

Sarah Roose

By: Sarah Roose
Education: Animal Healthcare
Student number: 920127001
Module: Project Stage
Teacher Tutor: K. Bolding
Company: EM Agriton BV
Address: Molenstraat 10-1
8391 AJ Noordwolde
Website: www.agriton.com
Supervisor: J. Hoekstra Feersma
Van Hall Larenstein
Noordwolde, January 13, 2015

Preface

Before you is the investigation report on the application of EM in treating thrush. This research I carried out in the course of my internship project at EM Agriton BV Noordwolde.

Agriton had developed a product for use on hoof, hoof and skin and during my internship I could put a research focused on the application of the product by hoof problems in horses. I got the chance to set up a research independently and to perform and because it is to do your own thing in this way, to make decisions, approach the right people, and perhaps most importantly, from your own mistakes to learn, I want to thank Mr. Jan Feersma Hoekstra and Albert the Puijselaar very much for this opportunity.

For this test I had obviously horses with thrush needed. The team Startlijsten.nl has given me the wonderful opportunity to post an article and a call for this I am very grateful to them. This call came so many reactions and applications from enthusiastic people. Unfortunately fit because of the time not everyone on the route. It was very fun to work with this group of people and I want to thank everyone again, without motivated participants the trial would not have been possible.

Besides the participants I would like to thank a number of people in this way: Mr Menno Holzhauer, veterinarian at the Animal Health Service, for its cooperation and assistance in setting up a score distribution and brainstorming on the experimental design. Joost Ydema and Marco's Dierenkliniek Wolvega Brown, for their hospitality, knowledge sharing and the ability to attend a hoof surgery. Hans van Maurik of Dierenkliniek Emmeloord for the frank discussion of hoof diseases in horses. Jan van Delden for helping and joining in the statistical part of the investigation and finally, one of the most important people related to my internship, Klaas Bolding, my teacher supervisor from Van Hall Larenstein, for the good guidance around my internship.

Following this research, there is still a personal message that I still called will in this report: as you will see in this report, there is relatively little research on the disease thrush, because, they say, "horses not suffer from this condition." It would be better to say, "We do not suffer from the condition." The horses are in most cases not lame, but while watching the horses have reacted indeed a painful reaction when touching the affected parts heels. Personally I do not believe that the horses do not suffer from and I wonder what the consequences of thrush are in the long run, I hereby object instance possible arthritis by relieving the back of the hooves. Enough food for thought and fodder for researchers so.

In this report, first drew attention to the potential for treatment with EM and here I want to wish you a pleasant reading.

Noordwolde 13 January
Sarah Roose

Resume

Because thrush is a common problem in horses, this research was conducted. Research by the Animal Health and the Faculty of Veterinary Medicine in 2012 showed that 48% of the examined horses thrush occurred. In this research is finding ways this using Effective Microorganisms (EM), a mix of good microorganisms: lactic acid bacteria, yeasts, actinomycetes, photosynthetic bacteria and fermenting fungal species, treat. For this purpose a gel is developed in which the EM have been added. The expectation was that the bacteria and yeasts from the gel to compete with the microorganisms that cause thrush, creating a good environment in the beam and the hoof is healthy again. This study sought to answer the question "what is the effect of treatment with a gel with Effective Microorganisms (EM) on horse hooves with thrush?". We also looked at the relationship between the barn hygiene and severity of the condition.

In an experimental comparative study examined whether there is a difference between the conduct of the rotstraalinfectie in a hoof that has been treated with EM hoefgel and in a horseshoe which has not been treated. For this purpose it is sought to horses with thrush in at least two horseshoes, in order to get the same

horse-factors in each group. The owners carried out the treatment and the hooves are scored three times: before treatment the treatment after one week and after five weeks of treatment. When scoring looked at the characteristics: hardness, humidity, odor, heel degradation, degradation and sole beam deterioration. In cooperation with the GD are here scores attached. The treatment that is tested in this study consisted of one week of daily treatment, and thereafter to handle the three days.

For the experiment were 36 horses available in the Netherlands, these horses are logged in response to an article about the research on Startlijsten.nl. Eventually 34 horses throughout the study period made full. In Microsoft Excel and IBM SPSS Statistics 22.0, the data are processed with Generalized Linear Mixed Model results are tested.

Thrush is a condition in which the radius of the hoof rotten, it is caused by various micro-organisms including the *Fusobacterium necrophorum*, and the *Candida Albicans*. These micro-organisms are normally found in and around humans and animals, but they may be detrimental under specific conditions.

The EM technology originated in 1982. The operation of EM is based on competition between groups of micro-organisms. The EM mix consists of anaerobic and aerobic microbes, they provide for the suppression of undesirable microorganisms, promote decomposition of organic material, suppressing odors and support plant growth.

