



Synergies from co-digestion of grass silage with other feedstocks

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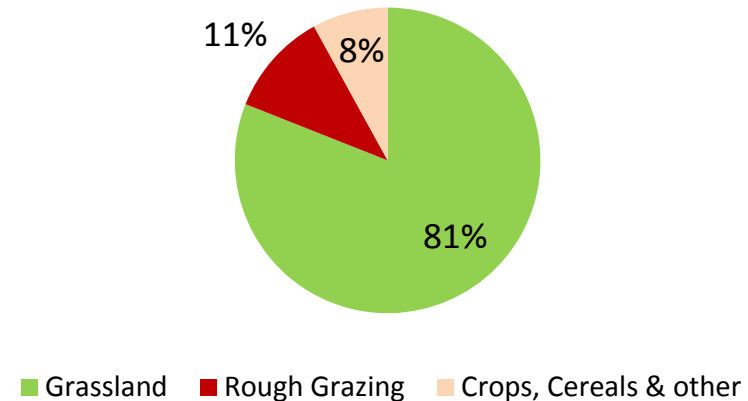


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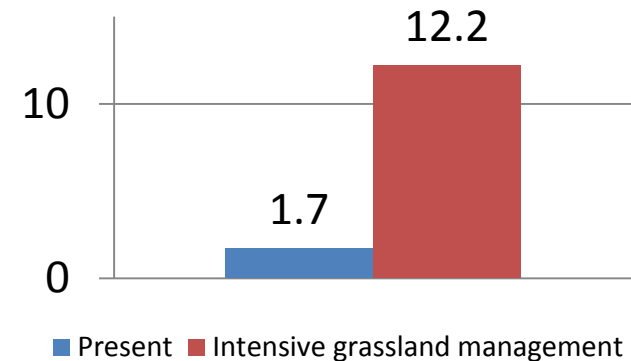
Introduction

- Ireland has 4.2 M ha of agricultural land.
- 1.7 M t of dry matter (DM) in excess of livestock requirements (McEniry et al., 2013).
- Intensive grassland management → Up to 12.2 M t DM/annum average by more (McEniry et al., 2013).
- 10% of Ireland's grassland area → Fuel up to 55% of all passenger cars (Wall et al., 2013).
- In 2010 there were 1.07 M dairy cows → 7.07 M t DM/annum for 20 weeks winter storage period of slurry (Wall et al., 2013).
- Long term mono-digestion of grass silage can suffer due to a deficiency in essential nutrients
 - Addition of slurry can provide these nutrients.
- Co-digestion of silage and slurry may produce synergistic effects providing higher biogas yield compared to mono-digestion of silage or slurry.

