TITLE: Lameness and Locomotion Scoring of Dairy Cows

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Lameness and Locomotion Scoring of Dairy Cows

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INTRODUCTION

One major problem that goes unseen by most people in the dairy industry is lameness. There is definitely a problem with lameness due to feet and legs issues on most dairies. Without the proper care of the feet a cow would not be able to make it to the milking parlor twice to three times a day. Most dairymen are selecting for superior genetics in the sense of increasing milk yield when it may be more profitable improving the overall structure of their cows. This could potentially decrease lifetime milk production and the life span of the typical milking cow if not properly taken care of.

Some solutions to this would be providing better cow comfort, hoof care, nutrition and less stress on the cow. If these four areas are maintained correctly then there should be little no problems of lameness. Cow comfort could be improved by routine maintenance in the free stall barns such as providing more bedding in the stalls, routine raking of the stalls, and flushing the lanes more often. In the sense of claw care dairymen might look at routine trimming of their high performance cows and maybe even the heifers that are about to enter the milking string. In the area of nutrition dairymen should keep a close eye on cows that are transitioning to a new ration in hopes that the cow does not react in a negative way that would affect the growth of the hoof. Dairy cows are easily prone to stress and that is why it is crucial to keep them as comfortable as possible by installing enough fans during the warm
seasons and enough shelter for them to get out of the rain or cold during the winter seasons.

These factors could be beneficial to the dairymen by increasing the lifespan of the average cow and quite possibly lifetime milk production. This project will evaluate dairy cattle lameness through the use of locomotion scoring and identifying problems associated with the hoof, as well as finding efficient ways to improve the cows’ locomotion scores.
LITERATURE REVIEW

Lameness issues

Lameness is one of the hidden problems on a dairy. Most dairymen forget to pay closer attention to lameness when it comes to the longevity of their milking cow or heifer. When breeding dairy cows it is important to look at overall conformation of the cow to see if changes need to be made. The foot structure consists of the hoof and locomotion score of each cow or heifer. By keeping a close eye on the hooves and evaluating their locomotion scores this could help improve a number of the problems dairymen face with maintaining a sound and healthy herd. According to the locomotion score table done by Zinpro:

Locomotion scoring is based on the observation of cows standing and walking (gait), with special emphasis on their back posture. This system is intuitive and, therefore, easy to learn and implement. Use of locomotion scoring is effective for early detection of claw (hoof) disorders, monitoring prevalence in lameness, comparing the incidence and severity of lameness between herds and identifying individual cows for functional claw (hoof) trimming(5).

If dairymen pay closer attention lameness and foot health of their herd, many of disorders they will come across later will be reduced. The key is early detection and prompt treatment to minimize losses, improve outcome, and reduce animal suffering (8). In order to run a successful dairy there are numerous aspects to maintain in obtaining the end product—milk. Dairymen have to take into consideration breeding, feeding, milking, calf care and overall maintenance of the dairy such as cow comfort,
waste management and milking barn upkeep. There are many factors to consider in providing the best care of dairy cows.

**Basic anatomy of the hoof.** When evaluating a herd of cows it is essential to know the structures of the hoof in order to properly diagnose the problem. First off is the coronary band which is the soft pink tissue at the top of the hoof. Beneath the coronary band is what is called the coronary cushion which is made up of many tissues and veins. The tissues and veins act as a cushion when the animal exercises helping pump blood through the foot. Further down is the wall which is shiny and smooth and usually runs parallel with the coronary band.

Inside the hoof at the tip are the lamellae. The lamellae cover tiny ridges on the inside of the hoof and these ridges attach to the coffin bone. The bone that is at the end of the hoof is the coffin bone. Reaching the bottom of the hoof is the sole made up of very thick tissue. At the back of the hoof is the bulb which is thick with a rubbery feel to it. Connected to the bulb is the digital cushion which acts as a shock absorber and helps in circulating the blood back to the body. Then there is the heel consisting of both the bulb and digital cushion. In order for the cow to move properly and function on a daily basis all these structures have to be working together.

