

Outline of Presentation

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Teagasc - ASSAP



- Context – Title of IIS
- Water Quality
- Farmyard Issues
- Silage
- FYM/ Slurry
- Other Nutrient & Sediment hotspots
- Ideas & Tools for investigations

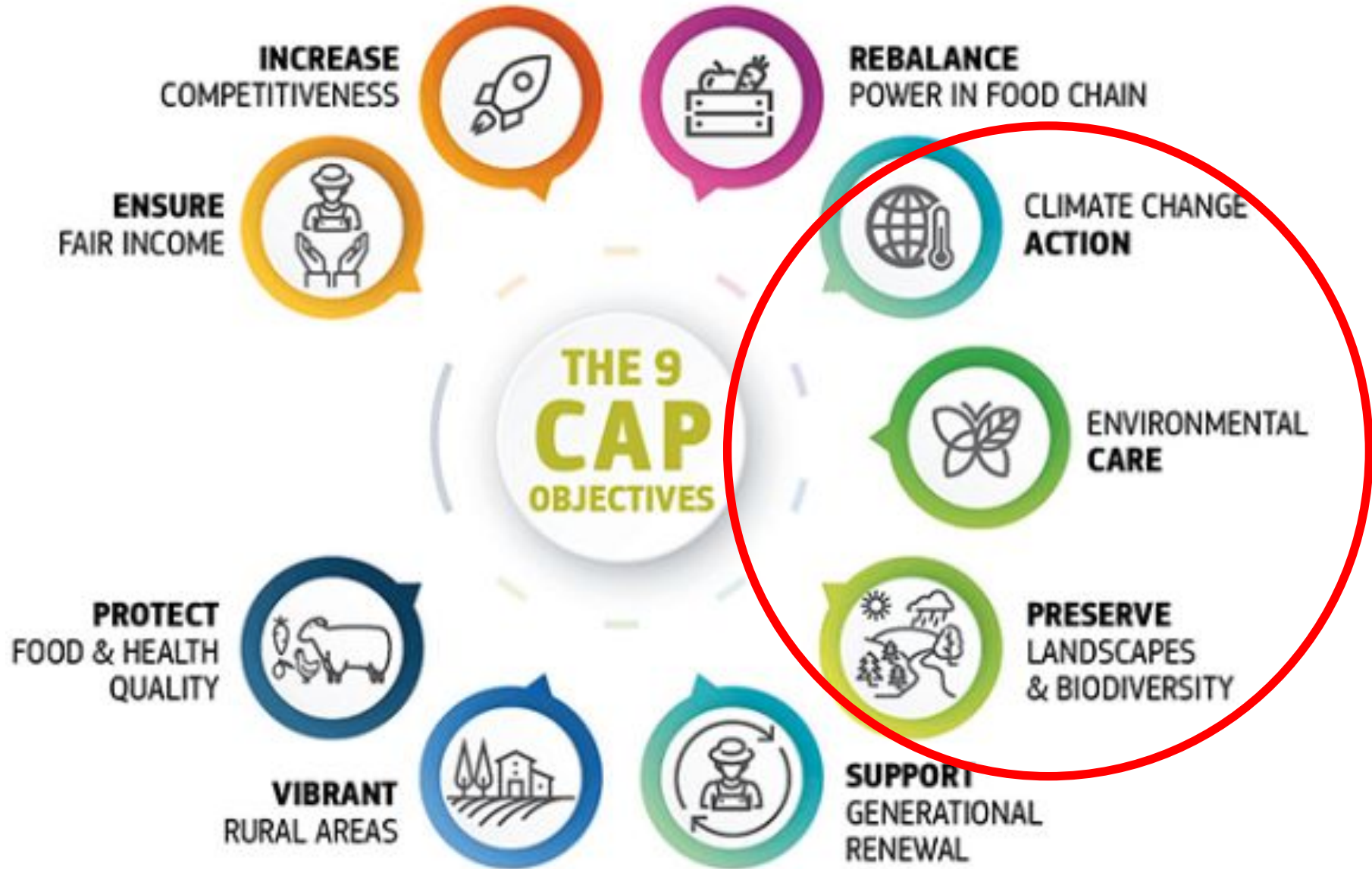


Context



- IIS - Exploring Nutrition & Nutrients – The importance to Irish Agriculture of their Effective Use and Management
- Grass based system – Green Image
- Derogation – New Regulations – 40% of Dairy Farms inadequate storage
- Cross compliance
- New CAP in 2023
- Biodiversity, Water Quality and Gaseous emissions