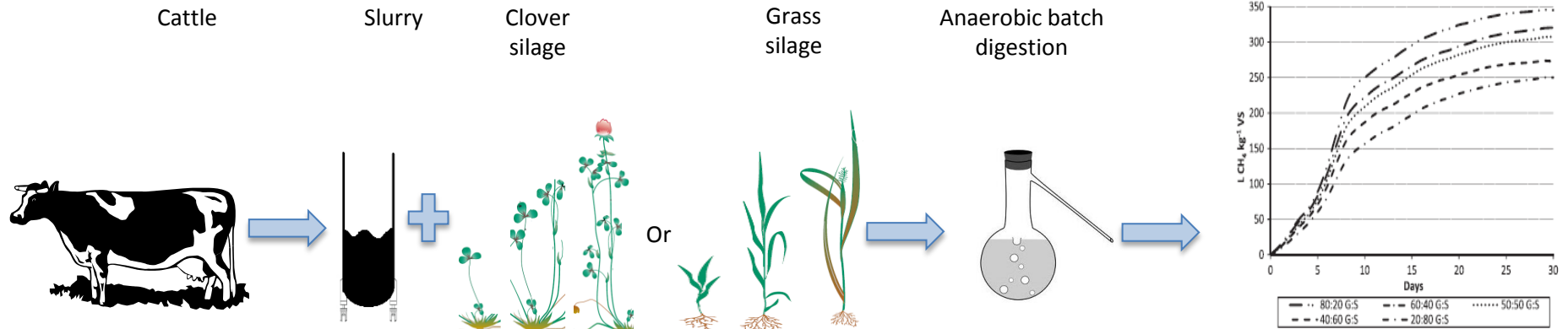
Ireland's agricultural land utilization



Grass silage in excess of livestock requirements



Co-digestion of grass/red clover silages with cattle slurry

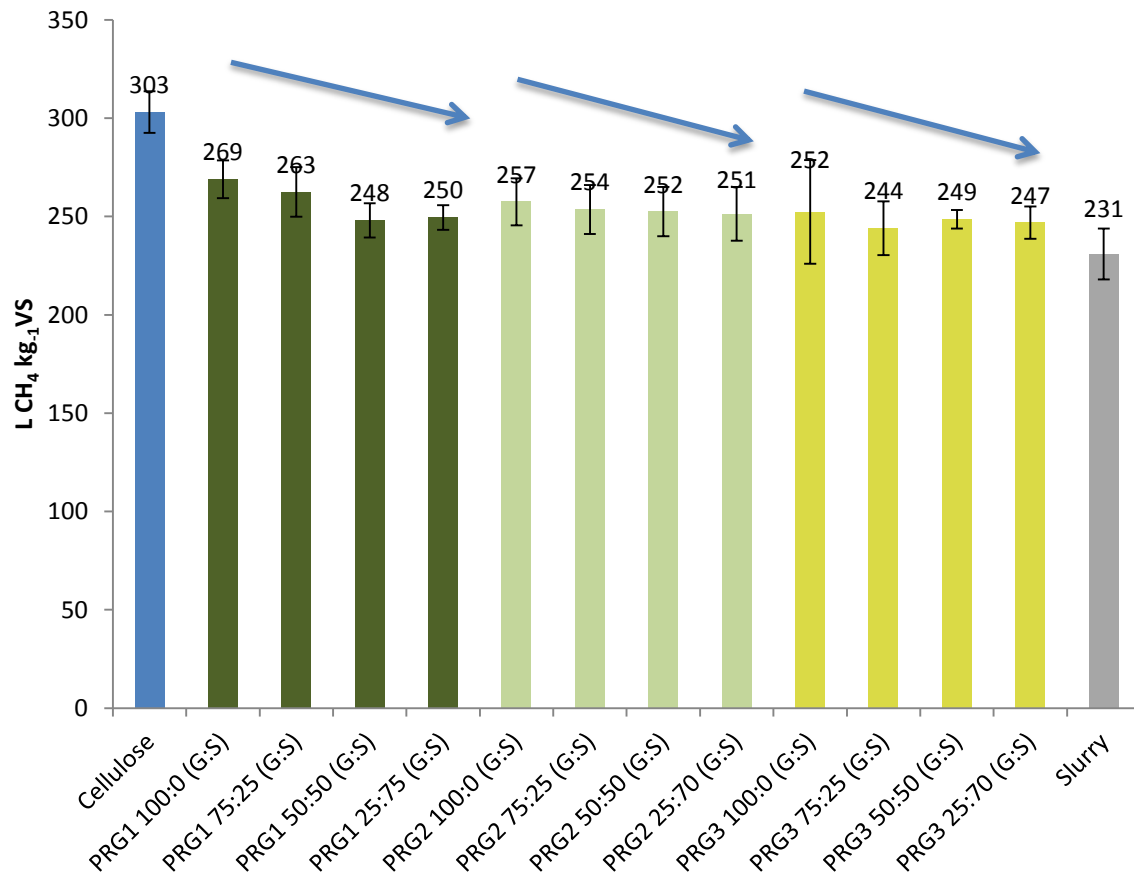


Specific methane yields for co-digestion. G - grass silage, S - slurry (Wall et al, 2013)

- BMP test (Results until 26 days)
- 160 ml serum bottles (70ml working vol.+90ml headspace)
- 5 different Silage:Slurry ratios
 - (G:S – 100:0, 75:25, 50:50, 25:75, 0:100)
- Pressure and gas composition measured on days 3, 6, 10, 12, 15, 19, 23 and 26

