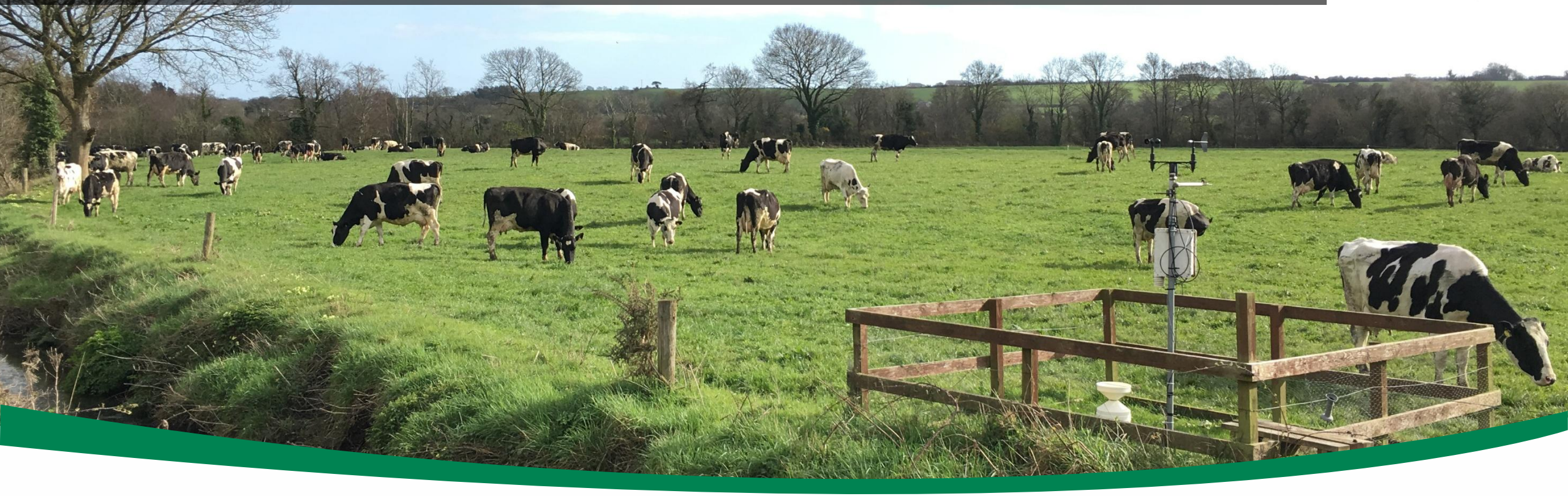
The Closed Period for Slurry Spreading

-it's role in preventing nutrient loss

Edward Burgess, Teagasc's Agricultural Catchments Programme



AGRICULTURAL CATCHMENTS PROGRAMME

Teagasc
Agriculture and Food Development Authority

An Roinn Talmhaíochta, Bia agus Mara
Department of Agriculture, Food and the Marine

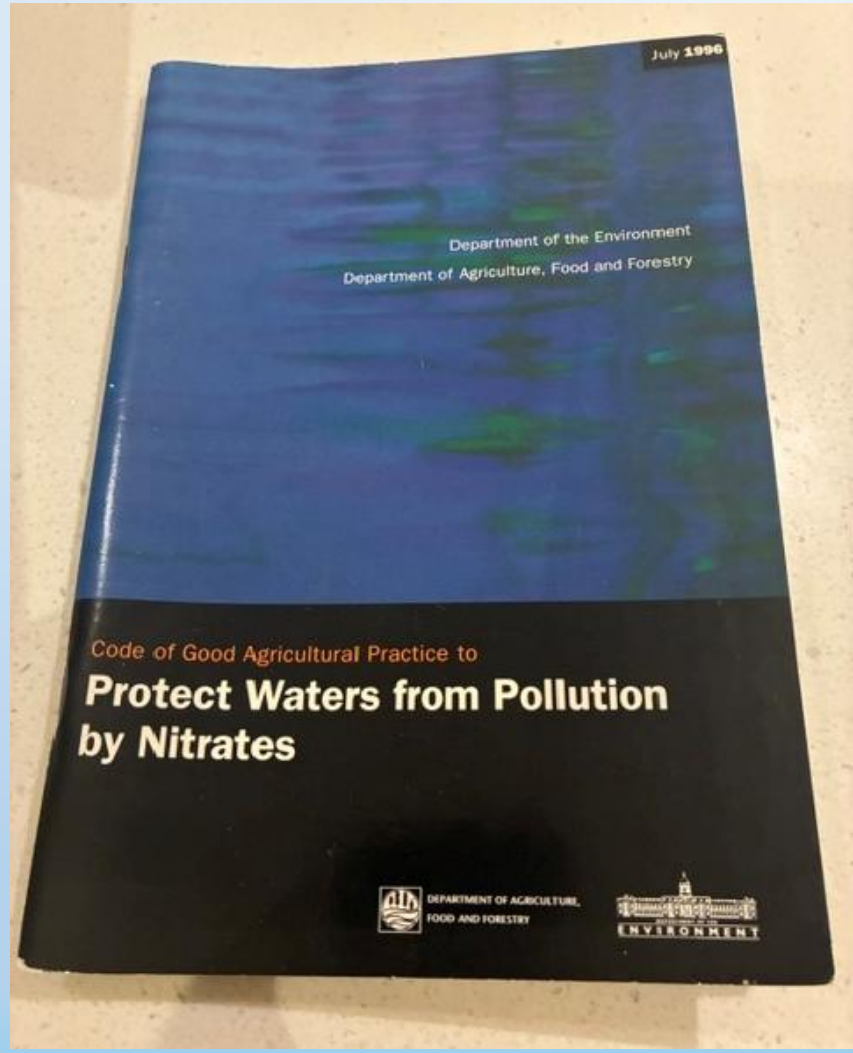
Why have a “Closed Period” ?

- **Minimise pollution risk to water and maximise nutrient uptake**

- **The amount of nitrate leached is determined by two things:**

  a) **The amount of water passing through the soil profile**

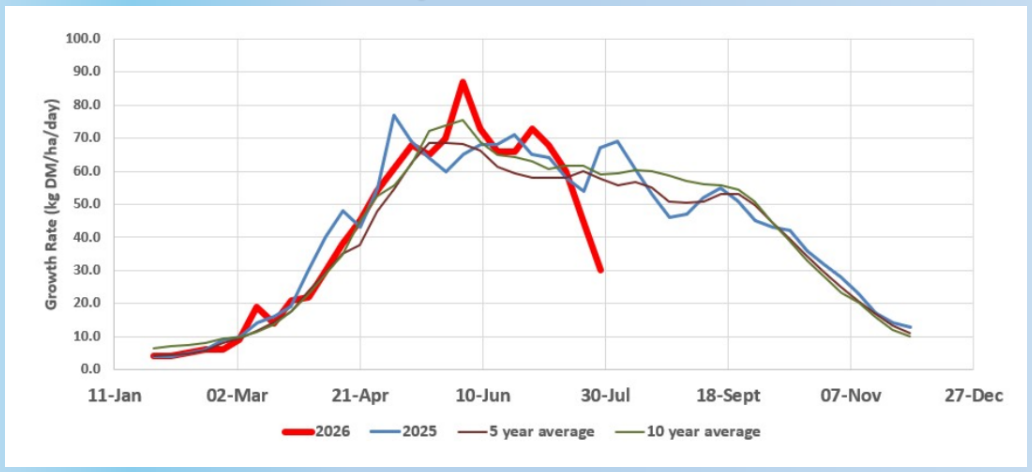
  b) **The concentration of NO_3^- in the soil when leaching starts**



