Investigating ill thrift in growing lambs.

Professor Neil Sargison  R(D)SVS
Why do we need to adopt a planned animal health approach in the management of this problem?
Today, farmers and vets around the world must take the concept of efficient and environmentally-friendly, sustainable livestock production very seriously.

• “Perfect storm” (Professor John Beddington, 2009).
  – Population growth.
  – Reduction in availability of productive land.
  – Urbanisation and changing lifestyles.
  – Global warming threats to food and water resources.
  – Failures of drug and chemical disease control.
• Today the world population is >7 billion
  – India $1.2 \times 10^9$ (360 people/sq km.)

• Need to be fed, clothed, housed and provided with energy.

• Importance of national and global agricultural production.

• Challenges of global warming and water demand mismatch.

• Essential to secure efficient and sustainable livestock production.
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- India 1.2 x 10^9 (360 people/sq km.)

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UK sheep farming is part of a global food producing industry. Lamb growth efficiency has a major impact on profitability and greenhouse gas production.
Why do lamb growth rates matter?

• (Putting subsidies and synergies with other farming systems aside) sheep are kept to convert a farm’s primary resource into a marketable product (meat).

• Profitability is related to the efficiency of conversion of forage to meat.

• The feed conversion efficiency of ill thrifty lambs can be half that of thriving lambs.

• The longer lambs are kept on a farm, the more they are predisposed to compounding effects of other diseases.
What growth rates would you expect from weaned terminal sire-cross lambs?

- 10 g/day
- 50 g/day
- 100 g/day
- 250 g/day
- 500 g/day

Responses
- 0
- 11%
- 11%
- 67%
- 11%
Significant impact of lamb growth on the profitability of the sheep enterprise.

- Lambs growing at 100 g/day have a feed use efficiency of 8%.
- Lambs growing at 300 g/day have double the feed use efficiency of 16%.
  - The slower growing lambs need to eat more to produce the same meat yield and produce more greenhouse gases.
Example Tamil Nadu, India.

- Family farm
  - 80 cows
  - 100 ewes
  - 40 buffalo.
- Access to scrub grazing.
- Poor milk yields.
- Calves and lambs are ill thrifty.

Poor lamb growth is a worldwide cause of inefficient productivity and poor animal welfare. The investigative approach to the problem is globally applicable?
Poor lamb growth is a worldwide cause of inefficient productivity and poor animal welfare. 

The approach to the problem is globally applicable?
Poor lamb growth – an opportunity for planned animal health. Where do we start?
Targets. What percentage of your clients monitor the growth of their weaned lambs and intervene when targets are not met?

- <5%  
- 10%  
- 25%  
- 50%  
- >80%

Responses

- 60%  
- 20%  
- 10%  
- 10%  
- 0
Targets. For those who do monitor weaned lamb performance, what is the most commonly used tool?

- Routine electronic weighing and EID assisted recording.
- Routine weighing and recording using traditional (eg. dial weigh scales and notebook recording) methods.
- Experience of the desired appearance of the lambs.
- Monitoring of slaughter dates and weights.
- Other.

Responses
- 0
- 30%
- 40%
- 30%
- 0
• Few sheep farmers routinely weigh their finishing lambs.
• Ill thrift problems are often only identified when lambs fail to reach slaughter weights as expected - economic and environmental inefficiency has already been incurred.
• Importance of monitoring to identify production limiting disease in finishing lambs before significant economic loss occurs.
• Need for a sound diagnostic approach.

Individual flock targets and benchmarking.

80 g/day since weaning
January – ill thrifty store lambs dosed with a BZ anthelmintic and a flukicide.

• **One approach might be** -
  – Assume trace element deficiency and supplement with copper, cobalt and selenium?
Either -

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- Improvement seen (because sheep moved).
- **Money spent on expensive chelated minerals for the next decade.**
- Subclinical losses continue because the primary problem was never identified.
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- Subclinical losses continue because the primary problem was never identified.
• UK farmers are bombarded with information about animal health benefits of mineral supplementation, coming from people selling products.
  – bull and ram fertility?
  – cow and ewe conception rates?
  – calf and lamb survival?
  – cow and ewe body condition.
  – cow and ewe deaths?
  – calf and lamb growth rates?
  – carcase quality?
• Are these expensive products actually necessary?
• Is their use cost efficient?

‘Muck and magic’ or shrewd investment?
Important trace element deficiencies in farmed ruminant livestock.

- **Cobalt**
  - ill thrift in ruminant lambs.

