

SUMMARY STATEMENT

ADSA FOUNDATION SCHOLAR AWARD NOMINATION PRODUCTION DIVISION

This Award Nomination for **Dr. Victor E. Cabrera** is based upon his accomplishments, contributions, and impacts on the area of dairy farm management and economic decision-making and his extension work on the creation and dissemination of decision support tools, extension publications, extension lectures, and development and maintenance of an effective dairy management webpage, all which are supported by scientific applied research in the light of interdisciplinary and participatory work. Dr. Victor E. Cabrera combines applied research with interdisciplinary approaches and participatory methods to deliver practical, user-friendly, and timely decision support tools for dairy farm management. These scientific tools are aimed to improve dairy farm profitability, environmental stewardship, and enhance the resilience and long-term sustainability of the US dairy farm industry.

Due to the intrinsic integrated nature of the dairy farming enterprise and to the particular characteristics of each dairy farm system, consistent advancements in sustainability have to include the multiple, complex, and variable relationships among components of dairy farm systems. A new paradigm is recognized: research and extension are integrated and applied within a systems approach. No single research-extension message is universal and every component of a dairy system is inter-connected and consequently affected and affecting the other ones. Interdisciplinary and participatory methods become then essential together with the development of customizable decision support tools that are farm and market specific, and that account for the integrated and interrelated nature of these factors. Dr. Cabrera has interiorized and applied these concepts since very early in his career.

Moreover, there is a disconnection between research and extension. Premier institutions performing state-of-the-art research have failed to efficiently disseminate research results to final users. Therefore, applied research and differentiated extension messages integrated in decision support tools such as those portrayed in the work of Dr. Cabrera are essential to overcome this issue.

During his undergraduate research, Dr. Cabrera used modeling techniques such as multiple regression methods to parameterize whole farm production functions with the aim to optimize the use of resources and farm profitability as well as to study the impact of farm management decisions on farm sustainability. During his Master's research, Dr. Cabrera developed dynamic linear programming models to simulate entire farm systems and to test innovations that promote farm sustainability. During his Doctoral Dissertation, Dr. Cabrera studied the economic and environmental impacts of dairy farm management strategies with respect to herd, crops, facilities, and manure disposal. Dr. Cabrera's Ph.D. Dissertation led to the development of the Dynamic North Florida Dairy Farm Model (DyNoFlo), a user-friendly decision support tool intended to maximize (minimize) profits (environmental impacts) in whole dairy farm systems. The DyNoFlo is driven by a stochastic Markov-chain dairy herd flow model that integrates feed, dairy cattle manure, crops, climate, soils, economics, and optimization modules in a dairy management decision support system. The creation and methodologies used for the DyNoFlo model and its accompanying extension publications and outreach efforts are being extensively used by Florida dairy producers, and have been presented in multiple national and international scientific meetings, and published in 6 journal articles.

Later, during his short postdoctoral training, Dr. Cabrera initiated a new line of work that included the interplay of farm risk management, climate impacts, and governmental interventions using concepts such as stochastic simulation, nonlinear optimization, and farmer's risk aversion preferences. This work led to the publication of 6 journal articles and several decision support tools (<http://agroclimate.org>), which are still active in the Southeast Climate Consortium (<http://www.seclimate.org/>) and being used by farmers (in the US and internationally) to make decisions for improved profitability while decreased environmental impacts according to seasonal climate predictions.

Between 2006 and 2008, Dr. Cabrera worked as an extension dairy specialist and assistant professor at the New Mexico State University. His major contributions included: (i) improve dairy farmers' accountability and abatement of environmental emissions and (ii) enhance the public's perception and image of the dairy farm industry with respect to industry's environmental and socio-economic impacts. A series of scientific decision support tools, journal articles, and extension fact sheets document these facts. The NMSU Dairy Extension website (<http://aces.nmsu.edu/ces/dairy/index.html>) that was originally designed and developed by Dr. Cabrera remains active as the information center hub for the dairy industry in New Mexico and this still highlights Dr. Cabrera's decision support tools and publications.

