Technical Note

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SAC

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Woodchip Corrals

SUMMARY

- **Corrals are a low cost system that allow fields to be de-stocked over the winter without the high capital cost of buildings.**
- **Trials have shown significantly better stock performance compared with alternative overwintering systems. They are particularly suited for dry suckler cows (lower feed intake/less dung produced).**
- **Unlined and unsealed corrals present an unacceptable risk of water pollution on most sites and are not recommended without a full pollution risk assessment.**
- **Mistakes have been made in corral location, design and management which have resulted in corral failure and pollution problems. Before committing to a new corral, it is advised that a visit is made to view existing functional corrals with advice from SAC and approval from SEPA being sought.**
- **Select a suitable site and design the corral to accommodate the required stocking density and ensure that effluent treatment facilities are adequate and functional.**
- **Corrals require effective management both throughout the winter (frost periods, etc.) and at the end of the winter when decisions about re-chipping and maintenance will need to be considered.**

Woodchip corrals have been used as a cost-effective system for over-wintering cattle compared with conventional housing. Operational performance in Scotland and elsewhere indicates that not only is stock health and welfare better from rearing outdoors but economic performance is also enhanced. Environmental risks, however need to be taken into account at all stages of design, construction and operation.

There are estimated to be upwards of 600 woodchip corrals in use in the UK with considerable opportunities for further installations provided that potential water pollution risks are resolved at the site selection and design stage.

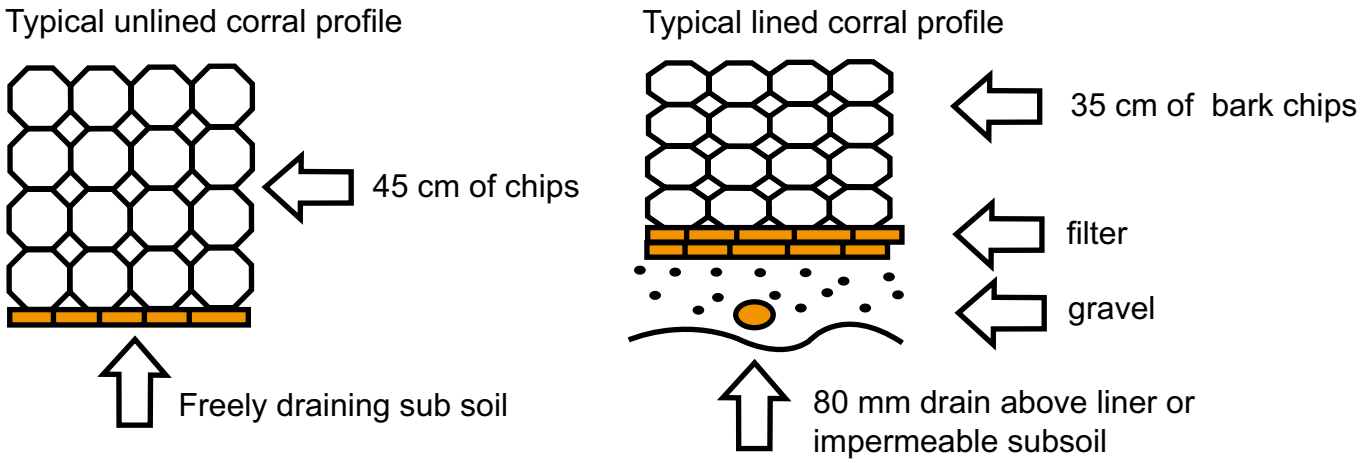
What are Woodchip Corrals?

Un-roofed outside enclosures, bedded with woodchips for over-wintering cattle (and occasionally sheep).

The term 'woodchip corrals' generally covers both unlined corrals and lined corrals (often called stand-off pads), which are described as follows:

- An unlined corral is a woodchip layer overlying free-draining soil.
- A lined corral or stand-off pad is a woodchip layer overlying an impermeable subsoil or lining, allowing effluent to be collected, treated and recycled.

SAC receives support from the Scottish Executive Environment and Rural Affairs Department



As unlined or unsealed corrals have a potential to pollute groundwater, it is unlikely that the construction of new unlined corrals will be allowed without a comprehensive groundwater risk assessment by a qualified soil scientist/hydrogeologist to ensure that risk of groundwater pollution is low. The cost of this assessment will be prohibitive and in many sites such an assessment is likely to indicate an unacceptable pollution risk. In most locations, unlined or unsealed corrals can no longer be considered an environmentally sustainable system.

Why use Corrals?

