RANGE COW NUTRITION MANAGEMENT EVALUATOR

Russell Gum,[1] George Ruyle,[2] Richard Rice,[3] and Eric Schwennesen [4]

INTRODUCTION

Many of the important decisions ranchers make involve the management of the nutritive intake of their cows. Decisions such as levels and timing of supplemental feeding directly impact the level of nutritive intake of cows. Decisions such as choice of breeding date indirectly impact the level of nutrition by changing the timing between the periods of the pregnancy—calving cycle with high nutritive needs and periods of forage availability. This linkage between ranchers decisions and the nutritive intake of range cows is complex and involves many factors. Further, the linkage between the nutritive intake of range cows and their production is also complex. This complexity makes the analysis of decisions impacting nutritive intake of cows a very difficult task.

In order to provide ranchers a tool to analyze decisions which impact range cow nutritive intake, a computer simulation of the range cow nutrition—production process has been developed. This program allows ranchers to predict the results of alternative strategies of managing the nutritional intake of their cows and evaluates the results in economic terms.

The purpose of the range cow nutrition—production simulation is to predict the results of rancher decisions given an observed or predicted diet of the range cow. The simulation tracks the input to the cow and calf on a daily basis, and predicts their weight daily and predicts the calving rate for the cows. The simulation is run for a period of seven years and a summary measure of the present value of the cows production over the seven year period is produced to be used as a yardstick to economically compare different alternatives or conditions.

To use the evaluator, information on the diets of the cows and the nutritive content of the forage they are eating is necessary. The diet data is obtained by microscopic analysis of fecal samples to identify undigested plant cells. The nutrition data is obtained from laboratory analysis of forage samples. Since both diets and the nutritive value of the forage change as the seasons change these analyses must be repeated on a monthly basis. For ranches which have not developed this information the program can still be used by inputting data from nearby ranches or even from ranches in other areas with similar conditions.

Once the diet and forage data are collected and entered into the computer, information on the beginning condition of the cow and on the current management practices, such as breeding dates and supplementation, must be input into the computer. The computer then predicts the performance of the cow for a period of seven years and produces a series of graphs, which are useful in analyzing the results and formulating alternative strategies for the computer to evaluate.

The following is an example of how a rancher might use the program. First the rancher, working with technical help from an extension agent, would develop an estimate of the composition of the diet and the nutritional composition of the forage species in the diet. An example of such information in a graphical form is displayed in Figure 1. The line labelled “1” is the percent of

the cow's intake made up of this particular plant species over a complete season. The line labelled "2" is an estimate of the percent phosphorus contained in this particular forage over the season while the lines labelled "3" and "4" are estimates of the protein and TDN percentages. As can be seen in the example, both the percentage of the diet and the nutritional value of the forage vary greatly over the season.

Next the rancher would specify the particular management scheme to be used for the base run. For our example, this is a breeding date of May 15th, an initial weight of 900 pounds for a bred cow, a weaning date of October 15th, and no supplement. The model is then run on the computer with the results as shown in Figures 2 and 3. Figure 2 shows the life production of the cow under the base conditions. As can be seen in the figure, the cow loses weight and the calving rate declines until in the forth year she skips a calf and regains some of the lost weight. After this she again declines in weight and skips another calf in year seven. Figure 3 shows detail of the nutritional situation over the season. The line labelled "1" is the predicted gain per day given the diet and forage nutrition. Line "2" is the gain which would be predicted based only upon the phosphorus content of the forage under the assumption that the other components of nutrition protein and energy were readily available. Line "3" is the predicted gain based on the protein level and line "4" is the predicted gain based on the energy level, again assuming the other components of nutrition are available. The graph demonstrates the fact that energy must be available for gain and that the other components of gain combine with energy to result in gain. At the start of the year energy is very low with the result that the cow loses from one to two pounds a day for the first three months of the year. For the next three months the energy availability improves but the cow continues to lose weight at about one quarter pound per day. After six months the summer rains result in new forage and the cow gains weight until winter. During this four month time of weight gain, it is clear from the graph that while the cow has an excess of energy, protein levels and particularly phosphorus levels are limiting factors in keeping the cow gain below the gain possible if the energy were fully utilized.

The economic results depend upon both calf weights, which are simply a function of the forage available between calving and weaning, and upon the calving percentage of the cow over her lifetime. For the base run the lifetime value of the cow's production expressed in present dollars is 777 dollars under conservative estimates of calf prices. This value will be used as a yardstick to judge alternative management strategies.

