Farmers Club Charitable Trust Agricultural Educators Award 2014

Dr Nicola Blackie

Technology, Cow Comfort and Cooling - what we can learn from Kentucky Dairy Farms

The following report documents my visit to Kentucky 5th July to 2nd August 2014 using the Farmers Club Agricultural Educators Award funding.

During my visit I was based at the University of Kentucky in Lexington and became part of the UK Dairy Science Programme as a visiting researcher.

I arrived on the Saturday and was on my first farm on the Monday which was in Western Kentucky which was several hours drive from Lexington (first of many road trips). We were visiting the farm to evaluate it for the SQMI – Southeast Quality Milk Initiative, as part of this; 93 farms across Kentucky will be assessed for parameters which may influence milk quality such as housing, milking machine performance, milking routine, cow condition and many more. This is a large scale project which is designed to improve the milk quality in the region, somatic cell counts (SCC) and level of milk production have been identified as areas which require improvement in the south east of the United States. SCC legal limits are considerably higher in the United States with the US legal limit for SCC in raw milk current regulatory limit being 750,000/ml, this is in contrast with the UK where milk with an SCC of more than 400,000/ml is deemed unfit for human consumption by the European Union. As a result of this more US producers are aiming for lower SCC levels to allow them to export to European markets. Currently the vast majority of herds with a SCC above 400,000/ml are located in the SE region of the United States as a this initiative has been set up to help farmers to improve their milk quality. As part of this visit and another subsequent visit I was involved with collecting data, this included locomotion scoring and cubicle measurements. This farm was quite small with only 30 cross-bred cattle; the average herd size in Kentucky is slightly smaller than that of the UK with an average herd size of 91 cows (US Dairy Statistics, 2013) compared to 125.

Following this visit I was invited to an annual meeting in Western Kentucky hosted by the KDDC – Kentucky Dairy Development Council. This meeting was held at an agricultural supply store and located in an Amish area; the store did not have any electricity so a generator had to be brought in to power the laptop and projector. A series of talks were presented by Extension staff from the University of Kentucky including subjects such as cow comfort and nutrition, I was invited to give a talk on the UK dairy industry which was well received with a lot of interest from the local farmers, and they were particularly interested

in what types of forage we use. During this visit photography was restricted however, I did get a couple of pictures.

Plate 1: Arrival of farmers to the meeting

There was a huge turnout with well over 150 people and this did not count the children (there were a considerable number). The children had a program of activities which ran in parallel with the technical sessions which were run by the graduate students from the University. This was mainly for the older children who were taught about Mastitis as children under the age of 5/6 years old do not speak English, they speak Dutch until they go to school.

We then moved to the owners farm for a practical session on body condition scoring, locomotion scoring and cleanliness assessments. This farm had a tie stall barn with no electricity used.

Plate 2 and 3: Cleanliness scoring practical sessions, note the propane lamps on the left for light

This farm used Tunnel ventilation to cool the cows and had big fans at one end moving the air; it was quite cool in with the cows. The fans are driven by a diesel engine which also runs the milking units of which he has 6. When we visited there were 63 cows in milk and 2 dry. Production was 65 lb/cow/day (29kg/cow/day), they had quite a few in late lactation when we visited.

Plate 4: Cows in tie stall barn with tunnel ventilation

The owner of this farm had an ingenious invention to create a TMR, he had invented a device that added the feed in layers which was then mixed through an auger to create a mixed ration which was taken to the cows in a barrow – all very labour intensive, and the diets are based on Alfalfa hay.

On the way back from the meeting Dave from the KDDC showed us a few farms with exciting new additions to improve cow comfort and keep them cool. Heat stress is quite an issue in Kentucky with approximately 125 heat stress days a year. Therefore keeping cows cool is key; I wonder how many heat stress days we get in the UK? I suspect it's more than we think given the changing nature of weather

The first farm had new gel mats for added cow comfort, I believe they are a step up from waterbeds. The beds were really soft and passed the knee test (if you are happy to drop to your knees in the stall then it's going to be comfortable for the cows).

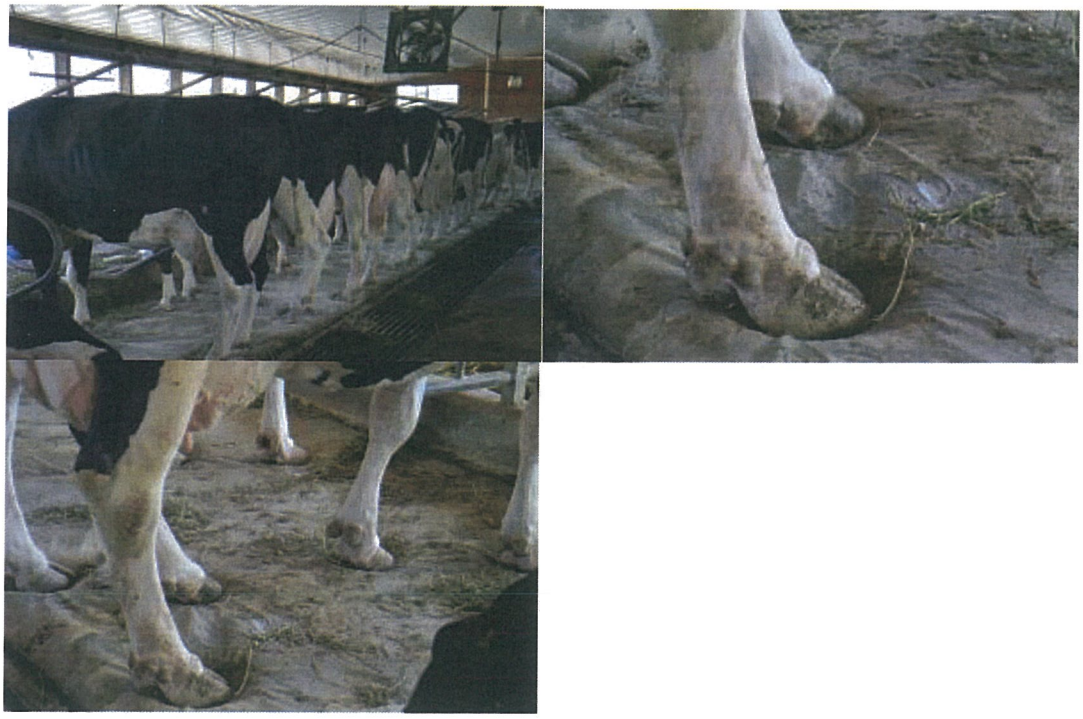


Plate 5-7: Gel Mattresses in a tie stall barn

These were pretty impressive mats, they have not been in long – will be interesting to see if they get an improvement in cow comfort and/or production in the long run. This farm had also installed a new fan/ sprinkler system as well to improve cow cooling.

Plate 8: Sprinkler/ fan system

This farm had no electricity and as such ran the fans with hydro-electricity

Plate 9-11: Fan system and feeding

The next farm we visited had also put new (more powerful) fans, this farm was not run by Amish, these farmers were Mennonite who allow the use of electricity and they use tractors, although they have steel wheels so cannot be used for transport on the road.

Plate 12-14: Slightly different ventilation system which was newly added

The fans are attached to a control panel which adjusts the fans according to temperature and humidity. There were fans at the other end of the barn to create tunnel ventilation.

