

Effect of Northern Cape diatomaceous earth on milk quality, parasite load and fertility of Jersey dairy cows

Conducted at two Free State dairy farms, South Africa

Started 3 June 2010; Finished 31 May 2011

ABSTRACT The efficacy of simple to use, non-toxic Northern Cape diatomaceous earth (NCDE) was evaluated for 12 months on 130 Jersey dairy cows on two dairy farms as a treatment against internal and external parasites and to increase milk quality (protein; butterfat) and fertility. All these factors were major problems in the herds at the start of the trial. These 12 month results were compared to previous statistics of 15 years. The cows were fed diets supplemented with NCDE at an intake rate of 125 gramme (g) NCDE per cow per milking cycle. Fecal egg counts (FEC), milk quality and fertility statistics were taken and assessed at the start of the trial and were similar compared to previous years. Significantly FEC were present at the start of the trial. FEC, milk quality and fertility were continuously monitored throughout the trial and preliminary reports were issued every four months and indicated significant changes in the results of the variables that were tested. The cows treated with NCDE had significantly lower FEC compared to the start of the trial and compared to the same time from previous years. Milk quality and fertility significantly increased compared to the start of the trial and previous years. Feed efficiency did not differ between the dietary treatments of the trial compared to previous years. Additionally, the effectiveness of NCDE to treat fly infestations was also evaluated. Compared to previous years, kraals almost had no flies during the trial despite an abnormally high rainfall season (750mm+). This seems to be the biggest advantage. It is important however to note that overall significant results for this trial were only visible after five weeks of NCDE use. In a previous experiment, the effectiveness of NCDE against gram negative bacteria *Escherichia coli*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa* was tested *in vitro*. At a 2% concentration and a contact time of 20 minutes the percentage inactivation was 84.6, 45 and 94 respectively. Relative to previous years, cows treated with NCDE appeared visibly healthier and needed less treatment. The overall somatic cell count was brought down from 1 000 000 to 500 000, and NCDE was part of an integrated plan to achieve this. The results of this trial indicate that NCDE has the potential to be an effective treatment to help control internal and external parasites and improve milk quality and fertility. All this might be due to the fact that the dairy cows treated with NCDE result in healthier animals and are then more resistant to health problems.

INTRODUCTION Consumers are increasingly concerned about the safe and ethical production of their food and milk and are putting more pressure on modern milk producers to implement safer products for animal health. Dairy farmers are increasingly faced with health problems in their herds. Increased drug resistance, stress factors and farming in confined areas are known to have detrimental consequences in today's dairy farming. These are challenging factors that need to be addressed more effectively than ever before in current market conditions.

MATERIALS AND METHODS A group of 130 Jersey dairy cows participated in the trial. Internal parasite loads were continuously assessed at a credible institution by fecal egg counts (FEC). Milk quality was continuously tested by a leading milk processing company. The source of DE used in this study was Northern Cape diatomaceous earth from the Rossville diatoms body, which contains pure amorphous silica and significant amounts of Calcium and Magnesium, all important characteristics in a diatom product for dairy use. Diatomaceous earth was formed

millions of years ago by fossilized diatoms and mainly contains pure amorphous silicon dioxide. NCDE was evenly mixed into daily rations in such a way that every cow had an intake of 125g of NCDE per milking cycle. Cows were milked twice daily and had a total intake of 250g of NCDE per day. Preliminary results were published every four months and the trial ended after one year. The preliminary results were consistent compared with final year-end results. Significant results were first noted only after 5 weeks of NCDE use.

RESULTS

Effect on internal parasites One proposed treatment for the control of internal and external parasites is to add diatomaceous earth (DE) (DE; Macy, 2000) to the diet of animals in production (Canadian Organic Growers, 2000). Scientific studies indicating that diatomaceous earth can be an effective treatment to control internal parasites do exist (Bennett, 2011; Dr. van Zyl, 2010). It has been suggested that DE may provide trace minerals that help the host cope with parasite burdens (McLean et al., 2005). The efficacy of NCDE against internal parasites was locally evaluated in a feedlot on Merino sheep in the Western Cape Province on *Haemonchus Contortus* and the results indicate that NCDE has the potential to be an effective treatment to help control internal parasites (Dr. van Zyl, 2010).