Co-digestion of grass/red clover silages with cattle slurry

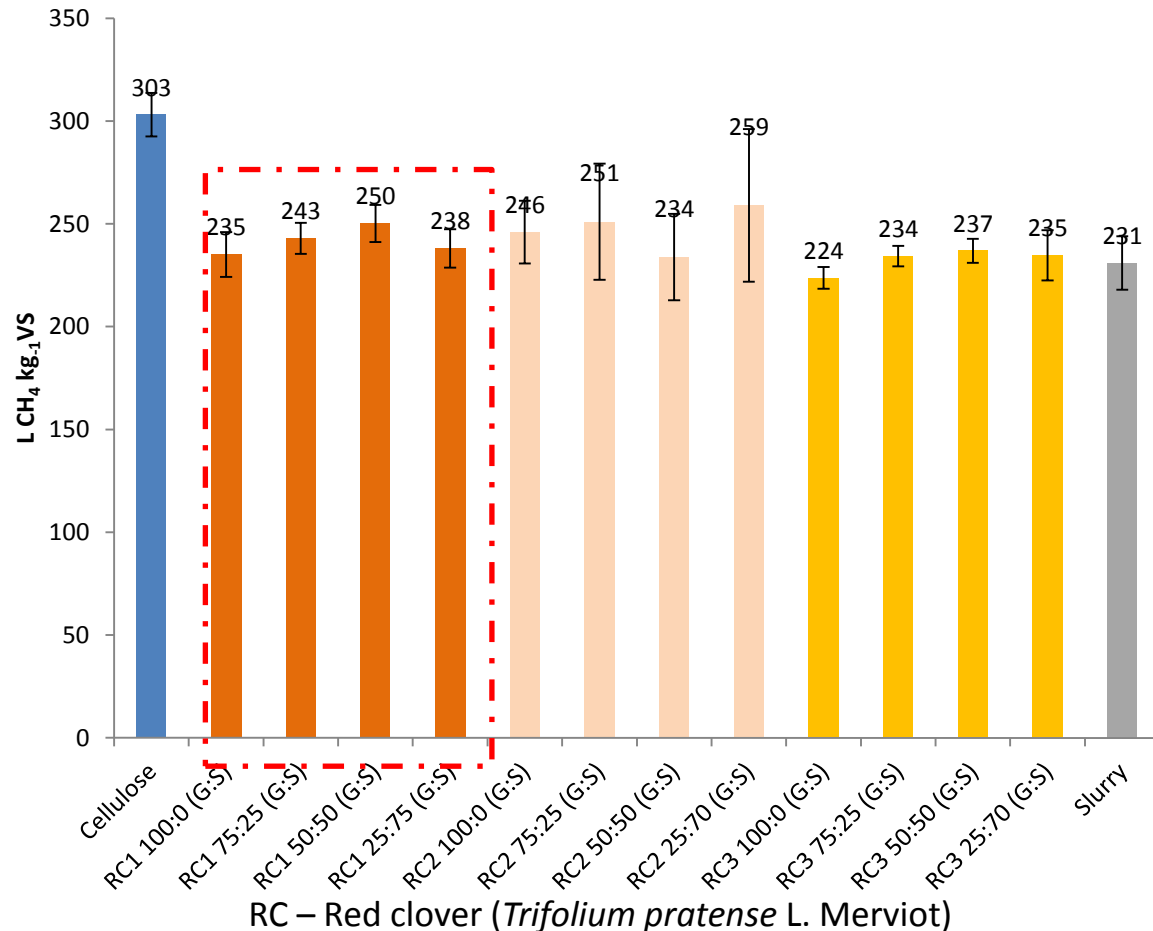
- BMP experiment for 26 days
- Specific methane yield decrease with decrease in silage ratio ($P < 0.05$)
- No synergistic effects



