FEET AND LEG PROBLEMS IN DAIRY CATTLE

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INTRODUCTION

Lameness is a major health problem of dairy cattle resulting in poor performance and significant economic loss. Causes are many and complex, solutions are few, complicated, and costly. For many the achievement of high milk yield has come at the expense of lameness. For this reason, a proper understanding of lameness conditions in terms of what they are, how or why they occur, and what to do about them is essential to minimize production losses as well as the loss of cows from these and related problems. The following is a brief review of some of the more common locomotion problems in dairy cattle.

INCIDENCE OF FEET AND LEG LAMENESS

Specific information concerning the incidence of lameness in the United States is limited, however, believed to be similar to that reported from the United Kingdom. One such survey of 48 veterinary practices involving 1821 herds found that the average annual incidence of lameness requiring treatment by a veterinarian was 5.6% of cows. Of these, 88% involved the foot. The majority of foot lesions (84%) involved the hind feet with 85% occurring in the outer claw. Upper leg lameness accounted for the remaining 12% of treated lameness conditions with 76% of these associated with the hind limbs. The most common cause of upper leg lameness was trauma. Two other surveys have reported average incidences of treated lameness at 6.3% and 7.3% annually. Whereas, the veterinarian generally sees only the worst cases the actual rate is likely much higher.

FEET AND LEG PROBLEMS AS A CAUSE FOR "INVOLUNTARY" CULLING

Cows which leave a herd by way of sale for dairy purposes or those which leave due to low production are removed for "voluntary" (at the will of the dairymen) reasons. Those which leave the herd due to reproductive failure, disease and injury, death, mastitis, or lameness are unintentionally lost from the herd. Since animals removed from the herd in the latter instance are not necessarily at the will of the dairymen they are termed "involuntary". In its proper (and most desireable) context, culling is a voluntary procedure applied to eliminate from the herd those cows with low milk-producing ability.

Lameness is reported to be the third most common cause of involuntary culling behind reproduction and mastitis. However, in terms of economic loss from culling, lameness may be

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the most costly per occurrence. Lameness severely limits milk production and reproductive performance. Estimates are that cattle which become lame, and are not attended to, can experience losses in milk production of 20% or more. Days open may be increased by as much as 33 days based on results from one study. Lame cows don't go to pasture, spend little time at the feed bunk, and prefer to lie down most of the time. If a cow doesn't eat she can't produce milk nor maintain body weight. Such cows are eventually culled for reasons of low production. However, while cows sold for reasons of poor performance generally retain market value for beef purposes, excessive weight loss of lame cows often results in substantial, if not near complete loss of carcass value. British surveys indicate that cattle sold to slaughter as a result of lameness have carcasses worth only one half as much as those sold to slaughter for other reasons.

THE INFLUENCE OF GENETIC FACTORS IN LAMENESS

Genetic factors have important effects on feet and leg traits in dairy cattle. Specific traits scored include foot angle, legs side view, and legs rear view. Heritability values tend to be low (particularly for legs rear view and foot angle) as scores can vary significantly depending on the cow's stance at the time of scoring. Simply moving the cow forward a few steps can make major differences in scoring of feet and leg traits. Other factors which markedly influence posture and stance are hooves in need of trimming or pain associated with claw disease. Heritability estimates for feet and leg traits on Holstein cows range from about .08 to .16 which means that single scores from an individual cow are not a reliable measure of that cow's genetic merit for a specific trait. However, where scores from multiple offspring are available, the breeding value of a specific bull or cow can be reliably estimated. Successful genetic improvement requires selection based on progeny tests of bulls and not on individual animals.

Cow legs should be sturdy with a strong pastern and good flexibility in the hock. Abnormally straight hocks, weak pasterns, sickle hocks, splay toes, or overlapping toes are associated with an increase in the incidence of lameness. The ideal conformation of the cow's foot should be short, steeply angled, high in the heel, and even clawed. The sole should be slightly concave with the majority of weight being distributed over the hoof wall. Some suggest that the ideal hoof angle is 50-55° for front feet and 45-50° for rear feet. Unfortunately, most are about 43 degrees. Studies have shown reduced survivability in first calf heifers with low hoof wall angles.

