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729

A Guide to Pipeline Manure Injection Systems

Pipeline injection systems for hog manure make efficient use of the nutrients present in the manure and minimize odour problems. However, they are costly to install. The level of investment varies with the size and complexity of the system. Here's what you need to know.

The pros and cons of pipeline injected hog manure

Pros

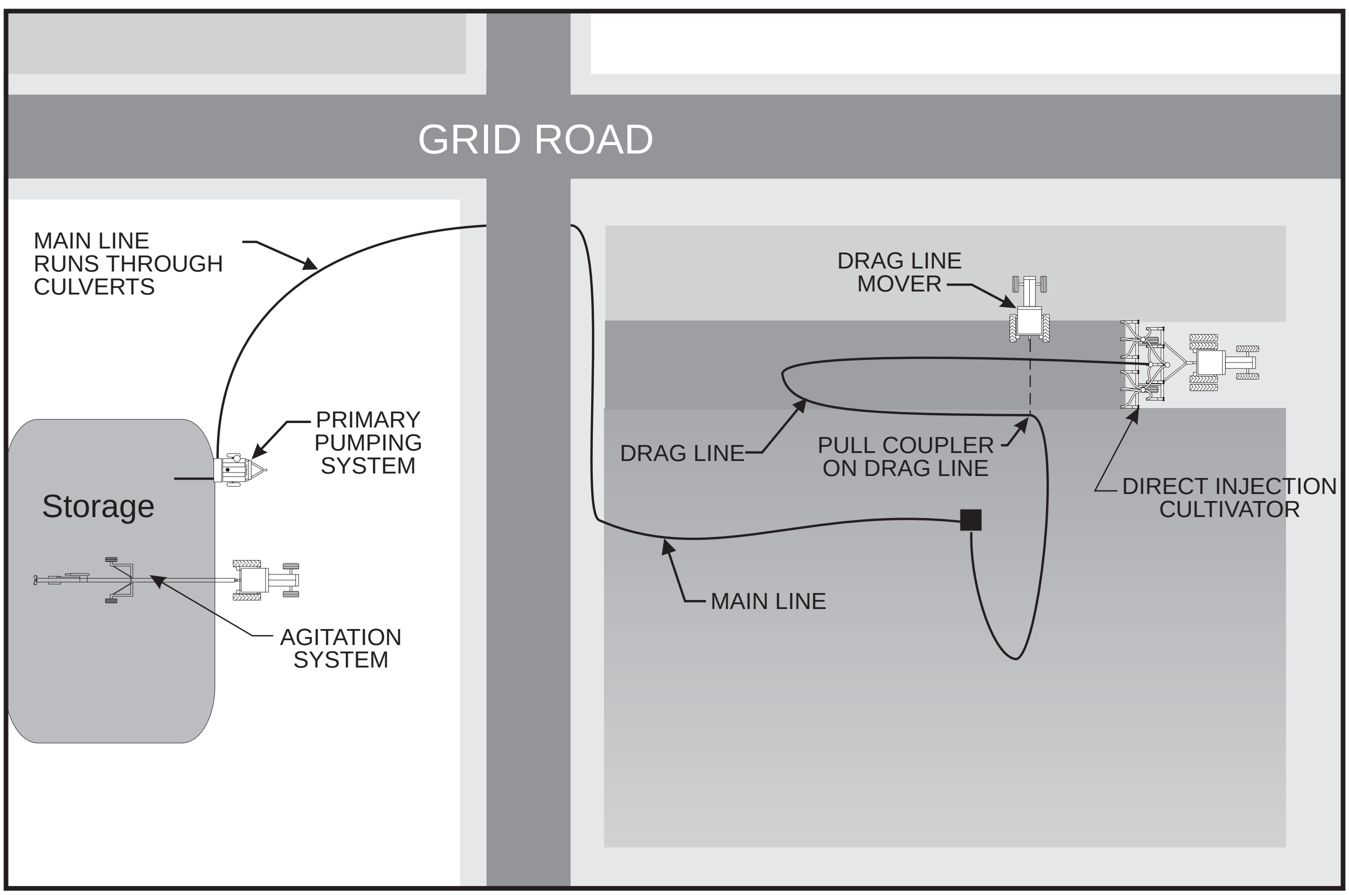
There are several advantages to applying liquid manure with an injection system. But the two major advantages are reduced nutrient loss and odour control.

Nitrogen management

The nitrogen content of manure is an economic resource. But, nitrogen can be lost to the atmosphere during traditional application methods. The degree of loss varies depending on the method used. For example, applying the manure through a sprinkler irrigation system could result in a 30 percent loss of the nitrogen. Injecting the manure into the soil all but eliminates nitrogen loss.

Continued on page 2

A typical pipeline injection setup.



What's Your Situation?

Depending on the size of your operation and other variables, you may also realize some of the following benefits of manure injection:

- Reduced transportation costs
- Reduced road damage when compared to large slurry wagons.
- Direct injection without the use of a slurry wagon may also reduce soil compaction in the field

Table 1.

Application Method	Nitrogen Loss	Comments
Sprinkler irrigation	30%	Fine particles increase ammonium - N loss. Loss will be greater in hot weather or with poor infiltration (clay soils) and lower with cool, wet weather and good infiltration (sandy soils).
Slurry wagon with splash plate and no incorporation	25%	Larger particles and lower trajectory reduce loss somewhat.
Slurry wagon with splash plate and immediate incorporation	3%	Timely incorporation reduces loss dramatically.
Injection	1%	Very little loss due to lack of contact with the atmosphere.

Losing nitrogen to the atmosphere is like losing money. A 4,540 cubic metre capacity (one million gallon) storage with an average nitrogen content of 2.0 kg/1000 litre (0.02 lb/gallon) contains about $6,000 worth of nitrogen if you assume a value of $0.66/kg ($0.30/lb). Losing 30% of the nitrogen represents a $1,800 loss.

Odour control

The second major advantage is odour control. Injection dramatically reduces odour in the field while spreading. Most injection equipment leaves no liquid on top of the soil from which odours can originate. However some odour will still occur from the storage due to agitation while pumping. Research is seeking ways to reduce odour during agitation.

Cons

The main drawback to pipeline manure injection is cost.