One possible reaction to the base results would be to check on the correspondence between forage availability and nutritional needs of the cow. Figure 4 displays how the cow's nutritional requirements change over the annual cycle. Requirements are high during the last trimester of pregnancy and during the time the cow is nursing her calf. After the calf is weaned the requirements drop considerably. Comparing the requirements to the results of the potential and actual gain chart result in the discovery that gain is highest at the time of the year where nutritional requirements are lowest. Since the requirements are tied to breeding date, one possible alternative to evaluate would be changing the breeding date to September 1st in order to better match up requirements and forage availability. Figures 5 and 6 display these results. The most obvious result is that the cow maintains her weight for the seven years and does not skip any calves. The gain graph shows that weight losses are moderated for the winter months caused by

reducing the nutritive requirements of the cow during this period. The economic yardstick for this alternative is $1,128. This is improvement over the base case of over 350 dollars all without any additional cost to the rancher.

Another possibility suggested by analysis of the base run is to remove the limitations on phosphorus during the period where it is limiting gain, by supplementing from July 15th through December 31st with a 6% phosphorus block at the rate of .2 pound per day and a cost of 20 cents per pound for the supplement. The results of this simulation are displayed in Figures 7 and 8. A definite improvement in performance over the base run can be observed. The limitation of gain by phosphorus is significantly reduced resulting in higher gains and the economic yardstick adjusted for the costs of the supplement, increases to 964, over a 150 dollar improvement.

What about a more traditional program of supplementation? What happens if we feed 1.5 pounds per day for 95 days beginning on November 1st of a 2% phosphorus, 25% protein and 65% TDN supplement. The results are displayed in Figures 9 and 10. The cows get fat. The calving rate therefore increases. The gains increase dramatically over the base run for the period the cows are being supplemented. The graph suggests that good use of the forage energy is being made with the addition of the limiting factors of phosphorus and protein to the cows diet. Most importantly the economic yardstick increases to 1,283 dollars, even after subtracting out the feed costs, over a 500 dollar increase compared to the base situation.

What about changing both the breeding date and supplementing? What about changing the timing of the supplementation? What about .....? The rancher can continue the process of evaluating alternatives quickly and cheaply by use of the computer simulation. Hopefully the computer results would lead to the selection of alternatives to further evaluate by real world testing and monitoring.

Conclusions

Ranchers in Arizona now have a new tool to help them evaluate decisions involving changes in range cow nutrition. As data bases on diets and forage nutritive values are expanded, ranchers throughout the state will be able to quickly and efficiently evaluate alternative nutrition management strategies. For further information on the Range Cow Nutrition Evaluator contact your County Extension Agent.

The authors are all members of the Integrated Range Livestock Management team, College of Agriculture, The University of Arizona.

Extension Specialist, Department of Agricultural Economics [1]
Range Management Specialist [2]
Livestock Specialist [3]
Cochise County Extension Agent [4]
Cooperative Extension
College of Agriculture
The University of Arizona
Tucson, Arizona 85721

