Unearthing the benefits of diatomite

Exploring the potential for diatomaceous earth to improve poultry management

Prepared and presented by Michael Sommerlad of “Poultry Works” for the World Poultry Congress, Brisbane 2008

Introduction

- About the presenter
- What is “Poultry Works”
  - Independent consultancy specialising in free-range and organic production systems
  - Focus on utilising the inherent physiological and behavioural characteristics of poultry to improve management and animal welfare
  - Researching and trialling alternative management techniques

Diatomite – what is it?

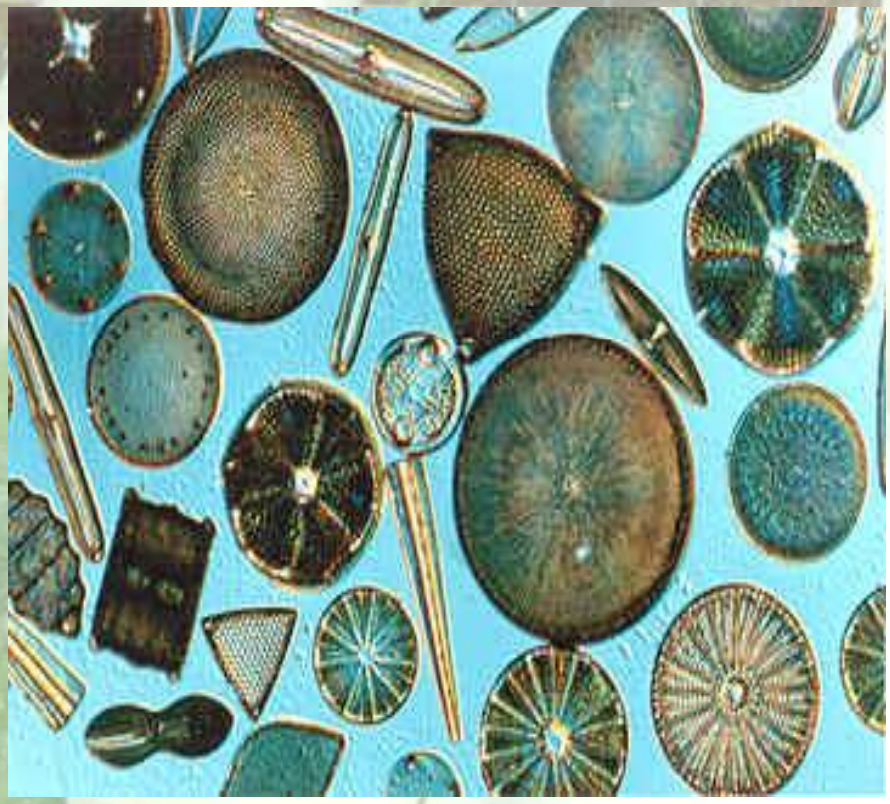


Image courtesy www.daviddarling.info

- Mined from sedimentary layers of diatom exoskeletons
- Distinct from “crystalline” silica or quartz, biogenic or amorphous silica is much more soluble, and is not a health hazard
- Over 25,000 different types of diatoms, each with a distinctive form or shape living in freshwater and marine environments

Background – external treatment

- Large volume of anecdotal material describing the use of diatomaceous earth to treat and control a range of livestock pests and diseases, as well as acting as a nutritional supplement
- Trialled “Absorba-Cide”, a fine diatomite powder registered with the APVMA (Australian Pesticides and Veterinary Medicines Authority) to control insect pests in stored grain, on an organic layer operation to treat red mite with 100% success
- Now using “Absorba-Cide” in a number of commercial environments to control red mite

Controlling red mite using "Absorba-Cide"

Image courtesy of www.livsmedelssverige.org

- What is red mite?
  - A blood sucking arachnid (related to spiders)
  - Life cycle can be completed in 7 days
  - Can survive for up to 34 weeks without food (chicken blood)
  - Can cause severe anaemia and sometimes even death, particularly of laying hens or broodies

Controlling red mite using "Absorba-Cide" (continued)