The cost of purchasing the equipment may be beyond the reach of an individual producer, depending upon the size of the hog operation and consequently on the amount of manure to be injected. It might make economic sense for a group of producers to combine efforts to justify the purchase of a system.

Custom application by injection may cost more than other methods such as an irrigation gun or slurry tankers. This is a reflection of the cost of the system, as well as the increased power (and fuel consumption) required to pull an injector while dragging the heavy supply hose. However, this higher cost must be viewed in light of the reduced nutrient loss, which may result in a lower net cost.

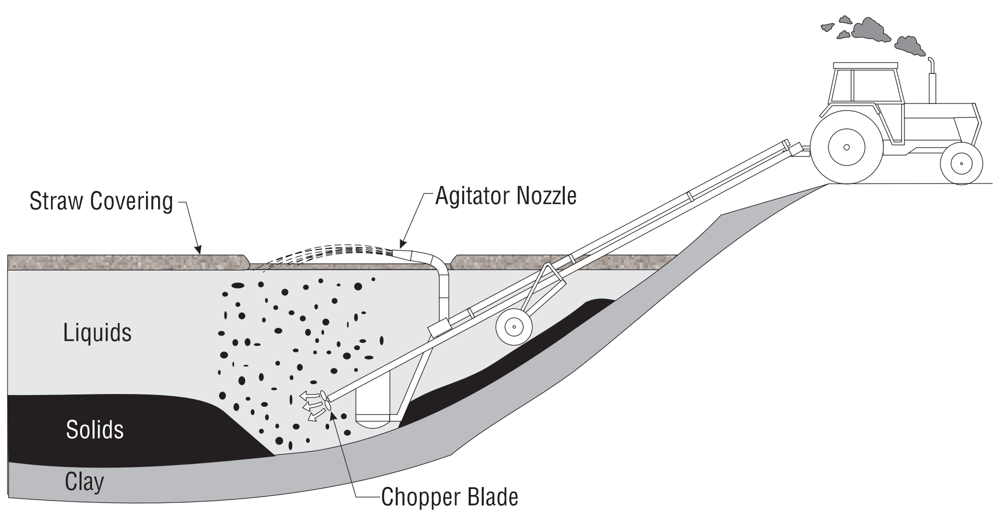
Also, current injection systems do not fit well into a direct seeding system due to the extensive soil disturbance caused.

System Components

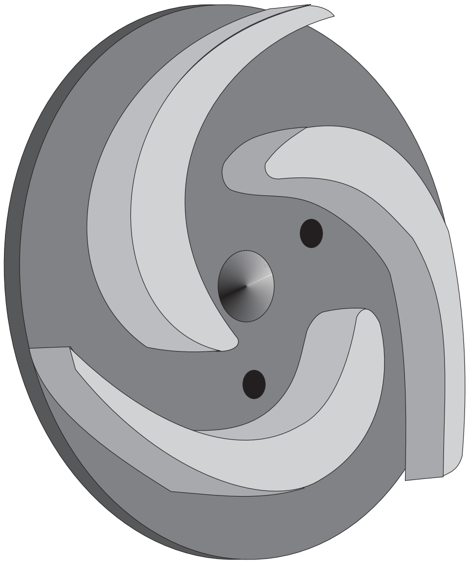
A complete pipeline manure injection system consists of at least one storage agitator, a manure pump, a main line from the pump to the field, a drag line (sometimes called an umbilical cord) to connect the main line with the injection equipment in the field, an injection implement and at least three tractors. An option to the drag line is a slurry wagon equipped with injectors which can be filled from the main line in the field.

Agitator

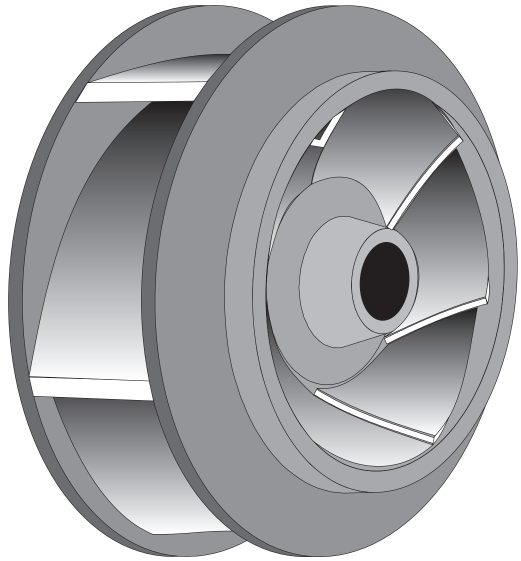
Storages common on the Prairies require agitation prior to and during pumping for complete emptying of the storage. Proper agitation also mixes the slurry to achieve a consistent nutrient content throughout the fluid.



For a weedy or straw covered storage, the agitator should also have a chopper system.



SEMI-OPEN IMPELLAR



CLOSED IMPELLAR

An semi-open impeller is best suited for pumping slurry with a high solids content. Closed impellers are typically used in high capacity irrigation pumps.

Most agitators use a propeller at or near the bottom of the storage to stir the liquid. They also use a hydraulically controlled water cannon to break up any surface crust and allow better mixing of solids.

For a weedy or straw covered storage, the agitator should also have a chopper system—either on the propeller or on the recirculating pump—to minimize plugging of hoses, fittings or the manure pump.

Proper agitation of the storage—especially a large one—may require moving the agitator to several places around the edge of the storage, or even the operation of more than one agitator. Agitation should continue throughout the pump-out.

Pump

A pump moves the slurry from the storage through the main pipeline to the field. Manure pumps are generally centrifugal pumps similar to those used for irrigation, but with open or semi-open impellers for handling manure solids.

Manure pumps may be either self-contained motorized units or PTO driven units.

A word about crop striping

Crop striping typically occurs when manure (or fertilizer) is injected in row spacings that are too far apart, or when the injected slurry is not spread widely enough when injected.

Look for machines that allow closer row spacings [as close as 30 cm (12 in)] and injection nozzles that create a slight back pressure. Back pressure helps spray (rather than pour) the slurry into soil openings.

Methods of priming manure pumps include a hand operated vacuum pump, using drive engine vacuum, or a hydraulically driven (from the tractor) feed pump. (The hydraulic feed pump is situated in the storage at the end of the inlet hose). Any of these pumps may include a chopper to prevent plugging of the pump. A separate chopper can be installed immediately in front of the main impeller.

