Pig Development Department

Pig Manure: A Valuable Fertiliser

Teagasc Pig Development Department

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First Edition

Teagasc
Agriculture and Food Development Authority

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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 31 of 2014) came into effect on 31st of January 2014, and will be in place for the years of 2014 to 2017.

A stated aim of the "Nitrates" regulations is to encourage the efficient use of organic fertilisers. Each cubic metre of slurry/manure is deemed to contain 4.2kg of total nitrogen (N) and 0.8kg of phosphorus (P) (unless another level of these nutrients is established in compliance with Article 34 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

The 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 €5.60 per m^3 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 €25.45 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).

	Nitrogen	Phosphorus	Potassium
Nutrient content kg / m^3	4.2	0.8	1.9
Nutrient availability %	50	100	100
*Fertiliser cost per kg €	1.00	2.00	1.00
Value €	2.10	1.60	1.90

Note: 1 m^3 equals 220 gallons.

*Based upon Chemical Fertiliser prices in Feb 2014 (ie Nitrogen at €1.00/kg, P at €2.00/kg and K at €1.00/kg).

Typically 1000 gallons of typical pig slurry (4.3% solids) can be considered equivalent, in chemical fertilizer 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 €5.80. A lorry tanker conveying 25m^3 or 5500 gallons will contain nutrients to the value of €140 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, there is approximately 2.3 million tonnes of pig manure produced mainly in the form of pig slurry on an annual basis. This manure needs to be managed in a proper manner. Proper management entails having proper storage facilities and management on the pig farm and it entails ensuring that the nutrients contained in the manures are utilised to meet crop requirements in compliance with "nitrates" regulations.

Organic fertilisers can vary greatly in their nutrient content. The Dry Matter % which can be easily measured on the farm is a good indicator of the nutrient content.

Table 2: Total Nitrogen (N), Phosphorus (P) and Potassium (K) in Pig Slurry in kg/ m^3 at various Dry Matter levels.

Dry matter %	Nitrogen	Phosphorus	Potassium
2	2.5	0.5	1.2
4	4.2	1	1.7
6	5.5	1.5	2.1
8	6.0	2.0	2.3
10	6.5	2.5	2.5

(Extracted from Tunney, 1987)

In order to determine how much pig slurry a farmer may use it is important to know the following:

The area of the farm, the organic stocking rate, the crops to be grown, the nutrient status of the soil, the proposed chemical fertiliser usage 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. The following table shows the organic N that is excreted per year by each livestock.

Animal Type	Organic N excretion (kg/hd/year)
Dairy Cow	85
Suckler Cow	65
Other Cattle > 2 yr old)	65
Cattle (1-2 yr old)	57
Cattle (0-1 yr old)	24
Lowland ewe (incl lambs)	13

The organic stocking rate also impacts on the Phosphorus requirement for grass growth: Farms with grassland stocking rates greater than 85kg organic N /hectare (one dairy cow/ha) have got the P allowance increased when compared to the previous regulations (SI 610 of 2010) as shown below in Table 3.

Table 3: Increase in phosphorus allowance.

Stocking rate (kg/ha)	Increase compared to SI 610 of 2010
86 - 130	+ 1 kg P / ha
131 – 170	+ 2 kg P / ha

Farms with grassland stocking rates of less than 85kg/ha lose 4 kg/ha relative to the SI 610 but this loss is compensated if the farm is selling a cut of hay or silage off the farm by an allowance of 40, 30 and 20 kg of P /ha at a soil index of 1,2 or 3 respectively – which was not factored into the previous rules. A further 10 kg/ha is allowed on these soils (not on a soil with a P index of 4) for each subsequent cut.

An extra P allowance of 15kg/ha is allowed for grassland that is being re-seeded on soils with a P index of 1, 2 or 3. Allowance has also been made for maize crops on soils with high P levels.

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 fed.

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 they can still assume Index 3 soil P levels as in previous versions of the regulations.

