



# Woodchip Pads for Livestock

## Introduction

Suitable winter feeding systems are often a challenge for livestock farms in the Northeast and elsewhere. Ease of feeding during winter conditions is a prime concern, as well as protection of pastures, especially during wet, muddy conditions when pugging and damage can occur. To address these issues, some level of confinement is often implemented on farms. With conventional confinement, negative effects on livestock comfort and performance can be significant in some situations, while accompanying environmental impact and nutrient management considerations are receiving more attention as water quality concerns increase in many watersheds. Woodchip heavy-use areas, or ‘woodchip pads’, offer an alternative to common winter feeding approaches. This fact sheet addresses key questions related this innovative approach to livestock comfort and water quality.

## Woodchip Pad Basics

### What are woodchip pads?

Woodchip pads are livestock heavy-use areas that have a drainage layer overlain by woodchips as a surface material. These systems have been used for years on beef and dairy farms in Ireland, the United Kingdom, and New Zealand, and have been documented to improve animal performance (Table 1). Systems require careful siting and design due to environmental and management considerations. Construction entails the excavation of soil to a 24” depth, followed by a shaping of the subgrade into a ‘ridge and valley’ configuration to encourage drainage. The subgrade is covered with geotextile, and then perforated pipe is placed in the valleys and connected to a solid pipe, which slopes to an outlet. A 12”-18” layer of drainage stone is placed over the pipe and subgrade, followed by a 10”-12” layer of selected woodchips. The perimeter of the pad is fenced and surface-bermed to prevent any off-site water from entering the pad’s drainage system.



Woodchip pad in operation during late spring in northern Vermont.



Pastures often become damaged during winter and late-fall/early-spring feeding. (Photo: Tom Basden, West Virginia University Extension Service)



Shaping of woodchip pad subgrade to encourage drainage.

	Wood chip pad	Slat Barn
Feed intake (lb DM/day)	24.0	20.9
Live weight gain (lb/day)	3.1	2.2
Carcass gain (lb/day)	1.7	1.4

Table 1: Performance of beef cattle wintered on a woodchip pad vs. indoors in a slat barn (French and Hickey, 2003).



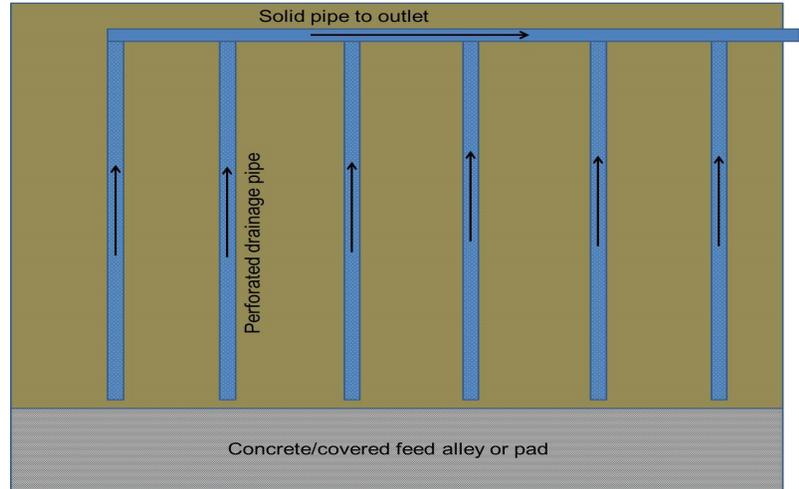
Large woodchips are important for woodchip pad longevity and drainage. (Photo: David DeVallance, West Virginia University, Wood Science and Technology)



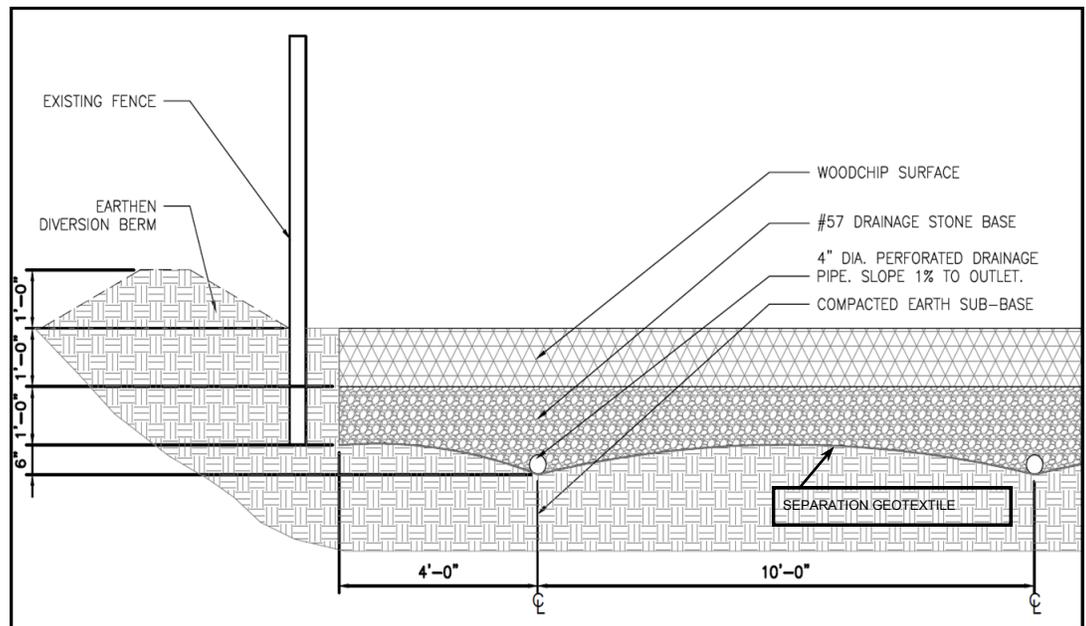
Drainage stone is placed over the perforated pipe. Accessible clean-outs are recommended to protect against clogging.

