

Sector: Livestock

1. Introduction

The livestock sector covers cattle (dairy and beef), sheep, pigs and poultry. King *et al.* (2006) conducted a baseline assessment of agricultural water use in England and Wales, and estimated total on-farm water abstraction to be in excess of 300 million m³ year⁻¹. Livestock rearing accounted for 119 M m³. Cattle use the most water, with a total requirement of c. 82 million m³, followed by sheep, at 17 million m³, poultry at 12 million m³ and pigs at c. 8 million m³ (Table 1). It seems likely that there is a fairly level demand by the pig and poultry sector, with production dominated by mostly year-round housing systems (Thompson *et al.*, 2007). For sheep and cattle, peak demands are likely to occur during the summer months, but drinking water intake by animals reared outdoors is affected by the dry matter content of their food supply as well as by weather conditions and, in the case of dairy cows, by milk yields. Table 1 shows the size of each livestock sector in 2008 and estimated overall annual water use per livestock species.

Thompson *et al.* (2007) concluded that in livestock farming in England and Wales most of the water use is for drinking, particularly for dairy cows, with little scope for savings. In addition, although direct water abstractions for agriculture are approximately equally divided between livestock and crop production, livestock farming is focussed in areas where there is relatively high rainfall and there is therefore less urgency to reduce water use. However, wastage still results in extra costs and in general farmers seem to be increasingly aware of water efficiency and water saving practices. Obviously farmers may not be able to invest immediately in new technology and in the short term, water saving may be focused on improved management practices. A water efficiency benchmark for the dairy sector developed by Dairy UK showed that with best practice, 0.5 litres water could be used per litre of milk produced but at present, the average is 1.3 litres water used per litre milk. If this was reduced to the benchmark figure, approximately 5.6 billion litres water would be saved annually (Dairy Supply Chain Forum, 2008). Reduction in waste during farm washing procedures has been identified as one opportunity for water saving as this makes up some 21% of water used for dairy cows, and further savings can be made through good management practices at the farm scale (Thompson *et al.*, 2007).

Table 1. Provisional UK statistics for 2008 (Defra statistics, 2008) and estimated overall water use (King *et al.*, 2006).

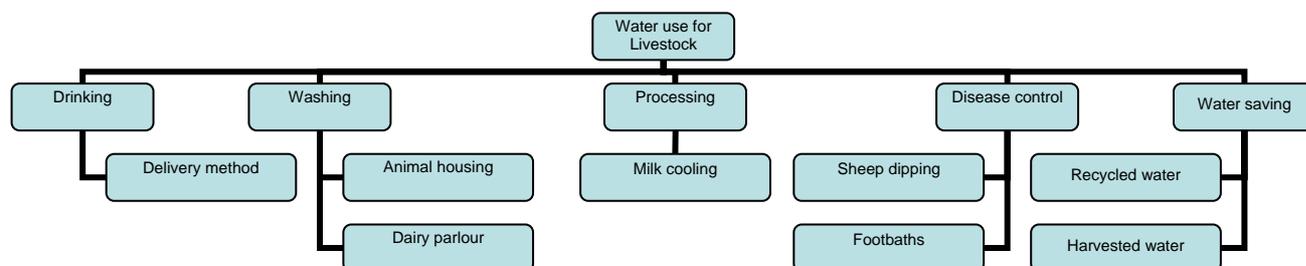
	No. head (,000)	Value of production (£M)	Annual water use in England ('000 m ³)
Cattle	4,224	2,070	81,998
Dairy	1,395	3,450	
Pigs	4,714	858	7,874
Sheep	33,131	822	17,272
Poultry	166,200	1,482	11,956

2. Hydrological pathways

Water use in the livestock sector occurs for four main purposes: drinking, washing, processing and disease control (Figure 1). King *et al.* (2006) showed that the

washing water requirements were relatively small compared with the volumes required for drinking. Expressed as a percentage of total water, drinking water requirements were 79% for dairy cattle, 87-99% for different categories of pigs, >99% for sheep and 96-99% for poultry, respectively.

Figure 1. Possible water use pathways in livestock production.



