Medical Management of Dairy Heifers from Birth to Breeding

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Introduction

The future of a dairy operation depends on the successful raising or procurement of heifer calves that will potentially equal and preferably exceed the milk production of the existing herd. In a modern dairy where rigid culling is practiced, 20-30% of the milking herd is usually replaced annually. Since mortality rates for young calves often exceed 20% under some management conditions, it is imperative that as many calves as possible be raised to maturity. This requires various disease control measures, including proper dry cow management, suitable calving facilities, colostrum feeding and navel disinfection in newborn calves, appropriate housing and adequate nutrition in growing calves. The following management procedures, adopted over many years of experience and research at Carnation Research Farm have been effective in reducing calfhood mortality to less than 3%.

General Procedures

Raising calves to healthy, mature heifers begins with proper management of the pregnant dry cow. At drying off, after cows are milked for the last time, the udder is infused with a long-acting cloxacillin, mammary-infusion product. Teats are dipped with an organic iodine preparation and *E. coli* bacterin (K99) is administered. A systemic insecticide like Warbex® is also applied to the dorsum to control external parasites and warbels. As an alternative, Ivermectin can be given to treat both external and internal parasites.

Dry cows are maintained in a large lot where they can exercise freely and be fed feed-lot style. Alternatively, cows could be turned out to pasture; however, letting them forage, dietary control is lost, aggravating postpartum diseases like milk fever and retained placentas. In the lot cows are provided a ration of oat hay, grass silage, beet pulp and a dry cow supplement consisting of three pounds of concentrates with vitamins and minerals added. The vitamins and minerals are thus force fed to meet or exceed NRC recommendations. This ration provides only sufficient nutrients for maintenance of the cow and development of the fetus. In an attempt to control milk fever, cows are limited to 75 gms of calcium and 25-40 gms of phosphorus daily.

Two to three weeks prior to parturition, dry cows are brought to close-up quarters and the ration changed to oat hay, corn silage, concentrates, and the dry cow supplement. The amount of grain is gradually increased to about 1% of the body weight or 15 lbs. The udders are retreated with a lactating infusion product, 7-ml of Mu-Se® is injected parenterally, and a booster *E. coli* vaccination given. Cows are watched closely for "making up." Just before parturition the cow is put into a thoroughly cleaned and disinfected box stall, freshly bedded with straw. Not only will this help prevent disease in the newborn calf, but will also reduce mastitis and nonspecific genital-tract infections.

In our herd of 400 cows, an individual assigned to the maternity barn monitors cows routinely and, hence, is available to assist cows during parturition, resulting in fewer calves dying during birth. Cows are allowed to labor for approximately one hour. When calving assistance is needed, the cow's tail is secured with a cord around her neck. The perineal area of the cow and the assistant's hands are washed before entering the vagina. Immediately after delivery into a bed of clean straw, the calf's navel is disinfected with 7% tincture of iodine and a navel clip applied. The cow is provided with as much warm water as she will drink. Within the first two hours of life the newborn calf is fed two quarts of high-quality colostrum from a nipple bottle. Another half gallon is provided within the next eight hours. The calf remains with the cow in the box stall for approximately 24 hours, at which time the calf is taken to one of the research facilities. Within the first 24 hours of life calves are injected with ½ cc of MuSe®. The navel is redipped at 4-5 days of age and the umbilical clip removed.

All calves are assigned to nutritional research studies, evaluating milk replacers and calf starters. All milk-replacer and calf-starter trials are compared to the following baseline protocol:

1. Two quarts of whole milk are fed twice daily. Alternatively, all milk-based milk replacers with 20% protein, 20% fat and less than 0.2% fiber can be fed. Milk replacer is fed at a rate of ½ lb dry powder twice a day, with an appropriate amount of water, usually equal to two quarts per feeding.

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2. Calf Manna® (25% protein, 3% fat and less than 6% fiber) is made available to calves at 2-3 days of age. When calves consume 1 lb of Calf Manna, they are switched to an 18%-protein starter with 25% Calf Manna. At 10 weeks of age the calf starter is replaced by a 16%-protein concentrate.
3. A high-quality alfalfa hay is made available ad libitum at two weeks of age.
4. Water is made available at all times.
5. Weaning is scheduled for five weeks if calves are consuming at least 1½ lbs of calf starter. Calves remain in individual pens for 1-2 weeks after weaning, before moving to community pens.