**Common diseases associated with laminitis.** A number of problems a cow faces during her lifetime are associated with—the hoof. Some diseases that
contribute to lameness are laminitis, white line disease, heel erosions, toe ulcers, horizontal and vertical fissures, sole ulceration and double heel (9). Laminitis is said to be the cause of many issues that a cow must face. Laminitis originates between the claw and claw horn of the hoof where many blood vessels circulate. If the tissues in the claw horn deteriorate it makes the hoof more susceptible to other hoof problems. There are three different terms associated with laminitis and they are sub-clinical, acute and chronic laminitis (2).

Sub-clinical laminitis is when the symptoms are not noticeable by normal observation. The factors that contribute to sub-clinical laminitis could be high levels
of carbohydrate in feeds, low levels of structural fiber in feeds, stress, poor management of replacement stock, and faulty housing. With these factors it’s important to evaluate the feeds that are being fed and the maintenance of the pens these cows are being housed in(1). There will usually be an appearance of a hemorrhage which is related with growth rate. The growth rate is about 0.20 inches per month and the thickness of the sole is about0.40 inches, so the hemorrhage is seen in the figure.

Figure 2. The hoof of a cow that has sub-clinical laminitis.
about two months after internal problems occur (3). This will usually cause a yellow
discoloration as a sign that sub-clinical is living in a herd.

Acute laminitis is fairly rare but, it is often caused be an overload of grains and
carbohydrates. These cows tend to be the ones that are lying for most of the day and
when they do stand up their feet tend to be held up underneath them (2). The major
local clinical signs in addition to intense pain include some swelling and temperatures
that are slightly warmer than normal above the coronary band in the soft tissue area
(3).

The last type of laminitis is chronic laminitis. The claw tends to be square and flat
while the surface is relatively ridged or deeply grooved giving a rippled appearance
(3). This is due to internal issues of the coffin bone being separated from the front of
the hoof wall. It is usually caused by feeing high energy feeds and could be heritable
(2).
Another disease that affects the hoof is white line disease. It accounts for 63 percent of reported cases due to lameness (9). White line disease is an infection that occurs between the wall and the sole on the front of the heel. It can easily be disrupted by an abscess in most situations. It is an important landmark because it is soft and can easily be penetrated by foreign objects (9). This usually is brought on by sub-clinical laminitis or walking on abrasive surfaces. When diagnosing white line disease it is crucial to know that there is only swelling in the heel of a single claw. Most people diagnose it as hoof rot, but they forget that hoof rot is a case of both the heels being swollen. One form of treatment is using a hoof pick and examining the white line to find the source of infection (2).

The next disease to look for is heel erosions. This normally appears on the smooth bulb part of the heel with the appearance of a black “V” shaped design. To detect heel erosions in a herd, a cow will usually become lame and the heel will be sore or sensitive to the touch. A cow can become unstable because they have uneven weight distribution on that hoof. This can be easily avoided by making use of a foot bath and having adequate hoof trimming procedures. For treatment it is best to stay away from antibiotic injections and focus more on spraying the infected area with a bacteriostatic agent (2).
Another problem that affects the hoof is a toe ulcer. This is classified as a rupture of the white line on the toe where there has been a rotation of the toe bone. Toe ulcers usually arise when cattle are being fed highly digestible forages or when there is a sudden change to a high energy diet. When a cow gets a toe ulcer she is typically in so much pain that the only course of action is to cull her because once the cow goes lame their most likely lame for life (2).

One problem that is generated frequently from stress is horizontal grooves and fissures. A horizontal groove is detected by looking at the wall of the claw and

Figure 4. An example of a toe/sole ulcer
determining if there is a depression running parallel to the coronary band. Whereas a horizontal fissure is the same problem except the claw horn will crack and eventually break off making the toe of the claw square in appearance. It is easy to detect a cow with horizontal grooves. Horizontal grooves are caused by stress and it can be calculated by observing the grooves in the claw (2).