ENVIRONMENTAL CONSIDERATIONS

The dairy cow evolved as a land animal and not one adapted to standing on hard, abrasive surfaces. In today's modern confinement systems, cows spend a majority if not all of their time on concrete. The unyielding nature of concrete surfaces encourages lameness through direct and indirect effects on laminitis and related claw diseases in cattle. Furthermore, confinement restricts exercise. Cows just don't have the same freedom to move about as they once did in traditional housing systems. Options for resting are limited to a free stall or the alleyway.

Considering what would be most natural for the cow, it's not hard to see why confinement generally increases feet and leg problems.

Concrete, depending upon how it is formulated and mixed, is capable of creating an extremely abrasive surface for cows' hooves. New concrete is more abrasive than old, and wet concrete is up to 83% more abrasive than dry concrete. Studies show that cattle hooves may wear more than they grow during the first 2 months on concrete. Animals on wet concrete suffer doubly; first, because of the increased abrasiveness associated with the wet concrete and secondly, because moisture softens the hoof horn thereby permitting an increased rate of hoof wear. A further cause of increased hoof wear occurs from crowding or rushing cattle which results in increased hoof wear from twisting and turning on rough abrasive flooring surfaces. For this reason, proper design of facilities which incorporates ideas for easing cow movement thereby reducing rotational forces on hooves are important housing considerations.

On the other hand, smooth concrete reduces wear and contributes to hoof overgrowth. It is also slippery and predisposes to injury, usually of the upper leg, from falling. Grooving the surface of smooth concrete floors increases traction, and while costly, is well worth the expense to prevent injuries from falling.

Environmental influences have a major impact on feet and legs. Cattle on concrete for extended periods are prone to lameness. Comfortable stalls with adjoining grass pastures or dirt lots provide cows with a break from the concrete and tend to reduce lameness problems.

NUTRITION AND FEEDING MANAGEMENT

Nutrition and feeding management are important considerations whenever a herd begins to experience a high incidence of foot problems, in particular, that associated with laminitis. A primary goal in feeding is to maximize dry matter intake in order to optimize milk production yet avoid conditions which might lead to rumen acidosis and laminitis. Consequently, it's a fine line between what's best for health and production and what may predispose to problems.

Throughout the south, a major dilemma involves feeding strategies to alleviate summer heat stress. During periods of hot weather most dairies attempt to increase the nutrient density (increasing the concentrate to forage ratio of diets) of rations as a means of maintaining dry matter intake. In itself this can be troublesome if not monitored carefully, however in addition it's a normal tendency for heat stressed cattle to eat less frequently (feeding during cooler times of the day only) but more at each feeding. The combined effect of these types of rations and feeding patterns increases the risk for rumen acidosis and laminitis in hot weather.

Total mixed ration (TMR) feeding has evolved as one method to lower the risk of laminitis. However, unless appropriately formulated, carefully mixed, and properly delivered most if not all of the benefits of TMRs (with respect to hoof health) can be lost. Hay and ensiled feeds should be chopped as coarse as possible and not overmixed to the extent that effective fiber attributes are lost. Lactating cows and heifers should be housed separately and introduced to the milking herd ration gradually, preferably through the use of transition rations

which contain a higher forage to concentrate ratio. The addition of sodium bicarbonate in quantities of up to 1% of the ration will aid in the reduction of rumen acidosis and may be helpful. Measures to reduce heat stress and encourage consistent feed intake throughout the day will minimize production losses as well as limit potential for lactic acidosis.

HOOF TRIMMING

Hoof trimming is a necessary health management procedure. Dairy cows simply will not produce to their full potential unless given the advantage of regular foot care. Further, beyond the obvious benefit of improved productivity, it's inhumane to neglect needed trimming of severely overgrown hooves. Herds are advised to adopt a foot care program in which hooves are trimmed (or at least evaluated) a minimum of 1-2 times per year. Large herds that utilize professional hoof trimmers may prefer to perform hoof trimming duties at the time of drying-off. For smaller herds, hoof trimming of lactating as well as dry cows may be necessary.