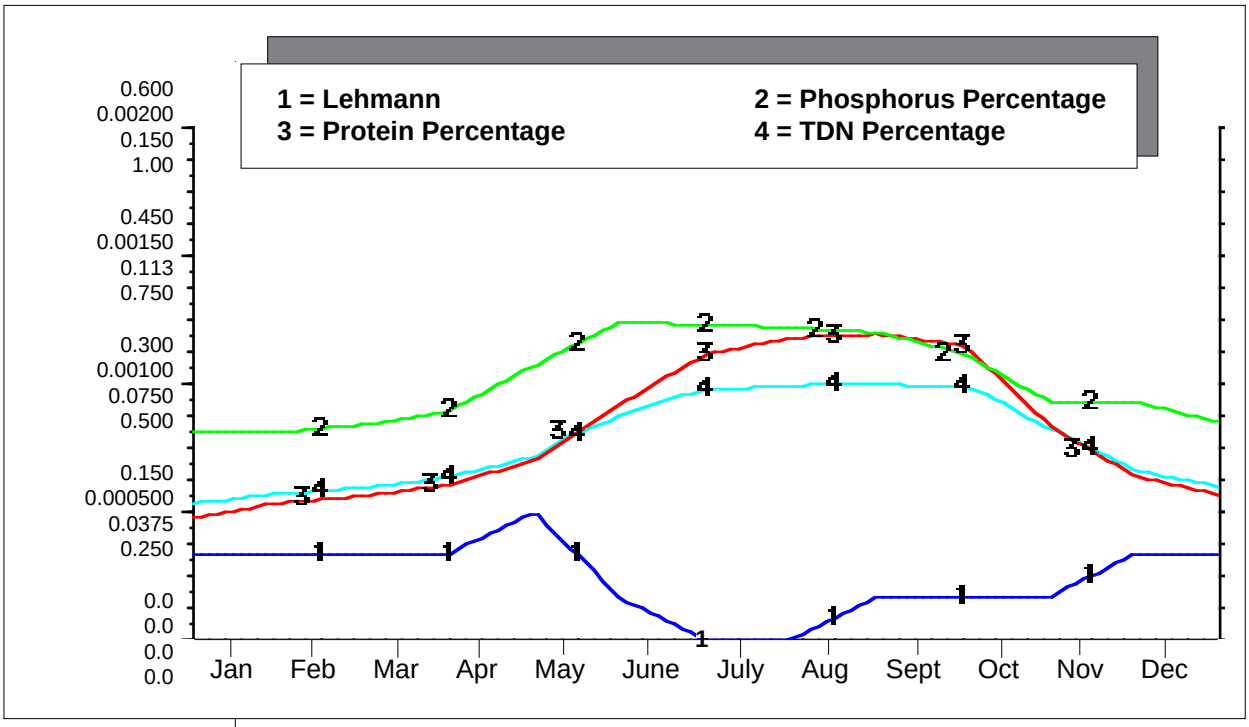
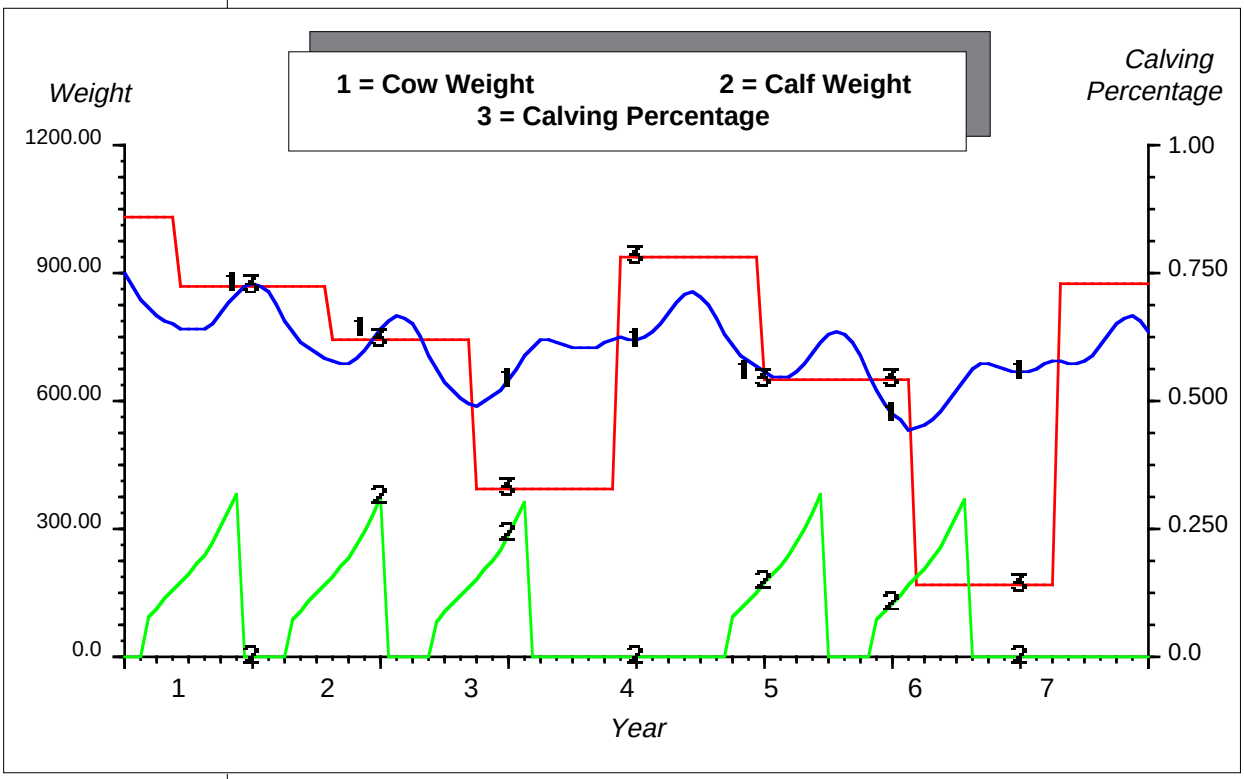


