SOLID | Sustainable Organic and Low Input Dairying

Sustainable approaches for production efficiency in dairy farming systems

- based on studies in the UK -

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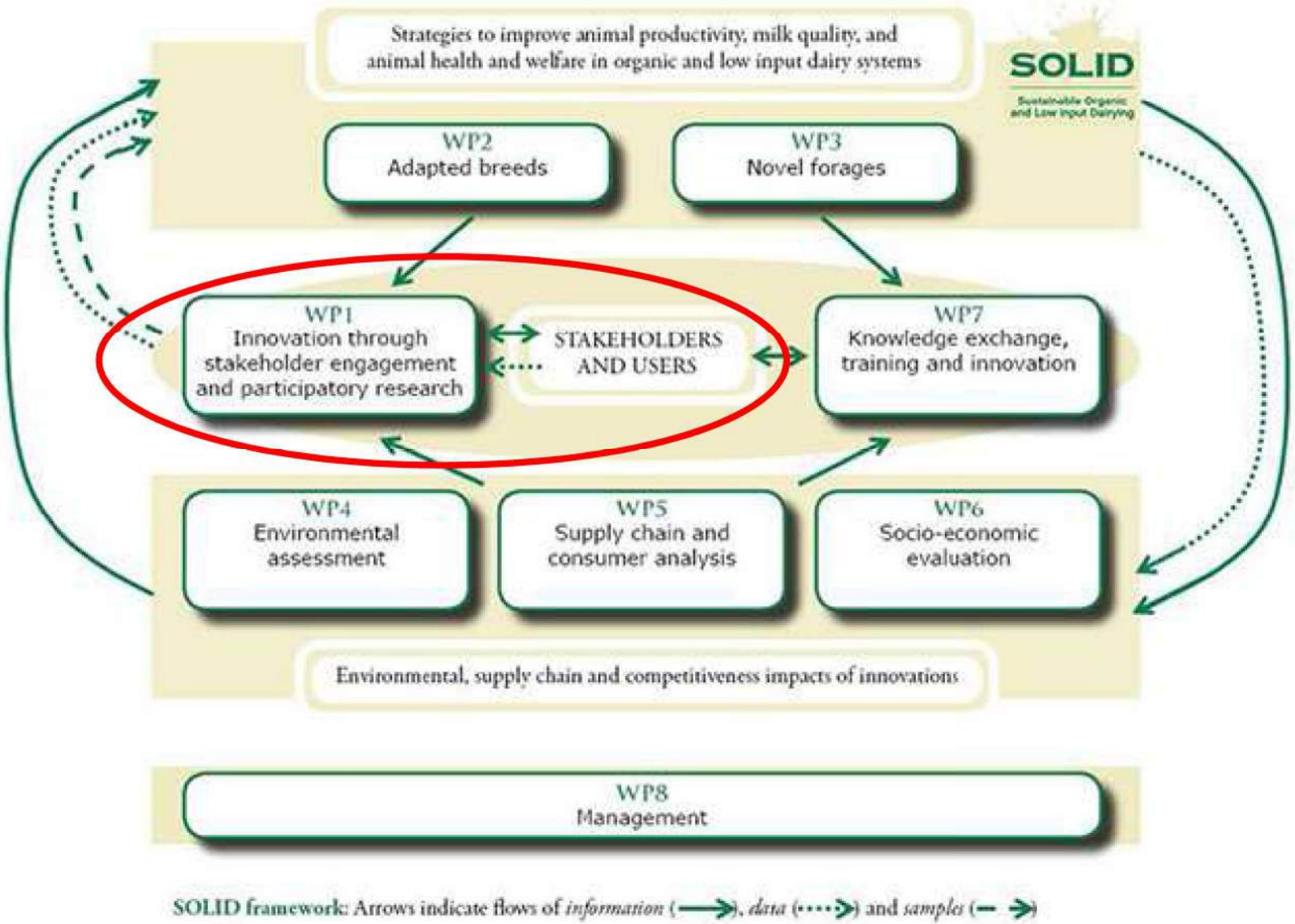
SOLID Regional Meeting

Thessaloniki, Greece, September 2015



SOLID framework: Arrows indicate flows of *information* (——>), *data* (····>) and *samples* (— >)

Key aspects of the SOLID project

- Involves farmers and stakeholders
  - Identifying research topics
  - carrying out the actual research

- With the aim to
  - Address practical problems and/or
  - evaluate novel management practices **at farm level**

Key aspects of the SOLID project

- Participatory research is
  - a systematic interaction between farmers and scientists
  - more commonly used in research for developing countries
  - less common in European projects

- Provides direct evidence to farmers/industry resulting in practical solutions

Key aspects of the SOLID project

- Types of Participatory Research approaches
  - **Discussion groups / stable schools / Field Labs**
  - **On-farm trials**
  - **Case studies**

Key aspects of the SOLID project

- **<u>Discussion groups / Field Labs</u>**
  - Facilitate exchange of experience and knowledge
  - Enable farmers to share ideas
  - Aim to improve practice/management
  - Normally farmer meetings are attended by a researcher and/or a facilitator who stimulate group discussions

Key aspects of the SOLID project

- **On-farm Trials**
  - Implies an increased level of farmer's involvement
  - The research topic usually is defined by the farmer
  - The specific question in research and the (**simple**) experimental approach is formed mainly by the researcher
  - The management and operation of the trials are a joint responsibility of farmer and the researcher.

Key aspects of the SOLID project

- **Case Studies**
  - The farmer carries out normal management practices, operations or the initiatives he would like to test in his farm
  - He/she is free to make modifications in the system
  - The researcher collects data, observes and analyses the biological and technical performance of the system being tested

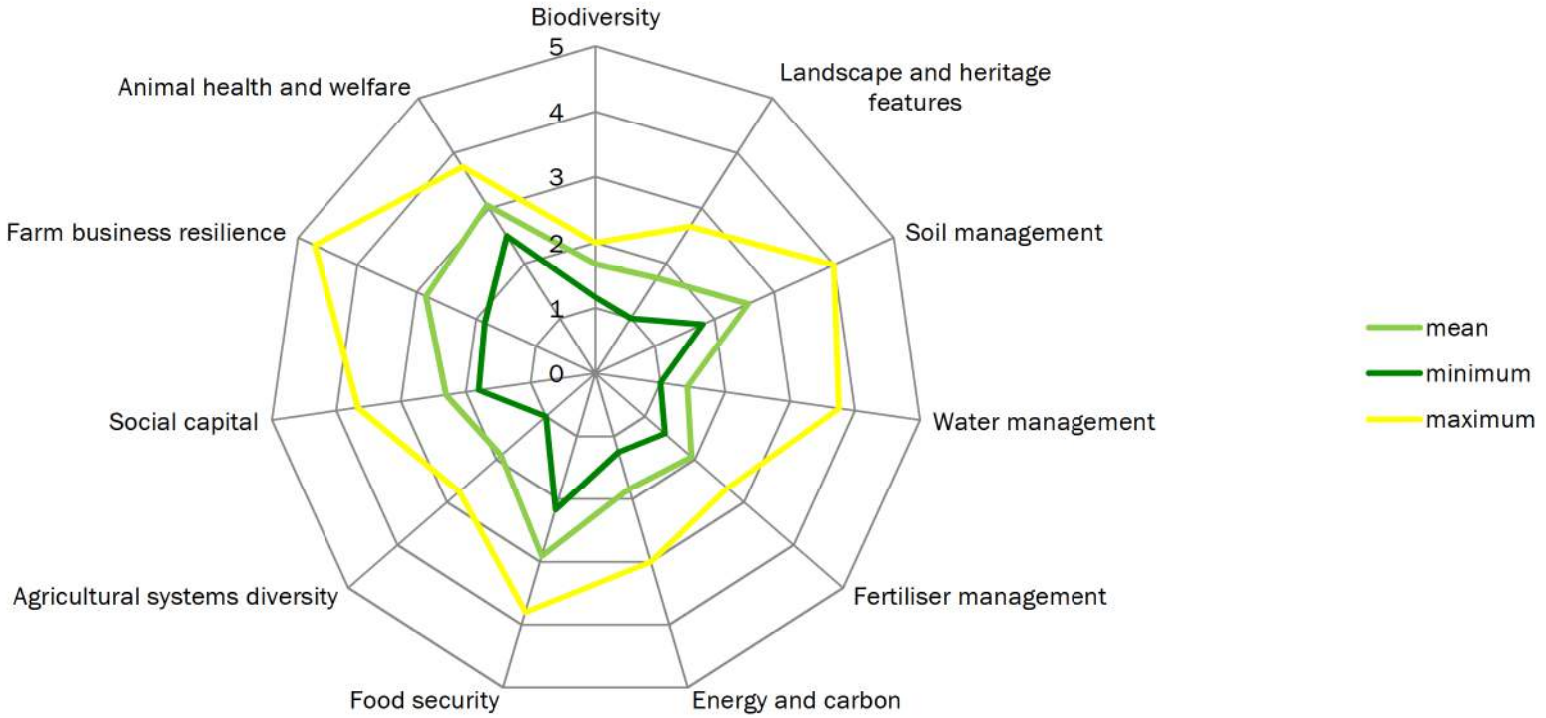
Key aspects of the SOLID project

- Types of Participatory Research approaches
  - **Discussion groups / stable schools / Field Labs**
  - **On-farm trials**
  - **Case studies**
- The type of the participatory research approach to be adopted generally depends on the research question