In general, hooves should be trimmed in such manner as to provide even distribution of weight between claws so that claw overloading (excessive weight bearing; ie. usually the outside claw in rear feet and the inside claw of front feet) is avoided. Hooves should be slightly sloped to return the load bearing to the outside walls of the hoof. Proper trimming of feet reduces stress on ligaments, tendons, and joints of the lower leg and serves to maintain normal conformation. When feet have overgrown to the point of causing abnormal conformation, frequent trimming over a period of several months may be necessary.

FOOTBATHS (See Appendix I.)

The effectiveness of footbaths has not been thoroughly studied. Limited information suggests some benefit from their use in herds suffering lameness associated with diseases of the interdigital skin and heels (ie. footrot, interdigital and digital dermatitis). Footbaths are considered to be less helpful for treatment of conditions involving the hoof such as laminitis, sole abscesses, or sole ulcers.

Footbaths are usually located in routes regularly travelled by cattle. As a consequence, most end up in milking parlor exit lanes. Depending on size of the footbath, number of cows through the bath, weather, and housing conditions, footbaths may become heavily contaminated with organic material in a relatively short period of time. Rinsing feet in a plain water bath prior to entry into the chemical bath extends the life of the chemical (mediciated) bath.

Large herds choosing to use footbaths may want to consider bathing individual barns or groups of cows rather than whole herd bathing through parlor exit lanes. Daily rearrangement of the milking order rotation, thereby permitting differing groups of cows access to fresh bathing solutions, is used by some as an alternative to bathing specific groups of cows. Regardless of the system used, footbaths are expensive to maintain and require consistent management effort.

CAUSES OF UPPER LEG LAMENESS

Upper leg lameness accounts for only 10-15% of lameness in dairy cattle. Of those that occur, most are in rear legs and associated with trauma or injuries occurring near or at calving. Specific causes include: paralyses, fractures, dislocations, cellulitis (inflammation of the subcutaneous soft tissues) of the hock joint, and rupture of the gastrocnemius tendon.

Paralyses

Paralyses result from nerve damage. Depending on severity lameness that results may be temporary or permanent. In order of occurrence (from most frequent to least frequent) they are: peroneal, obturator, radial, femoral, tibial, and sciatic nerve paralysis. The most common of these, peroneal and obturator, are described below.

Peroneal nerve paralysis is a common secondary complication with milk fever, downer cow syndrome, or other condition which may cause a cow to remain down for an extended period of time. The peroneal nerve innervates the rear legs and due to it's anatomical location is highly susceptible to damage in the "down cow" position. Prolonged pressure on the lateral aspect of the stifle joint, as occurs when cows are down, will cause damage to this nerve. In general the longer the cow is down the more severe the potential damage to this nerve. It is characterized by "fetlock knuckling" in the affected rear leg(s). There is no specific treatment and most will recover spontaneously in 1-2 weeks or less. Cow lifts with shoulder and hip support and wide belly bands for uniform distribution of the cow's weight are helpful.

Obturator nerve paralysis occurs almost invariably as a result of calving difficulty. The obturator nerve courses through the birth canal eventually branching out to supply the heavy muscles of the inner thigh region of the rear legs. Due to it's location in the birth canal the obturator nerve is subject to damage at calving. Prolonged pressure as occurs during parturition when a fetus becomes lodged in the pelvis for an extended period of time creates the potential for temporary or even permanent paralysis. Severely affected animals are unable to rise. Those which are able to stand, are predisposed to "doing the splits" or falling as a result of loss of innervation to the inner thigh muscles which under normal conditions keep the legs properly aligned and positioned for standing. Surprising to some, it's not so much the size of the calf that causes obturator paralysis, rather the length of time the calf is lodged within the pelvis.