3. Water for drinking

Most water used in livestock farming is for animal drinking, with supplies provided in troughs or through other drinking devices or from canals, streams, dew ponds and other natural sources, where access has to be planned carefully to avoid environmental damage, soil compaction or faecal contamination (Thompson *et al.*, 2007).

Cattle

On dairy farms, drinking water accounts for 50-75% of all water used (Receau; DairyCo, 2009a). Non-milking cattle use less water than lactating cattle (20 litres versus >100 litres water/animal/day) and calves use even less at 5-9 litres water/animal/day (Table 2; Thompson *et al.*, 2007; Environment Agency, 2007). Brugger & Dorsey (2008) measured water use with meters and found that cows drank 12-31 galls/cow/day.

Table 2. Drinking water requirements for cattle (King *et al.*, 2006).

Animal	Water volume (l/animal/day)	Total volume (l/animal/year)
Dairy cow - lactating	104.5	32,421
Dairy cow - dry period	20.0	1,095
Dairy cow - overall	91.8	33,516
Beef cow	20.0	7,300
Dairy and beef bull	20.0	7,300
Calves	5.0	1,825

Pigs

It is estimated that different categories of pigs drink vastly different volumes of water, with gestating females using around 18 litres per day, farrowing sows up to 30 litres and weaners as little as 2 litres per animal per day (Table 3; Brumm, 2005; Environment Agency, 2007).

Table 3. Estimates of drinking water requirements for pigs (l/pig/day⁻¹) (King *et al.*, 2006)

Category	Consultancy estimates ¹	Research estimates ²
Dry sows & gilts	6.0	10.0
Farrowing sows	30.0	21.0
Weaners	2.0	1.6
Growers	4.0	3.4
Finishers	5.5	5.7

¹ Source: Mike Brade, ADAS

² Derived from relationships between meal and water intake and slurry output (Smith *et al.*, 2000)

Sheep

The water requirements of sheep, like all other animals, vary with size, breed, stage of lactation and diet. Ewes require about 4.5 litres water/day, rams about 3.3 and lambs about 1.7 litres water/day (Thompson *et al.*, 2007).

Poultry

Poultry use between 0.09 to 0.22 litres water/bird/day (Environment Agency, 2007) but higher temperatures in poultry houses increase the amount of water used for drinking. Thus improvements to poultry house insulation and optimising stocking rate help to reduce water consumption (Thompson *et al.*, 2007). Ducks require water for both drinking and swimming/feather wetting (Thompson *et al.*, 2007).

Delivery method

Drinking water is delivered to livestock using methods ranging from direct access to natural sources such as streams, canals, ponds, to troughs and more sophisticated drinking devices e.g. nipple drinkers and nose pumps. DairyCo (2009a) suggest that farmers consider using ditches, ponds and rivers where possible, bearing in mind risks due to disease from contaminated water, pollution risks and effects on erosion and habitat damage. Access points to streams and canals need to be well managed to avoid soil damage through erosion and compaction, and to avoid contamination of the water source. If a significant proportion of summer drinking water could come from rivers, ponds etc this would have a significant impact on use of water from other sources. Solar powered water pumps might be used to extract water from these natural sources to troughs, thereby reducing the adverse effects of bank erosion and contamination to water courses (DairyCo, 2007).

The area of ground around troughs and drinking devices also needs to be protected from compaction. All water devices need regular maintenance to repair leaks or remove blockages, and regular cleaning to maintain good quality water. Cleaning itself can use vast quantities of water (Thompson *et al.*, 2007).

Troughs are a traditional method for water delivery but are open to contamination and are vulnerable to frost damage. They can be isolated when not in use to avoid frost damage leading to leaks and the float on ball-valves which allows ingress of feed water can be lowered to reduce the risk of waste through overflow. Smaller troughs require less water for cleaning. Long stretches of pipes increase the risk of leaks and, to eliminate this, it may be preferable to use a bowser tank to supply water

to adjacent troughs in remote fields or to pump water from a nearby water source. Farmers might consider using a large bowser tank fitted with troughs around the sides and back (Anon., 2006). Either diaphragm or sling pumps can be used to pump water and one pump can supply 20-30 beef or 10 dairy cows. If the water source is a stream, it needs to be at least 25 cm deep and the sling pump continuously feeds water to a tank fitted with an overflow to return water to its source. The pumps need regular maintenance to avoid clogging (Ontario MAFRA, 2004; Thompson *et al.*, 2007).

