

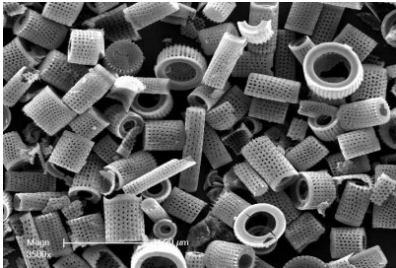
## **Diatomite in Animal Feeds**

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### **WHAT IS DIATOMITE**

Diatomaceous earth also known as Diatomite has been recognized as an organic product for animal health and nutrition. Diatomaceous earth is mined all over the world with countries like China and the USA being major suppliers. In South Africa it is mined from seven different fresh water sources in the Olifantshoek area by Diatoms SA and now, through a recent joint venture agreement further researched and developed and marketed by Animate Animal Health. It is a naturally occurring, silicon rich sedimentary rock made up of fossilized remains of millions of diatoms, a type of hard-shelled plant algae originally deposited millions of years ago in the earth from dried up seas and lakes. Once Diatomaceous earth is mined, it can be milled or processed into a myriad of types for an even greater variety of uses. The key to high quality Diatomaceous earth products is simply to ensure that the diatomite rock being mined is of sufficient purity and free from clays and other minerals. This sounds easy but in reality there are very few Diatomite deposits world-wide that are of sufficient purity, and even then, very careful extraction has to be effected to prevent inclusion of impurities. More demanding uses for diatomite such as for use in animal feed applications therefore call for a very homogenous product where most of the broken frustules are eliminated and the whole ones left intact. Important is to use food grade Diatomaceous earth, produced from natural freshwater sources with a neutral to alkaline pH of  $>7$ . This product has been approved as a feed supplement by organisations such as the FDA and USDA. In such case it is acceptable as an organic feed additive for livestock, such as the product coming from Olifantshoek. The Olifantshoek product has also been registered in terms of the South African Agricultural Department Act 36 of 1947, and also carries SGS, EU, GRAS and EPA approval. In fact it has been proposed that the choice of Diatomaceous earth is critical to any effect seen. The pool grade and filter grade, for example, have not been approved as a feed additive and it may be harmful to use them and they will not accomplish the desired results.

This is what a more purified diatomite material looks like, similar to the Olifantshoek product been distributed by Animate in South Africa.



Fossil Shell Flour Diatomaceous earth (referred to as Diatomite) used in livestock and poultry must be milled until it is almost completely amorphous. This means it has no crystalline ( $<0.5\%$ ) form left to cause damage to larger organisms instead it has small sharp edges which can damage tiny parasites, insects and larvae, on stored grain, in animal manure, on infected plants and in the stomachs of livestock and people. Diatomite is light in weight, chalk-like in appearance and very porous and easily crumbled into a soft fine white to off-white powder. This powder further has an abrasive feel, similar to pumice powder, and is very light, due to its high porosity. It has a particle size ranging from less than 1 micron to more than 1 millimeter, but typically 10 to 200 microns (10 microns and a median pore diameter of 1.2 microns for the Olifantshoek product). Diatomite is primarily amorphous silica ( $>86\%$  silicon) and is distinct from crystalline silica (sand) or quartz. Amorphous silica is

much more soluble than crystalline silica and is not a health hazard. In 1939, the Nobel Prize winner for chemistry, Professor Adolf Butenandt, proved that life cannot exist without Silica. At the same time Dr. Barbara Hendel stated that "Silica is the most important trace mineral for human health!" In addition, there is 5% sodium, 3% magnesium, 2% iron and 14 valuable trace elements such as selenium and copper present in Diatomite.

Over the years Diatomaceous earth has been used for many things from cat litter to water filters, food preservative to insect killer. The ancients used to use it to detoxify their bodies from heavy metals. It has also been used as a filtration aid, as a mild abrasive, as a mechanical insecticide, as an absorbent for liquids, as cat litter, as an activator in blood clotting studies, and as a component of dynamite. As it is also heat-resistant, it can be used as a thermal insulator.