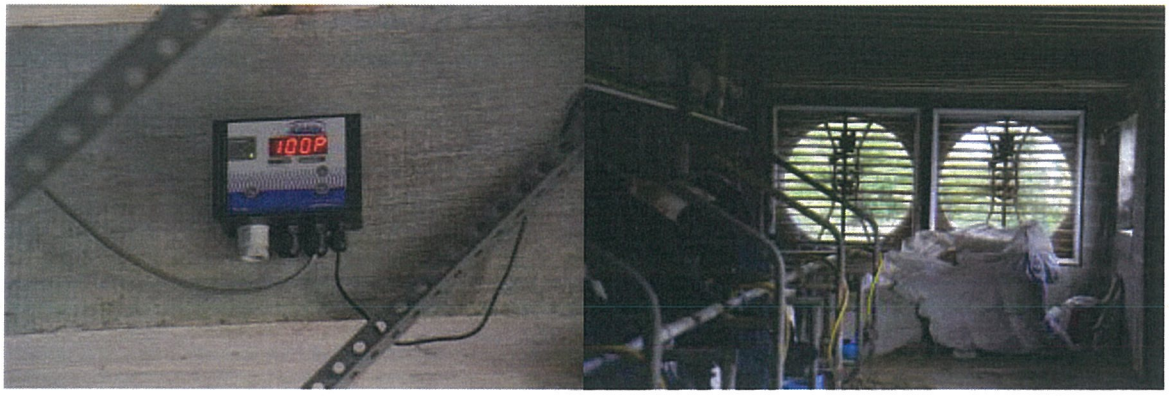


Plate 15-16: Control panel and large fans at the end of the building to create the tunnel effect

This farm had good production and was averaging 77lbs/cow/day (34kg/cow/day). The farmer believed that the addition of the fan system had a positive impact on production and he expected to see less of a drop in production in the hot months as a result.

The next farm we visited had a completely different form of cooling and had installed evaporative cooling cells which are similar to air conditioning. It was really cool in this building, again fans at the opposite end pull the cool air through the barn.

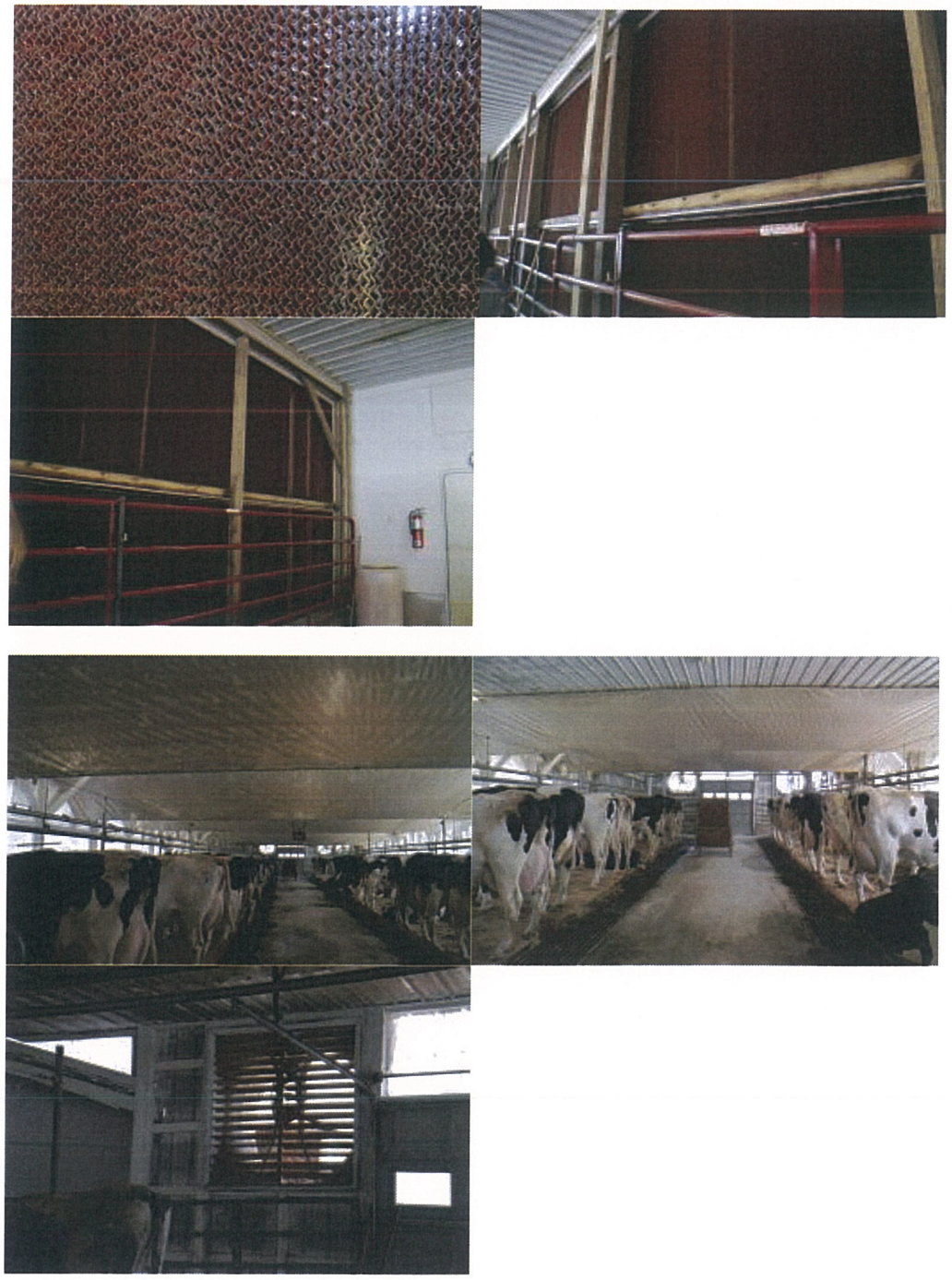


Plate 17 – 22: Evaporate cooling system

The farmer has also installed baffles to drop the cool air onto the cows

Plate 23: Baffles which drop cool air onto the backs of the cows

Again the production was very good with an average of 24000lb/cow/year (10886kg).

These farms gave me an excellent insight into cow cooling and comfort over a range of situations.

Compost Pack Barns:

Compost Pack Barns are an alternative loose housing system for dairy cattle. I thought I was going to see a version of a straw yard so what I found was actually quite different. These barns need really good ventilation and management to work well, this farm certainly managed their pack very well. It should be based on an aerobic composting process and depending on the care and weather can last a long time.

Plate 24-25: Compost Pack Barn system

To start the pack 1-1.5ft of wood shavings are added and then bedding is aerated to a depth of 8-10 inches twice daily to incorporate any faeces and to ensure that air is added to the compost to make sure it compost's efficiently. This ensures the cows stay clean, I certainly would have expected the cows to be dirty which they were not.

On this farm a modified cultivator was used which had sub-soiling legs on it to work the bedding deeper and make it comfortable for the cows.

Plate 26-27: Cultivator used to add oxygen to the compost system

There is a lot of interesting research being done on this kind of housing both in Minnesota and at the University of Kentucky, this research is surrounding production and health implications.

These cows were cooled using "Big Ass Fans" which are huge and really quiet. When we arrived the cows had been let out to pasture but it was starting to get hot so they were starting to make their way back to the barn.