Water bowls and step plate devices that operate a diaphragm to deliver water when needed can be effective in reducing water use. Water bowls are operated by pressure from the animal's nose and can be fitted with catch basins for younger or smaller animals, while the plate operated system is suitable for either young stock or sheep. Bite type drinkers and shallow bowls with lever-activated valves can be used for pigs to reduce water wastage as water can be released very easily from standard bite valve drinkers simply by nudging. Drinkers can be fitted with a guide to ensure the animal approaches straight on to prevent water escaping from the side of the mouth (Ontario MAFRA, 2004; Thompson *et al.*, 2007).

Bite-ball valves for pigs reduce wastage as a ball that operates water flow is set far enough back from the outlet to ensure that the animal takes the valve well into its mouth. The animal then has to bite down to release water. These can be used by all ages of animal and can reduce spillage by more than 40%, which, for a large pig unit, is a highly significant saving in both water consumption and reduced slurry. Trials have shown there is no effect on growth of the animals (AquaGlobe). A trial in Southern Alberta compared standard water nipple drinkers with bite-ball nipple drinkers on a 3,000 head commercial pig farm. During the one year trial, the bite-ball drinker sections of the barn used 35% less water. Barriers to adoption of these drinkers are the initial costs and lack of familiarity with the technology, which could be addressed through better spread of information (Larsson, 2006).

The Arato V range of drinkers produced in Germany offer a hygienic and efficient water system for pigs as a mechanism stops water flow while the animal swallows. They need no height adjustment for different animals, as do conventional nipple drinkers, and they cannot become contaminated with faeces, urine or fodder as do drinker basins and flooders.

Brumm (2005) found that a stainless-steel bowl drinker used 25% less water than a swinging drinker and that, although wet/dry feeders made no difference to water use, they did reduce the volume of water in the manure. This is important where pigs are reared on slatted floors over a manure pit but, where manure is collected in a lagoon, overflow water from drinkers can be of benefit to reduce odours and to assist flow through irrigation devices when applied to fields.

Nipple drinkers can reduce water use to 0.5 gal/pig/day for newly weaned pigs and around 1.5 gal/pig/day for finished pigs. However, it is important to provide pigs with adequate access to water to avoid stress problems. Research showed that one nipple drinker for 16-22 grow-finish pigs was insufficient, although other work found that reducing the number of nipple drinkers by half to 1 per 20 pigs did not adversely affect behaviour or production (Brumm, 2005; Brumm *et al.*, 2000; Li *et al.*, 2005). For sows, nipple drinkers waste too much water and increase the volume of slurry, therefore troughs are preferred, but nipples fitted inside water bowls can reduce water wastage by up to 40% (The Pig Site). For poultry, nipple and cup drinkers reduce spillage compared to bell drinkers but are not suitable for larger birds such as turkeys. Water spillage in poultry houses not only wastes water but also causes

problems with wetted bedding and greater ammonia emissions (Thompson *et al.*, 2007).

4. Water for washing

Compared to water for drinking, the volume used for washing down parlours, animal housing and yards is relatively small at around 13-30 litres per cow per day, with high-volume hoses using 22% less water (MAFF, 1998). However, the volume of water used varies enormously between farms (Thompson *et al.*, 2007). Volume hoses can be fast and effective for washing away loose dung but can use 10 times the flow rates of pressure washers (DairyCo, 2009a). DairyCo (2009a) provide advice for farmers which includes: using a trigger tap on the hose, using pressure washers for dried on dirt, using volume washers sparingly, using a scraper before volume washing, using a brush and bucket for some cleaning. They also provide a summary of the costs of washing down in different ways.

