Pig Manure: A Valuable Fertiliser

Teagasc Pig Development Department

Second Edition
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Authors:
Gerard McCutcheon and Amy Quinn

We would like to acknowledge the contributions of Mr. Mark Plunkett, Soil & Plant Nutrition Specialist, Johnstown Castle Research Centre, Wexford

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Introduction

It is well known that farmers can make substantial savings in fertiliser costs by using pig manure to grow their grass and tillage crops. Most of the pig manure produced on farms in Ireland is in the liquid form (slurry). Pig slurry is an organic fertiliser. It has a value because of the nutrients that it can supply for crop growth.

The EU Good Agricultural Practice for Protection of Waters Regulations (often referred to as the “Nitrates” regulations) have been reviewed and updated giving some flexibility to farmers using pig slurry. The new Statutory Instrument (SI 605 of 2017) came into effect on 1st of January 2018.

With increasing pressure to improve air and water quality the aim is to use pig slurry as efficiently as possible to replace chemical fertilisers during the growing season. Each cubic metre of pig slurry/manure is deemed to contain 4.2kg of total nitrogen (N) 0.8kg of phosphorus (P) and 2.2 kg of potassium (K) (unless another level of these nutrients is established in compliance with Article 32 of the Regulations).
Nutrient Content

The nutrient content is closely related to the solids or dry matter content. The solids content is variable depending mainly on the amount of water added either in the feeding and watering of the pigs or from extraneous sources such as washing of houses, leaks, spills or from roofs, open tanks or dirty yards. Good manure management on the pig unit will ensure minimal dilution with water. This will result in reduced storage and transport costs for the pig producer and a product with higher solids and nutrient content for the customer farmers. Pig manure that contains 4.3% solids is of reasonable quality. Good quality pig manure will often contain more than 5% solids. The nutrient content, availability % and nutrient value are shown in Table 1.

Fertiliser Value

Farmers can make substantial savings by using pig slurry to replace the nutrients supplied by chemical fertilisers. The actual value of pig manure as a fertiliser depends on how much chemical fertiliser is replaced as well as the cost of the chemical nutrients replaced. The fertiliser value of pig manure at 4.3% solids is currently valued at €5.36 per m³ when there is a requirement for N, P and K and when the availability of the N to the crop is 50%. This translates into €24.33 per 1000 gallons. As the solids content increases there will be a corresponding increase in the nutrient content and in the fertiliser value.
Table 1: Nutrient content and value of pig slurry (4.3% solids).

<table>
<thead>
<tr>
<th>Nitrogen content kg / m³</th>
<th>Nitrogen</th>
<th>Phosphorus</th>
<th>Potassium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutrient availability %</td>
<td>50</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>*Fertiliser cost per kg €</td>
<td>0.95</td>
<td>2.00</td>
<td>0.80</td>
</tr>
<tr>
<td>Value €</td>
<td>2.00</td>
<td>1.60</td>
<td>1.76</td>
</tr>
</tbody>
</table>

Note: 1 m³ equals 220 gallons.

*Based upon Chemical Fertiliser prices in Nov 2019 (ie Nitrogen at €0.95/kg, P at €2.00/kg and K at €0.80/kg).

Typically 1000 gallons of typical pig slurry (4.3% solids) can be considered equivalent, in chemical fertiliser terms, to a 50kg bag of an NPK product 19-7-20. For every one percentage point increase in solids content the value of 1000 gallons increases by €4.30. A lorry tanker conveying 25m³ or 5500 gallons will contain nutrients to the value of €134 based on 4.3% solids.

**Nutrient Management Planning**

Nutrient Management Planning entails meeting the crops nutrient requirement with the nutrients applied as fertiliser taking the nutrient status of the soil into account. The fertiliser may be in the organic form (i.e. animal manure) or inorganic form (i.e. artificial fertiliser).

The term ‘availability’ is often used for organic fertilisers such as pig manure, and this means how effective the nutrients in the pig manure are relative to chemical fertiliser. For example, if the N in pig manure is assumed to be 50% available, this means that 1 kg of total N in pig manure will be as effective as 0.5 kg of chemical N fertiliser.

In Ireland, over 2.4 million tonnes of pig manure is produced annually mainly in the form of pig slurry. This manure needs to be managed in a proper manner. Proper management requires having proper storage facilities on the pig farm and it also entails good management at spreading time to ensure that the nutrients contained in the manures are utilised to meet crop requirements. All farmers should be aware of their obligations to ensure compliance with the “nitrate” regulations (currently SI 605 of 2017).