## **DIATOMITE USE IN LIVESTOCK AND POULTRY PRODUCTION**

Food grade Diatomite users have reported four distinct uses in livestock and poultry production, namely insect and parasite control, mineralization, deodorization/absorption, and grain protection. At this stage one must admit that each use for Diatomite has its own folklore, facts and fiction associated with it of which some will be discussed below. Many uses including some of those presented here, are strictly reports of what people have done with the food grade Diatomite. More proper scientific work is therefore required to confirm the many positive testimonies and some peer reviewed work that already exists to give this product its rightful place in more effective and competitive "green" livestock food production practices. Optimal feeding levels in different species and for different applications will in particular be essential to develop through proper scientific studies. At this stage it appears that those levels will be anything between 0.5% and 2% of the total diet of animals or birds, but need to be finally expressed as milligrams required/animal or bird/day.

In Diatomite's mode of action, the shape of the diatom shells and the size of the holes in the surface of these shells play a very important role. In spite of the immense variations in shape and size, each diatom species has two things in common, chemically the same silica shell and physically an intricate perforated structure. Most of the total shell structures do not survive the mining and milling process. Surprisingly this is not a requirement for the numerous applications that exist for Diatomaceous earth. It is the myriad of interconnected pores and generally hard, irregular structure that is important to the functionality of this remarkable earth.

Being formed under water, diatoms will not dissolve in water. In fact, even in the stomach of animals or birds, surrounded with powerful digestive juices, they pass all the way through the body almost complete. A very small amount is leached out. As it passes through the stomach and intestinal tract, a number of important things happen. These happenings occur as safe and physical actions and not as chemical or nutritional.

### **Parasite and Insect control**

Controlling parasitic worms in a livestock operation is critical in maintaining a productive and healthy flock of sheep, or herd of cows, or young growing animals. Some insecticides have been banned due to the negative effects on animals and/or humans. The biggest driving force in the development of new insecticides has been the desire to replace toxic insecticides with "green products" to minimize the negative effects on the ecology in wilderness areas. It is true, that when used under the correct conditions, almost any chemical substance is 'safe', but when used under the wrong conditions most insecticides can be a threat to health and/or the environment.

Diatomite has been used for at least two decades as a natural de-wormer for animals. The veterinary faculty at Clemson University in South Carolina (Professor Jean Bertrand) was one of those that have clearly demonstrated that Diatomite can be used with huge success against internal worms and parasites. In their studies it increased the productivity and profit on dairy and cattle farms where an alternative for chemical products was required. Minnesota's Department of Agriculture also recommends Diatoms, while the Canadian Council for Organic Agriculture includes Diatomite on their suggested list of de-worming products. The National Council of Organic Standards (NSOB) and the National Experimental Council (NRC) in the USA have a data base of products published wherein they discuss the advantage of chemical inoculations and suggest that Diatomite be used as an alternative. Numerous South African farmers are already making use of Diatomite with great success. A few years ago, farmers in the Northern Cape noticed that wild animals visited certain areas and rolled in the soil. The observations that followed from this behaviour showed that there was a marked decline of the parasitic load on these animals. This observation was confirmed when containers filled with Diatomite were placed in trees and animals came to rub against them. Several trials followed and a marked effect was observed after a period of six weeks.

On a microscopic level Diatomite is extremely sharp with physico-sorptive properties; this is how it is used for example as an insect and ant killer. It is spread out finely in the area you need pest control and its abrasive action scratches off the water proof coating of the insects and absorbs lipids from the waxy outer layer of their exoskeletons, which basically causes them to dehydrate to death. Extensive studies for example on both ostrich and poultry has proven the product 100% effective against red mites, fleas, etc.

This abrasive action is also particularly good in humans and animals where medical-grade Diatomite is used in getting rid of unwanted parasites, worms (neutral anthelmintic de-wormer), etc. Another theory as to why Diatomite can be effective against internal parasites is that it acts as a buffer in the stomach creating a constantly neutral pH which results in an unsuitable environment for the feeding and reproduction of the parasites. Conversely, it creates an optimum environment for the animals' digestive systems. Some scientists believe that Diatomite is a de-ionizer or de-energizer of the worms or parasites. Regardless of the method of operation, farmers report definite control. More scientific evidence is required though to prove the different theories.

