

Simulated Global Warming Potential & Ammonia emission figures for a range of suckler herd breeding strategies and beef cattle finishing systems

Dr Jimmy Hyslop - SAC Beef Specialist



Background & Objective

- Animal and environmental parameters from a typical
 - 100 cow suckler beef herd

- Global Warming Potential (**GWP**) & ammonia associated with suckler beef systems is mainly:-
 - Methane (CH₄) } beef cattle - enteric fermentation
 - Nitrous oxide (N₂O) } “ “ - manure management
 - Ammonia (NH₃) } grazing, housing, FYM & fert storage & spreading

- Objective - Identify “win-win” scenarios that:-
 - benefit beef farm economic sustainability and
 - reduce environmental footprint of beef farms

Materials & methods



- **Simplifying assumptions:-**
- 100 cows suckle a calf through to weaning (barren cows sold)
 - breeding bulls also kept
- Autumn calving, calves weaned @ turnout (7-8 mths)
- These groups referred to as **breeding herd (H)**
- All heifers reared on farm (inc. purchased animals) - **replacements**
- All remaining weaned calves then enter a **finishing system (FS)**
- Typical upland grassland based farm (tight boundary for LCA)

Materials & methods

- Simulate GWP & NH₃ emissions from 20 suckler beef systems (**i.e H x FS**) combinations (in duplicate - i.e. 40 simulations in total - 2 breed types):-
 - **5 distinct suckler beef herd management strategies (H)**
 - Dx - Dairy cross beef (F1)
 - PB - Pure bred
 - RO - 3 breed rotational cross
 - CO - Composite breed
 - SS - Sexed semen strategy
 - X
 - **4 distinct weaned suckled calf finishing systems (FS)**
 - @ 12 mths intensive (conc based)
 - @ 18 mths semi intensive (forage:conc based)
 - @ 24 mths semi extensive (mainly forage with small conc input)
 - @ 30 mths extensive (forage only with no conc input)