Good footing is essential to cows suffering obturator paralysis. As with other paralyses there is no real specific treatment beyond supportive care. Protecting these animals from environmental exposure (solar radiation), providing them with feed, hay, and water, and occasional lifting and/or repositioning is probably most important to their recovery.

Fractures

Fractures most frequently result from traumatic injury. Whereas, long bone fractures in young animals can often be simply repaired with plaster casts, such is generally not the case for fractures in large heifers or adult cows. Instead, fractures in adult cattle often lead to slaughter of those affected. A cardinal sign with limb fractures is the lack of weight bearing on the affected leg. Fractures of the pelvis and spine are most often associated with falls. They tend to occur near calving. The provision of non-slip flooring is a key factor in minimizing such problems.

Dislocations

Dislocations of the coxofemoral (hip joint) are difficult to correct in cows. They can be the cause for moderate to severe disability and are best handled on a case by case basis. As with other causes of upper leg lameness these generally result from traumatic injuries.

Hock Joint Cellulitis

Hock joint cellulitis (swollen hocks) is often more of a cosmetic problem than a lameness problem. However, where the incidence is high it reflects a problem that may be related to lack of a sufficient number of stalls, flaws in stall design, or cow habit/behavioral patterns in which cows choose to lie on concrete rather than in available stalls. The problem disappears when cows are given access to pasture or dirt lots. Lameness can be severe in those cases where the infection extends into the hock joint.

Rupture of the Gastrocnemius Tendon

Rupture of the gastrocnemius tendon is an occasional observation in downer cows. It causes severe disability, and for all practical purposes, is not correctable surgically. Examination of downer cows should include some assessment of this important structure before treatment is instituted. Surprisingly, some will be able to stand despite rupture of this tendon. The only real option for these cases is slaughter or euthanasia.

LAMENESS ASSOCIATED WITH DISEASES OF THE FOOT

The majority of lameness (90%) is associated with diseases of the foot. Consequently, it's the place to start when examining a cow for lameness. Regardless, of one's impression that the lesion causing lameness may be due to an upper leg injury, it is absolutely essential to do a thorough examination of the foot. Only after a possible foot lesion has been ruled out should examination for an upper leg problem proceed.

Laminitis

Laminitis, also known as founder, is a diffuse inflammation of the corium (sensitive tissues) of the hoof. The disease occurs as an acute, chronic, and subclinical condition.

Acute Laminitis

The acute form of laminitis occurs sporadically, however, incidence is highest for 1st lactation animals within the first 30-60 days of lactation. Clinical signs include stiffness, pain, and extreme reluctance to walk. Some animals will stand with forefeet placed forward, whereas others may stand with their back arched and feet placed beneath them. Others will stand cross-legged in effort to redistribute weight more evenly to all claws. However, most animals spend the majority of time lying down. Pain can be exaggerated by forcing the affected animal to rise. Redness, swelling, and tenderness above the coronary band and over the bulbs of the heel may be noticeable. If the animal will permit, one may be able to feel increased heat through the walls of the hoof and over the coronet.

The causes, as eluded to earlier, are likely related to genetics, environmental factors, nutrition, and feeding practices. Some have noted a relationship between laminitis and toxic diseases such as mastitis, and metritis, or with metabolic disorders such as ketosis (acetonemia) and rumen (lactic) acidosis. Regardless of inciting cause, the lesion in the hoof involves a disruption in the microcirculation of blood to the nerve-rich tissues of the sensitive lamina of the hoof. Although localized the inflammation is severe and causes extreme discomfort during the acute stages.

Chronic Laminitis

Clinical signs associated with the chronic form of laminitis are mild and undetectable with the exception of noticeable hoof wall changes that occur over time. With chronic laminitis, hooves widen, flatten, and develop characteristic horizontal ridges (also referred to as growth arrest lines). Lesions of the sensitive lamina are the same as those described for the acute form of laminitis, however, occur more gradually resulting in less obvious signs of discomfort.