From the results it is striking that are the scores of treated group prior to the treatment was higher than the scores of the control group. After one week, the scores of the treated group dropped below that of the control group and in the weeks after they run off evenly. The decrease applies to both groups for this reason, there could be no significant difference demonstrated between the groups, in the course of time though. Also, it is to see the effect of the stable hygiene in the results, a poor hygiene gave higher scores.

Major points of discussion regarding the trial design, the differences in scores between the two groups at the baseline and the decision to treat a week daily and every three days. As for the data processing is the question of how much value is to be granted to the differences between the classes. Play a role in terms of content, two questions: first, the effect within the horse in the treatment of a hoof and in addition the effect on the environment in the stable by the treatment of a horseshoe.

It can be concluded that there is no effect of treatment with EM can be demonstrated. However, it is heartily recommended to do further research, possibly with a different setup. Especially because of the fact that the hooves are clearly improved. The influence of the stable hygiene could be demonstrated in this study, in which a worse hygiene creates a heavier disorder.

Index

1.

2. Introduction

1. Problem Description

The horse in the Netherlands the number of hoof problems seems an underestimated problem. A study by the Animal Health and the Faculty of Veterinary Medicine in 2012 showed that 72% of horses at the time of routine maintenance had one or more hoof disorders, with an average of 1.3 problems per horse. The most common disorder pale thrush, it was observed in 48% of horses from the research. This is an infectious disease whereby the hygiene of the environment plays a major role (Holzhauer, 2012).

Because thrush occurs so often there is a study on the use of products based on effective microorganisms (EM). Besides thrush multiple hoof problems which are infectious in nature and that may EM can be treated, but because thrush is so common, it was decided to focus on the research here.

The result of this research is the experience that EM are already successfully applied in various fields, such as forage conservation and barn hygiene, especially in dairy cattle. In addition, it was expected that it can be successful in the treatment or prevention of thrush. In the application of EM is one of the 'dominance principle': wherein the degenerative (poor, degrading) micro-organisms are in front of the regenerative (good, building) micro-organisms. These groups are both dominant, but there is still a third group is playing with it, the neutral micro-organisms. The neutral, also called opportunistic, micro-organisms on the side of the widest represented group (Higa, 1998). When, from this point of view, to thrush, a condition in which the hoof by "bad" micro-organisms from the living environment becomes infected, it is looked at, it is likely that by the addition of proper micro-organisms, can suppress the bad micro-organisms, so that the regenerating environment is maintained and the need remains healthy.

On the basis of this theory, it was expected that the bacteria and yeasts from the gel to compete with the micro-organisms in the hoof radius. The expected effect is that when the effective microorganisms dominate the degenerative effect of micro-organisms that cause the hoof thrush stops and that in turn is healthy.

Whereby it must be noted that the abnormal horn must be removed.

2. Purpose of the investigation

The aim of the study is to assess the effect of EM on the hoof health of horses. They specifically looked at the condition thrush, which research has been done into the differences between hooves were treated with EM and have not dealt with it. The study consisted of a literature review, in which attention is paid to the working principle of EM and hoof condition thrush. Next, there is carried out a field trial, in which the effect of EM is

measured at thrush in horses. The research was conducted at the beginning of the winter, between October 20 and December 5, 2014. By conducting research in this period there was a large number of horses with thrush available, this is because thrush often in this period plays up the wet conditions and structures. The goal was to get card within the study period, the effect of treatment with EM during this period has had on the infected farms.

3. Research questions

The main question of the research is:

"What is the effect of treatment with a gel with Effective Microorganisms (EM) on horse hooves with thrush?"

To answer this question, there is drawn up a number of questions:

- What is the difference between the course of the rotstraalaandoening by the hooves treated with EM and the untreated need?
- Is there a correlation between the severity of the rotstraalaandoening and barn hygiene?

4. Notions

Important concepts relating to the study are outlined below:

EM

EM stands for Effective Micro-organisms, EM products rests its operation on the presence of the micro-organisms. For this purpose, a mix used for aerobic and anaerobic, with and without oxygen live micro-organisms Allen regenerative micro-organisms, constructive organisms, which, when there are more than placing the degenerative micro-organisms, their habitat again in a healthy and vigorous state . In EM are mainly lactic acid bacteria, yeasts, actinomycetes, photosynthetic bacteria and fermenting fungal species (Higa, 1998).

Aerobic micro-organisms

With oxygen living organisms.

Anaerobic micro-organisms

Without oxygen living organisms, oxygen is harmful to these organisms.

Dominance Principle

The domination principle means that the largest group of micro-organisms, regenerating opposite degenerating micro-organisms prevails. This is enhanced by a large group of neutral micro-organisms, which cooperates with the dominant group (Higa, 1998).

Regenerating micro-organisms

10% of the micro-organisms are regenerating, constructive organisms, both aerobic and anaerobic organisms, these are the "good" micro-organisms which maintain life (Higa, 1998).

Degenerating microorganisms

And degenerating micro-organisms, 10% of the micro-organisms causing decay, caries disease and death. This poor micro-organisms may be both anaerobically and aerobically (Higa, 1998).