Comparisons of milk and replacers revealed that calves fed whole milk outperformed calves fed milk replacers of any kind (Table I, Fig I). Milk replacers with 22% milk protein and 20% animal fat were superior to replacers with soy isolate containing 22% protein and 10% fat. However, feeding milk replacer of acceptable quality, such as those with 20% protein, with some soy isolate, 10% animal fat and less than 0.5% fiber provides adequate growth of calves when they are raised in environmentally-controlled facilities with optimum disease prevention.

TABLE 1. Mean Weight in Calves Fed Different Qualities of Milk Replacer.

Age (Weeks)	Mean Weight Gain (Lbs.) Whole Milk N = 195	Milk Based MR 22/20 N = 75	MR with Soy Isolate 22/10 N = 75
1	4.08	2.60	2.56
2	8.69	5.75	4.10
3	15.71	12.37	9.71
4	25.55	20.73	18.06
5*	35.96	31.64	27.26
6	48.37	44.69	40.21
7	62.55	59.28	54.15
8	77.40	74.61	68.56
9	91.13	88.40	82.80
10	106.46	102.78	96.37

* Time of weaning

Performance of calves fed whole milk and milk replacers were compared using hematocrit, serum protein, serum cholesterol, serum triglyceride and blood glucose (Fig 2-6). These clinical measurements are good means for evaluating the performance of calves fed milk replacers. The values correlate directly with the quality of the milk replacer.

Although calves fed whole milk generally outperform calves fed milk replacers, they have a drop in hematocrit compared to milk replacer fed calves (Fig II).

The incidence of calf scours associated with different liquid feeding regimens is illustrated in Fig 7. Milk replacers with some soy isolate were associated with greater frequency of scours earlier in life, as compared to higher-quality milk replacers or whole milk. Although calves fed whole milk or

FIGURE 1. Mean Body Weight Gain in Two MR With Soy isolate 22/10 Compared to Whole Milk.

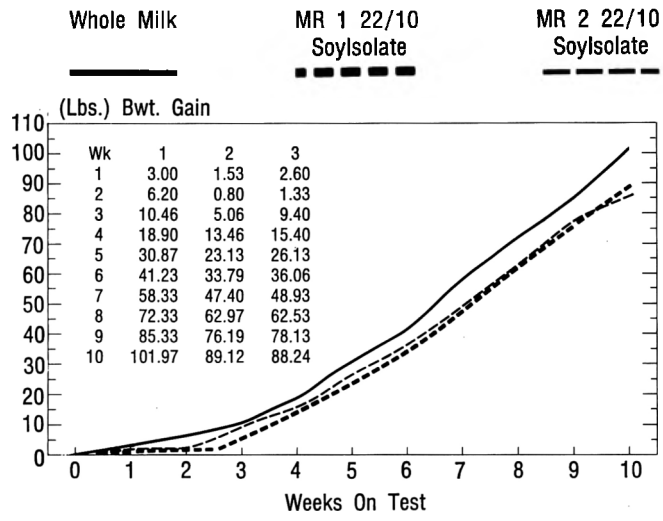
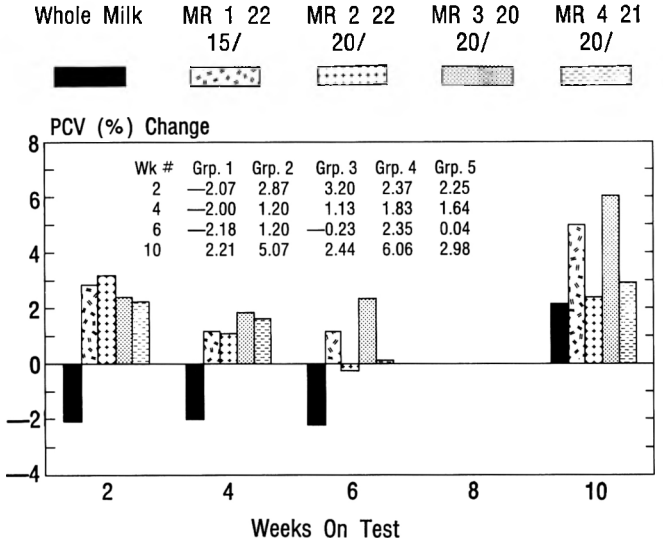


FIGURE 2. Change in PCV in Four High Quality Milk Replacers Compared To Whole Milk



high quality milk replacers generally outperformed calves fed a poorer quality milk replacer, the mortality was at least as low in calves fed milk replacers with some soy isolate in trials over a three-year period (Table II).