The cause of chronic laminitis is primarily associated with the feeding of high grain diets and confinement of animals to hard surfaces. Chronic laminitis predisposes to claw disease, particularly sole ulcers and sole abscesses.

Subclinical Laminitis

The subclinical form of laminitis represents possibly one of the most common and consequently one of the more significant forms of this disease. As implied by its name, clinical signs typical of laminitis are absent. Hence, it is often referred to as a syndrome associated with

a number of lesions that occur secondary to a reduction in the strength and hardness of the hoof horn.

Poor horn quality predisposes to an increased rate of hoof wear, greater risk of hoof injury and bruising, and a heightened potential for bacterial invasion of the hoof. As a result, lameness due to sole abscesses or ulcers may increase in affected herds. What's most important is that one recognize whether or not subclinical laminitis is the underlying cause. It's quite obvious that emphasis on treatment of the resultant conditions without correction of the underlying cause(s) only contributes to continued and likely even greater economic loss.

As with the acute and chronic forms of laminitis 1st lactation animals within the first 30-90 days of lactation are most susceptible. Causes are the same as those described for the acute and chronic forms. Lesions of the foot that are most characteristic of the subclinical laminitis condition include:

1) visible hemorrhages of the sole that may appear as pink staining of the hoof horn or hemorrhages arranged in the form of striations,

2) particularly soft, yellowish, and/or waxy appearing hoof horn which cuts readily with a hoof knife,

3) an increased incidence of toe ulcers and sole abscesses

Evidence of subclinical laminitis is an important clinical indicator of an advanced problem. Simply monitoring lameness is <u>not</u> an effective means of limiting financial losses from foot disease. Instead, regular hoof trimming and evaluation and accurate determination of the causes of lameness is essential. Regular review of the cumulative lesions observed at trimming and during the treatment of lameness forms the basis for early recognition of possible problems with subclinical laminitis.

There is no specific treatment, however, many recommend copper sulfate footbaths which may assist in hardening hoof horn (See appendix on footbaths). Prevention is aimed at avoidance of the lactic (rumen) acidosis syndrome. The following list (by no means exhaustive) provides a few practices for consideration with particular concern for 1st lactation animals:

1. Make feeding changes gradually.

2. Monitor intake of concentrates by springing heifers and dry cows (some suggest limiting these animals to 6-10 lbs./hd/day).

3. Feed a total mixed ration (TMR) with a properly balanced concentrate to forage ratio.

4. Develop a transition feeding group, and increase intake of concentrates gradually during early lactation.

5. Make feed available at all times and encourage animals to eat frequently.

6. Cows housed on concrete should have access comfortable stalls or pasture/grass/dirt lots for substantial periods each day.

White Line Disease and Sole Abscesses

This is one of the most common causes of lameness in the cow. It is characterized by acute and severe lameness almost to the extent that the cow will refuse to bear weight on the affected foot. Unlike footrot, swelling of the foot does not occur in the acute condition. Instead, swelling accompanies extension of the infection into the soft tissues of the foot that ultimately occurs when subsolar abscesses are denied prompt treatment.

Sole abscesses are a common sequel to laminitis which predisposes to disrupted blood flow and hemorrhage in the corium (sensitive lamina), and softening, widening and separation of the white line (junction between the hoof sole and wall) of the sole. Lesions in the corium form laminitis (sensitive lamina) occasionally lead to the formation of sterile abscesses. Sole abscesses may also result from a hole or crack in the horny sole (especially near the white line) that permits the entry of contaminants (small slivers of stone, gravel or grit) which secondarily establish an infectious process leading to abscessation between the sole of the hoof and adjacent sensitive soft tissues. As the infectious debris (pus) accumulates pressure builds up causing extreme discomfort. Unless the pus pocket is drained it will continue to enlarge and migrate upward until it reaches a soft tissue area in which it can rupture and drain.