Since April 2008, Dr. Cabrera is an extension dairy specialist and assistant professor in the Dairy Science Department at the University of Wisconsin-Madison with 70% extension appointment and 30% research appointment. His major

responsibility is to enhance the dairy industry profitability and sustainability in Wisconsin and elsewhere. His major contributions and impacts since then are related to improved dairy farm decision-making and increased profitability. These are accounted by a series of decision support tools strongly supported by refereed journal articles with large extension repercussions. The Wisconsin Dairy Management website (<http://DairyMGT.info>, developed and maintained by Dr. Cabrera) documents all this wealth of information. A unique section on this website is the “tools” section that lists the availability of a series of computer decision support tools (~30) as major contributions to the dairy industry. All the tools are free of charge available to any decision maker in Wisconsin and elsewhere. An increased number of these tools are being adapted and translated to other languages. Each tool is based on scientifically sound research and it is integrated with robust simulation and optimization techniques as well as transparent economic calculations. Each tool counts with a brief manual of instructions and most of them have a video demonstration of their practical use. Presentations and extension and research papers related to the tools are also available from the website. During 2010, the DairyMGT.info website had 24,700 “page views” with 8,100 visitors. Sixty three percent of the visitors were from the US. The rest of visitors were from a list of other 119 countries. These facts document the usage level of the tools and related documentation. Although it is difficult to measure the real impact of this work, it is possible to trust the 2010 yearly evaluation from the county extension professionals and farm consultants provided to the University of Wisconsin-Extension. These qualify every year (from 1 to 5, being 5 the best) extension specialist efforts. Dr. Cabrera’s efforts were qualified as 4.67 for the quality of extension information being provided by these tools and as 4.46 by the outcomes obtained from the information related to these tools. Additionally, comments included in the 2010 evaluation [for Dr. Cabrera] indicated:

- “The materials and tools created are outstanding”
- “Exceptional extension specialist; outstanding work with LGM Dairy”
- “Great job of developing some very useful resources in dairy management”
- “Tools are very useful and I use them a lot”
- “ A rapidly rising star among specialists”
- “Excellent resource creating a UWEX/Dairy Science leadership role in decision-making management tools;”
- “EXTREMELY collaborative!”

During his short career, Dr. Cabrera has published 23 refereed articles, 3 book chapters, 45 extension publications, presented in 48 scientific sessions, and in more than 90 extension meetings. Dr. Cabrera has created more than 30 scholarly decision support tools and has been pivotal to attract more than \$6.8 million of extramural funds to support research and extension work related to enhancing the US dairy industry. Dr. Cabrera is also currently secretary of the multistate project NC 1042: Management Systems to Improve the Economic and Environmental Sustainability of Dairy Enterprises.

This Award Nomination is based on Dr. Cabrera’s accomplishments in the development of practical, user-friendly decision support tools that are enhancing dairy farm management and economic decision-making in Wisconsin and elsewhere. The single most comprehensive list of readily available decision support tools for dairy management and economic decision making in the US is found at Dr. Cabrera’s webpage: DairyMGT.info → Tools, which contains a long list of tools classified according to management sections. Followed are brief descriptions, rationale, importance, and impacts of a selected group of Dr. Cabrera’s tools.

Selected Decision Support Tools for Dairy Farm Management

Nutrition and Feeding (DairyMGT.info → Tools→ Feeding)

Dairy farmers recognize that the largest item cost in a dairy farm system is feed, whether purchased or farm-grown. Consequently, managing and optimizing the milk income over feed cost is a critical decision that affects not only economic sustainability, but also environmental stewardship. Farmers also recognize that every farm is completely different and that market conditions are constantly changing. Therefore, beyond established farm rations, there is a need for tools to adjust permanently feeding strategic decisions. Take as an example corn grain and its highly volatile price. Corn is a staple feed commodity in dairy farms and consequently its price influence largely the diet cost. With sudden corn price swings farmers raise the question if they should re-consider the amount of corn in the diet. This question can be responded by estimating the marginal value of milk to corn according to lactation stage and current amount of corn in the diet. The optimal use of corn would occur when the marginal value of milk equals the marginal value of corn, which at research-based feed efficiency levels, would solely depend on the ever changing price relationship of milk and corn. The

tool “**Corn Feeding Strategies**” shows these relationships in a graphical and interactive way so dairy farmers can optimize the amount of corn grain in the different farm feeding groups according to changing market conditions.