Neutral micro-organisms

The neutral or opportunistic group of micro-organisms is by far the largest group, about 80%. This anaerobic and aerobic micro-organisms may also degenerative and regenerative works. Depending on whether they associate themselves with the dominant group of microorganisms (Higa, 1998).

Thrush

Thrush is an infectious disease of horses' hooves, also pododermatitis (or English: Thrush) mentioned. Because the need to be constantly exposed to dirt and moisture, reducing the resistance of the hoof, another poor hoof quality and lack of exercise give it effect. Allowing micro-organisms which are usually present in the vicinity of the horse, are given the chance to put in the (deep) grooves of the hoof radius a degenerative process in motion. This involves the jet as it were rotting, falling apart and there is a stinking fluid and sometimes pus separated (Hoof Specialist Klaas Feuth, 2013). From a number of microorganisms are known to play a role in the occurrence of thrush: the anaerobic bacterium *Fusobacterium necrophorum* (Petrov & Dicks, 2012) and the fungus *Candida Albicans* (Davies, 2012).

5. Content report

In this research, after this introduction first read how the research is designed and implemented, including materials and methods. Subsequently, the information is processed from the literature review in chapter three. The results of the studies shall be made visible in the fourth chapter. Then these results are discussed in chapter six and then to formulate a conclusion. Finally, the sources used are displayed and added a number of annexes, referred to from this report.

3. Material and methods

This chapter will describe how research is designed and implemented.

1. Type research

The research consisted mainly of a practical study, which sought is the effect of EM on thrush in horses. Prior

literature research is done about this, the causes, pathogens and current treatments for thrush.

2. Research Design

The study was conducted as an experimental comparative studies (case-control study), hereby investigated whether there is a difference between the conduct of the rotstraalinfectie in a hoof treated with EM hoefgel and in a horseshoe remained untreated. With the aid of a score sheet is determined the severity of the condition, and on the basis of a survey of such other elements as are depicted, and is given a score for the hygiene.

We searched for horses with a rotstraalinfectie at least two horseshoes, this ensures that test group and control group were in the same circumstances. In each case one of the two having treated and in three affected hooves, two were treated with the EM hoefgel and one untreated. Treatment with EM means that there is a gel is lubricated in the radius of the hoof containing 10% EM solution. The EM solution is a solution of 50% EM and water, it contains lactic acid bacteria, photosynthetic bacteria and yeasts (EM Agriton BV, 2014).

The owners of the horses carried out the treatment. They do so knew what was or was not treated. It was agreed that they do not treat the control unless they no longer felt this responsibility, all in close consultation. All participants carried out the treatment on the basis of a manual which as [Appendix 1](#) is incorporated to this report ,.

Prior to treatment, all having been scored, this was the baseline. Next, the hooves of the treated group are treated every day for a week. After this week all having been scored again and the treatment is continued after which it was treated to three days. After five weeks of treatment, the need for last scored. We have chosen this method of treatment because it is in the EM theory assumed that by adding the good microorganisms a tipping point may be reached within a short period, after which this healthy environment only requires maintenance (Hammes, 2011).

3. Study population

The study population consisted of horses with thrush in the Netherlands. It may be noted that the number of horses in the Netherlands is estimated at 350 to 400 thousand horses and ponies (Agricola, Wheels, & Kistenkas, 2008). In addition, a study by the Animal Health showed that 48% of all examined horses had rotstraalaandoening (Holzhauer, 2012).

The research unit was thus a horseshoe with thrush. In total there were 34 horses have tested and 107. The group treated with EM consisted of 54 farms and the untreated group consisted of 53 do. The study started with 36 horses, downtime for various reasons, there are still two of the 36 horses fallen.

The participating horses are found by placing an article and a call on the Dutch platform for the equestrian competition: Startlijsten.nl, in addition there are a number of applications received by a call on the greatest horse forum Netherlands: Bokt.nl. The article is included in [Appendix 2](#) of this report.

4. Data collection methods

The data for this study was obtained by scoring the hooves in the practical as well by taking a survey of all participants, this survey back to view the report. The scoring of the hooves is done three times, on the basis of a score form, see [Appendix 4](#) Here, the hooves are scored by the investigator to know six characteristics: Hardness, humidity, odor, heel degradation, jet degradation and sole degradation. Subsequently, based on the pictures and the collected scores attributed a score. This score is based on the classification of the Animal Health Service in conjunction with the scores of the scoresheet. This score layout is shown in [Appendix 5](#) .For both the scoresheet and the classification of thrush, the higher the score, the more severe the thrush.

5. Processing and analyzing the data

The obtained data was first made clear in Microsoft Excel 2010, then the data in IBM SPSS Statistics 22.0 processed. Using Generalized Linear Mixed Model has been reviewed the research question.

4. Literature review

To gain insight into the condition thrush in horses was carried out a literature review. This chapter is to read what is thrush, which pathogens play a role, which current treatment methods are used and what role EM could play in this.