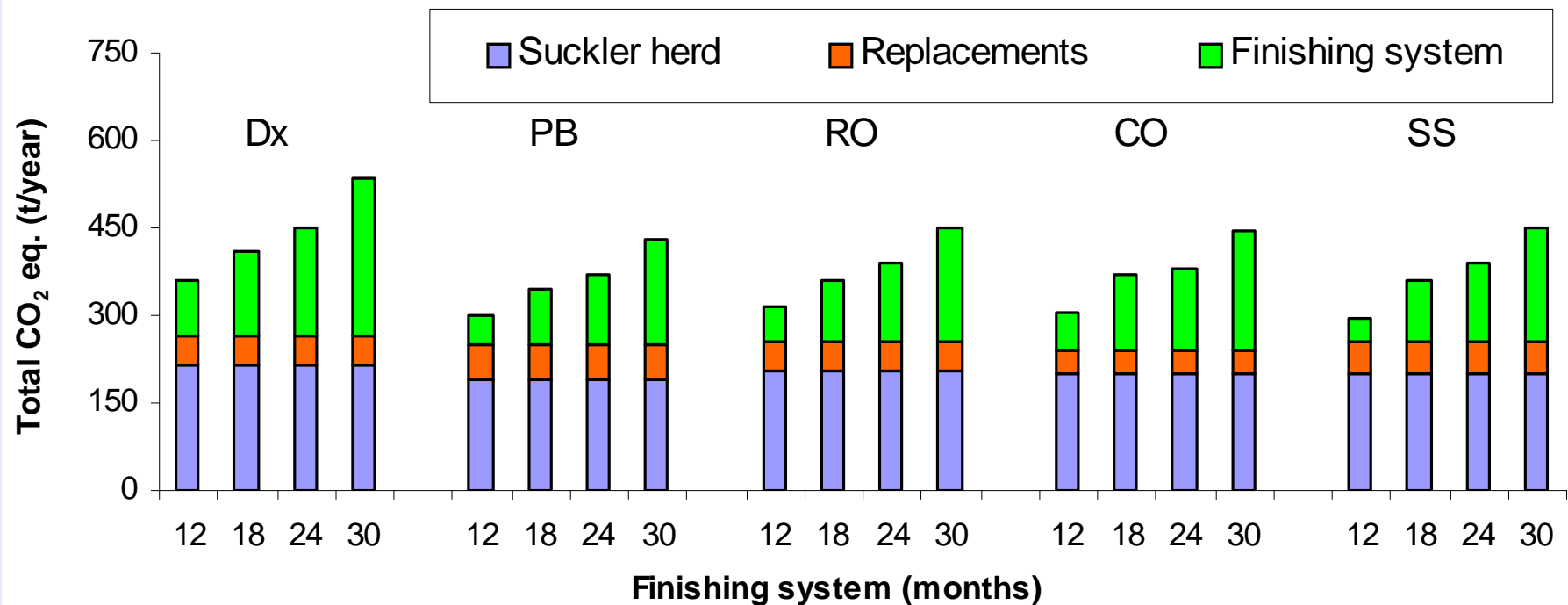
GWP & NH₃ simulations:-

- Animal input & output data based on
 - BREEDS (bio-economic simulation model)
- GWP data based on **Tier 2 methods** from IPCC (1996 & 2000)
- NH₃ based on UK standard methods (Misselbrook *et al*, 2000, 2003)
- Both CH₄ & N₂O **converted to CO₂ equivalents (i.e GWP)**
 - using 100 yr conversions
 - 21 & 310 g/g respectively (IPCC, 1996)
 - Statistical analysis
 - ANOVA (5x4 factorial with 2 reps)

Results - **GWP** (as CO₂ Eq) emissions from 100 cow suckler herd (t/year) - (**H x FS combinations**)



Figure 1. Relative GWP contributions from the suckler breeding herd, heifer replacements and finishing cattle system (H x FS)

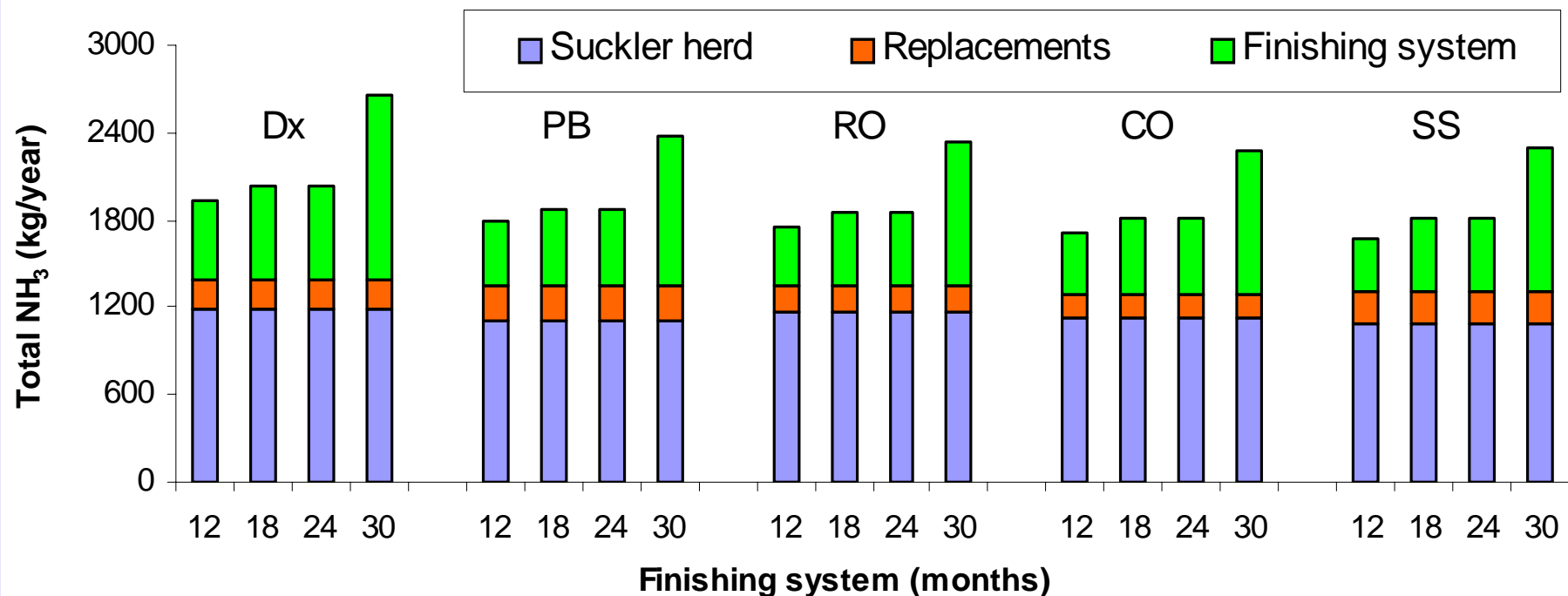


- Choice of finishing system is key determinant in GWP of beef systems

Results - NH_3 emissions from 100 cow suckler herd (kg/year) - (H x FS combinations)