Under Article 15 of SI 31 of 2014 the Phosphorus Index system is as follows:

Table 4: Phosphorus Index System.

Soil Phosphorus Index	Soil Phosphorus Ranges (mg/l)	
	Grassland – Mineral Soils	Other Crops
1	0.0 – 3.0	0.0 – 3.0
2	3.1 – 5.0	3.1 – 6.0
3	5.1 – 8.0	6.1 – 10.0
4	> 8.0	> 10.0

*Reference SI 31 of 2014

Farmers can make substantial savings by using pig slurry to replace the nutrients supplied by chemical fertilisers. The use of pig slurry based upon the value above of €25 per 1000 gallons can yield substantial savings on fertiliser costs.

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. They 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 unit will have different solids contents.

Case Study

A number of calculations were done to compare the old and the new regulations. A case study was undertaken based on a farm of 40 ha (100 acres) of grassland with varying organic nitrogen stocking rates and low concentrate usage. The summary of the calculations are shown below in Table 5 where no soil sampling has been done on the farm and Index 3 soil P is assumed. The year 2014 includes the "transitional provision" for 5 kg/ha of P and the years 2015/16 allow for the 3 kg /ha of P above the crop requirement. The calculations in year 2017 show the volume of pig slurry that a farm may use after the "transitional provision" ends in 2017.

The calculations show that the amount of pig slurry that a farmer may use is slightly reduced for the farm with a stocking rate of less than 85 kg organic N /ha represented here with a stocking rate of 60kg organic N /ha. No allowance for the sale of hay or silage from this farm has been made. If this farm is producing a lot of grass (some for sale) the P allowance in this case would be increased.

The calculations in Table 5 are indicative only. They clearly show that the farmer with a stocking rate between 86 to 130 kg/ha (represented by a stocking rate of 111 kg/ha) will have an increased requirement for pig slurry in 2015 and 2016 and after the "transition arrangement" ends in 2017. This is because of the increased P allowance for these farms.

Table 5: The volume of pig slurry that a farm may use under SI 610 of 2010 (old regulation) and SI 31 of 2014 (NEW Regulation) at varying Stocking Rates where Index 3 is assumed for the farm.

YEAR	2014 (m^3)	2015/16 (m^3)	2017 (m^3)
Org N Stocking Rate of 60 kg/ha			
Calculation as per old regulation	703	603	453
Calculation as per NEW Regulation	666	566	416
Org N Stocking Rate of 111 kg/ha			
Calculation as per old Regulation	564	510	360
Calculation as per NEW Regulation	564	564	550
Org N Stocking Rate of 145 kg/ha			
Calculation as per old Regulation	236	236	236
Calculation as per NEW Regulation	236	236	236

If soil samples are available for the farm and show that the farm has some land in soil P Index 1 or 2 the allowance to use pig slurry would increase. The case study above was re-calculated based on 25% of the farm being in each soil P Index (ie Index 1,2,3 and 4). The volumes of pig manure that the farm can now use are shown in Table 6. This shows that at the low and medium stocking rates the farm can increase their use of pig slurry - because of the 50% availability of P when used on soils with a P Index of 1 and/ or 2 .

Table 6: The volume of pig slurry that a farm may use under SI 610 of 2010 (old regulation) and SI 31 of 2014 (NEW Regulation) at varying Stocking Rates where 25% of the soil is in index 1,2,3 and 4.

YEAR	2014 (m^3)	2015/16 (m^3)	2017 (m^3)
Org N Stocking Rate of 60 kg/ha			
Calculation as per old regulation	853	753	603
Calculation as per NEW Regulation	904	804	654
Org N Stocking Rate of 111 kg/ha			
Calculation as per old Regulation	564	564	510
Calculation as per NEW Regulation	564	564	564
Org N Stocking Rate of 145 kg/ha			
Calculation as per old Regulation	236	236	236
Calculation as per NEW Regulation	236	236	236

This shows an increased requirement for pig slurry because of the soils in Index 1 and 2 for phosphorus.

Contacts

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

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