Beef Cattle Methane – Current state of play.....

Sam Clark, UNE, Australia

SUCCESS IS A TEAM EFFORT

PixemWeb.com

Ross Evans, Donagh Berry, David Kelly, Ben Hayes, Jason Archer (Susanne Rowe), Steve Miller, Rachelle Hergenhan, John Crowley (the Abacusbio team), Mike Coffey (Abby Moran, Raph Mrode, Marco Winters, Harriet Bunning), Megan Rolf (and the KSU team), Christine Baes, Christian Duff,Tom Granleese, Elly Navajas
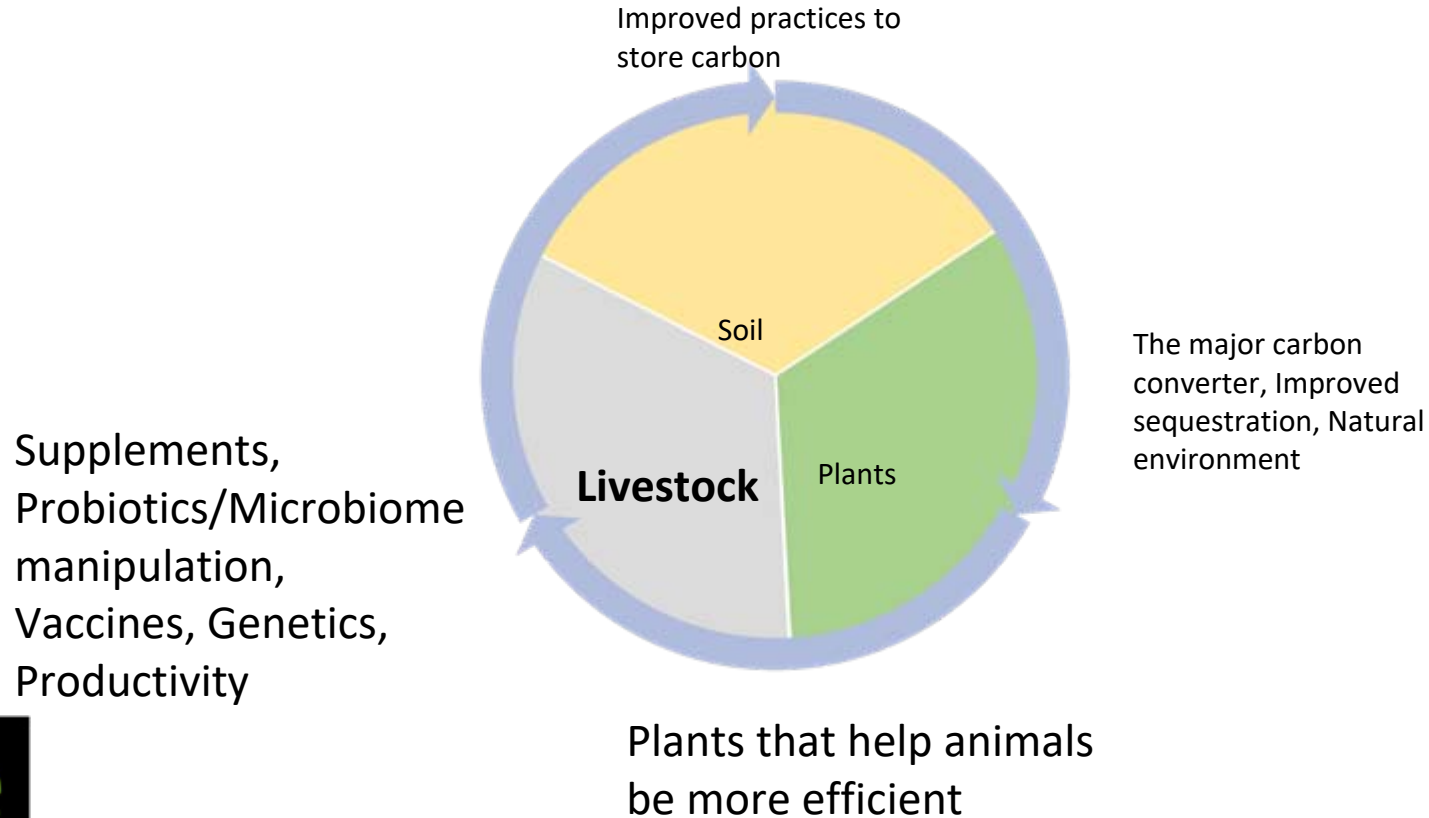
- Ireland, UK, North America and Canada, New Zealand, South America (Uruguay), Australia