For effective use, the Diatomite must be fed long enough to catch all the newly hatching eggs or cycling of the worms through the lungs and back to the stomach. At this stage a minimum of 60 days is suggested at 1-2% of dry weight of the total ration. Do not give it to very small pregnant animals such as cats, guinea pigs, etc. and do not feed continually to babies or very small adult animals such as cats, hamsters, etc. The material may be fed on a continuous basis to larger livestock for continuous parasite control and other use.

To assess the efficacy of Diatomaceous earth as an alternative to anthelmintics in grazing ruminants, two scientific studies were carried out in the UK by Dr Barbara McLean. Animals treated with anthelmintics and groups of untreated animals were included for comparison. They concluded that cattle and sheep which received the Diatomaceous earth supplement had low Faecal Egg Counts (FEC) for the duration of the experimental period, similar to animals in the anthelmintic groups.

In addition, numerous on-farm trials have also been done in South Africa to determine the impact of Diatomite as a natural pesticide replacement for internal parasite control. One trial was conducted in a sheep feedlot in the Northern Cape from March 2009 to improve the quality of life of Dorper lambs and help remove internal parasites. This was done by including Diatomite in their feed as opposed to inoculating them. Inoculation is labour intensive and subjects the animals to stress because of the handling factor, whereas

Diatomite is a natural non-toxic pesticide included in their feed and causes no stress. Inoculating is also expensive, whereas Diatomite is inexpensive and therefore a more cost effective treatment with no side effects. Usually chemical treatment only kills internal parasites with no additional benefits, and has a withdrawal period prior to the animal product being marketed. Parasites also build up resistance against many of the chemical products and parasite reinfestation usually starts again soon after dosage with chemical treatments. Because no chemical action or reaction takes place, this process is mechanical in nature and no resistance or immunity can therefore be built up to it. It may also be thought of as a mechanical barrier or repellent.

Faecal samples of lambs in the Northern Cape study were collected the day before the trial started and sent to a renowned animal health company to be analysed for worm egg content. The lambs were divided into five groups with 15 animals in each group and placed in separate pens. Chalk colouring and ear tags were used to identify each pen. Each animal was weighed and manually graded. An average weight was given for each pen. All five groups received a Covexin injection on arrival which helps curb deaths from pulpy kidney and Pasteurella. For experimental reasons two groups received a 20 mm liquid diatom dose as well. Group one which is classified the control group received an injection for killing worms from a renowned animal health company.

The lambs were fed lucerne for the first three days to adjust from the veldt to feedlot conditions. Finishing pellets containing diatomite concentrate were slowly introduced to the lambs over a period of a further six days until they received 100% finishing pellets on day 10 containing 1% and 2% Diatomite. The control group was fed on finishing pellets containing no Diatomite.

Lamb weights increased during the experimental period in the feedlot. The group of lambs fed with 1% Diatoms Pellets weighed 10% more than the control group after 46 days. When slaughtered the lambs all graded A2's and A3's. First worm egg count reading of all lambs was 2 400. Final reading of lambs using Diatomite varied from 150 to 750. The control group which was inoculated for experimental reasons with a serum to kill worms had a reading of 600.

Due to serious intensification of wildlife farming and breeding farms over the last 20 years, game, similar to sheep and goats, have experienced an increase in internal parasite loads, which often prove fatal. Internal parasites like round worms, i.e. *Haemonchus spp* and other helminths, have caused great economic losses to game farms nationwide. Typical treatments used until now in combating helminths are chemical anthelmintics such as Ivermectin and Levamisole.

Unfortunately over time and due to bad dosage practice, worms have even in game developed a resistance to the chemical anthelmintics. Diatomite has shown to have positive health effects in informal trials done on specific game farms country wide. One such recent trial done by Dr Peter Rodgers on sable antelope has shown a 95% decline in faecal egg counts from a small group of sable antelope over a period of one year.