Treatment requires drainage of the abscess through the sole, if possible through the original site of the contaminant's entry. The entry site can usually be visualized as a dark spot on the surface of the sole following cleaning and paring of the superficial layers of the solar horn. Once the entry site is located careful paring out of the track leading to the pus pocket is required until drainage is accomplished. Care should be taken to establish drainage, however minimize peripheral damage. The hole established for drainage of the abscess may be packed with small cotton ball soaked in Kopertox or iodine. Many animals will show immediate improvement, whereas others in which abscessation was more extensive may take several days to improve. There is no need for antibiotic therapy unless the infection extends to deeper tissues of the foot.

Sole abscesses are extremely painful. For severe cases, pain can be mediated through the application of a foot block to the unaffected claw of the affected foot. This elevates the damaged claw and removes weight-bearing on the affected claw (Technovit - Dr. Jorgensen Labs, Cowslips - American Giltspur). Blocks will eventually fall off (or wear off) after a period of several days to a couple of weeks.

Sole Ulcers

A sole ulcer is described as a circumscribed loss of the horny sole which exposes the corium (sensitive tissue immediately beneath the sole) of the foot. Sole ulcers tend to be the most debilitating of lameness conditions affecting dairy cattle. The typical lesion is usually found

at the junction of the sole and the heel. However, some may occur at the toe secondary to laminitis and rotation of the pedal bone. Appearance of the lesion will vary according to it's maturity. Early ulcers appear as nothing more than a circumscribed area of fresh tissue that may be uncovered in the process of hoof trimming. More mature or long-standing sole ulcers may be covered initially by rough, irregular horn tissue that when pared away exposes granulation tissue which bleeds freely if damaged.

As indicated, laminitis is thought to be a major cause of sole ulcers. The combination of softened solear horn and heel erosion predispose the outside claw to excessive loading and wear. The additional strain and pressure applied to the heel/sole region exacerbates dysfunction of the underlying corium and leads to development of the lesion. Treatment requires removal of the necrotic (dead or decaying) horn tissue followed by elevation of the affected claw with a footblock attached to the unaffected claw. All healthy horn tissue should be left in place. Regular hoof trimming is an important factor in lowering the incidence of sole ulcers. Periodic trimming maintains appropriate weight-bearing on all claws and reduces the potential for excessive claw-loading and sole ulcer development.

Footrot

Footrot is a contagious disease of cattle characterized by inflammation of the soft tissues of the foot and sudden lameness. The affected foot becomes severely swollen and most cows will resist weight bearing. The typical lesion begins as a superficial lesion in the interdigital skin (skin between the toes) progressing rapidly to affect deeper tissues of the foot. The lesion has a characteristic foul odor which may be helpful in differentiating it from other conditions. The incidence tends to be higher during the winter months and confined cattle are believed to be affected more frequently than pastured cattle.

When identified early, treatment with antibiotics (Penicillin, Albon, or Naxcel) is very effective. The interdigital lesion is treated by cleaning and application of topical antiseptics or antibiotics. Some prefer to apply a bandage or flimsy wrap. Control and prevention may be aided through the use of footbaths containing a 5-10% copper sulfate solution (see formulas and advice for mixing in appendix 1 of this paper).

Hairy Heel Warts - Digital Dermatitis

Digital dermatitis (alias, hairy heel warts) in the United States were first described as herd problem in 1980 following an outbreak of the disease in 2 New York dairy herds. Following these accounts, not much was heard or written about the problem and, athough it continued to occur sporadically, the number of herds affected appeared to be relatively few. However, since 1990 digital dermatitis has reached near epidemic proportions throughout North America.

The lesions of digital dermatitis tend to occur on rear feet about 90-95% of the time. Studies in Florida suggest prevalence of the disease may be as high as 50% of the herd. Others have suggested even higher incidence rates. Lesions are typically located on the back of the foot

just above and adjacent to the interdigital space. Some are located above and/or adjacent to the bulbs of the heels and still others may be located on the posterior aspect of the pastern or in the interdigital space. Early lesions may be ulcerative and round or oval with a distinct rim demarcated by erectile hairs that surround the edges. Lesions usually appear to be moist with a surface resembling a raspberry or strawberry. Lesions are extremely sensitive and cows will react painfully to spraying with water or other direct contact. Disturbance of the inflamed tissue may result in mild to moderate bleeding.

