

Milk Production at Campo Longley –

A review and analysis of the inputs and outputs

Campo Longley was established in 2009 with the aim of becoming one of the best dairy farms in Uruguay, building upon the success of Longley Farm in the UK. From the beginning of 2014 Agnieszka and Cameron have been permanent residents on the farm, taking a more hands on approach after a time of short visits from Australia. This has seen a number of improvements to the farm such as the introduction of “Australian” fencing and plans for automatic cup removers and milk metres in the dairy.

As at Longley Farm, Campo Longley uses Jersey cows to achieve the highest quality milk. Good results are already being achieved, with the farm having the fifth highest milk quality of all Conaprole farms in 2011/2012. However the farm is yet to reach its full potential.

The Jersey cow is one of the world’s best milk producing “machines” and as such requires the perfectly balanced diet to achieve its full potential; a diet that is slightly different to other breeds of dairy cow. It is important to get the correct mix within the diet considering that around a third of Campo Longley spending is on concentrate feed, rising to 50% if fertilisers and seeds for pastures are included. The relationship between concentrate feed and the pasture grass, which provides the majority of the cow’s intake, is another important consideration.

However, as the vast majority of milk is water, it is also vitally important that the cows consume enough good quality water. Recent tests into possible bore water sources around the farm, organised by Agnieszka, have not had the most positive results with only Campo 3 having potable water.

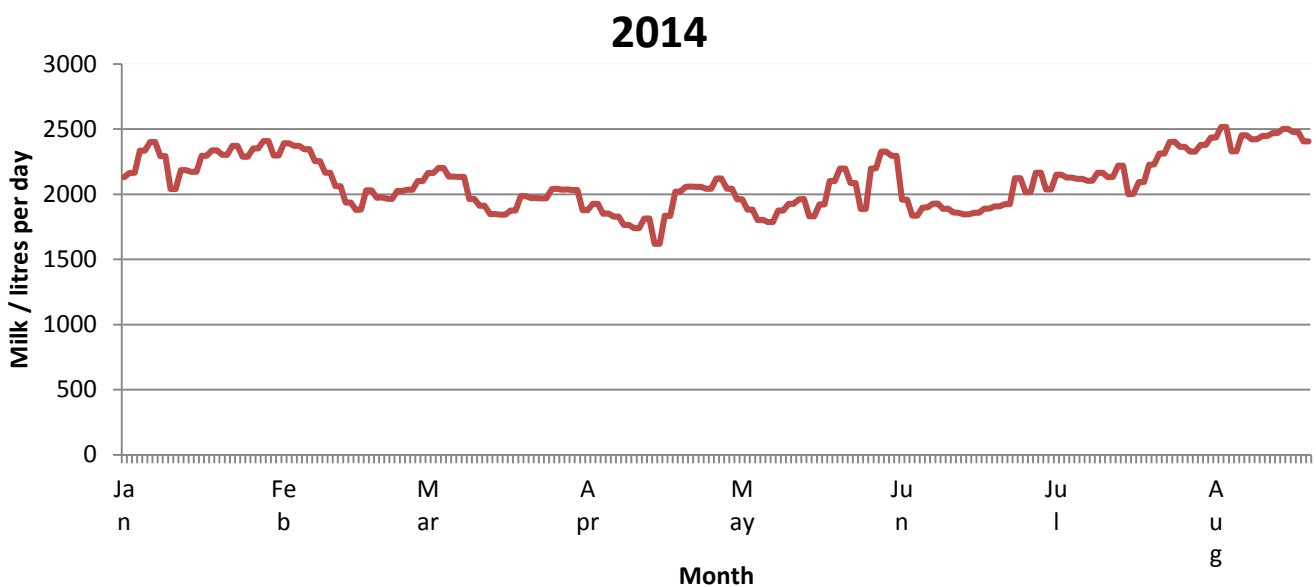
This report will proceed to look at the contents and yield of milk produced and use this to help analyse the balance of nutrients within the diets of the cows. Furthermore we will try to establish the amount of concentrate feed that is wasted during milking.