Key aspects of the SOLID project

- **Identification of the research questions**
  - The emphasis is on ***working*** with farmers
  - Farmers can be unaware of sustainability issues on their farm or don't see it like that or simply don't care
  - Rapid Sustainability Assessments were carried out on a number of farms in each country
    - overall sustainability of their farms
    - not only immediate practical needs

Sustainability assessment of goat farms in Greece



Thematic area	Topic	Approach	Country
Feeding and forage	Home grown proteins	On-farm trials	FI
	Use of by-products	On-farm trials	ES, RO
	Irrigation of pastures	On-farm trial	GR
Natural resources use	Soil management, pasture productivity and grazing	Case study with monitoring of forage production	UK
Environmental impact	Responding to climate change	Discussion group & farm case studies	DK
	Impact of different protein sources on carbon footprint	Case study using LCA	IT
	Impact of intensification on biodiversity	Comparative case studies with assessments and modelling	AT
Animal management	Reducing antibiotic use	Discussion group with by on-farm trials	UK
	Herbs in pasture	Comparative case studies	DK
	Maternal /nurse cow rearing of calves	Farm case studies with monitoring of calf growth	UK, DK
	Impact of farm practices on concentration of iodine in milk	Comparative farm case studies	UK

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Reducing antibiotic use – Field Lab

- Treatment of mastitis in organic dairy farms relies largely on antibiotic use
- In the UK, farmers use a special liniment commercial cream containing 35% mint oil
  - to soften swollen and inflamed udders
  - as an oedema preventative treatment at calving time
  - to mitigate the use of antibiotic treatments

Reducing antibiotic use – Field Lab

- Farmer group meetings were held every 3 months
- Knowledge transfer about the application of the liniment mint oil cream
- Communication of potential benefits
- **Lead to an on-farm trial**

Reducing antibiotic use – Farm Trial

- To test effect of a liniment cream containing 35% mint oil on cows' SCC, following treatment of the udder

- **Six** farmers committed to participate

Reducing antibiotic use – Farm Trial

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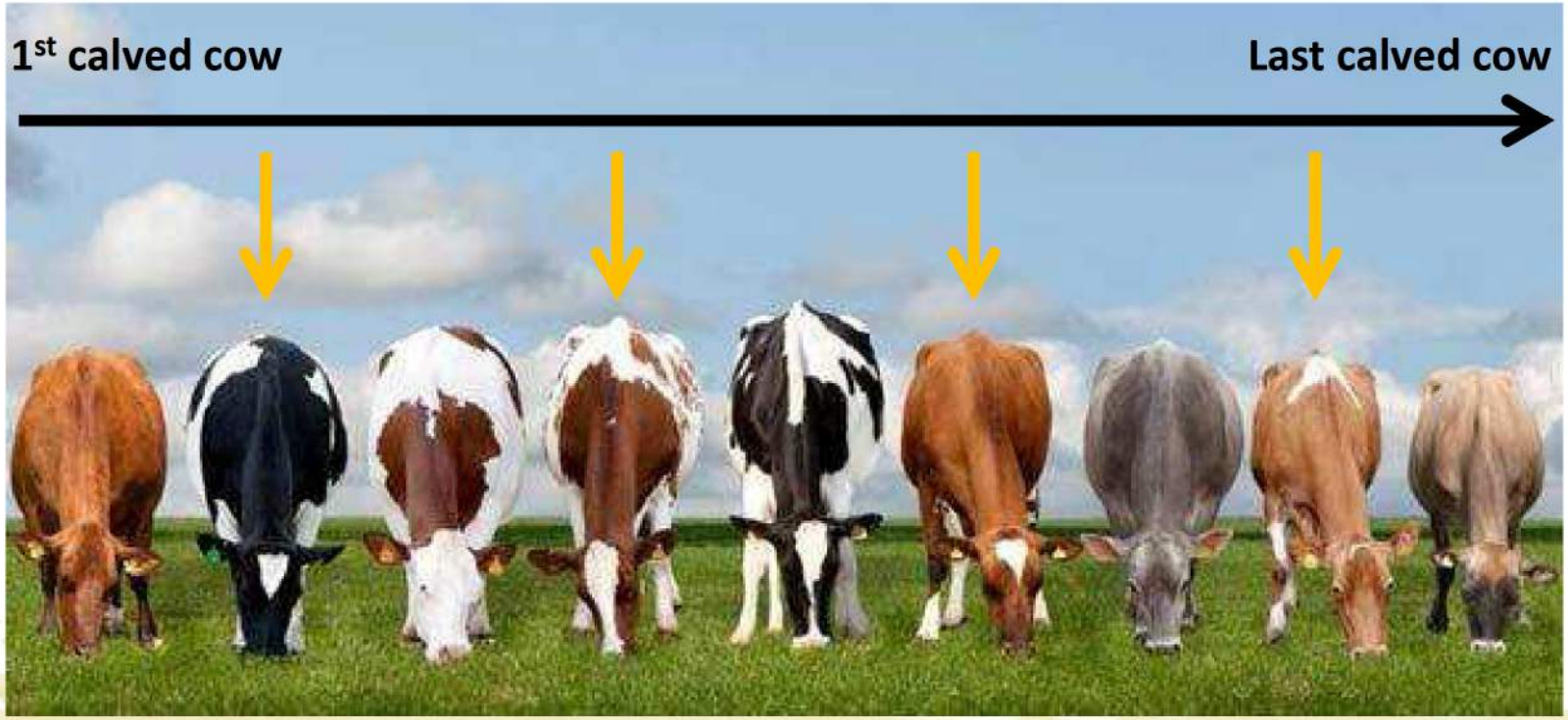
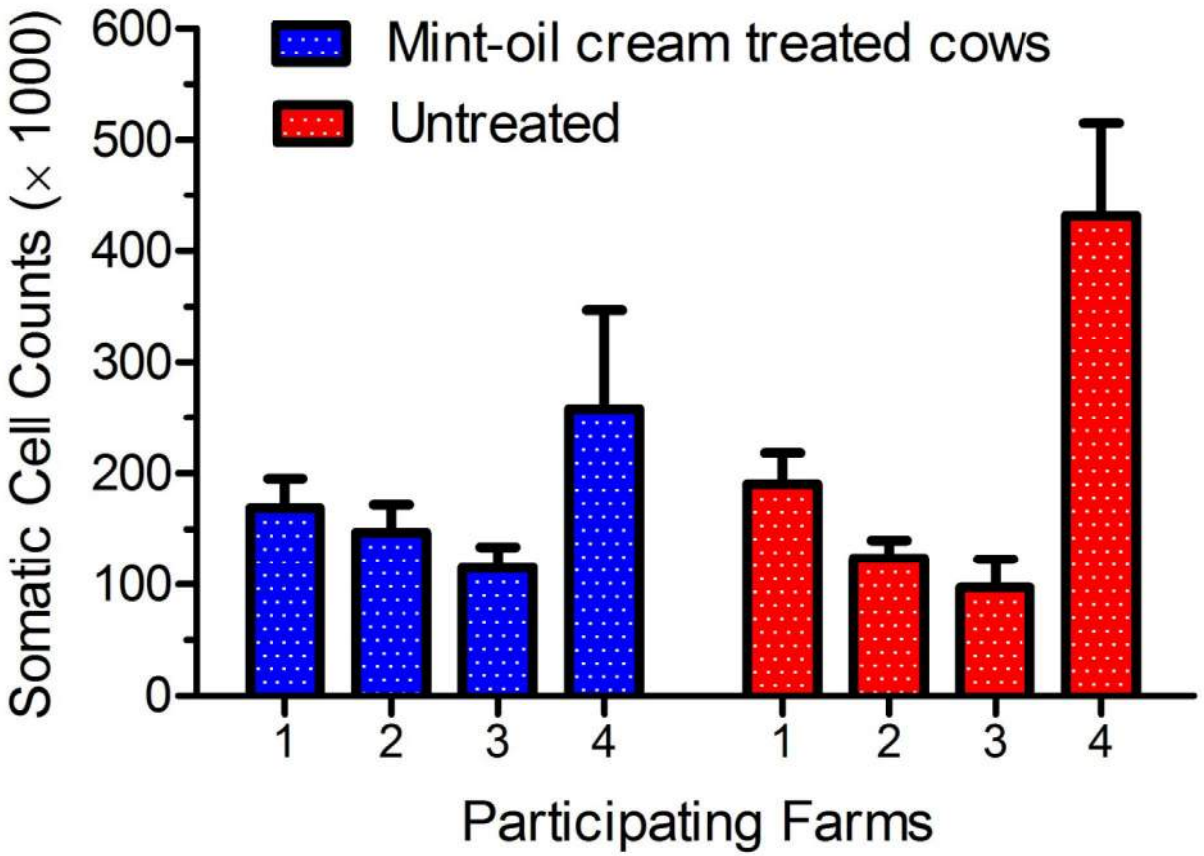