- **Selenium**
  - ill thrift in cattle and sheep.
  - poor reproductive performance (ewes and rams).
  - white muscle disease (all ruminant species).

- **Copper**
  - wool changes in sheep.
  - brittle bones.
  - swayback in lambs and deer.
  - ill thrift in cattle.
  - poor reproductive performance in cattle.
  - poor milk yields in cattle.

- **Iodine**
  - neonatal lamb and calf mortality.
  - poor reproductive performance.

- **Various specific inherited susceptibilities or disorders.**
How do you know if animals will benefit from trace element supplementation?

Trace element deficiency, infectious disease, injury or starvation?
– Assume trace element deficiency and supplement with copper, cobalt and selenium?

– Improvement seen (because sheep moved).

– Money spent on expensive chelated minerals for the next decade.
– Assume trace element deficiency and supplement with copper, cobalt and selenium?
– Improvement seen (because sheep moved).
– Money spent on expensive chelated minerals for the next decade.

Is this approach appropriate?
Either -

- Assume trace element deficiency and supplement with copper, cobalt and selenium?

- Improvement seen (because sheep moved).
- **Money spent on expensive chelated minerals for the next decade.**
- Subclinical losses continue because the primary problem was never identified.
Or - adopt a rational approach to the diagnosis and management of the problem -

– Are these animals performing to targets?
– Identify the constraints by rationally investigating any animal health problem.
– Ensure that the most appropriate remedies are used efficiently, based on assessment of the individual circumstances.
– Evaluate the response and cost benefits.
– Monitor to ensure satisfactory productivity.
• Or - adopt a rational approach to the diagnosis and management of the problem -
  – Are these animals performing to targets?
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Planned animal health.
Flock or herd health planning.

- Are these animals performing to targets?
- Identify the constraints by rationally investigating any animal health problem.
- Ensure that the most appropriate remedies are used efficiently, based on assessment of the individual circumstances.
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Ill thrifty April-born, Scottish Blackface wether lambs during January.

Weaned onto good pasture in August.

Moved onto forage rape in October.

Housed and fed ad lib cereal/beet pulp in December.

Regular wormer and flukicide treatments.

Etc..
Why are these lambs ill thrifty?

- Ectoparasite infestation.
- Trace element deficiency.
- Anthelmintic resistant helminth parasitism.
- Lameness.
- Don’t know.

Responses
- 17%
- 0
- 8%
- 0
- 75%
Investigation to ensure a useful diagnosis.

- The common causes of ill thrift in growing lambs are well defined -
  - poor nutrition
  - perinatal management and disease
  - parasitic gastroenteritis
  - cobalt deficiency
  - selenium deficiency
  - liver fluke
  - other specific infectious and management problems –

Importance of a rational approach to avoid a misleading diagnosis.
Rational diagnostic approach - disease history.

- Farming system and feed management throughout the year.
- Times of lambing and weaning.
- Lambing percentage and spread.
- Worming regime and anthelminitics used.
- Previous trace element problems and supplements used.
- Observations of scouring, coughing, lameness or skin disease.
- Weather conditions.
Rational diagnostic approach - disease history.

- Farming system and feed management throughout the year.
- Times of lambing and weaning.
- Lambing percentage and spread.
- Worming regime and anthelmintics used.
- Previous trace element problems and supplements used.
- Observations of scouring, coughing, lameness or skin disease.
- Weather conditions.
Clinical examination - the whole farm and environment.

- Pasture and feed availability over the whole farm.

Look and ask.
Clinical examination - the whole farm and environment.

- Variation in size and weight within the group.
- Body condition scores across the group.
Clinical examination - the whole farm and environment.

- Lameness.
- Coughing.
- Diarrhoea or dags.
- Ocular disease.
- Pruritus.

Look and ask.
Appropriate sample collection.

- **Faeces**
  - worm egg counts.
  - (coccidia oocyst counts.)
  - (identification of fluke eggs.)

- **Serum**
  - vitamin $B_{12}$.
  - (selenium.)

- **Blood**
  - GSHPx.
  - (selenium.)

August – history and clinical examination inconclusive – worms or trace elements?
Appropriate sample collection.

- **Faeces**
  - worm egg counts.
  - coccidia oocyst counts.
  - identification of fluke eggs.
  - cELISAs.

- **Serum**
  - vitamin $B_{12}$.
  - (selenium.)
  - ELISAs.

- **Blood**
  - GSHPx.
  - (selenium.)