Choosing the proper sized pump must be done in consideration of the entire system (see "Sizing the System").

Ball-Park Figures

Table 2. A summary of equipment costs. (You can use the worksheet on the back page of this report as a guide in pricing out your own system.).

Item	Approximate Cost
Lagoon agitator	$5,000 - $15,000
PTO driven pump	$5,700 - $12,000
Main line	$12,000 - $25,000
Drag hose	$16,000 - $24,000
Injector	$10,000 - $24,000
Hose reel	$5,600 - $12,000
Flow meter	$1,700 - $8,000
Hose couplers	approx $3,200
Total approximate price range	$59,200 - $123,200

Main Line

The main line conveys the manure from the pump to the field. Either aluminum irrigation pipe or a coilable mainline hose may be used. If hose is used, it must be strong enough to withstand the pressures produced by the pump. Working pressures are typically in the 1035 kPa (150 psi) range, while burst pressures are in the 3450 kPa (500 psi) range. Note that pumps used in the example at the end of this report do not exceed 1500 kPa (220 psi).

The main line is generally 150-200 mm (6-8 in) diameter. With a larger pipe or hose, less pressure is lost along the line and less energy consumed.

The main line can be 3 km (2 miles) long or longer. Longer distances require higher energy consumption and result in lower flow rates in the field. A second pump may be required at some point along the line to maintain adequate flow rates.

Choosing pipe or hose for the mainline is based on price and convenience. Hoses are considerably more expensive than aluminum irrigation pipe. But, hoses are much more convenient in that they can be wound on a hose reel for quick set up and removal. Manure pump-out contractors who cannot afford the time required to install and remove aluminum pipe may prefer to use hose.

Drag Line

The drag line connects the main line to the injector. This hose is usually a 100, 125, or 150 mm (4, 5, or 6 in) in diameter. The drag line must be very durable and abrasion resistant because it is pulled across the ground behind the injector and when moving from one place in the field to another.

Most injector manufacturers suggest using two 200 m (660 ft) drag hoses to apply manure to 16 ha (40 acres) in one setup. The two drag hoses are connected by a pull coupler so that the second hose can be moved by a second tractor when moving across the field or moving to the other side of the main line.

Hose Reels

Hose reels help in laying out and picking up the main line and drag hose.

The hose reels are powered hydraulically, or by a PTO or gas engine, and are mounted on a front-end loader, three point hitch or on a trailer. They often contain multiple reels (two to eight) with different sized reels for different sized hoses. The reels can be oriented horizontally or vertically.

Some hose reels include an air purge system to empty hoses before being reeled up.

Injection/Application Tools

There is a wide range of manure injectors and applicators available for use with pipeline manure systems. Most are three point hitch mounted, but would also work as pull type implements. A typical injector is 12 feet (3.6 m) wide with a 12 to 24 in (300 to 850 mm) spacing between injectors.

Injectors

Knife or spike injectors open a narrow slit in the soil surface about 5 cm (2 in) deep into which the liquid manure is injected. These injectors work well when sidebanding a row crop, but need to be placed not more than 300 mm (12 in) apart to avoid striping in cereal crops.

Since the opening created by these injectors is relatively small, application rates must be very low so the manure does not spill out on to the ground surface.

PAMI has developed an injection system that mounts to a standard 16 ft (4.9 m) wide cultivator. Preliminary testing of the delivery tubes and manifold distribution system showed even distribution using 12 in (30 cm) row spacing. Sweeps provide complete coverage of manure, reducing odour. Crop striping also appeared to be less of a problem when compared to machines with wider row spaces. A cutting system in the manifold prevents plugging.

Sweep injectors open a horizontal slit about 10 cm (4 in) below the soil surface, allowing the manure to spread across the entire width of the sweep. Sweeps are generally 30 cm (12 in) wide. Full-width coverage will prevent crop striping.

Sweeps help maintain as much trash as possible on the soil surface. They also allow higher application rates than knives without manure coming to the surface.

Losing nitrogen to the atmosphere is like losing money.

Subsoiling injectors are not common in North America, but are used in Europe and Great Britain. These units inject manure at depths up to 40-60 cm (16-24 in). In many cases, application this deep may reduce the benefits of manure injection, and increases machinery power requirements.

Shallow injectors are used for grassland, but again are more common in Europe and Great Britain. These injectors make a vertical slit up to 15 cm (6 in) deep into which the manure is inserted. They significantly reduce odour compared to broadcasting, but are not as effective at controlling odour as other injectors.

Incorporation Equipment

Incorporation implements use a nozzle or set of nozzles close to the ground either ahead or directly behind a tillage tool. The two most common types are a rotary aerator with adjustable angle and an S-tine cultivator to mix the manure into the soil.

Generally speaking, these machines result in more nitrogen loss and odour emissions than injectors. (See Table 1). And since they require some disturbance of the soil surface to incorporate the manure, they are not compatible with zero-tillage operations.

Surface applicators are also available. These include dribble bars and spread bars with low pressure nozzles that emit large droplets close to the ground for reduced odour emission and ammonia losses. Dribble bars use drop tubes spaced 20-30 cm (8-12 in) to deliver the manure from the manifold to the ground surface.

Flow Dividing Manifolds

Most manure application and injection implements use a flow-dividing manifold to evenly distribute the manure across the width of the applicator.

Some manifolds are very simple, with no moving parts, while others are more complex. One type uses a hydraulically driven rotating knife to chop any straw or solids in the manure and mix it prior to entry into the smaller hoses. A second type uses a series of rotating cams to open and close outlet holes in sequence, providing very even distribution.

Many of these tools also have a hydraulic flow shut-off valve so that flow can be stopped when the injection tool is out of the ground. A remote flow diverter at the pump is necessary when using a flow shut-off valve so that abrupt pressure changes do not burst pipes or hoses.

Flow Meter

Manure application rates can be estimated using pump curves and friction loss factors, but for more precise application rates a flow meter should be used.

The two main types of flow meters are electromagnetic and doppler type meters.

Both types of meters are installed between the drag hose connector and the manifold and can be set up with a display in the tractor cab, allowing the operator to match his groundspeed to flow rate in order to apply the desired rate. This also aids in changing application rates to match varying soil conditions in the field.

