







4 Conclusions

- Over the data collection period we saw a lower level of worm burden (FEC) on the lambs on the herbal pasture in comparison to the conventional plots
- The pasture grown by the herbal leys was comparative to the conventional pasture in terms of overall dry matter yield, with herbal leys responding better in dry conditions.
- Daily liveweight gains of the lambs on both the herbal and conventional plots were similar. The lambs on the herbal pasture had higher growth rates in 2022, probably due to the herbal leys dealing with the drought conditions better than the conventional leys.
- On average, the herbal pasture had a higher sugar content than the conventional pasture.
- The herbal pasture did not deplete the soils of calcium as much as the conventional pasture.
- In dry/drought conditions the herbal pasture coped better, and grew more herbage in comparison to the conventional pasture.
- It would be beneficial when using herbal pasture to have a 30+ day grazing rotation, as the 27/28 day rotation which the project was working on seemed to affect plant population by year 3, as far as having a reduced herbal population.
- Due to the regular FEC data collected during this project, as an added outcome, Techion were able to calculate the possibility of having drench determine the efficacy of wormer treatments on the 3 differing sites, on the variety of worming products used. Where lack of efficacy was observed this was likely due to wormer resistance, but other factors such as correct administration of wormers need to be considered. What we found was that there where varying levels of treatment efficacy / resistance on each farm, and ongoing some caution needs to be used in deciding products to use. Potentially some more work to confirm these issues needs

to be done. This information is a positive, in that it gives the farmers data to help improve the decision making process.

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