Animal Feeds:
What we feed livestock matters

Samuel Smith (Chair)
Forum for the Future

Karen Luyckx
Feedback

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Feed Compass

A collaboration focused on:

Accelerating momentum across the animal feed system to act on sustainability.

forumforthefuture.org/feed-compass
Fresh clearance eating into forest, Bolivia
Image credit: Mighty Earth
Common non-forage feed ingredients:

- **Cereals:** corn, wheat, barley, oats, sorghum etc
- **Protein meals:** soybean, rapeseed meal, lupins). Often co-products
- **Plus fats and oils, minerals, feed additives etc.**
What does mainstream industry focus on?

1. **Food/feed safety:**
   - Reputation / animal health

2. **Efficiency:**
   - Getting the most out of every ounce.
   - Precision feed, amino acid supplements.

3. **Price:**
   - Least cost formulation
only £2.43
Soy: a troublesome, cheap and useful protein source

Major focus area for UK retailers, but traction is limited.

- A highly efficient source of protein
- 75% of global production goes to animal feed
- Europe imports ~95% of its soy (mostly S. America).
- In UK ~26% known as from regions free from deforestation
  (See 3Keel supermarket supply chain research)
- Transparency and certification is low. Globally only ~1-2% is certified.
Novel animal feeds

- Insects
- Algae and seaweed
- Single cell proteins
- Amino acid supplements (less novel)
- Biochar
Meeting future animal feed demands...

~280 million hectares of additional land by 2030

(this is impossible)
Thank you

Samuel Smith
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Safe leftovers for pigs and other omnivores

Karen Luyckx
Avoiding food – feed competition

• Co-products

• Food waste

• Marginal grassland

African Swine Fever
Making leftovers safe for feed

1. Collection
2. Traceability
3. Nutrition
4. Sorting
5. Preventing contamination
6. Shredding
7. Heat treatment
8. Monitoring
9. Transport
War-time Advertisement:
“Swill is more appetising when steam-cooked in an Alfa-cooker and the nourishment value is increased. The pigs like it, thrive on it, and it takes less time to prepare. The waste food is sterilized, all bacteria killed, by steam cooking - a big safeguard against Swine Fever, Foot and Mouth diseases, etc.”
Christine Page
Smiling Tree Farm
Why what we feed animals matters
Why Animal Feed Matters

• It affects the **health & wellbeing** of the animal
• It affects the **flavour & nutritional value** of their meat or milk
• How animal feed is produced/grown can either create or destroy **wildlife habitat**
• It can regenerate **soil health** or erode soil
• It can sequester **carbon** or emit it
“the health of the soil, plant, animal and man is one, and indivisible”

~ Sir Albert Howard
Smiling Tree Farm, South Shropshire

- Small-scale 70 acre pastoral farm
  - Steep land (650-1020ft) unsuited to growing arable crops
- Traditional Hereford beef suckler herd
- Cow-calf micro-dairy of Jersey cows
- No routine wormers, medications or vaccinations
  #AntibioticFree #Homeopathy
- **Feed: diverse pastures & browsing trees**
- Certified organic
- Farm run using holistic management, organic & permaculture principles
- We practice **Regenerative Farming**

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Cows are ruminants

- Fossil records show grasses and ruminants co-evolved 50m years ago
- A rumen is a bio-digester: filled with microbes that ferment cellulose
- Cellulose is the most abundant organic compound on the planet
- Cows turn human inedible plants to highly nutritious human edible food
- Starches (grains) negatively impact rumen health
Cows are UPCYCLERS

Through the magic of fermentation they take human inedible plants and upcycle them to highly nutrient-dense foods.
Nutrients in Milk

Fat-soluble nutrients particularly impacted by diet of cow

There is huge variation in actual micro-nutrient content which depends primarily on the diet of the cow, but also her breed, age, health, stage of lactation & contentedness.

**FAT SOLUBLE MICRO-NUTRIENTS:**
- Omega 3 - the essential DHA form
- CLA - conjugated linoleic acids
- Vitamin A & beta carotene
- Vitamin D
- Vitamin E
- **Vitamin K2** - vital nutrient deficient in most

The fat-soluble nutrients are needed for the effective absorption of the water-soluble nutrients - always drink WHOLE milk.

