BEEF CATTLE FEEDLOTS:
WASTE MANAGEMENT AND UTILISATION

3. Management of odour, dust and flies

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Manure is most odorous two days after wetting.

Even small areas of wet manure can be significant sources of odour.

Sedimentation basins are generally more odorous than holding ponds.

Introduction

Odour, dust and flies can cause conflict with neighbours, create an unpleasant workplace and affect cattle performance and staff welfare.

Sources of odour

Odour at cattle feedlots is mainly the result of anaerobic breakdown of organic matter, primarily in manure but also in waste feed. While good siting and feedlot design (particularly drainage) are vital in minimising odour, good hygiene and waste management are also imperative.

Odour release sites at a feedlot can include

- pens and cattle handling facilities
- drainage systems including sedimentation tank or basin and effluent holding pond
- feed storage and preparation areas and silage pits
- manure and effluent utilisation areas.

Two days after wetting, odour emissions from wet feedlot manure can be 50–100 times higher than those from dry pads and the odour is more offensive. Even a relatively small area of wet manure could be a significant odour source.

Pad temperature and moisture content are the most important factors influencing odour emissions from the pen (Nicholas et al. 2004). However, the depth of manure influences the rate of pad drying and hence the length of time over which higher odour levels persist.

Odour emission rates for sedimentation basins are generally greater than those from holding ponds. Pond rates under stable conditions are generally very low, but they can suddenly increase greatly after a significant inflow.

Odour from manure stockpiles, compost piles and silage pits are similar to those of feedlot pads. The character of odour from these sources seems to be less offensive than those from pads and ponds.

To minimise odours, limit the depth of manure over the pad, maintain an even feedlot surface and use practices that facilitate rapid drying of manure. Odour is reduced by cleaning pens frequently, and regularly removing

- manure or waste feed that has accumulated under fencelines and may impede drainage
- manure that accumulates along feedbunks, water troughs and aprons
- manure that settles in the drains, settling pit or sedimentation basin after rainfall.

As manure stockpiling areas can be a source of odour under wet conditions, good drainage from the windrows themselves and the pad is important. Section 2 provides more details.

Odour control

Areas or activities where there are opportunities to control odours include

- pen cleaning
- cleaning of drains and sedimentation tanks and basins
- pond desludging
- manure screening
- manure spreading
- effluent irrigation
- disposal of mortalities.

As there is some flexibility in the timing of these activities, it is useful to have a basic understanding of atmospheric conditions that can disperse odours.

Atmospheric conditions and their effects on odour dispersal are:

- Unstable atmosphere – typically the atmosphere is unstable on a warm sunny day when hot eddies of air rise from the land surface and cause significant mixing of the atmosphere. Odours are rapidly dispersed and carried upwards, quickly reducing odour intensity away from the feedlot. Because these conditions promote rapid dispersion, they are ideal for carrying out most odour-generating activities.
- Stable atmosphere – occurs on cold, still clear nights when the air at the land surface stays cool and remains trapped below an inversion layer. Little atmospheric mixing occurs below this layer and there is little dispersal of odours. Odours remain at relatively high intensity at some distance from the feedlot. These conditions are unsuitable for undertaking activities that will generate significant odour.
- Neutral atmosphere – occurs on heavy overcast days and odour dispersion is only moderate.

Effluent and manure utilisation should occur only when the prevailing weather conditions are unlikely to result in odour and dust nuisance for nearby residents. Consider the wind direction and strength, the time of day and the atmospheric stability. A plan showing the location of all nearby neighbours and a simple wind vane will help to show which neighbours are at risk of odour nuisance from effluent or manure utilisation on particular fields. It is also useful to understand the relative sensitivities of different neighbours to odour.

It can be worthwhile to develop an annual utilisation plan that takes into account seasonal wind directions, rainfall patterns and crops grown. Different paddocks might be selected for utilisation at different times of the year depending on risk.

To reduce odour nuisance to neighbours, spread manure or irrigate effluent

- frequently to minimise events with large odour generation
- evenly
- in the morning when the air is warming rather than late in the afternoon

Good pen foundations help to reduce problems of odour or dust.

On cold, still mornings, air will be trapped below an inversion layer, restricting odour dispersion.

Do not spread manure if heavy rain is predicted.

Suitable bunk design prevents build up of manure and associated problems of odour and flies.

Cattle movements along lanes can be a significant source of dust in dry conditions.

A water cart can be used to suppress road dust.

- as close to the ground as possible, particularly for spray irrigated effluent
- then as soon as possible harrow, disc or chisel plough to incorporate manure into the soil
- spray effluent as close to the ground as possible, and avoid high-pressure guns.

But do not spread (or irrigate)

- if the wind is blowing towards a neighbour
- if rain or heavy cloud are expected – use weather forecasts
- just before weekends or public holidays, particularly if close to a public area
- very dry manure that will result in dust being blown towards neighbours.

Also

- Eliminate all wet patches in drains and yards
- Avoid stockpiling wet manure as this produces very strong odours, even after spreading
- Train all staff in the mechanics and importance of odour dispersion
- Undertake public relations exercises – advise neighbours before spreading manure or irrigating effluent, even if winds will not blow towards them.