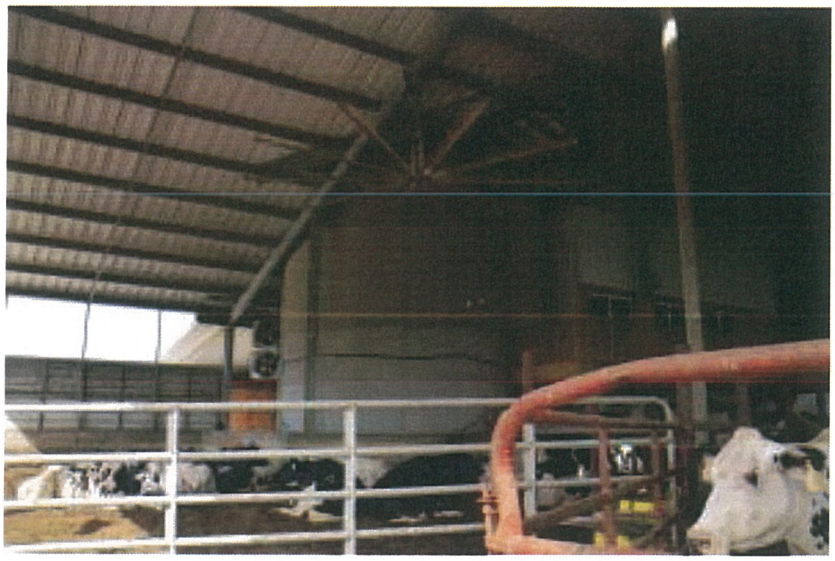
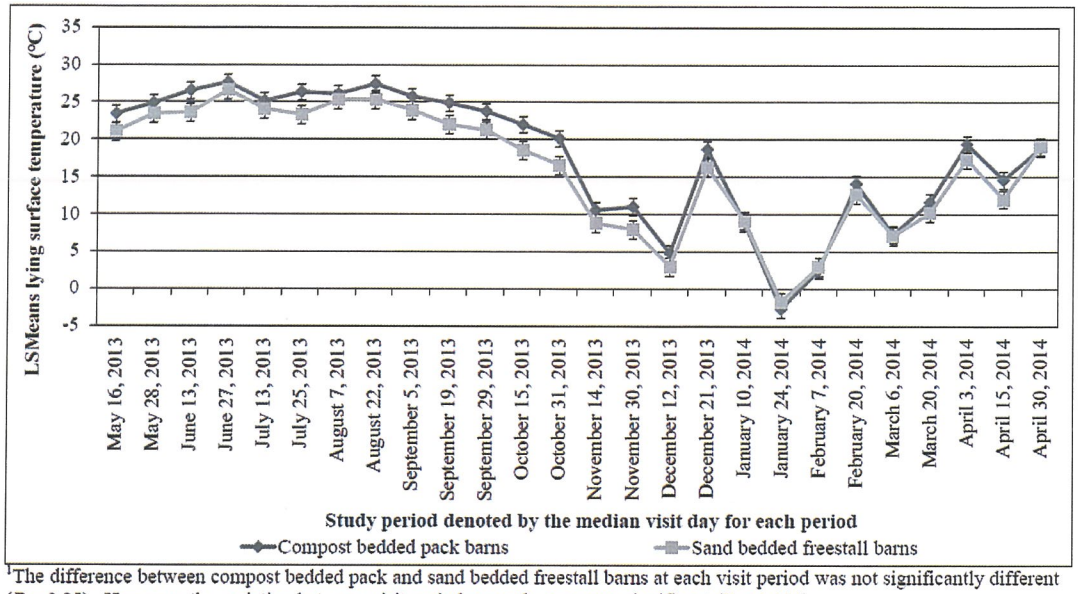


Plate 28: Big Ass Fan

The compost pack barn is an interesting concept and it would be interesting to know if it would work in the UK given our humid and damp weather. It is really different to a deep bedding system although the researchers tell me it is easy to get wrong and does require considerable skill to produce the compost. Research conducted during 26 visits periods from May 2013 to May 2014 for 8 compost bedded pack and 6 sand bedded freestall barns in Kentucky showed no significant differences between the housing systems for locomotion score, hock score or hygiene scores (Eckelkamp, 2014). Similarly this research showed no significant difference in herd SSC or reported incidence of clinical mastitis (Eckelkamp, 2014) which is promising for this alternative housing system. The fact that this system uses compost has lead to farmers suggesting the bed might be hotter than a sand based system however research by Eckelkamp (2014) showed this not to be true across the farms in Kentucky assessed (See Figure 1)



[1]The difference between compost bedded pack and sand bedded freestall barns at each visit period was not significantly different ($P = 0.95$). However, the variation between visit periods over the year was significant ($P < 0.001$).

Figure 1: Surface temperature of bedding in compost pack barns vs. sand bedded cubicles (Eckelkamp, 2014)

It has also been noted that cows show more variation in lying positions on the compost pack system with it appearing that they display more REM sleep which is being investigated currently by students at the University of Kentucky at the moment. Further a survey into farms using Compost Pack Bedding systems demonstrated the producers felt that "cow comfort", "cow cleanliness", and the "low-maintenance nature of the system" were the benefits they enjoyed (Black et al, 2013). This system also has the advantage that cows can perform natural behaviours such as caudal licking and ear scratching which can sometimes be difficult in cubicle (freestall) systems due to slippery conditions underfoot (Plate 29).

Plate 29: Cow scratching in a compost pack barn

There has been a wealth of research undertaken at the University of Kentucky and some of the management considerations are given in this document which features a number of the farms I visited http://www2.ca.uky.edu/agc/pubs/id/id206/id206.pdf.

Conference and Farm Visits:

As part of my visit I went to the American Dairy Association Annual Conference in Kansas City, this was the biggest conference I have ever been to. There were so many sessions that it took military planning to see what I wanted to. I joined in on a pre-conference tour to a Heins Family Farm – Higginsville Missouri this was a very new farm, they relocated to the site in 2009 after spending 2 years building the dairy on a new site. They went from a small dairy and pig farm to the one we visited which is milking around 650 cows.

The site has been designed in such a way that if they want to they can expand up to 2000 cows. The infrastructure and space is already there in case they choose to expand. They are the biggest farm in the area with most herds in Missouri being around 100 cows. There are 25 people on the pay role with 15 being full time and the rest being seasonal and college students etc. The owner is heavily focused on staff incentive and retention with substantial bonuses offered for good performance. The production was very good with an average milk yield of 79-80 lbs/cow/day (around 36 litres/cow/day). Cows are milked 3 times daily.

The cows are managed in large airy buildings with sprinkler/ fan cooling and have sand based free-stalls (cubicles).

Plate 30- 33: Hiens Family Farm cow housing

The cows are zero grazed as the land is quite heavy and can get pretty wet and they are concerned about the level of compaction from that number of animals. The diets are based on maize (corn) silage and rye silage (something I had not heard about). The reason they use maize and rye is the fact they can double crop which is pretty intensive! The crops are irrigated with the water collected from the sand reclamation/ yard cleaning system.

They used to use contractors for the silage making but found that that often meant it was made at a less than optimal time as they did not have control so they have now purchased the relevant kit to do it themselves. The diets were based around Rye and Maize silage. The size of the operation allows them to buy in bulk feed.

The yards are not scraped – I quickly realised there are not many automatic scrapers in the parts of America I have visited. On this farm the yards are flushed with water (quite a lot and under pressure) 12 times daily. The entire site is sloped slightly to the back of the buildings to help with this, the system they use is extremely well designed and relatively simple in that it does not rely much on mechanics which is just as well given the wearing nature of sand.

Yard flushing:

Plate 34-36: Water under pressure flushing the yards

This mixture of water, sand and manure flows to the end of the building where some clever engineering separates the three. Using this system they can reclaim around 95% of the sand they use. It's hard to describe but the water flows out of the building towards a block work holding area, this acts a bit like a beach with the sand being washed to the side and the

water/ manure ends up in the holding area where the manure is washed to the end and the water then slowly seeps through the blocks into a lagoon where it is pumped back to the flush tank or used to irrigate crops.