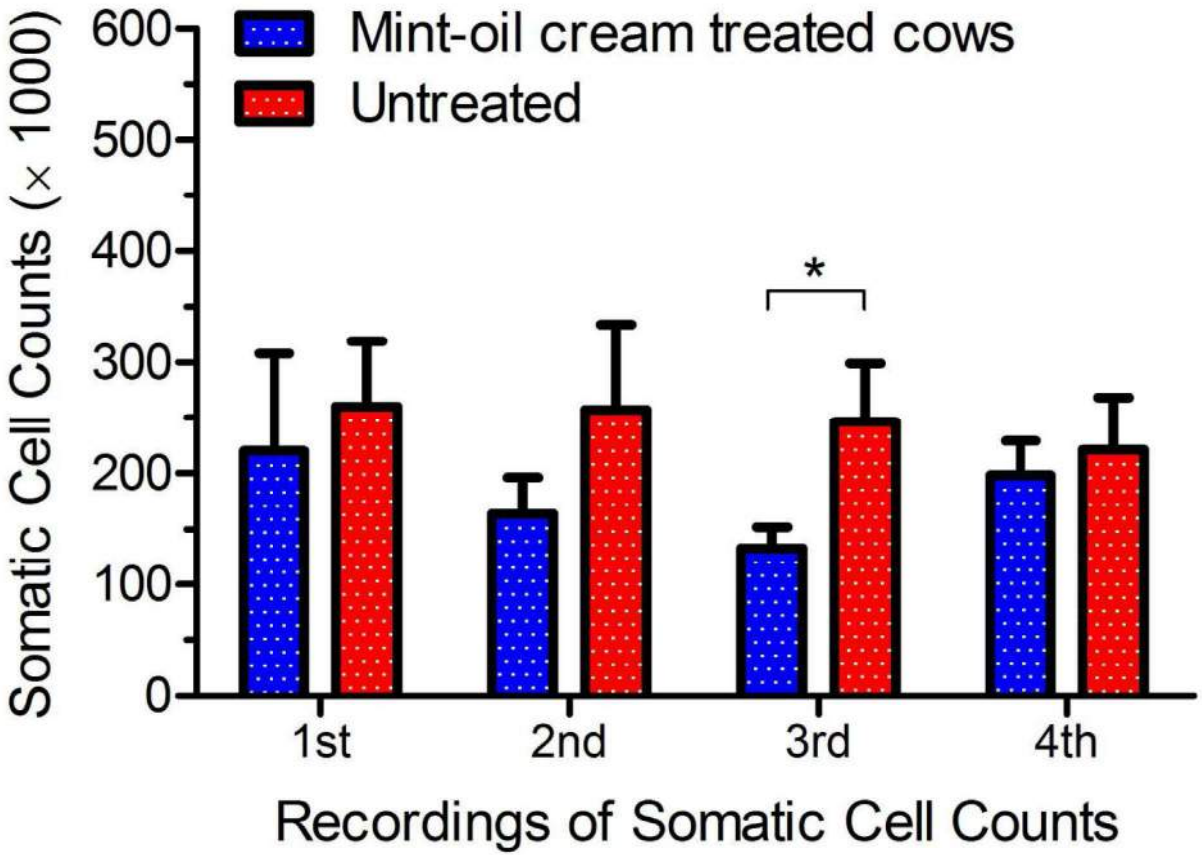
Reducing antibiotic use – Farm Trial

- To test effect of a liniment cream containing 35% mint oil on cows' SCC, following treatment of the udder
- **Six** farmers committed to participate
  - Every second newly-calved cow was treated for 4 days
  - Somatic cells counts were recorded for 4 months via NMR
  - SCCs in milk increase as a result of an immune response to a mastitis-causing pathogen

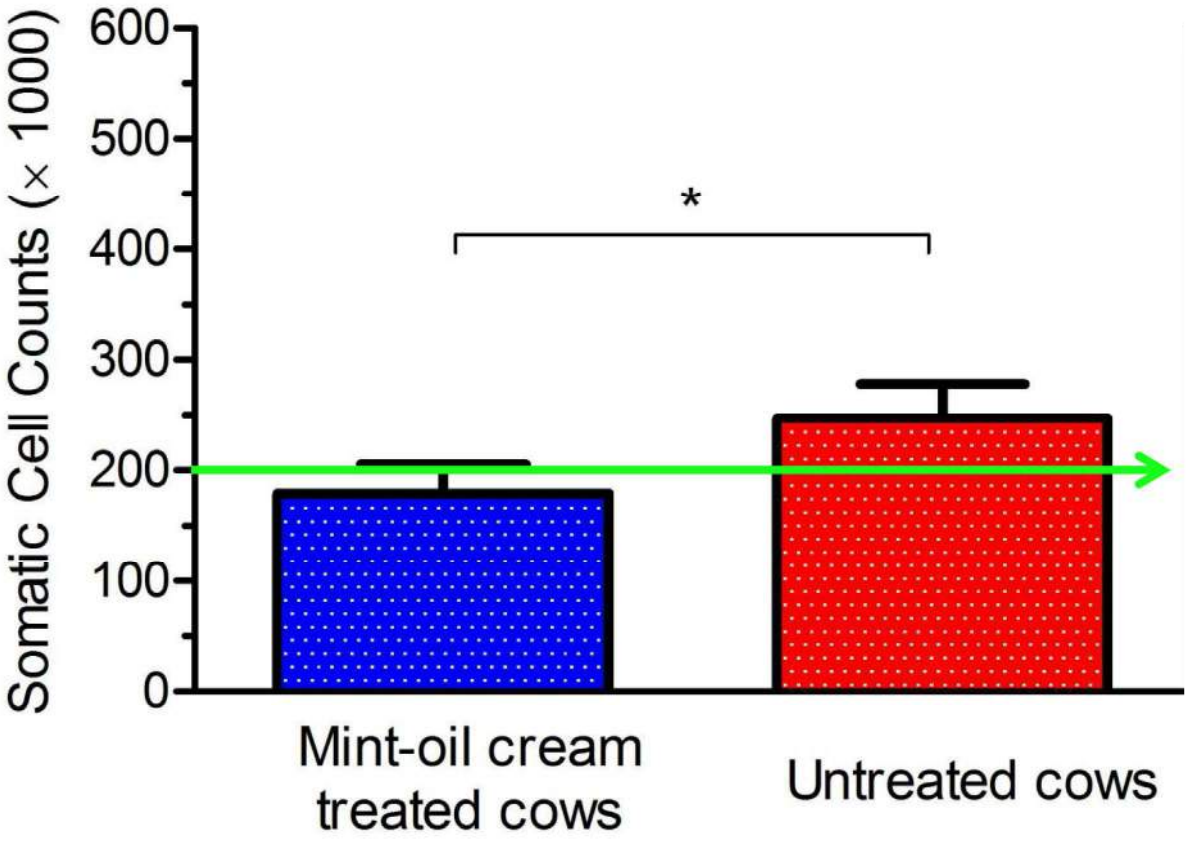
Reducing antibiotic use – Farm Trial



Reducing antibiotic use – Farm Trial



Reducing antibiotic use – Farm Trial



Reducing antibiotic use – Farm Trial

- **Two farmers withdraw from the study**
- Somatic Cell Counts were systematically **lower in the treated** cows both on farm basis and over the period of the study
- **Liniment mint oil cream treatment could act as a complementary practice to prevent mastitis**
- But the mode of action remains to be investigated

Performance of mixed lays

- Case Studies -

Typical landscape of farm location

Performance of mixed lays

- Case Studies -

- **Why mixed lays and diverse swards?**
- LegLink Project (2013)
  - **Multiple locations across the UK**
  - **12 legume and 4 grass species**
  - **Sown in monocultures or Mixture**
  - **The study mixture was compared to farmer-chosen ley mixtures**

Performance of

- Case Studie

- **Why mixed lays and diverse s**
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Performance of mixed lays

- Case Studies -

- **Why mixed lays and diverse swards?**
- LegLink Project
  - **Species-rich legume-based leys** can maximise pasture productivity and other ecosystem services
  - **Functional diverse plant species mixtures** can be optimised and fine-tuned to farm-specific needs

Performance of mixed lays

- Case Studies -

- **Why mixed lays and diverse swards?**
  - **Increased above-ground biomass** compared to monocultures
  - **Productivity increases over time**
  - Greater **stability of** biomass **production**
  - Effects are more profound on **less fertile soils** (low organic matter)
  - Mixing species with different properties allows **better weed control** throughout the season.

Performance of mixed lays

- Case Studies -

- **Why mixed lays and diverse swards?**
  - **Greater resilience** to variable weather, management conditions
  - Inclusion of species with slower N release can result in **lower N losses and better utilisation**
  - Nitrogen losses from ***White clover*** and ***Red clover*** were 2–3 times greater than those from either ***Black medic*** or ***Lucerne***.