CCT: Sustainability & Policy and Economics



LO 2.3 a
CCT: Sustainability
& Environment

Water Quality Catchment Scale



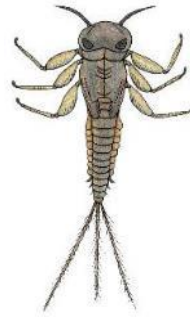
LO 2.3 a
CCT: Sustainability
& Environment



What will the 'bugs' tell us about water quality?



Pollution sensitive species



Mayfly

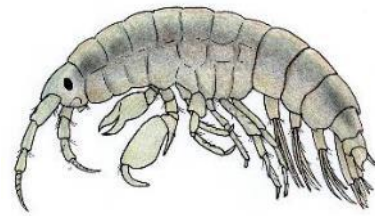


Cased Caddis



Stonefly

Pollution tolerant species



Freshwater Shrimp



Leech



Blackfly Larvae

Main Pressures/ Pathways

- Phosphate (Run-off)
- Nitrate (Leaching) (Ammonium – Peat)
- Sediment (Bare soil)
- Toxic Effects (Herbicides & Spent Dip)

Water quality pressures identified in PAA's - Nationally

To date diffuse P, N and sediment losses account for 73% of the pressures identified in PAA's where investigations have occurred.

Table 5: Water quality pressures identified in PAA's

P Loss (Diffuse)	31%
N Loss (Diffuse)	16%
Sedimentation	26%
Point Source Losses	15%
Toxicity and Pesticides	6%
Ammonium	6%

Land management practices account for 45% of the issues identified.

Land Management Issues	High	Moderate	Low	Total
P loss through overland flow	390	295	68	753
Drinking points & stream fencing	297	242	89	628
Buffers	290	287	98	675
N leaching from light soils	190	120	29	339
Sediment loss	139	84	18	241
Farm roads, gateways and underpass	134	89	35	258
Drain cleaning & maintenance	130	101	44	275
Herbicide /pesticide and sheep dip use	116	96	36	248
Rock outcrops/karst features	54	36	5	95
River bank erosion	52	23	11	86
Drinking troughs	50	68	58	176
Culverts/river crossings	39	32	9	80
Unsuitable drainage delivering nutrient and/or sediment	38	29	7	74
Field boundary management	32	23	21	76
Supplementary feeding and sacrifice paddocks	28	57	20	105

Nutrient management practices account for 34% of the issues.

Nutrient Management Issues	High	Moderate	Low	Total
Preparation and implementation of NMP	345	243	112	700
Organic manure timing, location and method	264	237	48	549
Achieving appropriate soil fertility (Lime P&K)	211	199	53	463
Weather and fertiliser management	179	121	45	345
Identify and Manage Critical Source Areas (CSA's)	177	130	15	322
Timing - early & Late N and P	161	120	29	310
Fertiliser type	83	98	70	251
Sloped fields	64	113	46	223
Chemical fertiliser spreading	37	70	25	132
Fertiliser rates	21	30	20	71
Correct management of high OM soils	18	35	35	88
Other	13	9	6	28
Recorded import/export of organic manures	4	5	8	17

Farmyard management practices account for 21% of the issues.