1. Thrush

Thrush is a disease of the radius of the hoof, the radius is the triangle, of which the back side of the hoof is running to the middle, as shown in the adjacent figure. The radius of grooves, the grooves which balls from the heel (in the picture above) in a triangular shape toward the center of the hoof run. The middle beam quarry, the quarry which runs through the center of the beam, which often occurs in the quarry thrush. When the horse has thrush, are in the radius degenerative micro-organisms present, which affect the radius. There is no specific organism to designate as the cause, but it is most commonly found *Fusobacterium necrophorum* and the fungus *Candida albicans* (Davies, 2012).

The *Fusobacterium necrophorum* is normally found in the oral cavity, intestinal tract and urinary tract of

humans and animals (Smith, 1975). The condition is associated with necrosis and abscess formation (Wilson & Miles, 1975). The outer membrane of the bacterium contains lipopolysaccharide, an endotoxin which brings about a vigorous immune response, when the bacterium enters the body of human or animal (Todar, 2012). In addition, *Fusobacterium necrophorum* differs from that exotoxins cause hemolysis, degradation of leukocytes and cell degradation. Usually the *Fusobacterium necrophorum* plays only when the host is already another infection or a wound suffered (Langworth, 1977). The *Fusobacterium necrophorum* causes include bovine foot rot (Arendzen, 1999) and diphtheria in calves (Hanekamp, Smits, and Wieringa, 1989). The yeast-like fungus *Candida albicans* is found in the environment of humans and animals. Normally it lives as a harmless germ guest on mouth and digestive system of mammals. Nevertheless, the *Candida albicans*, in humans, the most common cause of fungal infections. Infection can occur when the immune system is reduced, the skin or the mucous membrane is damaged as well by hormone treatments (Smet, 2006). Thrush frequently occurs in wet, unsanitary conditions, wherein the horse is in urine and manure. Even leaving out the daily hoof care and regular maintenance by the farrier affects developing thrush. Horses with steeper and therefore often need high heels are especially sensitive, because these horses radius quarry is often deep (Baxter, 2011).

2. Effective microorganisms (EM)

EM stands for effective micro-organisms, this is a mixture of lactic acid bacteria, yeasts, actinomycetes, photosynthetic bacteria and fermenting fungal species (Higa, 1998).

1. Arise EM technology

The Japanese professor Teruo Higa is the man who stood at the cradle of the EM technology. He came here more or less by chance contact by children. As a lecturer at the University of Okinawa, he was engaged in the tropical horticulture and was involved in various projects at home and abroad. As a result of his health problems, he came to the realization that the use of chemical agents sometimes the cause of this might be. When he was involved in a project where the plants were diseased and the chemicals were not healthy, he discovered that these plants started to grow again when they were in a ditch that drained kitchen sewage were thrown. Then began his research into the possibilities and the right composition of microorganisms. After a long search Professor Teruo Higa found the right combination of microorganisms. He called these Effective Microorganisms ie EM. In 1982 EM ready for use since 1996 and is available in the Netherlands (Higa, 1998).

5. Results

After the execution of the test and the collection of the data, they are analyzed. This chapter shows the results of the test.

1. General impression seriousness rock traartaart avenue disorders

To see a general impression to get the distribution of scores in the figures below the distribution by measuring time on the scores. In [Figure 2](#), the score distribution hooves of the treated group, in [Figure 3](#) the distribution of scores of the untreated hooves.

[Figure 2 Overview different scores for each measurement point in the treated group](#)

[Figure 3 Overview different scores for each measurement point in the untreated group](#)

The data collected through the survey, did not variables that influenced the severity of the thrush condition. These characteristics include age, race, purpose, hours spout, spout soil, type of bedding in the stable staple diet and have had earlier rotstraalinfecties. Of all these parameters, no relationship could be demonstrated by the seriousness of the current infection.

2. Treatment Effect

The research question, what is the difference between the course of the rotstraalaandoening by the hooves treated with EM and untreated hooves, is tested using Generalized Linear Mixed Models. In [Figure 4](#) it can be seen the course of the scores of the two treatment groups at the three measurement points. In this state, the red line of the scores of the group treated with EM and the blue line for the scores of the control group.

[Figure 4 Conduct rotstraalscore per group \(IBM SPSS Statistics 22.0, GLMM\)](#)

Between the different measuring time points to see is a significant difference in the level of the scores $GLMM, F(2, 315) = 36.819, P = .000$. Between the course of rotstraalaandoening in the different treatment groups, no significant difference was demonstrated $GLMM, F(1, 315) = 0.137, P = .712$. See [Figure 5](#).

3. [Figure 5 Effect on rotstraalscore \(IBM SPSS Statistics 22.0, GLMM\)](#)

Influence stable hygiene

In order to acquire a picture of the influence of the stable hygiene is on the severity of the rotstraalaandoening, this factor is included in the statistical model. In [Figure 6](#), the scores for each measurement time are spliced to the valuation of the barn hygiene. When this is broken down further, as shown in [Appendix 6](#), it appears that the trend can be seen here, does not differ by treatment group.