Then there are vertical fissures which are known as sandcracks to most dairymen. A sandcrack is identified by a vertical crack up the claw generally on the outside front claw. Most studies have found sandcracks to be the most painful form of lameness a cow must endure (2). A vertical fissure has many types that can be identified. Type 1 vertical fissures have to deal with the coronary band because the cracks are up high. These are the most severe due to the fact that they are so close to the joint. Most of the time vertical fissures can be overlooked because they appear around the coronary band where most manure and mud is collected hiding the crack. A type II sandcrack is identified by a crack that stretches halfway down the claw from the coronary band. The last one is type III in which the crack extends all the way down the claw and will have the presence of a large groove separating the sandcrack in half. These grooves and fissures are uncommon in dairy cattle. If dairymen were to experience a horizontal or vertical fissure the best way to deal with it is by trimming the claw (2).

Sole ulceration is a raw sore that appears on the inside of the claw on the hind hoof. Most sole ulcerations occur due to poor claw care, incorrect trimming, and walking on abrasive surfaces. With proper care of the hoof, pressure can be relieved or
placing a shoe on the hoof. The most effective technique in dealing with sole ulcers is regular trimming and checking the occurrence of sub-clinical laminitis in a herd to make sure further problems don’t arise (2).

One of the last diseases a cow can accumulate is a double sole. This is when the claw grows two soles that are separated by a space or opening. A double sole will appear after there has been a sudden change to a cow’s ration. When a cow has a double sole one might observe her plodding as she walks but this can be fixed with proper trimming (2).
Figure 5. A cow with heel erosion and a double sole.

**Diseases that are associated with infection.** Hoof rot is an infectious bacterial disease that appears on the skin between the claws and accounts for 17 percent of cases due to lameness (9). This disease can affect a large number of animals over a short period of time. Bacteria associated with foot rot can grow in soil or in the cow internally. The cow will usually be in extreme pain with swelling of the entire foot. Over time the skin between the claws will separate and begin to produce a foul odor. It is important when treating hoof rot not to bandage between the toes because it could open up the wounds and cause further infection. When dealing with hoof rot the foot should be placed in a protective boot to prevent further infection. Hoof rot can be treated with a few different injections like penicillin, oxytetracycline, and sulfas (2).

The next disease is called digital dermatitis also known as Mortellaro’s disease. This infection is highly infectious and can be detected due to sores and raw areas that surface on the skin of the heel (2). It accounts for about 20 percent of cases due to lameness (9). Digital dermatitis will surface when there is poor hygiene or when cattle are brought into an infected herd. This is easily observed by watching for cows that are reluctant to walk. These cows will usually have raw bright red sores on the bulb of their claws. The sores can sometimes be hard, thin and have wart-like growths on them. As far as treatment for digital dermatitis, it is best to treat as soon
as it is detected. Once detected make sure to thoroughly wash the infected area and treat in a medicated foot bath. So, it is crucial that dairymen keep a close eye on the soundness of their herd to ensure the health and longevity of the cow (1).

The practice of proper trimming. With dairy cattle hoof trimming can make all the difference if done frequently and correctly. The purpose of foot trimming is to re-establish appropriate weight-bearing within and between the claws of all four feet (8). If dairymen focus more on hoof trimming it could increase the average lifespan of their milking cow. When a cow is balanced she will bear her weight equally which is all reflected on the way the hooves were trimmed and taken care of. On a dairy it is crucial to have routine hoof trimming as well as employ a professional to make sure the job is done correctly the first time. If a herdsman that is in charge of feeding is asked to trim hooves on a pen of cows the job will not be done as thorough as someone who actually specializes in trimming hooves. When trimming hooves, especially if it is done often small amounts of the hoof should be removed in order for horn tissue production to increase. The cows hoof grows relatively slow at about five mm per month and that is why it is beneficial to trim small amounts (8). A trimmer will usually see overgrowth at the toe which is due to the hoof horn being hard and growth is more rapid because the rate of wear is less at the toe (8). An important aspect of trimming hooves is the equipment that is used. Two common pieces of equipment that are used on a dairy are hoof nack and the tipping table. A hoof nack
is used mostly when examining the hoof by using a hand crank to pull up the leg (2). Basically it is a portable device that can be clamped to pipes to aid in trimming a cow’s hoof. With the tipping table the cow is loaded into a chute where it is then tipped on its side to be examined and have its hooves trimmed. Most of the time a tipping table is used for bulls and beef cattle because the animal is restrained a lot better than with a hoof shack.