Electromagnetic flow meters cost approximately $7000-8000.

Dopplar meters are available for as little as $1700. While these meters are not as accurate as the electromagnetic meters, they are still reasonably accurate for measuring manure flow.

A flow meter is an asset if you are selling your manure to a another farmer as a nutrient source. Nutrient analysis of the manure combined with the amount applied will determine the amount of nutrient delivered to the field. This helps to establish the amount you may charge for the manure.

Because of the cost, flow meters are more likely to be purchased by custom operators who apply many millions of gallons of manure each year.

Tractors

Tractors are required for storage agitation, moving hoses, injection, and perhaps pumping. Depending on system setup, between three and five tractors will be needed.

Storage agitators are PTO driven. Those with only a propeller require up to 75 kW (100 hp) from the tractor PTO. Agitators with a recirculating nozzle or loading pump generally require about 97 kW (130 hp). A very large storage may require more than one agitator and therefore more than one tractor.

Pumps can be driven by tractor PTO or by a dedicated engine. Tractor-driven pumps usually require between 97 and 112 kW (130 - 150 hp) depending on the pump and application rate.

Where two lengths of drag hose are used, a tractor is required for moving the hose around the field. It should be approximately 75 kW (100 hp) with front wheel assist for better traction in wet conditions. This tractor can also be used to lay out and pick up the hose with a hose reel, and should be equipped with the necessary compatible accessories.

The tractor should be between 90 and 112 kW (120 - 150 hp), depending on the size and type of injector. The tractor must pull the injector as well as the drag hose along the ground behind it. A fully loaded drag hose can weigh up to 2450 kg (5,400 lb).

For easier turning with the drag hose attached, the tractor should have front wheel assist or 4WD. This tractor will usually require a three point hitch—standard mount for most injectors—although increasing numbers of pull type cultivators are being equipped with injection systems.

Table 3: Tractor Requirements

Implement	Tractor		Other Needs
	Number Required	Power Required	
Agitator	1 or more	75 - 97 kW (100 - 130 hp)	PTO
Pump	0-1	97 - 112 kW (130 - 150 hp)	PTO
Drag Hose	1	75 kW (100 hp)	Front-wheel assist, 3-point hitch, front end loader
Injector	1	90 - 112 kW (120 - 150 hp)	4WD, 3-point hitch
Total Tractors Required: 3 - 5			

Sizing the System

In order for the pipeline injection system to function properly as a unit, individual pieces of equipment must be sized with the whole system in mind.

The major factors to consider when sizing pumping equipment include the distance from the storage to the field and the average flow rate needed for the desired application rate. The desired application rate is determined by considering a combination of:

- nutrient content of the slurry
- nutrient requirements of the soil
- capacity of the injectors
- speed of travel

Pressure is lost along the system between the pump and the injectors because of a variety of natural factors. This accumulated pressure loss is called the Total Dynamic Head (TDH). For our example, TDH is best expressed as a pressure. In a properly sized system, the pressure available at the pump must be equal to the TDH when the system is operating at the desired flow rate.

A rule of thumb for pipe sizing is that the liquid velocity—the speed the slurry moves through the pipe—needs to be greater than 0.3 m/s (1 ft/s) to keep the solids suspended, and less than 1.83 m/s (6 ft/s) to avoid problems associated with abrupt pressure changes.

Simply put, the system should be sized so that enough slurry is delivered to the field to keep the injector supplied at the proper pressure and volume, with enough velocity along the pipe to keep solids suspended, but not so much pressure that damage to the system could occur.

Other information needed to determine system size is pressure loss factors for pipes and the injector, and pump curves for various available pumps.

An Example

The following is an example sizing procedure.

Assume that the proposed system has the following properties:

- Design flow rate through the system = 60 L/s (790 gpm).
- Field is 800 m (½ mile) from the storage.
- 800 m (½ mile) of 150 mm (6 in) aluminum pipe is used as the mainline.
- 400 m (¼ mile) of 130 mm (5 in) drag hose conveys the slurry from the mainline to the injector.
- Manure is being injected over 16 ha (40 acres).

Calculate the Total Dynamic Head (TDH). The total dynamic head is the sum of:

- Suction lift (sl) - pressure required to lift water from inlet to pump
- Head difference (hd) - pressure required to lift water from the height of the pump to the height of the injector
- Discharge pressure at the injector (dp)
- Friction loss (fl) - pressure lost due to friction in the pipeline/hose

Assumptions

sl = 240 kPa (35 psi) (equivalent to 4.6 m or 15 ft)

hd = (-)80 kPa [(-)11.5 psi] (equivalent to the injector being 1.5 m or 5 ft lower than the pump)

dp = 69 kPa (10 psi)

fl = CQ2L, where

A Visual Representation of TDH

C = friction loss coefficient for the following pipe diameters:

0.00114 for 100 mm (4 in) hose
0.000455 for 125 mm (5 in) hose
0.000284 for 150 mm (6 in) hose
0.000142 for 150 mm (6 in) aluminum pipe

Q = flow rate in litres/second

L = hose length in metres

Table 4 contains the pump pressure and power data for three different pumps used in this example. Note that most data for American manufactured pumps and hoses are made available in horsepower and US gallons. However for consistency, these calculations are presented in metric. Conversions are provided in Table 5.

Table 4: Flowrate Pump Data

	Pump A		Pump B		Pump C	
l/s	kW	kPa	kW	kPa	kW	kPa
19	30	552	101	1448		
25	34	517	104	1379	97	1207
32	37	483	112	1344	101	1172
38	39	414	119	1276	104	1138
44	41	324	123	1207	108	1103
50	42	241			112	1034
57	45	138			115	1000
63					119	896
82					127	552

Table 5: Conversion Table

SI Units	Imperial Units	US Units
1 l/s	13.2 gpm	15.9 gpm
1 kW	1.34 hp	1.34 hp
1 kPa	0.145 psi	0.145 psi

The simplest procedure to use for sizing the system is to do it graphically.

• Plot the pump data (power and pressure vs. flowrate) and the system curve (total dynamic head vs. flowrate) on the same graph.
• Determine at what flow rate the system curve and the pump curve (pressure) cross. This is the flow rate that this matched system is capable of running at.
• If this flow rate is not sufficient, then a different pump should be selected, or changes made to the system, such as using a larger diameter hose to reduce friction losses.
• Once the flow rate has been found, project from that flow rate up to the pump power curve to determine the power requirements to drive the pump.