Analysis of output – milk

Milk is the main source of income for Campo Longley so it is essential that it is of the highest quality and largest volume. The farm is paid depending on fat and protein content. The Conaprole milk cooperative currently pay P\$56.88 per kg of fat and P\$146.82 per kg of protein. They also deduct P\$0.739 per litre. This encourages farms to produce the highest quality milk and not to water it down. There are also a number of quality bonuses related to the levels of Somatic cells and bacteria within the milk. Campo Longley is currently paid these bonuses and should aim to continue in this way.

According to the UK National Milk Records Production Annual Report 2008, the average Jersey cow should be capable of producing 5617 kg, or 5439 litres, of milk per lactation; although the daily amount will vary depending upon stage, with peak yields between four and eight weeks after calving. This milk should contain 5.29% fat and 3.84% protein. These are the targets that Campo Longley should be aiming for and they are supported by the DairyCo Breeding+ 2010 report which states that Jersey milk should contain 5.31% fat and 3.85% protein. Whilst some farms in other parts of the world are achieving higher levels in fat than this, up to 7% in some cases, we believe 5.31% to be a reasonable target for a Uruguayan farm given the different conditions and techniques in use. However, hitting this target does not mean that there is no further room for improvement.

The cows at Campo Longley currently produce around 2436 litres of milk per day, August average. Although this has varied throughout the year with a high of 2536 litres in early August and a low of 1620 litres in mid April. However there has been an increasing trend reflecting the farm’s improvements. The total number of litres each day throughout 2014 is shown below in figure 1.

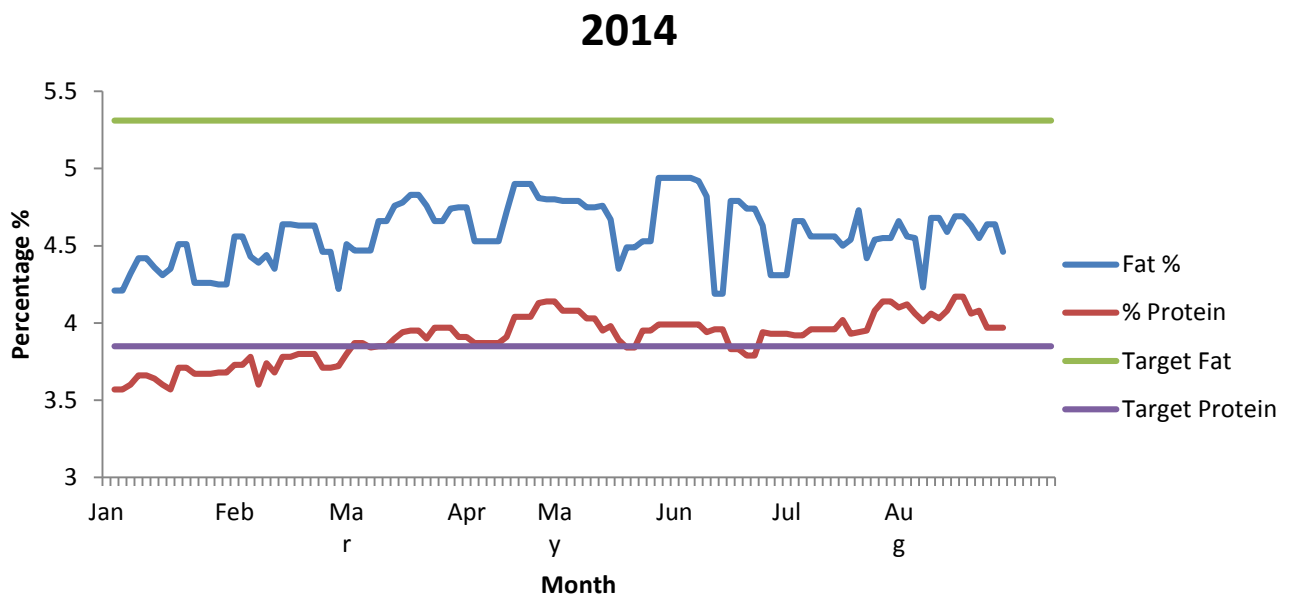


Reasons for the variation in the amount of milk produced throughout the year include the number of cows in the dairy and the stages of lactations of these cows. Furthermore factors such as the previous day’s weather and the distance the cow must walk to the dairy will affect milk yields. If the weather has been cold or the walk long, then the cow will have had to expend more energy; leaving less with which to produce milk.