Figure 1



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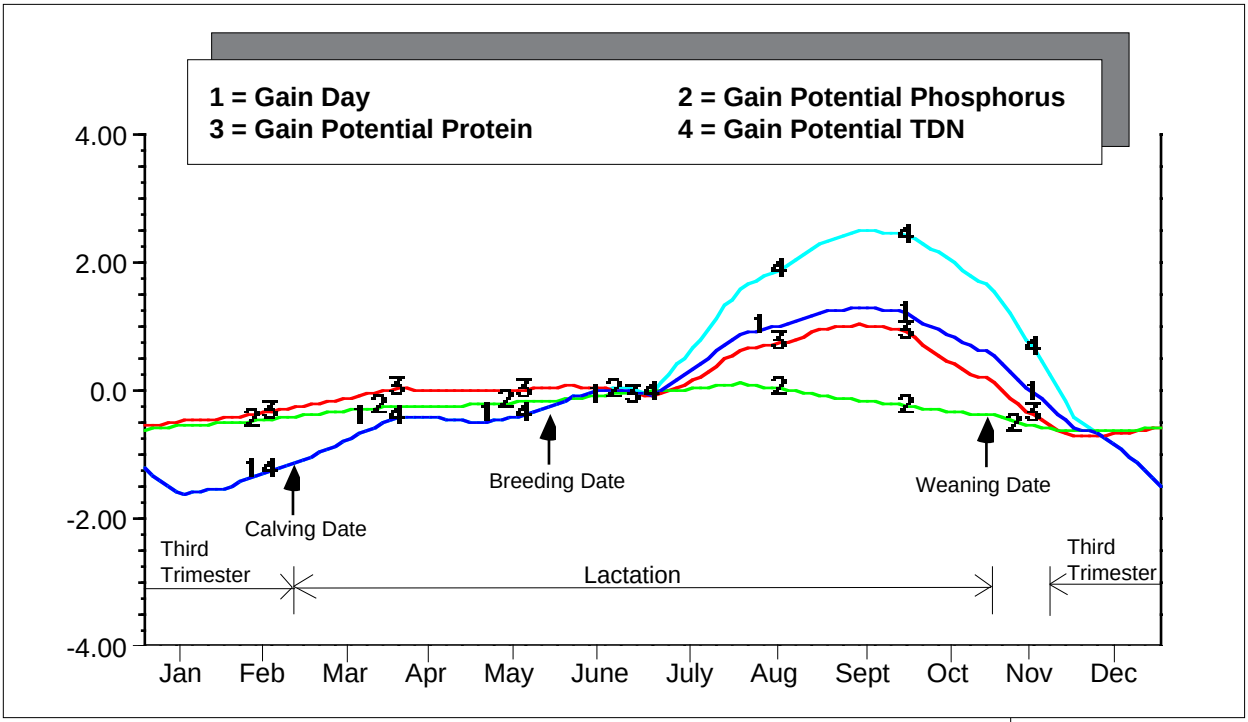

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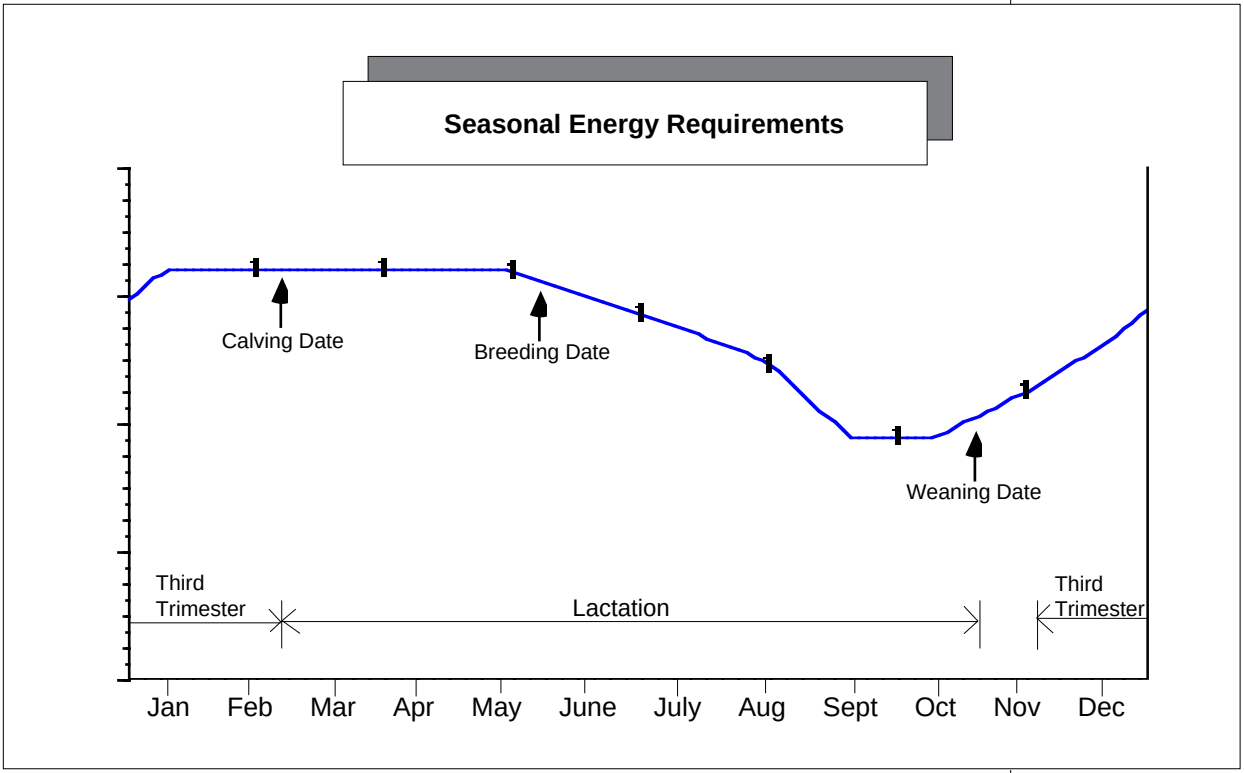