[Figure 6 Rotstraalscores disaggregated hygiene classes \(IBM Statistics 22.0 GLMM\)](#)

The influence of the stable hygiene seem significant, *GLMM*, $F(2, 309) = 6.869$, $P = .001$, in [Figure 7](#) is made visible.

4. [Figure 7 Effect on rotstraalscores including hygiene scores \(IBM SPSS Statistics 22.0 GLMM\)](#)

Model

In [Figure 8](#) the model is schematically shown. The model is rejected as not enough to be able to estimate the rotstraalscore in good, but it does give an idea of the magnitude of the effects with respect to each other. The model assumes an initial value which is set at measuring moment Three (measurement = 3), wherein the hoof or treated with EM (Treatment = 1), and wherein the stable hygiene poor (Stable hygiene = 2) is. From these initial values are displayed in each factor, the effect on the score, the orange line to this is for a decrease in the score, so a healthier horseshoe, the blue line represents increase in the score, so a more affected hoof. The thickness of the line shows how big the effect is. The greatest effect with respect to the initial value is created when the stable hygiene at the moment of measurement is good (Stable hygiene = 0). The difference with an untreated hoof (Treatment = 0) under the same conditions is given the thickness of the line many times smaller and, moreover, are not significant. The latter was in the previous paragraphs is also made visible.

Debate

In this chapter the results of the study will be discussed. First of all, with respect to the experimental design, then the processing of the information, and finally the content.

1. Experimental design

The trial ran with 34 horses, these were spread over 21 companies, this will give a horse a lot of different circumstances which may affect the effect of the treatment or of the omission of treatment. For this reason, there are required per horse in the test group and having placed in the control group. This allows for the same conditions of test and control group, but has the disadvantage that pilot and control group can influence each other.

It was decided to compare treated with hooves that have remained totally untreated. Thus, there is used no placebo agent, because the treatment was carried out by the owner and not by the researcher, this had no effect on the determination of the scores. The fact that the owners of the horses in advance knew what they had to do was still dealing with a disadvantage: in most cases, chosen to treat the most affected farms. This gave a big difference in the baseline. Because the need to be scored in order to first determine the need could participate in the trial, the choice was between whether or not to treat, on the spot made by the owner.

The treatment consisted of a week daily treatment and then every three days. In theory, that the treatment is tested. Nevertheless, there are, in practice, therefore, tested in fact two treatments, the treatment is adjusted during the examination, from daily to every three days. That it does not conform to the assumption in this way is to say that it does not remain in the daily treatment gave the same result. Changing treatment during an ongoing pilot is an initial investigation into the operation of a particular product a risky choice.

Finding happened participants for the trial through a call. This meant that motivated participants contact recordings. One possible disadvantage is that participants saw this research as "last resort". Because the owners of the treatments carried out, it is difficult to determine whether this consistently correctly happened and if untreated hoof actually remained untreated.

During the study, there were three score moments, in connection with the two phases of the treatment found this place in advance, after one week treatment and after 5 weeks treatment. This means there is little insight into what happened prematurely and that the measurement points are unevenly distributed over time can also give a distorted picture.

2. Data processing

The severity of rotstraalaandoening was divided into five classes: Class 0 is healthy and four seriously. The disadvantage of such a distribution is the fact that the differences between the classes does not have to be equal. The difference between healthy, 0 and class 1 may be greater than the difference between one and the class two, and vice versa as well. The fact that the disorder in "but" five classes is divided can ensure that small improvements and deteriorations not to be out of the scores.

The results of the test are included in IBM SPSS Statistics 22.0 with the method Generalized Linear Mixed Model (GLMM). This is within SPSS is the only opportunity to test two different treatment to different measurement intervals. Because characterized rotstraalscore, not a normal distribution had to be the most corresponding distribution are chosen, this turned out to be the Poisson distribution.

3. content

Participating horses were owned by different owners and those arriving by different companies. This brings with it many environmental influences. Different bacterial cultures that are present in the stables, for example, what will be asked in the horse sport. All different, uncontrollable influences. Because there is little research has been done into the causes of thrush, it is also difficult to take into account in a study of the treatment of this condition with the influences of all these different conditions.

To the conditions despite the uncontrollable issues still divided as equally as possible, his hooves treated by horse and untreated. The results of the study could not demonstrate significant difference between the treated and the untreated hooves hooves. However, the scores have dropped significantly. Between the beginning of the treatment and the last moment, so it was indeed to see improvement. This dropped the scores of the treated group during the first week of daily treatment, among the scores of the untreated group. In the second phase of the experiment, the scores were evenly off to each other. This result may be a number of questions: firstly, the question is, what happened when the hooves were treated daily throughout the trial, rather than after a week on the steps to treat the three days. Subsequently, it is striking that the disorder or decreases over time, but that this is also true for the untreated group. May be a relief of the condition, on the one hoof also have an effect on the recovery of the other hoof, or it may be such that by the application of EM in a number of having to effect this has on the bacteria in the horse's stable? Questions that may be asked by the results of the investigation, which may also be noted that it was in quite a number of cases to horses that failed to result in a variety of other means.