Plate 37: Water flowing out the sheds – note the sand collecting at the sides

Plate 38: Water flows down into the holding pen

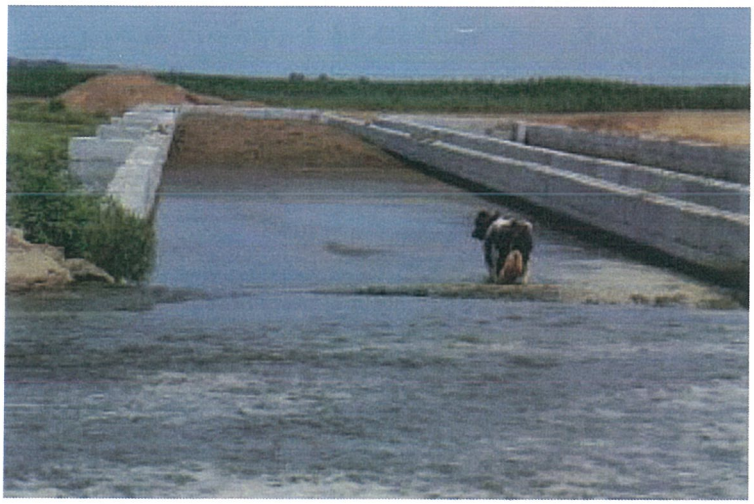


Plate 39: Water flowing into the holding pen

The cow in the picture had got out and decided to cool off! I could not get a picture without her. The manure is collecting at the far end and then the water seeps out

Plate 40: As the water slows down the sand settles out

This system is hard to explain but I was impressed with the level of engineering. The farm has their sand tested and it has acceptable dry matter and a low organic material content so is ok to reuse to bed the cubicles with – quite mind blowing how it all works!

Fair Oaks Farms:

One of the grad students and I travelled to Indiana to Fair Oaks farm a huge agri-tourism business. They have 30,000 dairy cattle and an 8000 sow breeding unit with visitor centre and farm tours.

Fair Oaks is a huge operation which I believe have been open since 2004. They have 11 units which involve 36,000 animals with around 29,000 cows in milk. We tried to get to see a bit more of the technical side but it was not possible so we went on the public tour which was really good but meant it was hard to take pictures through glass of the bus! Biosecurity was clearly very important to them and it really needs to be with the number of cows involved in their operations.

We visited one of the units which had around 3000 cows on it. It was hard to get a photo to show just how huge the buildings were!

Plate 41-43: Fair Oaks farm

The farm has cubicle (freestall) housing with sand bedding. Similar to the farm I visited in Missouri, they flood the yards to clean them. They then separate the sand for reuse, manure for fertiliser and for the anaerobic digesters which create enough energy to run the farm.

Plate 44-45: Anaerobic Digesters and manure separators

The cows are milked 3 times daily in a 72 point rotary parlor which was pretty impressive! The cows were really calm and most of them were actually chewing the cud as they travelled round! The milk nearly 24 hours per day with a one hour gap for cleaning in between each session. The cows are stripped, pre-dipped and dried before the units are put on.

Plate 46-49: Milking parlor at Fair Oaks

We were then driven through one of the yards of cows, can't quite remember but think the guide said it was 1/4 of a mile long! (excuse the reflections off the glass).

Plate 50-52: Cow housing at Fair Oaks

After the tour we went back to the main area which has a "birthing barn" were they have cows calving live, there is a traffic light outside it with red = nothing happening, amber = feet and green = feet/head hurry up!

The cows are brought to the birthing barn just before calving, I was not too sure about this practice as I guess I am not used to cows being moved that close to calving in the UK. However, the last two farms I have visited have moved cows really close to birth. We were lucky enough to see a calf being born which was cool (even though I have seen it lots of times before!). There is someone there all the time, the audience is encouraged to stay seated and be quiet and if required the member of staff will assist.

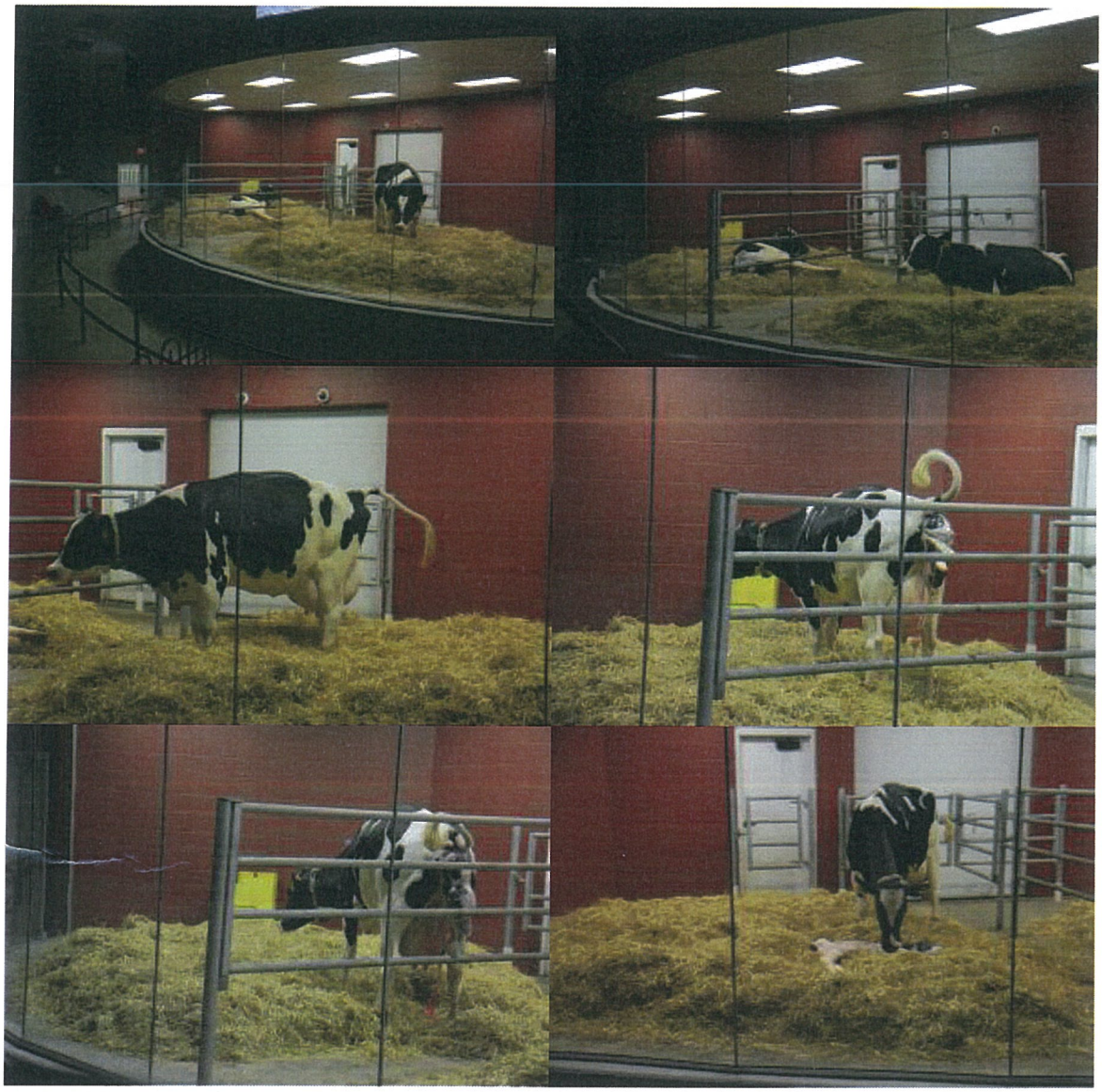


Plate 53-58: Birthing barn, an interesting tourist attraction

Kentuckiana:

Kentuckiana is an annual dairy exchange arranged through the University of Kentucky and Purdue in Indiana. Producers from both states join together for a number of farm visits and presentations over the course of 2 days. This year Kentucky was hosting and we went to Taylor and Adair counties about 2 hours away from the University. It started just after lunch and we visited two farms in the afternoon.