Take as another example the price of the main dairy cattle feed commodities and their relationship with milk price according to lactation feed efficiency changes. Research data indicate that the use of concentrates (i.e., corn, soybean meal) have a substantially higher impact on milk production during early or mid-lactation than in late lactation. Under this premise, increased use of forages is justified in late lactation to maximize the overall milk income over feed cost, which however will depend on ever changing feed commodity prices. The tool “**Income Over Feed Cost**” graphs the milk income over feed cost weekly for entire lactations according to 5 predefined diets (from high concentrate to no concentrate (all forage) diets) and allows farmers to interactively determine the impact of feed commodity prices on the dynamic milk income over feed cost value. Dairy farmers can fine-tune their feeding strategies to maximize their milk income over feed cost according to lactation stages and feed prices changes.

Sometimes, dairy farmers need additional help on formulating their diets to maximize their income over feed supplement cost. Research data indicate that the optimal level of concentrate supplements in a diet could be achieved by using milk production response to crude protein (CP), rumen undegradable protein (RUP), and rumen degradable protein (RDP) according to particular cow-group rations. The tool “**Income over Feed Supplement Cost**” performs an optimization according to defined feed ingredients, prices, and CP (RUP, RDP) restrictions to maximize the milk income over feed supplement cost when forage amounts are maintained. Dairy farm decision makers are able to select the most cost effective supplements in the diet, especially from the point of view of providing adequate amounts of RUP and RDP, which not only optimizes the net return, but reduces N excretion. By request, this tool is being translated to Spanish and adjusted to South American dairy farm conditions.

Another critical factor in the quest for feed efficiency and maximum milk income over feed cost is the analysis of “benchmarking” dairy farms with respect to feed efficiency, milk income, and feed costs. Results from surveying dairy farm rations and farm prices performed by county extension agents reveals an impressive difference regarding to feed costs, feed consumption, and overall milk income over feed cost among otherwise similar Wisconsin dairy farms. Therefore, a large and important opportunity exists to improve the milk value net of the feed costs. With participation of dairy farmers and extension agents, a web-based system (database) decision support tool was created and called the “**Dairy Extension Feed Cost Evaluator**.” This tool performs advanced feed costs comparison analyses among farms for a user or group of users within a region, state, or country throughout a defined timeline. To date, an estimated of 400 dairy farmers are permanently making feeding decisions based on benchmarking analyses performed with this tool.

Dairy farmers also require some simpler, cost-benefit, partial budgeting feed ingredient/additive replacement tools. The tool “**Optigen® Evaluator**” analyzes the value of including this slow release urea additive while maintaining diets at the level of protein and dry matter intake. The tool “**Dairy Ration Feed Additive Break-Even Analysis**” determines the additive’s additional milk production needed to justify its use.

Reproductive Efficiency (DairyMGT.info → Tools → Reproduction)

Reproductive efficiency plays a critical role in the economics of dairy farming. However, assess the economic value of it is extremely difficult and complex. Dr. Cabrera took the challenge to provide user-friendly, still scientifically robust tools that could help dairy farmers perform informed decisions regarding reproductive management. A first step on understanding the economic impact of reproductive programs is to demonstrate the milk value net of feed cost dependent on the parity’s pregnancy time and an established dry period. The tool “**Exploring Pregnancy Timing Impact on Income over Feed Cost**” shows interactively and dynamically a cow’s total milk income net of feed costs to a fixed parity’s pregnancy time and defined lactation curves. Dairy farmers are using this tool to better understand the economic impact and ramifications of changed reproductive parameters with respect to farm net returns.

Sexed semen is being widely adopted in the dairy industry. With the availability of this technology, dairy farmers have an additional decision to make. Farm-specific sexed semen’s economic value and, moreover, when and how to use it, are critical. The tool “**Economic Value of Sexed Semen for Dairy Heifers**” finds interactively the gain (or loss) of different reproductive program management strategies that include sexed semen compared with a strategy of solely using conventional semen, according to specific farm and market conditions. This tool has been translated to Spanish and Chinese and has been presented to dairy farmers in South and Central America, Europe, and Asia. Dairy farmers in Wisconsin and around the world are making better economic decisions regarding the use of sexed semen for heifers by using this tool.

Dairy farmers are required to do complex decisions regarding the best reproductive programs for the lactating herd population. Dairy farmers usually know which reproductive programs are more efficient from the reproductive point

of view of getting more cows pregnant. Farmers also have a good handle on costs incurred according to reproductive programs. Nonetheless, dairy farmers have difficulty assessing the profitability of reproductive programs. Not surprisingly, they have long demanded for a systematic economic analysis to analyze reproductive programs that include heat detection, synchronization, and combination of both. The tool “**UW-DairyRepro\$**” is a complex, still user-friendly, decision support system that assesses the economic value of 3 distinct alternative reproductive programs for a particular farm and market conditions. This tool allows farmers to be highly specific regarding their current or alternative reproductive programs. Besides reporting the most important reproductive parameters for each reproductive program, the tool finds the reproductive program with the best economic outcome and calculates the difference in net returns a farm would have when using alternative reproductive programs. Dairy farmers around the US are permanently using this tool to re-evaluate their reproductive programs with the aim of enhancing farms’ net return. By request, this tool is being translated o Spanish and adjusted to South American dairy farm conditions.