Awareness of cost of diagnostic tests?

Interpretation of results?

August – history and clinical examination inconclusive – worms or trace elements?
Gross postmortem examination and sample collection.

- Fresh liver for trace element assay.
- Examine liver for evidence of fluke.
- Check the abomasum for evidence of heavy parasite burdens.
- Check for respiratory disease and other post mortem signs.
Gross postmortem examination and sample collection.

Importance of not being sidetracked by incidental findings.
12<sup>th</sup> September - 500 April-born Suffolk and Texel cross lambs from a lowground flock of 400 Greyface ewes.

Ewes were dosed with moxidectin to control their periparturient rise in faecal worm egg counts and lambs were weaned onto ‘safe’ pasture.

Flock examination –
- good pasture.
- no evidence of lameness, coughing, scour or skin disease.
- lambs uniformly well grown.

**Faecal egg counts (epg)**

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<td>250</td>
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<td>Mean: 70</td>
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</table>

Interpretation of these results was introduced in a previous SVS Webinar.
• 12\textsuperscript{th} September - 500 April-born Suffolk and Texel cross lambs from a lowground flock of 400 Greyface ewes.

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  – good pasture.
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\begin{table}[h]
\centering
\begin{tabular}{|c|}
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Serum vitamin B\textsubscript{12} (pmol/l) \\
275 \\
51 \\
108 \\
157 \\
64 \\
138 \\
76 \\
\hline
\end{tabular}
\caption{Serum vitamin B\textsubscript{12} levels (pmol/l).}
\end{table}

\begin{center}
\textbf{Mean: 124 (Ref. 295 – 737)}
\end{center}
What action needs to be taken now?

• Treat ill thrifty lambs with a Cu/Co/Se/I slow-release glass bolus.
• Administer a cobalt bullet to each of the lambs.
• Administer vitamin $B_{12}$ injections to each of the lambs.
• Administer a $CoSO_4$ drench to each of the lambs.
• None of the above.

Responses

• 0
• 0
• 50%
• 13%
• 38%

Asked why 38% chose none of the above – no response.
• 12th September - 500 April-born Suffolk and Texel cross lambs from a lowground flock of 400 Greyface ewes.

• Ewes were dosed with moxidectin to control their periparturient rise in faecal worm egg counts and lambs were weaned onto ‘safe’ pasture.

• Flock examination –
  – good pasture.
  – no evidence of lameness, coughing, scour or skin disease.
  – lambs uniformly well grown.

Blood GSHPx (u/ml)
30.5
40.2
22.5
19.1
53.0
73.6
108.2
Mean: 49.6
(Ref. 42 – 200)
How should these results be interpreted?

- The lambs are selenium deficient and require immediate supplementation.
- Four of the lambs are selenium deficient and three are not.
- The lambs are not selenium deficient and no further action is required.
- Selenium deficiency is not the immediate cause of ill thrift, but is a potential threat.
- The lambs should all be given a selenium bolus or depot injection.

Responses
- 13%
- 25%
- 0%
- 63%
- 0%
Flock (and herd) health planning.

• Based on a rational approach to the diagnosis and management of the problem
  – are these animals performing to targets? ✔️ (They are not.).
  – identify the constraints by rationally investigating any animal health problem. ✔️
  – ensure that the most appropriate remedies are used efficiently, based on assessment of the individual circumstances.
  – evaluate the response and cost benefits.
  – monitor to ensure satisfactory productivity.
Cobalt and selenium deficiencies as examples of the need for sound understanding of disease principles.

- Ensure that the most appropriate remedies are used.
- Evaluate the response and cost benefits.
- Monitor to ensure satisfactory productivity.
Diagnosis of cobalt and selenium deficiencies as causes of ill thrift in lambs.

- Investigation of poor performance.
- Routine monitoring
  - determination of adequacy of supplementation.
  - determination of adequacy of reserves for the next high risk period.
  - determination of the need to spend money on trace element supplementation.
    - appropriate sample collection.
    - number of animals to sample.
    - which animals to sample.
    - management of animals before sampling.
    - interpretation of results.
    - contribution of other factors.

Investigation of poor performance.

Routine monitoring

- determination of adequacy of supplementation.
- determination of adequacy of reserves for the next high risk period.
- determination of the need to spend money on trace element supplementation.

- appropriate sample collection.
- number of animals to sample.
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- management of animals before sampling.
- interpretation of results.
- contribution of other factors.
Cobalt deficiency.