Figure 6. A tilt and/or tipping table that most dairymen use when trimming cows hooves.

Recommendations for using a foot bath. One recommendation that most dairymen use when dealing with diseases of the hoof is a foot bath (as seen in Figure 4). Foot baths may consist of the pre bath and the treatment bath. These baths should be placed about six feet apart (10). The foot bath does not cure most of the diseases a
cow can get on her hoof but it does help with decreasing bacteria growth. The most important time to use a foot bath is during wet weather, when there is a lot of standing manure and in times when contamination is at a high risk. It is most effective when used at least three to four times a week and should be changed after about every 200 cows (10). Immediately after walking through the foot bath a cow should enter a dry and clean area so that the solution can work properly (2).

Figure 7. A typical foot bath that cows must walk through after leaving the milking parlor.

When thinking about adding a foot bath on a dairy it can either be a permanent or movable system. With the permanent system there must be a special pathway made
for the cows to enter and exit the bath. According to Zinpro (2) the dimensions of the permanent foot bath should be: length of nine to ten foot minimum, width of three feet or more (walls may slope inward toward the base), and a depth of six to eight inches (four to six inches for the depth of liquid). With the movable or temporary foot bath it needs to be constructed in a way that makes it easy to move and inviting to the cow. Most of these foot baths are made of polystyrene with a special lining that helps distribute the solution to the whole foot. Along the bottom of the foot bath is foam plastic which is covered by a permeable membrane that hold the solution. For about every 25 cows that pass through the foot bath a gallon of the bath must be added. The solution in the foot bath usually consists of a few different types of compounds. One form of the foot bath is the combination of copper and zinc sulfate. These two liquids help in decreasing irritation in a five to ten percent liquid solution. Another product that can be added are antibiotics. Antibiotics should only be used to treat digital dermatitis or individual animals because it increases sensitivity to some organisms. This method can also be very expensive so a majority of dairymen will not use it unless they really have a problem. The last solution that might be used in a foot bath is formaldehyde. The suggested amount of formaldehyde according to Zinpro is three to five gallons of 36 percent formaldehyde solution per 100 gallons of foot bath solution. When using this product caution should be exercised because this solution can be harmful to both cattle and humans. Formaldehyde should be used in a ventilated area away from the cows bedding to reduce the occurrence of contamination. It is important to note that formaldehyde should not be used on open
lesions of the hoof. So, when thinking about installing a foot bath it is crucial to find one that fits into an already established pathway (2).

**Observing the cow for a locomotion score.** When evaluating cows, dairymen use a scoring system in which the cow is given a score between one and five depending on their stage of lameness (5). This should be done particularly on a hard surface because observing a cow move on a soft surface could lower the numerical score they are given (11). If done correctly, locomotion scoring can be a fast and easy way to detect lameness early on. For instance, a cow with a locomotion score of one should stand and walk level with a long stride (as seen in Figure 5). The posture standing and walking should be flat when viewed on a level surface. When a cow scores a two on the locomotion score it means she stands with a flat back but, on the move has a slight arch in her back (as seen in Figure 5). For a score of three on locomotion the cow will stand and walk with an arch in her back. The cow will have a short stride and have a minor limp on the infected hoof or hooves (as seen in Figure 5). On a score of four the cow will still have a arched back while standing and on the move but, she will tend to favor one or more limbs to bear weight where she is not hurting. The dew claws will sink in on the affected limb of a cow with a score of four (as seen in Figure 5). The last score that can be given to a cow is a five. With this score a cow will have an arched back while standing as well as when she is on the move. This cow will also be reluctant to move because she is trying to keep all her weight off the infected limb (as seen in Figure 5). In order to access these scores it is important to have some knowledge about the proper posture of a cow. If a cow does not have the
correct posture then it is right to predict that some type of hoof problem can be found. For instance, when a cow tracks out narrow with their feet close together or stands with their legs slightly crossed this could mean that cow has laminitis. Another