The first dairy was Tony and Ben Compton's farm. They were recognised at the 2013 Kentucky State Fair for producing the highest quality milk in Kentucky. They have 200 cows and have a somatic cell count (SSC) of 70/80,000 which is excellent. They have a rolling herd average of 26,000lbs of milk/cow/year (10,000 litres).

They have free stall barn (cubicles) bedded with very fine sawdust, this building is quite new as they have only fairly recently converted from a pasture based system.

Plate 59-60: Tony and Ben Compton's Farm

Above are some pictures (Plate 59-60) of the free stall barn, a number of producers were interested as to why the white curtains were not raised and were quite surprised due to the hot weather. Tony explained he never had them up as there is quite a strong wind that blows through the barn and the fans keep the cows cool.

Cows were fed a corn silage based ration and milked twice daily. The cows seemed quite comfortable in the cubicles however; it seems the bedding they use is quite dusty so most of the cows were grey not black!

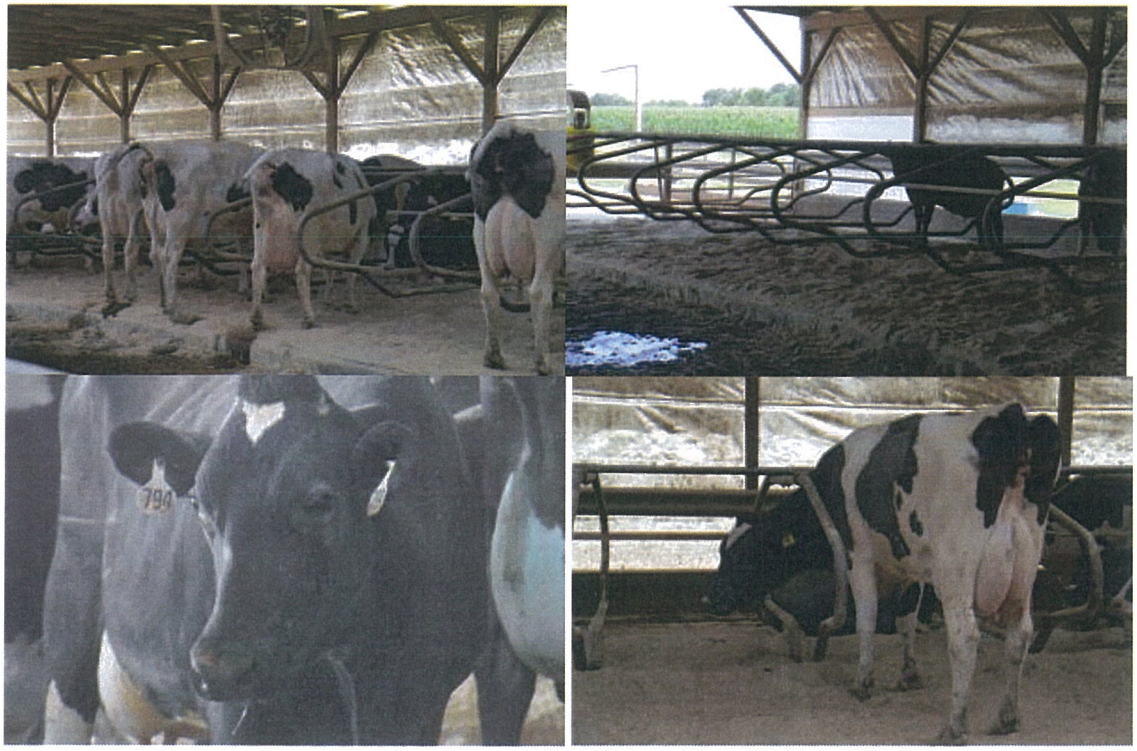


Plate 61-66: Cows in the new cubicle system

Notice some of the cows have their tails docked, this is done to improve cow cleanliness, not all producers do it and it's not done at all in the UK. Research done at the University of Kentucky have shown no benefit of docking on cow cleanliness and found these cows show more fly avoidance behaviors (Morabito et al, 2014).

Farm number 2 was Hutchison's Farm, Hutchison Holsteins have 150 pedigree registered cows went up to 3 time a day milking in early 2013 which has helped along with the instillation of waterbeds and the SEA cow scout system to improve production from 22,000lbs/cow/year to over 28,000lbs/cow/year (12,700 litres!!). The SSC at this farm was also really low at 160,000.

The farm has had some changes over the years from a pasture based system that utilised Alfalfa silage to one that uses almost all corn silage now.