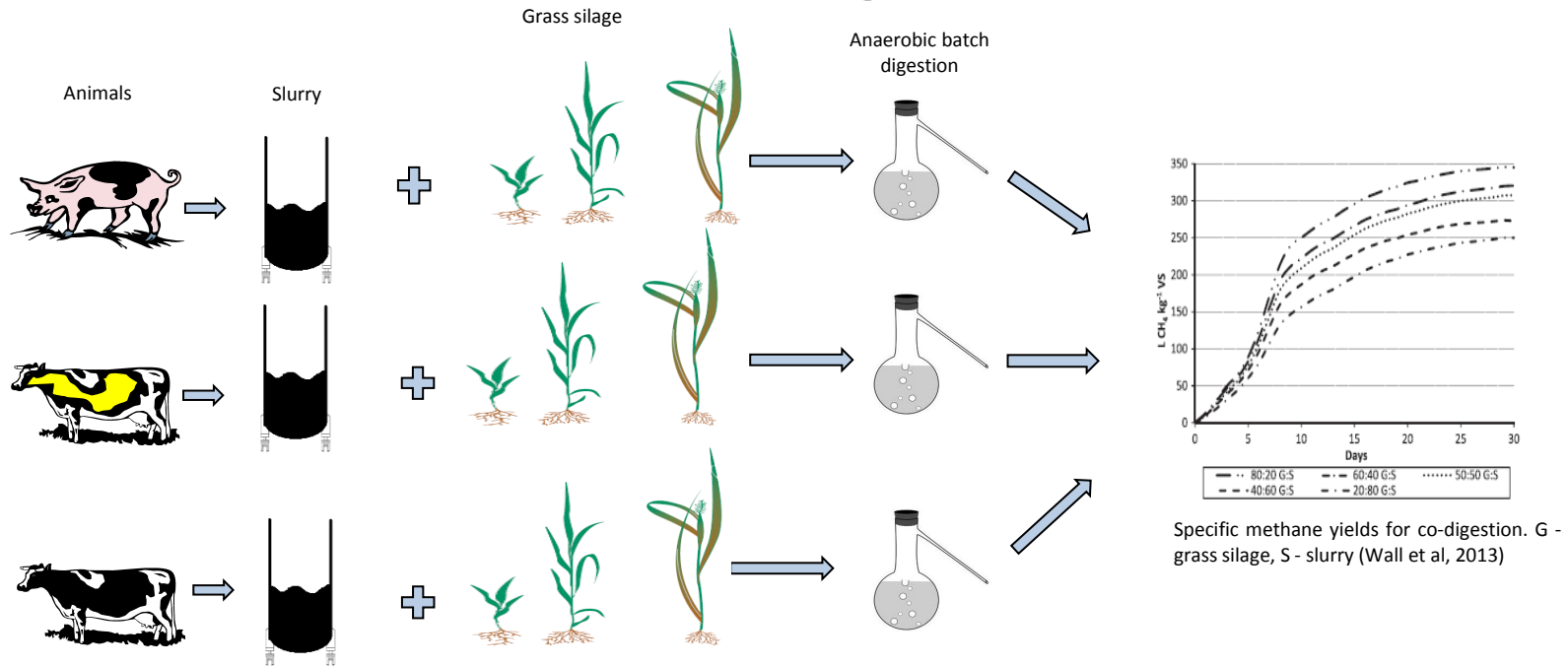
PRG - Perennial ryegrass (*Lolium perenne* L. var. Gandalf)

Co-digestion of grass/red clover silages with cattle slurry

- BMP experiment for 26 days
- Positive synergistic effect for growth stage 1 silage
- Maximum biomethane is produced at 50:50 (G:S) ($P < 0.05$)