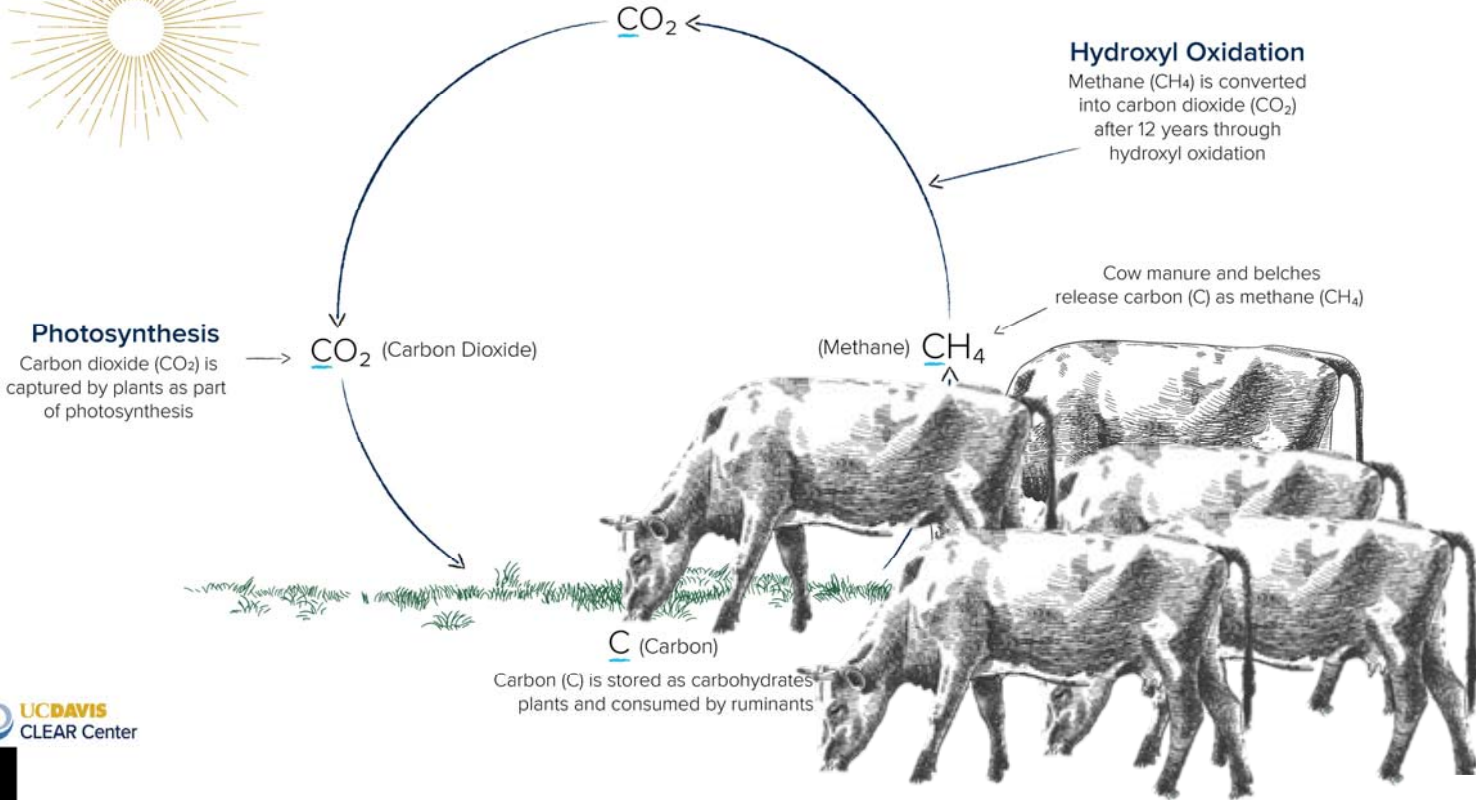- Thanks to funders and organisation that have contributed to activities

