

## EQUINE PRACTICE – FOALING MANAGEMENT

Recent studies of prefoaling milk (mammary secretion) electrolyte changes have demonstrated an increased ability to predict a mare's approaching readiness to foal. These electrolyte changes (especially with respect to calcium level) have also been shown to be related to the development of maturity of the foal in the uterus and its subsequent survivability following a normal delivery. The FoalWatch test kit (Chemetrics, Inc., Calverton, Va.) is used in this study to assist in the determination of when a mare is likely to foal, based on the kit's ability to detect changes in the prefoaling mammary secretion calcium carbonate ( $\text{CaCO}_3$ ) levels.

# The Use of a Prefoaling Milk Calcium Test Kit in the Foaling Management of Mares

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## Introduction

Normal gestational length can vary widely in the mare. By the time parturition is pending, the majority of mares foal during "non-business" hours for most horse owners, as well as veterinarians. Thus, many sleepless nights can be spent waiting up for the mare to foal. A 24-hour per day distribution of spontaneous foaling times for 239 mares is listed in Figure 1. Physical signs of the mare's approaching readiness for foaling include a gestation length of greater than 320 days, udder enlargement with the presence of colostrum (milk) in the teats, waxing on teat ends, and relaxation around the tail head, buttocks, and lips of the vulva.<sup>1</sup> While helpful, none of these signs is extremely accurate as a means of predicting when the mare will actually foal. Recent studies of prefoaling milk (mammary secretion) electrolyte changes have demonstrated an increased ability to predict the mare's approaching readiness to foal.<sup>1-4</sup> These electrolyte changes (especially with respect to calcium level) have also been shown to be related to the development of maturity of the foal in the uterus and its subsequent survivability (viability) following a normal delivery.<sup>5</sup>

The FoalWatch test kit (Chemetrics, Inc., Calverton, Va.) has been used extensively over many years by this author and has proven useful in the routine management of foaling mares. Its intended use is to assist in the determination of when the mare is likely to foal, based upon the kit's ability to detect changes in the prefoaling mammary secretion (milk) calcium carbonate ( $\text{CaCO}_3$ ) level. It is a tool that, when used in an appropriate manner, will allow one to attend the mare's foaling without an excessive number of sleepless nights. Alternatively, it can be used as a tool for accurately predicting when elective induction of parturition may safely be initiated. The advantages of this kit include its accuracy and repeatability compared with other test kits (or test strips) available on the market, its ease of use, its quantitative (numerical) determination of the  $\text{CaCO}_3$  level in each sample of prefoaling milk tested, and its economy. This article is a general description of its use on the farm.

## When To Begin Testing

Begin sampling and testing approximately 10 to 14 days in advance of the mare's expected foaling

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## FOALING MANAGEMENT OF MARES

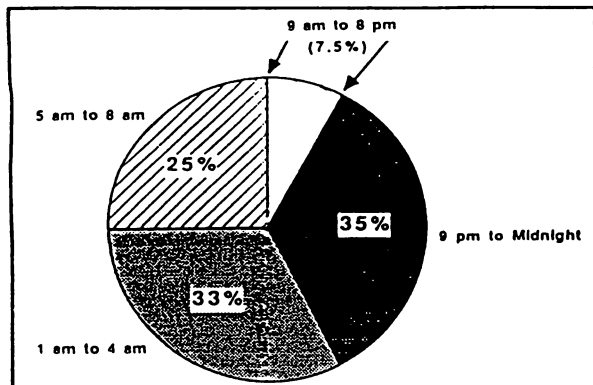


FIG. 1 — Foaling time distribution during the 24-hour day for 239 mares.

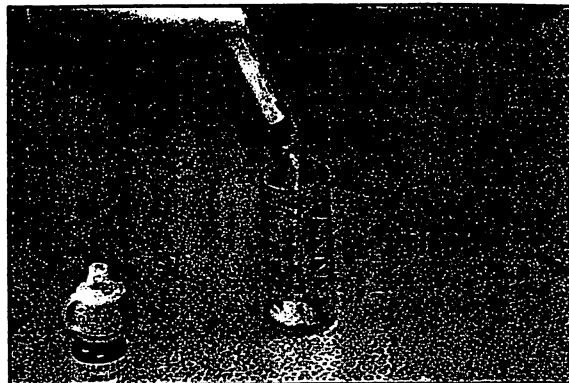


FIG. 3 — An appropriate measure of milk sample (1.5 ml) is placed in the testing cup.