Organic fertilisers can vary greatly in their nutrient content. The Dry Matter % can be measured on the farm using a slurry hydrometer (page 10). This can give a good indicator of the nutrient content.
In order to determine how much pig slurry a farmer may use it is important to know the following:

- The area of the farm (hectares),
- The organic nitrogen stocking rate in the previous year,
- The crops to be grown, the nutrient status of the soil (as determined by soil analysis), or otherwise P Index 3 is assumed,
- If silage or hay is sold from an area of the farm this should be reported as it increases the Phosphorus requirement on the farm,
- The chemical fertiliser usage in the current year, and
- The tonnes of concentrate feed fed to grazing animals the previous year.

### Organic Stocking Rate

A farm can only take in pig manure up to the point where the total organic N deposited on the farm is not greater than 170 kg/ha. The organic N deposited is the total N excreted by grazing livestock on the holding. Table 3 shows the organic N that is excreted per year by each livestock category.

### Table 3: Organic N excreted per year by each livestock category

<table>
<thead>
<tr>
<th>Animal Type</th>
<th>Organic N excretion (kg/hd/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy Cow</td>
<td>85</td>
</tr>
<tr>
<td>Suckler Cow</td>
<td>65</td>
</tr>
<tr>
<td>Other Cattle &gt; 2 yr old</td>
<td>65</td>
</tr>
<tr>
<td>Cattle (1-2 yr old)</td>
<td>57</td>
</tr>
<tr>
<td>Cattle (0-1 yr old)</td>
<td>24</td>
</tr>
<tr>
<td>Lowland ewe (incl lambs)</td>
<td>13</td>
</tr>
</tbody>
</table>

(Extracted from Tunney, 1987)
Article 20(1) now states “that where imported livestock manure is to be applied in any year to the land on the holding calculations shall be based on the previous calendar year’s stocking rate.” This is a change which allows farmers that use pig manure greater certainty in their calculations each year. It also allows these farmers do their calculations earlier in the year. If there were sheep or horses (or other non-bovine animals on the holding in the previous year) they should be factored into the calculation to determine the organic N on the farm.

**Simplification of Calculation**

The calculation to determine the phosphorus (P) requirement for a farm has been simplified and no longer requires the calculation of the P contained in the slurry/manure of the grazing animals (produced over the winter period).

**Phosphorus in Concentrate Feedstuff for Grazing Livestock**

Where grazing livestock are fed concentrate feedstuff the first 300kg of concentrate used per each 85kg (Livestock Unit of grazing livestock) is discounted when calculating the P in concentrates used.

**Soils with a P Index of 1 or 2**

The availability of P in organic manures such as pig slurry was deemed to be 100% available at all soil P indices. Now if a soil is Index 1 or 2 (see Table below) the availability of the P from organic fertilisers is 50%. The farmer can verify that the soil is Index 1 or 2 by soil sampling his farm. If the farmer does not soil test his land he/she may still assume Index 3 soil P levels as in previous versions of the regulations. Where soil testing is being done the soil tests must be done every 4 years and be representative of an area of 5 hectares or less.

Under Article 15 of SI 605 of 2017 the Phosphorus Index system is as follows:

**Table 4: Phosphorus Index System.**

<table>
<thead>
<tr>
<th>Soil Phosphorus Index</th>
<th>Soil Phosphorus Ranges (mg/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grassland – Mineral Soils</td>
</tr>
<tr>
<td>1</td>
<td>0.0 – 3.0</td>
</tr>
<tr>
<td>2</td>
<td>3.1 – 5.0</td>
</tr>
<tr>
<td>3**</td>
<td>5.1 – 8.0</td>
</tr>
<tr>
<td>4</td>
<td>&gt; 8.0</td>
</tr>
</tbody>
</table>


**On peat soils all recommendations for P are based on the Index 3 allowances.
If a farmer uses chemical P it will greatly reduce the level of pig slurry he/she may use on their farm. It is important that each farmer is aware of the volume of pig slurry they may use in compliance with the “nitrate” regulations to ensure maximum savings in fertiliser costs. The recipient farmer should have a fertiliser plan done by their own agricultural adviser/consultant and then let the pig farm manager/owner know how much they will need as early in the year as possible. The pig farm may then make arrangements to ensure a supply of the required volume.

Measuring Manure Dry Matter

The solids or dry matter content of a sample of pig slurry can be determined using a slurry hydrometer. This is inexpensive and relatively easy to use. However, it is very important to obtain a representative sample of manure when testing for solids. Pig manure solids tend to settle in the bottom of the storage tank. The manure from different parts of the pig unit will have different solids contents—depending on the water to feed ratio and it can be useful to assess the dry matter content in each section of the pig farm.

Nitrogen and Ammonia Losses

The nitrogen in pig slurry is in two forms. First there is the ammonium –N which is available for plant growth and secondly there is the organic-N which is not available to the plants at spreading time (but becomes available over time).