So where are we now?

The race has already begun!

Carbon management – what happens now?

Improved practices to store carbon

Soil

Livestock

Plants

The major carbon converter, Improved sequestration, Natural environment

Supplements, Probiotics/Microbiome manipulation, Vaccines, Genetics, Productivity

Plants that help animals be more efficient

University of New England

Biogenic Carbon Cycle

CO_2

Hydroxyl Oxidation
Methane (CH_4) is converted into carbon dioxide (CO_2) after 12 years through hydroxyl oxidation

Photosynthesis
Carbon dioxide (CO_2) is captured by plants as part of photosynthesis

CO_2 (Carbon Dioxide)

Cow manure and belches release carbon (C) as methane (CH_4)

(Methane) CH_4
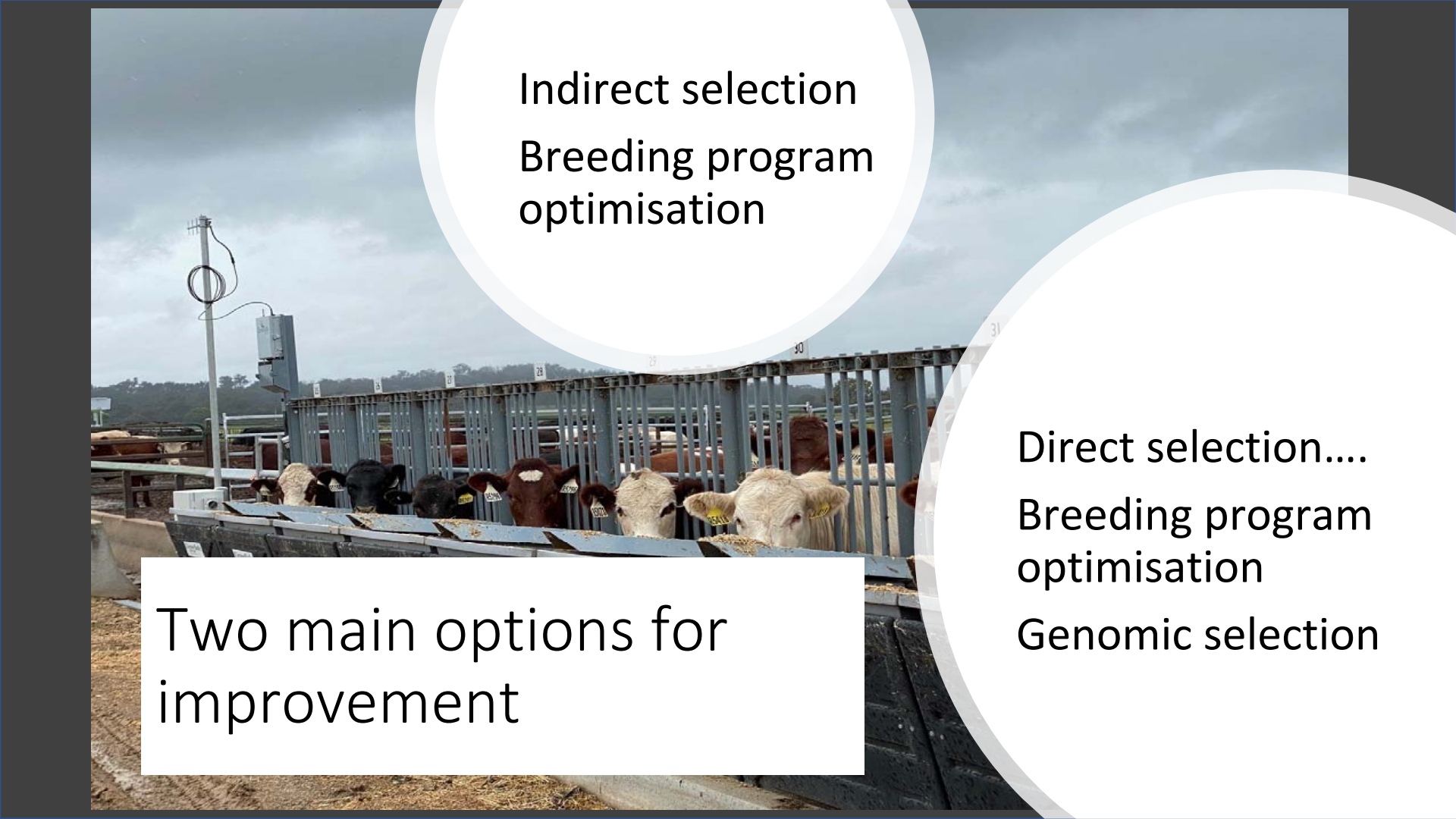
C (Carbon)
Carbon (C) is stored as carbohydrates plants and consumed by ruminants

