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A Decision Support System for Dairy Production and Expansion

Madison, Wis. – Several decisions are made daily on a dairy farm – some involve cow and labor management, others address crop and business concerns, and there are a host of others in between. Unfortunately, dairy producers do not always have enough information to make the best decisions for current circumstances. One could argue time constraints significantly hamper the ability to make profitable decisions all the time noted Victor E. Cabrera, University of Wisconsin-Madison/Extension dairy systems management specialist.

“Oftentimes there are too many variables that simply cannot be controlled due to the nature of the business. A combination of highly volatile market prices and increasingly complex technology and management strategies do not leave much margin for error, either,” he added.

In response, a renewed shift toward advanced information management is currently taking place within our dairy industry. Previously foreign words such as “modeling” and “simulation” are becoming commonplace, thanks largely in part to advancements in computer technology.

Cabrera said, “With the help of computers and some advanced mathematics, we are not only able to manage the herd events happening today, but effectively forecast changes in herd structure as well.”

The Dairy Expansion Decision Support System - a decision support system designed to explore dairy farm production and expansion scenarios and simulate specific metrics of their performance – provides critical information dairy producers need to actively manage risk on their dairies.

The versatility of the program’s structure offers potential use in several other areas including providing a tool for risk management in times of great uncertainty, particularly during periods of dairy expansion; accounting for future herd growth when considering livestock housing needs; and matching the proper facility design with specific user-defined goals in mind. The Dairy Expansion Decision Support System program and supporting documentation can be accessed via the UW-Extension Dairy Management website at: http://dairymgt.uwex.edu/.

UW-Madison dairy scientists began working on this project by drafting a few simple, yet very important goals: First, effectively simulate the natural biological progression of a real dairy herd and accurately forecast herd structure at a future point in time. Then, create a robust, yet user-friendly economic decision support computer program that could be widely adaptable to complex decision-making scenarios involving dairy

production and expansion. With these ideas in mind, the latest application in what promises to be a powerful lineup of risk management tools was created.

What is herd structure? Take a closer look at the people working on a 1,000-cow dairy, for example. There are several different workers who each have a specific skill set tailored to their role in keeping the dairy operational from day-to-day and beyond. Milking personnel are in charge of properly milking the cows, feeding staff keep the cows fed, crop employees ensure high quality feedstuffs are grown for the dairy, and managers ensure the whole farm remains in business well into the future. There are several other team members who support the mission of a dairy; this shortened list will suffice for our illustration. Clearly, the people in each respective category depend on each other to keep the whole farm operating. Without crops, the feeding staff would not be able to keep the cows fed. This directly affects the milkers, who know cows will not produce much milk if their energy requirements are not met, and so on. A similar arrangement is present within a herd of dairy cattle; however, we categorize them differently to enhance our management capabilities.

Herd structure defines the number and age of both individuals and specific groups of cows within any collective cohort at a definite point in time. If one were to look at the animal inventory on a dairy, it is easy to see how this breakdown occurs: There are heifers up to twenty-four months of age, cows in their first lactation, second, third, and beyond. At the beginning of each lactating cycle, a calf is born. If it is female, she most likely will be raised on-farm and eventually enter the herd two years later. At any time during the lactation, a cow can be removed from the herd and her spot is (hopefully) taken by a more profitable replacement animal. When you have any number of cows with all of these events occurring at once, management of the whole herd becomes quite a challenge.

A decision support system can be described as an organization of information that allows a person to make otherwise complex decisions, and in this case, forecasts, with relative ease. Of course, the accuracy of these forecasts is highly dependent upon the quality of information entered by the user. In its current state, the program incorporates over 120 input variables from various aspects of the dairy. Each input variable is defined by the user, meaning the program can be adapted to nearly any farm. Some inputs relate to specific cow information, such as milk production; others describe related economic and financial data, including milk price.

Once these essential pieces of information are entered into the Dairy Expansion Decision Support System program, the model predicts heifer growth over time, cow movement, and monthly cash flows. Specific information related to milk production, feed intake, and labor requirements are also utilized to improve accuracy in generating monthly cash flow figures. In the end, a present value analysis adds meaning to the projected values and offers solid supporting evidence to make informed decisions regarding many “what-if” situations.

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Sidebar:
Example of how the Dairy Expansion Support System tool works

Let's follow an example with a 200-cow dairy. Suppose John wants to double his herd's size within three years to accommodate his sister, Jane, and her family, as they want to move back to the farm and carry on the family tradition.

Currently, John and his family are milking 170 cows in a parlor/freestall setup that was updated 10 years ago. Although there are other concerns that need to be addressed (manure storage, land, feed, etc.), John and Jane want to finalize plans for their new freestall barn, which is scheduled to be finished six months from now. It will house the entire milking herd and include extra space for calving pens. The existing freestall barn will house heifers and dry cows. Their current facilities are already overcrowded, with only 150 stalls available for lactating cows. They have been saving up to purchase bred heifers, but are unsure of how many to buy once the new 400-cow freestall barn is built. John and Jane are also concerned about the number of calvings per month, figuring out correct pen sizes, and ensuring they have enough labor available when the milking herd is moved to the new barn.

This is the exact point where the Dairy Expansion Decision Support System tool goes to work. After filling in the input values to describe the herd, a simulation was run on the computer within a matter of minutes. The results suggest a total of 114 heifers should be purchased in months 7, 8, and 9 (38 heifers per month) to achieve just over a 100% stocking density at the end of three years. At that time, there would be 402 total cows and an estimated 22 percent increase in income over variable costs per cow.

However, other potential scenarios could be explored. What would happen if John and Jane were to wait until months 34, 35, and 36 to purchase heifers instead? When comparing scenarios, it is useful to look at the total net present value and make a decision based upon which option generates a higher value. A comparison of the results indicates John and Jane could attain a 16.5 percent higher net present value over the 3-year period by purchasing heifers in months 7, 8, and 9 rather than in months 34, 35, and 36.

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