Animal housing

About 21% of the total water used on farms is used for hygiene reasons e.g. washing buildings between batches of animals, cleaning calf pens, washing dairy and milking equipment (Receau). A flood-washing system has been introduced recently from the USA (Thompson *et al.*, 2007). This is generally used in housing and feed yard areas and is thought to provide more effective cleaning than by scraping alone. The water is collected and recycled via a lagoon system, with sedimentation and overflow – this allows re-use of the water for washing down, though it is suggested that a daily addition of c. 20% water volume is necessary. Since feeding yards and cubicle passageways would not normally be washed down in the UK, this system does not reduce water use. Normally, unless there are specific animal disease or health reasons, no cleaning water is used in stock accommodation for both adults and young stock, whether dairy or beef. Periodically, slurry or manure and soiled bedding are cleaned out and fresh litter spread, perhaps after a disinfectant spray. Depending on the condition of the animals, there may be an additional requirement for stock washing in the case of finished beef cattle, for compliance with meat hygiene requirements (Anon., 2002). In the UK, pre-wetting and scraping to ease dirt removal is preferred as it not only reduces water consumption but also reduces the volume of slurry, saving £1.50-4.70 /cow/yr in removal costs (Thompson *et al.*, 2007; Environment Agency, 2007).

Water efficient dairy sheds can use as little as 20% of the water used in the average dairy (DairyAustralia). A key reason for this efficiency is the re-use of dairy water for yard washing. Water saving advice from DairyAustralia includes:

- Sweep or scrape floors and yards before washing down to greatly reduce the amount of water needed;
- Periodic automatic flushing of the yards during milking to make the clean-up quicker and easier. Dampening down the yard as the cows move through it reduces the water needed to clean it afterwards;
- Overhead sprinklers, garden sprinklers or automatic sprays ensure that the yard remains damp enough for easy washing;
- Poly pipe, with holes to let the water dribble out, and placed at the top of the yard slope keeps the surface wet without wetting the cows;
- Minimising the time animals spend standing in the yard reduces the amount of manure that needs to be cleaned up;
- In general, high-volume, low-pressure systems are better at moving manure;
- Use of recycled water for yard wash;
- Diverting plate cooler water into wash down tanks for yard cleaning;

- Installing a treatment storage pond to enable water to be recycled for yard washing or irrigation;
- Installing appropriate flood wash tanks to suit the yard washing requirement and positioned strategically to optimise performance.

The volume of water needed for washing pig pens varies between 0.09 and 0.37 litres daily per pig rising to 5.63 litres for farrowing sows. The amount of water needed depends on temperature, feeding regime age and method of production. (Brumm, 2005; Brumm *et al.*, 2000).

Poultry houses are usually thoroughly cleaned out between batches of birds but water can be saved by using products that require less dilution. Some egg-laying houses may be dry cleaned. Water can be saved by removal of much of the contamination before washing either by scraping or soaking and steam cleaning can be most effective (Thompson *et al.*, 2007).

Little water is needed to wash down housing for sheep (Thompson *et al.*, 2007).

Dairy parlour

Simple practices can save water e.g. soaking before washing down and dampening before milking, using a pressurised system for cleaning with trigger outlets on hoses, installing fast-wash systems for bulk tank cleaning (which use as little as 1.5% of the tank capacity) (DairyCo, 2009a) and arranging for milk collection on alternate days to reduce the water used for bulk tank cleaning by half (Thompson *et al.*, 2007; DairyCo, 2009a). The Milk Development Council (2007) suggest that water savings of 30-60% can be made by using high-pressure bulk tank washing systems.

Although there may be some scope for reducing the volumes of water used to wash modern parlour plants, the ISO standards set the wash volumes at 18 litres/unit and manufacturers are reluctant to set wash volumes below this because of non-compliance with the standards (DairyCo, 2009a).

Using efficient machine washing equipment can reduce water and energy use e.g. the DeLaval cleaning unit C200 and trombone super wash can reduce water use by 20-30% which also reduces the amount of detergent needed and energy to heat the water (DeLaval).