UCDAVIS
CLEAR Center

une
University of
New England

What do we want to improve?

- Life-time methane output

- Per unit of product?

- Per unit of resource use (intake, energy)?

Indirect selection

Breeding program optimisation

Direct selection….

Breeding program optimisation

Genomic selection

Two main options for improvement

Indirect selection

We have already been doing it!

But we can get BETTER

- New indexes
- production system efficiency

- Increased production per cow
- Improved disease resistance
- Increased fertility

- Dilute fixed maintenance costs
  - Fewer cows to produce same product
- Reduced wastage of productive days
- Reduced wastage of infertile cows and fewer replacements
- More opportunities to select best cows
  - Sexed semen has helped

- Lower environmental cost
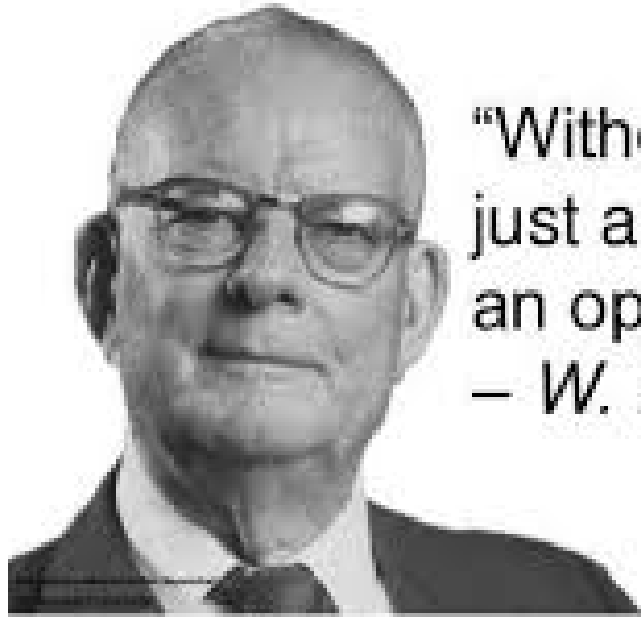
"Without data you're just another person with an opinion."
– *W. Edwards Deming*

I genotypens ålder är fenotypen kung

Im Zeitalter des Genotyps ist der Phänotyp König

#PHENOTYPE IS KING!

Genotyypin aikakaudella fenotyypi on kunigas

Genotyyppiaikakaudella fenotyyppi on kuningas

Fenotype blijft de koning

في عصر التركيب الجيني
البيانات المظهرية هي الملك

En la era del genotipo ...
¡El fenotipo es el rey!