Figures 1, 2 and 3 show the total dynamic head (system pressure) curve plotted against pump performance curves for 3 pumps. Given the choice of these three pumps, Pump C matches closest to the design flow rate of 60 l/s (790 gpm) (Figure 1). The two curves actually cross about 52 l/s (687 gpm) which would require almost 113 kW (152 hp).

Figure 1. Pump Curve For 125 mm Drag Hose

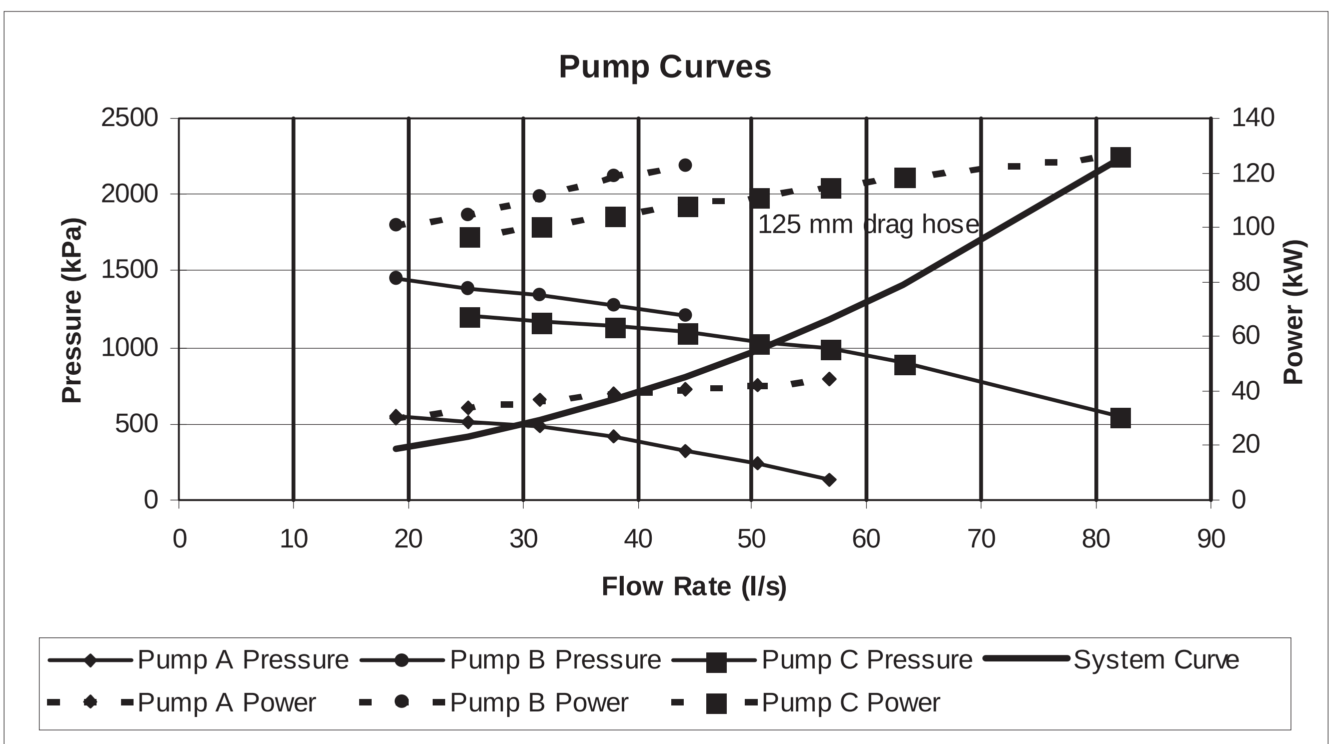


Figure 2. Pump Curve For 100 mm Drag Hose

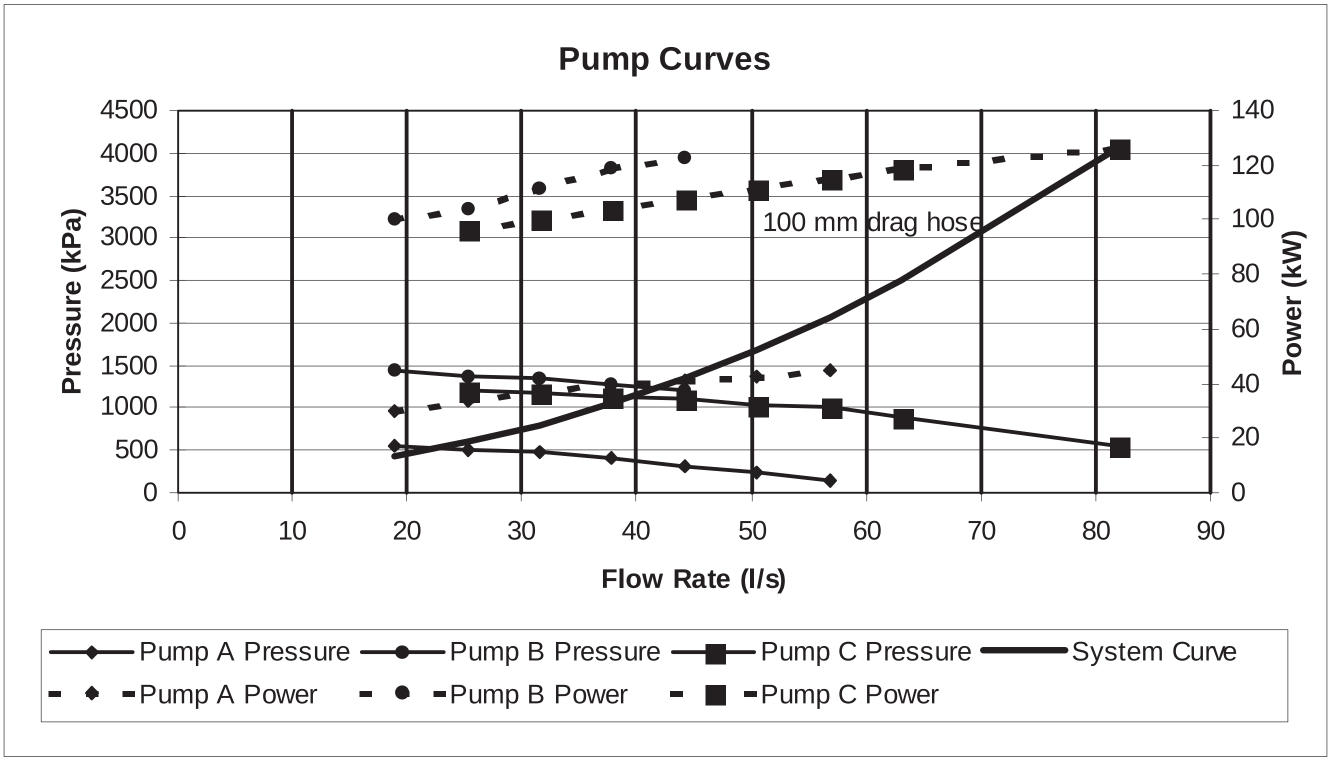
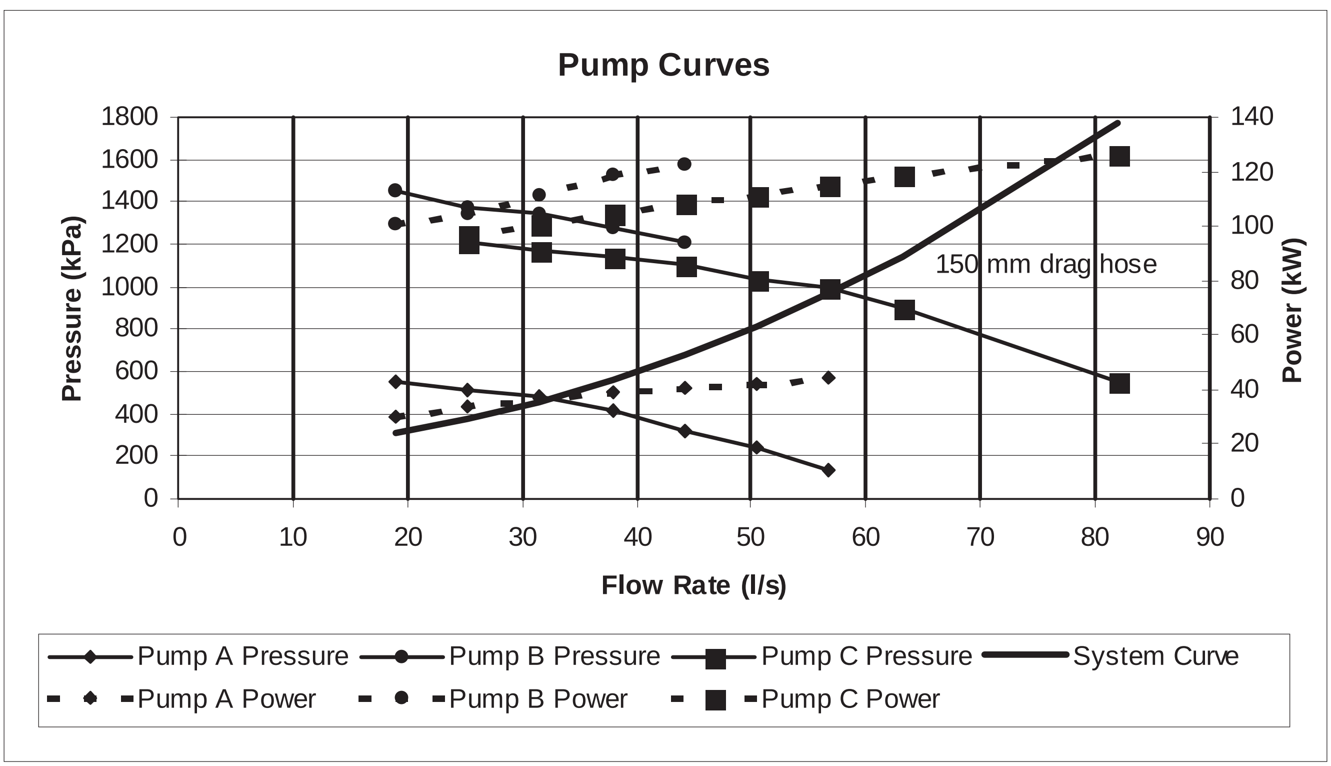


Figure 3. Pump Curve For 150 mm Drag Hose



If a 100 mm (4 in) drag hose was used instead of the 125 mm (5 in) drag hose, the curves cross at about 40 l/s (529 gpm) (Figure 2) and for 150 mm (6 in) drag hose they cross at about 57 l/s (753 gpm) (Figure 3). The 150 mm (6 in) drag hose has a slight power and pressure loss advantage over the 125 mm (5 in), but is more expensive. The difference in cost for 400 m of 125 mm and 150 mm of drag hose is approximately $3000. Using the 100 mm (4 in) drag hose significantly reduces the flow rate available with that pump, so would not be desirable unless design flow rate was much lower.

If a suitable combination of hose and pump is not found on the first try, the process becomes one of trial and error until a reasonable match is found.

To Buy or Hire?

After you have decided on the best system for you, calculate whether the cost of buying the system can be justified or if hiring a custom operator is more economical. (Use the worksheet at the back of this report).

Even if you already own enough tractors or can rent more if needed, at least $60,000 worth of equipment is needed for the example calculated in the previous section.

In order for the purchase of such a system to be economical, the operation must be sufficiently large. Alternatively, a group of producers can share the cost. Table 6 provides a detailed summary of equipment costs.

Volumes required to break even for purchasing a pipeline injection system compared to using a custom operator were calculated using a computer spreadsheet developed at PAMI. The calculations included all equipment, fuel and labour costs, including costs associated with tractors that may already be present.