Corrals can be constructed at relatively low-cost and if managed properly, provide a dry bed and a healthy environment for stock.

The main benefits are improved animal welfare and stock performance. Trials conducted in Ireland with finishing cattle over a three year period consistently show weight gains of 15-20% in favour of cattle outwintered on woodchip corrals compared with alternative over-wintering systems.

530 kg Charolais steers were offered a total mix ration comprising half grass silage and half concentrate. Those kept on corrals had 8-14% higher feed intakes, but 35% higher liveweight gains and over the 133 day finishing period, produced £28/head extra margin. It is thought that the main reason for the significant difference in performance may be due to cattle indoors being under greater stress. Whilst cattle indoors or outdoors produce the same amount of heat, those indoors find it more difficult to dissipate this energy to cool down. As a result, cattle experience additional stress leading to a reduction in feed intakes and lower weight gains.

Many suckler producers have found incidences of pneumonia reduced when calves are weaned on to corrals compared to utilising sheds. Whilst the majority of Scottish corrals are used for over-wintering spring calving suckler cows, store cattle or dairy replacements, autumn cows with calves at foot have also performed better on corrals when compared with a housed system.

Other potential benefits:

- Low maintenance costs at £15-25/animal/annum.
- Labour-saving in feeding and cattle handling.
- Reduction in sward poaching, soil compaction and erosion.
- Improved stock performance due to a healthier environment.

Environmental Concerns

The effluent draining from corrals is highly polluting and will contain high concentrations of ammonia, phosphate and faecal micro-organisms. Together with a high Biochemical Oxygen Demand (BOD), the effluent could pose a serious risk to the water environment if not contained and collected. The main concerns are:

- Surface water pollution where effluent is allowed to enter drains or run-off directly to watercourses.
- Leachate draining from the base of an unlined corral percolating into vulnerable groundwater.
- Overstocking of the corral leading to it becoming overloaded with faeces and urine, resulting in an overflow of contaminated run-off.
- Sufficient storage capacity is not available to contain effluent after high rainfall events.
- Drainage within the corral bed or below the bed becomes blocked, resulting in waterlogging and effluent run-off.
- Uncertainty over how to re-use, re-cycle or dispose of the spent woodchips.

Table 1: Effect of Winter Accommodation System on Finishing Cattle Performance

	Corral	Slats with Access to Corral	Straw Bedded	Slats
Feed intake (kg DM/day)	10.88	10.58	9.79	9.5
Live weight gain (kg/day)	1.39	1.33	1.10	1.01
Carcass gain (kg/day)	0.77	0.76	0.64	0.64

Source: French, Hickey, Moloney and Lenehan 2004

Table 2: Effect of Winter Accommodation on Autumn Cow and Calf Performance

	Corral	Housed
Feed intake (kg DM/day)	12.1	11.7
Calving to conception internal (day)	86	122
Proportion in calf	92%	69%
Calf weaning weight (kg)	317	303

Siting the Corral

Given the significant polluting potential of woodchip corrals, particularly unlined ones, the advice of SAC and/or SEPA should always be sought before a corral is built and if modifications are being made to the original design.

Test pit(s) excavation will be required to determine soil conditions and drainage status.

To ensure effective management and to minimise pollution risk, the following site selection factors must be considered when locating a woodchip corral:

1. **Proximity to water courses and water supplies**
   - At least 50 m away from a watercourse, or ditch.
   - At least 50 m away from a drinking water supply, spring, well or borehole.
   - Access to drinking water supply for stock.
   - Not overlying permeable soil in Groundwater Vulnerable Zone or within a Nitrate Vulnerable Zone (if unsealed corral).

2. **Land form**
   - Gently sloping site with 2-3^{o} gradient to effluent collection drain.
   - No upslope water draining to site.
   - Easy access for stock and machinery.
   - Upslope of effluent store or effluent treatment system to allow gravity drainage and avoid pumping.

3. **Aspect**
   - Open (avoid too much shelter from buildings/trees).
   - South-facing, sunny location without shade, but open to light winds to promote surface drying.

4. **Soil type**
   - Free-draining sandy or gravelly soils to provide dry sites for construction and management. These soils will most likely require a liner for effluent collection to protect groundwater from pollution.
   - Heavy clay soils, if sealed, will not require a liner but will require under-drainage and a collection system for effluent.
   - Avoid poorly drained and peaty soils.
   - Avoid very stony and rocky soils which damage liners.