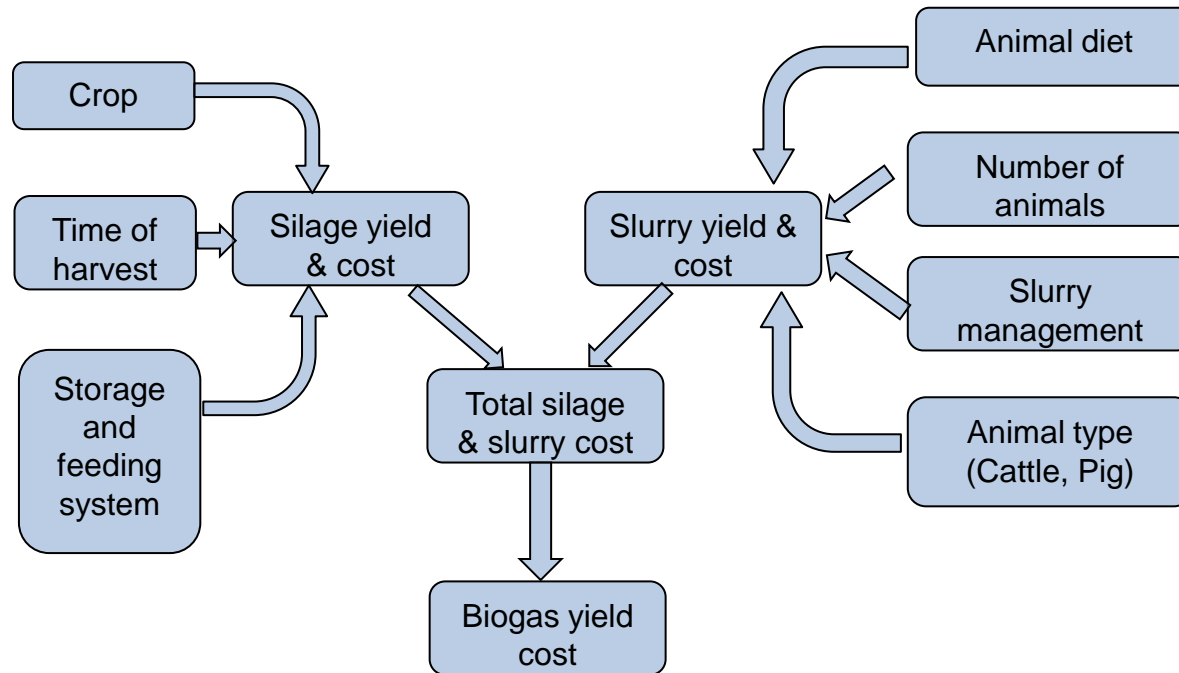


Co-digestion of different slurry types with grass silages

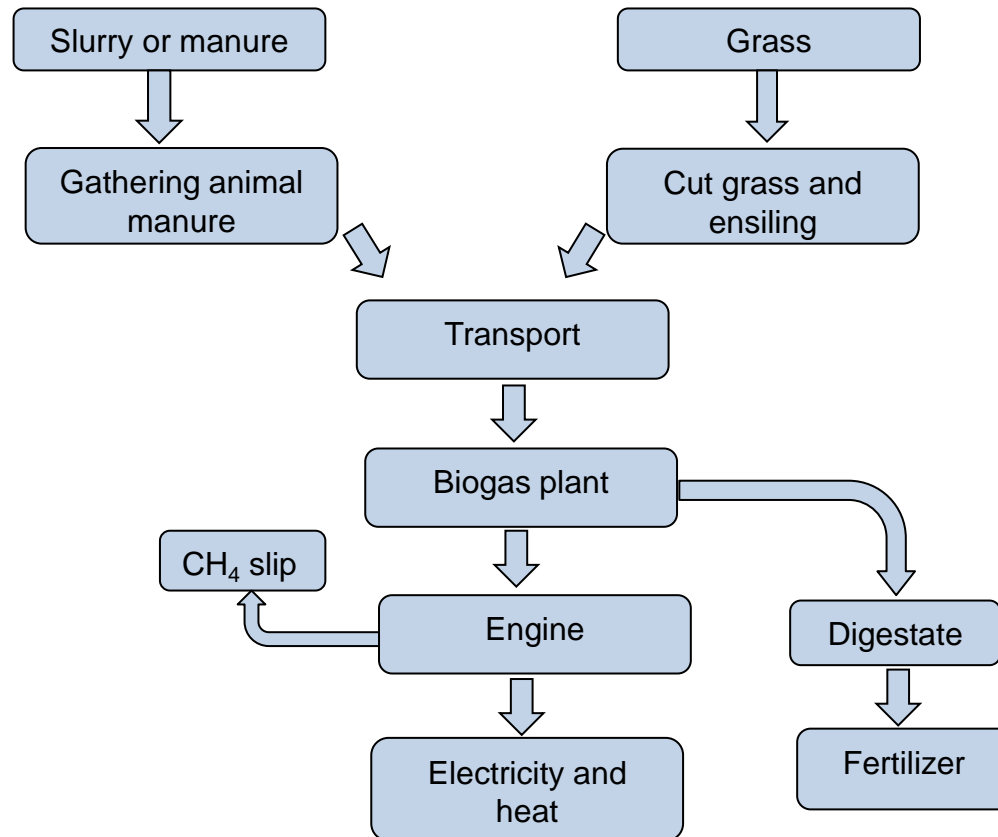


- Impact of different slurry types → Pig and cattle
- Impact of different growth stages → Three growth stages
- Investigation of synergistic association by co-digestion of silage and slurry

Economic modelling of biogas yield from the co-digestion of silage and slurry



LCA of anaerobic digester fed with grass silage and slurry mixture



Question?





Thanks for listening



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