Figure 4

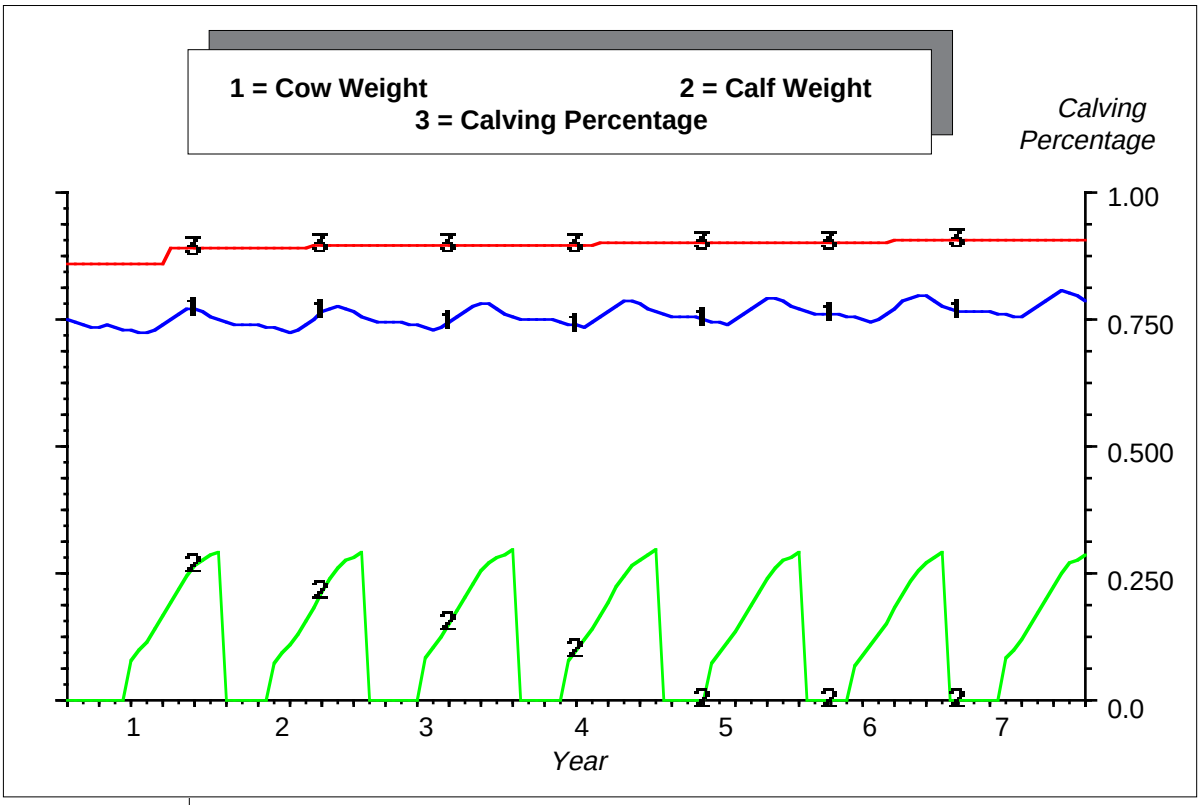


Figure 5

