

Massey University Project Dairy 1

A profitable, low input, pasture based dairy farm

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Introduction

How will we dairy farm in the future? Most likely we will use a variety of farm systems as we do now, but they will all need to meet the challenges of environmental compliance, financial sustainability, happy farm workers and healthy cows.

Project Dairy 1 is about developing a low input, future farm business that is kind to the environment, livestock and people (Figure 1). It is a living lab project, open to the community, that will rigorously monitor and document the effects of the changes to the farm system as it transitions to as low an environmental footprint as possible while being a financially sustainable, commercially run farm.



Figure 1. The purpose of Project Dairy 1 is to create an environment for collaborative multidisciplinary research to demonstrate leadership and deliver innovative solutions around issues of environmental stewardship, community connection, and animal health and welfare in dairy farming.

Early changes to the farm resulted from a farm re-design to decrease N leaching, in compliance with Horizons Regional Council's One Plan targets. The Massey University Agricultural Experiment Station No 1 Dairy Farm was converted from a twice a day milking, split calving, town milk supply system to a once a day (OAD), spring calving, seasonal milk supply system for the start of the 2013/2014 season. Some cows were milked over the preceding winter to honour the twice a day contract. This resulted in cow numbers being decreased from 370 to 240 at the start of the 2013/2014 season. This season there are 246 cows at 2.1 cows/ha. The effective area of the farm is 120 ha.

The change to OAD decreased farm costs which partly compensated for the revenue lost from lower cow numbers. Also, as part of the re-design, the use of the paddocks adjacent to the Manawatu River was changed (Figure 2). As a result of these changes, which are explained in more detail below, the N leaching loss from the farm estimated from Overseer decreased from 42 kg N/ha/year to 25 kg N/ha/yr. Our 5 year target is 18.

Number 1 Soils

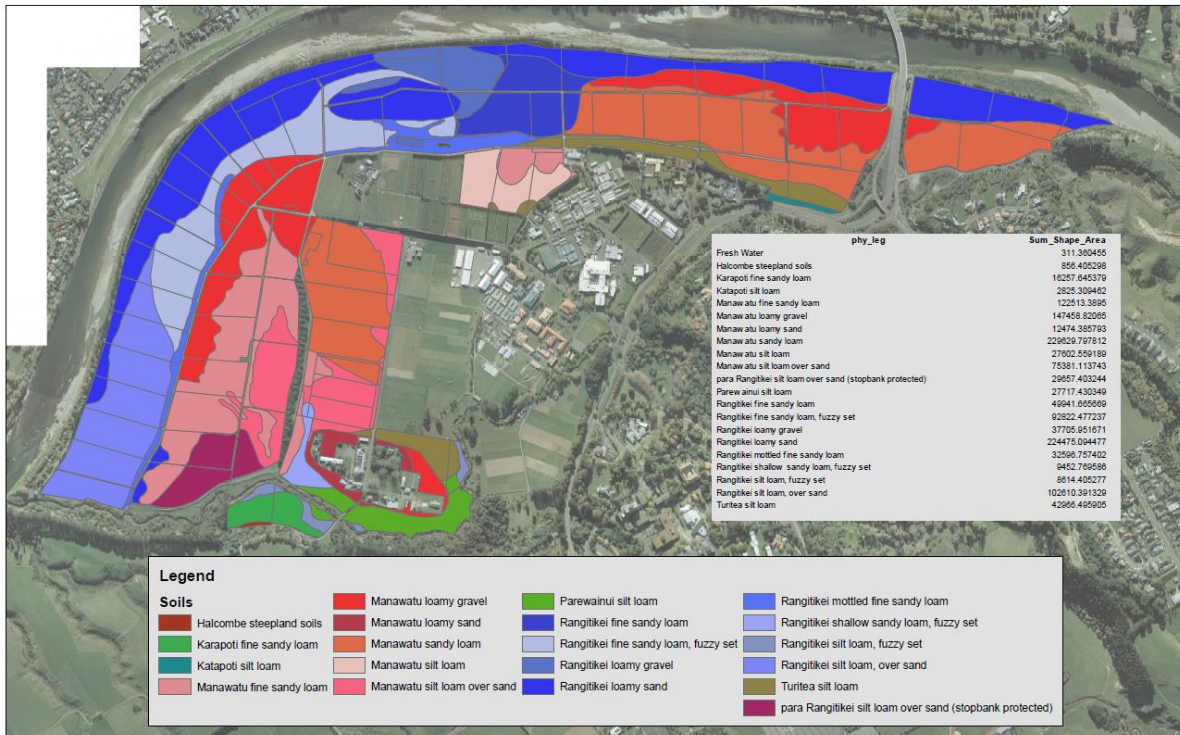


Figure 2. Soil types and farm map of No 1 Dairy Farm. The soils are free draining with gravel underneath.