7. Conclusion

The results and discussion there are quite a number of issues were identified, from which a number of conclusions and recommendations have emerged. In this chapter will be presented.

The main question of the study was as follows: "What is the effect of treatment with a gel with Effective Microorganisms (EM) on horse hooves with thrush" This is tested by taking a treated and an untreated group of five weeks. This showed that the hooves were significantly improved in five weeks, but this is true for both the treatment group and the untreated group. So it can be concluded that no difference was found between the two groups. Therefore, the previously described expectation is that EM can help prevent thrush, can not be adopted on the basis of this study.

Because the barn hygiene possible effect could have on the success of the treatment, the stable hygiene is compared to the severity of the condition, barn hygiene was found in this study or to have an effect: stables with poor hygiene gave a significantly higher score than stables a moderate or good hygiene, in between was found no significant difference. The effect of the stall on the hygiene scores, was true for both the treated and the control having to hooves.

In the discussion were discussed some aspects of the research, here are some recommendations, which are described below.

To begin with, it would be valuable if more investigation into the condition thrush itself. Although it is very common little research has been done into the causes, the causes and consequences of thrush. In order to treat more focused and to perform a more targeted study for the treatment of thrush is specifically investigating thrush important.

A second recommendation is conducting the survey again in which a number of important issues to be changed. Based on the results, the effect was not adopted, but the results seem promising. Following the experiences from this study a similar investigation could be conducted. Therefore, a solution would have to be sought for the changing environmental influences, for that reason, 'animals' should be kept in-house and handled in-house.

In order to exclude influences within the animal can be considered one of the horses and all the other horse did not handle.

When it is still working with individual owners is a placebo means a big must, this may be prevented that people still have to go deal with that were left untreated and can prevent most serious have all come in the treatment group while the least worst hooves serve as a control.

For without the influences of environment and the animal itself to investigate the effect of EM could be done on a laboratory scale research. In this way, the effect can be to the microbes which cause thrush may be tested. Here it is important that more research be conducted into the real causes of thrush.

Another important point is to continue to treat a daily basis, then it can in a subsequent investigation always different treatments are compared with each other.

Finally, there is this study a number of questions have emerged, where possible, follow-up research to be done: first, the impact on the overall health and recovery of remaining need in treating the most affected farms. It is also interesting to know what happens in the horse's environment, through the administration of EM via the hooves.

8. Following this study, more research and the treatment of thrush thrush, possibly with EM to recommend wholeheartedly.

Bibliography

- Agricola, H., Wheels, P. v, & Kistenkas, F. (2008).. *Paardenhouderij landscape and how local authorities tackle it?* Called on September 8, 2014, from Gelderland nature and environment association: www.gnmf.nl
- Arendzen, I. (1999). How do I stink leg under the thumb? *Applied Cattle, Sheep and Horses*, 21-23.
- Baxter, GM (2011). *Manual of Equine Lameness*. Hoboken: John Wiley & Sons.
- Davies, H. (2012, November 4). *Jets: the cushions of the hoof*. Retrieved from Paardenhoeven.info: www.paardenhoeven.info
- EM Agriton BV. (2014). *Microbiological investigation into hot and cold gel*. Noordwolde: EM Agriton BV.
- Hammes, E. (2011). *Healthy horses*. Utrecht: International Books.
- Hanekamp, WJ, Smits, AC, & Wieringa, HK (1989). *Housing beef bulls of 0-6 months*. Lelystad: Research Station for Cattle, Sheep and Horses husbandry.
- Higa, T. (1998). *Effective microorganisms*. Utrecht: Publishing Jan van Arkel.
- Hoof specialist Klaas Feuth. (2013). *Thrush - Hoof Health*. Recalled on September 3, 2014, by Hoof Health: www.hoefgezondheid.nl
- Holzhauer, M. (2012). *Hoof Diseases in image*. Deventer: Animal Health Service.
- Langworth, BF (1977). *Fusobacterium necrophorum: Its Characteristics and Role as an Animal Pathogen*. *Bacteriological Reviews*, 373-390.
- Mau, F.-P. (2008). *EM practice*. Utrecht Publishing Jan van Arkel.

- Petrov, KK, & Dicks, LM (2012). *Fusobacterium necrophorum, and not Dichelobacter nodosus, is associated with equine hoof thrush*. Stellenbosch: Department of Microbiology, University of Stellenbosch, South Africa.
- Smet, K. d. (2006). *Study of cell death in Candida albicans*. Ghent University in Ghent.
- Smith. (1975). *The pathogenic anaerobic bacteria*. Springfield: Charles C. Thomas Publisher.
- Todar, K. (2012). *Bacterial Endotoxin*. Recalled on September 19, 2014, of Todar's Textbook of Bacteriology: www.textbookofbacteriology.net
- Wilson, GS, & Miles, A. (1975). *Topley and Wilson's Principles of Bacteriology, Virology and Immunity*. Baltimore: The Williams & Wilkins Co.