Ill thrift, open fleeces, hollow sublumbar fossae, low grade conjunctivitis and anaemia.

Poor milk production in ewes?
High perinatal mortality rates and susceptibility to infection in newborn lambs?
Diagnosis of cobalt deficiency.

• Soil
  – soils derived from acid igneous rock are low in cobalt.
  – Mn, Fe & Ni in the soil interfere with plant cobalt uptake.
  – soil pH >6.3 can affect cobalt availability.
  – soil compaction can reduce pasture uptake of cobalt.
  – drainage can reduce pasture cobalt uptake.

• Pasture
  – plant species differ in ability to accumulate cobalt.
  – confused by soil contamination of samples.
Relevant history - animal requirements.

• Cobalt is required for the manufacture of vitamin B\textsubscript{12}, which is required in the liver for the utilisation of rumen-derived propionic acid in energy production.
• Poor utilisation of propionic acid results in reduced dry matter intakes.
• Sheep have a higher requirement for cobalt than cattle and deer.
• Growing animals have a higher requirement for vitamin B\textsubscript{12} than adults.
• The requirements of pre-ruminant animals are low.
Where sheep and cattle are grazed on similar pastures, cobalt deficiency is frequently diagnosed in the sheep flock, but not in cattle.
Pasture improvement by reseeding and topdressing with lime resulted in severe cobalt deficiency in weaned lambs on this property, with no previous history of trace element deficiency.

Manawatu, NZ.
Animal samples.

- Postmortem findings
  - fatty liver changes associated with ill thrift.
- Dose response trial.
- Serum vitamin $B_{12}$ concentrations
  - immediate dietary intake
    - diagnosis of deficiency.
  - large individual variation unless animals are severely deficient.
  - affected by:
    - change of pasture.
    - concurrent liver disease.
    - yarding.
Animal samples.

• Liver vitamin B\textsubscript{12}
  – guide to limited continuous body storage
    • **diagnosis of deficiency.**
    • determination of the need to supplement to see animals through the main risk period.
    • monitoring of a supplementation programme.
      – little individual variation.

• Blood or urine methylmalonic acid (MMA)
  – curvilinear relationship between MMA and vitamin B\textsubscript{12}.
  – raised levels support a diagnosis of cobalt deficiency.
  – **cannot be used to predict the need for supplementation.**
Vitamin B\textsubscript{12} reference values.

- Based on numerous controlled supplementation trials.
- An indication of the probability of a weight gain response at a particular concentration of vitamin B\textsubscript{12}.
- Based on the mean of 10 serum or 3 liver samples (outliers removed).
- Diagnosis of deficiency – use lower ‘normal’ value.
- Prediction of sufficiency – interpret in the lower end of the ‘normal’ range.
- Different reference ranges for ewes and lambs.

(Clark, RG and others, NZVJ 37, 7-14, 1989)
Ovine white liver disease (OWLD) and hepatic encephalopathy.

- Mid October.
- 250 BF ram lambs.
- Grazed on improved in-byre pasture.
- Poor body condition (mean <1.5).
- Housed and introduced to sugar beet pulp.
- 12 sick within 24 hours of housing
  - lack of menace.
  - sudden onset depression.
  - progression to stupor.
  - fine muscle fasciculations.
  - ataxia.
  - head pressing.
  - 8 died.
  - no response to vitamin B\textsubscript{1} injections.
  - raised GGT, GLDH & AST in group.
  - liver vitamin B\textsubscript{12} <0.1 \text{µg/kg}.
  - fatty livers on postmortem.
- Group response to Co supplementation.
• **Short term Co supplementation**
  – oral drenching with cobalt sulphate.
  – foliar liquid application of cobalt sulphate.
  – vitamin $B_{12}$ injections.

• **Long term Co supplementation**
  – intraruminal cobalt bullets.
  – pasture top-dressing with cobalt sulphate.
  – free access mineral supplements?
Why are these lambs ill thrifty?
Laboratory findings:

- FWECs (x10) – all zero.
- Fluke eggs – all negative.
- Mean GLDH (n=5) - 5.5 iu/l.
- Mean Vit B₁₂ (n=10) - >1000 pmol/l.
- Mean GSHPx (n=5) - 15.6 u/ml.

The evidence suggests that these lambs are currently selenium deficient.
Selenium deficiency.

- A common cause of ill thrift in weaned lambs.
- An occasional cause of white muscle disease in lambs.
- Selenium responsive infertility.
• Protection of cell membranes from damage by reactive oxygen metabolites in a complementary role to vitamin E.