Calf starters also can affect the growth of calves. The mean weight gain in calves fed different qualities of calf starters along with whole milk was compared (Table III). Calves fed high-quality calf starter of 25% protein, beginning at two days old, outperformed calves fed calf starters containing 16% and 18% protein. The high-quality calf starter, Calf Manna®, reversed the drop in hematocrit that occurred in milk-fed calves (Fig VIII).

Nutrition of the Older Calf

At Carnation Research Farm, calves are weaned at 5

FIGURE 3. Mean Total Protein Change in 3 MR with Soy Isolate. Compared To Whole Milk

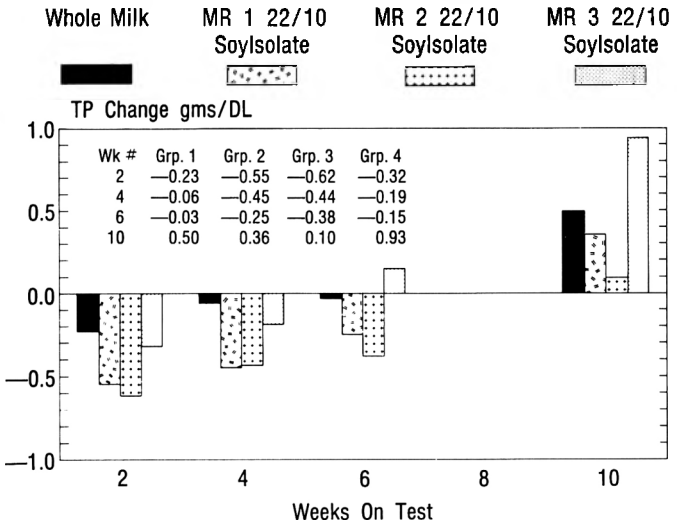
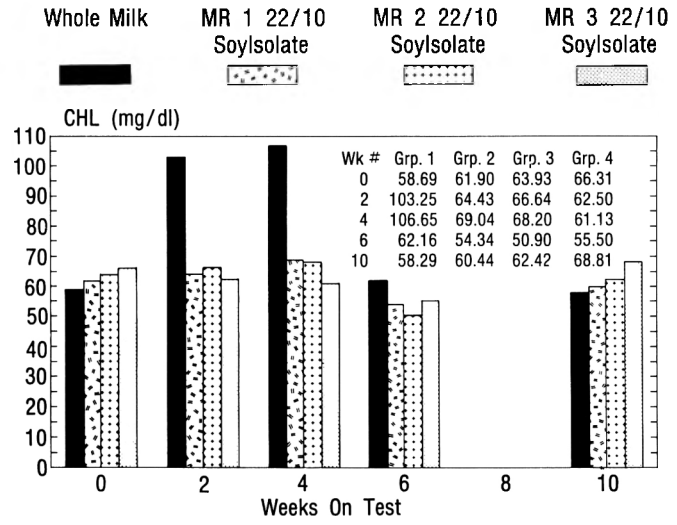


FIGURE 4. Mean Cholesterol in Three MR with Soy Isolate. Compared To Whole Milk



weeks old. This is not a problem if calves have been free of diseases and are consuming 1½ lbs of an 18% protein calf starter. However, some calves, not at this level, are kept on liquid feed in order to get optimum growth. As a calf's demand for nutrients increases, grain consumption increases as the amount of liquid feed is kept constant. The transition from liquid feed to dry feed is thus more easily accomplished.

Hay fed to calves should be of excellent quality and alfalfa with crude protein of >18%, a TDN value of >50% and a crude fiber value of <25% is preferred. About 6 months of age, calves can be switched to a 14-16% protein dairy concentrate, with a good quality roughage, such as alfalfa, and possibly, corn silage. Up to 6 lbs of grain should be fed to ensure a gain of about 1½ lbs per day. As heifers get older, the amount should be reduced, especially when the roughage is of high quality. Free choice minerals providing calcium, phosphorous, magnesium, trace minerals and salt, should be made available.

