

Waste Management FACTSHEET



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COLUMBIA**

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DAILY SCRAPING MANURE MANAGEMENT SYSTEMS FOR DAIRY FARMS

There are many ways to handle manure on a modern dairy farm. The purpose of this note is to assist South Coastal British Columbia dairy producers in the selection of manure handling systems which are compatible with barns designed for daily tractor scraping.

DESIGN CONSIDERATIONS

1. Manure can be handled as a solid, semi-solid or liquid. Dairy manure will vary in consistency depending on the type of management and animal housing (Table 1). It should also be kept in mind that frozen or air dried manure has the same handling characteristics as solid manure.
2. The tractor scraping operation is considerably easier if there are not corners to turn. The barn layout should feature straight alleys which lead directly to the manure drop.

TABLE 1 EXPECTED MANURE CONSISTENCY	
HOUSING AND MANURE MANAGEMENT SYSTEM	EXPECTED MANURE CONSISTENCY
<ul style="list-style-type: none"> ➤ Bedded young stock housing and calf pens ➤ Tie stall with bedding ➤ Curbed slab manure storage with roof to eliminate runoff 	Solid
<ul style="list-style-type: none"> ➤ Tie stall with limited bedding ➤ Deep bedded free stall with paved passages ➤ Covered storage, no milking centre wastewater added 	Semi-Solid
<ul style="list-style-type: none"> ➤ Tie stall with no bedding ➤ Free stall with restricted bedding and concrete floor or rubber mats with paved passages ➤ Free stall with slotted floor passages and restricted bedding ➤ Open storage (no roof) ➤ Covered storage with milking centre wastewater added. 	Liquid

3. All scrape alley surfaces should be roughened to prevent animal slippage. The best type of concrete surface is a “diamond” scoring pattern impressed on the wet concrete surface when the floor slab is being placed. A more expensive method is to cut scores into the hardened concrete surface.
4. Manure is contained in the scrape alley by concrete curbs. These should be 200 mm (8 in) in height. Curbs lower than 200 mm allow manure to slosh into the stalls during the scraping operation.
5. Modern dairy practice tends to prefer liquid or semi-solid manure management systems. Solid manure management may still be preferred by some operators who do not want to replace existing facilities.

TABLE 2 MANURE MANAGEMENT SYSTEMS			
MANAGEMENT SYSTEM	TRANSFER METHOD	PUMP TYPE	STORAGE FACILITY
Tractor Scraping Liquid Manure	Gravity flow channel to storage	None required	Below grade
	Directly to storage		
	Gravity flow channel to reception pit	Chopper pump Air pump Piston pump	Above grade
Tractor Scraping Semi-Solid Manure	Directly to storage	None required	Below grade
	Gutter cleaner to storage		
	Gravity flow channel to storage		
	Gutter cleaner to reception pit	Auger Air pump Piston pump	Above grade
	Gravity flow channel reception pit		
Tractor Scraping Solid Manure	Gutter cleaner	Manure stacker to curbed slab storage	Below grade
	Tractor scrape out of barn	Front-end loader	Above grade

MANURE MANAGEMENT COMPONENTS

Depending on existing equipment and farmer preferences, every dairy farm has different manure handling needs; there is no single “best” manure management system. Table 2 shows the choices which are applicable to a daily scraping manure handling system.

TRANSFER METHOD

Tractor Scraping – A tractor equipped with a scraping blade is used to remove the manure from the free stall alleys. There are many available scraper designs both commercial and homemade. A simple but effective scraper can be constructed out of a large diameter industrial tire which has been cut to form a semi-circular blade.

Some of the smaller tractor models available today have very small front wheel diameters. This can lead to a tractor passage problem over manure drop slots in the barn floor. Check with the tractor dealer to determine if the tractor can safely pass over such slots.

Gravity Flow Slurry Channel – Gravity flow slurry channels are becoming popular in new barns as a method of transferring liquid manure from the barn to storage. The advantage of gravity flow channels is that they have no moving or mechanical parts. For details on the construction and operation of such structures, refer to the BC Ministry of Agriculture and Food, [Factsheet No. 383.350-1 “Gravity Flow Slurry Channels for Dairy Manure”](#).