**TABLE 1. Locomotion scoring guide with suggested targets (% of herd).**

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
<th>Back</th>
<th>Assessment</th>
<th>DMI (%)*</th>
<th>Yield (%)*</th>
<th>Target (%)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Normal</td>
<td>Flat</td>
<td>Cow stands and walks with back level. Gait is normal.</td>
<td>100</td>
<td>100</td>
<td>75</td>
</tr>
<tr>
<td>2</td>
<td>Mildly lame</td>
<td>Flat/Arched</td>
<td>Cow stands with back level but arches back to walk. Gait is normal.</td>
<td>98</td>
<td>99</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>Moderately lame</td>
<td>Arched</td>
<td>Arched back evident when standing and walking. Gait is short strided.</td>
<td>95</td>
<td>97</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>Lame</td>
<td>Arched</td>
<td>Arched back is always evident. Gait is deliberate, step at a time. Cow favours one or more legs/feet.</td>
<td>83</td>
<td>93</td>
<td>0.5</td>
</tr>
<tr>
<td>5</td>
<td>Severely lame</td>
<td>3-Legged</td>
<td>Cow demonstrates an inability, or extreme reluctance to bear weight on one or more legs/feet.</td>
<td>64</td>
<td>84</td>
<td>0.5</td>
</tr>
</tbody>
</table>

common sight is when a cow knuckles over at their fetlocks which could mean that there is pain in the heel. For the milking cow this could mean that the cow has sole ulcers and for a young heifer it could be a sign of laminitis. Another problem with posture is when cows stand with their feet forward or camped under themselves. This type of posture is associated with issues that deal with the toe because the animal is trying to keep pressure off of it. One common thought that people make is that cows that are ‘cow hocked’ have a conformation problem but this problem in their
Figure 8. Locomotion scores 1-5 (7).
posture is actually due to the heel of the outside claw growing to long (2). The last common posture problem cows will have is being camped back which means that the legs will be held back further than normal and not underneath the animal. When an animal has this problem it usually means that there is pain in the heels so the cow will shift their weight to their toes. These are just a few of the common problems a dairymen might observe while watching cows during locomotion scoring. This is why it is important to study this scoring technique to make sure that cattle are getting scored properly and are not getting misdiagnosed.

**Key factors that influence lameness.** A majority of the time lameness is not just caused by poor hoof care, but by other factors that are crucial in running a successful dairy. Some of these factors are cow comfort, claw care, behavior or stress problems and nutrition.

Cow comfort starts in the barns where cows spend a majority of their day eating and lying down. It is recommended that a cow should be lying down for ten to fourteen hours a day. This would be an ideal situation but it is not always what is observed when walking through a barn. Dairymen should encourage lying down by having ten percent more free stalls that number of cows (9). The factors that influence the amount of time a cow spends lying down are poorly designed stalls, the number of stalls, and whether they are comfortable to the cow. If a stall is built too small the cow will have a hard time getting in and out, which will cause the cow to not want to use the stall and spend more time standing in the alley ways or perching herself on the
edge of the stall. When a cow spends all of her time standing it puts pressure on the hoof causing problems if not taken care of. A cow that is able to lie down for the ten to fourteen hours will want to exercise more which stimulates the blood flow in the hoof and keeps the cow from acquiring any type of disease or infection. If the cow stands for a prolonged amount of time she will eventually become susceptible to disease in the long run. A way in increase time spent in the free stalls is by using sand. Sand is optimal stall bedding, providing cows comfort and traction at the same time (3). Overall sand is the best choice to increase cow comfort as long as it is free of small stones that could eventually penetrate into the sole horn.