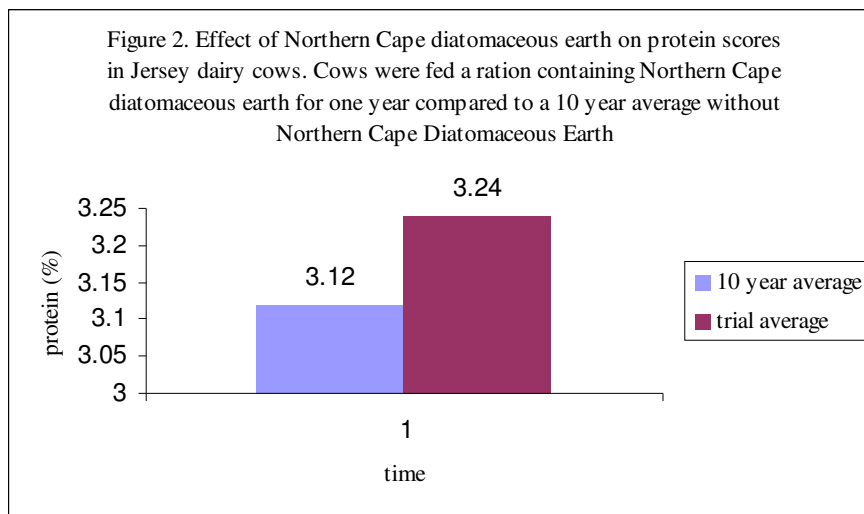
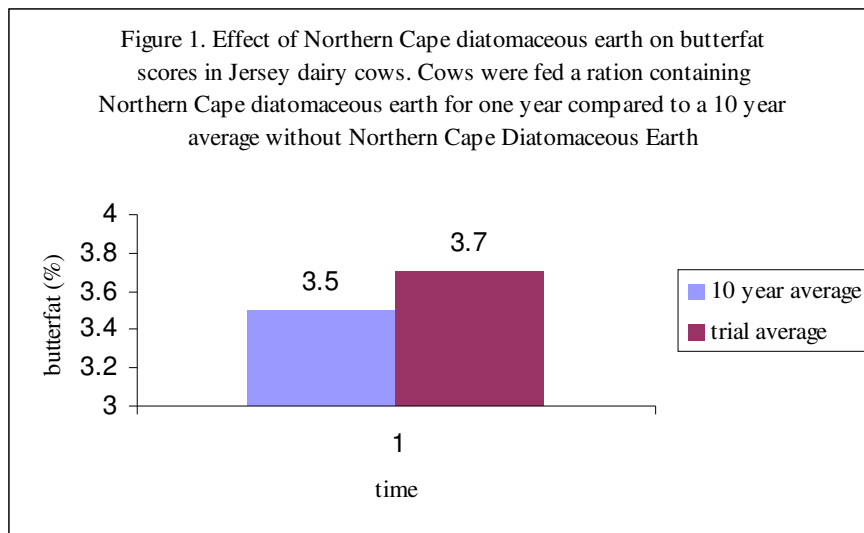
At the start and during this Jersey dairy trial cows were randomly selected and fecal collection was regularly undertaken and sent to the laboratory. FEC at the start of the study indicated a significant parasite burden. A decreasing FEC was noted from five weeks and the FEC remained negligibly low for the duration of the trial. This result compared to previous years' statistics indicates that NCDE treatment can be an effective treatment to help control internal parasites.