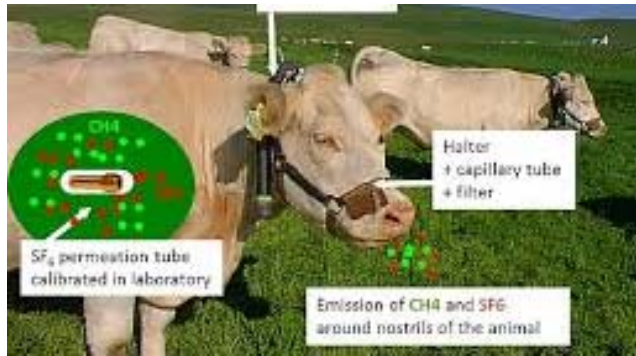Την εποχή του γονοτύπου, ο φαινότυπος είναι βασιλιάς!

فینوٹائپ بادشاہ ہے

SRUC

Measurement Technologies

- Everything is just a proxy…… or estimate of life-time methane production

- Large focus on when, who, where, how often to record

- All countries → indirect selection and breeding program improvements
- Countries building references →Ireland and Australia
- Other countries at early stages → who, when, how often to record, many small projects, validating recording procedures, overlay to feed additive projects
- New Zealand – alternative recording tool (s) (P?..AC)

More happening that first meets the eye..... More investigation of potential needed

South America (example)

Systems in place for improvement (Brazil, Uruguay and Argentina)

Feed intake and production system improvement emphasis

Plans to record some methane on progeny test programs

Example - INYA Hereford Information Nucleus (Uruguay) - ~200 CH4 records

Don't forget other traits too – Adaptation

Heat stress, water intake, health and disease

Some of Asia and Africa

Many small holder systems

but in some countries → central breeding programs

Cows are often wealth and core to improving living standard

North America and Canada

Megan Rolf (and her team at Kansas State), Christine Baes, John Crowley

- Many groups with a few GreenFeeds (both standard and pasture systems)
- Some with a few hundred records
- Working on collection protocol for a GreenFeed, particularly in grazing settings
- Reference building in the near future

Characterization of the number of spot samples required for quantification of gas fluxes and metabolic heat production from grazing beef cows using a GreenFeed

Elizabeth A Dressler, Jennifer M. Bormann, Robert L. Weaber, and Megan M. Rolf[1]

Department of Animal Sciences and Industry, Kansas State University, Manhattan, KS 66506, USA
[1]Corresponding author: megrolf@ksu.edu

New Zealand – P...AC

- AgResearch - 6 Accumulation Chambers suitable for cattle up to about 400 kg

- ~120 heifers through these chambers, twice a couple of weeks apart (July '23).

- Rumen contents and buccal samples

- Aim to look at the rumen microbiome analysis →developed in sheep → useful in cattle?

- Results → chambers worked well, methane measurements were repeatable.

- So an excellent start, but a long way to go for genetic parameters, etc.

(Republic of) Ireland

- 34 Greenfeeds – no sniffers dairy, beef, dairy-beef - growing & mature animals – indoors & grazing

- To-date
    - >2000 indoor methane measures in growing animals (+feed intake, carcass, ultrasound, growth……)
    - Growing ~800 annually
    - All types of crossbreds (including dairy-beef)
    - >400 (and growing by several hundred annually) growing beef animals at grass (with some feed intake)
    - Small numbers of suckler cows (~500 dairy cows)
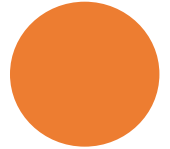
(Republic of) Ireland

- National multi-breed genomic evaluations launched for growing cattle in 2022
- Carbon sub-indexes for total merit indexes launched in 2024