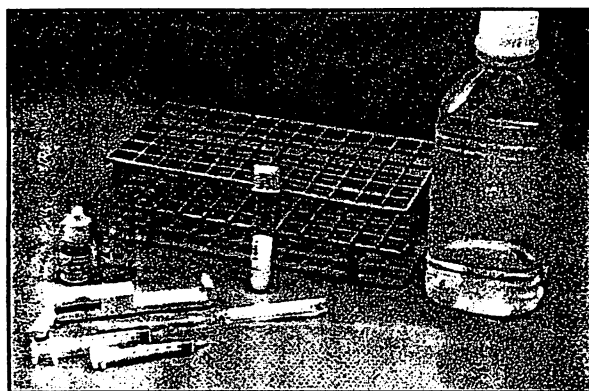


FIG. 2 — Milk sample in collection tube, distilled water, test tube rack, Titret test kit with indicator dye solution, testing cup, Titrettor,™ and glass Titret ampoule.

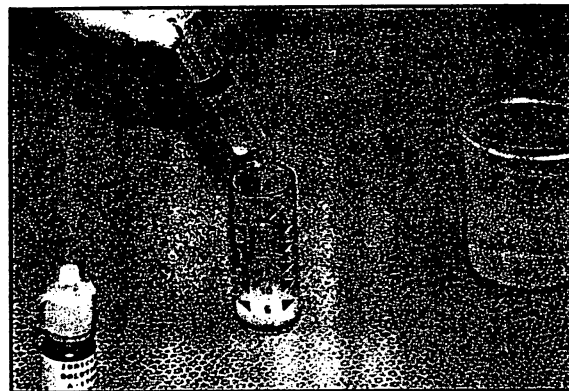


FIG. 4 — Distilled water (9 ml) is added to dilute the milk sample.

date (calculated as 335 to 340 days from the last known breeding date). In mares with an unknown breeding date, testing should begin as soon as some udder enlargement is noted and a small amount of secretion can be obtained from the teats without undue effort. It is best to keep a close check on udder development on a daily basis and practice massage of the mare's udder and teats to allow her to get used to your presence in this area. Once a day sampling is sufficient until values of  $\text{CaCO}_3$  exceed 100 ppm. Thereafter, twice daily sampling is recommended. More accurate assessment of the mare's readiness to foal will be from daily late afternoon to early evening sampling. Since a few mares will foal in the daytime, a morning sampling should not be neglected and is highly advisable when  $\text{CaCO}_3$  values first exceed 125 ppm.

### Testing Procedure

Wipe the udder and teats with a clean, dry, soft paper towel prior to attempting to collect a sample. This reduces the amount of skin debris

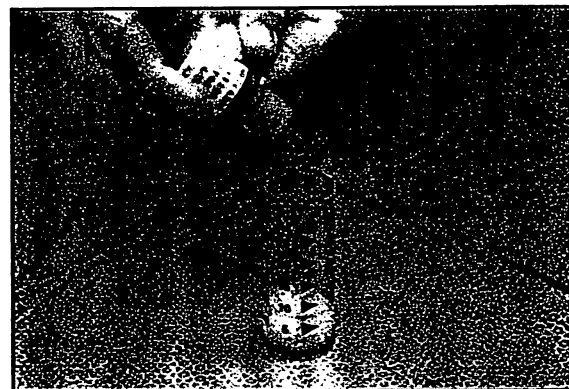
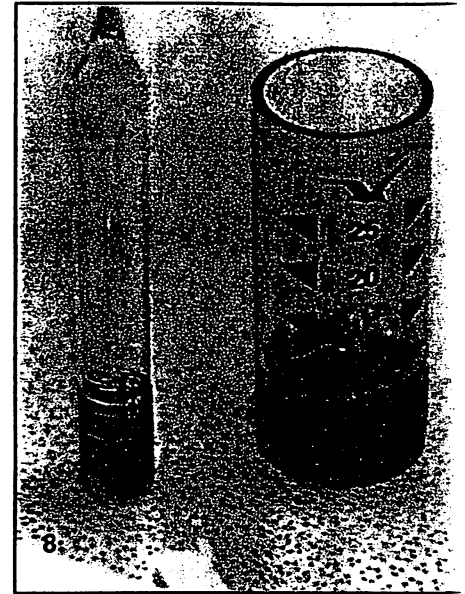
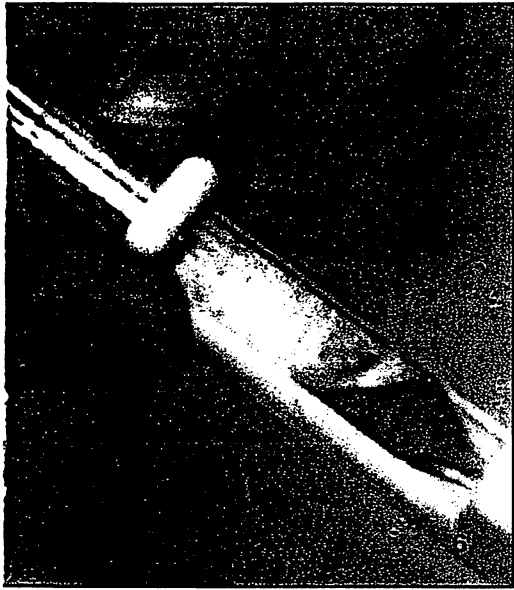