5. **Site drainage**
   - No springs or seepage (surface or groundwater) upslope or beneath the site.
   - No under-drainage crossing site. Any field drains must be intercepted above the site and re-routed around the site to avoid contamination with effluent.
   - No watertable within 4 m of ground surface.
   - No flood risk.

6. **Land area required (m^2 per animal)**
   - Dry cows, 15 m^2.
   - Finishing cattle, 12 m^2.
   - Store cattle, 8 m^2.
   - Sheep, 3 m^2
   - Separate feedstance, sloping away from corral to effluent collection tank.

Site Preparation

As labour and fuel costs are likely to continue to increase, corrals are best sited close to existing silage pits and the main steading to reduce time spent feeding and handling/moving stock. Having selected a suitable site, calculate the corral area required based on stocking density plus feedstance area and access requirements.

Corral Construction

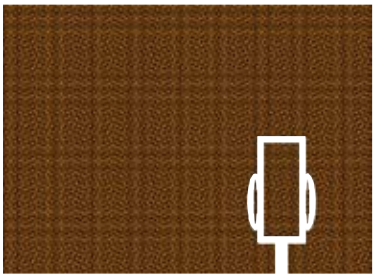
Corral construction should be time-tabled for Spring or Summer when ground conditions are dry, over-compaction is minimised and risk of sediment pollution from the works is avoided.

- Strip topsoil layer down to form subsoil base.
- Remove topsoil and re-use within farm the soil came from.
- Check carefully for the presence of field drains, intercept and re-route as required.
- Grade subsoil base to create slope or mound to assist effluent collection.
- Clay soils (non-cracking) – puddle and seal with roller to provide an impermeable layer at least 1 m thick with a permeability coefficient of <10^{-9} m/s. All other soils – install impermeable liner.
- Install 80 mm Ø drainpipes at 3 m centres, draining to a 100 mm collector drain at outfall.
- Backfill with 200 mm depth of permeable backfill, 20-40 mm Ø. A drainage raft of 400 mm deep stone can be used as an alternative to pipes and backfill.
- Lay coarse geotextile filter on permeable backfill surface to prevent ingress of solids into the drainage layer.
- Install recommended depth of chips (minimum 40 cm)

Design Layout

Four basic design layouts:

Feed On (using feedtrailer or ringfeeder, i.e. no scrape passage)



- No slurry to handle.
- Requires effluent treatment.
- Heavier soiling of woodchips.
- Low labour and machinery requirement.
- Need to replace chips around feeder every year.
- Loss of fertiliser value.

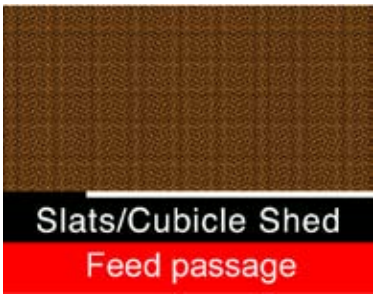
Feed Off (integrated scrape passage)

- Requires slurry storage. The total volume of slurry produced likely to be very similar to that produced on a yard.
- Reduced soiling of woodchips.
- Labour to scrape/spread.
- Slurry has fertiliser value.

Feed Away (use existing concrete)

- Could use existing slurry system.
- Reduced soiling of woodchips.
- Labour to scrape/spread.
- Slurry has fertiliser value.

Feed Inside (utilise existing shed)



- Uses existing slurry system.
- Reduced soiling of woodchips.
- Expands use of existing sheds.
- Can improve overall stock performance.
- Utilise existing labour.

Chip Size

Large woodchips are more effective for both cattle and sheep as it is easier for stock to tramp dung through the top 7-10 cm of woodchips, leaving the surface cleaner to lie on. The target is fist- to palm-sized chips (7-12 cm long and 7 cm wide). Smaller chips can be used which will be more comfortable but will need to be renewed sooner. Expect a corral built using large woodchips to last two winters, but a small chip corral may only last one winter before becoming too dirty on the surface.

Stocking Density

The majority of problems caused by corrals are due to overstocking. As the winter progresses, having seen how well the cattle are doing on the corrals and with other cattle still outside poaching fields, there is a tendency to put extra stock into the corrals, resulting in muck overload and increased pollution risk. Maintaining the correct stocking density is essential.

Recommended Minimum Lying Area (per animal) and Chip Requirements

	Lying Area (m^2)*	Chips vol. (m^3)	Chips wt (t)
Cows	15	6 m^3	3.0
Finishing cattle	12	5 m^3	2.5
Stores	8	3 m^3	1.5
Sheep	3	1 m^3	0.5

**(Excludes feed stance area)*

Depth of Chips

Recommended minimum 40 cm depth, but recent SEERAD funded trial demonstrated that chip depth could be decreased to 30 cm if constructed on a drainage layer.

