Progress on woodchip pad research

One year in, the LINK-funded research into woodchip pads is producing some interesting results. North Wyke Research's Dave Chadwick updates us on the project so far

Woodchip pads are used as a generic term to embrace both stand-off (out-wintering) pads constructed over an impermeable subsoil or lining, with drainage pipes directing effluent to a tank or store and woodchip corrals which overlie freely draining soil, with no impermeable base or lining.

However, potential adverse effects of lower-cost corrals on water pollution risks, due to uncontained runoff or drainage to both surface and groundwater, have been overlooked and installation is no longer generally permitted by the Environment Agency.

Management of woodchip pads can also impact significantly on their success. For example, overstocking of the pad can lead to overloading with faecal solids, resulting in increased risk of contaminated run-off and sealing of the pad bed or drainage pipes, resulting in a build-up of slurry within the woodchip matrix.

Some background to woodchip pads and plans for research were outlined in Grass and Forage Farmer, last year (Autumn 2008).

ADAS are leading a study on the design and performance of woodchip pads. This research is funded through Defra's Sustainable Livestock Production LINK programme, with industry funding (see panel). It aims to determine key management factors controlling the performance of woodchip pads for stock out-wintering, with acceptable liveweight gain, welfare and reduced potential environmental emissions.

Four experimental woodchip pads have been constructed at North Wyke Research in Devon (see below).

The pads are 10m x 10m (100m^2 area) in size with an option of including a further 10m x 3m concrete feeding area from which slurry can be scraped and collected.

The boundary of each pad is fenced, with metal feed fences and each has its own drinking water supply.

Pads were constructed after grading the soil surface to a 3 degree slope. A geotextile membrane was placed over soil to reduce the risk of puncturing the plastic liner which was placed on top of this. Drainage pipes of 15cm (6") were arranged over the liner and directed through 'tipping buckets' to record the volume of effluent from each pad, before discharging to an existing store.

Feed fences on the pads can be moved to achieve on-pad or off-pad feeding and this will also allow adjustments in the area per animal.

In the overwintering season 2008-2009, experimental pads were used to investigate the effect of woodchip size, area allowance (m^2/animal) and feed management on productivity. Woodchip pad surface condition or dirtiness and effluent quality - including total nitrogen, nitrate-N, ammonium-N and phosphorus were also monitored.

Chip size

The lower 30cm (1ft) of each pad was filled with large 7.5cm (3in) chips. This being the standard chip size used in pads in most of UK. Timber used for chipping was fresh felled pine. The top 20cm (8in) of each pad was filled with one of four different chip sizes; 7.5 cm, 2-3cm, 1cm (3in, 1in, 0.4in) and sawdust.

Area allowance

The number of Charolais x Friesian steers (starting liveweight of about 450kg) were adjusted on each pad to target two contrasting area allowances of about 11.8m^2 and 18.6m^2/animal.

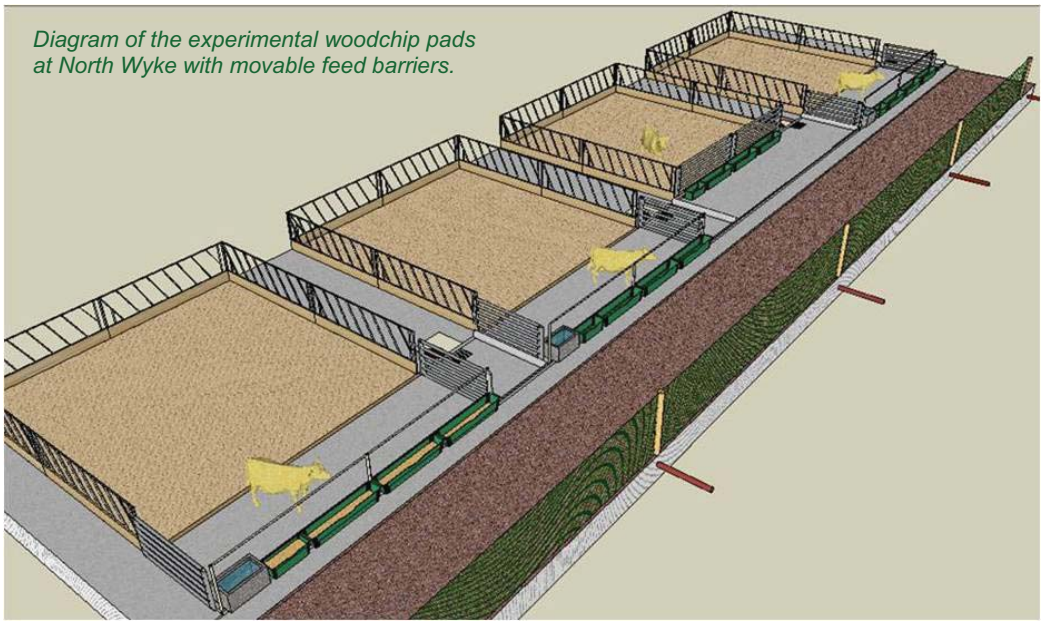

Diagram of the experimental woodchip pads at North Wyke with movable feed barriers.