FIG. 5 — The diluted sample is mixed by swirling, then one or two drops of the indicator dye solution are added.

and dirt that might contaminate the sample, although such contamination will not alter the test result to any appreciable extent. This step is strongly recommended if the mare has been out in the weather and is wet. The hands of the person doing the sampling also should be clean and dry. Two to 5 ml of prefoaling mammary secretion should be obtained per mare. It should be col-

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FOALING MANAGEMENT OF MARES



**FIG. 6** — The Titrettor is set up according to product insert instructions. The tip is immersed in the sample fluid and a small amount is aspirated into the evacuated glass ampoule. The Titrettor is rocked to mix the solution before further aspiration of sample fluid. **FIG. 7** — Small amounts of fluid are aspirated to titrate the reaction to the end point; the color of the fluid in the glass chamber has changed from its initial orange-pink to blue. **FIG. 8** — The glass vial is removed from the Titrettor and inverted; the scale is read to the nearest line that the blue fluid crosses at its meniscus. To convert to ppm  $\text{CaCO}_3$ , the value from the scale must be multiplied by 50. *Continued*

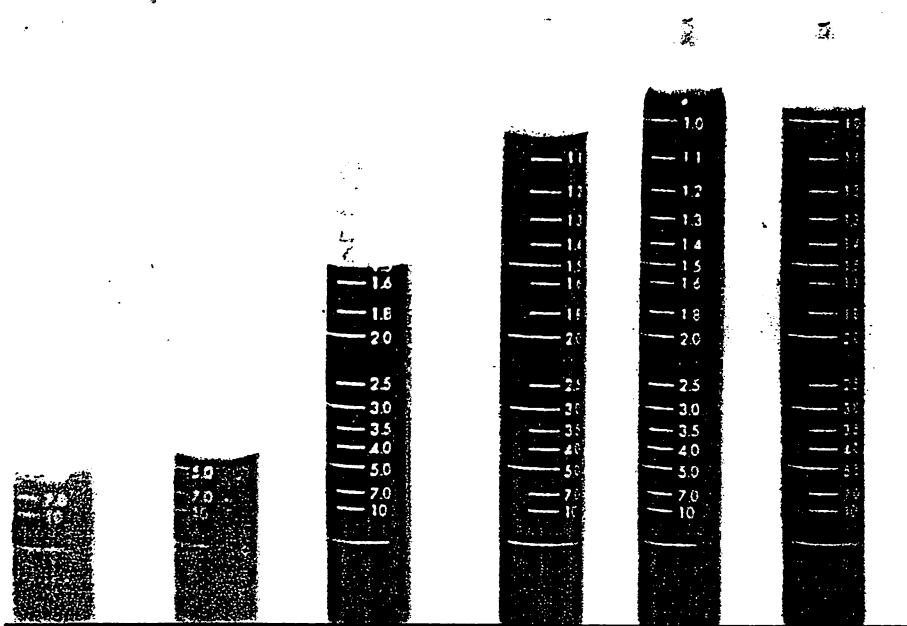


FIG. 9 — Six FoalWatch tests from a mare on consecutive days prior to foaling. Day 0, the sample obtained from 1 to 24 hours prior to actual foaling, is on the left. Day 5 is on the right. Days 4 and 5 have failed to change to a blue color and have filled the entire glass chamber, indicating the sample  $\text{CaCO}_3$  was less than 50 ppm. Day 3 began to change to blue near the top line on the chamber scale (1 scale line  $\times 50 = 50$  ppm  $\text{CaCO}_3$ ). The Day 2 sample changed to blue at a scale reading of 1.5 (75 ppm  $\text{CaCO}_3$ ). The Day 1 sample changed to blue between 4 and 5 on the scale (200 to 250 ppm  $\text{CaCO}_3$ ). Day 0 changed at 5 on the scale (250 ppm  $\text{CaCO}_3$ ).

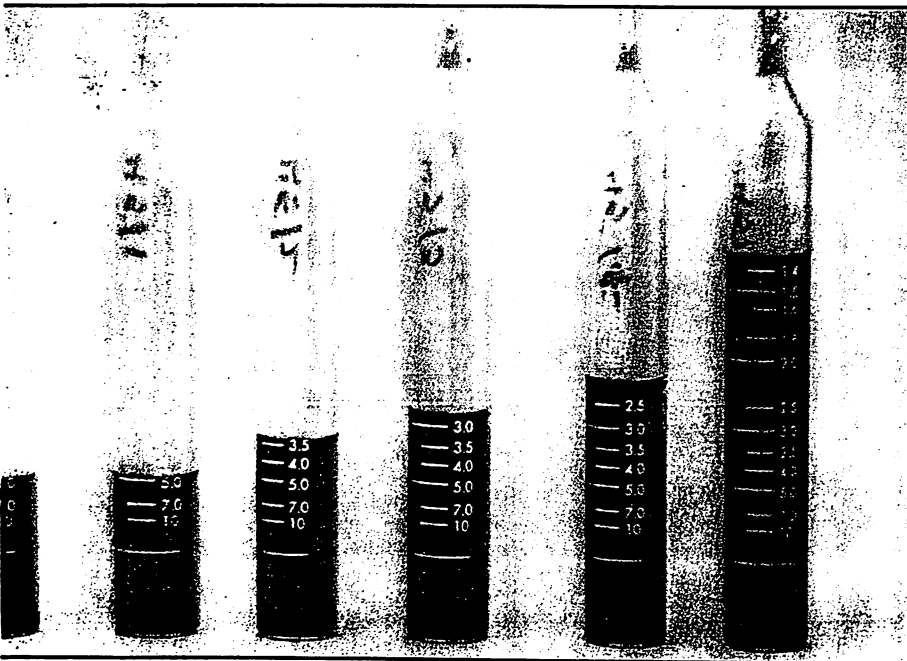


FIG. 10 — Similar pattern from a second mare to contrast that from Figure 9. The sample from Day 0 is on the left, and Day 5 is on the right.