The farm map illustrates how No 1 Dairy Farm follows the Manawatu River, with 3.5 km of river frontage. Palmerston North city, with a population of 82,000, is just across the river to the top of Figure 2. In the longer term there will be increased riparian tree planting and a community walkway along the river, but in the short term grazing has been constrained in the paddocks adjacent the river.

At the southern end of the farm 20 ha are in either lucerne or a herb (plantain, chicory) and clover (red clover, white clover) mix. The paddocks still in pasture are managed to minimise leaching by limiting the non-grazing time the cows spend in the paddock when leaching is likely. A programme of direct measurement of N losses from the farm into the ground water is planned and a pilot study has been implemented.

Feed supply

There was no imported feed this season, but 17 t DM PKE and 20 t DM maize silage already on the farm was fed out along with 90 t DM grass silage, 48 t DM lucerne silage and 22 t DM lucerne hay made on the farm. Otherwise, the feed supply was grazed pasture, 12 ha of summer crops (Barkant turnips, Hunter leafy turnip, Winfrid rape) used as part of the re-grassing programme, and 10 ha of herb and clover pasture.

The lucerne paddocks (10 ha) provide a deep rooting forage crop in the area where the Turitea Stream meets the Manawatu River. It is mainly cut for silage and hay and is only grazed once per year at the end of the growing season to clean up the crop for over wintering (Figure 3). The grazing is by either the cows or heifers and they are moved once they have finished grazing the break to minimise urination on the paddock. In the current growing season (2014/2015) 13,650 kg DM/ha were harvested.

The herb and clover pasture (10 ha) is grazed as a forage crop in two hourly breaks so that the cows can moved back to the pasture paddocks (classed as less prone to N leaching) before they urinate. The herb and clover pastures provide a high nutritive value perennial crop with deep roots on some of the river edge paddocks. These pastures were established in October 2013. Their average cover and daily growth rates are shown in Figure 4. An earlier experiment on the farm showed that the herb and clover mix produced 17 t DM/ha in a season that the ryegrass and white clover pasture produced 14 t DM/ha.

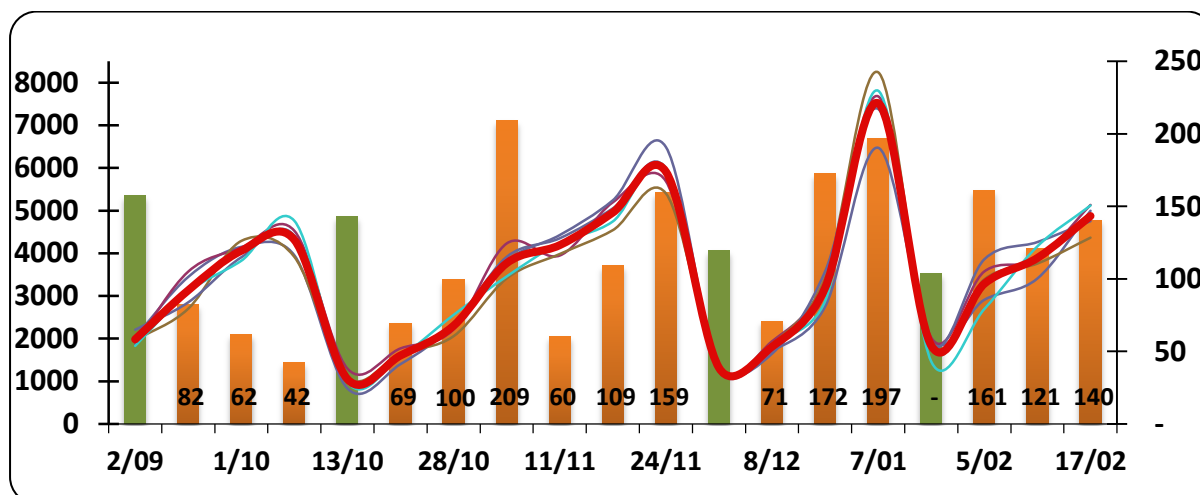


Figure 3. Lucerne production and plant density over the growing season. The red line is the average cover, the brown bars the lucerne daily growth rate (kg DM/ha/d), and the green bars the plant density (plants/m²).