- Red mite – problems with control
  - Carried by wild birds, particularly sparrows that use chicken feathers to line their nests
  - Does not live on the birds – hides in dark places in the shed during the day, and can be difficult to reach with poisons
  - Short life cycle – numbers can increase rapidly in the right environment

Red mite - control

- No “silver bullets”
- “Integrated pest management” is the most effective strategy – use a number of tools
  - Understanding
  - Prevention
  - Treatment

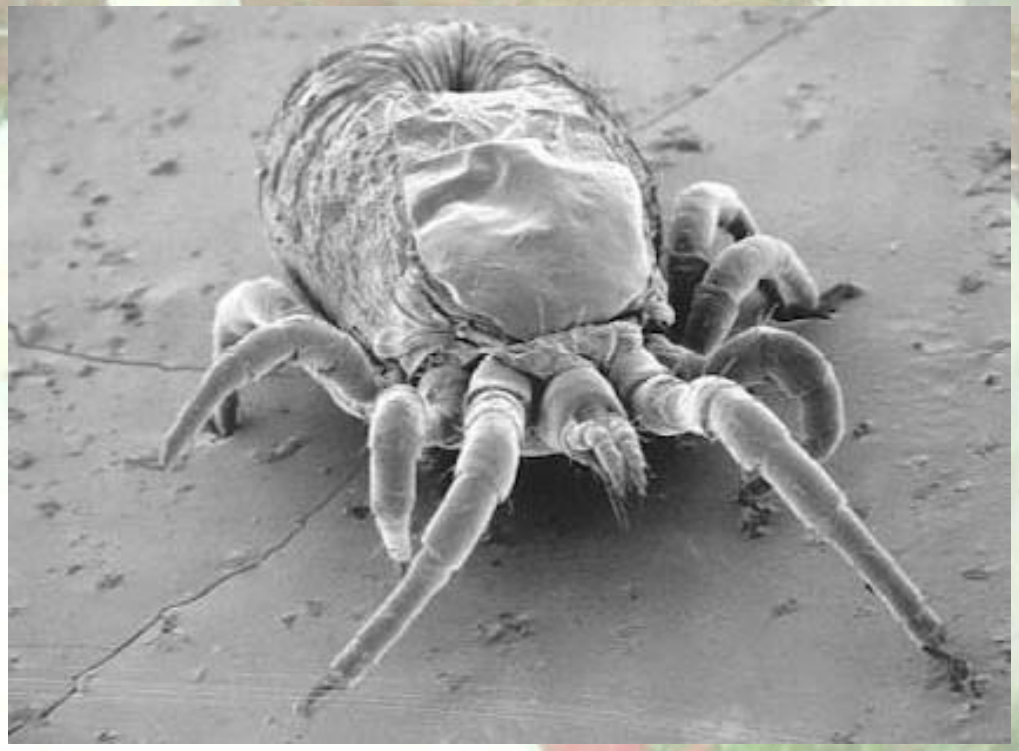


Image courtesy of www.elafricano.com

Red mite - control (continued)

– *Understanding*

- Become familiar with the life cycle and the habits of the pest
- Use this knowledge to your advantage – for example, we know that the mites cannot fly or travel far by themselves, and are normally spread by other birds, so control the entry of birds onto your site. We also know that the mites hide in dark places during the day, so we can target these areas with appropriate treatments

Red mite – control (continued)

– *"Prevention is better than a cure"*

- Quarantine all new birds and treat with an appropriate pesticide
- Reduce the likelihood of sparrows and other wild birds coming into contact with your fowls
- Become aware of biosecurity – think about where you've been and what you're wearing when visiting with other breeders or going to shows. Remember, that one female red mite brought onto your site is all that it takes to start an entire population.