As important as find out the value of specific, well-defined reproductive programs is to explore the value of improving reproductive efficiency. The tool “**Dairy Reproductive Economic Analysis**” is a Markov-chain stochastic dynamic model packed in a simple to use web-based application. This tool integrates detailed parameters of pregnancy, abortion, and culling risks to perform iterations during 9 lactations until a herd reaches a steady state. Then, the economic value of a reproductive program is determined by using predicted milk production curves, calve value, replacement costs, and other economic figures. The end result is a net return tied to a reproductive performance. An additional option allows farmers to determine the economic value, in dollars per cow per year, of improving reproductive efficiency (e.g., improving 21-d pregnancy risk from 15% to 20%). Dairy farmers are using this tool to make informed reproductive investments and managerial decisions conducive to improved farms’ reproductive efficiency and profitability.

Heifer Management and Cow Replacement (DairyMGT.info → Tools→ Heifers / Replacement)

Whether farmers raise or not heifers on-farm, they benefit from decisions regarding the rearing of heifers. One first step on the economic decision about heifers is to determine the overall cost associated with rearing heifers according to farm defined conditions and the estimated time to first calving. The tool “**Heifer Break-Even**” calculates the daily and accumulated cost for rearing heifers up to 12 months, 24 months, and beyond 24 months according to farm defined prices for forages, corn, and soybean meal. Farmers use this tool to decide if to raise their own heifers, use custom-raising heifer services, or simply buy heifer replacements, according to market prices.

When farmers raise heifers on-farm, another decision comes along: to use or not accelerated feeding programs for boosting the early development of heifers. The tool “**Cost-Benefit of Accelerated Feeding Programs**” gives dairy farmers the opportunity to compare hand-by-hand their current heifers’ feeding program with an alternative accelerated feeding program within farm defined conditions. This tool shows economic differences at weaning and calving and calculates the amount of milk needed to pay for heifer rearing costs. Dairy farmers are permanently using this tool to evaluate the use of alternative accelerated feeding programs for dairy heifers.

In addition to the decisions of raising heifers and if to use accelerated feeding programs, dairy farmers want to know the number of heifers needed to maintain (or increase) the herd size according to farm long-term goals, reproductive efficiency, and heifers’ culling rates. The tool “**Heifer Replacement**” calculates interactively the number of needed replacement animals (springer heifers) responding to farm specific data inputs.

Furthermore, dairy farmers would need to buy additional springing heifers if the number of heifer replacements is lower than the required number to achieve the goal of maintaining or expand the herd size. Consequently, dairy farmers need support on estimating the right price to pay for springing heifers purchased as replacements. The tool “**Calculate the Value of a Cow**” performs a simple projection of the net return a cow would have under farm specific conditions. This value indicates the maximum price a farmer should pay for a replacement to breakeven its cost. Because of the uncertainty in the milk price, milk production, and the productive lifetime of the cow in the herd, the model presents results under different price and lifetime scenarios, so farmers can make decisions based on their assertion of the future prices and their risk preferences. By request, this tool is being translated o Spanish and adjusted to South American dairy farm conditions.

Production (DairyMGT.info → Tools→ Production)

Dairy farmers face several decisions regarding production-related issues. In order to make best decisions, they would like to know how their farm milk production compares to similar farms. Besides comparing milk amount produced per animal, the shape of the lactation curves is critical to pinpoint management weaknesses and strengths of a particular farm. The tool “**Lactation Benchmark Curves for Wisconsin**” displays different parity lactation curves for herds with a rolling herd average fluctuating between 18,000 and 30,000 lb/cow/yr. These curves were obtained by processing 3.6

million lactation records provided by AgSource Cooperative Services (largest DHI processing center in the Midwest US). Dairy farmers then use their own lactation curves to compare with those benchmarks.