We have used “Control de Lechero” data, which measures the amount of milk each cow produces, to generate a number of estimates for the amount of milk produced per cow per lactation. This data is collected once a month so may not be the most reliable but it correlates well with the information from the milk docket. Our lactation estimates varied greatly, as did the number of litres produced each day, with a low of 4036 litres in April and a high of 5327 litres in July. Over the course of 2014, and in previous years, we believe there has been a significant shortfall in

the amount of milk produced compared to the potential of the cows. However, as the estimate for July shows, there have been large gains in recent months and August appears to be better still. It is clear that Campo Longley is moving in the right direction with regards to milk yields and we fully expect yields to continue to increase.

However the quality of the milk is equally important. To analyse this we have used the information on the contents of the milk, provided by Conaprole when the milk is collected. This data



has then been compared to the potential of the cows, according to DairyCo. The levels of fat and protein in the milk during 2014 are shown below in figure 2.

This shows that the amount of protein in the milk of the cows at Campo Longley is very good. There has been an increase in protein since the start of the year and for most of the time in recent months; the amount of protein is higher than would be expected. For the year to date, average protein levels are 0.9% up on the expected level. This shows that the cows are transferring the high levels of protein in the food, particularly the concentrate, into milk very effectively.

On the other hand the level of fat in the milk is consistently below what we would hope. The fat levels are also far less consistent than that of protein, with a high of 4.94% in June and a low of 4.19% also in June. This apparent milk fat depression has led us to investigate further.

Analysis of input – Feed

From the previous analysis it is clear that the milk produced at Campo Longley is lacking in fat content. DairyCo provide a simple list of ways to increase the percentage of fat in milk. It is summarised below.

Factor	Relevance to Campo Longley
Increasing the forage to concentrate ratio	The forage to concentrate ratio is currently around 2.5:1. There is a consensus that the cows are not getting enough forage.
Feeding high fibre forages	The quality of forage at Campo Longley is currently mixed, with some of high quality and some which is less good. This will improve over time.
Feeding high digestible fibre concentrates	The total fibre content of the feed in the dairy is 12%.
Feeding concentrates little and often to stabilise rumen pH	The cows are fed twice a day when they are milked in the dairy. They each receive approximately 3kg twice a day.
Avoiding high oil by-products such as distillers and brewers grains	Campo Longley does not currently use distillers and brewing grains. We would not recommend their use in the future.
Avoiding whole oil seeds such as full fat soya and whole rape seed	The current feed concentrate contains soya expeller, a by-product from soya processing that is high in protein.
Avoiding fish oil products	Campo Longley doesn't use fish oil products. We would not recommend their use in the future.
Feedings small amounts of a protected fat	Campo Longley does not currently use protected fats in the concentrate feed; however there have been some positive experiences in Australia.

With regards to the factors above only a few apply to Campo Longley, they will be discussed below.

Jersey cows are naturally efficient at digesting fibre. This is because they spend a longer time foraging and ruminating than other breeds of cow. This means that the fibre particles are smaller when they reach the rumen, allowing for greater digestion and more efficient use of fibre. This is one of the main reasons that Jersey milk is higher in fat than others.

There are two mechanisms by which fibre is turned into milk fat. These are De Novo synthesis and direct uptake of fatty acids from the blood. All dairy breeds have a similar uptake of fatty acids directly from the blood. These are long chain fatty acids and come from the small intestine or body fat stores. Where Jersey cows are different from other breeds is in the De Novo synthesis of short chain fatty acids.

De Novo synthesis makes short chain fatty acids in the mammary glands. Jersey cows are well suited to this type of milk fat synthesis and their milk therefore contains a higher proportion of short chain fatty acids than other dairy breeds; thus explaining the higher overall fat percentage. For De Novo synthesis to occur efficiently there must be the correct ratio of acetic acid to propionic acid in the udders. There must also be sufficient butyric acid. The minimum ratio of acetic to propionic acid is 3:1. It has been shown that infusing either acetic or butyric acid leads to an increase in milk fat percentages, whereas infusing propionic acid has the opposite effect. However we are unable to measure the levels of these acids ourselves so cannot be certain that imbalances here are the cause of low fat levels.