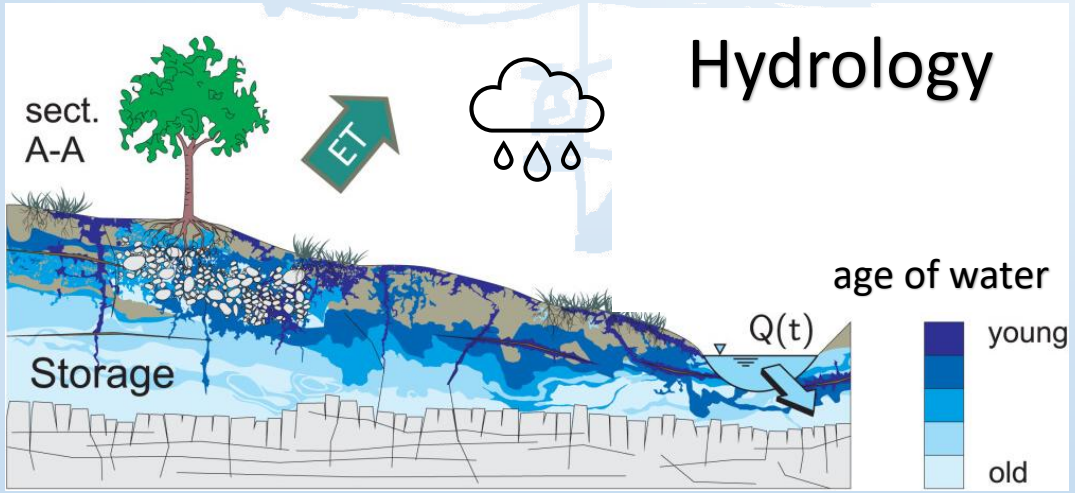
D. C. Whitehead, Grassland Nitrogen 1994