Table 6: Detailed equipment pricing, 1996

Equipment	Quantity	Unit Price	Price Range
150 mm (6 in) aluminum pipe	805 m (2640 ft)	$14.80/m ($4.50/ft)	11,880
150 mm (6 in) main line hose	805 m (2640 ft)	$31.60/m ($9.60/ft)	25,400
150 mm (6 in) drag hose	402 m (1320 ft)	$48.10/m ($14.80/ft)	19,500
125 mm (5 in) drag hose	402 m (1320 ft)	$40.61-60.50/m ($12.38-18.44/ft)	$16,300-24,300
Suction hose	7.6 m (25 ft)	$69/m ($21/ft)	$525
Pump (PTO drive)	1	$5,700-12,000	$5,700-12,000
Injector	1	$10,000-24,000	$10,000-24,000
Hose reel	1	$5,600-12,000	$5,600-12,000
Lagoon agitator	1	$5,000-15,000	$5,000-15,000
Flow meter	1	$1,700-8,000	$1,700-8,000
Hose couplers	4	$800	3,200
Total (1996 prices)			$60,000-12,400

The calculations assumed:

- the cost for custom application of $1.54/m3 (0.7¢/gal)
- 7% interest rate*
- $7/hr labour rate
- 35¢/l ($1.59/gal) fuel cost
- distance to the field of 3.2 km (2 miles)

*The same interest rate is used for borrowing and return on investment

With these assumptions, the calculations concluded that in order to break-even with the cost of establishing your own system:

- a minimum yearly volume of approximately 154,360 m^3 (34,000,000 gal) is required if the manure is all at one site, or
- eight storages of 22,700 m^3 (5,000,000 gal) in volume, or
- 56 storages of 4,540 m^3 (1,000,000 gal) in volume.

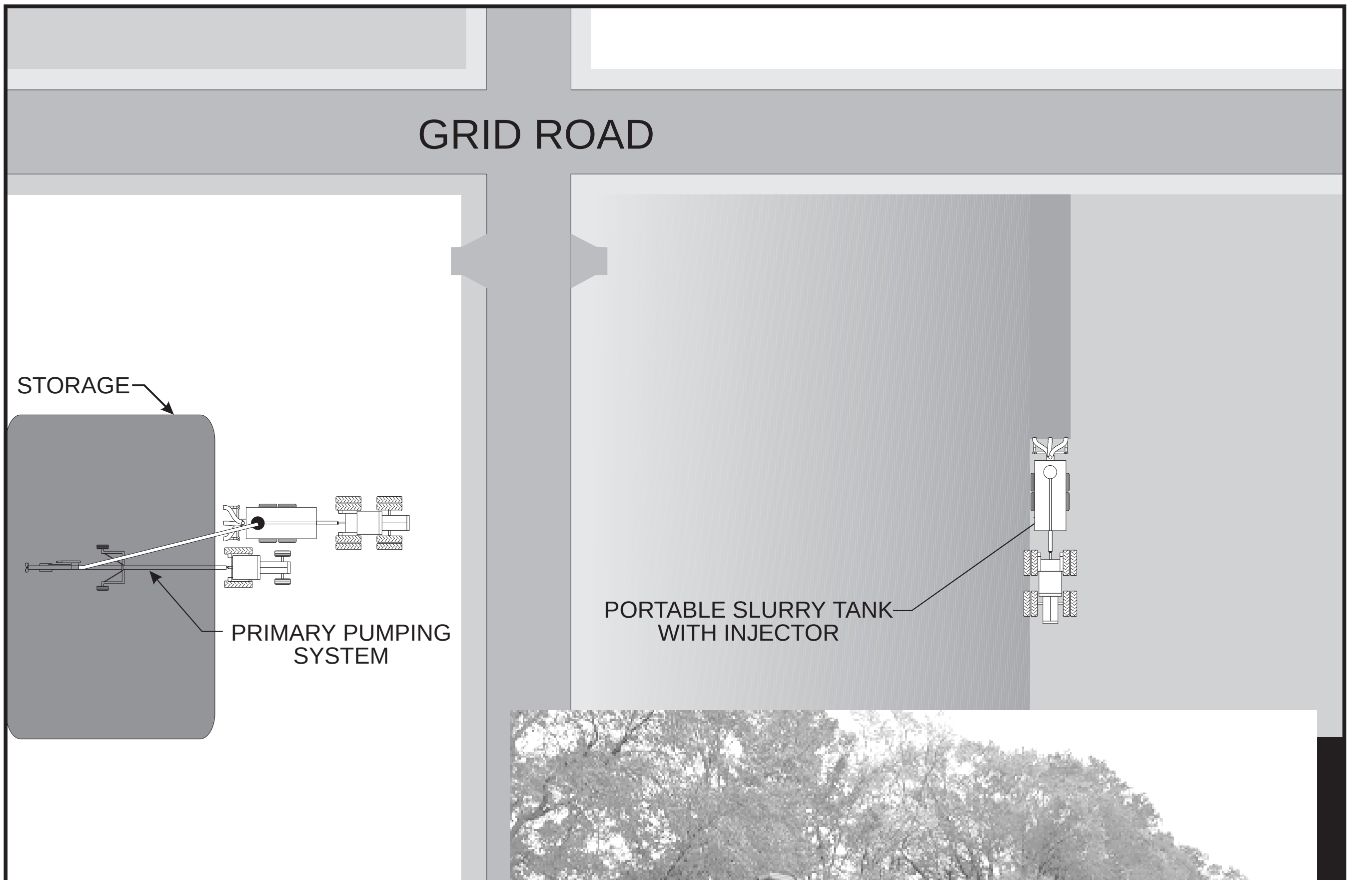
Most of the demand for contractors to empty storages comes from late August to whenever the ground freezes in late October or early November.

Some hog operations use storages designed to be emptied twice per year. This, combined with a few producers who couldn't finish pumping their storages in the fall, creates some demand for storage pumping in the spring. However the spring pumping season is generally shorter than the fall season as there is usually only a month between the time the ground is thawed and when the crop should be seeded.

A custom operator must have the mobility and ability to serve a large number of clients to make the investment worth while. Often, a custom operator will also have to purchase or lease tractors, adding to the capital cost of the injection system.

However, expansion of the Prairie hog industry presents an opportunity for more contractors to get into the business.

Look for a contractor who is able and willing to apply the manure at the proper rates for crop production. A contractor that can provide you with a nutrient analysis —even just nitrogen—can calculate the proper application rate and has the capability to meter and adjust his application rate to meet the proper rate will save you money.



A nurse tank mounted injection system is less labour and equipment intensive than pipeline injection, but is not economical for long haul situations. Scattering storage cells throughout an area for close proximity to fields may be part of the solution.