Performance of mixed lays

- Case Studies -

- **What did we study?**
  - Productivity and composition of grazing diverse swards
  - Compare diverse sward productivity with that of ryegrass-white clover

Performance of mixed lays

- Case Studies -

Productivity and composition of grazing diverse swards

- 1 Case study farm, 220 ha mixed dairy /arable farm in South West, UK
- Diverse swards consist of 10 grass species, 6 legumes and 5 herbs
- Mob grazing was introduced as an approach to increase Soil Organic Matter

Performance of mixed lays

- Case Studies -

To compare diverse sward productivity with that of ryegrass-white clover

- 4 Case study farms
- A range of grasses, legumes and herbs, designed for grazing and robustness have been sown on 3 farms in 2013
- Farmers agreed to monitor the performance of the pastures
  - A. Grazing Data (Paddock size / Number of cows / Grazing duration / Average live-weight)
  - B. Percentage cover of sown mix (DAFOR scale)
  - C. Estimation of Forage DM Yields

Performance of mixed lays

- Case Studies -

- Assessing Forage Productivity

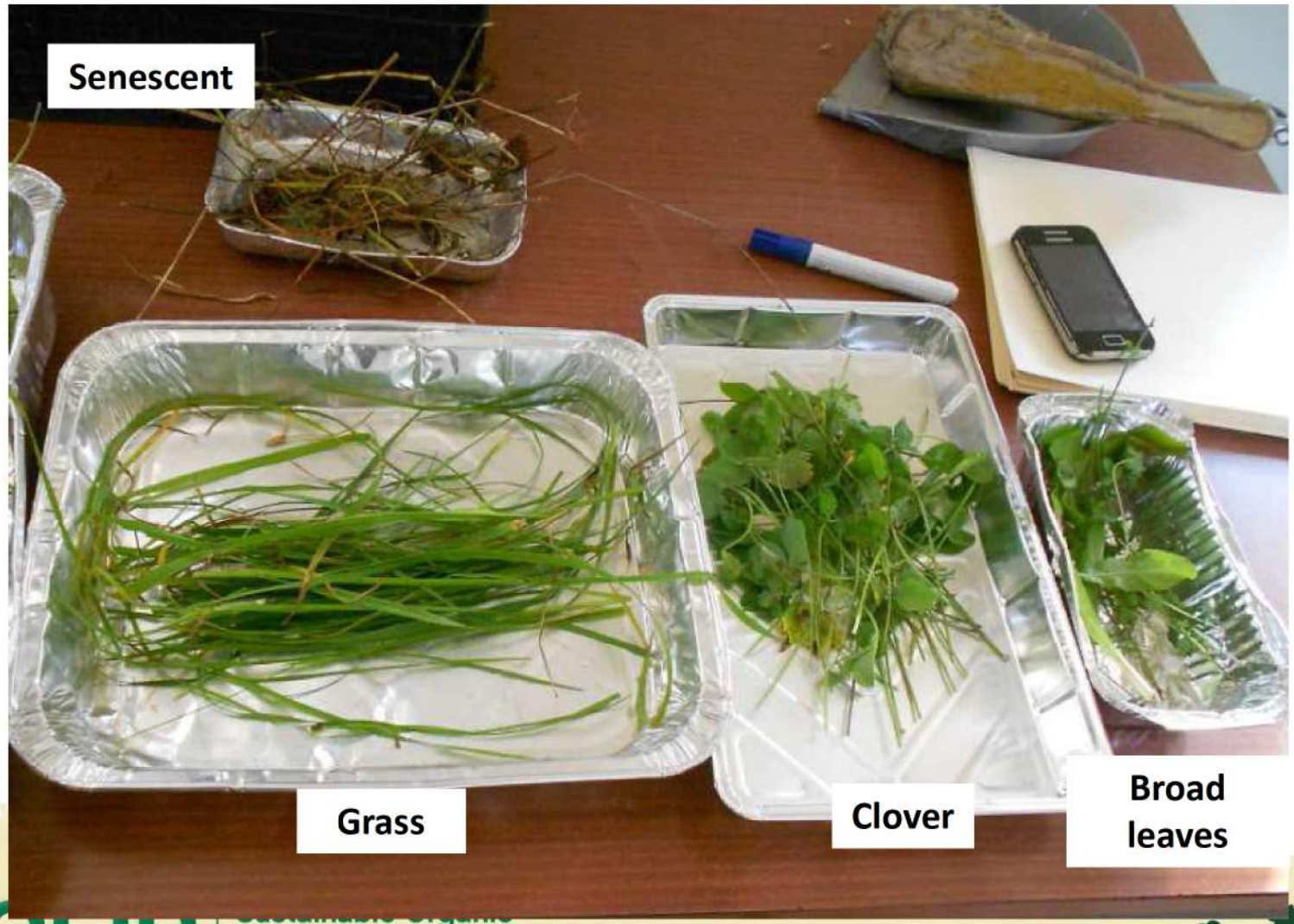
Performance of mixed lays

- Case Studies -

- Assessing Forage Productivity

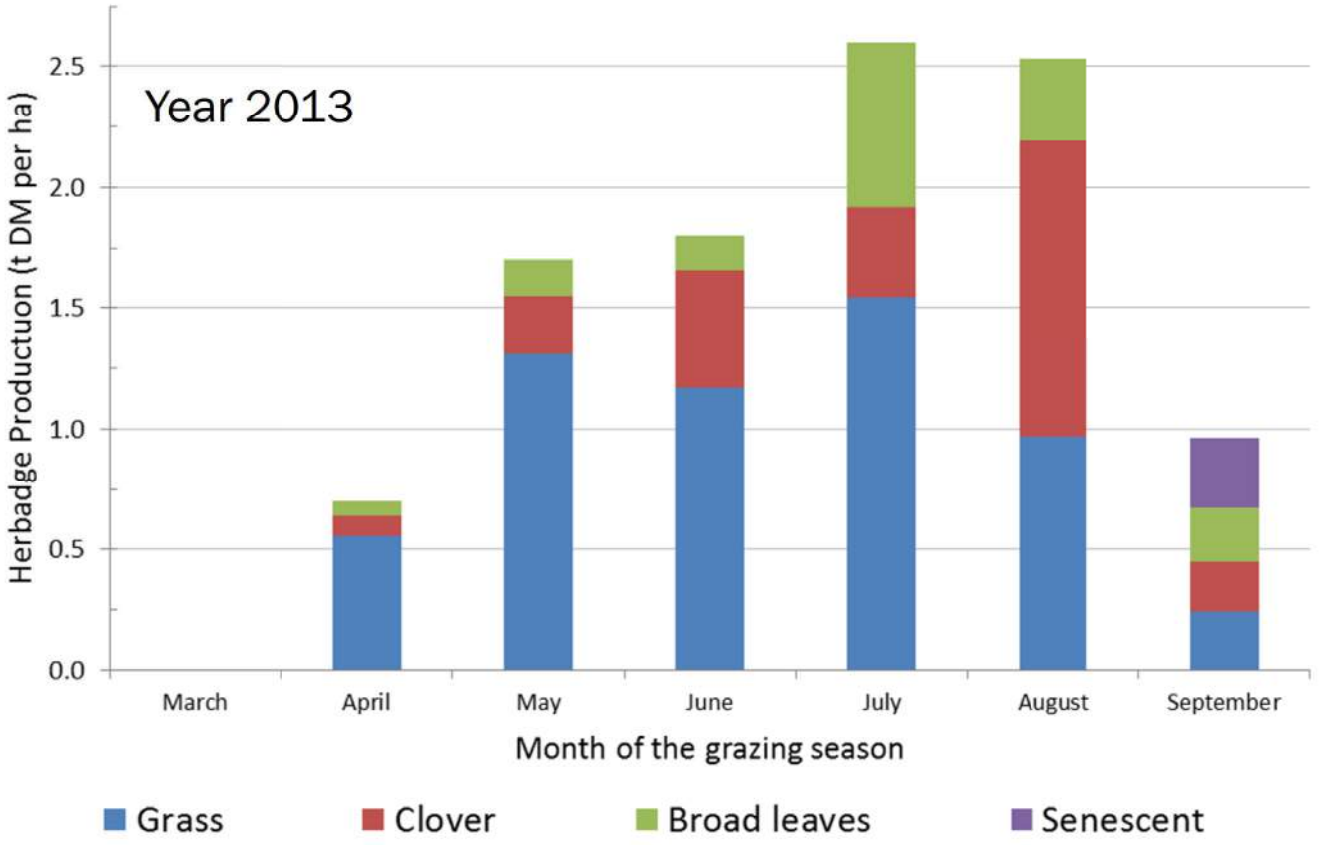
Performance of mixed lays

- Case Studies -



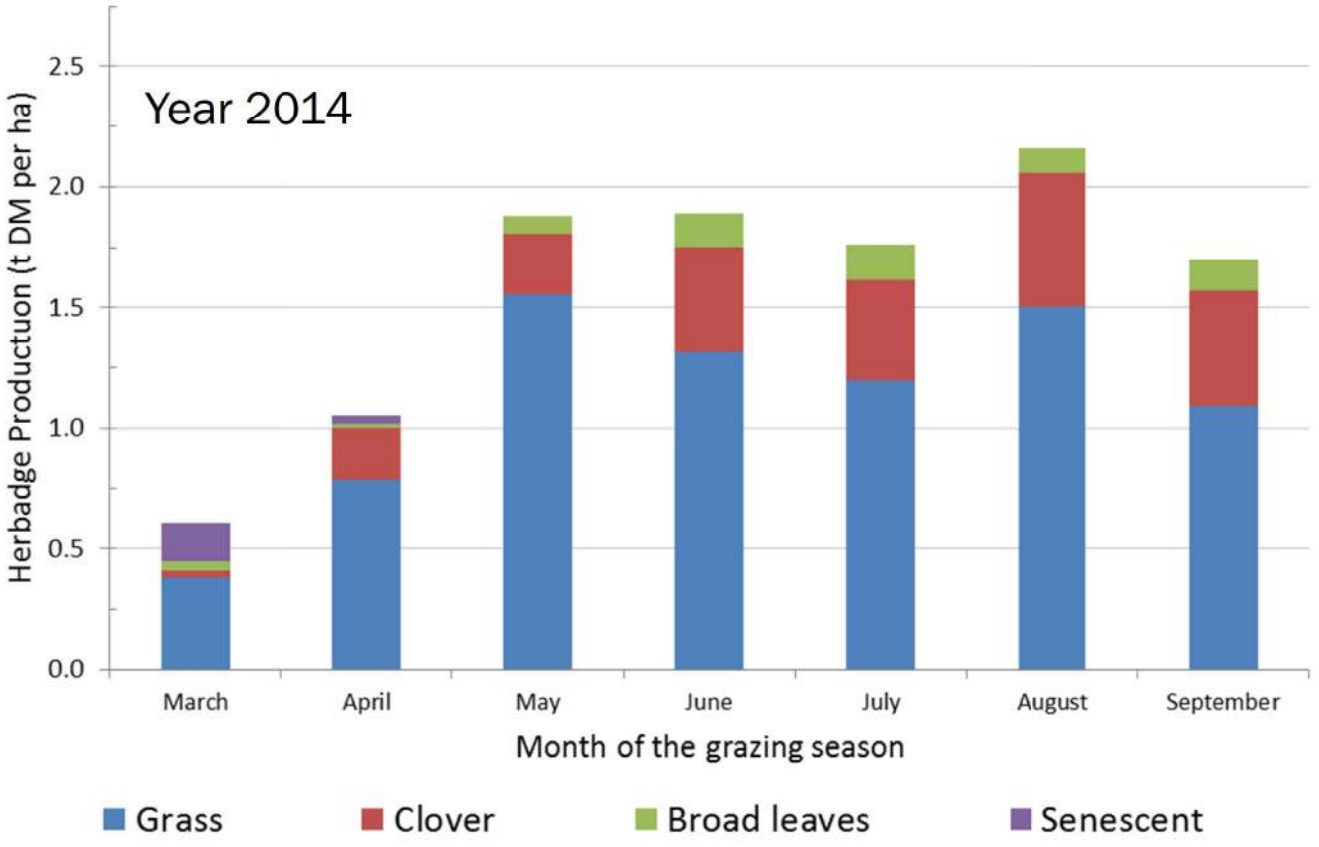
Performance of mixed lays

- Case Studies -



Performance of mixed lays

- Case Studies -



Performance of mixed lays

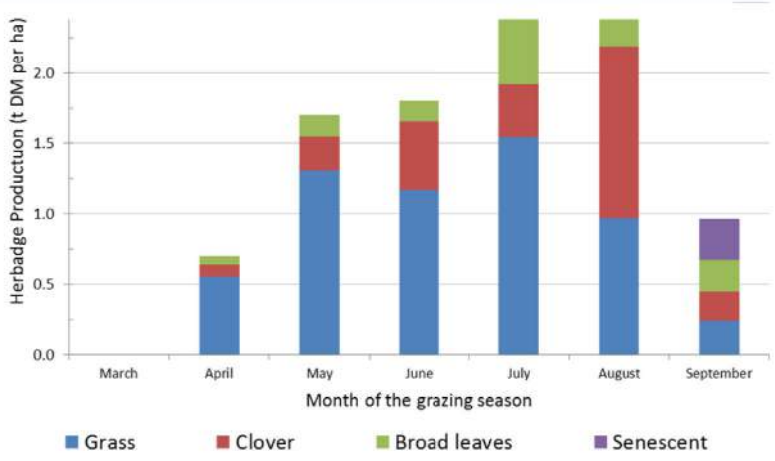
- Case Studies -

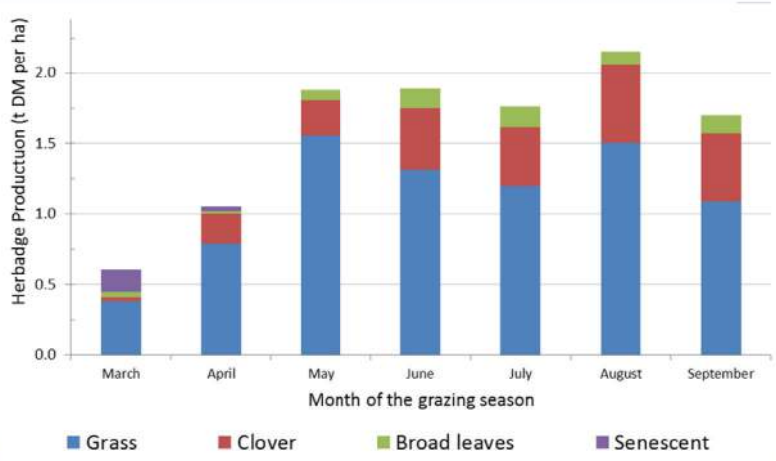
Total Production (year 1)

Plant Species	tonnes	%
Grass	5.79	56%
Clover	2.61	25%
Broad leaves	1.61	16%
Senescent	0.30	3%
Total Production	**10.3**	100%

Total Production (year 2)

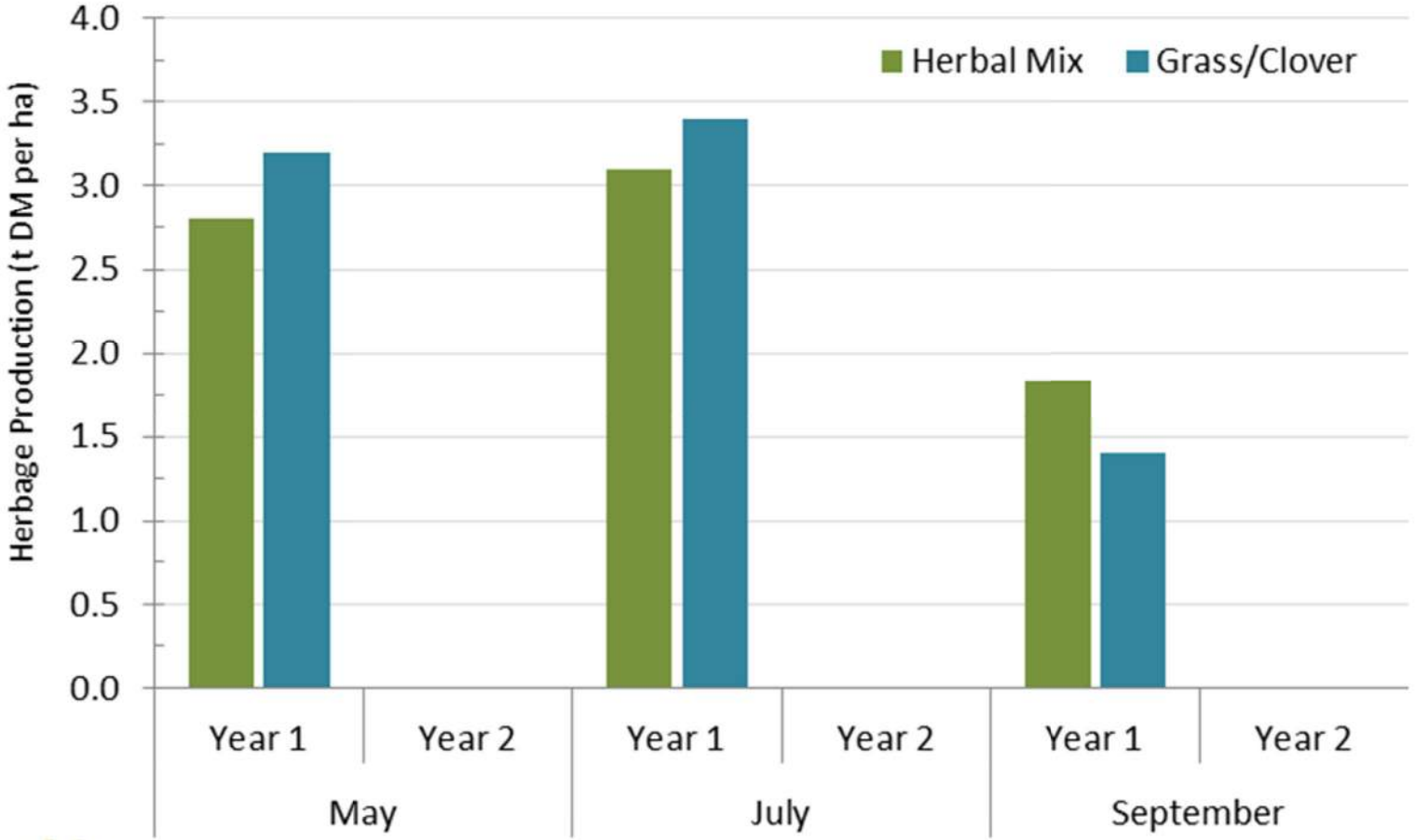
Plant Species	tonnes	%
Grass	7.84	71%
Clover	2.38	22%
Broad leaves	0.65	6%
Senescent	0.19	2%
Total Production	**11.0**	100%