Choice of Timber

Scots Pine produces the best chips followed by Spruce with Larch the least effective. To avoid the chips "flaking" into smaller sections the wood should be reasonably green. The larger chippers will handle up to 20 cm diameter in 3-4 metre lengths. One tonne of timber will produce approximately 2 m^3 of woodchips dependent on timber drymatter. When the chipper is on site, recommend stock pile of 0.5 t/animal as a reserve for maintaining the corral over the next 2 years.

Other Design Features

Square corrals work best with the chipped lying area in a shallow dome (upturned soup plate). Most use ordinary fencing to contain stock and keep costs down. Alternatively three rows of crash barrier can be used which can be reduced to two rows by threading the barrier through tyres to fill up the space. This is also more animal friendly. Water troughs should be placed outside the chipped lying area and protected against frost. A kick bar (railway sleeper) positioned where stock move on to/off the bedded area helps keep the chips cleaner.

Management and Maintenance

Satisfactory performance of corrals relies on the maintenance of an open, well-drained bed.

Corrals need to be managed. At recommended stocking rates, using normal large chips, be prepared by the end of the second winter to scrape off top 15 cm of dung/chips. If you have overstocked a corral and

begin to see a lot of dung building up on the surface, use an excavator with an extending boom to gently scrape off, avoiding compaction of the bed. Applying 10-15 cm depth of new chips will be adequate to rejuvenate the bed, but decide whether the whole area needs to be re-chipped. Putting new chips down on the middle strip where most cattle will be lying is becoming more popular.

The coarse chips can be screened and recycled to existing or new corrals and the spent chips and dung can be spread on stubble fields and ploughed down in accordance with the PEPFAA Code.

During periods of heavy frost, dung does accumulate on the surface and whilst this usually gets trodden down after thawing, the corral can get dirty for a short period. When designing the corral try to incorporate a runoff paddock that can be stocked until the frosty weather is over.

Typical Costs

Costs will be dependent on design layout. If the corral can be integrated alongside existing yards/buildings for feeding on, only the basic lying area needs to be constructed. If it is possible to utilise an existing effluent tank, slurry/effluent storage costs will be reduced, provided adequate additional storage capacity is available.

Construction options:

1. Fully chipped area with stock fed on the bed. This reduces capital cost (no scrape passage) and associated labour but chip bed area behind the feed stance will require annual replacement;
2. Concrete scraped passage with slurry storage;
3. Slatted effluent storage tank (unroofed and roofed).

Typical Cost – 40 Cow Corral

	£/Cow
Timber (£22/ton)	66
Chipping (£12/ton)	36
Fencing	10
Site works (including drainage layer/pipes)	75
Total	**£187/cow**

To add a scraped passage, will increase cost to £215/cow.

To provide effluent storage will increase cost to £515/cow.

This can be compared with a straw-bedded shed for 40 cows, which would cost £750-£900/cow with an estimated maintenance cost of £75/cow/year compared with £25/cow/year for the corral.

Effluent Management and Treatment

Effluent from corrals is highly polluting and must not be allowed to enter a watercourse. Such effluent must be collected and stored in existing slurry storage tanks/lagoons, if capacity is available, or new storage facilities provided[1]. Following storage, the effluent can be spread on land in accordance with the PEPFAA Code when soil conditions are suitable, via slurry tanker or low-rate irrigation.

Average effluent volumes to be stored and landspread can be calculated from:
Corral surface area (m^2) × Average daily rainfall (0.004 m) + slurry produced (allow an additional 5%), e.g.

Corral for 40 cows:
Area (600 m^2) × average daily rainfall (0.004 m) = 2.4 m^3/day rainwater effluent + slurry (0.12 m^3) = 2.52 m^3/day (4000 gallons/week).

To reduce effluent storage and spreading costs:

1. Divert all clean surface run-off away from the corral at the construction stage.
2. Roof the feeding area.
3. Consider using a constructed farm wetland treatment system for any lightly contaminated effluent issuing from the corral prior to discharge to a watercourse. Sufficient land area will be required and an effective constructed wetland system will have to be professionally designed with approval being sought from SEPA. This may mean a licence to discharge being required.

[1] The slurry storage facility must conform to the Silage, Slurry and Agricultural Fuel Oil (Scotland) Regulations 2003.

Finishing cattle on corral with scrape passage

Sheep on corral (2nd winter)

Chipper in action

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