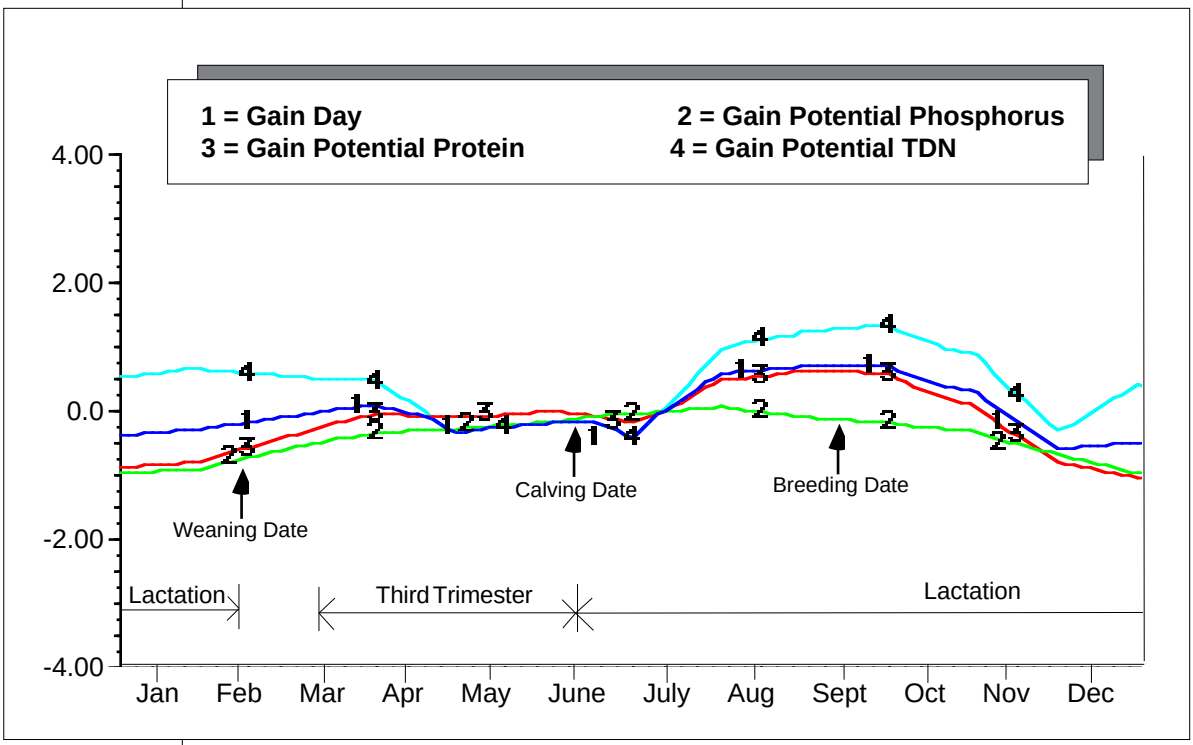
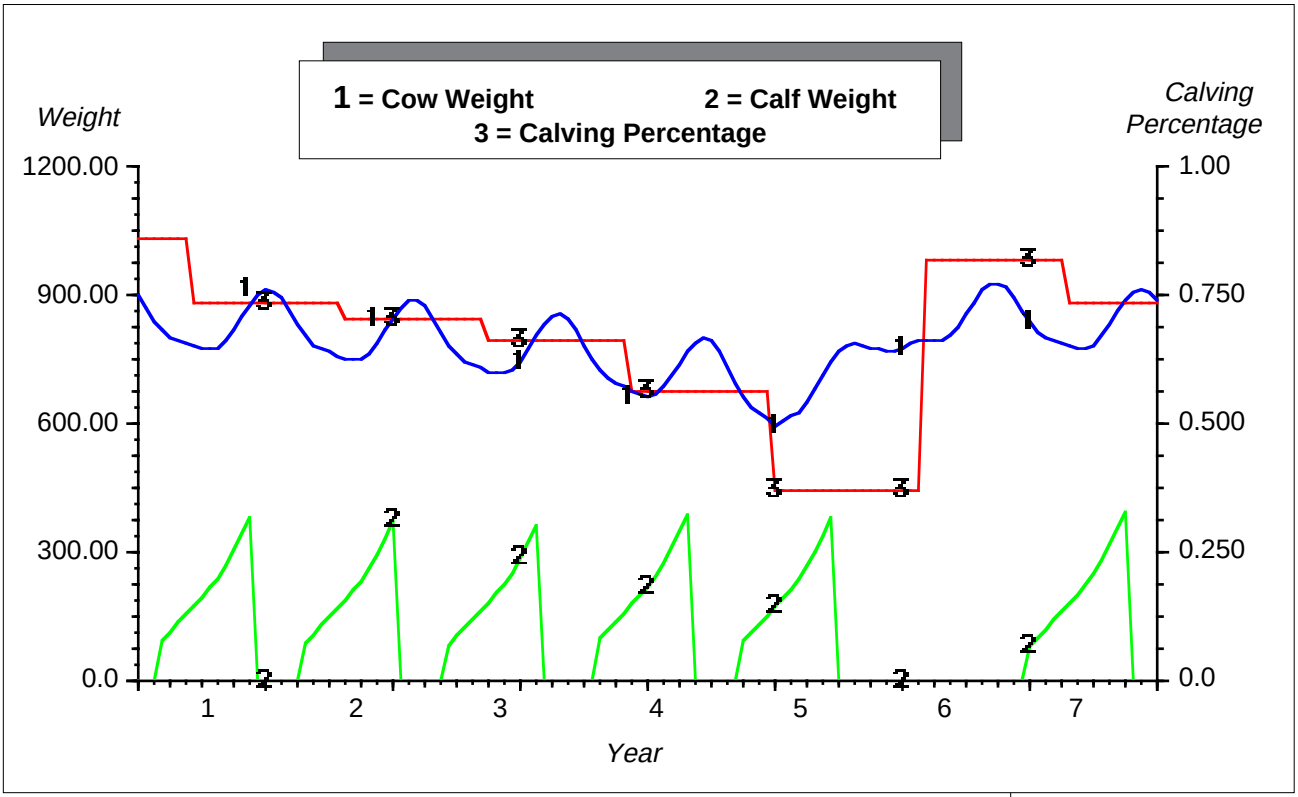