Farmyard Management Issues	High	Moderate	Low	Total
Clean and grey water management	171	173	107	451
Silage pits and effluent storage	144	72	34	250
Loose housing and FYM storage	134	130	71	335
Round bale storage	116	138	83	337
Dirty yards	100	101	20	221
Slurry storage	91	67	40	198
Drain connection from yard to water	90	42	10	142
Pesticide storage and diesel/oil tanks	17	49	27	93
Cattle and/or sheep handling facilities	16	27	24	67
Other	6	9	4	19

Farmyards – Soiled Water

- Has a biochemical oxygen demand (BOD) of less than 2500 mg l⁻¹ and less than 1% dry matter (DM) content (S.I. No.31 of 2014) and is stored separate from slurry.
- Soiled water must be collected and kept separate to slurry on all holdings
- From 1st Jan 2022 spreading of soiled water will be prohibited between 15th November and 15th January
- 4 Weeks soiled water storage in place by 31st December 2024

Farmyard Issues

- Highest risk attributed to ditches connecting farm yards and outlets to streams.
- Legacy P accumulated in ditch sediment from yards and at outlets over time.



Science of The Total Environment

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Ranking connectivity risk for phosphorus loss
along agricultural drainage ditches

Thomas Moloney , Owen Fenton , Karen Daly 

Round Bales

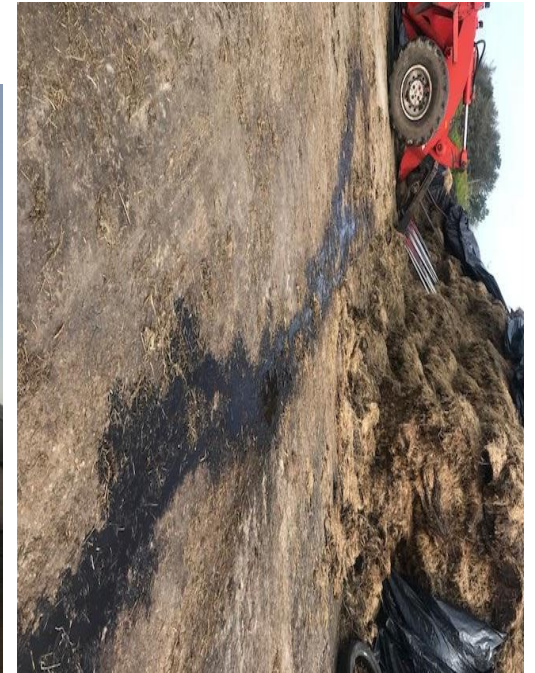
- Do not store within 20m of waters, incl. dry drains
- Wet bales, with a low dry matter – possible leakage
- Watercourse in the background, less than 5m from the bales, and bales also located on very wet soil



