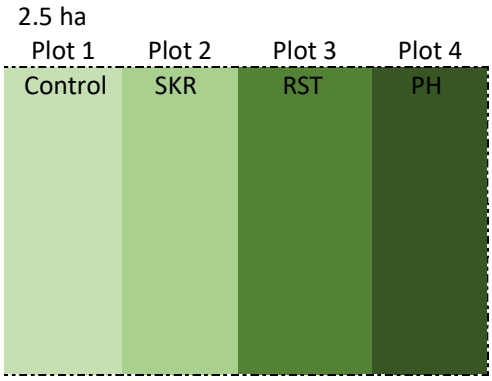
Multispecies sowing demonstration on heavy soils: Project Report

Activity description
This demonstration aims to identify appropriate multispecies sowing techniques for heavy soil types in Victoria's south west, and to quantify the economic and environmental costs and benefits of multispecies pastures when contrasted with a low performance perennial grass system.

Site Information
The 2.5 ha site is divided equally into four treatments:

- Control (standard pasture)
- SoilKee Renovator (SKR)
- Rotor Strip Till (RST)
- Power Harrow (PH)



Summer Seed 2022
10 kg vetch
4 kg sunflowers
4 kg tillage radish
2 kg fodder rape
2 kg buckwheat
6 kg millet
2 kg red clover
.5 kg chicory
.5 kg linseed
.5 kg MPT turnip

This site is a heavy black cracking clay with compacted soil occurring under a 5-10 cm thick root mat. As a proof-of-concept site, the theory is that if multispecies can be established successfully at this challenging site, it will likely be possible on any farm with a heavy soil type in the south-west.

Table 1. Site inputs and information

	Control Pasture	**SoilKee Renovator**	**Rotor Strip Till**	**Power harrow**
Sowing Date	N/A	2.2.2023	2.2.2023	7.2.2023
Sowing Rate	N/A	62 kg/ha*	31 kg/ha	31 kg/ha
Sowing depth	N/A	10cm**	10cm**	3cm
Rainfall		55mm: 2.2.23***	55mm: 2.2.23	No rain until 28.2.2023
Seed Cost	N/A	$333	$166	$166
Hourly Rate	N/A	$250	$300+GST	$375+GST
Contractor plot cost	N/A	$500	$660	$385
Baiting	$66	$66	$66	$66
TOTAL COST	**$66**	**$899**	**$892**	**$617**

All costs including GST except stated as 'plus GST'

*The contractor miscalibrated the SKR sowing rate, so the rate/ha was doubled

**The SKR and RST plots were sown deeply to allow seed-soil contact below the root mat to occur

***The site was planned to be sown in December, but the late season delayed contractors and resulted in a February sowing timing.

Report prepared by Jade Killoran, Healthy Farming Systems

Table 2. Results

DM Cut 1.7.2023	Energy	Protein	DM %	t DM/ha	**$/t DM**
Control Pasture	9.7	20.0	16.7	3.6	$18
Power harrow	10.3	21.9	11.6	5.7	$108
Rotor Strip Till	10.3	21.9	11.6	5.5	$162
SoilKee Renovator	10.3	21.9	11.6	5.5	$163

COMMENTS

-To provide a very broad contrast, the average pasture production cost on the milking platform across 25 farms in the Dairy Farm Monitor Project in the SW in 2021/2022 was **$137/t DM** with a total of **6t produced across the year** (4t/ha directly grazed and 2t conserved). The power harrow produced feed at $108/t, while the soilkee renovator and rotor strip till produced fodder at just over $160/t DM. This reasonably cost-effective biomass production under very challenging circumstances is a promising result, and indicates that multispecies forages could be a cost-effective fodder option.

-The soilkee renovator plot suffered from the excessive sowing rate, leaf biomass production was reduced and brassica tubers/roots were also not fully developed due to crowding of plants.

-The rotor strip till plot showed negative effects of deep seed placement as all cultivated soil remained in sowing rows. 10cm cultivation depth reduced establishment rate, particularly small seeds such as millet, clover, chicory, turnip and fodder rape.

-Power harrow cultivation placed seed very shallowly in the soil profile and due to the intensity of cultivation, reduced base pasture competition. Establishment percentage was higher as a result.

-Cricket predation was severe in the first 3 months after sowing and despite two baitings, likely affected establishment percentage and biomass production of all plots.