High levels of propionic acid also decrease the pH of the rumen, making it too acidic. This can be caused by excessive levels of ruminally available starch in the ration, or from starch that has been treated to increase its availability. Wheat and flaked maize contain large amounts of ruminally available starch. The ration fed to the cows at Campo Longley contains 17% maize and 12% wheat bran. This makes up almost 30% of the total ration and we are concerned that this is slightly high and could be leading to excessive levels of propionic acid in the rumen.

Both acetic acid and butyric acid are produced in the rumen through the digestion of fibre. It is therefore vitally important that the cows at Campo Longley are fed sufficient fibre and that the digestion of fibre is encouraged through a stable rumen pH. We would suggest increasing the amount of fibre fed to the cows at Campo Longley. In particular Neutral Detergent Fibres (NDF) which is a measure of the plant cell wall material that is not soluble in water. The current target for NDF in the ration formula is 25%-30%, however studies have shown that for Jersey cows the optimum milk quality and yield occur at 35-40% dietary NDF.

The final factor that could prove useful at Campo Longley is protected fats. A fat is protected if it cannot be degraded in the rumen of the cow but can still be broken down later in the digestive tract. They can then be directly converted into milk fat. Protected fats can be made up of fatty acids such as palmitic acid, a C16 fatty acid. However there are differences in the fat produced by this method which means that protected fats are not suitable in all cases, such as where milk is used for high quality cream. We believe that, since Campo Longley milk is sold directly to Conaprole and payments depend on fat quantity, this may be something to trial in future.

Analysis of input – Water

Water makes up the largest percentage of milk and is the most important daily requirement of all mammals. Initial observations of the water supply at Campo Longley were not perfect. A number of pastures lacked access to water, in most cases the troughs were there but either not connected or on the wrong side of a fence. However once Cameron and Agnieszka returned, things began to improve.

The original water troughs, tanks and exposed pipes had been destroyed by a large hailstorm the previous year. The repair process has been lengthy however it has provided the opportunity for improvement. Initially, the water for the pastures on the lower half of the farm came from the dam; however this water is of poor quality. The reconnection of troughs has allowed these to be joined to the network of troughs being fed from the bore water at Campo 3. This water is of a much higher quality; the only good quality ground water on the farm, and is therefore more likely to be drunk by the cows. There are plans for another bore hole on Campo 1, however this is to feed the houses and dairy.

Milk yield is closely related to the quality and availability of water. The amount of water that cows require depends on a number of factors, including milk yield, dry matter content in food and temperature. The dry matter content of the ration given in the dairy is 89% and the air temperature is often very high; so the cows at Campo Longley may need up to 70 litres of water if they are producing large volumes of milk early in the lactation. Normally they will require around 50 litres each per day. Cows like to drink in groups so it is important to ensure that there is sufficient trough space; DairyCo recommend 70cm per cow when 10% of the herd drink at once. For example a 150 cow herd requires 10.5 m of total trough space. Campo Longley is slightly down on this level but, improvements are being made. DairyCo also recommend that pasture cows should not have to walk more than 250m to drink. The vast majority of Campo Longley's troughs are within this distance and we do not propose relocating any troughs again.

Experiment - waste concentrate feed

The majority of dairy cows are fed their concentrate ration in the form of a pellet during milking. However at Campo Longley the cows are fed a powdered ration when they are milked. This system has a number of different challenges and complications compared with pellet feeding.

For example, powdered ration is less palatable than pellets. The dry powdery texture of the feed is unpleasant to consume in large quantities without water, which is unavailable in the dairy. This means that the cows cannot consume as much ration as they would if it were pelleted. This

lower intake leads to lower milk outputs and worse body condition as they do not consume as many valuable nutrients that are present in concentrate feed. Furthermore the powdery nature of the feed means that as the cow tries to eat it, some of the food is blown away. Not only does this mean that ration is wasted and the intake is lower, it also creates a mess in the dairy.

Our experiment aims to measure the amount of concentrate ration that is wasted during each milking. To do this we cleaned and emptied the feed bins down one side of the dairy before each milking and measured the residue afterwards. Photo 1 shows the bins prior to cleaning and photo 2 shows them after one milking.