Appendix 1 Manual therapy

Contact EM Agriton BV

<i>General information:</i>	<i>contact investigation:</i>
Molenstraat 10-1	Sarah Roose
8391 AJ Noordwolde	sroose@agriton.nl
www.agriton.com	06-20440388
0561-433115	

For questions, comments or concerns like as soon as possible to contact us!

Manual investigation rotstraalbehandeling

This manual is designed so that it should be clear how the treatment should be done, what are the important moments and when it is important to contact us.

Treatment

During the study period, there is always one per pair having treated, it is selected prior to the study random. When a horse with three affected need to be treated for two, and one is not. Because it is important that all the horses in the same manner to be treated, the treatment should be carried out as follows:

1. The hooves, preferably after the drive, gently scratch and clean brush. So that the product can be applied directly to the hoof and no more dirt in between.
2. Of the arranged hoof the whole beam, with an emphasis on the middle groove, instillation with the gel, until the whole range is covered. It is important that at least the green and orange section, as shown in the figure below is covered. Whereby special attention should be paid to the orange colored section. The product is packaged in a bottle with a spout cap, so that the deeper part of the middle groove, can be easily achieved.
3. The horse aside for 5 minutes on a paved surface.

There needs to be treated according to the following treatment schedule:

- Day 1 t / m 7: daily treat, as described above.
- Day 8 t / m 35: 1 times per 3 days of treatment, starting at day 10, and then day 13, 16, 19, 22, 25, 28, 31 and 34.

Score Moments

The score will be times by prior arrangement, prior to the treatment. And 7, and between day 10 and after day 34 after the start of treatment.

Before the start of the treatment, these data will be recorded. "Important dates" can be noted this.

If unable to attend gladly timely contact.

Animal welfare

Because animal welfare at all times paramount in the investigation, we ask you to keep a close eye on the horse. The EM product is not in any way harmful to the health of humans and animals. We expect from experience and theory that it has a positive effect, but we can not guarantee the operation of the product. One week after the start of treatment, we will score the disease, evaluating it and discussing the sequel. With real concerns about the situation of the horse, we ask you to contact us. For sufficient time to make the choice to change anyway example to other treatment.

Remaining

In the study is no charge and participation is entirely voluntary. Because it is for the study of great importance that all horses are treated in the same way, we ask you to follow the agreed schedule. When here, for whatever reason, must be departed from, or when you want to terminate the participation, we ask you first contact us, so that everything may take place in close consultation.

Participation in the study is at your own risk, ie EM Agriton BV accept no liability with respect to the actions you take on your horse. As to the product, it is a harmless product, which does not have any negative effects.

Appendix 2 Article thrush Startlijsten.nl

Almost half of our horses has stinky feet !?

6 October 2014 Sarah Roose

Thrush, nearly half of the horses in the Netherlands has ever! But how bad is it? How come? And what may we do about it? Soon we will launch an investigation of an alternative method for the treatment of thrush. Your horse has thrush and want to join, you can!

The last three months of the year have now begun again, this often means that most of the horses are stabled again more. The fact that the horses, the greater part of the day in their stand box may cause problems. In the autumn and winter months effects are more frequent problems, colds, strangles, stable legs, but also thrush.

Pilot research, ^{one} of the Animal Health Service (GD) revealed that approximately 48% of horses thrush. Chances is that you also sometimes have had to deal with.

Thrush is an infectious disease, the hygiene of the environment plays a major role in its occurrence. Thrush is therefore not caused by one specific pathogen, but by degenerative (degrading) bacteria and fungi commonly found in the environment. The most common causes are the bacterium *Fusobacterium necrophorum* and the fungus *Candida albicans*, normal inhabitants of the intestinal tract of humans and animals second. However at a reduced (local) defense can cause these two microorganisms diseases, this fungus causes people most fungal infections, the bacteria causes the cows foot rot and cause them thrush in horses.

What happens when a rotstraalinfectie? The word says it all, the jet rot away. The bacterium causes necrosis, so the tissue dies and that gives stench. This smell is therefore a feature of the rotstraalinfectie, in addition, there will be fluid from the beam and sometimes even pus. It usually stops not die of itself, therefore it is important that it is handled. In most cases, the horse is not lame, but this can certainly as a result of the rotstraalinfectie. Especially when the infection penetrates inside, it is said that because of this beam cancer arises, but here the experts are still not out.