FIGURE 5. Mean Triglyceride Change in 3 MR with Soy Isolate. Compared To Whole Milk

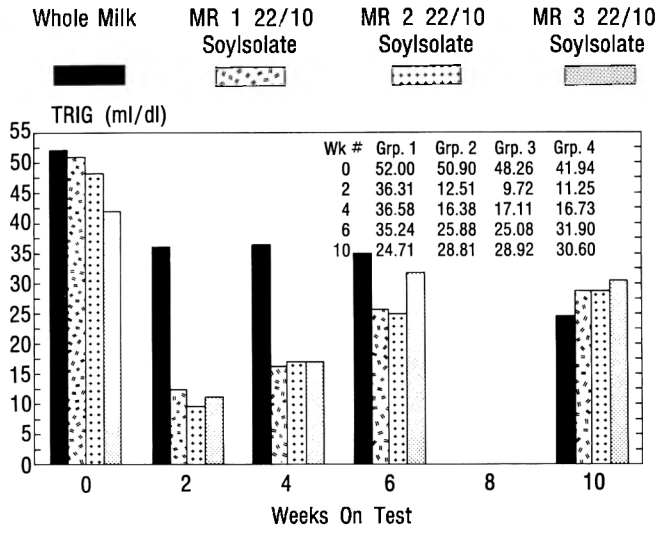


FIGURE 6. Mean Glucose Change in 2 MR with Soy Isolate. Compared To Whole Milk

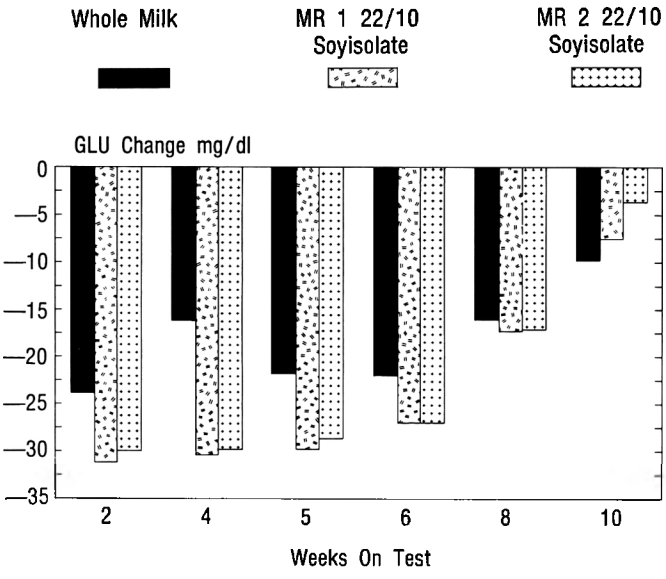


TABLE 2. Calf Mortality in Calves Fed Whole Milk, High Quality and Acceptable MR over a 3-Year- Period.

Product	No. Calves	Mortality	No. Removed from Trial
Acceptable M.R.	337	1 (0.3%)	22 (6.5%)
High Q. M.R.	238	2 (0.8%)	11 (4.6%)
Whole Milk	286	3 (1.0%)	29 (10.1%)

FIGURE 7. Mean No. of Days Treated for Scours Comparing. High Quality MR, MR with Soy Isolate and Whole Milk