APPENDIX I

Equipment Manufacturers and Sales Outlets:

North American:

Bazooka Farmstar, Inc.
P.O. Box 869 Washington, Iowa 52353
Phone: (319) 653-5080
Fax: (319) 653-5806
injectors, storage and pit agitators, hose reels, hose

Holland Equipment Ltd.
P.O. Box 339 Norwich, Ontario
N0J 1P0
Phone: (519) 863-3414
Fax: (519) 863-2398
Aerway aerator

Hydro Engineering, Inc.
P.O. Box 98
Young America, Minnesota 55397
Phone: (612) 467-3100
injectors, pumps, hose

Liquid Waste Technology, Inc.
P.O. Box 250 Somerset, Wisconsin 54025
Phone: (715) 247-5464
Fax: (715) 247-3934
injectors, storage and pit agitators, hose reels, hose, pumps, flow meters

Managro Harvestore
P.O. Box 128 Winnipeg, Manitoba
R3Y 1G5
Phone: (204) 488-5078
Fax: (204) 488-5009
LWT injectors, pumps, hose, agitators, Slurrystore

European

Allan Fuller, Ltd.
Sedbury Works, Chepstow, Gwent
NP6 7YE
Phone: 011-01291-620324
Fax: 011-01291-625899
injectors

Anker Machinery
60 The Avenue Southampton, Hants
S017 1BD
Phone: 011-01703-233193
Fax: 011-01703-339272
shallow grassland injectors

Greentrac, Ltd.
Steeple Ind Estate, Antrim, N. Ireland
BT41 1AB
Phone: 011-08494-64599
Fax: 01-0836-625899
shallow grassland injector

Master Farm
33 London Road Marks, Tey, Colchester, Essex.
C06 1DZ
Phone: 011-01206-210732
Fax: 011-1206-213176
s-tine injector

Slootsmid
Kuijpers BV 'Slootsmid' Postbus 507
7245 ZG
Larsn (Gld)
Phone: 011-05738-1227
Fax: 011-05738-2131
disc-type injector

Timber Land Products Ltd.
Station Sidings, Milby Road, Boroughbridge,
N.Yorkshire
Y05 9BL
reciprocating stiff leg subsoiling injector for grassland

Vallely Engineering
Ridge Road, Ledstone Lock, Leeds, West Yorkshire.
LS25 7BS
Phone: 011-01132-861295
Fax: 011-01132-320100
stiff leg subsoiling injector
surface applicators
hose reels

Veenhuis
Veenhuis Machines BV Almelaseweg 54
8102 HE Roobe
Phone: 011-05720-52145
Fax: 011-05720-58384
injection equipment

Veredo
Veredo Dodeweard BV Welijsestroot 25a
6669 DJ Dodeweard
Phone: 011-0885-1254
Fax: 011-0885-2471
injection equipment

APPENDIX II

Custom Manure Injectors in Manitoba and Saskatchewan:

Manitoba

Ron Boisvert
Assiniboine Injections
Box 126, Rathwell, MB R0G 1S0
(204) 749-2123 Fax: 204-749-2109

Peter Dueck
Crocus Pumping Inc.
Box 295, Rosenort, MB R0G 1N0
(204) 746-6298 Fax: 204-746-6992

G & S Pumping
Box 4006, Arborg, MB R0C 0A0
(204) 378-2875

H & R Manuring
Russ Harder, Box 2904, Steinbach, MB R0A 2A0
Landmark, MB
(204) 326-9461 Cell: (204) 355-7542

Managro Harvestore
2319 McGillivray Blvd., Winnipeg, MB R3Y 1G5
(204) 488-5078

Eric Remple
16 Roselawn Bay, Niverville, MB
(204) 388-4299

Saskatchewan

Bob McLeod
Caron Crest Farms
Box 466, Caronport, SK S0H 0S0
306-756-2742 Fax: 306-756-2742

Bill Neudorf
Box 422, Hague, SK S0K 1X0
306-225-4466

Sands Septic
RR5, Site 28, Box 37 Prince Albert, SK S6V 5R3
306-764-7330

Peter Voldeng
MDC Services
Box 640, Naicam, SK S0K 2Z0
306-874-2244

NOTE: PAMI recognizes that many producers and agri-businesses use imperial measurements. Normally, PAMI publications present imperial measurements first, and metric measurements second. However, manufacturers performance data for equipment referred to in this Research Update alternates between imperial and US gallons, making direct comparisons difficult. For simplicity, we have used and presented metric measurements first, and imperial measurements second in this special case.

Worksheet For 'Ball Park' Estimate for Cost of Purchased Equipment

This worksheet will help a producer initially assess whether owning an injection system is viable.

A. Total pumping and injection equipment cost ($) = ____________________

B. Expected equipment lifetime (yrs) = ____________________

C. Annual volume of liquid manure to be applied (imp. gallons) = ____________________

D. Flow rate of pump (gpm) = ____________________

E. Hourly Labour Rate ($/h) = ____________________

F. Approximate Hours Worked (h) = **C / D** = ____________________

G. Tractor and Fuel Cost ($) = **F x $110/h** = ____________________
(for 3 tractors and one engine driven pump)

OR

= **F x $128/h** = ____________________
(for 4 tractors with a pto powered pump)

H. Equipment Cost ($)***** = **A x (2.195 + 0.0027 x F) / B** = ____________________

I. Labour Cost ($) = **(F x 2 (people) x E)** (operational labour cost**)**

+ (32 (person hours) x E) (setup/take-down labour cost) = ____________________

J. Total Cost ($) = **G + H + I** = ____________________

K. Volumetric cost (cents/gal) = **J / C** = ____________________

***** Equipment cost includes depreciation, maintenance, and interest on the capital cost. These equipment cost factors are derived from the Saskatchewan Farm Machinery Custom and Rental Rate Guide, 1996.

Assumptions include:

1. All manure is in one storage
2. Eight hour setup/take-down time
3. No equipment moves required
4. Interest rate = 7%
5. Salvage value of machinery = 10%
6. Fuel price = $0.35/litre ($1.59/imp gal)
7. Annual tractor use = 500 hours

This Research Update summarizes information from two longer engineering reports available from PAMI: RP0394, *Pipeline Injection of Liquid Manure*, and RP0995, *Hog Manure Application Techniques.* A small charge may apply.

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