Recycling detergent wash water saves on detergent and energy costs for heating water. Some water and additional chemical is added as needed. Acid detergent solutions designed for use in cold water are well suited for re-use (DairyAustralia). Capturing and storing the solutions for re-use requires minor changes to the pipework and an extra sealed wash barrel. Capturing and storing the alkali solution is more problematic as the solution needs to be hot when used (at least 65°C). This means that the storage barrel needs to have a heating element and good insulation. Regular monitoring of pH and top-ups are required and the solutions need replacing every 2 - 6 weeks (although some farmers do it less frequently). Commercial re-use systems are available but most examples in Australia have been put together by farmers and chemical supply companies on a case-specific basis.

The last hot (sterilising) rinse from plant washing can be saved and re-used as the first pre-rinse at the next milking – saving 200-800 litres per day. It is important that the pre-rinse water is warm (around 38°C) so the wash barrel should be covered and well insulated.

Air injectors (also called 'flushing pulsators') increase turbulence and improve cleaning – making it less likely that additional cleaning of the plant will be required

(DairyAustralia). Air injectors are usually located on the milk line. They periodically (2-3 cycles per minute) admit air, creating a large slug of wash fluids to increase mechanical scrubbing down the milk line. They are standard issue on newer installations but some older dairies with milk lines of 50mm or more may benefit from a retrofit if cleaning is less than ideal.

A new enzyme based method to clean milking machines, Lactivate, has been produced by Ecolab and comprises an acid clean to remove any scale, alternated with a detergent process. As there is no pre-rinse, the system saves water and energy. In 2008, the system won the RABDF's Prince Philip Award (Ecolab).

5. Processing

About 25% of total water use on dairy farms is for cooling milk (DairyCo, 2009a) with plate coolers using between 2-3 litres water per litres of milk, although a ratio of 2:1 water to milk is recommended (DairyCo, 2009a). As the volume of water is substantial it can be re-cycled for stock drinking or cleaning (Receau; Thompson *et al.*, 2007; DairyCo, 2009a) and the surplus should be stored (DairyCo, 2009a). Advantages and disadvantages of plate cooler water re-use are discussed by DairyCo (2009a).

6. Disease control

Approximately 2.25 litres water per animal is needed for sheep dipping. Water is also needed for footbaths to control foot rot and the volume of water required can vary from 100 litres for a 'walk-through' bath to 300 litres for 'stand in' types. Low volume footbaths, washing footbaths or mats (to replace footbaths) can reduce water use (Environment Agency, 2007; Thompson *et al.*, 2007; DairyCo, 2009a).

7. Water management and water saving

Simple improvements to water management involve using water more efficiently, reducing mains water pressure, regular maintenance and cleaning, preventing and repairing leaks, using isolation valves and emptying unused troughs, using triggers on hoses and washing equipment and reducing the amount of water entering the slurry system e.g. by reducing the amount of water used for washing.

More capital intensive methods to improve water management include water harvesting, recycling water e.g. from plate coolers, changing to more efficient drinking systems and covering yards where animals shelter to reduce the volume of slurry (Dairy Supply Chain Forum, 2008; Environment Agency, 2008). Thompson *et al.* (2007) suggested that the use of water meters to give accurate measures of water use and an immediate check on leaks can help avoid wastage and monitoring is a valuable tool to help farmers to improve water use efficiency (Brugger & Dorsey, 2008). DairyCo (2009a) list a number of approaches to leak detection, including the use of specialist data loggers. Some systems can alert farmers when there is a change in the flow pattern (Hydrocheck Ltd.). Meters should be checked regularly and any anomalies investigated (Brugger & Dorsey, 2008; Hybu Cig Cymru, 2008). Water flow rate can affect the amount of wastage and Brumm (2005) found that spillage from pig drinking devices could be reduced from 23% to <9% when the flow rate was lowered from 2080 ml per min to 650 ml per min.

Water can be saved by harvesting rainwater or by recycling water after it has been used for another process as mentioned above. Water used in association with milk production has to be very clean to prevent the introduction of pathogens but as mains

water is used in plate cooling it is suitable for animal drinking or washing. As mains water in 2008 cost between 80-140p per m³, this can be very cost effective (Hybu Cig Cymru, 2008; Receau Ltd., 2006).