Gutter Cleaner – Gutter cleaners work very well provided that they operate on level ground. In many cases, gutter cleaners were installed in tie stall barns designed for solid manure handling. Changes to free stall format with minimum bedding have resulted in the inappropriate use of gutter cleaners for handling liquid manure. The usual arrangement was to have a gutter cleaner feed an elevator stacker for transfer of solid manure to curbed slab storage. Elevator stackers are meant for solid manure only and should not be used to lift semi-solid or liquid manure.

Use gutter cleaners to move liquid manure on a level plane from the barn to either a below ground manure storage facility or to a below ground reception tank.

Reception Tank – A reception tank should be used where above grade manure storage structures do not allow level transfer of manure from the barn. A reception tank is a below ground manure receiving vessel sized to hold from one to seven days of manure production. The extra storage allows for freeboard when repair or servicing is required to equipment used in lifting the manure to the above ground storage. Construction is usually of concrete. Manure is pumped from the reception tank to the above grade storage facility.

PUMP TYPES

Augers – Augers or screw conveyors are best suited to semi-solid manure. Provided that the auger is equipped with a properly sized electric motor, augers are mechanically reliable. The chief

disadvantage of augers is that they have a relatively low flow-rate compared to a conventional manure pump. During winter operation, it is important to reverse the auger after use to empty the auger tube and prevent freeze-up.

Air Pumps – Air pressure manure transfer systems are suited to semi-solid or liquid manure. A large underground steel tank with an air-tight lid is used as a reception tank. When the lid is closed, air is pumped by compressor into the tank and the resulting air pressure “blows” the manure into the main storage tank through a 300 mm (12 in) PVC pipe. This system can transfer manure up to 46 m (150 ft) from reception tank to storage. These systems are quite effective but are expensive to purchase and install.

Because the piping is underground, air pumps are excellent in cold climates. A disadvantage is the limited size of the reception tank. Depending on manure volume, it may require more than one “blow out” during each barn cleaning period.

Piston Pumps – Piston action pumps are suited to solid or semi-solid manure, but will also move liquids. Piston pumps are either of the solid or hollow piston type. Solid piston pumps are the more expensive, and are meant for manure with a very heavy solid matter content. Hollow piston pumps are less expensive but are not as effective at moving manure with a high solid matter content. This system will also transfer manure up to 46 m (150 ft) from pump to storage.

Centrifugal Chopper Pumps – Centrifugal chopper pumps are suited only to liquid manure. A heavy-duty pump is a necessity. Open impeller pumps with chopper blades at the pump inlet are usually the most effective type of impeller.

STORAGE FACILITY

The farmstead layout and the choice of an above or below grade storage facility will affect the whole manure management system.

If possible, locate the manure storage at the lowest elevation on the farmstead complex. Manure tanks located at an elevation which is below that of the barn floor eliminate the need for “lifting” the manure.

RATING OF CHOICES

In the ideal situation where a new farm complex is being planned on a site which allows below grade manure storage, the best daily scraped manure system for South Coastal British Columbia is a liquid manure tank filled by a gravity flow manure channel. The only mechanical equipment required for such a system is a manure agitator and vacuum tanker for manure removal from the storage tank.

In all other cases, the best dairy scrape manure management system will depend on the unique needs of each individual farmstead. Table 2 presented above lists the possible daily scrape manure handling systems in order of preference.

SUMMARY

For more information on manure management and equipment, refer to the following publications available from the Resource Management Branch of the BC Ministry of Agriculture and Food. The staff can give assistance in selecting the best manure management system for your unique situation.

380.700-1	Management and the Nutrient Value of Manure
380.750-2	Manure Gas
381.210-1	Slotted Floor Freestall Dairy with Sub-Floor Manure Storage
383.000-1	Manure Storage Structures
383.100-1	Earth Bank Storages for Dairy Manure
383.100-2	Sizing Dairy Manure Storage Facilities
383.350-1	Gravity Flow Slurry Channels for Dairy Manure
383.510-1	Circulatory Agitation Systems for Dairy Manure Storage Tanks
386.100-1	Environmental Guidelines for Dairy Producers

FOR FURTHER INFORMATION CONTACT

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