Photo 1

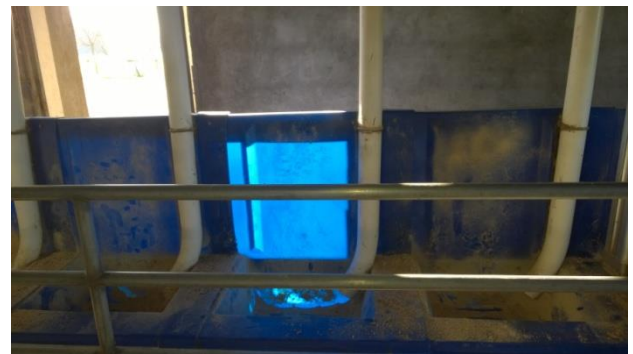


Photo 2

The state of the bins before they were cleaned was not up to the high standards of cleanliness expected and executed around the rest of the farm. Where water has got into the bins the powder had built up and solidified into a lump which in some cases had gone dark and soft, as shown in photos 3 and 4. Whilst we do not know exactly what is in the build up we do not think it right that the cows are eating from bins with this beside them.



Photo 3

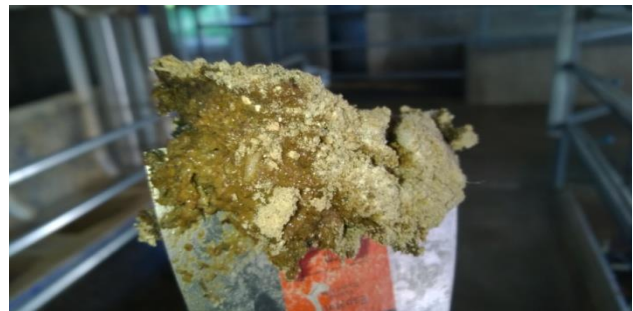


Photo 4

The cleaning also highlighted the surprising amount of wear on the bins themselves. Where the cows have been struggling to eat the powder, the bottoms and backs of the bins have worn down and become very thin. This high level of wear would be very unlikely to occur if the ration were pellets. It is interesting to note that this had previously gone unnoticed because of the layer of dirt on the bins.

After the first milking we used brushes and paint scrapers to clean the bins again. We also swept the floor to ensure we collected as much of the waste feed as possible. However we are well aware that we will not be able to collect the entire waste ration. Some of the powder will be blown away by the drafts and wind and some will be carried out on the cows. Our results are estimates and it is important to remember that the dairy is not a closed environment and that there are outside influences affecting our results.

The experiment lasted 5 days, encompassing ten milking sessions. We hope this repetition will improve the reliability of the results. The results for each session are shown in the table below.

Number of Cows per Milking Session	Total Amount of Ration per Milking Session / Kg	Amount of Waste Ration / Kg	Average Amount of waste per cow /Kg	Percentage Waste	Notes
72	216	24.3	0.34	11%	
72	216	25.1	0.35	12%	
73	219	24.4	0.33	11%	
73	219	32.6	0.45	15%	
72	216	42.5	0.59	20%	
72	216	40.0	0.55	19%	
72	216	22.2	0.31	10%	Grazed area cut by 10 paces, time in dairy increased by 15 mins until end
72	216	11.5	0.16	5%	
72	216	15.5	0.22	7%	1 bin was unable to be counted due to water from cleaning
72	216	11.2	0.16	5%	

The average amount of waste per session was 24.9 kg, per cow this is 346 grams. This equates to 12% of the total ration fed and a daily cost of 220 Uruguayan Pesos or around 10 US dollars for the 72 cows we measured. So the average waste for the whole dairy each session is likely to be around 50kg at a cost of around US\$20, or US\$40 per day.

This experiment was undertaken whilst the cows were eating the best rye grass pasture the farm has to offer. We believe that the levels of waste were so high on some days because the cows were not hungry; there were large amounts of good grass left behind in the pasture. However after the area to be grazed was reduced, the cows were still hungry when they entered the dairy having eaten all the available pasture. This was highlighted by the fact that they walked to the dairy of their own accord, without needing to be fetched.