Performance of mixed lays

- Case Studies -



Performance of mixed lays

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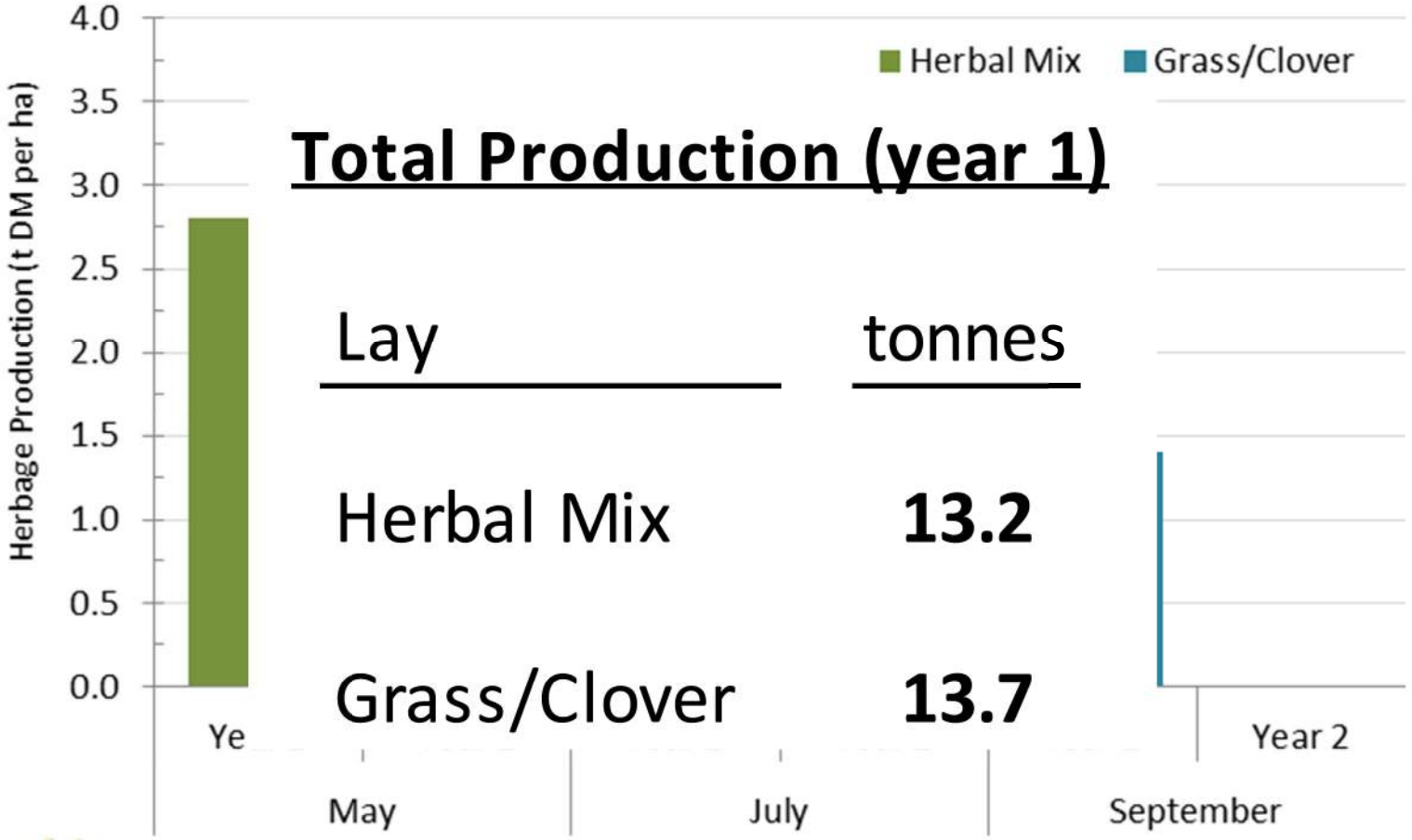
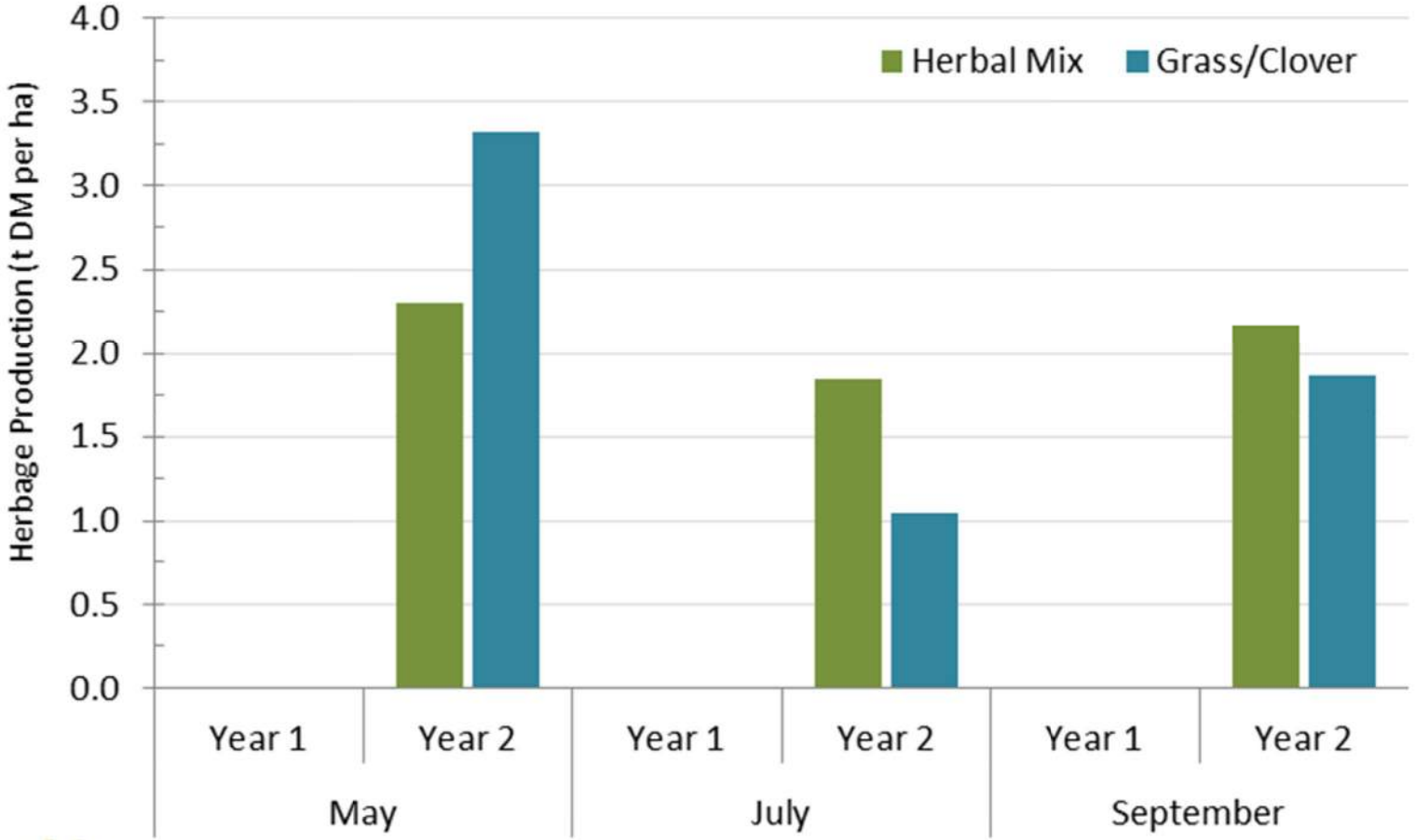


Total Production (year 1)

Lay	tonnes
Herbal Mix	**13.2**
Grass/Clover	**13.7**

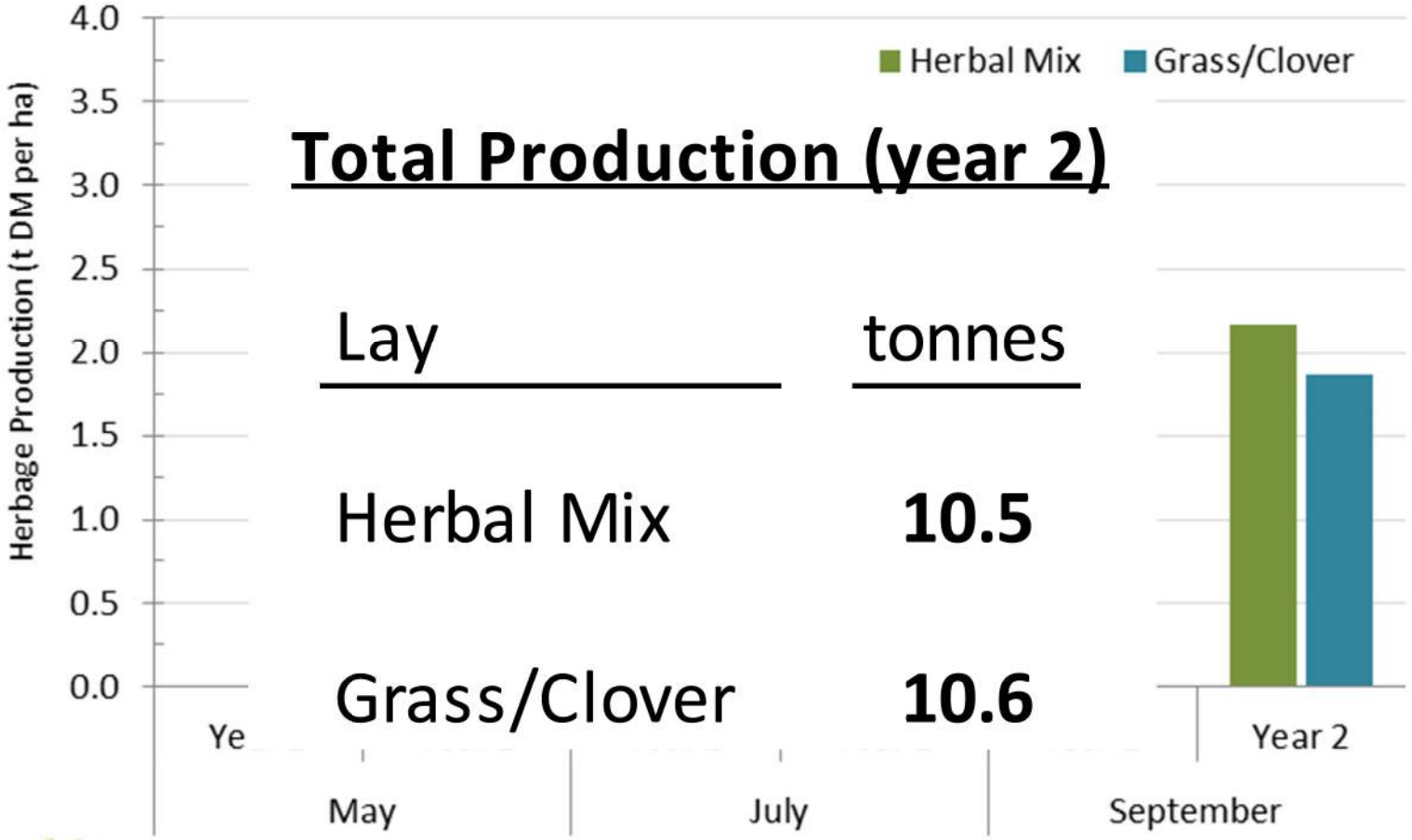
Performance of mixed lays

- Case Studies -



Performance of mixed lays

- Case Studies -



Total Production (year 2)