Factors Influencing Nutrient Loss

Crop Demand

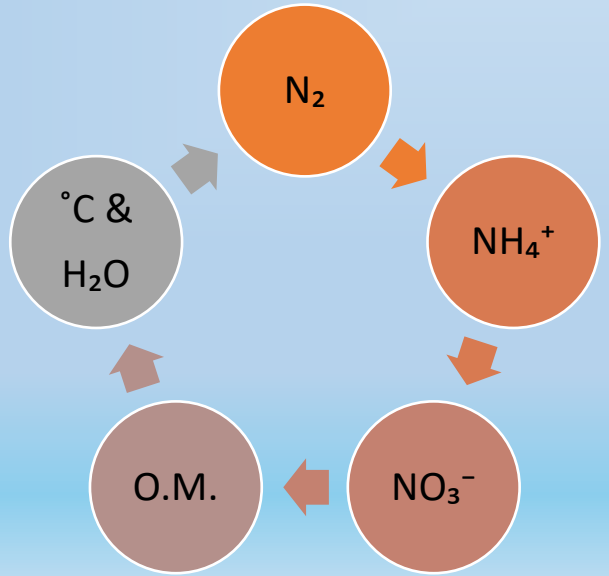


Hydrology



Nutrient Supply

AGNAV



Time of the Year





The Nitrogen Cycle

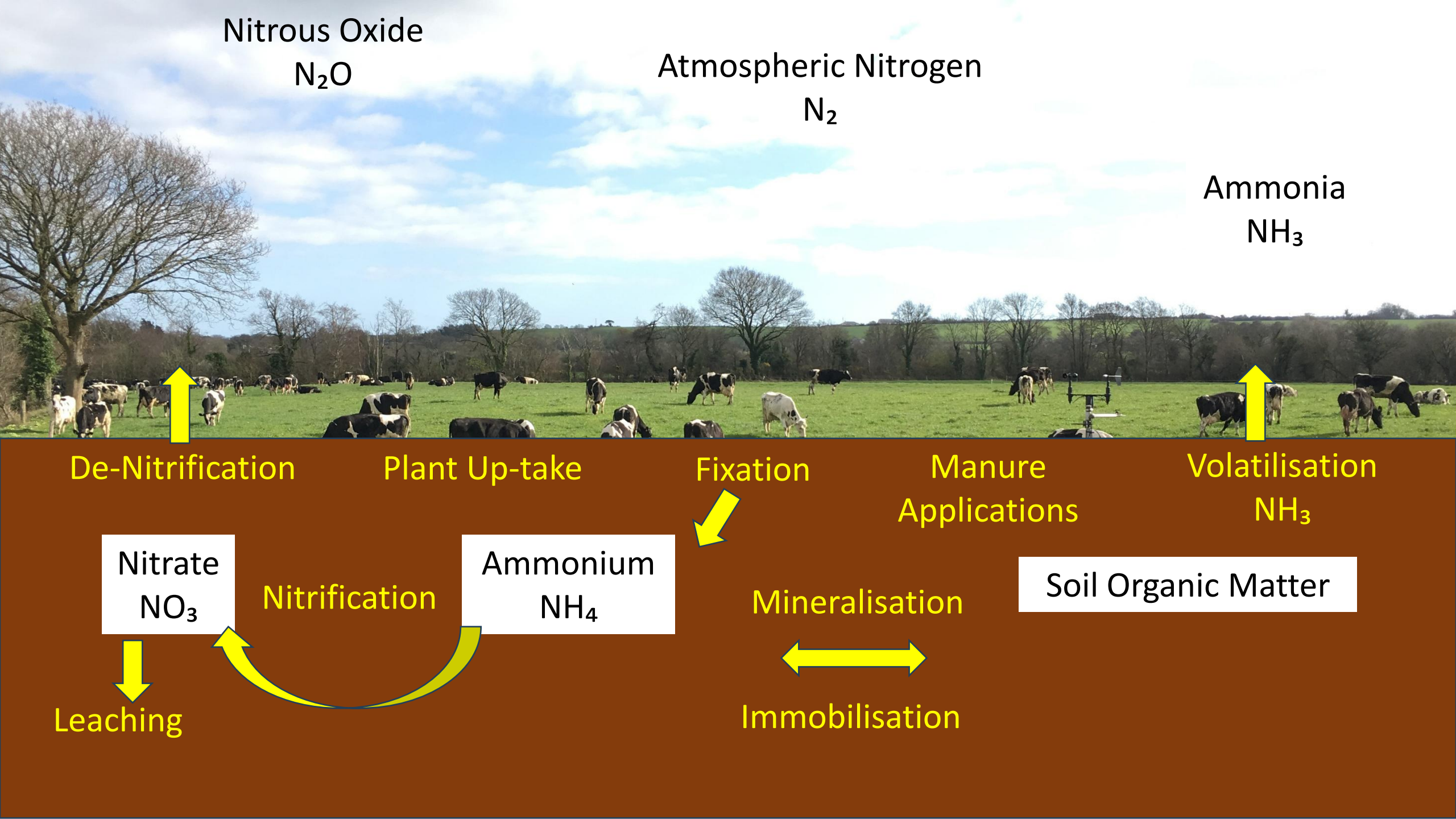


Nitrate
NO_3

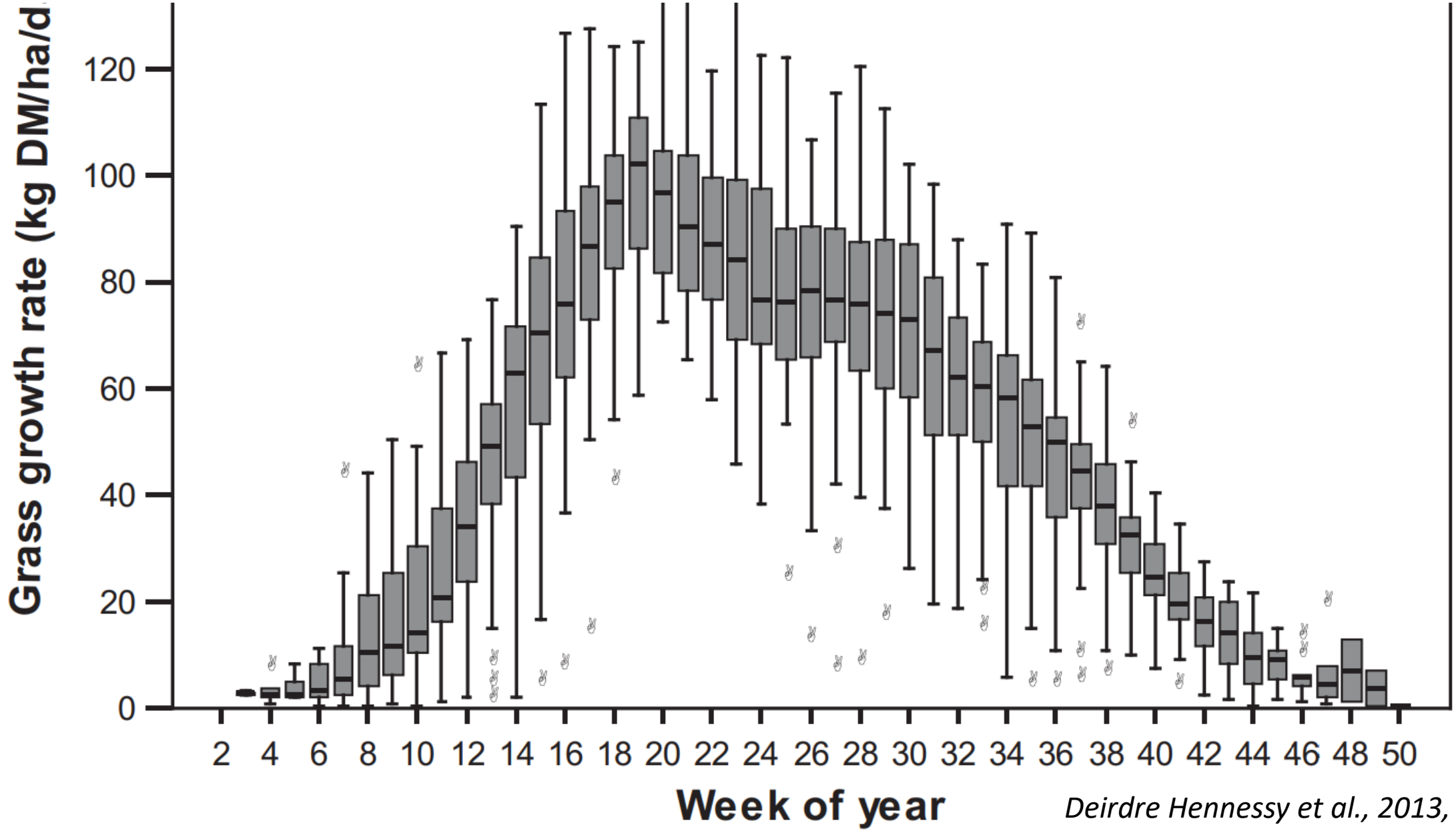
Ammonium
NH_4

Soil Organic Matter


Atmospheric Nitrogen
N_2
Fixation
Manure Applications
Nitrate NO_3
Nitrification
Ammonium NH_4
Mineralisation
Soil Organic Matter


Nitrous Oxide
N_2O
Atmospheric Nitrogen
N_2
Ammonia
NH_3
De-Nitrification
Plant Up-take
Fixation
Manure Applications
Volatilisation
NH_3
Nitrate
NO_3
Nitrification
Ammonium
NH_4
Mineralisation
Soil Organic Matter
Leaching
Immobilisation