LO 2.3 c, 4.3.3 b, 4.3.2 a

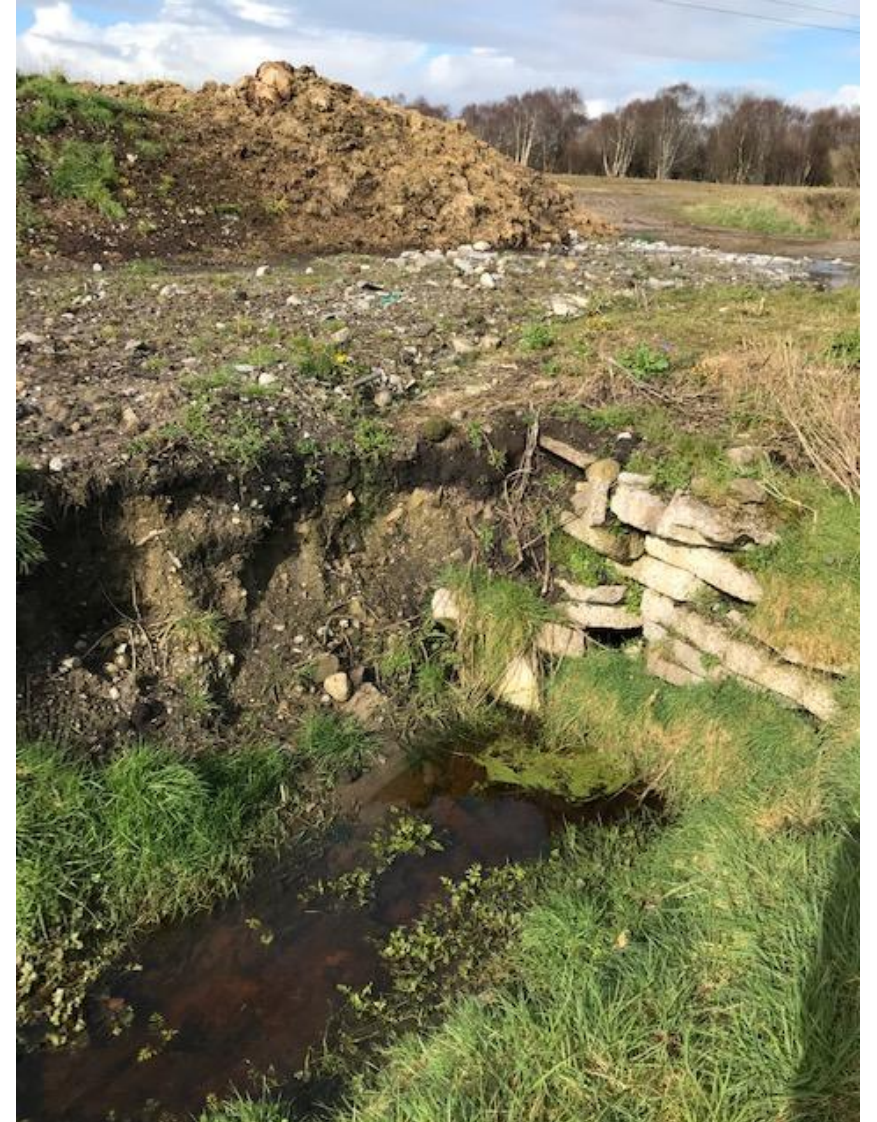
Silage Pits

- Having adequate storage for silage effluent
- Concrete base is sound with no cracking
- Effluent channels are clear and working properly
- Silage face is cleaned often minimising blockages of the effluent channels
- Waste silage is stored correctly



Farmyard Manure

- FYM must not be stored or landspread between 1 Nov to 31 Jan (inclusive) in Donegal and Leitrim and between 1 Nov to 15 Jan in Sligo
- Collect all organic fertilisers, effluents and soiled waters produced in buildings and yards in a way that will prevent run-off or seepage, directly or indirectly, into groundwater and surface water
- Do not spread within 5m of surface waters (extended to 10 m – 2 week either side of the closed period)



Farmyard Manure

- Any surface watercourse where the slope towards the watercourse exceeds 10% (10m)
- Storage of FYM in a field must be at least 20 m away from all surface waters
- When spreading consider
 - Surface waters
 - Soil conditions
 - Slope of the field
 - Adequate buffer
 - Weather



Overgrazing of Peat soils

- Overgrazing exposes bare peat
- Sediment lost with heavy rainfall
- Takes a long time for the vegetation to recover



LO 2.3 a,
2.2.2 a,
2.2.2 d

Exposed Soil – Rutting & Poaching



LO 4.3.3 b

Yards, Clean and Dirty water



Farmyard Pinch Points

Milking Facilities

- Soiled Water Management
- Dairy Washings



Yards

- Handling Facilities
- Fuel Points Bunded
- Concrete Surface Soundness

Clean Water Controls

- Drainpipes
- Guttering
- Diversion Manholes

Sheds

- Slurry Storage
- Bedding Materials
- Seepage

Silage Pits

- Silage Effluent
- Silage Waste
- Effluent Collection

LO 2.3a,
4.3.3 b

Yards, Clean and Dirty water



Drainage

- Any maintenance to surface water drains should only be carried out during the months July to September.
- Fish and their spawning grounds are protected under the Fisheries Acts (1959 – 2010).
- In-stream works should not be carried out without prior consultation and approval of Inland Fisheries Ireland (www.fisheriesireland.ie)



Drinking Points

- Water troughs to be located at least 20m from watercourses on farms with grassland stocking rates above 170 kg N/ha from 1st January 2021



Tillage

- No ploughing or tilling may take place within 2m of a watercourse (stream/river) marked on the modern 1:5000 OSI scale OSI map or better except in the case of grassland reseeding or establishment.