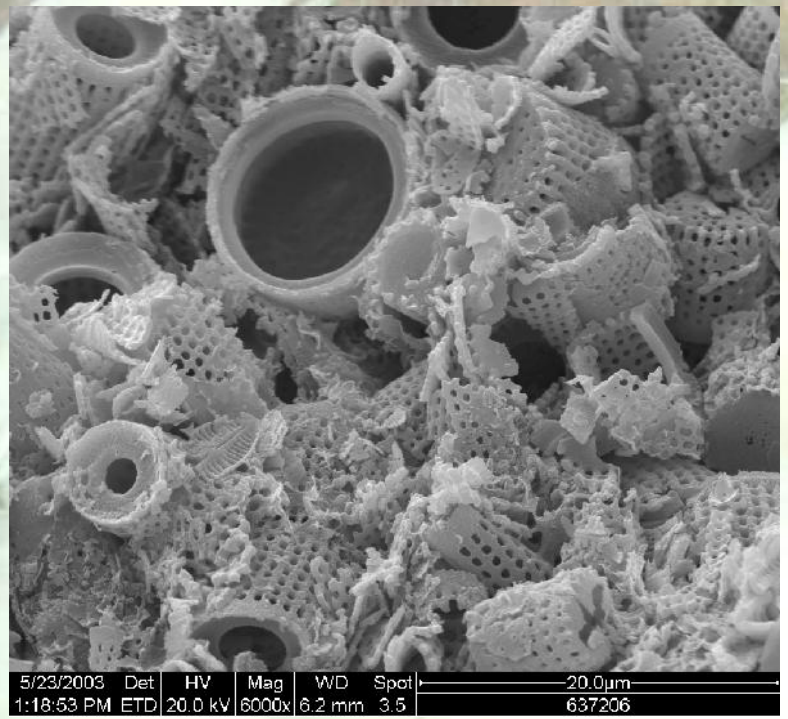
Red mite – control (continued)

- Treatment
  - Remember treating the birds during the day is largely ineffective because the mites hide away in dark, secluded and often inaccessible places
  - Targeting the mites' hiding places is the most effective method of treatment
  - Most chemicals rely on contact with the pest to achieve control
  - Overuse of a particular chemical, particularly if the chemical is used at concentrations lower than the manufacturers recommendations, can lead to the development of resistance within the mite population. Try and rotate between different groups of chemicals

Red mite – “Absorba-Cide”

- What about non-chemical alternatives?
  - **Introducing “Absorba-Cide”**
    - An inert, grey powder
    - Manufactured from heated and finely crushed diatomaceous earth
    - Works as a “physical” control rather than a chemical one
    - Provides ongoing protection whilst ever it is dry
    - Currently registered with the AVPMA to control insect pests in grain storage

Red mite – “Absorba-Cide”

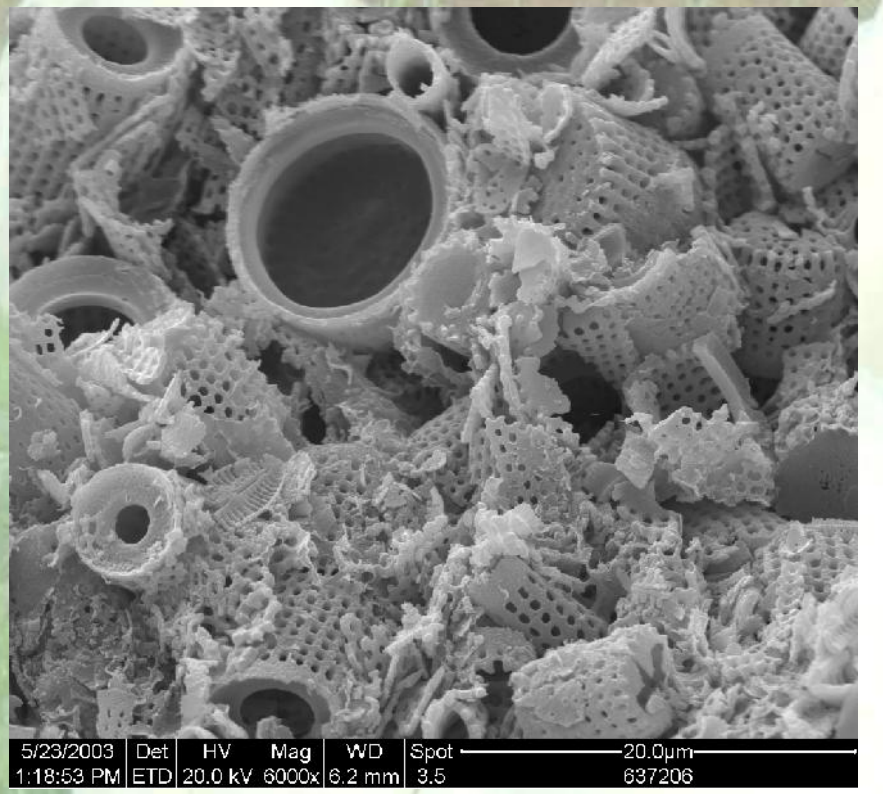


This is a micrograph, taken at 6000X magnification, of the unique, freshwater diatom used to make “Absorba-Cide”