**WATER SOLUBLE MICRO-NUTRIENTS:**
- Calcium
- Magnesium
- Phosphorus
- Potassium
- Selenium
- Zinc
- Folate
- Vitamin C
- Vitamin B1, B2, B3, B5, B6, B12
Microbes & nutrition

• A cow is a walking bio-digester!
• When a cow grazes, she is not feeding herself, but the microbes in her rumen
• 1ml of rumen fluid contains around:
  – 25 billion bacteria
  – 10 million protozoa
  – 10 thousand fungi
• Each cow has a quadrillion \(1,000,000,000,000,000\) rumen microbes!!!
• By-products of microbial action on forage is what nourishes the cow & in symbiosis microbes in cow saliva stimulate plant growth
• BUT what the cow eats directly impacts the balance of microbes & the resultant by-products => nutritional value of her milk or meat
• Changes to rumen pH causes microbial populations to change, below pH 5.4 microbes die, lactic acid builds up => rumen acidosis
• Concentrates like cereals, soya, brewers grains, fodder beet, maize, etc all lower rumen pH => poor cow health, produce impacts human health
A new study has shown that both organic milk and meat contain around 50% more beneficial omega-3 fatty acids than conventionally produced products.

Largest study of its kind

Analysing data from around the world, the team led by Newcastle University, reviewed 196 papers on milk and 67 papers on meat and found clear differences between organic and conventional milk and meat, especially in terms of fatty acid composition, and the concentrations of certain essential minerals and antioxidants.

Publishing their findings today in the British Journal of Nutrition, the team say the data show a switch to organic meat and milk would go some way towards increasing our intake of nutritionally important fatty acids.
Grass-fed beef vs Grass-fed ‘grain-finished’ beef

Pasture diversity
Is vital to the health of soil & cow microbiome
Provides invertebrate & small mammal habitat
NOT just ‘grass’-fed: diverse pastures contain many different species of grasses, herbs, forbs, etc. ‘Grass-fed’ could mean a monoculture of rye grass soaked in chemicals.
Flavour starts in the Soil

• Flavour & nutrition inextricably linked
  – Innate desire to hunt & gather diverse range of foods containing health-giving nutrients
  – Complex nutritional richness creates complex flavour
  – Phytonutrients create a myriad of flavours & aromas
  – Palates corrupted by refined & processed foods

• Plants exchange ‘exudates’ (liquid carbon/sugar) for nutrients
  – More diverse soil life, deeper roots, more ‘solar panels’ = more connections & more nutrients available
  – Plants produce phytonutrients (antioxidants & myriad other micro-nutrients) to grow, reproduce, attract pollinators & protect itself from disease or pest attack
  – These phytonutrients health-giving to grazing animals & humans => organic produce more nutritious
  – Plant alkaloids are the medicinal components of food

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Herbs oversown into pasture
Salad bar beef: some herbs natural anthelmintics
Cattle kept healthy naturally: no need for wormers, vaccinations, etc
Importance of species diversity & root depth
Diverse hedgerows
shelter, shade, browse for cows
more invertebrate & small mammal habitat
Trees as important as pasture
self-medication for cows
more wildlife habitat
Trees as important as pasture

silvopasture

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Trees as important as pasture
shelterbelts of over 20 species
Mob-grazing – nothing new mimicking natural grazing systems

Old saying: “Never leave the sheep in the same field long enough to hear the church bell ring twice”

Andre Voisin’s book Grass Productivity, written in 1959

In essays on agriculture from 1777:

To obtain this constant supply of fresh grass, let us suppose that a farmer who has any extent of pasture ground, should have it divided into 15 or 20 divisions, nearly of equal value; and that, instead of allowing his beasts to roam indiscriminately through the whole at once, he collects the whole number of beasts that he intends to feed into one flock, and turns them all at once into one of these division; which, being quite fresh, and of sufficient length of bite, would please their palate so much.
Mob-grazing paddocks
Pasture, a carbon pump, the ultimate perennial crop
Converting to Silvopasture
What does this equation represent?