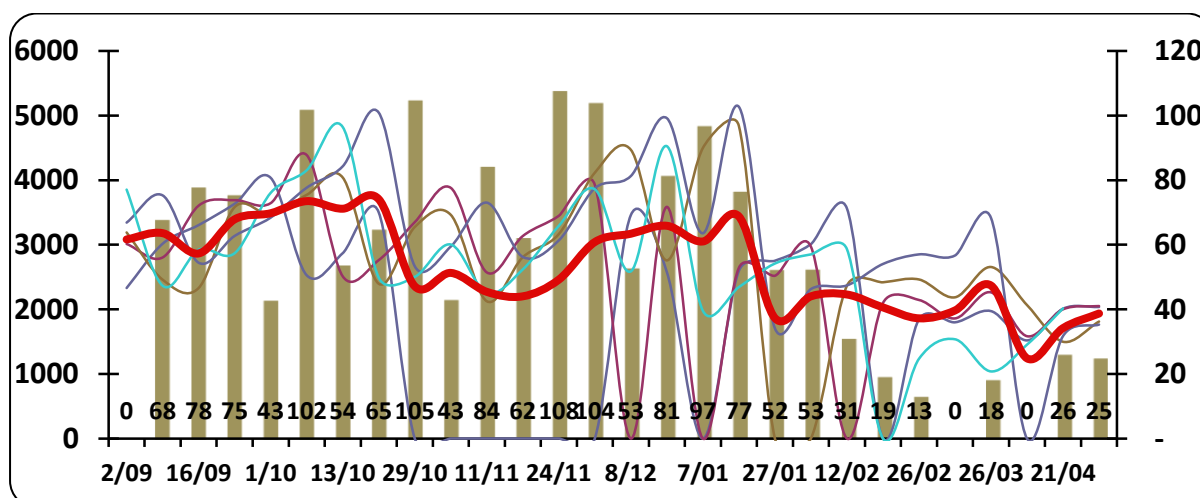


Figure 4. Herb (plantain, chicory) and clover (red clover, white clover) pasture production over the growing season. The red line is the average cover and the grey bars the daily growth rate (kg DM/ha/d). The other coloured lines are the cover in individual paddocks.

The farm has been modelled using Farmax to optimise the farm feed supply and demand for the current farm system, and to explore different management strategies. A summary of the Farmax modelling is shown in Figure 5. The baseline scenario suggests pasture cover targets are difficult to maintain under the current farm system and this effect may be further exaggerated throughout spring and early summer as a result of the herb crops. The modelling estimates for the mean long term climatic conditions for No 1 that it is possible to support 270 cows producing 400 kg MS/cow in a OAD system.