- How does “Absorba-Cide” work?
  - Two modes of action
    1. ***Dehydration***
    2. ***Abrasion***

Dehydration – because of all the tiny pores and spaces within the structure of the exoskeletons, “Absorba-Cide” is extremely absorptive, and is capable of holding over twice its own weight in water. When tiny creatures such as red mite come in contact with the powder, they are literally “sucked dry”, and die.

Red mite – “Absorba-Cide” (cont.)



Abrasion – during the crushing process, many of the exoskeletons are broken up, creating countless jagged edges (see micrograph). These edges are capable of cutting the “skin” (known as “cuticle” or exoskeleton) of the mite, allowing even faster dehydration, and increasing the risk of death by predation or infection.

Red mite – “Absorba-Cide” (cont.)

- How is “Absorba-Cide” used?
  - The powder is applied around the “hiding places” of the red mite. Anywhere that two surfaces come into close contact with each other is a favourite place for mites: where perches are attached to the shed, under nest boxes or around the walls are good places to start. Learn to identify the tell-tale white “powder” that is found around red mite hiding places; these are the old “skins”, cast off by growing mites.
  - Simply sprinkle the powder generously around any areas where the mites are known to be.
  - “Absorba-Cide” ceases to be effective if it gets wet – avoid damp places (mites like to keep dry too).
  - “Absorba-Cide” continues to work whilst ever it is dry, providing sustained control of the mites for up to 4 weeks (or even longer in certain circumstances).

Red mite – “Absorba-Cide” (cont.)

- Is “Absorba-Cide” safe?
  - “Absorba-Cide” has no chemical action
  - It is an extremely fine powder, so gloves and breathing protection should always be worn whenever it is being applied
  - It will not harm the birds, in fact, it can be a useful addition to the birds’ diet (more on that later!).

Red mite - summary

- Can become a serious problem to poultry keepers, even killing birds in some cases
- Use as many tools as possible to control the pest, remember:
  - Understanding
  - Prevention
  - Treatment
- There are no “silver bullets”, only sound management
- Try using “Absorba-Cide” to provide sustained control of the mites and reduce the risk of chemical resistance on your site

Background – internal treatment

- Conducted a series of preliminary field trials using “Molodri” (a 50/50 blend of fine milled diatomite and molasses) as a nutritional supplement for both monogastric and ruminant livestock species
- Found a general improvement in overall health, weight gain and condition
- Closer scrutiny of animal health, using faecal egg counts, revealed a small but consistent decline in roundworm eggs in treated birds, and surprisingly, almost total elimination of coccidiosis oocyst output
- “Molodri” is currently used as a standard inclusion in a number of commercial poultry rations

Moving inside – time for a look at roundworms and coccidiosis

Image courtesy of www.thepoultrysite.com

Image courtesy of www.dsp.kvl.dk

- **Roundworms**
  - A common problem for most poultry keepers and growers, particularly where birds are housed on litter
  - Not likely to kill birds, but can seriously depress growth and egg production

Roundworms - continued

Image courtesy of www.janssenpharmaceutica.be

- A number of factors predispose birds to infection including:
  - Age (less than 3 months)
  - Infection with coccidiosis
  - Dietary deficiencies in Vitamin A and protein