Grass Growth Rate at Moorpark 1982 to 2010

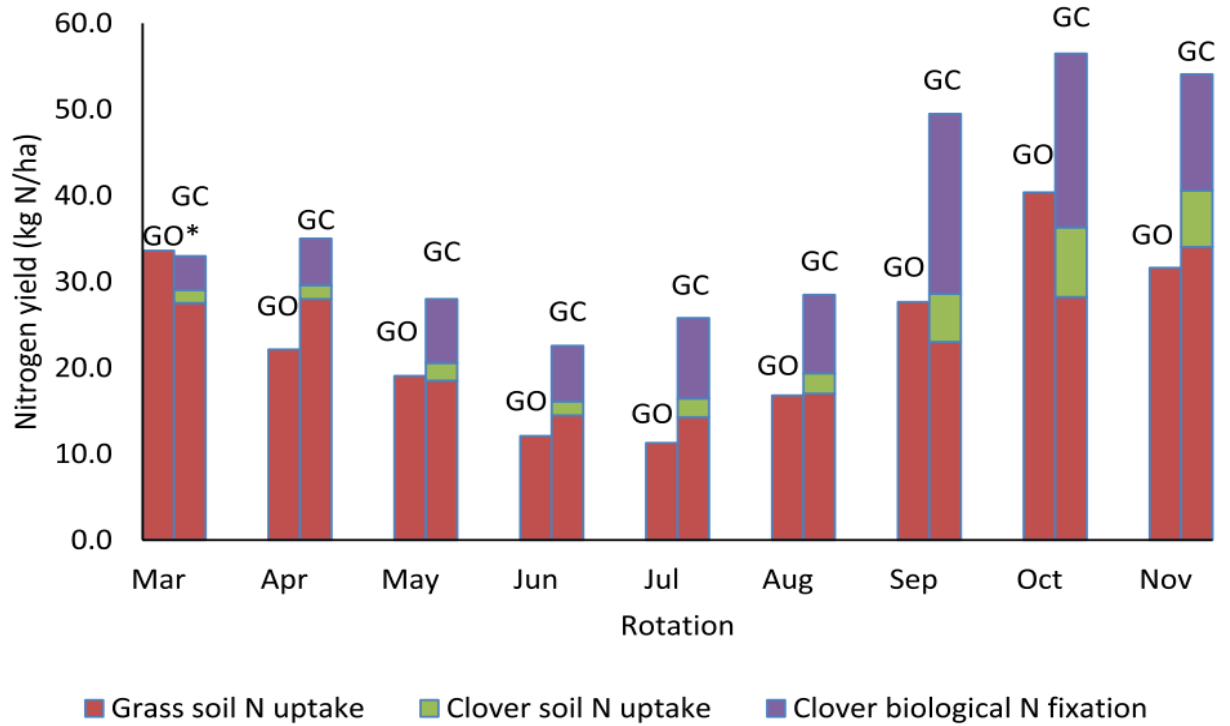


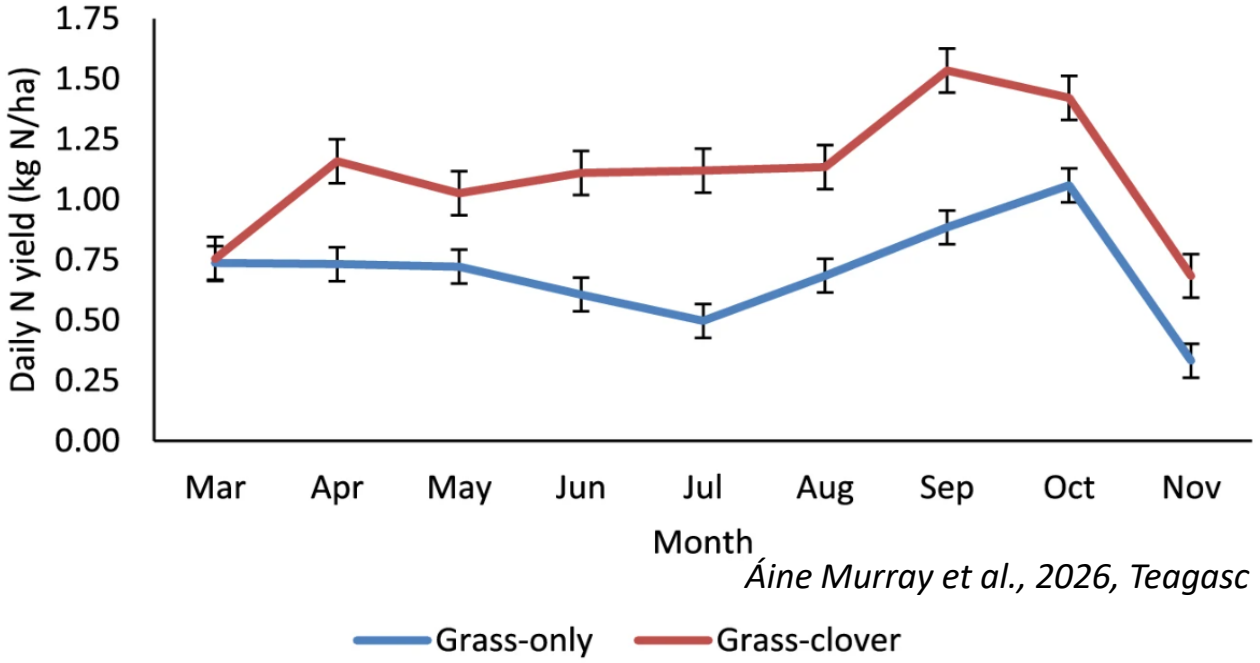
Deirdre Hennessy et al., 2013, Teagasc

N Yield in Grass only & Grass Clover Swards

Zero N applied 2020-2021

- 185 kg N/ha from grass only sward
- 284 kg N/ha from grass-clover sward (+99kg)
- N uptake was highest in Spring and Autumn
- Maximum uptake per rotation
  - 44 kg in October for Grass only
  - 56.5 kg also in October, for Grass Clover
- Reduction in N likely due to SMD





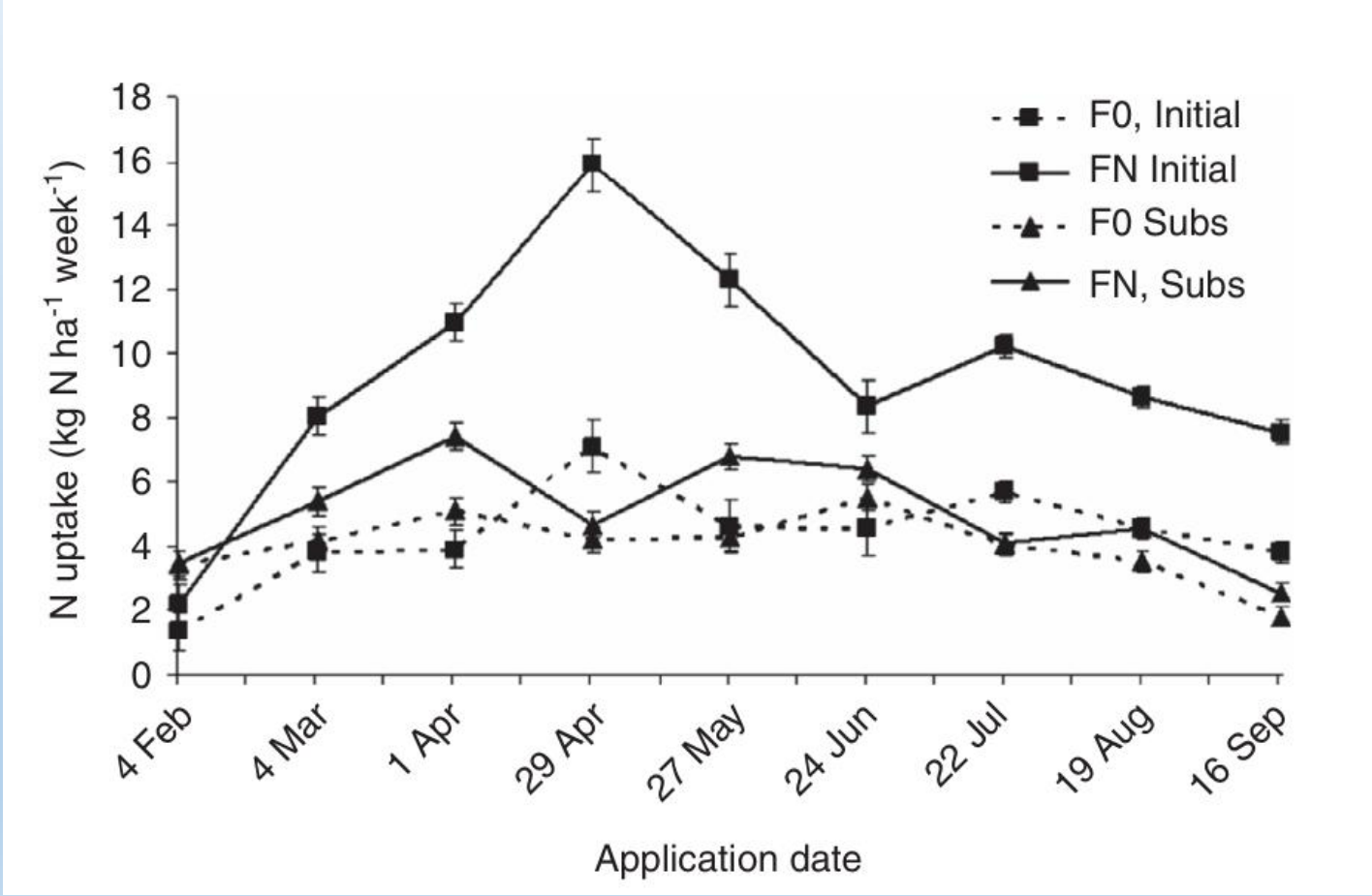
Áine Murray et al., 2026, Teagasc

Clonakilty												
2020	– 1.7	– 2.4	7.1	30.0	19.6	35.7	41.5	34.2	14.5	– 0.1	– 4.5	– 3.7
2021	– 0.6	– 2.7	8.0	29.4	9.7	22.9	46.5	30.8	24.3	– 1.8	– 1.7	– 4.1
Moorepark												
2021	0.3	– 3.1	7.6	27.3	16.6	30.5	48.1	39.4	16.9	– 0.4	2.1	– 1.7

N uptake in fertilised and unfertilised grassland

weeks 0-4 (initial ■) & 5-8 (subsequent ▲) post application

- N uptake follows grass growth rates
- April, May and June had the max N uptake
- Background N supplied 165 kg/ha/yr and over 7 kg/ha/week in May
- On fertilised grass background N supplied 49% of N taken up