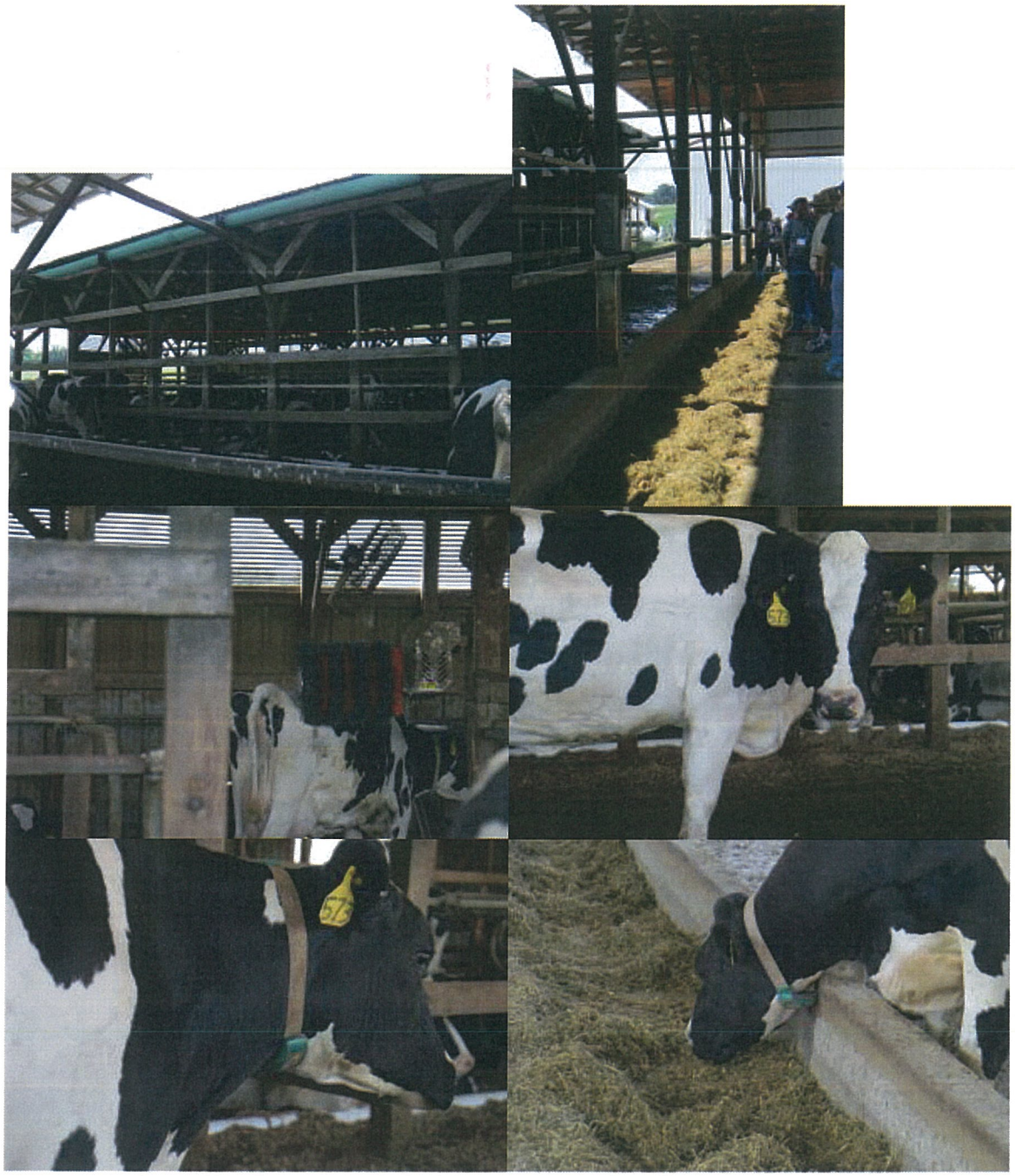


Plate 67-72: Hutchison's Farm

The green tags on the collar are the cow scout system for heat detection. They have also added rubber flooring to the alley ways to improve cow comfort. This farm was really impressive in terms of production and cow comfort. That evening I was the invited speaker for the events dinner, what an honor and a great bunch of farmers to speak for, an article written following the event can be found here

http://www.progressivedairy.com/news/progressive-events/12600-kentuckiana-dairy-exchange-offers-perspectives-on-lameness-exports.

Day 2 started at 7:30am as we had three farms to see before lunch. Farm one was Corbin dairy which have 300 cows in milk and a rolling herd average of 26,000lbs/cow/year (11,800 litres). This farm has both sand freestalls and compost bedded pack barns. This farm has been involved in a research trial using the AfiMilk heat detection system in comparison to synchronisation which has improved fertility, heat detection is currently around 63%. The farm is currently expanding with the numbers of heifers being brought in exceeding the cull rate.

The freestalls were well designed and had a good access to water for the cows, huge troughs. The reason for the lid over the water trough was to discourage algae growth.


Plate 73-74: Water troughs

Housing is shown below; they had both sand based freestalls and a compost pack barn. Sand is used as its cheap at $10/ton. The compost barn is managed slightly differently than others as they add sawdust every other day and its then stirred twice the next day morning and night with a tiller to incorporate it. Cow cooling was done through the use of sprinklers and fans.


Plate 75-76: Cattle Housing

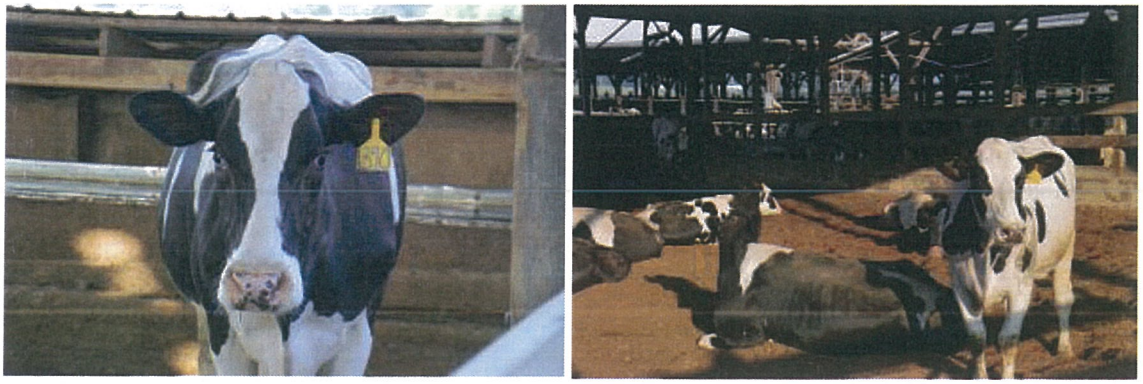


Plate 77-78: Compost barn

Next we went to see the new calf feeder which they have only had for a few weeks, it's a computer fed system with calves fed milk replacer and stepped up to around 7.3 litres per day before being stepped down to encourage solid feed intake. The calves were really clean and content and it was good to see he weighed the calves at the start and end of the milk-fed phase to monitor growth.

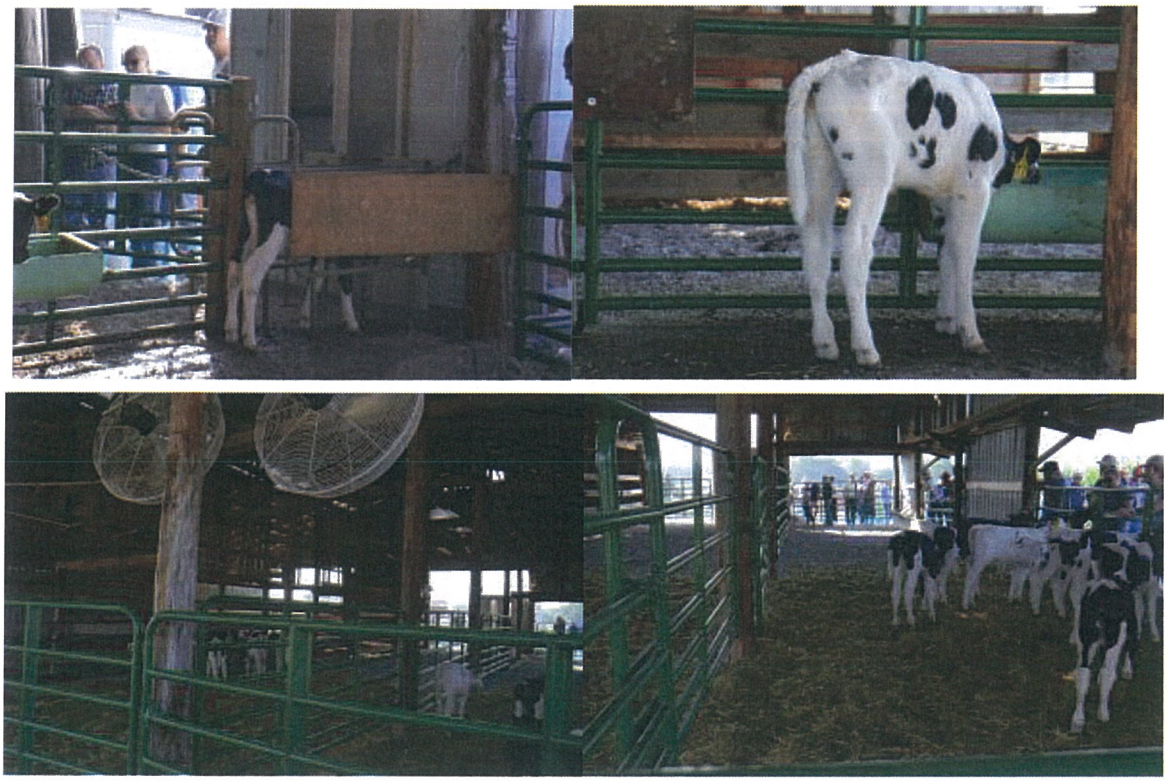


Plate 79-82: Computer calf feeder

The calves had fans too to keep them cool. The farmer seems really happy with the new system and it would be interesting to see if it improves his growth rates at all from the previous system which was individual hutches.