When a dairyman is building their facility it is crucial to keep the size of the cow in mind. As a cow reaches their full growth potential they are well over a thousand pounds, making it hard for them to move around in a small area. For instance, when a cow enters a stall or leaves the stall she must lunge forward. There should be enough space at the front of the partition for the cow to make that lunge forward. Free stalls should range from nine to ten feet in length due to the large size of the cow. For the width the size should be about fifty to fifty-two inches wide. But this size differs depending on the stage of life the cow is in whether it be a heifer or in their dry period. For heifers the stalls should be smaller at forty-five inches in width and for a dry cow the width should be about fifty-four inches. With regards to the neck rail it should be high enough that it does not hinder the cow from rising or hit their withers. A free stall should also have a low curb for the cow to step over when entering the stall. That is why when building a barn the curb should be no less than six inches
high which will decrease the chance of the cow perching on the stall or standing in the alley ways. When looking at the front of a stall open fronts seem to work the best because it allows for more ventilation and they help in maintaining a drier bed for the cow.

As for the bedding and walking surfaces cows like to feel comfortable and dry. This is why it is crucial to remove any wet bedding or manure on a daily basis to keep the cow comfortable. According to Zinpro a dairymen should provide dry, comfortable rest areas so cows spend minimal amounts of time standing in wet alleys (7). Any barns that have abrasive or wet walking surfaces can result in excessive claw wear and have increased incidence of lameness. Another way to reduce lameness is looking at the surfaces that cows walk on. It may be worth the cost in reducing lameness by grooving smooth concrete and placing rubber mats in feed lines and traffic lanes (9). Dairymen should also look at keeping an upward slope in the stall to make it easier for the cow the get up and lie down.

The second factor to look at is claw care. The hooves of a cow should be trimmed on a regular basis which in return can increase a cow life by one lactation (1). When the claw of the cow is balanced the weight will be distributed equally among all four hooves reducing hoof diseases. Because of this it is important to hire skilled workers who know what they’re doing or else problems could become disastrous. Dairymen should really look into who they are hiring and what type of equipment they are using to ensure there is no harm done to their cows. Cows should go through routine
trimming throughout the year and what this does is allows the dairymen to remove small amounts of the horn from the sole of the hoof. By removing small amounts it will stimulate new hoof growth and produce a stronger and healthier tissue. One of the crucial times to trim the hooves is about eight weeks before calving. But it is best that the dairymen keep a record on all cows as far as trimming and other treatments that they have gone through when treating the hoof. This will allow them to see what times of year problems arise and which are most common for them to treat for. Most of this information is mentioned earlier on in the section on hoof care.

Another factor that influences lameness is behavior and stress problems. With dairy cattle it is important to keep them happy and comfortable. Cows like to have a routine and when that routine is changed they experience some type of stress or behavioral change.

One issue that really affects a cow is competition. Cows will establish a pecking order like most animals do but with adequate space the occurrence of competition is rare. That is why the alley ways should be wide enough for the movement of cows during feeding and milking time. With regards to heifers overcrowding will cause them to have to wait during feeding while the more aggressive heifers eat. This causes a heifer to engorge having three to four times a day instead of having thirteen to fourteen meals throughout the day (3).

As for stress it plays an important role in lameness. Stress ultimately reduces the body’s ability to resist disease and can deplete the body of nutrient reserves. There
are four factors that contribute to stress and they are management, aggression, nutrition and disease. Management has to deal with times of weaning, vaccination, transportation and reduced exercise. All of these factors can cause a cow to stress because these are changes in their established routines. With aggression there will be a change in the cow’s behavior because of a poorly designed facility or spending too much time standing instead of lying down in the free stalls. With regards to nutrition stress can be induced when there are changes in the ration such as low or poor quality fiber, high energy feeding and trace mineral imbalance. And of course stress in high in times when the hoof is affected by disease because the cow cannot cure a disease on its own. Signs of stress will show up during the hot summer days when the cows begin panting (as seen in figure 6). Panting will lead to respiratory alkalosis which causes an increase in saliva loss due to drooling and a decrease in rumen pH. This in turn can lead to metabolic acidosis which causes weakened claws. There will usually be a breakdown in the supportive connective tissue causing a poor quality horn formation. So, when working with dairy cows it is crucial to keep their routine the same and keep them comfortable so as not to initiate any further problems that could potentially lead to lameness (1).