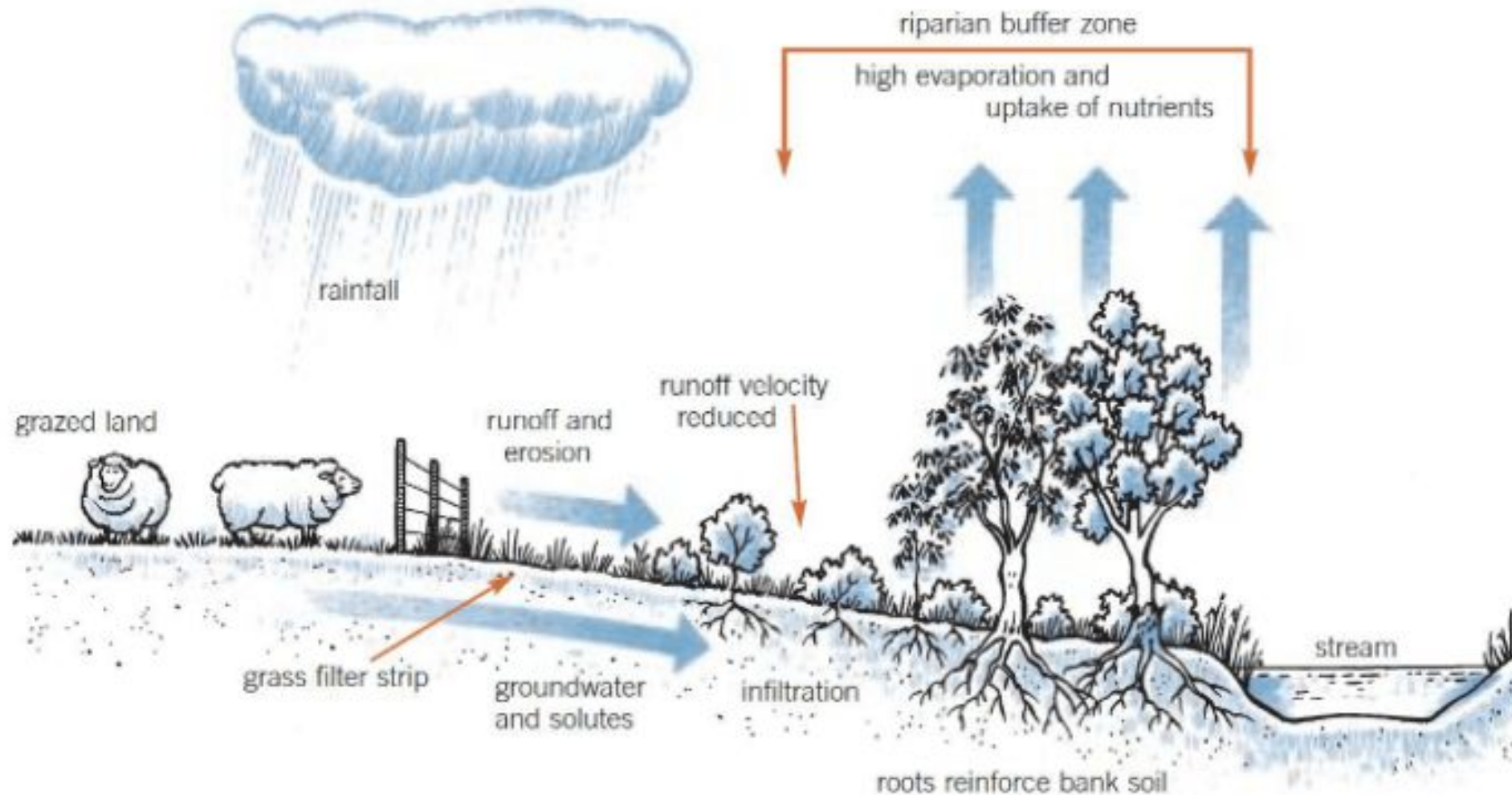
Tillage

- Filter Fences
- Geotextile Mesh
- Inserted 8 inch into the ground and Staked
- V or W shape to slow the flow, so water doesn't flow in a straight line
- Short Term Measure
- Capturing the Sediment and Phosphate



Processes that occur in the Riparian Margin to improve water quality

Processes that occur in the riparian zone to improve water quality and stabilise streambanks. Illustration Paul Lennon.



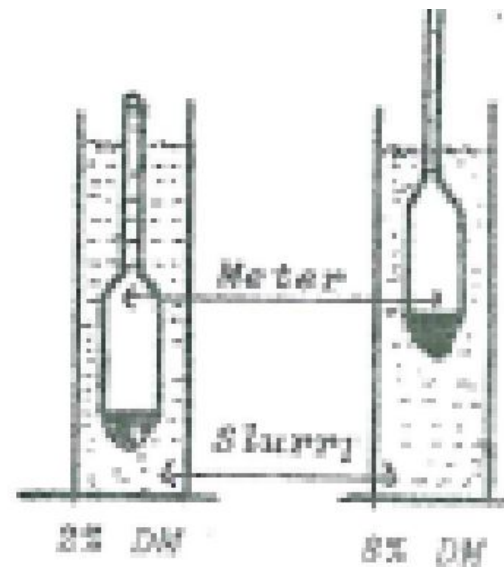
LO 2.3 a, 1.2 c, 1.2 d

Approximate N, P, and K content of cattle slurry in kg/10m³

Cattle Slurry			
N	P	K	% Dry Matter
15	1.5	20	2
25	3	30	4
35	4.5	40	6
40	6	50	8
45	7.5	55	10
47	9	60	12



LO 2.3 a, 1.2 c, 1.2 d



<u>% dry matter</u>	<u>Concentration</u>
1 - 4	low
4 - 7	medium
7 - 10	high

Table 1: Approximate total N, P and K content of Cattle and Pig Slurry in kg/10m³ (lbs/1000gals) at various dry matter levels

Cattle Slurry			% Dry Matter	Pig Slurry		
N	P	K		N	P	K
15	1.5	20	- 8 -	20	3	12
25	3	30	- 4 -	30	8	17
35	4.5	40	- 6 -	40	12	20
40	6	50	- 8 -	50	17	22
45	7.5	55	- 10 -	55	22	22
47	9	60	- 12 -	60	26	22