Effect on external parasites Scientific studies indicating that diatomaceous earth can be an effective treatment to control external parasites do exist (Dawson, 2004; Maurer et al., 2009). DE works mainly by absorbing the waxy outer cuticle of insects upon contact, causing death by means of desiccation (Quarles, 1992; Fields, 2000). The abrasive property of DE also aids to the damage of the cuticle (Quarles, 1992; Korunic, 1998). DE has thus been recognized as an effective insecticide. DE is present in manure if it has been mixed into an animal's feed rations.

Fly infestations are one of the biggest problems in intensive dairy farming. The build-up of resistance to conventional treatment methods also adds up to the increasing problem. The most visible result from this Jersey dairy trial was the observation of gradually diminishing fly populations starting in week 5. Compared to previous years' statistics, fly infestations were eventually reduced by up to 70% and were kept that way for the duration of the trial, despite record rainfall. A possible explanation for the 5 week window period might be the fact that it took that amount of time for all the manure on the farm to be converted to manure containing diatoms, thus creating a gradually unfavourable environment for flies.

Effect on milk quality Butterfat (Figure 1) and protein content (Figure 2) scores from the trial did differ significantly compared to the average of the previous 10 years. Milk was tested on an ongoing basis for quality control.

In a recent scientific study (Bennett, 2011) the use of diatomaceous earth in diets of organically raised free-range layer hens was evaluated in 2 breeds of commercial egg layers. Hens fed the diet containing DE laid larger eggs containing more albumen and yolk than hens consuming the control diet. These indicate that a correlation might exist between better quality produce and the addition of DE into a ration.



Effect on fertility Fertility was a major problem at the start of the trial and a solution was needed urgently. After one year fertility levels were improved to previous years' standards. A possible explanation might be the presence of various trace minerals in DE. It has been previously recognized that a positive correlation exists between trace minerals and fertility.

Effect on bacteria In a previous experiment, the effectiveness of NCDE against gram negative bacteria *Escherichia coli*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa* was tested *in vitro*. At a 2% concentration and a contact time of 20 minutes the percentage inactivation was 84.6, 45 and 94 respectively. This might offer some insights as to why cows in the trial year had only one 'trimming' of hooves for the year instead of the normal 4 times per year. This might also offer an explanation as to why NCDE was part of the solution in bringing down the somatic cell count from 1 000 000 to 500 000.

The buffer Since DE contains Magnesium and is a form of fossilized algae, it may also act as a buffer to maintain an optimum pH for optimal rumen functions. The conventional buffer was taken out of the feed rations at the start of the trial. No acidosis was detected during the trial. This indicates that it is possible that the conventional buffer can be halved or even fully replaced with DE.

FINANCIALS

At an inclusion rate of 125g per cow per milking cycle, 250g per cow per day is needed for 2 milking cycles.

At a cost of R6.50 per kg, the cost per cow per month is R48,75.

When taking out the buffer, the cost saving from the buffer is R0,95 per cow per day which is R28,50 per cow per month. (When taking out half of the buffer, the cost saving from the buffer is R14,25.)

The real cost per cow per month is then R48,75 minus R28,50. This equals R20,25 per cow per month for two milking cycles.

The cost of R20,25 per cow per month must then be compared with the benefits as discussed.

The savings as a result of the benefits as discussed in this trial, can be between R50 and R90 per cow per month, before the cost of NCDE is deducted.

The profit or financial benefit per cow per month for this trial is between R29,75 and R69,75.

It is important to note that these figures are an indication and that circumstances and problem intensity varies from farm to farm. This means that one farmer may even experience a better financial benefit, and another farmer might experience a lesser financial benefit.

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SUMMARY Dairy cows fed diets supplemented with NCDE at an intake rate of 125 gramme (g) NCDE per cow per milking cycle may provide the following benefits: (1) control internal and external parasites, (2) improve milk quality, (3) increase fertility (4) reduce the conventional buffer, (5) reduce veterinarian bills and (6) improve the overall health of dairy cows, creating a more profitable environment.

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