Figure 6



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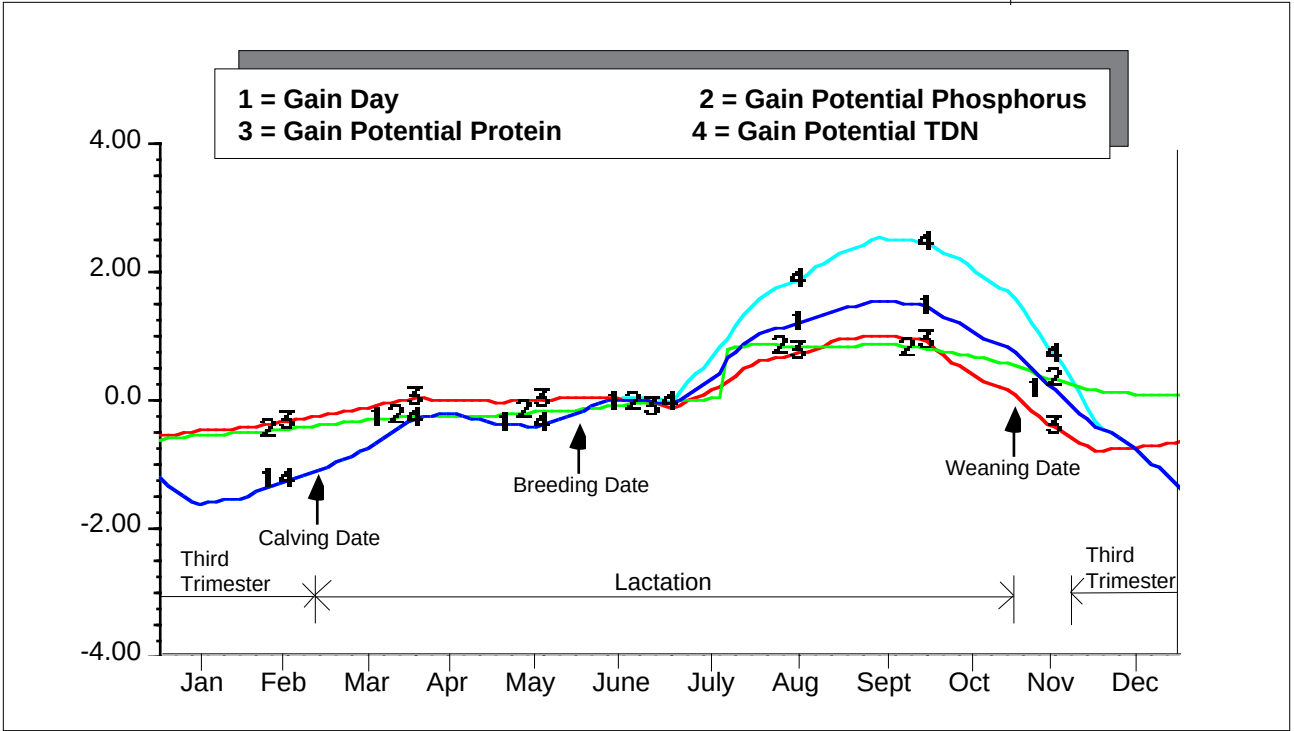