## **Mineralization**

Feeding Diatomite to poultry or livestock has constantly shown gains in production. This gain could probably be attributed to any single or combination of factors as described in this article. One obvious answer would be that the Diatomite reduced the parasite population which resulted in decreased stress on the animal and increased food assimilation. Maybe the "mineral" content of the Diatomite plays some role in this as well. Diatomite does provide a broad-spectrum of naturally occurring chelated minerals that include calcium, magnesium, iron, phosphate, sodium, titanium, potassium and others. Depending on levels

that will finally prove optimal, the mineral/trace mineral content that it provides could replace a small portion of the total mineral/trace mineral premix. However, the properties it contains in improving the absorption of other minerals and trace minerals, in particular the effect of silicon on improved overall mineralization (e.g. bone) as scientific studies (amongst others researchers of the University of Wisconsin) have clearly proven, could rather be the reason for enhanced performance. In vivo experiments with rats for example revealed a relationship between silicon and calcium in bone formation where dietary silicon increased the rate of mineralization. Subsequently it also showed to be positively involved with magnesium and fluorine in the growing bone of the chicken. Other studies support this for they have indicated that silicon is involved in the metabolic chain of events necessary for the epiphyseal cartilage sequences required for normal bone growth.

Dr Edith Carlisle undertook a study in the mid 1970's at the University of California (J. Nutr. 106:478-484, 1976) where she demonstrated the essentiality of silicon for growth and development in chickens. From this study, it was reported that the silicon supplemented group had thicker legs and larger combs in proportion to their size as well as a significantly higher incremental average daily gain (36g over 24 days). Dr Carlisle also demonstrated that the site of action was in the glycosaminoglycan-protein complexes of the ground substance.

In humans for example, silicon has also been proven to be responsible for the depositing of minerals into the bones, especially calcium. Some scientists even refer to it as a precursor for calcium that could replace some calcium if it becomes insufficient. Specific work by a group of Orthopaedic Surgeons in Pennsylvania (Prof A.R. Vaccaro) and New York (Dr J.F. Brandoff; Prof J.S. Silber) further proved that silicate selectively replaced phosphate in the calcium-phosphate lattice structure and potentially provides a catalyst for bone formation.

In animals and poultry there are various examples across species where production or health problems are linked to calcium deficiency. Feeding Diatomite with its possible large range of functions may therefore serve at the same time as a comforting tool to alleviate or prevent any calcium related performance or health issues if and when they may occur.

### **Deodorization/Absorption**

Since deodorizing and absorption are natural functions of Diatomite they can be added as another major farm use benefit. These two functions will continue to happen as undigested Diatomite passes through with manure. Reduced fly hatching is usually observed in manure from livestock fed Diatomite. Some dairy and pig farmers are also spreading it in bedding (for odour and moisture control) in addition to that coming through the manure. There is no reason why it will not be very effective in the bedding of broiler and free range layer chickens. Evidence also shows that it binds  $\text{NH}_3$  very effectively, which will certainly have big health effects and is a reason for the product being such a good odour reducer in most intensive farming operations.

In today's world, most of all food (animal or human), all water and air contains harmful substances, which taken internally causes stress on the immune system. Each individual Diatomite shell has a strong negative charge and it is very fortunate that many harmful things entering the body have a positive charge. Acting as a magnet, the negatively charged shell attracts and absorbs positive things that are small enough to go through the holes. Because of the strong charge, each shell can absorb a large number of positively charged substances, irrespective of whether they may be chemical or in the form of bacteria or viruses. They pass on through the stomach and intestine, taking these harmful substances out of the body. Gram positive bacteria that are usually targeted in ruminant animals by the use of antimicrobial feed additives may also bind to the negatively charged shells if Diatomite would be added into the feed of such animals. This could further mean that Diatomite may perhaps be an effective replacer for antibiotic and antimicrobial products

commonly used to perform these functions. An in vitro assay study was also recently done at Onderstepoort to determine the impact that Diatomite (2% concentration) exposure may have against *Escherichia coli* (ATCC 25922), *Staphylococcus aureus* (ATCC 29213) and *Pseudomonas aeruginosa* (ATCC 27853). From the report it was evident that after only 20 minutes the three bacterial isolates were inactivated 86.8%, 46.7% and 94.5% respectively.