Most dairy units or cattle farms are suitable for rainwater harvesting systems as they have large areas of roof over the animal housing. If fitted with guttering and downpipes, rainwater can be funnelled into storage tanks and this also prevents excess water being added to the slurry. At present it would appear that most water from roofs is wasted although it would be possible to collect a total of 450 m³ from buildings for a 200 cow herd, equivalent to about 12% of the herd's drinking water (Thompson *et al.*, 2007). The Environment Agency estimates that a typical dairy farm could meet 20% of its water demand through rainwater harvesting alone and, if filtered e.g. by UV, the water would be suitable for all farm uses. Rainwater could also be used to wash down pig housing (Thompson *et al.*, 2007). Receau estimated that up to 40% of the water used for drinking and washing could be harvested from roofs with annual savings of £5,865 from the cost of mains water. In a survey in 2009, DairyCo (2009b) found that more farmers are collecting rainwater and more had increased the efficiency of dirty and clean water separation which improves the use of dirty water as a fertiliser.

DairyAustralia list a range of management options that will lead to low, moderate and high water savings respectively. They are:

Low Water Savings

- Wake-up cows first
- Feed adequate fibre
- Voluntary cow flow into dairy
- Mud and stone trap at laneway-yard junction
- Yard drainage
- Solids trap for re-use systems
- Gate scrapers and auto-flushing
- Hydrant wash systems
- Flood wash - riser systems
- Flood wash - tank systems
- Tipping drums
- Sprinklers
- Dribble bars
- Curb operation of plate cooler water pump
- Enhance vat cleaning
- Check plant wash regime
- Increase turbulence
- Re-use final rinse water
- Install 'non-stick' surfaces in the dairy
- Use cow ankle straps on pipework
- Wet surfaces prior to milking
- Use low pressure hoses
- Strategically wash teats
- Dry wipe teats
- Use trigger nozzles on udder hoses
- Fix leaking troughs
- Reduce evaporation from water storages

Moderate Water Savings

- Reduce the time cattle spend on the yard

- Stock handling
- Wash section closest to the shed only
- Concrete surface and grooving
- Yard slope
- Short, high volume hoses
- Hose nozzles
- Manual scrapers
- Mechanical scrapers
- Flow rate / Cooling efficiency
- Tailor water to milk flow
- Strategically wash platform
- Use gloves to clean rubberware and pipework
- Drink from troughs
- Stop leakage from dams
- Catch rain water from shed roof

High water savings

- Alternative (bore) water supply
- Wash yard less frequently
- Re-use water from effluent ponds
- Divert and use rainwater from yards
- Recycle water for other dairy processes
- Store and re-use plate cooler water
- Re-use detergent wash

8. Farm case studies from a range of sources

Farms recycling plate cooler water

Brackenburgh Home Farms, Cumbria is a mixed farm of 1,500 acre including arable, dairy and sheep. Modernisation of the dairy unit, covering feeding passages, harvesting rainwater from roofs (1.5 mm provides 10 m³ water) and recycling plate cooling water for livestock drinking (3 m³ /day), reduced mains water use by a third to 20 m³ /day and reduced the volume of slurry produced, saving £1,500 /year. Water use per cow has decreased by 13% to 87 litres per day. Harvested and recycled water is stored in a 10 m³ tank and is monitored through a sight glass. Buffer strips alongside water courses were created and reed beds may be introduced for treating effluent from the septic tank (Environment Agency, 2005 & 2007).

Great Wollaston Farm (a LEAF Demonstration Farm), Shropshire is a 242 acre mixed farm growing winter wheat, winter barley, spring lupins, maize, peas and spring barley with a 110 cow dairy herd. The dairy uses 2355 m³ water/year, of which 735 m³ is used for plate cooling. The latter is now collected and reused for animal drinking and washing down, directly saving water and reducing the volume of slurry. With water costing 107p per m³ annual direct water savings were £786 and, with the reduced slurry treatment costs, a total of £2358 per year was saved (Environment Agency, 2007).