The last factor that contributes to lameness is nutrition. When a cow’s normal feed pattern is altered there could be some increase in hoof problems as well. According to a report by Paul R. Greenough (2) the principal factors that change the normal pattern are high levels of concentrates or fat (energy) in the diet with poor quality and/or low levels of roughage (fiber). If the dairymen does not recognize these
changes in feeding it could possibly lead to acidosis which is a factor that leads to laminitis in the hoof. Acidosis is difficult to manage when the largest part of the diet contains carbohydrates (9). The consequences of feeding an unbalanced ration to a cow are increases in acid production which in turn will lower the pH. Once this happens the cow can pick up infectious diseases such as metritis, mastitis and a retained placenta due to the death of gram negative bacteria from a lowered pH.

Dairymen should also look at the particle size of feed because increased particle size increases cud chewing and, therefore, increases saliva production and aids in efficient digestion to keep the cow health and strong enough to fight off lameness problems (9). It’s crucial to have a ration balanced for calcium, phosphorus, and vitamins A and D for good bone and tissue health as a preventive measure (9). All these problems eventually trickle down to weakened claws which in turn can lead to lameness.

Dairymen need to pay close attention to their trace minerals, vitamins and grass and forage management to make sure they can keep their cows from developing any lameness problems.

**Economic costs of cattle lameness.** For the most part the average cost to treat a lame cow is about $125 to $150 based on cost of labor, treatment such as antibiotics if needed, and any milk withheld(5). So a dairy that has a 1,000 cow herd with a 10% lameness rate, there would easily be $12,000 to $15,000 in extra costs for dealing with lameness(5).
In a study done by Zinpro they recorded the following economic loses for each number on the locomotion score chart. For a score of one there were no loses due to the fact that the cow is perfectly sound and nothing has been disrupted in her daily routine. With a score of two there was a loss of about two percent of milk (5).

Figure 9. The dairy cow heat stress chart with regard to temperature and humidity.

The researchers at Zinpro concluded that, “cows having a score higher than two were 2.8 times more likely to have increased days to first service, 15.6 times more likely to
have more days open, 9.0 times more likely to have increased services/conception and be 8.4 times more likely to be culled (5).” For a cow that scores a three there would be a loss of about four percent of her milk. At a score of four the cow would be losing about nine percent of her milk due to lameness issues (5). And finally with a score of five the cow begins to lose about fifteen percent of her milk (5). With lower milk yields, reduced reproductive performance, higher voluntary culling rates, discarded milk, and the additional management effort required to care for lame cows accounted for the majority of economic losses (8). At this point it is hard for a cow to even make it to the parlor for a two to three time a day milking.

The dairyman is responsible for the lameness control on the average dairy. Research found that 88% of lameness cases are observed in the hoof. A majority of these cases are associated with the hind foot and most of those cases are associated with the outer hind claw (4). A dairyman should set up a lameness control program to decrease the occurrence of lameness problems. These include monitoring lameness incidence and causes, planned foot trimming program, regular foot bathing, prompt treatment of lame cows, specific management of first lactation cows, and clean and comfortable walking surfaces for cows (4).
CONCLUSION

Through the use of locomotion scoring the dairymen can address a variety of problem before they even start. Dairy cattle lameness is a serious problem that affects almost every dairyman whether they know it or not. By evaluating their cows on a regular basis the issue of lameness can become a thing of the past. Lameness is a hidden problem that cows face, which can eventually affect the major aspects of their life such as cow comfort, claw care, transition, and nutrition. In order to improve the problem of lameness on a dairy it is crucial to come up with a program that fits the way the dairy is ran. This means that if there are enough workers to observe the problem and do it on a daily basis with the same consistency then it is something that is worth investing in. But, if a dairyman is short handed and cannot afford to hire extra workers to evaluate the cows then other solutions will have to be looked into. Locomotion scoring is not for everyone and that is why dairymen should only use it if it fits into their program.