The exact cause or causes of digital dermatitis remains a mystery, however most believe that more than one infectious organism is likely involved. Early reports of digital dermatitis suggested a viral etiology because of the wart-like appearance of lesions. Yet, despite several attempts no one has been able to detect viruses associated with the lesions. Lesions, lameness, and pain all regress rapidly following treatment with antibiotics, lending further support to a bacterial etiology.

Specific approaches to therapy have included surgical excision, footbaths and/or topical treatment with various disinfectants and caustic chemicals, cryosurgery (freezing), and electrocautery (burning). More recently, topical antibiotic treatment under a bandage has become a popular method to treat individual animals; specifically, topical treatment with cotton balls or gauze soaked in oxytetracycline hydrochloride or in a lincomycin/spectinomycin combination product under a duct tape bandage. Most cows are remarkably improved within 24-48 hours with bandage removal at day 5 following application. Observations to date clearly demonstrate the organisms to be highly susceptible to antibiotic treatment.

Treatment on a herd basis is usually performed with footbaths or by application of a topical antibiotic spray. Data gathered from field trials at the University of Florida with oxytetracycline and lincomycin suggest that herds may achieve excellent control with topical spray treatment. These antibiotics used in an intensive spray treatment regime as outlined below were shown to reduce prevalence of active disease to 0 in treated herds (See Appendix II. for specific information on mixing, etc.).

Suggested Treatment Protocol:

1. Wash all feet of all cows and examine for lesions, identify affected cows with a crayon, leg band, or other ID system

2. Treat all feet of all cows (regardless of the presence of a lesion) in the herd for a period of 5-7 consecutive days. Apply topical spray treatment once daily.

3. After completion of the 5-7 day treatment - continue daily topical spray treatment of cows with visible lesions only until resolved.

A number of other non-antibiotic preparations are presently being marketed. Most have not been thoroughly evaluated in well controlled research trials. Early indications are that the response to treatment is generally favorable, but variable and less than that obtained with topical antibiotic treatment. Time and experience with these products may establish a clearer role for

these materials in combination with topical or systemic antibiotics for control and prevention in herds. They are advantageous in the fact that they present little or no residue potential and may be more resistant to neutralization from contact with organic material. At least one of these, Hoof Pro Plus (SSI Corp., Los Gatos, California), a pH adjusted ionic copper sulfate formulation, did reduce prevalence of digital dermatitis in a Florida study and lameness in a Wisconsin study when used as a topical spray.

Despite the apparent resolution of digital dermatitis following treatment, reoccurrence is common and often within 3-6 months or less. It is likely that some form of continuous treatment will be necessary to keep the disease in check. Until other suitable alternatives can be determined from controlled studies, the best bet for treatment and control is topical spray using either oxytetracycline or lincomycin. In some herds footbaths may provide acceptable treatment and control results.

A word of caution.....the occurrence of digital dermatitis in epidemic proportions has spawned the emergence of a multitude of treatments and treatment advice. Stay with therapies that demonstrate some level of effectiveness from controlled research trials. Digital dermatitis is a manageable disease, however, complete eradication from herds once they become infected is rare. Treatments offered above are at best "stop-gap" measures, but will reduce prevalence of the disease in herds. Until such time as "true solutions" become available, dairymen are advised to utilize treatment stratagies with established efficacy.

SUMMARY

Feet and leg problems constitute a major health concern. The causes and/or predisposing factors are many and include: nutrition and feeding, housing and environment, concurrent disease, management factors and genetic influences. The majority of lameness (90%) occurs in the foot. Routine examination of lame cows and feet at the time of treatment or trimming can provide valuable information regarding subclinical foot diseases such as subclinical laminitis. Claw diseases (sole ulcers and abscesses) are a primary cause of lameness in most herds and are predisposed by laminitis and confinement on concrete. Footrot and digital dermatitis are diseases with an infectious component responsive to antibiotic treatment, particularly when identified early-on in the course of disease. Lameness is a complex disease. Dairymen should strive to understand the primary types of lameness occurring in their operations, and work toward finding solutions by directing effort at the factors most likely responsible.