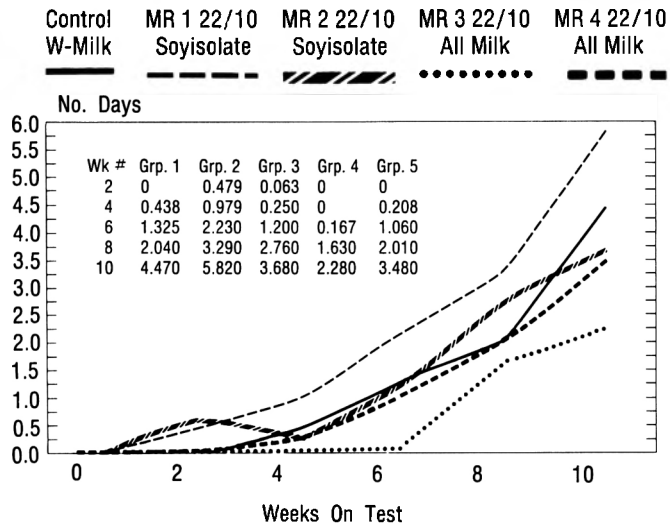
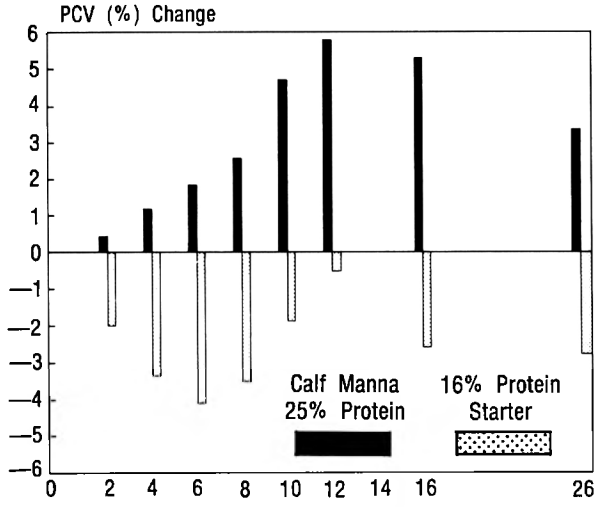


TABLE 3. Mean Weight Gain in Calves Fed Different Qualities of Calf Starters Along With Whole Milk.

Age (Weeks)	Mean Weight Gain (Lbs.) 16% Prot. C.S. N = 195	18% Prot. C.S. N = 30	C.M. 25% Prot. N = 75
1	4.08	4.10	4.88
2	8.69	9.85	9.13
3	15.71	15.55	16.44
4	25.55	24.50	27.63
5*	35.96	33.15	38.98
6	48.37	46.85	52.78
7	62.55	61.50	71.14
8	77.40	80.05	88.30
9	91.13	92.90	99.22
10	106.146	106.00	112.37

* Weaning was at 5 weeks of age.

FIGURE 8. Mean Packed Cell Volume Change Comparing Calves Fed Calf Manna and a 16% Protein Starter.



Disease Control

The two most important diseases encountered in raising calves are scours and pneumonia. Some of the important preventive measures utilized at Carnation Research Farm, including immunization of dry cows with *E. coli* (K99) vaccine, cleaning and disinfecting box stalls for newborn calves, colostrum feeding, navel disinfection and using high-quality milk replacers, have already been mentioned.

In addition, the type of housing is important. Because of the location of facilities on a hillside, heavy precipitation in Reseach Farm are housed in barns with individual tie stalls. Tying calves separately with complete separation between stalls reduces the spread of disease-causing agents. An outbreak of scours can often be stopped by placing calves at some distance from calves that are experiencing disease. Feeding utensils can be an important fomite for transmitting infectious agents. Hence, each calf has its own feed pan and bucket. Liquid feed is provided only by nipple bottles. Nipples are soaked in a disinfectant between feedings, and the bottles scrubbed and disinfected.

At Carnation Research Farm, calf scours is treated according to the following protocol: The feeding regime is maintained as usual and liquid feed is provided morning and night regardless of the severity of scours. Oral electrolytes with high dextrose concentrations, lycine as an amino acid, and acetate as the buffer are provided once midway between the milk or milk-replacer feedings. Ten mls of oral spectinomycin are added to the electrolyte solution. The rectal temperature of young calves is taken daily. If rectal temperatures exceed 103°F, calves are given parenteral spectinomycin at 5 mg per lb. If calves become dehydrated, oral electrolytes are provided again in the middle of the night. With this regime, we find that calves continue to gain weight in spite of scouring for several days.

Environmental factors are very important in relation to calf pneumonia; however, the subject of housing and environment is beyond the scope of this paper. For much of the country, calf hutches without artificially-controlled environments are the best and most inexpensive way to house calves. When calves are housed in barns, environmental control becomes more critical, especially for the prevention of calf pneumonia. Environmental factors to be considered are:

1. Wall and ceiling insulation
2. Ambient temperature
3. Relative humidity
4. Ventilation
5. Population density
6. Pen construction and bedding
7. Sanitation and disinfection

Calf pneumonia is a serious disease problem at Carnation Research Farm. Several years of research in calf pneumonia have revealed the following:

1. The incidence of calf pneumonia is loosely related to

ambient weather and conditions with more cases occurring in the fall, winter and sometime spring. However, there has been no consistent pattern from year to year.