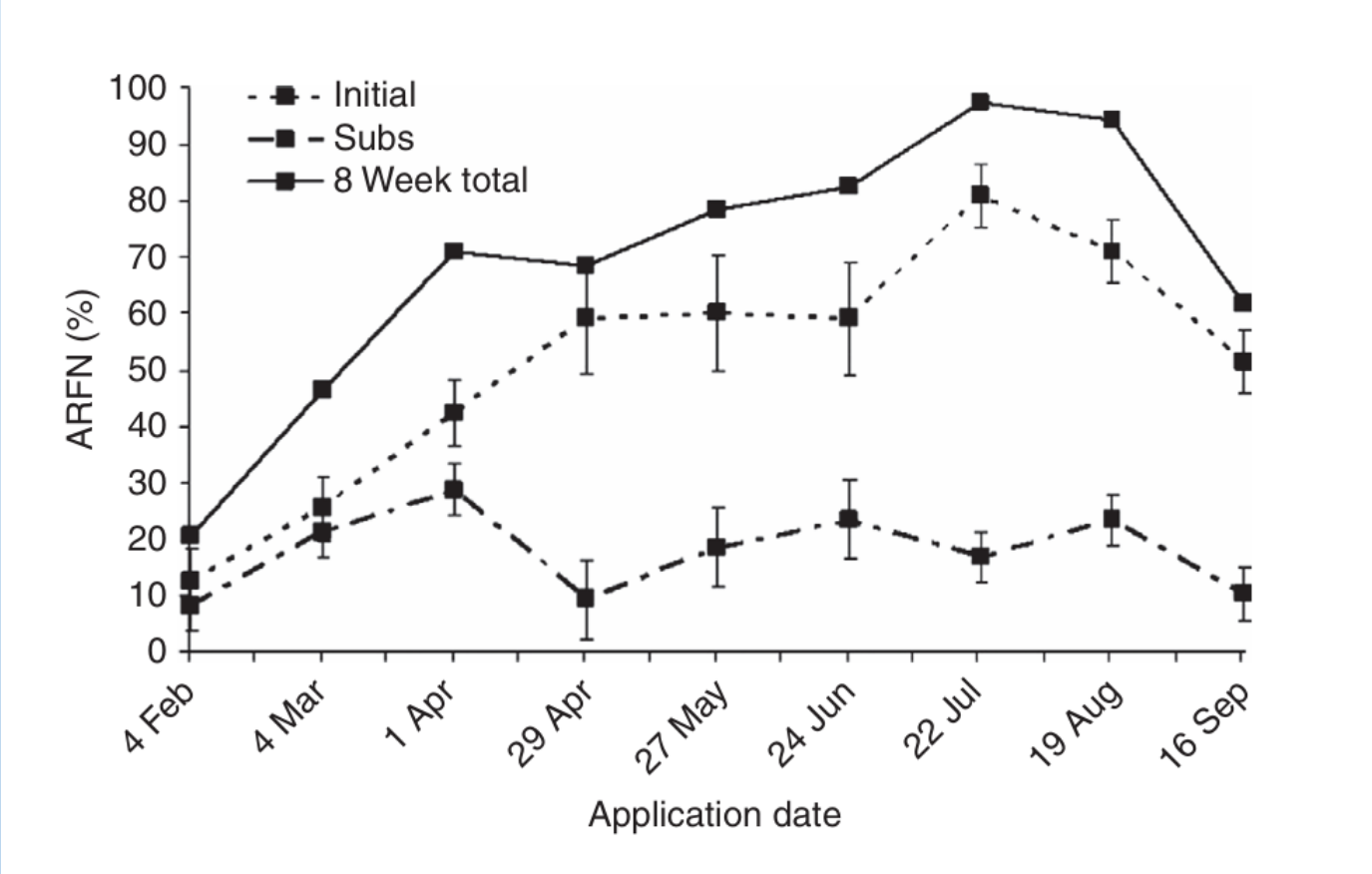


Murphy, O'Connell et al., 2013

% Recovery of applied N over 8 Weeks

weeks 0-4 (····), weeks 5-8 (·–·–·–) and 8 weeks total

- 70 to 100% recovery over 8 weeks from April to August
- 21% recovery in early February
- 46% recovery in March
- N Recovery in weeks 5 to 8 remained between 10 – 20% throughout
- Portion recovered in weeks 5 to 8 much lower in autumn



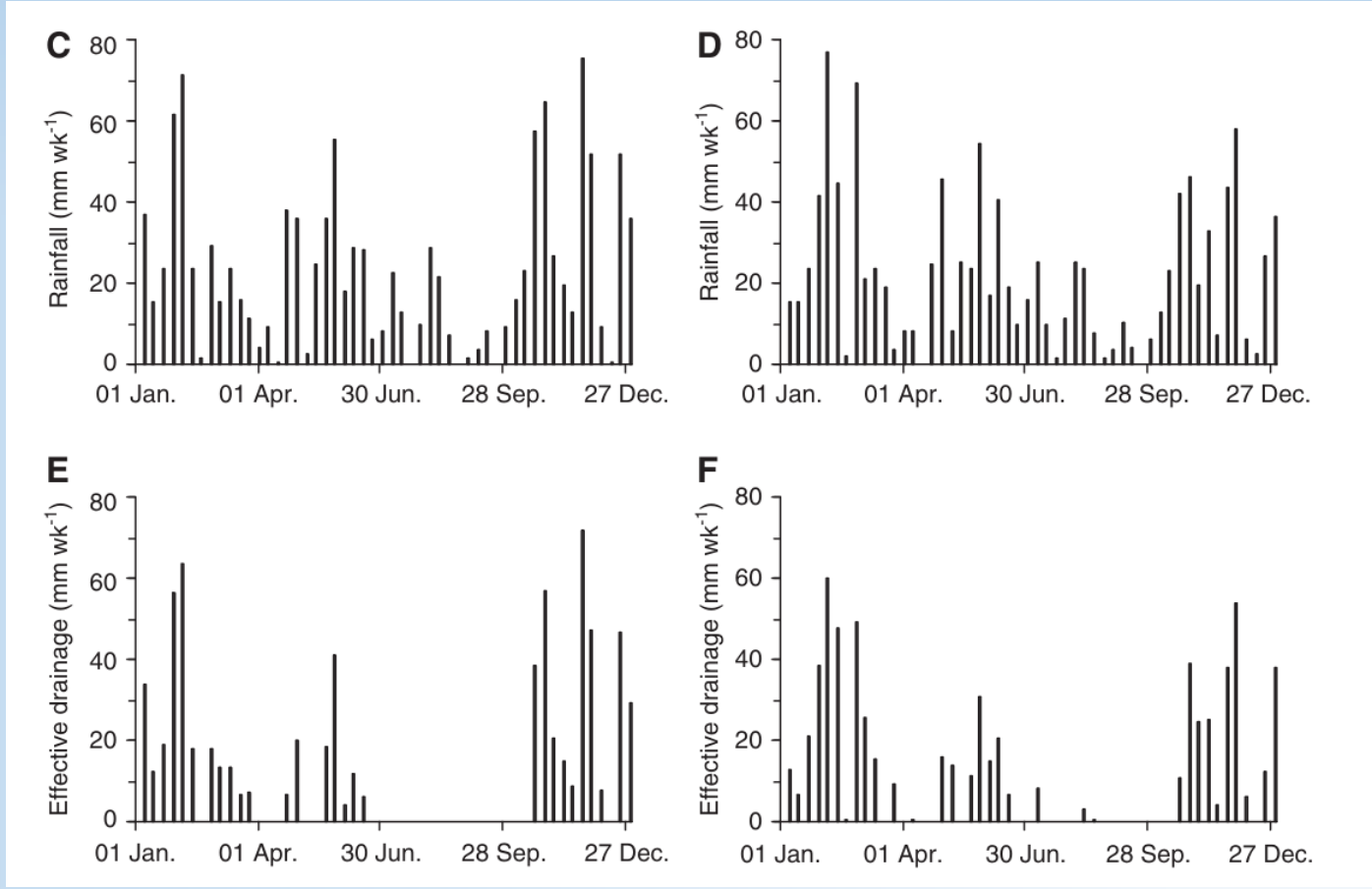
Murphy, O'Connell et al., 2013

Rainfall, Evapotranspiration & Effective Drainage

40 week period 4th Feb. to 11 Nov. 2022

	Moorepark	Solohead
Annual Rainfall	1195	1145
40 week Rainfall	820	868
Effective Drainage	378	434

Lowest effective drainage occurred in both sites between July and September (along with the highest Soil temperatures).