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APPENDIX I.

FOOTBATHS

I. COPPER SULFATE - WET BATH

A. 10% Solution = 16 pounds in 20 gallons of water

1. Hot water will hasten dissolving. Addition of some vinegar will aid dissolving in hard water. The solution must be kept reasonably clean since manure will de-activate it. Copper sulfate should not be allowed contact metal due it's corrosive properties and because contact with metal may inactivate the copper sulfate.

2. It is irritating to the feet and should not be used repeatedly at a concentration greater than 10%.

3. Sheep are very sensitive to ingested copper and will be poisoned by it if the residue is discarded where they have access to eat it.

II. COPPER SULFATE - DRY BATH

A. Add 1 part powdered copper sulfate to 9 parts slaked lime

III. FORMALIN* (NOT RECOMMENDED)

A. 5% Solution = 1 gallon of 36% formaldehyde in 19 gallons water.

1. It is very irritating when inhaled and should only be used or mixed outdoors. It is also irritating to the skin and feet and should not be used repeatedly as a footbath at greater than 5% concentration. Formalin tends to harden the hooves with repeated use. Any residue solution should be discarded and a fresh batch mixed before each use. Otherwise, the mixture may become too concentrated from evaporation.

2. Formalin is monitored by the Environmental Protection Agency under SARA Title III and all suppliers and/or distributors are required to keep records of sales. No more than 500 lbs. should be kept on site at any one time.

* Readers are advised that while Formaldehyde is a popular treatment for foot problems it is a carcinogen and has been banned in several states. Use with extreme caution!

FOOTBATHS

IV. ZINC SULFATE

A. 20% Solution = 34 lbs. powdered, Agricultural grade zinc sulfate monohydrate (36%), per 20 gallons of water.

1. This is non-irritating to the feet and can be used daily.

2. Effectiveness for controlling foot problems in cattle is largely unknown.

APPENDIX II.

TOPICAL TREATMENT FOR DIGITAL DERMATITIS

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SUGGESTED PRODUCTS:

Terramycin-343 by Pfizer (102.4 grams oxytetracycline HCl)
Terramycin Soluble Powder by Pfizer (10 grams of oxytetracycline HCl)
Lincomix soluble powder by Upjohn (16 grams of Lincomycin HCl)

MIXING INSTRUCTIONS:

Oxytetracycline HCl soluble powder

Mix 1 packet of Terramycin-343 in 1 gallon of distilled water. This makes a 25 mg/ml concentration. If using the 51.2 gram packet of Terramycin-343, add 2 packets to 1 gallon of distilled water or 1 packet in a half gallon to achieve same concentration.

Smaller herds or herds treating a smaller number of animals may use 1-2 Terramycin (10 gram packets) in a quart of water. This makes a 10-20 mg/ml concentration of oxytetracycline which is more dilute but still effective.

Lincomycin HCl soluble powder

Mix 1 packet of Lincomix in 2 liters (quarts) of distilled water. This makes an 8 mg/ml concentration of Lincomycin HCl.

DIRECTIONS FOR USE:

Use as a topical spray at the rate of 10-20 cc per foot. Apply to heels and interdigital space (cleft) or areas with visible lesions using a garden-type hand pump sprayer or other suitable spray treatment device.

SUGGESTED TREATMENT REGIME

Week 1

Treat all feet of all cows once daily for a period of 5-7 consecutive days.

Week 2 and beyond*:

Continue daily topical spray treatment of all cows with visible lesion(s) only.

*Because lesions tend to reoccur topical spray treatment must continue indefinitely!

PRECAUTIONS:

This treatment represents an extra-label use of these products, dairymen are advised to consult with their veterinarian for proper labelling and further instruction.