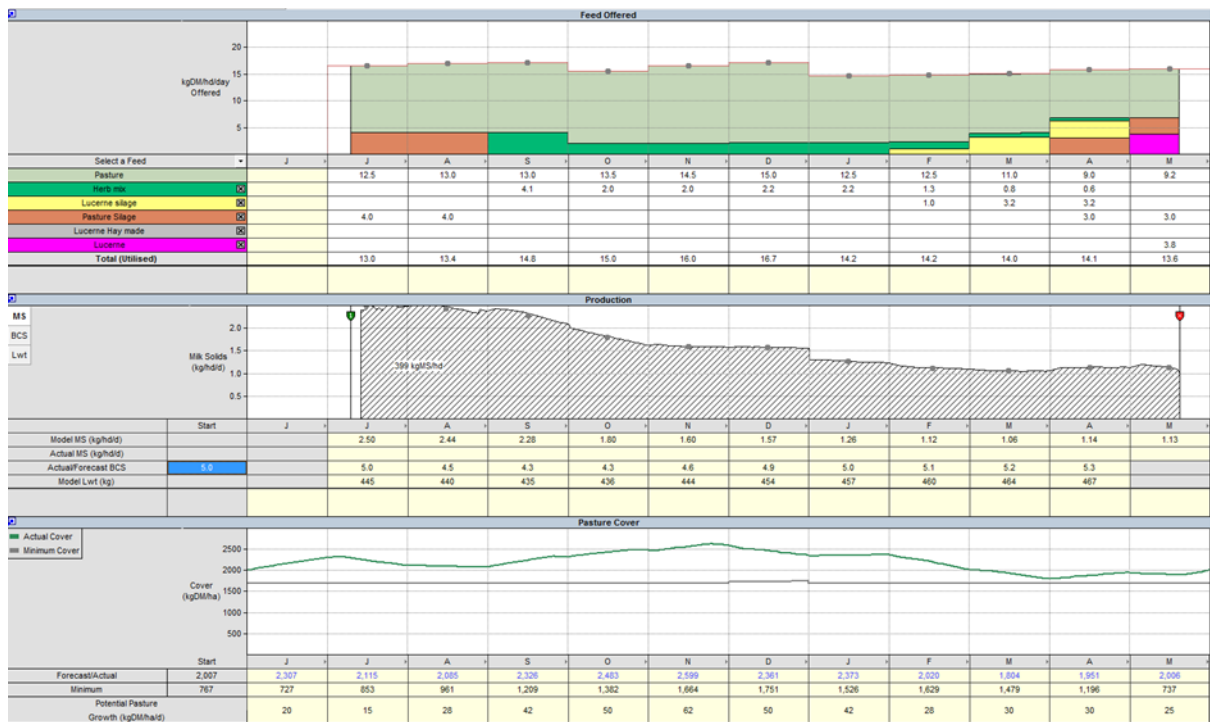


Figure 5. Farmax output for the current OAD on No 1 Dairy Farm.

Cow performance

The provisional data for this season are 90,300 kg MS at 367 kg MS/cow and 753 kg MS/ha. The cow performance was good for only the second season of OAD and a lower than average summer rainfall, but the target is 400 kg MS/cow and 900 kg MS/ha. These targets appear achievable given the improving per cow production as the herd adapts to OAD, plus the potential to increase cow numbers by 15 next season based on the Farmax modelling and the observations of the manager.

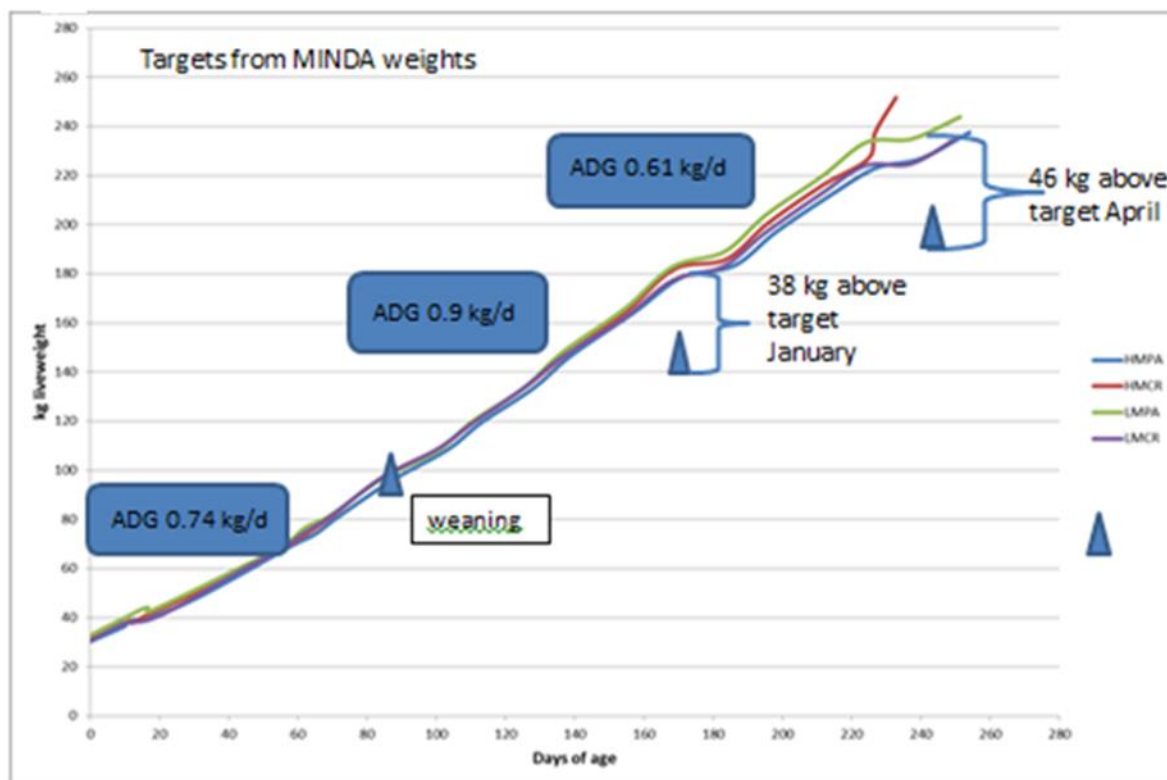
A potential advantage of OAD is that it results in increased reproductive performance and improved animal welfare, resulting in higher cow survival rates. The productive and reproductive performance of the No 1 herd will be monitored over the long term. The first season results are in Table 1. Note that the herd is balanced across Friesian, Jersey and Crossbreds which will enable comparisons between breeds over time. This season the 6 week in calf rate was 84 % and the empty rate 9 %. A OAD breeding index is being developed in collaboration with LIC.