DISCUSSION

Overall, the sowing demonstration was a success, generating ROI data for each of the three machines, and identifying the power harrow as the most cost-effective multispecies sowing method at the first sowing. The power harrow was more cost effective at this site due to the ability of this wider machine (6m) to sow the plot in less time in comparison to the soilkee renovator and rotor strip till. The power harrow also placed the seed at a shallower depth in comparison to the other machines, and showed a higher and more even multispecies establishment rate as a consequence.

In comparison, the rotor strip till, which also cultivates the ground quite aggressively, showed a reduced establishment rate. This is due to sowing depth. The rotor strip till very successfully 'worked' the root mat in the sowing row, but did not displace any material, leaving the seed effectively underneath 10cm of well cultivated root mat/soil. Future work at this site, or sites with similar conditions, would ideally include a shallower sowing using the rotor strip till machine, to judge its effectiveness at cultivating the root mat and potentially providing enough seed-soil contact for improved establishment at shallower depths.

In comparison to the other two machines, the soilkee renovator is a low impact sowing machine, cultivating less than 20% of the paddock area, as compared to 100% with the power harrow and 50% (approx.) with the rotor strip till. The soilkee renovator proved quite effective at this site, which can be attributed to several factors. The first factor was grazing management. While the pasture was not

chemically terminated, it was heavily grazed in late December, reducing biomass competition, and the site received no rainfall between grazing and the sowing in February, resulting in the base pasture being much less competitive than it would be at the more common autumn or spring sowing timings. Furthermore, at sowing, the soilkee renovator ran a mulcher on the front of the tractor, turning in biomass and further reducing competition. Finally, the soil spreading action of the soilkee while sowing helped to establish smaller seeds such as millet, fodder rape and clover from a greater sowing depth than the rotor strip till, as it threw soil out of the sowing rows, and reduced the depth of soil from which seedlings emerged. Due to appropriate grazing management pre-sowing, mulching and soil spread, the soilkee renovator proved effective at sowing this site.

Overall, given the intentionally difficult circumstances at the site, which included the known factors of: no chemical termination pre-sowing, competitive perennial pasture, heavy root mat and no prior fertiliser history and also included an undesirable sowing window in February due to contractor scarcity, and high cricket and slug numbers, the multispecies mix proved very tenacious and established well.

The sowing demonstration evoked considerable interest from the farming community as hoped, and two field days were conducted on the 2nd and 5th of May, with approximately 80 people attending over the two days.

The Corangamite Council funded field day on 2nd May attracted over 50 people to the site for a 2-hour information session. Multispecies benefits, species ID, machinery choice, grazing management and soil health and environmental benefits of multispecies pastures were discussed over the sessions.

The field days helped to demonstrate to farmers the tenacity and productivity of multispecies pastures, particularly when successfully establishing at such a challenging site. Many farmers had never seen soil so compacted and challenging, and confidence in multispecies establishment was improved.

The site is now being grazed by 10-month-old weaners and although the quality (energy and protein) is similar across the demonstration area (see Table 2) the weaners clearly prefer the multispecies rather than the pasture control, highlighting the value of forage diversity. The power harrow plot shows a small amount of pugging damage/bare ground, while the other two plots have no soil damage evident. All plots are in good condition overall.

In summary, the demonstration has fulfilled its chief objective of demonstrating a range of sowing machinery, and their ROI from an initial sowing. The site has certainly improved farmer exposure to multispecies and associated knowledge and confidence amongst the field day participants, and has quantified the growth potential of the multispecies at the site.

Furthermore, the popularity of the field days has clearly shown that multispecies pastures are of interest to local farmers, while local HDLN project results have shown economic and environmental benefits on-farm. Further work in the region appears warranted.

Further Research

While the site has begun the process of proving that multispecies can be established under challenging conditions in the south-west, identifying sowing machinery which will suit very heavy soil types, and quantifying ROI for each machine, further work should be done in the region in order to provide ground-truthed recommendations for local farmers, who have clearly shown interest in the progress of the site.

In order to identify whether multispecies pastures are a beneficial addition to south-west livestock businesses, the ROI from fodder production and the theorised improvement in soil health from the adoption of multispecies, must be quantified across multiple trial sites.

If the multispecies are proven to be economically and environmentally viable in the south-west, in order to drive adoption, the identification of appropriate sowing machinery and the creation of a transition pathway from a conventional system to a regenerative system through analysis of outcomes from the trial sites must also be documented and disseminated to farmers. This research is vital to understand the potential beneficial effects that multispecies pastures can provide in terms of fodder production, ecosystem health and function, and farm business sustainability and resilience.