Lay	tonnes
Herbal Mix	**10.5**
Grass/Clover	**10.6**

Performance of mixed lays

- Case Studies -

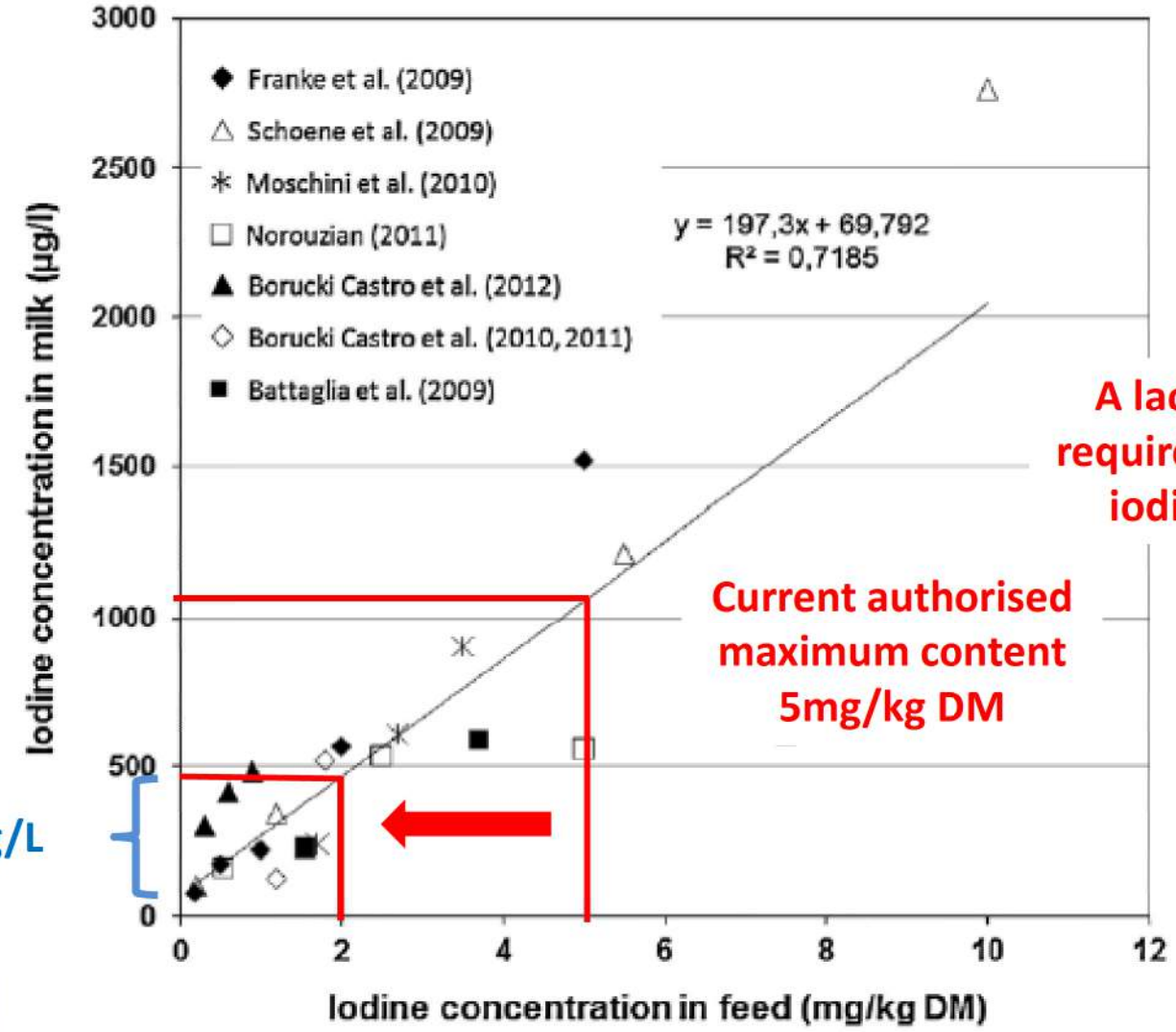
- **Two farmers withdraw from the studies**
- There was a large variation in herbage composition between months and years of sampling
- No significant difference in DM yield was found between the two swards compared (diverse vs grass/clover)
- **Diverse swards can serve as a viable alternative to traditional pastures**
- Soil samples will be analysed later this year to determine Soil Organic Mater

Iodine levels in milk

- Case Study -

- Iodine is an essential trace element for animals and humans because it is necessary for
  - energy metabolism
  - growth and brain development
- Recent studies in the UK (Bath et al. 2012 & Payling et al. 2015) report that Organic Milk is low in iodine and this is a public-health concern [!]

Iodine levels in milk



A lactating cow requires 0.45 mg of iodine/kg DM

Current authorised maximum content 5mg/kg DM

30 – 300 µg/L

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[Source: Flachowsky et al., (2014)]

Iodine levels in milk

- Case Study -

Iodine concentrations in milk (µg/L)

Author(s)	Country	Type of farming	
		Organic	Conventional
Rey Crespo et al. (2012)	Spain	78	157
Bath et al. (2012)	UK	144	250
Payling et al. (2015)	UK	404	595
Johner et al. (2012)	Germany	58	112
Jahreis et al. (2007)	Germany	112	169
Köhler et al. (2012)	Germany	92	143
Rozenska et al. (2011)	Czech Republic[1]	302	350
Dahl et al. (2003)	Norway	72	199
		137	**232**

**Source EFSA Journal 2013 and Flachowsky et al., (2014)*

[1]Sheep milk

Iodine in organic milk is lower that in conventional milk but within normal/optimal levels (i.e. 30 – 300 µg/L)

Iodine levels in milk

- Case Study -

- Iodine is an essential trace element for animals and humans because it is necessary for
  - energy metabolism
  - growth and brain development
- Recent studies in the UK (Bath et al. 2012 & Payling et al. 2015) report that Organic Milk is low in iodine and this is a public-health concern [!]
- **The Organic Milk Suppliers Cooperative (OMSCo) and farmers wanted to test why organic milk is lower in iodine which are the implications**

Iodine levels in milk

- Case Study -

- Milk Iodine concentrations was determined in 800 organic dairy herds throughout the UK in late 2013 (OMSCo)
- 12 farmers within south-west of England were selected/contacted to participate in the case-study
- Farms were categorised as L (low<60 µg/L), O (optimal 60-120 µg/L) or H (high> 120 µg/L)
- Bulk milk samples and forage/feed samples were analysed for Iodine on monthly basis
- Farm practices were collected through a questionnaire