Next stop was Sidebottom Dairy who were winners of 2013 farm of the year competition. They are first generation farmers which is now managed between father and son. They milk 250 cows with a herd average of 22,000lbs/cow/year (10,000 litres), milked through a brand new GEA milking parlor. They started in 1985 with 15 cows and have built the business from there.

Again this farm combined housing systems with freestalls and a bedded pack system. This was not a compost pack as the sawdust is kiln dried it does not heat and they do not stir the pack. They add bedding every other day, they hope to expand by another 200 cows but feel it will be on freestalls as they do not have the space for another bedded back system and also cost and availability of sawdust is a limiting factor. They like to have a combination of housing systems as some cows do better on one rather than the other so they have the flexibility to do what is best for the cows. They also feel there is no difference between the types of housing with mastitis level and SSC being similar and the herd SSC being around 200,000.

Plate 83-86: Sidebottom dairy housing

This farm used to be 3 times daily milking but due to them finding it hard to find labour willing to do the night milking they have changed to 2 times daily milking with exception of the fresh cows who are milked 4 times daily. These cows are milked at the start and end of milking with about 4 hours between these milkings, later in lactation they go back down to 2 times a day. Cows are grouped by age not by stage of lactation to minimize how often cows

change groups as they feel changing groups has a negative impact on production. This is an interesting concept that is subject to a lot of research at the moment.

Calves were managed in hutches and all bottle fed, they used to be bucket fed but there were issues with Salmonella scours due to issues with getting everyone to clean to the same level. Now all the bottles go in the dishwasher to clean!! I thought this was a pretty good idea teats on the top and bottles on the bottom! The calves here looked really good, again some were tethered and some had pens.

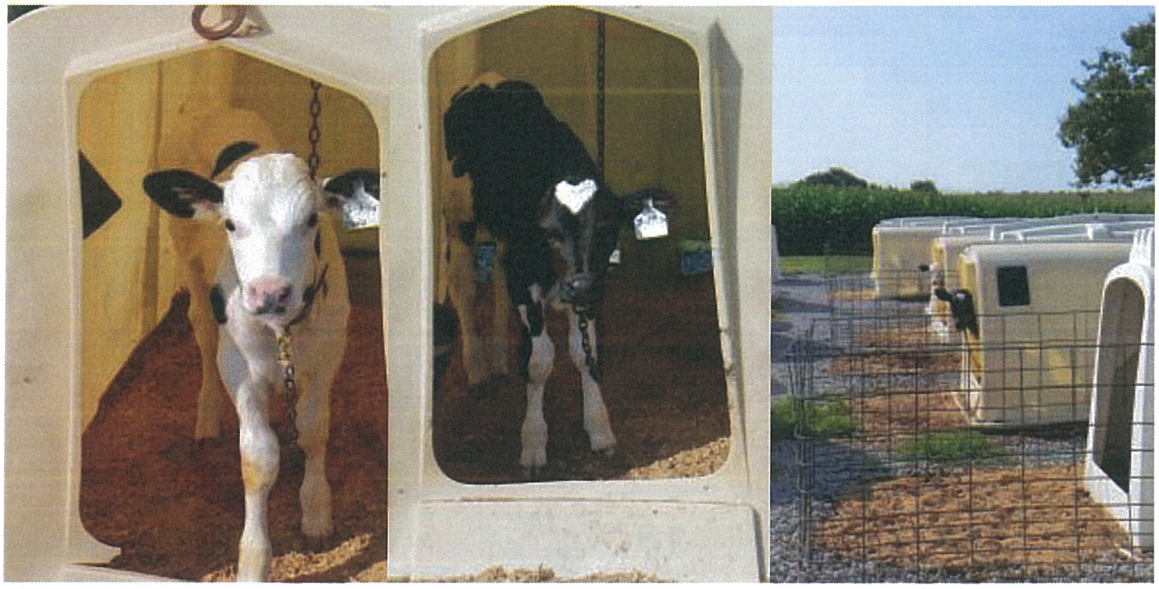


Plate 87-90: Calf housing, the hutches were raised to increase ventilation when it is hot.

There was a lot of research at the ADSA meeting about covers for the hutches to keep calves warm in the winter and cool in the summer, really interesting stuff.

The final farm was the Cowherd Farm, they milk 200 cows with a rolling average of 24,000lbs/cow/year (10,900 litres). This farm had a compost pack barn and also have a farm equipment business. This farm also had a new calf barn with automatic feeders.

They manage their compost pack slightly differently than others and add a lot more sawdust but they have access to cheap sawdust. I am not sure how often they mixed it. Cows again were cooled by fans and had sprinklers over the feed bunk.



Plate 91-93: Compost system at Cowherd Farm, the tractor and cultivator above was used to mix the compost.

Oestrus detection was done via activity monitor and I noticed some cows had the "scratch cards" which the silver coating gets removed as the cows are mounted:

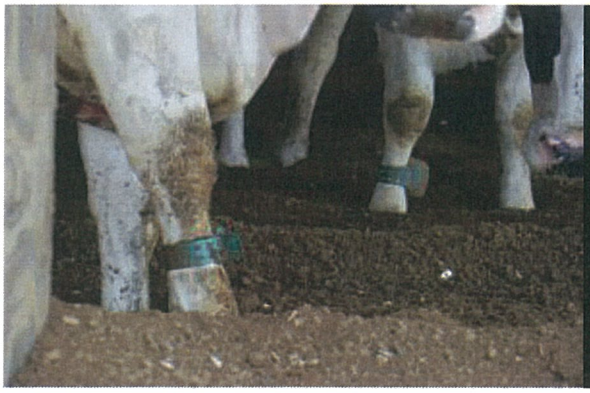



Plate 94-95: Oestrus detection

Research Project:

As part of my visit I also conducted a research project, the majority of data have been analysed however, it is hoped to investigate the data further before publication.

The following research was undertaken from the 14th to 18th July 2014:

Background:

It has been well documented that lameness influences lying behaviour with the majority of studies showing an increase in lying behaviour (Blackie et al., 2011a; Blackie et al., 2011b; Galindo et al., 2000; Galindo and Broom, 2002; Hassall et al., 1993; Singh et al., 1993; Walker et al., 2008). The converse was seen in the study of Cook et al. (2004) where lame cows spent less time lying down.

Feeding behaviour is also affected by lameness, where Lame cows have been shown to change the location of feeding; lame cows chose to visit the feed troughs closer to the milking machine (Bach *et al.* 2007). Similarly, Margerison *et al.* (2002) have also shown that lame cows consume significantly fewer meals per day and have larger meals over a shorter time. Lameness did not significantly affect dry matter intake in this trial (Margerison *et al.* 2002). A recent study has used feeding behaviour to try and predict lameness (Gonzalez *et al.* 2008). Acute lameness was shown to decrease feed intake and feeding time slightly which was accompanied with an increase in feeding rate for around 7 days before onset of acute lameness (Gonzalez *et al.* 2008). There were also changes in feeding behaviour for chronic lameness compared to non-lame cows (Gonzalez *et al.*, 2008). Feeding time has also been shown to be not different between lame and non-lame cows (Galindo and Broom 2002; Cook *et al.* 2004). However, lame grazing cows have been shown to spend significantly less time grazing than non-lame cows (Hassall *et al.* 1993)

As well as lameness social rank may also influence feeding behaviour, for example Melin et al. (2007) noted that low social rank cows spend 39 minutes per day less time feeding than those with a high social rank (175 mins/d Vs. 214 mins/d, respectively).