2. The major viral infections of cattle, including IBR, BVD and PI3 do not have a major role in the etiology of calf pneumonia.
3. Chlamydial agents do not play a major role in the etiology of calf pneumonia.
4. Transtracheal lavages from pneumonia have demonstrated a 75% recovery rate of mycoplasma, but only a 5% recovery rate of ureaplasma. This suggests that myco-plasma species may be associated with disease.
5. Of bacterial agents recovered from transtracheal lavages, only *Pasteurella multocida* and *Pasteurella haemolytica* were frequently isolated. *Pasteurella multocida* was isolated from the trachea of about 2/3 of the cases, while *Pasteurella haemolytica* was isolated from the trachea of about 1/5 of the cases. In calves that died or were euthanized, *Pasteurella haemolytica* was isolated from the lungs of 3/4 of the cases.
6. Evaluation of commercial and autogenous *Pasteurella multocida* and *Pasteurella haemolytica* bacterins revealed neither was effective in preventing calf pneumonia. Vaccination with either bacterin resulted in increased occurrence of fever after vaccination, and an increase in pneumonia after booster innoculation with the autogenous bacterin.
7. We have evidence that the Bovine-Respiratory-Syncitial Virus is involved in the etiology of calf pneumonia. We have positive isolations and seroconversions.

The protocol for treatment of calf pneumonia is as follows: Initial treatment consists of penicillin, 30,000 units per lb of body weight subcutaneously once daily. If, after two days the response to penicillin is poor, spectinomycin, 5 mg per lb of body weight subcutaneously, twice daily, is substituted. If spectinomycin is not effective within two days, Ditrim® or Trimethiprim®, 1 ml per 20 lbs of body weight subcutaneously, once daily of the 28% solution, or 1 ml per 40 lbs of bodyweight, of the 48% solution is given. Parenteral antibiotics are given for two days after the body temperature is below 103°F and then a similar antibiotic is given orally for another three days.

Transtracheal lavages are performed periodically to identify causative agents and perform sensitivity testing.

Immunization Schedule

An important aspect of disease prevention in dairy calves is a sound immunization program. At Carnation Research Farm the immunization schedule is as follows:

Two Weeks Old

Hemophilus somnus vaccine, *Pasteurella multocida/Pasteurella haemolytica* vaccine and Bovine Respiratory Syncitial Virus Vaccine (experimental investigation).

Two Months Old

Hemophilus somnus and wart vaccine

Four-to-Five Months Old

Brucella vaccine and wart vaccine

Six-to-Seven Months Old

Males and Females—Clostridial disease 7-way. Females only—IBR, BVD, PI3, Lepto-5-way & *Hemophilus somnus* vaccine.

Annually

Lepto 5-way to unfreshened heifers ≥ six months old. IBR, BVD, PI3, Lepto-5-way and *Hemophilus somnus* vaccine to cows at 30-days postpartum.

Lepto-5-way to cows at the time of pregnancy rechecking three months after conception.

E. coli bacterin at drying off, *E. coli* bacterin and *Hemophilus somnus* vaccine at retreatment of udder, three weeks prepartum.

Other Management Procedures

A. At birth, calves are given ½ ml of Mu-Se® subcutaneously.
B. At two months of age, 1 ml of Mu-Se® is administered.
C. At six weeks of age, calves are dehorned by electrocautery and supernumerary teats removed surgically.
D. Internal and external parasites are controlled by periodic treatment. Panacur® is used twice in the spring on pastured heifers and again in the fall. A systemic organophosphate like Warbex® is applied to the dorsum of the animals in the spring and fall.
E. Coccidiosis is prevented by using Deccox® either top dressed or mixed in the grain and fed to weaned calves.
F. Ringworm is treated topically with fungicidal ointments when only one or two calves are affected. For group treatment, Orthocide Garden Fungicide®, 50%-Chevron Chemical Co., is applied with a pressure sprayer at 400 to 450 lbs pressure. The appropriate mixture for cattle is .45-.50 lbs per 20 gallons of water. This concentration is doubled for facilities, fences, mangers, etc.