Figure 1. Relative NH_3 contributions from the suckler breeding herd, heifer replacements and finishing cattle system (H x FS)

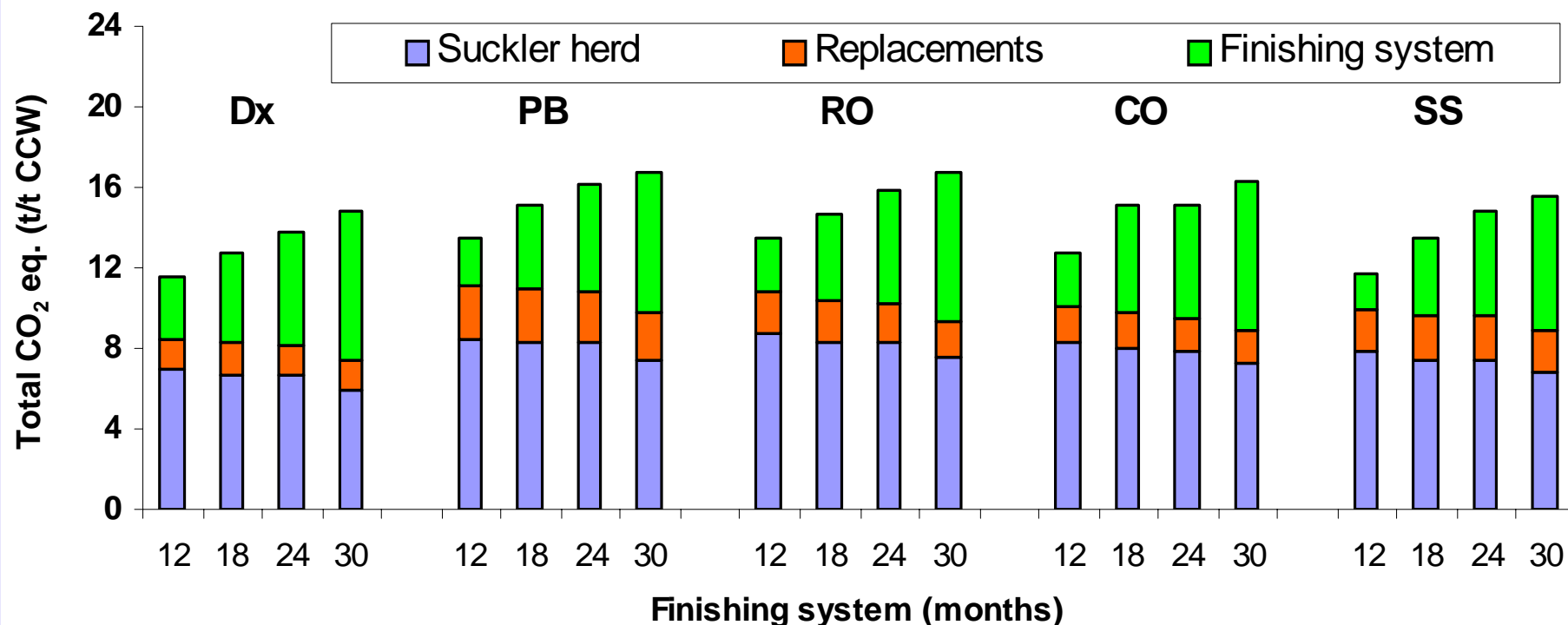


- Choice of finishing system is key determinant in NH_3 emissions from suckler beef production systems

Results - CO₂ Eq. / CCW sales from 100 cow suckler herd (tonnes CO₂ Eq. / tonne CCW sold)



Figure 5. Relative GWP contributions (t CO₂ eq. / t CCW) from the suckler breeding herd, heifer replacements and finishing cattle system (H x FS)