Roundworms - continued

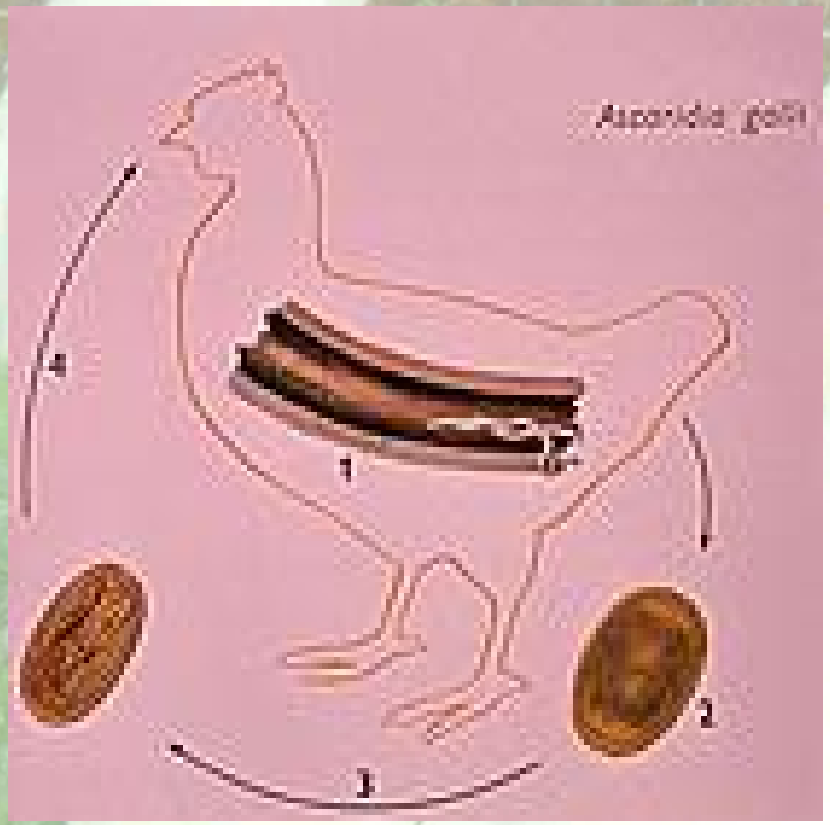


Image courtesy of www.janssenpharmaceutica.be

- Due to the simple, direct life cycle, prevention from infection is difficult once the worms are established on a site.
- Chemical treatments are available, some working better than others.

Roundworms - continued

- And the good news is:
  - Birds can develop a resistance to roundworms with age
  - Good nutrition, with appropriate amounts of animal based protein, vitamins A and B and calcium all assist the bird in combating worm infestations
  - Gizzard development can also reduce worm infestations

Coccidiosis

Image courtesy of www.myoops.org

- Caused by a protozoan parasite of the genus *Eimeria*
- A significant disease for all poultry keepers and growers
- Responsible for many poultry deaths in both pure bred and commercial flocks