LO 2.3 a, 1.2 c,
1.2 d

Available Nutrient Content & Guide Value (€) of Organic Fertilisers 2021

Organic Fertiliser Type	N kg/m ³ (units/1,000 gal) ⁷	P kg/ m ³ (units/1,000 gal) ^{6,7}	K kg/ m ³ (units/1,000 gal) ⁷	Value €/ m ³ Or (€/ 1,000 gal) ^{4,5}
Liquid Manures				
Cattle (6% DM) (SI 605,2017) ¹	2.0 (18)	0.8 (7)	3.5 (32)	6.8 (31)
Cattle (6% DM) (Actual) ²	1.0 (9)	0.6 (5)	3.5 (32)	5.1 (23)
Pig (4% DM) ³	2.1 (19)	0.8 (7)	1.9 (20)	5.9 (27)
Soiled Water	0.48 (4)	0.08 (0.7)	0.6 (5)	1.2 (5)
Solid Manures				
	N kg/t ¹ (units/t)	P kg/t (units/t)	K kg/t (units/t)	Value €/ton
Dungstead Manure	1.4 (3)	0.9 (2)	4.2 (8)	7.0
Farmyard Manure	1.35 (3)	1.2 (2)	6.0 (12)	9.0
Poultry ³				
Broiler / deep litter	14 (28)	6.0 (12)	18.0 (36)	43
Layers (30% DM)	6.85 (14)	2.9 (6)	6.0 (12)	19
Layers (55% DM)	11.5(23)	5.5 (11)	12.0 (24)	35
Turkeys	14 (28)	13.8 (28)	12.0 (24)	57
Spent Mushroom Compost	1.6 (3)	1.5 (3)	8.0 (16)	12
<p>¹ Nitrogen availability based on Nitrates Directive SI 605, 2017 (Cattle slurry total N of 5.0kg & 40% availability). Conversion - kg by 2 = units</p> <p>² The actual value of N in Cattle slurry (Green Book) is approx. 9 units/1,000 gallon (Based on total N of 2.4kgN/m³ @ 40% N availability by LESS application). Spring application of organic manures is required to maximize N recovery. Manures should be tested to determine manure nutrient content</p> <p>³ Incorporation of high N manures within 2 to 6hrs after application assume 50% N availability</p> <p>⁴ Value of N = €1.04/kg. P = €2.32/kg, K = €0.83/kg for 2021 (Nutrient values based on price / volume of range of fertiliser products).</p> <p>⁵ Cost of spreading & transport not included. ⁶Reduce P availability to 50% on P index 1 & 2 soils.</p> <p>⁷ Values under units/1,000gals or per ton have been rounded to closest unit.</p>				

Updated 26th January, 2021

Nitrate, P and Ammonia Strips

PARAMETER	High Status EQS (rivers)	Good Status EQS (rivers)
Ammonia	0.04mg N/l	0.065mg N/l
Ortho P	0.025mg P/l	0.035mg P/l



- Average phosphate concentrations of less than 0.025 mg/l P and less than 0.035 mg/l P have been established in Ireland as legally binding national standards (EQS) to support the achievement of high and good ecological status respectively.
- For water, **1 ppm = approximately 1 mg/L** (also written as mg/l) of contaminant in water
- To **convert** from units of **nitrogen** (NO₃-N) to **nitrate** (NO₃), multiply the value by 4.427
- To convert PO₄ to P, **divide by 3**. To convert P to PO₄, multiply by 3