Hygiene and daily care plays a major role in preventing thrush, but also the horse's own defense capabilities. A horse with a deep narrow beam is more prone to thrush, which ensure the hoof mechanism is often less effective, this mechanism not only ensures proper blood circulation but also to repel dirt 3. In addition, the horse's overall resistance is an important factor, but it also provides an interaction when the horse has thrush. Thrush is relatively easy to treat, it is important that the farrier cut away the rotten part. In addition there are available many different means, from Egyptian ointment to zinc oxide and formaldehyde to tar. Most methods are effective against thrush but it's not all that friendly to use or the environment. Tar is preventive use good, but when the infection is present, it is not recommended because this infection is completed, there are the causes of thrush just very pleased with them, since these microorganisms live without oxygen. Copper sulfate is very damaging to the environment, formalin falls within the category of 'possible carcinogen' ^{fourth} and long to use it paved the jet, which of course can cause problems. In addition, most of the treatment methods rely on the killing of microorganisms, may begin to occur, sooner or later, therefore, resistance problems.

For these reasons, despite the fact that there are already quite a number of products that help a new product developed by EM Agriton BV. And I, Sarah Roose, student of Animal Health at Van Hall Larenstein in Leeuwarden, should investigate the effects of this product. This hoofgel is purely natural, and its operation is based on EM, Effective microorganisms (eg yoghurt, beer, Yakult etc.), how does this work then? For this, just as a bit "EM theory": everywhere are microorganisms present (bacteria, fungi and yeasts), yet there are only a small number of bad and good micro-organisms, there is also a large group of "fellow travelers", they choose the side of the most present. So if we by adding EM, good microorganisms prevailed give the environment in the beam in theory will remain healthy. In practice, EM applied successfully against the aforementioned foot rot in cattle for example, and a number of people have also been successfully used against thrush.

After several good experiences we want to investigate this product on a slightly larger scale. We want to start with this month. This is where we horses with thrush, preferably we look for horses with at least two infected farms, in the northern half of the Netherlands, but can always respond! What is expected of you? That you perform the treatment as directed, that I may come by three times to score the need and that you contact with questions or problems.

So you horse has thrush and you are curious about the outcome of this investigation, please register at the following address! Participation is free of course and everything is in good consultation. Also with questions or comments, please email us!

Upon registration, like your name, address, contact information and indicate how many and which have been affected. Can email to: sroose@agriton.nl

Sources:

1. Holzhauser, M. (2012). Hoof disorders in image. Deventer: Animal Health Service.
2. Smith. (1975). The pathogenic anaerobic bacteria. Springfield: Charles C. Thomas Publisher.
3. Nassau, JR (2004) Hoof problems. Baarn: Forte Uitgevers BV (ISBN 90 5877 222 5).
4. *Formalin*. (2014) Animal Health Service: www.gddiergezondheid.nl.

Appendix 3 Survey

Appendix 4 Score form

Name owner:								
Horse number:								
Date:								
Score Moment:								
Definitions:								
0. No deterioration of the beam.								
1. What harm middle ray quarry, without softening, proliferation or necrosis.								
2. Slight damage to the jet grooves, with softening. (Especially the middle radius pit)								
3. Excessive deterioration of central beam quarry with extension to the lateral beam grooves, with softening and necrosis.								
4. Heavy hamper the full beam, with softening, necrosis, and proliferation.								
LV	Score:							
	Hardness:	Hard	1	2	3	4	5	soft
	Humidity:	dry	1	2	3	4	5	pus
	Odor:	Neutral	1	2	3	4	5	typical smell
	Heel Depletion:	Not	1	2	3	4	5	entirely
	Ray Depletion:	Not	1	2	3	4	5	entirely
	Sole Depletion:	Not	1	2	3	4	5	entirely
LA	Score:							
	Hardness:	Hard	1	2	3	4	5	soft
	Humidity:	dry	1	2	3	4	5	pus
	Odor:	Neutral	1	2	3	4	5	typical smell
	Heel Depletion:	Not	1	2	3	4	5	entirely
	Ray Depletion:	Not	1	2	3	4	5	entirely
	Sole Depletion:	Not	1	2	3	4	5	entirely
RV	Score:							
	Hardness:	Hard	1	2	3	4	5	soft
	Humidity:	dry	1	2	3	4	5	pus
	Odor:	Neutral	1	2	3	4	5	typical smell
	Heel Depletion:	Not	1	2	3	4	5	entirely
	Ray Depletion:	Not	1	2	3	4	5	entirely
	Sole Depletion:	Not	1	2	3	4	5	entirely
RA	Score:							
	Hardness:	Hard	1	2	3	4	5	soft
	Humidity:	dry	1	2	3	4	5	pus
	Odor:	Neutral	1	2	3	4	5	typical smell
	Heel Depletion:	Not	1	2	3	4	5	entirely
	Ray Depletion:	Not	1	2	3	4	5	entirely
	Sole Depletion:	Not	1	2	3	4	5	entirely

Appendix 5 Classification thrush

Appendix 6 Graph effect stall hygiene

Sarah Roose • EM Agriton BV • Molenstraat 10-1 • 8391 AJ Noordwolde • www.agriton.com