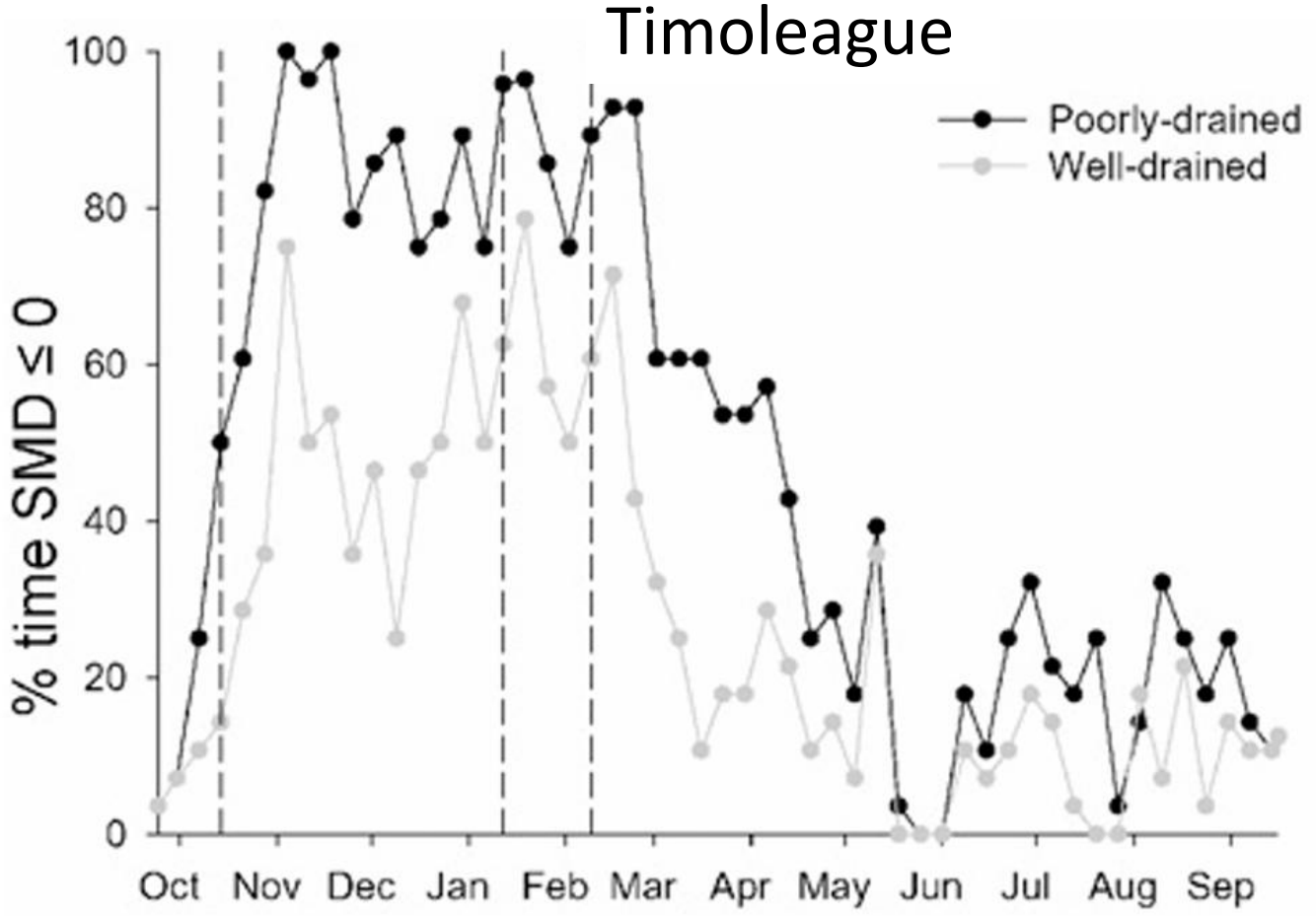


Murphy, O'Connell et al., 2013

Soil Moisture Deficit in ACP Catchments

4 year period (2010 -2014) on poorly & well drained soils

- Soils with SMD ≤ 0 transport available nutrients quickly and are higher risk
- SMD ≤ 0 from week 2 in closed period to end of February all the time on poorly drained soils (except Timoleague).
- On well drained soils SMD ≤ 0 between 20 & 80% each week for the same period



M. Shorel et al., 2016

Soil Moisture Deficit in ACP Catchments

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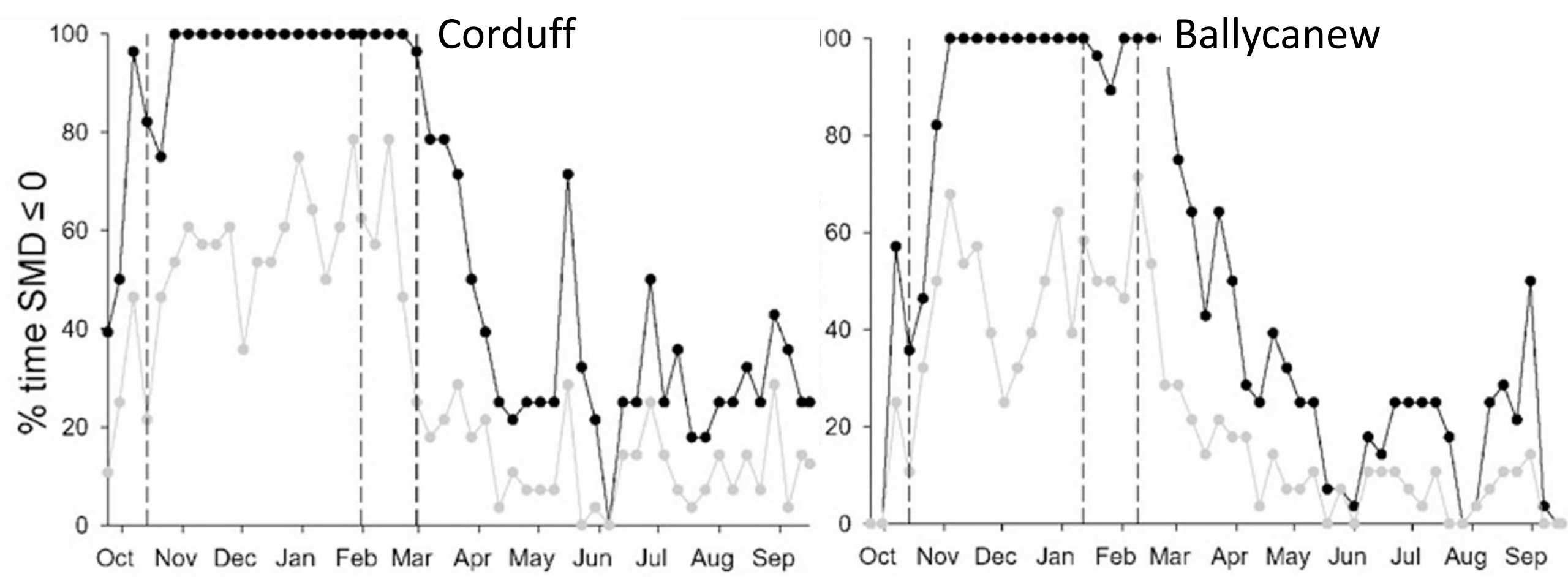


M. Shorel et al., 2016

Rainfall and River-flow in the ACP





Nutrient Loss across 5 ACP Catchments

	Annual kg / ha / yr	Range	% in Closed Period	Range
Total Phosphorus (TP)	0.76	0.3 – 1.2	43%	33 – 54%
Total Oxidise Nitrogen (TON)	23	10 – 35	45%	36 – 56%