Bow Farm, near Wedmore, Somerset runs a 150 cow dairy herd yielding 5500 litres per cow on 92 ha grassland. Although the cows use ditches for some of their drinking water, they mostly use large troughs fed by mains. The farm uses a milk plate cooler and collects the cooler water but has insufficient storage capacity to collect it all. Therefore, the water feed is turned off manually half way through milking to avoid water running to waste. Outflow water drains to a holding tank which is connected to the volume washer pump, used for parlour wash down. When a plate cooler was originally installed on the farm, the water drained to a drinking trough in the collecting yard but it would often overflow resulting in wastage of water and extra slurry. Therefore the plate cooler water was connected both to the tank for the volume washer and to another water trough accessible post milking. A ball valve on the volume washer tank ensures that once full, flow is diverted to the trough (Milk Development Council, 2007).

JR & M Weekes & Sons, South Wales, is a livestock farm with dairy, lamb and beef. It produces around 225,000 litres of milk per year. To improve overall efficiency and reduce water wastage, each pipe supplying water to drinking troughs is fitted with an isolation valve to enable easier access for repairs and all pipes are lagged to avoid winter damage. Pipes are drained when not in use and are regularly inspected for leaks. Water from the coolers is recycled and used to water the cows or to clean the parlour (Environment Agency, 2001).

A farm from the USA, Straus Family Creamery, Marshall, California is a dairy farm which recycles the water from the creamery and from washing the milking barns (5,000 gallons per day). The water is processed in ponds then reused for cleaning purposes. Methane from the wastewater ponds is captured and used to generate 90% of the dairy's electricity (Water Stewardship, 2008).

Farms harvesting rainwater

Sheepdrove farm, Berkshire is a 2,000 acre mixed organic farm with about 60% used for livestock and the rest growing cereals, beans, borage and seed crops. Water conservation is a high priority and water use is metered. Dew ponds have been built for livestock watering to avoid the use of mains or abstracted water and a lake is used to irrigate trees, water compost and provide wallowing for pigs. These save around 1,626 m³ water/yr, about 10% of the total abstracted water. Waste water passes through a Dissolved Air Flotation plant and reed bed before being fed into the lake and any overflow goes to a willow plantation before feeding back into the aquifer. Capital costs were £330,000 but it is estimated that these will be recouped in 18 months. After that savings of £229,000 will be made annually. Sheepdrove Farm won the Environment Agency water efficiency award in 2005 (Environment Agency, 2005).

Taylor's Down Farm is a 142 ha dairy farm in Devon where average annual rainfall is 1,500mm. The dairy herd of 180 cows has to be brought in under cover from October until May. Rainwater from the gutters not only goes to storage but also diverts water away from the slurry saving > £2,000 per year in slurry storage and spreading costs (Environment Agency, 2008).

Julian Hasler, Gloucestershire, farms 900 ha rearing pigs and grows wheat, OSR, and spring barley. Water in the area is generally pumped from aquifers but the farm installed a water collection system, directing rainfall from building roofs to an underground sump made from a buried 200 litre bulk container. From there, it is pumped to a metal storage tank and the water is used for filling and cleaning the sprayer and other equipment. Excess rainwater goes to an open ditch that supplies a wildlife pond. It may also be used for supplying drinking water for the outdoor pigs. There are plans to install a lined bio-bed into the system which would filter the drainage water from the concrete sprayer filling area for reuse with the sprayer (Farming Futures).

Oakey Farm, Moreton Valence, Gloucestershire runs a 430 cow dairy herd on 127 ha pasture with a further 49 ha of contract grown forage maize. They produce 7800 litres per cow. In 2006 a new dairy was installed but prior to this all water was mains. Tests on a bore hole revealed that the water saline and plans to use this source of water had to be abandoned. Instead, a roof water collection was installed with the water draining into a lagoon. A submersible pump mounted below a raft lifts the water to a steel container and after passing through a 120-micron filter then through 20-micron paper filters it goes for UV treatment. It is then stored in an above ground plastic tank of approximately 18,000 litre capacity which has a mains water supply as a back up. This water is used for stock drinking inside the buildings, parlour wash down and for the initial milk plate cooling. Mains supply is still used for field trough drinking, for udder washing and washing milking equipment washing. Erosion has been limited by using a plastic pipe attached to the inlet which floats on the surface. There have been some problems with clay sediment in the filters. Around 4392m³ of mains water have been saved annually and savings of over £10,000 per year are expected. The farm has also negotiated an abstraction from a nearby British Waterways canal for less than 20m³/day, an amount for which no abstraction license is needed (Milk Development Council, 2007).