$6\text{CO}_2 + 6\text{H}_2\text{O} + \text{sunlight} \Rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$
All life depends upon

PHOTOSYNTHESIS:

\[ 6\text{CO}_2 + 6\text{H}_2\text{O} + \text{light energy} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \]

Carbon + water + sunlight => liquid + oxygen

dioxide \hspace{2cm} sugar

The “liquid carbon pathway” (Dr Christine Jones)
Pumping carbon via plant root exudates into the soil

*Every bite primes the carbon pump*

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The Poop Loop!

SOIL MICROBES PROVIDE NUTRIENTS TO PLANT.
SOIL MICROBES FEED ON THE SUGARS, MULTIPLY AND ARE PREDATED BY OTHER MICROBES WHOSE POOP CONTAINS VITAL NUTRIENTS WHICH ARE ABSORBED BY THE PLANT.

PLANT FEEDS
SOIL MICROBES:
PLANT PHOTOSYNTHESIS USES SUNLIGHT ENERGY, H₂O + CO₂, TO MAKE LIQUID CARBON IN FORM OF SUGARS TO FEED SYMBIOTIC SOIL MICROBES VIA ROOT EXUDATES.

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Regenerative Agriculture
starts with a focus on supporting the
“Poop Loop”
to maximise photosynthesis &
root exudates
and
provide plants with micro-nutrients
Grazing impact on plant roots
Carbon sequestration, soil health, water retention...

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Carbon moooves...

It’s not the cow
It’s the how
Regenerative Agriculture

Sequesters more carbon than it emits
Carbon in soil

For every gramme of carbon stored in the soil, the soil can hold an extra 8 grammes of water

1g carbon = 8g water held in soil

Tillage, bare fallows, synthetic fertilisers, ‘cides (killers: herbicides, fungicide, etc) all release that carbon turning CO2 sinks into sources
Carbon is fertility

The annual costs of soil degradation in England & Wales are between £0.9 and £1.4 billion, with a central estimate of £1.2 bn. These costs are mainly linked to loss of organic content of soils (47% of total cost), compaction (39%) and erosion (12%).

*The total costs of soils degradation in England & Wales, Cranfield University (2015)*

The UK has lost 84% of its fertile topsoil since 1850, with the erosion continuing at a rate of 1cm to 3cm a year.

*The Committee on Climate Change (CCC) report (2015)*
Grazing tall grass
Each bite primes the carbon pump

How to sequester carbon:
“Put them in when the grass is up to their knees,
take them out before you see their feet.”
Dr Christine Jones

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Enteric vs fossil methane

Food Climate Research Network
@FCRNNetwork

Replying to @FCRNNetwork and @freerangedairy

The difference between fossil methane and livestock methane is when the methane breaks down to CO2: with fossil methane, that CO2 is additional to the atmosphere, but with livestock methane, the CO2 is not additional to the atmosphere.

1:03 PM · Aug 9, 2019 · Twitter Web App
Cycling vs adding carbon

Cows fed perennial polycultures cycle & recycle carbon (including methane) using sunlight & rain

Any food or feed grown, harvested & transported using fossil fuels ADDS carbon
Carbon in, carbon out

Solar-powered Perennial poly-culture

Fossil fuel powered Annual mono-culture

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• It affects the flavour & nutritional value of their meat or milk
• How animal feed is produced/grown can either create or destroy wildlife habitat
• It can regenerate soil health or erode soil
• It can sequester carbon or emit it
So feed cows:

• Perennial polycultures of
  – Diverse pastures
  – Browsing hedgerows & trees
• Use holistic/mob grazing practices to
  – Stimulate photosynthesis & carbon sequestration
  – Build soil health, fertility & water retention
  – Integrate wildlife & food production
Future challenges/opportunities

Challenges:
• Reconnecting the consumer with food production
• Overcoming the perception that ‘cheap food’ is cheap
• How to beat the $$$$$$ driven food propaganda!

Opportunities:
• More and more enlightened consumers are looking for high quality, ethically produced food, they appreciate its value and wish to support small-scale, local producers
Thank you

Christine Page

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