- Disproportionately high loads during the closed period

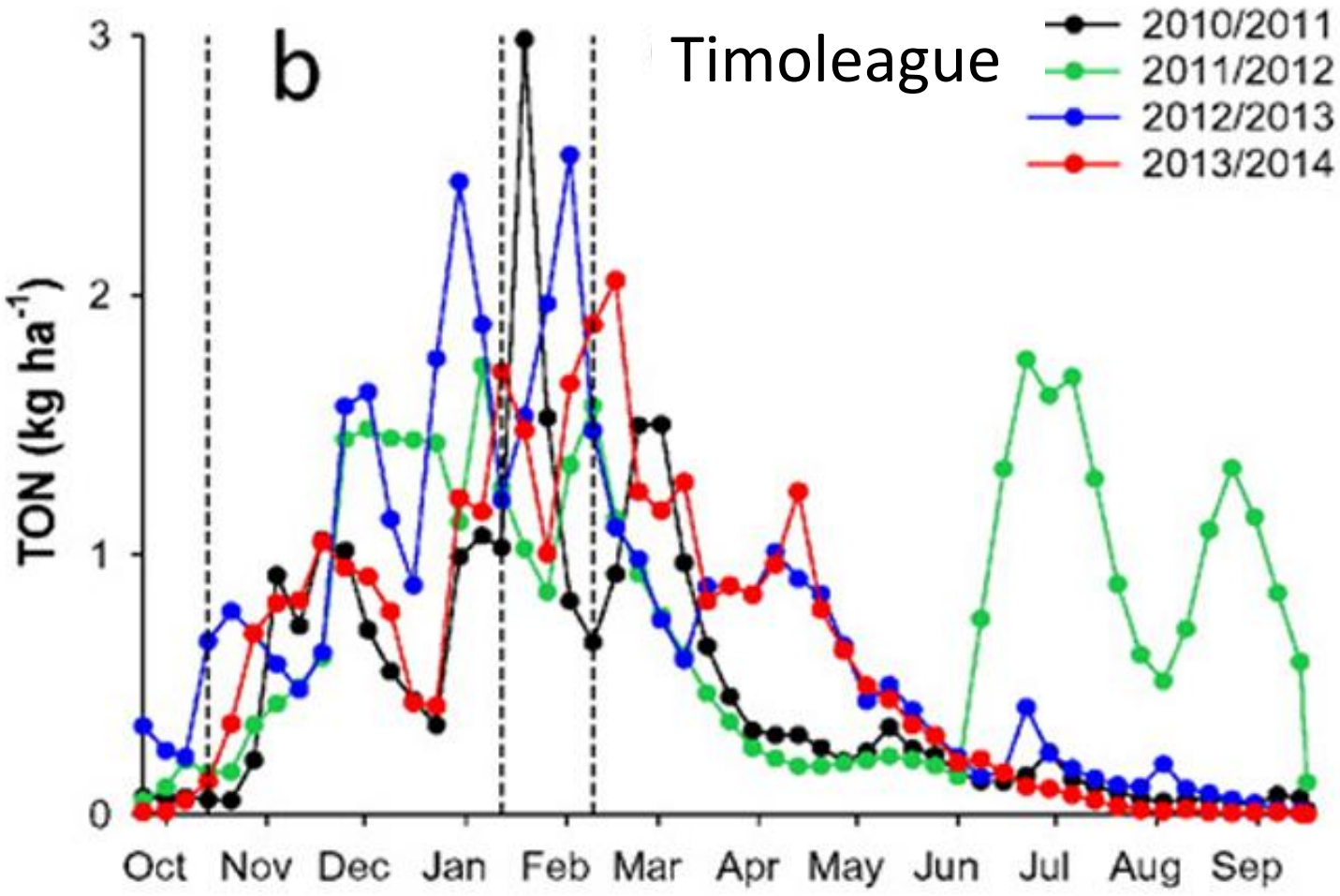
M. Shorel et al., 2016

- Majority (57% N and 55% P) lost during the remainder of the year
- Spring and Summer rain storms have significant impact

Weekly Nutrient loads ACP Catchments

4 year period (October 2010 -2014)

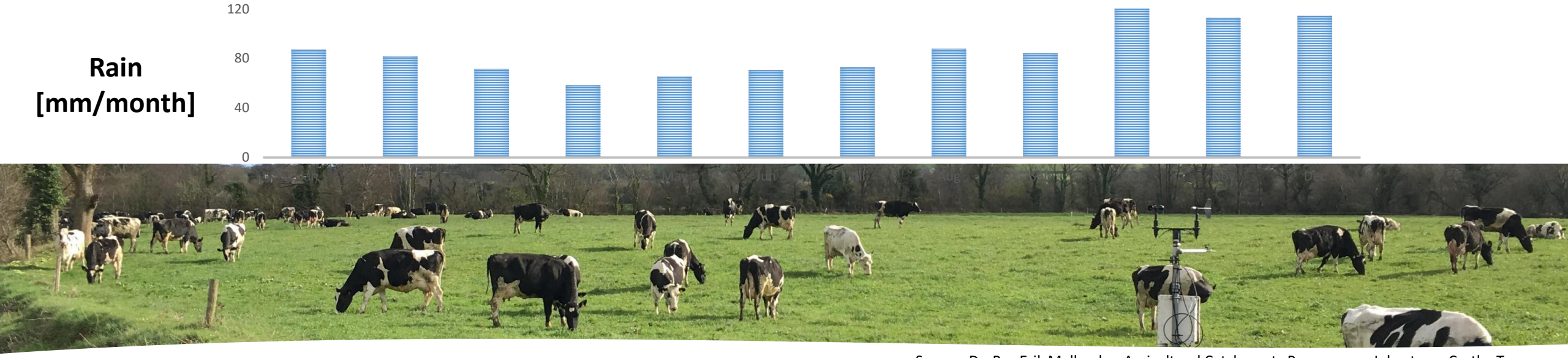
- Losses during the closed period reflected soil hydrological conditions
- Any increase in “source pressure” during these periods will exacerbate existing losses
- Losses can be divided into those from
  a) Soil stores – residual
  b) Recently applied - incidental