By benchmarking herd's lactation curves, dairy farmers may contemplate a new set of decisions to improve productive performance such as switching the number of milking times per day or re-consider the use of bST. The tool "**Economic Analysis of Switching from 2X to 3X Milking**" performs a farm-specific partial budgeting analysis of the projected gain (or loss) when a farmer decides to milk 3 times a day instead of 2 times, or vice versa. The tool "**Economic Analysis of Using bST**" displays the economic gain (or loss) of using bST as an interactive sensitivity analysis according to ever changing milk price and estimated milk increase because of bST under specific farm conditions.

Some dairy farmers are also interested in the possibility of either expand or modernize their farm facilities or increase their herd size. Therefore, they require support on important decisions that will drive the future of the dairy farm operation. The tool "**Decision Support System Program for Dairy Production and Expansion**" is a spreadsheet application that allows dairy farmers' outline their current farm conditions regarding herd structure and market conditions, define a possible plan of expansion or modernization including required loans (for facilities and animals), and project the cash flow of the entire farm up to a period of 54 months in the future. Dairy farmers use this tool to test scenarios that will help them to achieve the best cash balance in the short, medium, and long-term according to defined goals.

Price Risk Management and Financial Assessment (DairyMGT.info → Tools → Financial)

Unfavorable prices of milk and feed commodities together with increased price volatility are creating large uncertainty in the dairy farm business, which menace the economic sustainability of dairy farms, whether these are conventional, organic, small, or large. Recent unprecedented uncertain times have prompted to re-visit farm's financial status and look for alternatives to stabilize net returns. It is critical to explore price risk management alternatives such as the relatively new revenue insurance program called Livestock Gross Margin for Dairy (LGM-Dairy) and to assess farm financial performance compared with peers.

In brief the LGM-Dairy can protect the net margin (milk value less feed cost or milk income over feed cost) at a much lower cost than using comparable options in the future markets. Collaborative efforts of Dr. Cabrera have led to the development of the number one place for information and analysis related to LGM-Dairy in the US including the creation of the "**LGM-Analyzer**." The LGM-Analyzer is a web-based easy-to-use suite of data intense simulation and optimization integrated modules that are helping hundreds of dairy producers on the decision of using LGM-Dairy. The LGM-Analyzer not only replicates the official premium calculation of the USDA Risk Management Agency, but is capable of perform historical sensitivity analysis as well as complicated optimizations to minimize the premium cost at a level of target guaranteed income over feed cost. This suite of tools is also capable of comparing the LGM-Dairy with more traditional price risk management tools such as puts (Class III milk) and calls (corn and soybean meal) for feeds as a bundled price option ("**Bundled Options**").

The LGM-Analyzer connects live with the dairy and grain-based futures and market (SQL continuously updated database) to determine the premium cost a particular farmer could expect according to a guarantee income over feed cost. Furthermore, a unique module ("**Least Cost Optimizer**") lets the user to minimize the LGM-Dairy premium cost at a defined level of income over feed cost insured. Simulation and optimization models are grounded on scientific articles, described in several extension publications, and disseminated through hundreds of extension presentations. Government incentives to LGM-Dairy including substantial premium subsidies, which took into effect in December 2010, are motivating a large utilization of this revenue insurance product. Therefore, the LGM-Analyzer is having increased usage and popularity, which are only expected to increase even more in the future.

Other tools in the area of analysis of the LGM-Dairy include the "**LGM-Dairy Feed Equivalent**," a tool to covert feed diet ingredients to corn and soybean meal equivalents to be used for a LGM-Dairy contract and the "**Net Guarantee Income over Feed Cost**," a tool to help dairy farmers find the income over feed cost to break-even all other costs of production, which should be covered by using LGM-Dairy.

Also, performing a farm's financial benchmark assessment is critical in the process of measuring the financial health of a farm. Moreover, it is usually required by lenders in order to consider loan applications. The "**Wisconsin Dairy Farm Benchmarking Tool**" is a database application connected to the University of Wisconsin Center for Dairy Profitability (<http://cdp.wisc.edu>) that calculates 15 financial ratios including variables of liquidity, solvency, profitability, repayment capacity, and financial efficiency for a group of 500+ Wisconsin farms during a period of 10 years. The tool then compares each one of these ratios with those of a particular farm. Therefore, farmers can easily assess their financial health compared with their peers. Furthermore, the tool provides a DuPont analysis, in which a farm is contrasted against the population of Wisconsin farms with respect to revenue and profit generated for every dollar invested.