Dust control

Dust in feedlot pens should be controlled for the comfort and safety of cattle and workers, and to avoid impacting amenity. The health effects of dust depend on their concentration, size distribution, composition and persistence. Large dust particles (>10 µm) are typically responsible for adverse aesthetic impacts (e.g. soiling and discolouration) rather than health concerns. Finer dust particles are strongly linked to respiratory symptoms; these fine particles can remain suspended in the atmosphere for days and travel long distances.

Dust concentrations can be high downwind of feedlots, with a peak concentration typically seen around sunset with increased cattle movement and stable atmospheric conditions at that time. However, nuisance dust from the feedlot is unlikely to travel far enough to cause nuisance above that from other agricultural activities.

Control dust by minimising the depth of manure over the pad, by managing the moisture content of pad manure and by watering roads and lanes. For most feedlots, dust will need to be controlled only periodically.

Temporarily increasing the stocking density is one way to add moisture to the feedlot pad as it increases the rate of urine and faeces added to a given area. However, the capacity to vary stocking density may be limited by the conditions of the feedlot's licence or permit.

Mobile water tankers are useful for controlling dust on roads and lanes. Controlling dust loss reduces the exposure of sharp gravel so watering roads may provide an additional benefit through reduced wear and tear on tyres. Typically tanker sizes range from 20,000–25,000 L up to 40,000 L capacity. These tankers should be fitted with 30–90 kW pumps to supply a discharge rate of 2,000–10,000

L/min. Depending on the design of the tanker nozzles, water can be spread in a band 2–24 m wide (Sweeten and Lott 1994). The main determinant of tanker efficiency is turnaround time for loading and travel between the load and spreading points. In large feedlots, this can be minimised by providing multiple fill-up points. Roads can also be sealed to eliminate dust from this source.

Amending feedlot pad surfaces with wood chips might cushion hoof impact that causes dust and reduce dust directly by decreasing evaporation from the pad.

Since pen cleaning disturbs pad manure and creates dust, it should be avoided when the manure is very dry. However, the pens still need to be cleaned at an acceptable frequency (see Section 2).

Spreading dry manure can generate significant dust and should be avoided, especially under windy conditions.

Sealing internal roads is costly but greatly reduces dust.

Fly control

Feedlot operators consider flies to be a nuisance. The most important impacts (Vrech et al. 2004) are

- poorer working conditions
- risk to human health
- spoilage of feed
- poorer animal welfare
- potential for chemical residues
- production losses.

Of the major fly species found at feedlots, only house flies and stable flies breed at the feedlot; other species predominantly breed elsewhere. Flies breed in a number of relatively small areas, the most common being manure, vegetation and moist areas e.g. in hospital and induction areas, under fence-line manure, drains, silage pits and heavily grassed areas adjacent to the feedlot.

Dust released during manure spreading

Pen cleaning has a short-lived effect on fly breeding since manure quickly builds up under fences after cleaning. Because this manure is not trampled by the cattle it provides a good larvae habitat. Most feedlots use fly control including baits, insecticide sprays and traps. Fly baits have limited effectiveness as they attract and kill only adult house flies. There are also resistance issues with these. On the whole, insecticidal treatments have limited effectiveness.

Integrated pest management (IPM) systems that incorporate mechanical, physical, biological and chemical controls are likely to be most effective.

The RULES developed for IPM for control of nuisance flies at a feedlot site (based on Urech et al. 2004) are:

- Reduce fly breeding sites through
  - good manure management: clean under fencelines, sedimentation basins, drains, hospital pens and manure stockpiles
  - clean up feed spilled near the bunks, hospital pens, stables and feed mill

Fly bait station

Regularly mowing grassy areas around feedlot pens reduces habitats of fly larvae.

Vegetation growing into sedimentation basins and holding ponds provides a site for flies to breed.

  - good feedstuff storage – some ingredients, such as molasses and silage, attract more flies. Clean up spills and keep silage well covered
  - appropriate mortalities management – compost and cover completely
  - maintaining the feedlot troughs, drains, sedimentation basins and vegetation management by mowing or slashing around the feedlot complex, particularly areas adjacent to drains and pens

- Using insecticides selectively
  - rotate chemical groups
  - target insecticide use towards hot spots
  - use residual adulticides, particularly on resting sites rather than manure
  - use larvicides that will not affect beneficial insects
  - use baits for house flies with rotation between chemical groups.

- Lot feeding design principles, including
  - suitable pen foundation and slope
  - good feed bunk and water trough design
  - fence design that allows for easy cleaning
  - good construction of drains, sedimentation systems and effluent holding ponds
  - well-designed manure stockpile and composting area.

- Enhancing populations of biological control agents through
  - biological control agents, such as parasitic wasps, predatory mites and entomopathenogenic fungi, that can play an important role in killing larvae and flies; further development is needed
  - sustaining target parasite and predator populations through appropriate management
  - boosting parasite populations through strategic releases.

- Systematically monitor fly populations by
  - scouting adults and larvae to determine population thresholds
  - using traps for adults; larval density ratings for immatures
  - observing animals.

Further reading

DAFF 2011, Using weather conditions to reduce odour impacts, Department of Agriculture, Fisheries and Forestry, Brisbane, Qld.

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