Chip sizes: 7.5cm (above), 2-3cm (below) and sawdust (bottom).

Feed management

Cattle on the pads were either fed from the woodchip or from the concrete stance. Cattle were fed clamp grass silage (*ad lib*) plus concentrates, targeted to attain 1kg liveweight gain a day.

Observations

During this first experimental season, treatments were applied and observations made over successive seven week periods.

This necessitated removal of cattle and the top 20cm (8in) of woodchip from each pad every seven weeks and replacement with fresh wood-

chip, plus adjusted stocking area allowances as required.

Weight of soiled woodchip was measured after removal and samples were taken for analysis.

Measurements of live-weight gain were made for each animal at the start and end of each of the seven week periods, along with body condition scores and dirtiness scores. Silage intake was estimated and the quantity of slurry from concrete stances was scraped and weighed twice a week.

Samples of silage and slurry were taken for analysis, to enable a nitrogen balance to be estimated.

Effluent from the pads was also sampled 2-3 times a week for analysis.

Initial results for liveweight gain show all stock on all treatments achieved more than 1kg daily liveweight gain.

Stock on the sawdust seemed to achieve the greatest gain at an average of 1.4kg/day, compared with an average of 1.2kg/day on the 7.5cm chip size.

This suggests sawdust was more comfortable for stock than the coarser chips, although there did not appear to be any difference in livestock behaviour between chip sizes.

There was also an indication of greater liveweight gain for stock with a greater area allowance; 1.4kg/day at 18.6 m^2/animal, and 1.2kg/day at 11.8 m^2/animal.

However, further data analysis and analysis of feed intake estimates are being carried out to determine if these differences in liveweight gain are significantly different.

Feed management had no apparent effect on liveweight gain.

During the start of one of the 7-week periods, there was a very dry spell with no rain for two weeks. On the pad where cattle did not have access to the concrete feed stance and were fed on the pad, a substantial build up of faecal solids was observed approximately 2m behind the feed face.

This accumulation suggests rainfall is important for the washing of excess slurry solids into the woodchip. It is a combination of the treading action along with rainfall which keeps the surface of the pads clean. It was necessary to remove this faecal material on this one occasion and top up the pad with fresh woodchip.

Experimental pads at North Wyke in use winter 2008-2009.

Stock performed well throughout the study on all treatments, even in very cold conditions in early February 2009, when the only welfare issue was ensuring a constant supply of drinking water in freezing conditions.

Table 1 summarises the effluent quality from the third 7-week period. The effluent contained concentrations of ammonium-N, nitrate-N and total N similar to those found in typical dirty water.

Total P concentrations of pad effluent were much lower than found in dirty water and slurry, but may reflect the retention of faecal solids in woodchip on the pads.

Further analysis of results will allow researchers to determine if chip size, stocking rate and feed management influenced effluent quality.

Measurements of gaseous ammonia emissions were also made from the different treatments during each 7-week period. Ammonia emissions are thought to be lower from this type of outwintering system than from conventional cattle housing, as urine infiltrates into the pad and is less prone to ammonia loss compared to urine deposited on impermeable surfaces like concrete.

Data are being analysed and will be available soon to determine if the use of woodchip pads could help the UK meet its target for reducing ammonia emissions, under international agreements.

Table 1. Average concentration of nutrients (mg/l) in the drainage from experimental pads for the third 7-week period.

Chip size	Total N	NH_4N	NO_3N	Total P
7.5cm	640	560	0.7	33
2-3cm	780	620	0.5	18
1cm	410	290	1.8	38
Sawdust	750	360	0.7	54
Typical dirty water	850	460	Trace	520

The current project is also addressing what to do with the 'spent' woodchips at the end of winter. The larger chip size (7.5cm) cannot be spread on land, so the aim is to leave these at the base of the pads where drainage will keep them relatively clean.

The smaller chips (2-3cm, 1cm and sawdust) could be applied to land, but there is concern that their high carbon to nitrogen (C/N) ratio could make them resistant to breakdown, at least on grassland soils. Therefore, some of the spent chips are being stored and actively composted to determine the best way to manage them and reduce the C/N ratio before applying to land. Agronomic trials have just begun using spent, but non-stored/composted woodchips (of the three smaller chip sizes) on grassland.

Productivity and environmental results from the first overwintering season on the experimental pads will be examined together with data on effluent quality and livestock performance from commercially operated pads (near Loughborough, E. Mids; Brecon, Powys; Pontesbury, Shrops and in association with Teagasc, Ireland from a pad in Co Cavan). The results will determine the most important questions to address in the second overwintering period on the experimental pads.

An open day is planned for early spring 2010 at the experimental pads at North Wyke Research.

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