The absorption characteristics may probably be one of the most important traits Diatomite could have. Too little peer reviewed work unfortunately still exists and therefore Animate has made this specific trait one of the key areas that will be researched on this product within the next 12 months.

### **Grain Protection and Anti-caking Properties**

Another use to mention would be grain and flour storage. Diatomite offers a great and easy answer to chemical contamination of stored grain and feeds. Irradiation could be used, but cost and negative health effects make it very undesirable. Grain board tests in Canada have proven in the field that Diatomite protects stored grain without contaminating it. The fresh water diatoms are preferred to sea types for several reasons. The bio-activity seems to be better and the health ramifications of breathing the fine white dust seems to be almost negligible because of its 99% plus amorphous structure compared with a higher percentage crystalline structure.

Diatomite also has wide application for an anti-caking agent in grain storage as well as mixed feeds. This helps for better flowability, mixing and handling by preventing particles from clumping together.

### **TESTIMONIES AND OFFICIAL RESULTS**

Diatomite further also appears to aid directly in feed conversion and production performance, and promotes better health and animal product quality (e.g. egg shells). At the same time silicon in Diatomite stimulates energy and cell metabolism and helps prevent kidney stones and health infections of the urinary tract. It further strengthens and stimulates the immune system and stimulates hair growth and improves its shine, luster and strength (application in horses and show cattle).

Below are just a few of the typical numerous global and local testimonies by veterinarians and larger farming operators on results and observations made in their operations with commercial studies.

1. Two controlled on farm lamb feedlot performance studies have been conducted in South Africa. One trial used 75 lambs (Trial 1) and another 30 lambs (Trial 2). The lambs in both studies were randomly allocated into different groups. In Trial 1 three treatments were evaluated (Control with no Diatomite, 1% Diatomite and 2% Diatomite). In this trial a significant reduction in worm egg counts was observed for both Diatomite treatments after 31 days of feeding compared to the Control group. Significant performance improvements were also measured for the Diatomite treatments. Feed conversion rate was improved by 5% and 11% and overall profitability per lamb was R12-35 and R35-35 in favour of the 1% Diatomite and 2% Diatomite groups respectively above the Control group. In Trial 2, two treatments were evaluated (Control with Cidectin, 1% Diatomite without Cidectin). Significant performance improvements were also measured for the 1% Diatomite treatment in this trial. ADG was improved by 1.12kg live weight and overall profitability (accounted for Cidectin and Diatomite cost in each treatment) per lamb was R16-44 in favour of the 1% Diatomite group above that of the Control group.