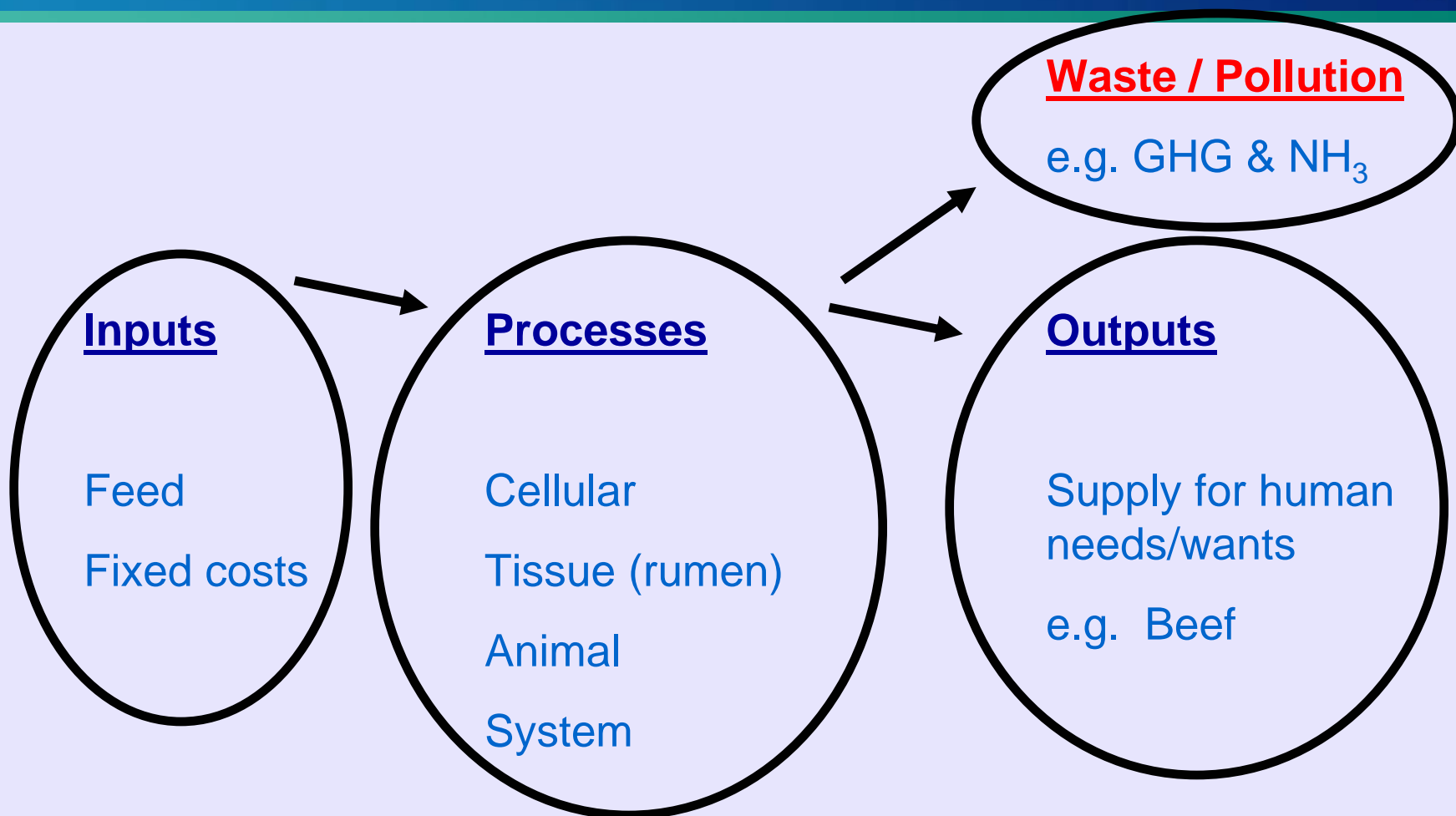
- Herd effect alter CO₂ / CCW sales by 16% (min-max)
- FS effect alter CO₂ / CCW sales by 28% (min-max)
- Herd x FS effect alter CO₂ / CCW sales by 46% (min-max)

Conclusions



- GWP & NH₃ effected by the nature & type of suckler beef production systems
 - simply reducing herd size is not sufficient
- Both breeding herd and finishing system management are important
 - but in particular
- **Intensive, short duration, feed efficient systems are more environmentally friendly**
 - **The farmer gains the feed & fixed cost efficiency (win)**
 - **The planet gains through reduced GWP pollution (win)**

Implications for beef systems



- **The way to reduce Global warming in practice is to improve the efficiency of the processes that we use to turn raw inputs into a supply of human needs/wants**

Acknowledgement



- Defra provided the funding for this work