• Greatest concentrations of reactive oxygen metabolites are found in muscle and white blood cells.

• Role of selenium in the prevention of nutritional muscular dystrophy and immune system disorders.

Adapted from Underwood, E.J. and Suttle, N.F. (1999)
Diagnosis of selenium deficiency.

• Soil and pasture
  – a good indication of animal selenium status.
  – areas of low soil selenium concentration are mapped.

• Animal
  – the best indication of selenium status.

• Serum and liver selenium
  – contemporary selenium intake.

• Blood glutathione peroxidase (GSHPx)
  – long-term selenium status.
  – little individual variation (3 or 4 samples).
Selenium deficiency - reference ranges.

- Overseas reference values based on numerous growth response trials.
- Difficult to provide firm guidelines for British livestock due to requirements for vitamin E.
- Consideration of class of livestock, time of year, etc.
Selenium supplementation.

- **Short-term supplements**
  - oral dosing with sodium selenate.
  - subcutaneous injection of sodium selenate or selenite.

- **Long-term supplements**
  - controlled release subcutaneous injections of barium selenate paste.
  - intraruminal elemental selenium pellets.
  - (pasture top-dressing with slow-release prills containing barium and sodium selenate).

**Risk of toxicity.**
Diagnosis of white muscle disease.

- **Clinical signs**
  - **differential diagnoses:**
    - joint ill.
    - pneumonia.
    - spinal abscessation.

- **Postmortem findings**
  - necrotic lesions in the myocardium.
  - symmetrical myonecrosis of the hindlimbs
    - difficult to interpret.

- **Histopathology.**

- **Creatinine kinase concentrations > 500 IU/ml**
  - difficulty differentiating from exertion due to catching.
Selenium deficiency - cattle.

- Ill thrift in growing calves.
- Infertility in severely deficient cows.
- Poor milk production in severely deficient animals.
- **White muscle disease**
  - congenital.
  - delayed in 1 - 4 m.o. calves
    - sudden onset - stress or exercise.
    - stiff.
    - Recumbency.
    - respiratory distress.
    - sudden death.
- Retained foetal membranes.
- Prolonged calving.
- etc....
How should poor reproductive performance be investigated?

- Barren and twinning rates (the scanning percentage) are determined by:
  - Onset of oestrus behaviour
  - Ovulation rate
  - Fertilisation
  - Conception
  - Foetal development
  - Foetal survival/abortion

A basic understanding of each stage is required to ensure a logical approach to the investigation and management of poor reproductive performance.
Example.

- Flock of 400 Halfbred ewes.
- Rams introduced mid-October and removed in March.
- Protracted lambing period and high barren rate for several years.
- Some ewes observed to be mated after moving to turnips in late December.

May
17 late lambers.
18 barren.

What targets for barren rate and ewes lambing during the first 18 days of the lambing period should be achievable?

What are the possible reasons for the high barren rate and protracted lambing period in this flock?

How should this problem be investigated?
• Ewes had been cycling at ram introduction
• Rams were sound
• Keel marks consistent with implantation failure of early foetal death
• Toxoplasmosis, border disease and fascioliasis ruled out
• Selenium or iodine deficiency?

May 17 late lambers. 18 barren.

What targets for barren rate and ewes lambing during the first 18 days of the lambing period should be achievable?

What are the possible reasons for the high barren rate and protracted lambing period in this flock?

How should this problem be investigated?
Diagnosis of selenium responsive infertility.

- Normal blood glutathione peroxidase concentrations
  - long-term selenium status.
- Response to supplementation
  - related to other management changes.
- Controlled supplementation trials.
- Blood selenium concentrations?
  - short-term selenium status.
  - expensive.
  - pooled samples?
  - reference ranges useful?
• FWECs \((x10)\) – all zero
• Fluke eggs – all negative
• Mean GLDH \((n=5)\) – 5.5 iu/l
• Mean Vit \(B_{12}\) \((n=10)\) – >1000 pmol/l
• Mean GSHPx \((n=5)\) – 15.6 u/ml
A globally-applicable template for improved planned animal health.

Are these animals performing to targets?

Identify the constraints by rationally investigating any animal health problem.

Monitor to ensure satisfactory productivity.

Evaluate the response and cost benefits.

Ensure that the most appropriate remedies are used efficiently, based on assessment of the individual circumstances.
Discussion: the value of performance data in health planning.

Poor kid growth in a Malabari goat herd in Kerala.

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BUCK M E 44.85