Iodine levels in milk

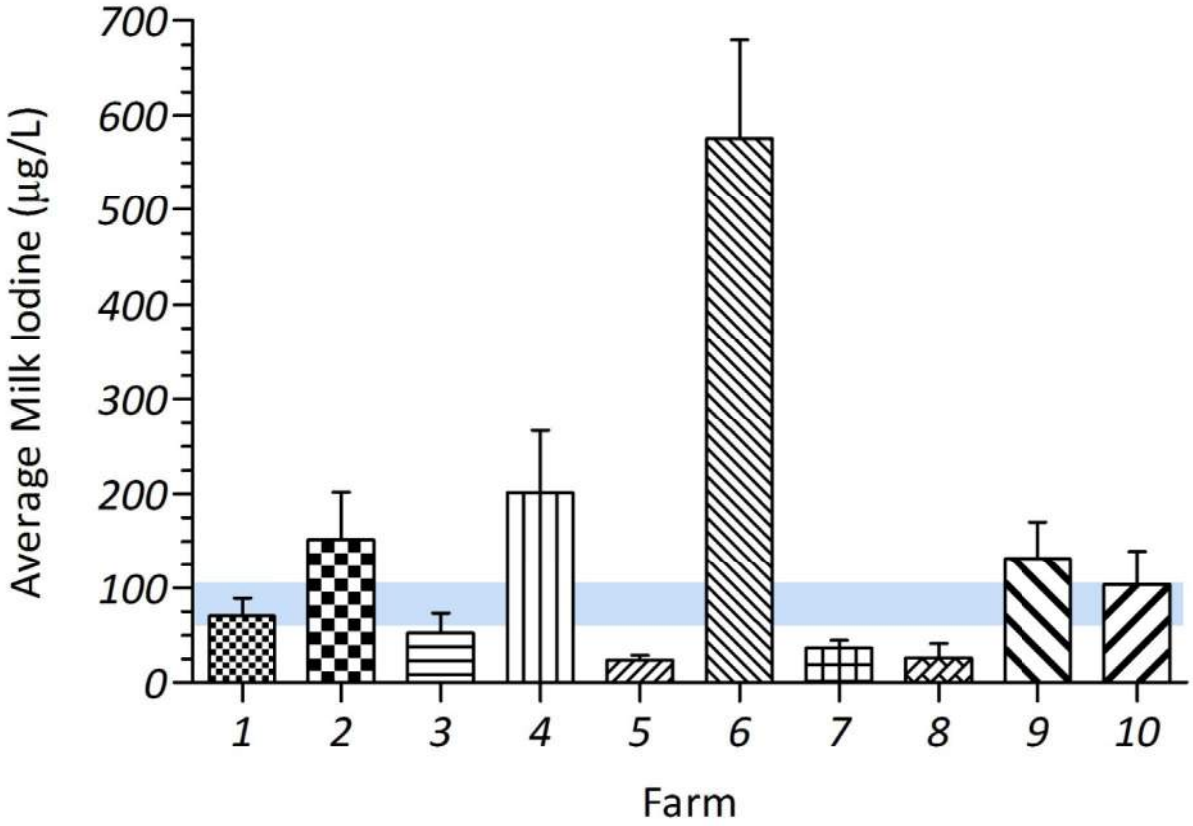
- Case Study -

L < 60 µg/L
O = 60 – 120 µg/L
H > 120 µg/L

Farm[1]	location	Group[2]	Farm Practice		
			Iodised Rock Salt	Iodine-based Pre-dip	Iodine-based Post-dip
1	Oxfordshire	O	Yes	No	Yes
2	Wiltshire	O	No	No	No
3	Wiltshire	O	Yes	No	Yes
4	Wiltshire	H	Yes	No	Yes
5	Devon	L	No	No	No
6	Gloucestershire	H	Yes	No	Yes
7	Wiltshire	L	Yes	No	No
8	Devon	L	No	No	No
9	West Sussex	H	No	Yes	Yes
10	Gloucestershire	H	No	No	Yes

Iodine levels in milk

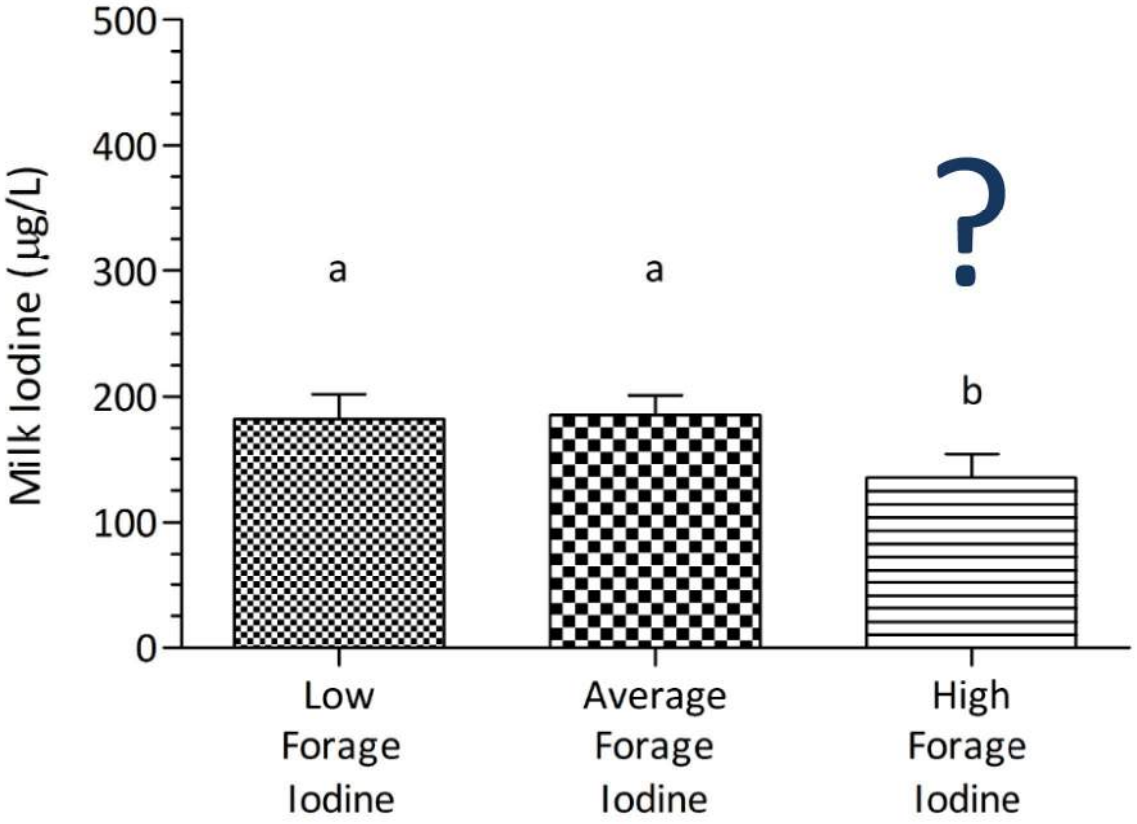
- Case Study -



Milk iodine concentrations in each farm averaged over the sampling period (i.e. May to December 2014)

Iodine levels in milk

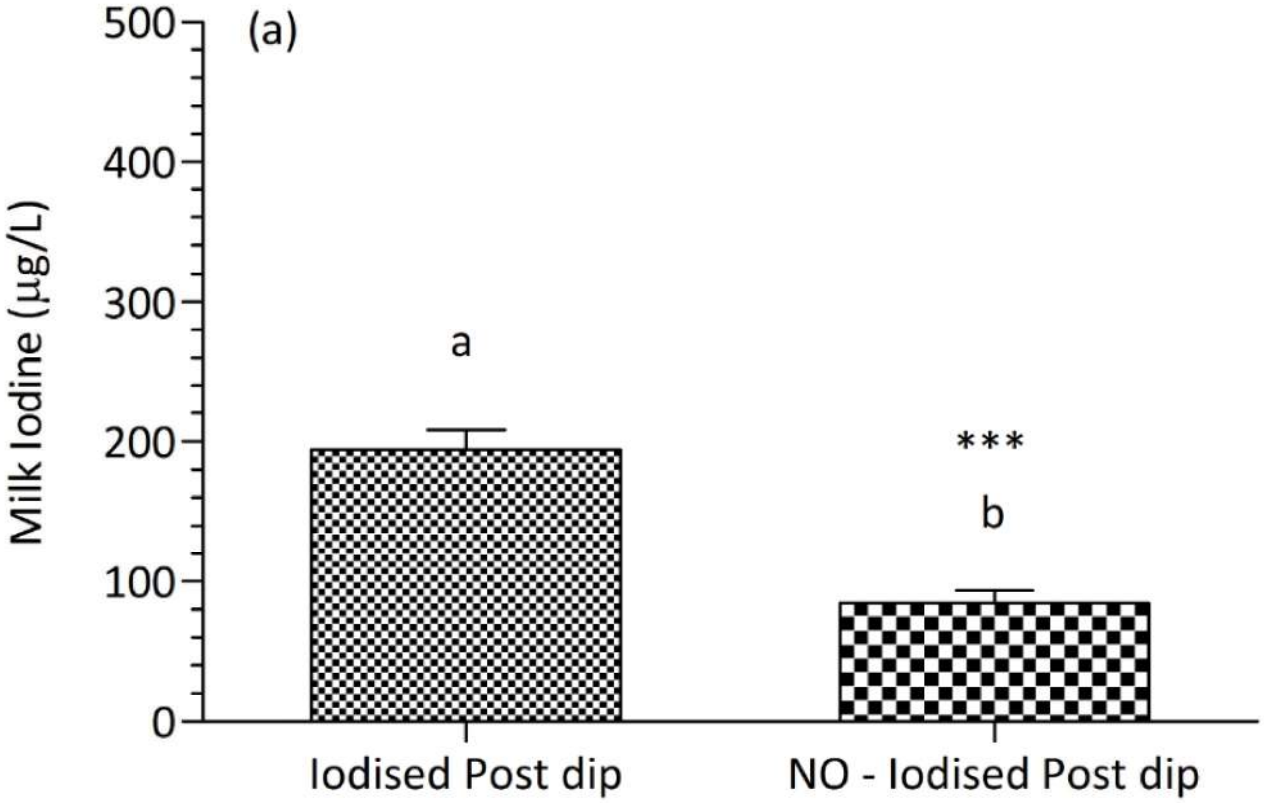
- Case Study -



Effect of forage Iodine content milk iodine

Iodine levels in milk

- Case Study -



Effect of iodised teat disinfectants on milk iodine concetrations

Iodine levels in milk

- Case Study -

- **Two farmers withdraw from the studies**
- Iodised post-dip teat disinfectants is the most important influencing factor for the iodine concentration in milk
- Iodine concentrations in milk do not serve as a robust indicator in identifying nutritional shortfalls in iodine intake
- Average iodine concentrations in milk are within or above optimal levels in the study farms based on the literature (i.e. >120 µg/L)
- Milk iodine concentrations were systematically low in some farms
- Further attention in order to alleviate recent concerns that organic milk contains less iodine than conventional milk

Iodine levels in milk

- Case Study -

- **Does organic milk impose a heath risk?**

- According to the Scientific Advisory Committee on Nutrition (SACN, 2014) dietary iodine intake in the UK for the adult is 140 µg **while for toddlers it is 70 µg per day**

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Conclusion

Farmer-led research is an effective way to bring together the scientific approach with the farmers' practical and context knowledge in finding solutions to problems experienced by farmers and to develop sustainability.






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Thank you

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