Coccidiosis - continued

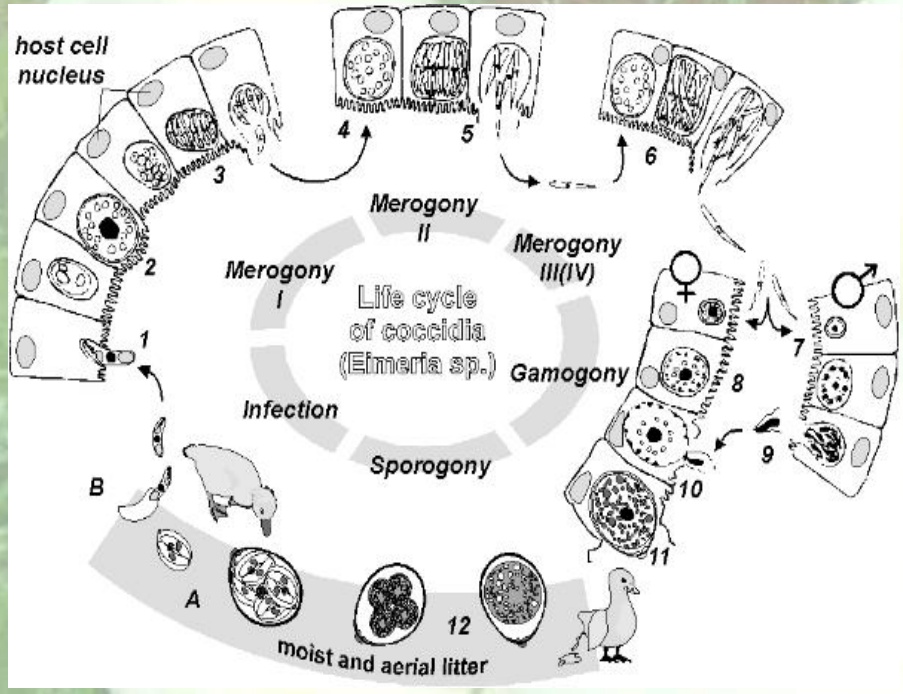


Image courtesy of attra.ncat.org

- Enormous reproductive capacity-

  One “egg” (oocyst) can produce over 100,000 new oocysts in less than 7 days
- Significant losses of young birds can occur, particularly between the 3rd and 6th week
- However, birds quickly develop immunity to this disease under the right conditions

Coccidiosis - continued

- Coccidiosis can be controlled by a number of methods including:
  - Vaccination
  - Chemical treatments
  - Appropriate husbandry practices
    - Biosecurity
    - Litter management
    - Encouraging appropriate gizzard development

Gut instincts

- Gizzard development has now been raised as a means of assisting in the control of both roundworms and coccidiosis – why?
- The gizzard is the “teeth” of the fowl, and grinds up food for digestion
- By encouraging development of the gizzard, not only are the incidence of certain parasites reduced, there is also a marked improvement in digestive efficiency

Gut instincts - continued

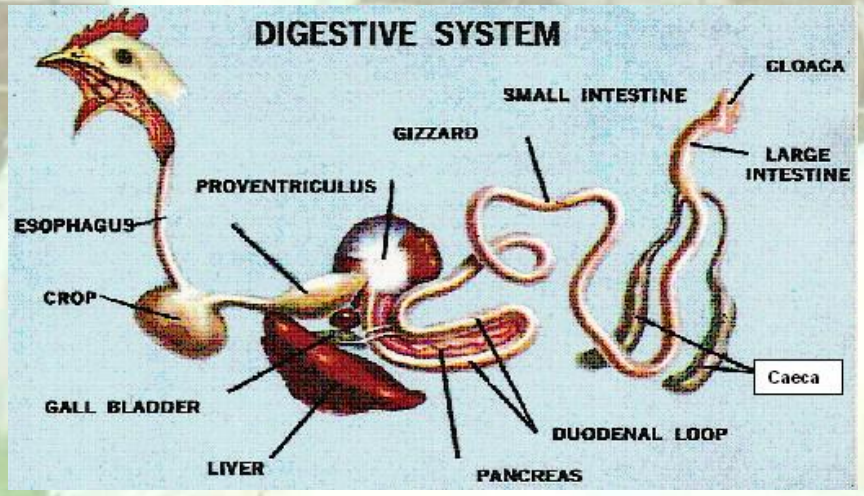


Image courtesy of www.nzfsa.govt.nz

The gizzard and the proventriculus (the "true" or glandular stomach of a fowl) have a unique relationship, cycling digesta between the two organs, decreasing particle size and increasing acidity

- When poultry are fed a combination of whole grains and insoluble grit, the digestive efficiency of the gizzard is enhanced, because not only are the grinding muscles of the organ developed and strengthened, the sphincter muscles that control the flow of digesta in to and out of the gizzard are also strengthened

- **NOTE** Whole grain should only be fed to poultry as part of a nutritionally balanced ration, and never as the sole source of food. The nutrient requirements of poultry varies widely between different ages and classes of stock, and all poultry keepers should ensure that they feed their birds appropriately