### Does the type of woodchip matter?

Larger, screened woodchips are critical for a well-drained surface that will not clog. Woodchips that are commonly used for commercial heating applications work well ('bole' chips). These woodchips are typically 2" x 2" x 0.25" and have been screened to remove fine particles. We have tested hardwood and softwood chips, and find both work well. Hardwoods are expected to absorb less water (meaning more runoff), while softwoods may degrade quicker.



Plan view of drainage system beneath woodchip pad. Perforated pipes are commonly spaced 10 feet apart, and sloped toward the solid outlet pipe.



Profile view of an example woodchip pad.

Animal Type	Minimum space requirement per animal (ft <sup>2</sup> )
Dairy Cow	130
Cow-calf pair	110
Beef cattle (>2 yr)	110
Cattle (1-2 yr)	90
Cattle (<1 yr)	65

Table 2: Recommended stocking density by animal type (Source: United Kingdom Dept. of Agriculture Fisheries and Food)

### What size of woodchip pad is appropriate for my herd?

It is highly recommended that livestock are fed off of the woodchip pad, on an adjacent concrete feed alley, for example. This will greatly extend the usable life of the woodchips and keep animals cleaner. Stocking densities are listed in Table 2. Woodchip pads are only recommended for lactating dairy cows when they have access to daytime pasture (BRP, 2011).

## Handling Drainage Water

### How should the drainage water from the woodchip pad be handled?

While many of the manure nutrients are retained within the woodchips, drainage water is still polluting and must be handled appropriately. Typical nutrient concentrations can be many times lower than barnyard runoff (Table 3). An agricultural engineer and agency personnel can assist with handling and treatment considerations during the design process. Options include storage in a holding pond for later land application, or distribution to a vegetative treatment area. The option selected depends greatly on the proximity to surface water, topography, and surrounding soils. The drainage water handling system cost can have a large influence on the total cost of the woodchip pad system.

### How much drainage water should be expected from a woodchip pad?

One of the key advantages of woodchip pads vs. concrete is that woodchip pads produce up to 50% less dirty water. This reduces the infrastructure, labor, and space required to handle and/or treat this water. The woodchips absorb a significant amount of incoming rainfall, and then it evaporates during drier days. A study over two years found that only **24%** of incoming rainfall on a woodchip pad left the system as drainage water (Faulkner et al., 2015).

	Average (mg/l)	Maximum (mg/l)
Total Nitrogen	117.1	155.1
Total Phosphorus	6.2	12.9
Dissolved Phosphorus	4.4	8.2

Table 3: Nutrient concentrations in drainage water from a woodchip pad for fifteen storms (Faulkner et al., 2015).



Woodchip pad in operation during late fall in West Virginia. Cattle are fed in adjacent roofed winter feeding structure, and have free access to the woodchip pad. Woodchips and spent manure are composted in the structure. Drainage water is sent to a vegetative treatment area (not visible).



Water samples taken from woodchip pads using a variety of different types of woodchips. (Photo: David DeVallance, West Virginia University, Wood Science and Technology)



Drainage water holding pond constructed for effluent from a woodchip pad.



Buried holding tank for woodchip pad drainage water. Water is dosed from tank to adjacent vegetative treatment area.



Woodchips being unloaded with a live-bed trailer, and spread with an excavator during construction.



Geotextile between subgrade and drainage stone increasing bearing strength of surface and provides additional support for equipment traffic.

## Operation and Maintenance

### How often do the woodchips need to be replaced?

Replacement of woodchips depends on how heavy the woodchip pad is used, the length of the winter, as well as the weather and other factors. It is recommended that the top 2" - 3" of woodchips be removed once every spring, after the stocking period. These woodchips should then be replaced in the fall with a topdressing before winter begins. Additional years of on-farm experience will provide more information on how long the deeper woodchips will last.

### What happens to the spent woodchips?

Woodchips that are removed from the woodchip pad will be laden with manure, and should be composted before field application. The woodchips provide a carbon source for the compost process, and do not hinder composting (like sawdust) due to their size and relative surface area. Once composted, they can be field applied. Forage yield was equal from composted woodchips applied at 143 lb N/acre and synthetic fertilizer applied at 54 lb N/acre (BRP, 2011). Use of any compost as a fertility source also has the benefit of increasing soil organic matter.

## Cost

### How much does it cost to build and maintain a woodchip pad?

Construction costs are variable depending on location and how drainage water is handled. In the Northeast, costs have ranged from \$163/cow for a system with a vegetated treatment area for drainage water, to \$920/cow for a system with a lined drainage water holding pond. Woodchip costs vary widely, and range from \$30/ton to \$65/ton, delivered. Financial assistance may be available through various agencies.

## For More Information

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