	Friesian	Jersey	Crossbred	Herd	National	P	Difference %
N	39	44	89	172			
Days in milk	235a	26	246b	16	240ab	26	241 1.9 266 <0.0001 -9
Milk yield, kg/cow	4036a	132	3130c	136	3661b	112	3549 62.0 4480 <0.0001 -21
Fat yield, kg/cow	180.0a	6.7	184.9a	7.0	192.7a	5.8	184.0 2.7 212 <0.0001 -13
Protein yield, kg/cow	145.6a	5.0	132.3b	5.1	144.0a	4.3	140.6 2.2 170 <0.0001 -17
SCS	6.72a	0.24	6.90a	0.29	6.67a	0.21	6.40 0.1 7.55 <0.0001 -15
Live weight, kg/cow	525a	6.1	464c	6.4	504b	5.1	485 3.5 460 <0.0001 5
BCS	4.34ab	0.06	4.24c	0.06	4.39a	0.05	4.40 0.02
Milksolids /100 kg of LW	61.7b	2.4	70.5a	2.5	67.0a	2.0	67.1 0.9 83.0 <0.0001 -19
Start of mating to first serv	10.8	1.6	11.1	1.70	11.2	1.4	
Submission rate 21 days	98a	4.5	97a	4.7	96a	3.9	96 1.6 79 <.0001 22
Conception rate 42 days	87a	5.8	84a	5.40	84a	3.8	85 2.7 65 0.0298 31
Empty rate	4.1a	5.0	5.9a	5.1	3.6a	4.2	5.0 1.7 13.0 <0.0001 -62

Table 1. Productivity and reproductive performance of dairy cows from different breed groups under once a day milking at Massey University dairy farm No 1 (season 2013-14).

Calf and heifer rearing

This season all the heifer calves were reared on the farm as a trial to determine the effect of alternative pre- and post-weaning diets, colostrum quality and parasites on the growth rates of dairy heifers. The liveweight gains from birth to first calving and subsequent milk production will be studied. Some heifers were grazed on the herb and clover pastures this season to compare their growth with heifers on ryegrass pasture. To date there is no difference between the treatments but all of the heifers are above target weights.



Calf treatments

- HMPA – Calves fed high milk and grown on pasture post weaning
- HMCR – Calves fed high milk and grown on forage herb crop post weaning
- LMPA – Calves fed low milk and grown on pasture post weaning
- LMCR – Calves fed low milk and grown on forage herb crop post weaning

Figure 6. Heifer calves' growth compared with MINDA targets when fed different combinations of milk (4 litres vs 8 litres) and pasture (ryegrass/white clover vs herb/clover).

Conclusions

The vision for Project Dairy 1 is evaluating changes in a commercial dairy farm that will lead to the farm having a low environmental footprint while being financially sustainable. Changes such as OAD will be fully evaluated but if they do not work they will be changed. It is this ethos of change, measure and adapt that will drive the transition of No 1 Dairy Farm to being a farm of the future based on a low input system. The project is open to the community and will both take ideas from the community and share the development of the farm with the community.

Acknowledgements

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