Gut instincts - continued

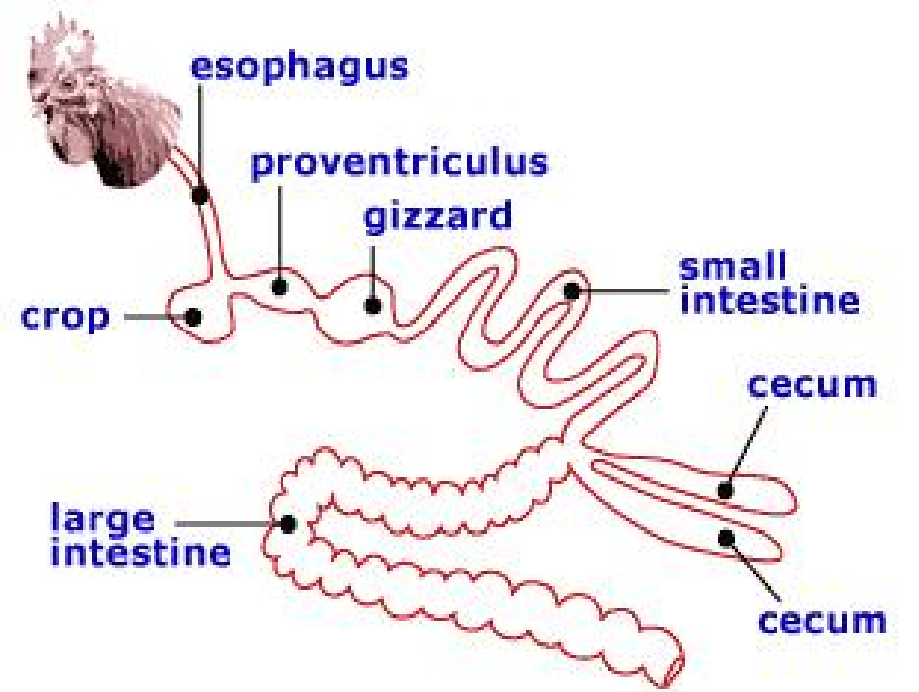


Image courtesy of www.oregonstate.edu

- Studies by the late Professor Rob Cumming demonstrated that a healthy, fully functioning gizzard was capable of reducing the number of coccidiosis oocysts that are shed by a bird
- Whilst the exact mechanism behind this process is not fully understood, it is believed that the combination of extremely low pH (high acidity) and powerful grinding action within the gizzard destroy the coccidiosis sporozoites that are released from the oocyst

Gut instincts – “Molodri”

- Enhancing the birds natural abilities –
  - **Introducing “Molodri”**
    - A blend of fine diatomaceous earth and liquid molasses
    - Palatable, sweet smelling grey powder, easy to handle and manage
    - Can assist the grinding efficiency of the gizzard, improving digestion and potentially reducing parasite numbers
    - An excellent source of biogenic silica

What's so special about silica?

- Silica is an essential element for both plants and animals – 7 grams of silica in the human body
- Plays a key role in many physiological and metabolic functions, and is particularly important for healthy bone development
- Chickens fed silica deficient diets suffered from a number of skeletal deformities, poorly formed joints and reduced cartilage content

Gut instincts – “Molodri”

- “Molodri” – other benefits
  - The molasses in the “Molodri” improves the palatability of stockfeed, and can be used to encourage shy feeders or young chicks to the feed trough
  - Unlike the silica contained in most soils, which is largely unavailable to living organisms, the biogenic silica in diatomaceous earth is available to both plants and animals
  - Research into the positive effects of diatomaceous earth on hind gut microflora is ongoing

Gut instincts – summary

- Both roundworms and coccidiosis are significant problems to poultry keepers
- Poultry can develop varying levels of immunity to both organisms
- A correctly functioning gizzard helps to not only aid in the control of these diseases, but also improve the overall health of the bird
- The action of the gizzard can be enhanced by adding “Molodri” to poultry feed

“Unearthing the potential of diatomite” - conclusion

- Managing external parasites and other diseases in poultry requires both good management and husbandry skills
- There are a number of different tools available to poultry keepers to assist them in managing disease
- Recent research has added some diatomaceous earth based products to that list
- For more information go to www.bellsouth.com.au , www.mtsylvia.com.au or email me at michael@poultryworks.com.au

Acknowledgements

I would like to thank the following people –

☺ The organisers of this great event; for giving me the opportunity of making this presentation

☺ Mr Jim Finger; for his assistance and support, and his commitment to the poultry fraternity in Australia

☺ The late professor Rob Cumming; for his gentle and unselfish desire to share good science with all poultry keepers

☺ And finally you , my audience; for your attention and courtesy, I trust you are able to use some of this information to your continued advantage.

Michael Sommerlad