2. In a dairy herd 15-20% higher butterfat was recorded compared to the group that had no Diatomite. All fly larvae in the manure were destroyed. Diatomite was also very effective in fully replacing the chemical de-wormer in the herd.
3. In another dairy herd the Diatomite group improved in milk quality (butterfat increase from 3.7 to 3.9%) and cow health. The product's buffering capabilities in the rumen helped digestion allowing for better nutrient utilization of the same diet. It also stopped cows from eating dirt.
4. One test involved 12 dairy cows, one half of the cows in each group had five percent by weight of the feed replaced with Diatomite. Composite milk samples of four consecutive milkings were analyzed for fat, solids-not-fat, and protein. Test results showed a milk fat percent increase from 3.97 percent to 4.04 percent and a milk-solids-not-fat increase from 3.76 percent to 3.81 percent in the experimental animals over the control animals.
5. Another test involved a herd of purebred Jerseys, which were fed Diatomite on a "free choice" basis, i.e. without mixing it in with the feed. At the end of 18 months there was a 15 % average increase in butterfat as well as a 15 % increase in milk per cow.
6. Complete odour and fly control was observed in a dairy barn with Diatomite treatment. It also successfully replaced some of the current mineral supplement and resulted in more shiny coats and general health improvement.
7. In another test, alternate Holstein-Friesian calves, destined to be retained in the herd, were fed 4g of the Diatomite earth in the morning milk feeding. This amounted to approximately 1% of the dry food intake of the calves. After 8 weeks, the test animals showed an increase in weight of 1.36kg per calf over the control animals. At the end of 16 weeks, the increase in weight of the test animals over the control animals was 2.26kg, and at the end of 17 weeks, the increase was 5kg.
8. Diatomite eliminated calve scours by 99% in a herd of 2000 dairy calves. This operation completely stopped to use vaccines and antibiotics. Coats of calves are also shinier. Flies, larvae and excrement odour have almost been completely eliminated.
9. A pasture study in Minnesota, USA on Holstein heifers (227kg) showed no worms either mid- or late season when these animals consumed 65g Diatomite per day (0.3g/kg BW).
10. In a test involving the feeding of Diatomite to feeder steers, the average gain of the test animals was 1.29kg per day compared with 1.06kg for the control animals. After a 3-month period, the average increase in weight of the test animals over the control animals was 28.3kg.
11. Diatomite was also fed to milk goats by mixing in one handful of finely divided product with the daily ration of each goat. Prior to the usage of Diatomite, the goats were infested with worms and it was unsatisfactory to feed them worm medicine because it made the milk unfit for human consumption. After feeding them Diatomite, there was no more trouble with worms and the Diatomite did not affect the taste of the milk in any manner whatsoever.
12. Tests on feeder pigs eliminated internal parasites in the test group in 7 days. Odour was noticeably less offensive after 21 days. Fly population decreased markedly after 6 weeks and feed conversion improved.

13. In a test involving 1300 feeder pigs kept on concrete at all times and varying in age and weight from weanlings of 8 weeks, to market age, one half of the pigs were fed a regular ration and the other half had two percent, by weight, of the regular ration replaced with Diatomite. On the third day following the beginning of the test and for 3 to 4 days thereafter, round worms (Ascarids) were observed in all pens of the control pigs. Parasite studies, direct smear and flotation method, showed no internal parasites at any time in the test group. The control group, even though previously de-wormed with Piperazine, had Ascarids (low level) and *M. hirvudinaceous* (low level). By the tenth day, all test pigs had stopped rooting and destroying the wooden feeders while the control group showed no change and continued to destroy feeders and fences at the same rate. They also continued to root in the holding pens prior to shipment.
14. Two controlled on farm broiler performance studies have been conducted in South Africa at medium sized operations. One trial used 36000 birds and another ±6000 birds. These birds were randomly split into two groups; a Control and a 2% Diatomite treatment group. In the 36000 bird trial growth was improved by 11% and mortality was reduced by 1.2%. In this study the profitability per bird was R0-95 in favour of the Diatomite group. In the 6000 bird trial growth was improved by 6.3% and feed conversion by 4.2%. In this study the profitability was R0-30 per bird in favour of the Diatomite group.
15. Tests on laying chickens showed less flies with 16000 White Leghorn Caged Layers (8000 in control and 8000 in treatment group) and 75 percent less deaths (14-16/day for control vs 2-5/day for treatment group). Droppings were also of drier consistency. Diatomite vs non Diatomite use also gave a 2-4 case/day increase in egg production and egg breakage went down.
16. Diatomite eliminated the need to further de-worm horses. Its presence in the faeces prohibited larvae and development of adult flies and thereby reduced fly problems. It also stopped horses from chewing fences.
17. In a test on dogs, hookworms disappeared after the first day when Diatomite was fed to dogs and puppies at the rate of one full tablespoon per day to large dogs and one full teaspoon per day to small dogs and puppies.
18. Diatomite was fed to grey-hounds at the rate of 450g mixed in with the rations for sixty dogs of all ages. One litter of pups which had been receiving the ration with the Diatomite mixed in with it for approximately four months, were wormed for a check test and there were no visible signs of worms of any kind. All of the dogs, full grown and pups, showed a marked improvement in health and appearance.