Brynkinalt Home Farm, Wrexham runs a 70 cow dairy herd with followers and 100 ewes on 96 ha of land. It also grows maize and barley for cattle feed. Approximately 479 m³ of rainwater is harvested annually from roofs and fed into two storage tanks. This is used for cattle drinking. Capital outlay was low as the existing infrastructure was used and, as water costs £1.20 per m³, approximately £574 is saved per year. In addition, the harvested water no longer runs into the stored dirty water (Environment Agency, 2009).

Oaklands Farm Eggs Ltd, Shropshire produces eggs on one site of 6.5 ha and the buildings are designed to collect rainwater, feeding it into two lagoons. After treatment it is used for the 1.4 million hens for drinking. Capital of nearly £750,000 was invested to develop the system but it is estimated that this will be recouped after 6 years as £120,000 will be saved in annual water charges (Environment Agency, 2009).

Farms monitoring water usage to detect leaks

Oxenford Farm, Ilminster, Somerset comprises 80 ha and runs a 140 cow dairy herd yielding 7500 litres per cow. Only mains water is used although some drinking water comes from ditches and, as consumption was high, it was decided to determine average daily use to help to monitor leaks. A data logger used for just over a month helped to determine the farm did not have a leak so alternative water sources were investigated. A site investigation revealed a spring that could provide a secondary water supply (Milk Development Council, 2007).

East Clyffe Farm, Wiltshire comprises 820 acres of arable and livestock on chalk land. They won a water efficiency award in 2003 by reducing water use and returning surplus rainwater back to the chalk aquifers. The owner observed water flow with meters and used the results as a basis for a water saving plan. Leaks in underground pipes were identified and dealt with; trees, beetle banks and other conservation works reduced water run off; outdoor pig pens were redesigned and the land subsoiled to eliminate soil erosion and run off, and flooding was reduced around farm buildings. Water consumption decreased by 1,000m³ to <10,000m³ in three years even though livestock numbers increased and this eliminated the need for an increase in the abstraction licence. Sleeping policeman were constructed to channel water run off to a useful area instead of it running to waste (Environment Agency, 2003).

Summary

Guidelines to save water and reduce wastage on livestock farms include:

- Regular maintenance of existing systems and equipment to ensure efficient operation.
- Use meters to monitor water usage.
- Check for, and repair leaks.
- Isolate and empty troughs when not in use.
- Use bowser tanks or pump from a nearby source to supply water to troughs. This reduces the length of pipework and associated leak risks.
- Adjust ball valves on troughs to prevent overflow.
- Use smaller troughs that require less water for cleaning.
- Use nose or plate operated drinkers instead of troughs to ensure fresh water and to reduce the volume of water needed for cleaning.
- Change to drinkers that reduce spillage e.g. bite ball valves, nipple drinkers, Arato-V drinkers.
- Fit drinkers with catch basins to retain overflow and make them suitable for smaller animals.
- Fit drinkers with a guide rail to ensure that animals approach head on. This prevents water seeping from the side of the animal's mouth.
- Pre-soak parlours, yards and housing to loosen dirt before washing.
- Scrape yards to remove dirt before washing.
- High pressure hoses speed up cleaning but use more water.
- Use high-pressure bulk tank washing systems to save water.
- Use Lactivate, a new enzyme based method from Ecolab, to clean milking machines and reduce water use.
- Arrange for alternate day milk collection to reduce bulk tank cleaning.
- Cover yards to prevent rainwater adding to the volume of slurry.
- Harvest rainfall from roofs for animal drinking and washing.
- Recycle water where possible e.g. milk cooling water can be re-used for animal drinking or washing.

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