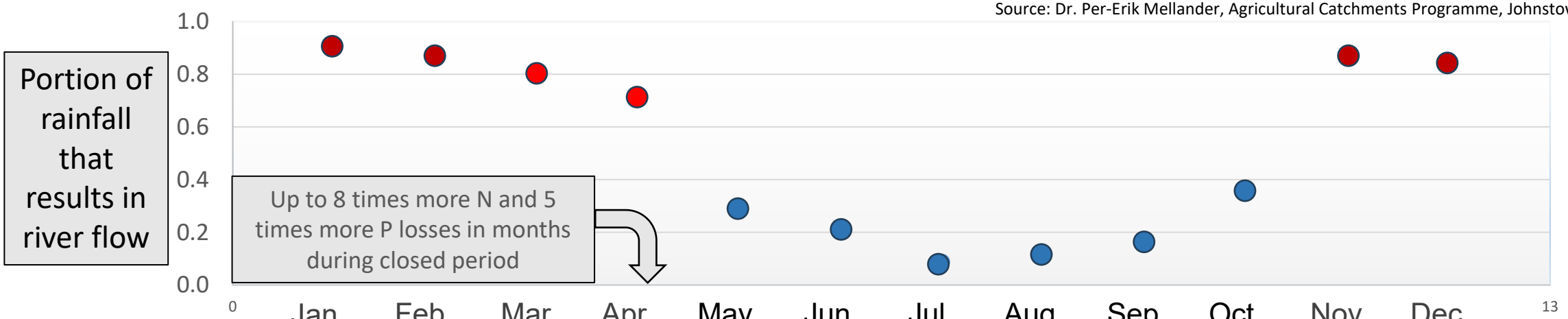
M. Shorel et al., 2016

Ballycanew

Rainfall generated 6 times more discharge in winter than in summer



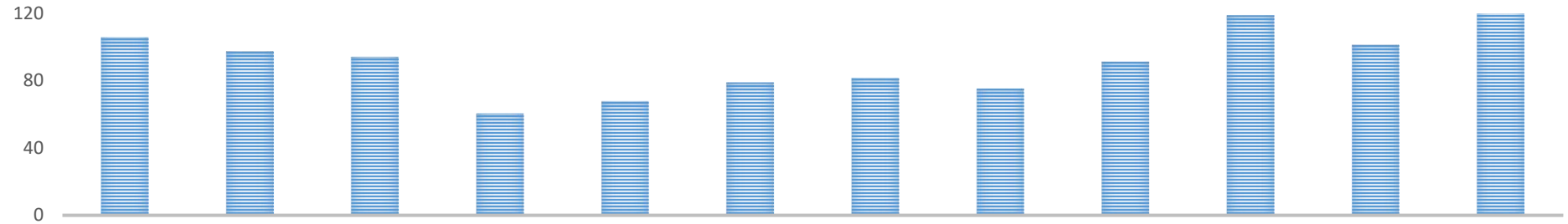
Source: Dr. Per-Erik Mellander, Agricultural Catchments Programme, Johnstown Castle, Teagasc



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
Monthly N Kg/ha:	**1.82**	**1.47**	**1.35**	**0.86**	**0.59**	**0.38**	**0.16**	**0.35**	**0.43**	**1.60**	**2.66**	**2.56**	**14.2 N**
% of Annual:	13%	10%	9%	6%	4%	3%	1%	2%	3%	11%	19%	18%	kg/ha/yr
Monthly P Kg/ha:	**0.131**	**0.111**	**0.101**	**0.076**	**0.041**	**0.038**	**0.016**	**0.067**	**0.046**	**0.167**	**0.238**	**0.217**	**1.25 P**
% of Annual:	10%	9%	8%	6%	3%	3%	1%	5%	4%	13%	19%	17%	

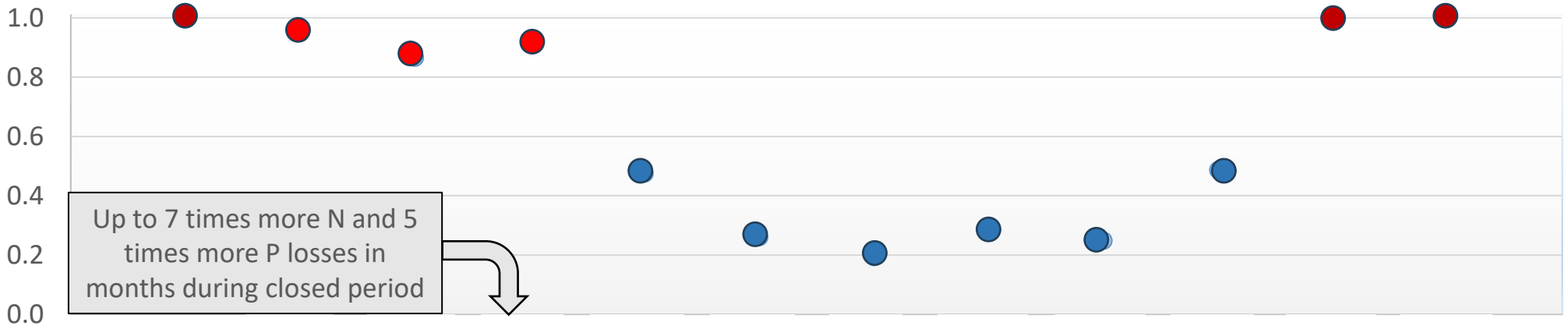
Timoleague

Rainfall generated 4 times more discharge in winter than in summer





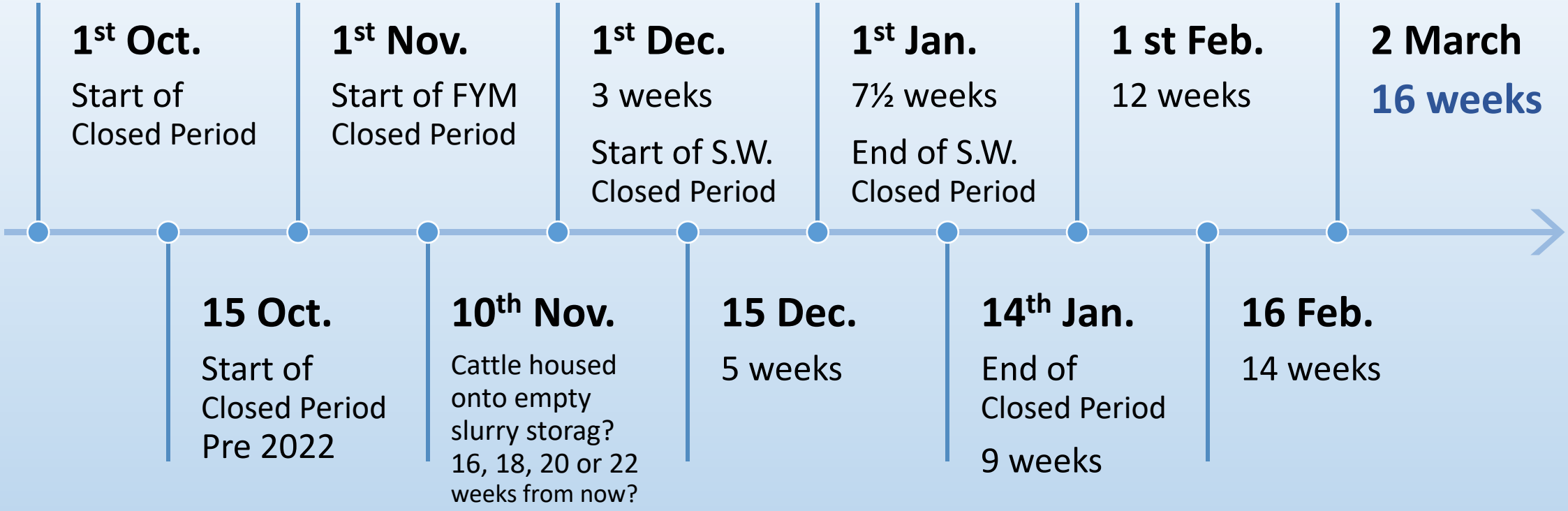
Source: Dr. Per-Erik Mellander, Agricultural Catchments Programme, Johnstown Castle, Teagasc



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly N Kg/ha:	**7.92**	**5.54**	**5.06**	**3.20**	**1.70**	**1.10**	**0.91**	**0.87**	**1.31**	**3.49**	**6.17**	**7.42**
% of Annual:	18%	12%	11%	7%	4%	2%	2%	2%	3%	8%	14%	17%
Monthly P Kg/ha:	**0.165**	**0.120**	**0.101**	**0.047**	**0.025**	**0.039**	**0.030**	**0.032**	**0.046**	**0.117**	**0.108**	**0.187**
% of Annual:	16%	12%	10%	5%	2%	4%	3%	3%	5%	12%	11%	18%

Annual Average
44.7 N
kg/ha/yr
1.02 P

The Closed Period and Storage Capacity



- Closed Period and storage capacity are not the same thing
- Do not spread slurry when: (a) the land is waterlogged, (b) flooded or likely to flood, (c) snow-covered or frozen, or (d) heavy rain is forecast within 48 hours