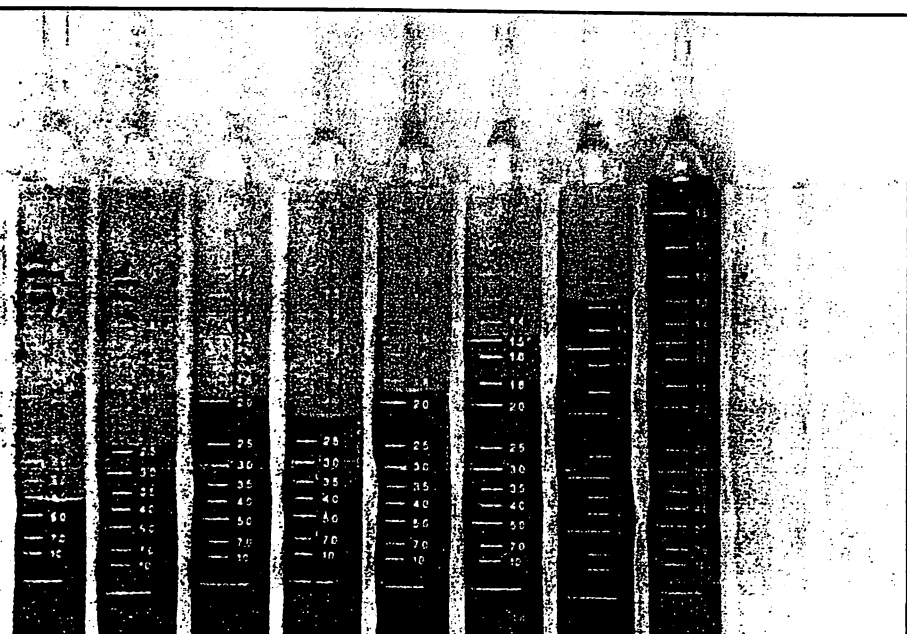


FIG. 11 — Similar pattern from a third mare to contrast that from Figure 9. The sample from Day 0 is on the left, and Day 7 is on the right. Between Days 2 to 4 the level of  $\text{CaCO}_3$  reached a plateau at around 75 to 100 ppm before increasing to 125 ppm on Day 1 and 200 ppm on Day 0.

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lected in a clean manner by gently stripping a small amount from each teat, using thumb and index or middle finger, into a clean plastic test tube or other sampling cup. The cup or test tube can be re-used if it is thoroughly rinsed with distilled water and then dried between uses.

The sample should then be taken to a clean, dry, and preferably warm area for testing. A syringe is used to draw up exactly 1.5 ml of the sample. All of the measured sample is placed into a test cup, and exactly 9 ml of distilled water is added. This dilution (i.e., ratio of one part mammary secretion to six parts distilled water) of the prefoaling milk sample is important since it adjusts the calcium level within the milk to an appropriate range for testing by the test kit. This must be carefully and accurately performed at all times. After the dilution is completed, one or two drops of an indicator dye solution (supplied in the test kit) are added to the test sample. The instructions supplied with the kit should be followed exactly as described in the product insert. Attach the flexible end of the valve assembly over the tapered tip of the glass Titret so that it fits snugly. Lift the control bar of the Titrettor™ and insert the assembled Titret into the body of the Titrettor. Hold the Titrettor with the sample pipe in the solution for testing and press the control bar gently to break the prescored tip of the glass Titret tip. (Because the Titret is sealed under vacuum, the fluid inside may be agitated when the tip snaps). With the tip of the sample pipe immersed in the sample solution, press the control bar firmly, but briefly, to pull in a small amount of sample fluid. The fluid in the glass Titret chamber will turn orange to pink. Press the control bar again briefly to allow another small amount of sample to be drawn into the tube. After each sample addition into the glass Titret chamber, rock or invert the entire Titrettor apparatus to mix the fluid contents. Watch for the color to change from orange-pink to blue. At the transition stage, you may first note a slight grayish discoloration, or the solution in the chamber might appear to be colorless. Repeat aspiration of small aliquots until the desired color change is detected and remains without reverting to pink. Invert the glass Titret chamber and read the Titret scale at the stable color change. If bubbles are present in the solution at this point, stand the vial upright for a few minutes and read the scale again. There may be a slight alteration in the actual value once the bubbles have disappeared. (Step by step photographs are presented in Figs. 2-8). Base your estimate of the actual value on the bubble-free reading, estimated to the nearest pre-marked line on the

scale. The resultant scale unit on the glass Titret is multiplied by 50 for conversion to parts per million (ppm) of calcium carbonate (CaCO<sub>3</sub>). No further calculation is required.\*

### Interpretation of Results

When the prefoaling mammary secretion calcium carbonate first equals or exceeds 200 ppm: there is a 51% probability that foaling will occur within the next 24 hours; an 84% probability that foaling will occur within 48 hours; and a 97% probability that foaling will occur within 72 hours.<sup>5</sup> The majority of mares foal within a short period of time when a value of 300 to 500 ppm CaCO<sub>3</sub> is obtained. But not all mares can be expected to reach these higher values. For mares that have not yet reached 200 ppm, there is a 99% probability that foaling will not occur within the next 24 hour period.<sup>6</sup> This test does not predict the actual foaling time of the mare tested and cannot be expected to be 100% accurate in all mares. As with many biological systems, variations are to be expected; few diagnostic tests have the ability to be completely accurate and reliable with regard to predictive value in all situations. This test is an aid to foaling management programs, and is not intended to guarantee successful warning of impending foaling in all mares. It does, however, increase the likelihood that fewer sleepless nights will be spent waiting up for the mare to foal, especially for inexperienced owners and foaling attendants. Two representative mares' test results are presented in Figures 9 and 10.