Other Measurements

- pH Meter/ Strips
- Soil Moisture %
- Soil Temperature



Nutrients = 4 R's

- Right Source
- Right Place
- Right Time
- Right Rate

Other Sources of Information

- Met Eireann
- Soil & Silage Reports
- Teagasc Website – ASSAP

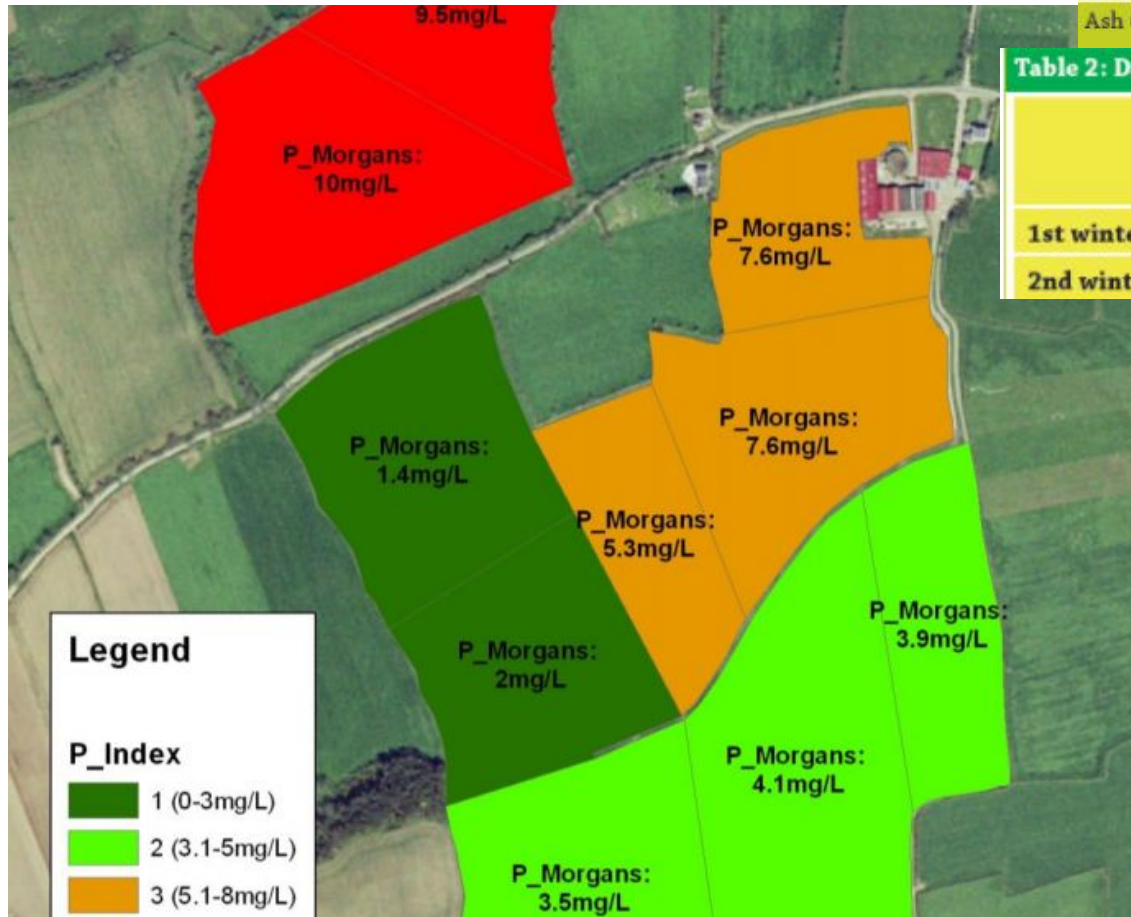


Table 1: Key information provided from a silage analysis

Unit of measure	Meaning	Low	High	Target
Dry matter (%)	Feedstuff less water content	13-17	40-55	28-32
pH	Measure of acidity	3.4-3.7	4.5-5.5	3.8-4.5
Ammonia - N (% N)	Indicator of grass N content at cutting	4-7	15-25	<10
NDF (% DM)	Measure of forage fibre and intake potential	42-47	55-65	<44
DMD (%)	Measure of quality	55-65	76-80	>72
ME (MJ/kg DM)	Energy content (linked to DMD value)	8-9	11-12	>11
UFV/UFL (unit/kg DM)	Energy content (linked to DMD value)	0.6-0.7	0.89-0.96	>0.89
Crude protein (% DM)	Measures N as indicator of true protein content	7-9	15+	>13.5
Ash (% DM)	Indicator of soil contamination	5-6	12-15	<8.6

Table 2: Daily winter weight gain targets for spring-born calf-to-beef animals at various stages

	21 month steers	23-24 month steers	28-30 month steers	19 month heifers	U16 month bulls	20 month bulls
1st winter (kg/day)	0.6	0.6	0.6	0.5	0.85	0.70
2nd winter (kg/day)	-	1.0-1.05	0.5	-	-	-

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Soil Moisture Deficits, Evaporation, Potential Evapotranspiration, Actual Evapotranspiration and Runoff:

- **Soil Moisture Deficit (SMD)** is the amount of rain needed to bring the soil moisture content back to field capacity.
- **Field capacity (SMD=0)** is the amount of water the soil can hold against gravity i.e. the maximum water a pot plant can be watered and not leak water. Negative SMD indicates a water surplus, which will be drained over time through either infiltration or overland flow or both.
- **Saturation** is reached when SMD= -10mm, i.e a water surplus of 10mm. Positive SMD is below field capacity and rain can infiltrate to the capacity of the SMD amount. In a saturated soil all of the available soil pores are full of water, but water will drain out of large pores under the force of gravity.