Ammonia N may be lost if it does not get into the root zone of the plant/crop quickly or attach onto soil particles. It is lost by a process where the ammonium –N is converted to ammonia gas (NH3) which goes off into the atmosphere. While ammonia gas is not a greenhouse gas, it has detrimental environmental effects which should be mitigated to reduce the losses of ammonia to the air. Using low emission spreading technologies can reduce this loss while increasing the ammonium –N available for crop growth.

Secondly and equally important is the timing of spreading. Spreading organic fertilisers in spring time (cooler damp weather) leads to lower risk of ammonia losses.

If slurry is spread in warm, windy and sunny conditions, the loss of ammonia to the atmosphere can be high. It is good practice to aim to get as much slurry spread early in the year (and reduce chemical fertiliser usage accordingly) when there is a large crop demand for N, P and K.

Reducing ammonia losses to the atmosphere is a win-win for the farmer and the environment if he/she is reducing their usage and expenditure on chemical nitrogen fertiliser.

Where slurry is spread on tillage land it should be incorporated into the soil as quickly as possible. Immediate incorporation (or within 3 to 6 hours of application) is recommended. Emission reductions of 70-90% are achieved where the slurry is incorporated immediately after application. By reducing...
the emissions you are increasing the fertiliser value of the slurry, and also reducing gaseous emissions.

**Low Emission Slurry Spreading**

The use of equipment such as a dribble bar, trailing shoe/hose, band spreader or slurry injection can reduce ammonia (and other gaseous) emissions compared to using a low trajectory splash plate. This is achieved by decreasing the surface area of slurry in contact with the air.

Slurry spread with a low emission method has a higher nitrogen fertiliser value (often referred to a Nitrogen Fertiliser Replacement value (NFRV) because of reduced ammonia loses when compared to slurry spread by a conventional splash plate. Research work with cattle slurry showed a 25% reduction in ammonia losses for the trailing shoe compared to the splash plate under Irish Grassland conditions (Reference: Teagasc, 2016 Major and Micro Nutrient Advice for productive Agricultural Crops). There is no reason to expect that this improved fertiliser effect would not be seen with pig slurry also.

The reduction in ammonia losses is greatest in the summer months. Therefore the use of low emission slurry spreading equipment in the summer months will give the greatest effect. Low emission techniques will help reduce odour at spreading time also.

The use of the band spreader - as shown below on tillage, or grassland can increase the nitrogen replacement value by 50% in the spring and up to 30% in the summer giving less ammonia losses and lower odour at spreading time. This saves money if the farmer reduces their chemical fertiliser levels accordingly.
## Contacts

For more information or to be put in contact with a pig farmer in your area, please contact your local Pig Advisor.

<table>
<thead>
<tr>
<th>Name</th>
<th>Contact No.</th>
<th>E-Mail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr. Gerard McCutcheon</td>
<td><strong>Telephone:</strong> 076-1111303 087-8303969</td>
<td><a href="mailto:gerard.mccutcheon@teagasc.ie">gerard.mccutcheon@teagasc.ie</a></td>
</tr>
<tr>
<td>Teagasc, Oak Park, Carlow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mr. Ciarán Carroll</td>
<td><strong>Telephone:</strong> 025-42388 087-2462925</td>
<td><a href="mailto:ciaran.carroll@teagasc.ie">ciaran.carroll@teagasc.ie</a></td>
</tr>
<tr>
<td>Teagasc, Moorepark, Fermoy, Co. Cork</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr. Amy Quinn</td>
<td><strong>Telephone:</strong> 076-1112723 087-3779015</td>
<td><a href="mailto:amy.quinn@teagasc.ie">amy.quinn@teagasc.ie</a></td>
</tr>
<tr>
<td>Teagasc, Moorepark, Fermoy, Co. Cork</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mr. Michael McKeon</td>
<td><strong>Telephone:</strong> 025-42259 087-6739178</td>
<td><a href="mailto:michael.mckeon@teagasc.ie">michael.mckeon@teagasc.ie</a></td>
</tr>
<tr>
<td>Teagasc, Moorepark, Fermoy, Co. Cork</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ms. Emer McCrum</td>
<td><strong>Telephone:</strong> 076-1112910 087-7940974</td>
<td><a href="mailto:emer.mccrum@teagasc.ie">emer.mccrum@teagasc.ie</a></td>
</tr>
<tr>
<td>Teagasc, Ballyhaise, Cavan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr. Louise Clarke</td>
<td><strong>Telephone:</strong> 049-4338634 087-6177268</td>
<td><a href="mailto:louise.clarke@teagasc.ie">louise.clarke@teagasc.ie</a></td>
</tr>
<tr>
<td>Teagasc, Ballyhaise, Cavan</td>
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Notes