## **RESEARCH AND DEVELOPMENT**

Dose response studies will be conducted at the University of Pretoria to determine optimal Diatomite feeding levels for lambs and feedlot cattle as the current recommended levels of 1% to 2% could be significantly higher than the optimal level that will finally be established and recommended by Animate. Similar dose response studies will also be conducted on dairy cattle. The criteria that will receive focus in these studies will be performance and health improvement, rumen buffering capacity, digestive improvement, parasite and fly control as well as the replacement of growth promoting antimicrobials and antibiotics.

In addition, dose response studies (0.5%, 1.25%, 2% levels) are already in the process to be conducted at the University of Pretoria to determine optimal Diatomite feeding levels for broilers as the recommended level of 2% used until now could also be much higher than the optimal level that will finally be established and recommended by Animate. At the same time



it will also be determined in this study if the product can either replace, or works in synergism, with antibiotics in broiler birds. Both these immediate ruminant and poultry studies will be the first of a series of studies to provide proper scientific data on the efficacy of Diatomite to enhance livestock and poultry production and improve profitability when Diatomite is fed to production animals and birds.

Intensive scientific studies on game (Diatomite treatment levels = 0.2g and 0.4g per kg BW) are also under way in conjunction with the University of Pretoria to optimize Diatomite feeding levels for parasite control and where extensive observations will be done to further justify the cost effective use of Diatomite as a replacement for chemical de-wormers.

Similarly, scientific dose response studies on pigs will also soon be conducted to prove the efficacy of Diatomite to enhance pig production and health, and improve profitability when Diatomite is fed to these animals.

A horse trial at a well known racing stable in South Africa is further underway where internal parasite elimination and fly control will be studied together with general health and appearance criteria. Based on observations of previous work, levels of 100-150g per 450-kg horse will be used in this study.

Depending on the outcome of all of the above initial studies, further research will be conducted to:

1. Better understand the mechanisms and sites of action of Diatomite (or silicon).
2. Determine its real efficacy and value in livestock and poultry production.
3. Determine its efficiency as a replacement for "non-green" products.
4. Further refine Diatomite feeding levels.

## **COMMERCIAL APPLICATION OF DIATOMITE AND USE WITHIN VALUE ADDED PRODUCTS**

Most livestock will acquire a "taste" for Diatomite if a small amount is mixed in with other feed. After acquiring a "taste" for Diatomite they may even take it free-choice, but in most instances it is necessary to thoroughly mix it with the regular feed ration. It has also been determined that it is advisable to feed the Diatomite to larger livestock animals on a regular basis for at least 60 to 120 days to obtain maximum results.

Diatomite is currently marketed in the form of concentrate (powder) which is mixed into feeds, licks, and blocks, which the animals ingest through various application systems. As described above, South African farmers have used Diatoms under extensive (veldt) conditions with excellent results. Animal trials under feedlot conditions have been conducted recently with excellent results as described earlier.

Specific products have been developed elsewhere where Diatomite is very effective to convert molasses in a 50:50 blend to a dry powder. While the benefit of molasses in such a blend is well understood, the Diatomite can be much more than just a carrier.

Another application is externally in the form of a rolling method, where 200 – 300 kg material is spread over a small area. Game and domestic animals will come and roll at these places. The diatoms come in contact with the parasites that will shrink and eventually die from dehydration. Similarly, the dusting of barns and areas alike with dry Diatomite to repel flies, and the feeding of Diatomite to cattle and other species in order to have a certain percentage of the Diatomite uniformly dispersed in the animals' excreta so that fly larvae will not proliferate therein.

Obviously Diatomite has great application as well for smaller domestic animals, especially as a natural product in combating parasites. A full tablespoon per day for large dogs and a full teaspoon per day for small dogs, puppies, and cats seems at this stage the most optimal dosage level. Adding Diatomite into the feed by Petfood companies may be the easiest way to ensure safe and effective access to such animals.