The study of Blackie et al. (2011b) demonstrated that lame cows may alter their lying/ standing behaviour patterns throughout the day. During this study it was thought that the cows may have been feeding at different times to avoid social conflict although it was not possible to ascertain this from the data collected.

Therefore, the aim of this study was to investigate the relationship between lying and feeding behaviour in lame and non-lame cattle and relate these findings to social rank.

Methods:

Forty-three cattle from the University of Kentucky Dairy were recruited onto the study, they were 242 ± 17.8 days in milk and were all housed in a freestall with access to a feed bunk. Each cow was fitted with an IceQube™ monitor which gives time spend standing, lying, motion index, length and frequency of lying bouts and step count. The cows will also have another sensor attached which can measure feeding behaviour (Cow Manager SensOor).

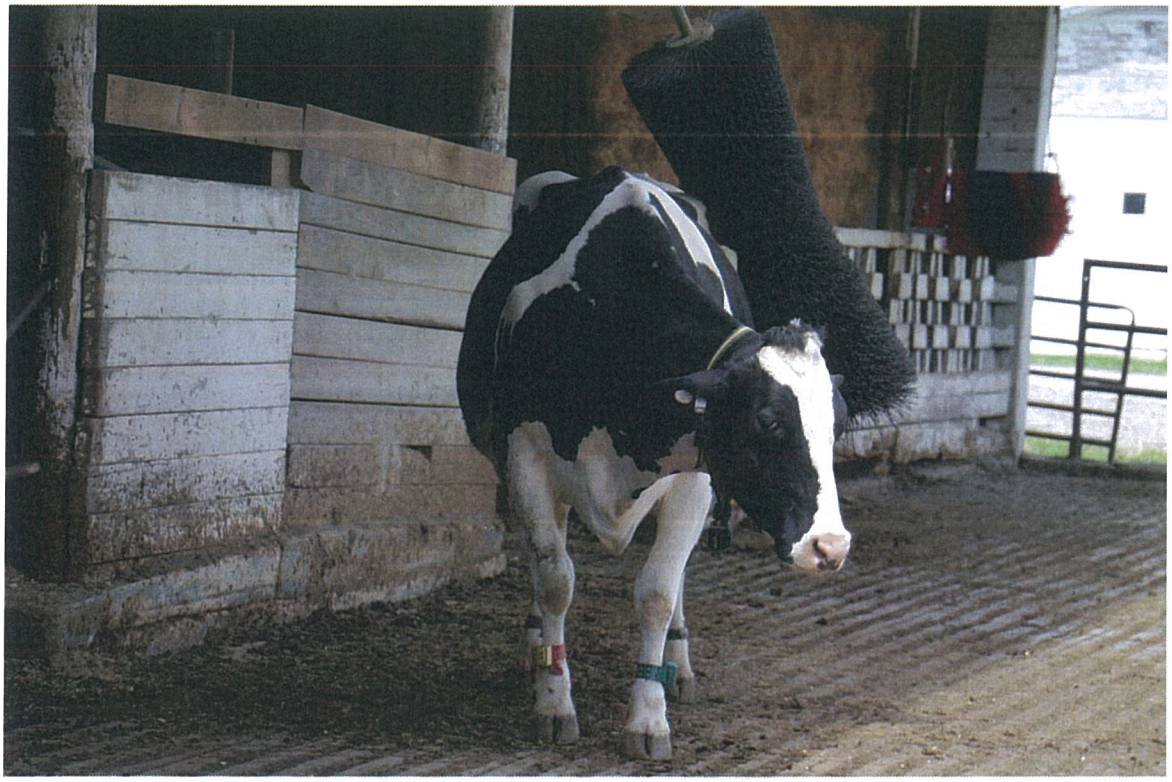


Plate 96: Experimental cow with sensors in place

All the cattle in the University of Kentucky herd have a number of technologies attached (Plate 96), these monitor different aspects of health and behaviour and are utilised as part of a large-scale ongoing project involving a large number of postgraduate researchers.

The cattle were locomotion scored at the start of the experiment, this will allow the cows to be categorised into lameness categories for analysis, using previous records it may be possible to further sub-divide cattle into those that are chronically lame and those that are newly lame. Cows were assessed for social dominance through assessment of displacements from the feed face, the initiator and receiver will be noted through visual observations and a dominance index was calculated (Galindo and Broom, 2000; Galindo et al, 2000; Val-Laillet et al, 2008a; Val-Laillet et al, 2008b). For analysis cows were then be categorised into high-ranking (index <0.6), middle ranking (0.4 to 0.6 index) or low ranking (index <0.4) (Galindo and Broom 2000). Some cows did not have enough interactions to calculate their rank (n= 8) the remaining were assigned high (n= 12), mid (n=11) or low (n=12) rank.

Data were collated and analysed using one-way Analysis of Variance using Genstat (17th Edition, VSN International Ltd).

Results:

Within the study population there were few lame animals and no significant difference in gait score, age or lactation number was found between the social rank groups. Table 1 shows the results of the study.

Table 1: Relationship between social rank and lying/ eating behaviour in Holstein dairy cattle

Parameter	Low (n=12)	Mid (n=11)	High (n=12)	SED	P-Value
Lying hours/day	10.23	11.70	10.22	0.755	0.098
Standing hours/day	13.77	12.30	13.78	0.755	0.098
Steps/ day	1502	1373	1106	309.2	0.426
Lying bouts/ day	18.3	17.9	17.6	2.25	0.963
Feeding hours/ day	3.61	3.48	3.42	0.638	0.955
Ruminating hours/ day	9.05	9.30	8.65	0.978	0.801

There were no significant differences between social rank and steps/day nor lying bouts/ day. There was a statistical tendency for mid ranking cows to have longer lying times and shorted standing times. Feeding and ruminating times were not affected by social rank.

Although there were no significant differences in step count the low ranking cows showed higher step counts compared to mid or high ranking cows.

Discussion:

No significant effect of feeding time was found between cows of differing social rank converse to these Val-Laillet et al (2008b) found that high ranking cows spent more time at the feeder than low ranking cows. Similarly Melin et al. (2007) found low ranking cows spend less time feeding. Further exploration of the data collected in the present study may give more insight into the times, frequency and length of meal bouts. In agreement with the present study, Lobeck-Luchterhand et al (2015) noted no relationship between social rank and feeding time in primiparous and multiparous Jersey cattle at different stocking density's with the exception of mid ranking cows at 100% stocking rate.

Displacements were assessed in the present study during fresh feed delivery and there is evidence that different resources my result in differing classifications e.g. brush, lying stall and feed bunk however, it was noted by Val-Laillet et al (2008a) that most displacements occur at the feed face.

In agreement with the present study Galindo et al (2000) found no difference between social rank and time spend standing, however Low-ranking cows spent more time standing still in passageways and standing half in the cubicles than middle- and high-ranking cows. It was not possible to ascertain exactly where the cows were standing in the present study.

These data give a starting point to help to understand the effect of social rank on the behaviour of Holstein dairy cattle.

Conclusion:

These data collected will be further analysed to ascertain the relationship between social rank and time budgets in dairy cattle. My aim is to submit this for publication in the Journal of Dairy Science or Applied Animal Behaviour Science Journal.

I am truly grateful to the farmers club for this amazing opportunity and to the University of Kentucky for involving me fully into their team and looking after me so well. The summer of 2014 is one I will never forget.

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