To further examine the effect of pasture grass on the amount of waste ration the experiment was repeated when the cows moved to a lower quality pasture. The results are shown below:

Number of Cows per Milking Session	Total Amount of Ration per Milking Session / Kg	Amount of Waste Ration / Kg	Average Amount of waste per cow /Kg	Percentage Waste	Notes
73	219	9.0	0.12	4%	
73	219	21.2	0.29	10%	
73	219	28.0	0.38	13%	
73	219	10.9	0.15	5%	
73	219	15.4	0.21	7%	
73	219	14.7	0.20	7%	
73	219	4.5	0.06	2%	Very poor weather
73	219	7.4	0.10	3%	Very poor weather
73	219	6.2	0.08	3%	Very poor weather
73	219	13.9	0.19	6%	

For the 73 cows we looked at the average amount of waste per session was 13.1 kg, per cow this is 180 grams. This equates to 6% of the total ration fed and a cost of 116 Uruguayan Pesos or around 5 US dollars. This is around half as much as when the cows were on the better pasture. This shows that when the cows are getting less energy from the pasture they will eat more concentrate feed. Consumption is further increased when the weather is bad and they need more energy to keep warm.

Our experimental procedure was inconsistent at best and we are therefore very cautious in making any recommendations based upon these results. However the practice of cleaning and attempting to sustain clean feed bins was enlightening. For example the high level of wear we found on the bins that was concealed by the leftover feed and build ups. If this had gone unnoticed it could have posed a serious problem when the plastic eventually wore through. A clear solution to this problem is to install stainless steel inserts into the bins to prevent the plastic wearing away. This will be a simple and cost effective solution to a potentially difficult problem. Another, perhaps obvious, finding was the difficulty in maintaining cleanliness in and around the feed bins. The powder contains very fine particles of dust which quickly become caked onto the plastic. This problem is made worse by careless cleaning of the dairy, wetting the bins. Once caked on this dust is very difficult to remove and could be a breeding ground for bacteria. Our best suggestion to prevent this sort of build up is a regular brushing of the sides and flat areas around the bin, which are most prone to these build ups, as well as a thorough cleaning less often, perhaps once a month. This is unlikely

to be a popular solution and as long as powder feed is used extra cleaning will be required. One other suggestion was to drill holes in the bottoms of the bins to allow them to be hosed clean; the holes would be plugged during feeding. This idea may be feasible when there is little waste; however when levels are as high as we have seen it would be both impractical and wasteful as the cows at the next milking eat some of the leftovers from the previous session.

Overall this experiment has shown the need for careful consideration of the effects that the amount and quality of pasture grass available has on the consumption of concentrate feed in the dairy. It has also shown the need for inserts in the bins to prevent excessive wear and highlighted the difficulties that powder feed brings to cleaning. It has not shown that the powdered feed is wasted in quantities large enough for us to recommend changing to pellets on these grounds alone. However when combined with the difficulties powdered feed poses to cleanliness, the increased wear on the bins and the lower palatability reducing feed intake; we can be sure that a move to pellets, when possible, would benefit the farm.

Conclusion

Our overall impression of Campo Longley is of progress. There has been much improvement in the last year; even during our short stay we have seen some steps taken, such as the new holding yards. However there are still improvements needed to make Campo Longley the best dairy in Uruguay. The level of fat in the milk is below target levels and this year the farm has lacked large amounts of high quality forage, although some of the rye grass on Campo 1 is performing very well. However we feel sure that improvements here will come with time, with more land being planted with better pasture each year as well as a move to more perennial pastures.

Water on Campo Longley has been a long term problem; the lack of potable water from boreholes makes it difficult to maintain a sufficient supply of high quality water. However a clever system of gravity fed troughs is making the best of the situation on Campo 1 and further investigation will hopefully yield better results elsewhere. Until then we are unable to make any recommendations although we would like to stress how important access to water is for the animals, particularly in the summer months.

Our experience of cleaning the concentrate feed bins proved both difficult and interesting. We found more than we first expected, with the levels of wear and cleanliness problems adding to findings about the amount of waste during milking. This was, in the end, perhaps more useful than actually determining the amount of waste; which, although considerable, was not high enough to lead us to recommend changing to pellets for solely this reason. Although we are sure that when possible, a move to pellets would be beneficial.

We would like to thank everyone at Campo Longley and Longley Farm for giving us this wonderful opportunity and for being so kind and helpful throughout. It has been a thoroughly enjoyable and interesting experience, one which we will never forget. We just hope that we have been of some use.

Andrew Baker & Grace Howarth