One area that should be looked at closely is cow comfort. With improvement in cow comfort a dairymen will begin to see happier cows and doesn’t California care about happy cows. Dairymen should make sure not to overcrowd his cattle. By overcrowding cattle the issue of survival of the fittest will come into play causing even more problems in the long run. Cow comfort should also include providing well designed and maintained stalls for the cows. If the cows are is a clean environment they are more prone to using the stalls and feedlots instead of standing on concrete all
day. Other problem that can potentially affect lameness is the issue of heat stress. The barns should be set up in a way that the cows can stay cool year round no matter what the temperature is. A cow functions the best between temperatures of 10°F all the way to 70-75°F where they will begin to experience some type of thermal stress on their body. Through the use of fans and shade shelter in the barns and feedlots cows can stay cool in conditions that their body temperature cannot handle. Flooring in the barns should provide good traction but, not wear down the cows hooves. The alley ways should either be clean or contain rubber mats so; cows can have the best footing when moving about the barn and traveling to and from the milking parlor.

These are all important aspects that should be looked at when improving cow comfort in order to decrease cow lameness.

Another area that should be looked at is hoof care. The basic idea behind hoof care is through proper trimming. A cow should have their hooves trimmed at least two times a year to catch any problems before they arise. With this the dairyman should provide a therapeutic trimming to the cow because one must work with these animals everyday so it is crucial to gain their trust and not startle them. One solution that should be practiced on all dairies is the use of foot baths. Foot baths need to be properly maintained and administered on a dairy to be beneficial in the long run. The key to most lameness is the environment that a cow is housed in and whether it is clean and dry. A cow that is housed in a wet environment will usually develop more hoof problems than that of a cow that is housed in a dry environment and the same
goes for the cleanliness of the facilities as well. By keeping a close look at a cows hooves and trimming them on regular basis lameness can be reduced.

When reducing lameness it is essential to also look at the transition period for the cow. Throughout most cows lifespan they will experience several transitions in the feed that they are fed. With cows it is crucial to minimize any abrupt ration changes that could potentially upset the rumen. In transitioning a cow a dairymen wants to look for the simplest transition in order to maximize his animals’ health in the end.

An area that should that should not be overlooked when improving lameness on a dairy is that of nutrition. A cow that is being milked two to three times a day should be provided a nutritionally balanced diet to ensure that she gets the best nutrition and produces a high quality product. First look at whether the feeder is properly mixing and delivering each ration to the cows. This helps ensure the dairymen knowing what their cows are getting and producing in the end. A ration should be carefully thought out because the number one priority of a feeder is to minimize sorting. This means a cow will only eat what looks and tastes good to her and leave everything else behind for another cow to eat. It is essential to feed the cow a diet that has a proper micronutrient fortification. If a cow does not get the proper nutrients supplied to her it can her overall health which can eventually lead to problems in lameness.

The issue of lameness will always be a problem unless these solutions are taken into affect and used properly on a dairy. Although research has been done to help bring
the problem of lameness into the light there should still be more research done on the topic of lameness in order to ensure all possible solutions have been looked at.

The literature review looked at the use of locomotion scoring on dairy cattle to detect lameness and other diseases of the hoof. To assess this problem data had to be compiled from many different sources as well as dairy producers to see where lameness could be improved on. All of the research came from dairy publication, dairy science journals, and class lectures. The structure for locomotion scoring mainly came from the data compiled by Zinpro to help in understanding how the scores correlated with certain diseases the hoof encountered. The material that is presented through this paper will allow producers to see where lameness can be stopped as well as how it is observed on a dairy. Not only could this paper be useful for dairymen but also beneficial to improving operations for lameness treatment in the future.
REFERENCES

1 Berry, Dr. Steven, and Dr. Jan Shearer. "Lameness on the Dairy." *Hoofprints* 2006: 2-7. Print.