### Interferences or Complications

Some mares are resentful of being milked, especially if they are maiden (first-time foaling) mares. Standing to the left side of the mare and facing her tail, press your left shoulder firmly against the middle of the mare's chest or mid-abdominal region, reach with your right hand first under her belly near the umbilicus, and rub gently and progressively toward the udder. Several attempts may need to be made to reassure the mare that no harm is intended. With the collecting cup in your left hand, gently squeeze the base of one teat with your right thumb and index or middle finger. Make this a pleasurable experience for the mare (e.g., offer her some grain while collecting the sample). The more comfortable the mare is while her prefoaling mammary secretions are being collected, the greater the likelihood that she will accept her new foal when one attempts the same procedure.

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It is not unusual for maiden mares to fail to develop much of an udder prior to foaling, in which case one's ability to obtain a sample for testing will be greatly hampered. The "first milk" (colostrum) is typically a very thick, honey-colored, sticky secretion. This is an appropriate sample to recover as calcium levels will be detectable just as with more "normal" appearing milk.

Mares that have been exposed during the last 60-90 days of gestation to fescue grass (specifically the Kentucky-31 variety) infested by the endophyte, *Acremonium coenophialum*, may suffer from the toxins that are produced within the grass. Such mares very often fail to undergo normal udder development prior to foaling (agalactia). Without a sample for testing, this kit will be of little help to predict time of foaling.

Since calcium contributes to the hardness of water, every precaution should be taken to rinse all reusable items thoroughly with distilled water prior to drying. Use only distilled water (supplied in the kit, or purchased from local grocery or drug stores) for all sample dilutions in the testing procedure.

Obtaining the small sample volume that is required for testing, on a once to twice daily basis, for the 10 to 14 days of average duration prior to foaling, does not deprive the foal of any significant amount of colostrum (or its antibody content). Many foals have been monitored during the research and development of this test kit, and in no case was a failure of passive transfer attributable to the sampling of prefoaling mammary secretions. In like manner, the quality of the mare's colostrum (its content of immunoglobulins) was not affected. Mares that are prone to "running milk" prior to foaling will do so whether they have been sampled for testing, or not. Such mares are still at risk of losing too much colostrum prior to foaling and should be managed accordingly.

The procedure of prefoaling mammary secretion sampling slightly increases the risk of mastitis development. This is true for any animal when milking is performed by hand, especially if precautions are not taken to wipe the skin and teat surfaces clean, and to dry them prior to obtaining the sample. If clumps of cellular debris, or pink to red discoloration in the milk sample obtained from the mare is noted, proper diagnostic work-up and treatment is warranted.

Repeated sampling of well over 100 pregnant mares during their last 10 to 30 days of gestation has been judged by this author to be an innocuous procedure. There have been no alterations in nor-

mal behavior or prefoaling activities. Premature parturitions were not observed in the mares included in the testing and evaluation of this kit. Likewise, prolonged gestations were not observed. It is cautioned that premature or precocious lactation, inappropriate to an individual mare's gestational length and/or expected foaling date, may be attributable to placentitis and the potential for premature parturition of a septic neonate.<sup>7</sup>

### Troubleshooting

It is not unusual for some mares to reach 100 to 175 ppm  $\text{CaCO}_3$  and remain at that level for several days before proceeding up the scale to 200 ppm, or above (Fig. 11). Variations occur between mares, and even within the same mare from year to year. Patience and careful monitoring on a once to twice daily schedule are a must. A dramatic rise, or significant change in value, over a 12- to 24-hour interval indicates that the mare is advancing toward her actual delivery.

Occasionally, a value will drop from the previous day's sampling. This is not a cause for alarm. Repeat the test and be certain that the dilution technique was accurate. Carefully draw up small increments of the diluted sample, inverting the Titrettor several times between each aspiration, reading the scale with each repetition, and observing the color change. Initial color of the diluted sample once the indicator dye has been added will vary from early in the mare's testing period to later when she is closer to foaling. Early samples will appear more orange in color; later samples will appear a rose-pink to reddish purple. This is a normal, observed variation and is not a cause for concern with respect to accuracy of the result. ■

#### \*AUTHOR'S NOTE:

The new FoalWalch Test Kit does not require this final calculation; the result is read directly from the Titret scale as ppm ( $\text{CaCO}_3$ ).

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