- On-going research
  - Developing SOPs
  - Automatic loading of data to national database + meta-data (e.g., diet)
  - Correlations across life stages and diet type (i.e., pasture v indoors)
  - Genetic evaluations
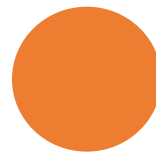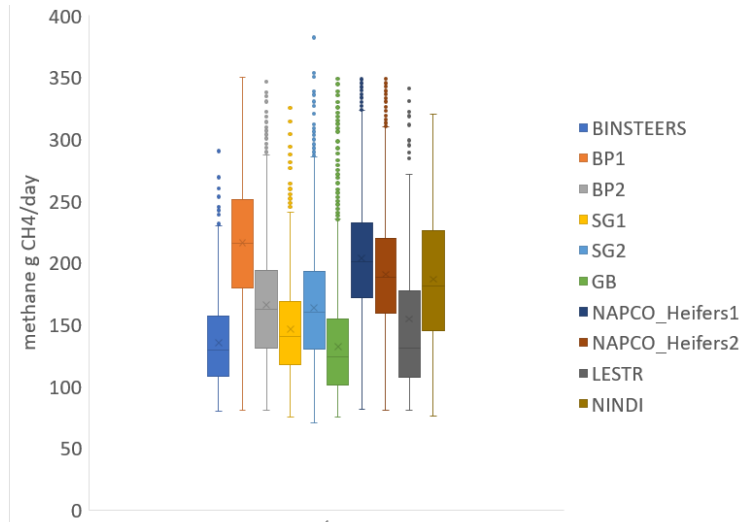
Australia – North and South

ZNE Agriculture Cooperative Research Centre

ZERO NET EMISSIONS
Agriculture CRC

A reference population for Northern Australian Beef Cattle

- 4500 Animals to be phenotyped (Greenfeed) and genotyped, 750 to date

Trait	Units	Heritability (std err)
Weight	Kg	0.67±0.25
Methane	Methane g/day	0.15±0.02
Methane intensity	Methane g/day/kg LWT	0.30±0.04

Legend:
- BINSTEERS
- BP1
- BP2
- SG1
- SG2
- GB
- NAPCO_Heifers1
- NAPCO_Heifers2
- LESTR
- NINDI

MEAT & LIVESTOCK AUSTRALIA

Measurements and number of animals - South

- Past records (2012-2015)
  - 1,046 young Angus bulls and heifers - respiration chambers
  - 119 Angus heifers and 326 Angus steers -Greenfeed

- New animals (6-8000 –Greenfeed – 4yrs (began 2022)
  - ~1200-1350 steers measured from 6 breeds
  (Angus, Hereford, Charolais, Shorthorn, Wagyu and Brahman)
  - ~650-750 heifers measured on pasture per yr
- ~3000 animals with >5 records
- Heritability estimates 0.15-0.4 (depending on trait definition)