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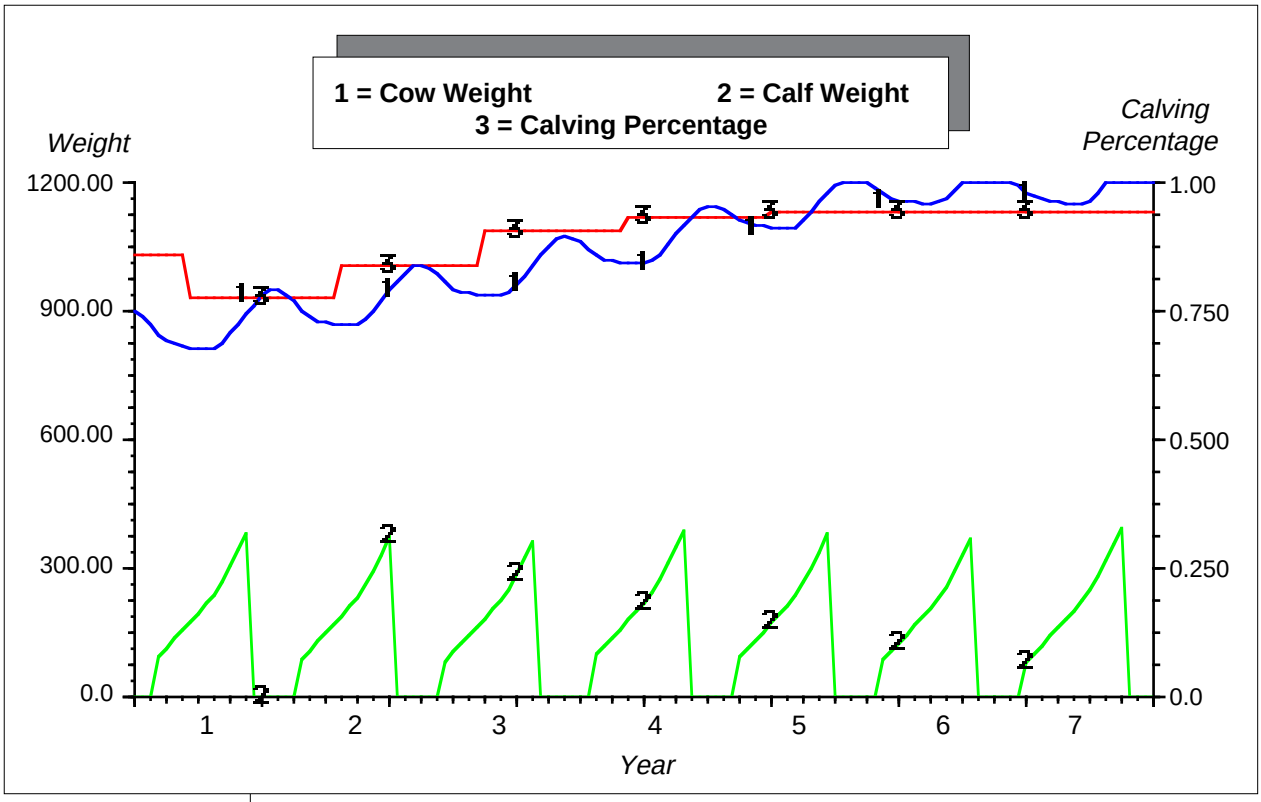

Figure 9

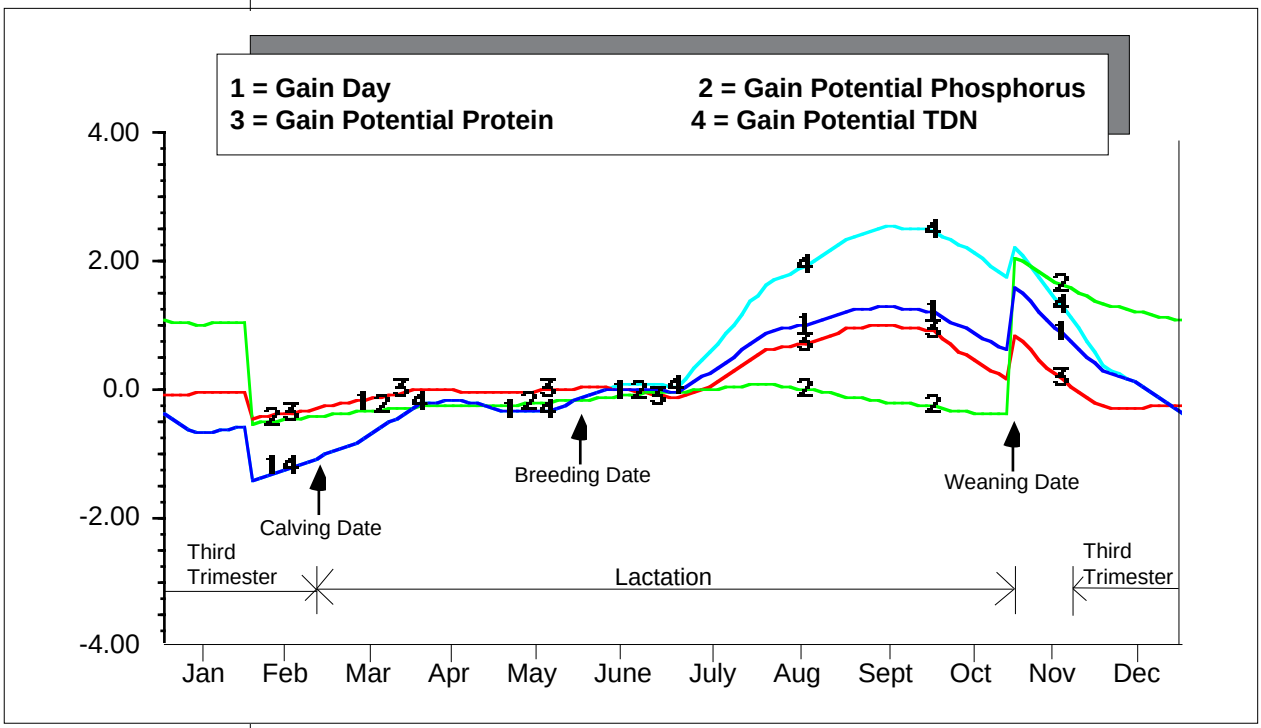

Figure 10

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