Trying to Get the Job Done with COWP

Copper wire particles

- Lambs and Kids
  - Studied under natural infection.
  - History of grazing on same pastures, but different times.
  - Grazed same area during study.
  - Kids – Spanish breed
  - Lambs – Wool and hair ancestry
  - Wethers

The Truth about Copper? Why Sheep Ewenique?

- Complicated and Complex
- Variable
- Unpredictable

WHAT IS COPPER?

- Nutrient
- Dietary Essential Trace or Micromineral
- Needed in Small Amounts for Essential Functions
- Generally Acquired through Feedstuffs
- Both Deficiency and Excess are Concerns

FURTHER POINTS IN UNDERSTANDING CU

Dietary essential

- Amount is a key
- Chemical form determines bioavailability.
- Liver is the primary storage tissue for Cu.
- Stress factors have a major role in release.
- Most Cu absorbed in preintestinal area.

Forms of Copper

- Copper sulfate ($CuSO_4$)
- Copper lysine (CuLys)
- Copper proteinate (chelation of Cu with amino acids)
- Copper oxide (CuO)

Key Points on Copper Homeostasis

- Normal levels of Cu in blood plasma are
  - 0.8 - 1.5mg Cu/L.
- Copper absorption is more important than its concentration in the feed.
- Copper requirement in sheep is 7 - 11 mg/kg (ppm) dry matter.

Homeostasis, cont.

- In sheep, copper absorption is relatively poor (1.4 - 12.8%) but influenced by ...
  - Type of diet, including forage type.
  - Level of Mo, S, Fe ... and to a degree Ca, Zn.
  - Protein level of the forage or feed.
  - Age of animal
    - Young animals (lambs) may absorb up to 90% of dietary copper

COPPER ABSORPTION LEVELS FOR SHEEP (NRC, 2007)

	Absorption Coefficient
Lamb, preweaning	
5 kg (~ 11 pounds)	0.90
10 kg (~ 22 pounds)	0.53
20 kg (~ 44 pounds)	0.20
Lamb, postweaning (pasture)	0.045
Lamb, postweaning (feedlot)	0.06
Ewe, gestation	0.06
Ewe, lactation	0.045

COPPER TOXOCOSIS IN SHEEP

> Phase I - Prehaemolytic. Copper accumulates in the liver to exceed 1,000 mg Cu/kg. Can last for a few weeks to more than a year.

> Phase II - Haemolytic crisis. Copper is released from the liver in lysosomes and blood copper value rises. Followed by haemoglobinuria, haemoglobinaemia, and jaundice. Lasts from hours to days.

>Death - may be "sudden"

TOXICOSIS, CONT.

> Variables include:
  > Breed and perhaps genetic type.
  > Environmental stresses

> NRC (2007) suggests maximum tolerable Cu concentration for sheep is 15 mg/kg dry matter when dietary Mo and S are at normal levels.

Why Copper Oxide Does not Kill Sheep?

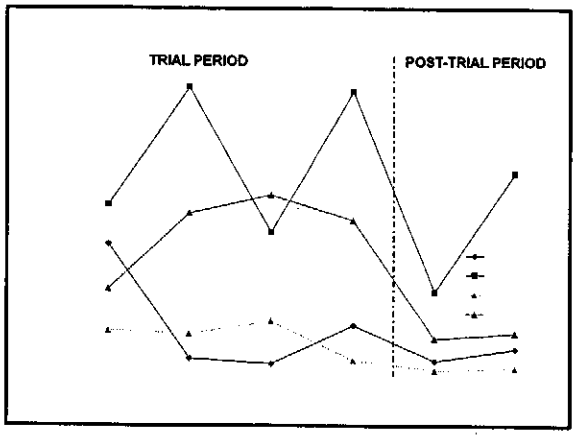
- Bioavailability very low.
- Form has an influence - particles vs powder.
- Duration of exposure may be short.
- Resides in one location so not multiple sites for absorption.

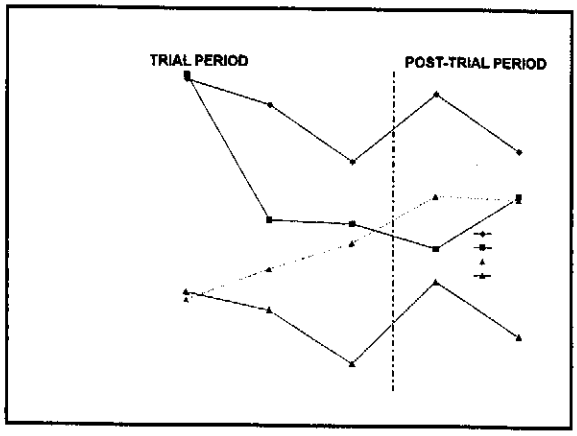
PROTOCOL FOR COPPER OXIDE IN INTERNAL PARASITE MANAGEMENT

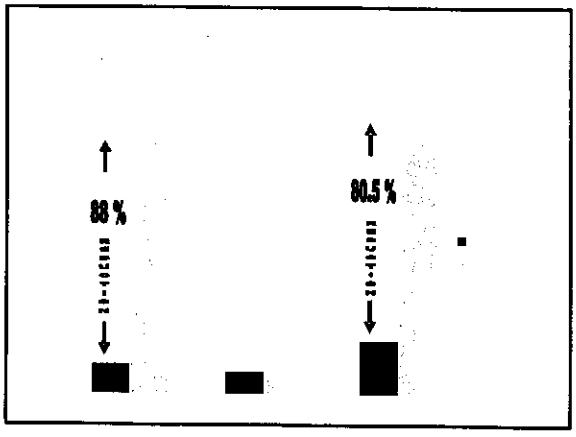
- Role in control of *H. contortus* which reside in abomasum.
- Bolus containing 0.5 g copper wire particles.
- Administer bolus up to need up to 2- 4g.
- Most effective in younger animals and during seasons when challenge is greatest.
- See www.SCSRPC.org reference for details.

What is the Truth Then?

- Copper is essential for sheep body functions.
- Level of consumption is usually adequate from forages (Soil influences level in plants)
- Supplemental copper may be toxic
  - Absorbed and accumulated in the liver.
  - Release triggered primarily by stress events.
- Certain supplemental forms can be used for H. contortus control w/o toxic outcome.
- Bioavailability is a key.







Small Ruminant Species Differences re COWP

- Indication that COWP useful short-term intervention.
- Indications of differences between lambs and kids
  - Level of response
  - Timing of response
  - Duration of response

SL, COWP, and Sheep

- Animals (sheep) highly susceptible to GIN infection will have high FEC regardless of (SL) grazing treatment.
- In experiments these animals i.d. via FAMACHA and treated w/COWP.
- When removed, SL treatment very visible.
- SL pellets effective w/ moderate infection but may not be so useful under overwhelming ...
- Concept of integrated approach being validated.

Summary

- Tools for an integrated approach including -
  - Pasture and grazing management
    - Rotation
    - Stocking rate
  - "Medicinal" plants
    - Condensed tannin-containing
      - Sericea lespedeza and others
  - Novel approaches
    - Copper wire particles, fungi trapping ...
  - Anthelmintics
  - Sheep genetics