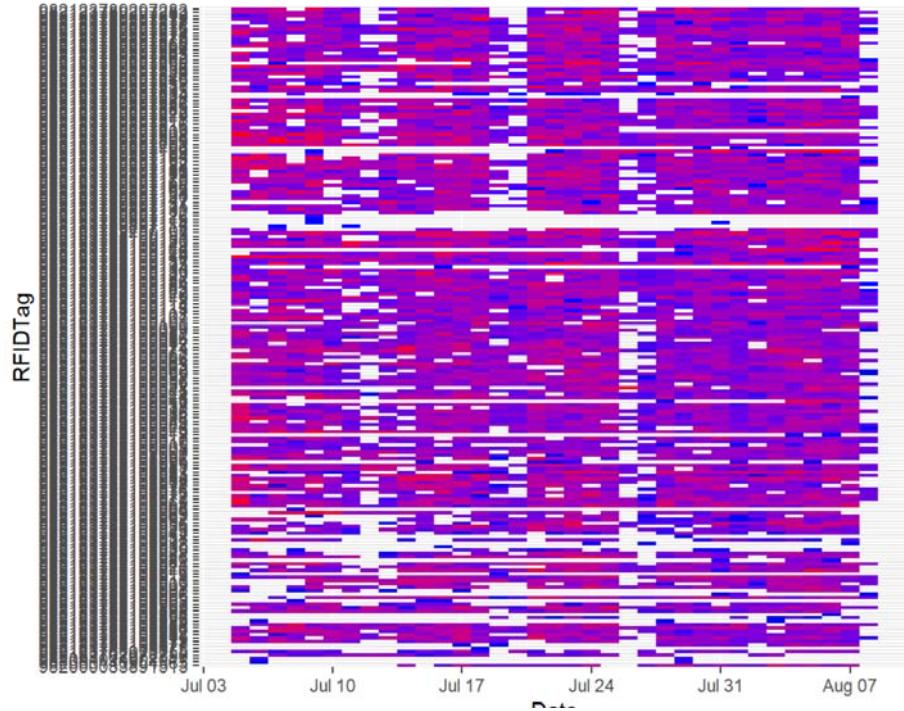# GreenFeeds

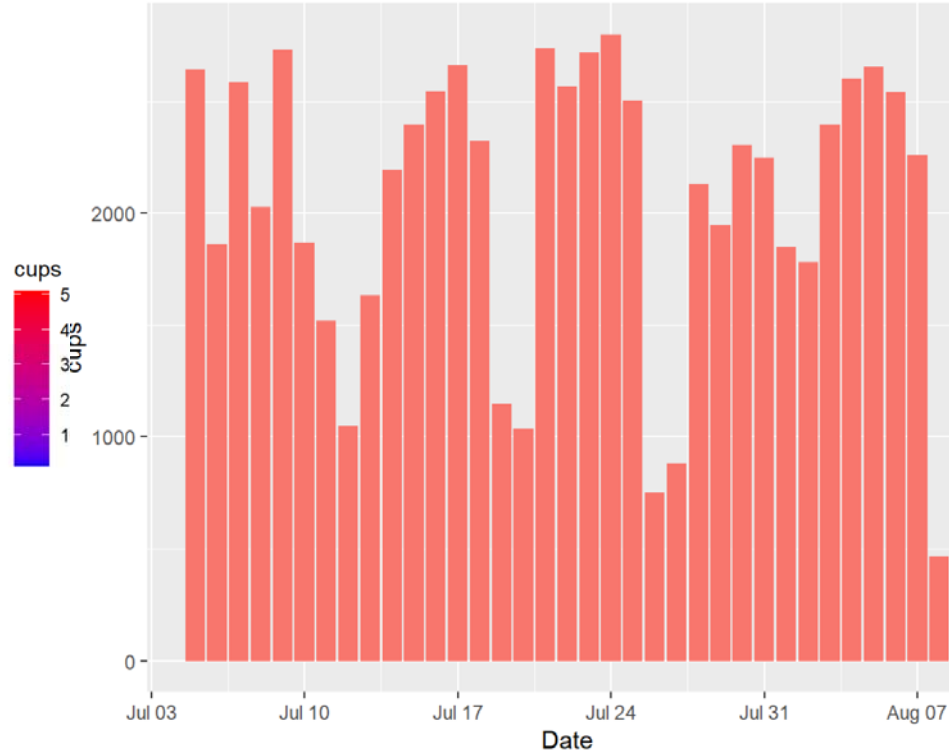- 20 South, 10 North
- 10 old for training

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New England

A common theme (across countries) - Training animals is important and challenging

Daily data monitoring essential! (at (nearly) real time)

C-Lock API - Automated pipelines, raw data

Summary

Two ways of managing emissions

• Optimising the breeding program (efficiency)

indirect selection (Ire, UK, NZ, Aus, Ur, USA, Canada)

• Direct recording and selection

#teamworkmakesthedreamwork

Current recording (everyone wants to)

• Two large programs (Aus, Ire) ~6000 records

• Lessons for recording – training, keep machines running, who to record

• Trait definition is important

• The whole system is important

• Its hard to go back to record the past – so planning is key – collect as much as you can!