A case study of the economic impact of utilizing Micro Technologies' Micro-Weigh Micro Ingredient Delivery System and Pro-Control Plus Feed Batching System in a dairy feed mill

by

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B.S., Cal Poly, San Luis Obispo, 2009

A THESIS

Submitted in partial fulfillment of the requirements

for the degree

MASTER OF AGRIBUSINESS

Department of Agricultural Economics

College of Agriculture

KANSAS STATE UNIVERSITY

Manhattan, Kansas

2024

Approved by:

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ABSTRACT

Micro Technologies is a technology company that innovates cattle feeding operation systems and solutions. Their goal is to offer "advanced, comprehensive and integrated animal management solutions that empower food producers to grow safe, wholesome food supply more efficiently and profitably" (Micro Technologies AmerisourceBergen 2024). Micro Technologies Micro-Weigh Micro Ingredient Delivery System is a machine that precision-weighs micronutrient ingredients and sprays them onto feed rations to create a ration with consistent micronutrient content. The Pro-Control Plus Feed Batching system is a computer system installed into dairy feed mills that is designed to make feed ration manufacturing more streamline, help manage macro ingredients, customize diets, consistently mix micro ingredients, and reduce batching time. Utilizing the two systems together offers dairy producers a more streamlined process with more consistent feed rations, and better operational conditions when compared to utilizing a mineral pre-mix.

The objective of this project is to explore the integration of Micro Technologies' Micro-Weigh and Pro-Control systems and their impact on feed and operation costs. Integrated into the project is the design of a decision tool that may be used by the Micro Technologies sales team to help a diary producer understand the costs and values of using these systems. This will be done through partial budgeting where we look at costs and values of the implementation of these systems. The paper will evaluate the difference in ration costs on a per head per day basis and analyze reductions and eliminations of other costs due to this change.

When using Micro Technologies' systems, micronutrients are purchased as packaged products from Micro Technologies, are stored indoors, and are directly administered through micro equipment. Because Micro Technologies does not charge customers for the use of this equipment, those expenses are realized through slightly higher costs of micronutrients compared to the cost of using a mineral pre-mix in the feed. However, there is value found in reduction of loss through elimination of shrink from the pre-mix and reduction of feed mill operation time which outweighs the additional costs of micronutrients. This paper will explore those costs and the value that comes from the Micro-Weigh and Pro Control systems.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGMENTS

I would like to start by thanking Dr. Brian Coffey for his patience and guidance throughout this project. I would also like to thank Mary Sullivan, Janelle Perryman, Dr. Featherstone, and all my other professors for making the MAB program beyond enjoyable. Finally, I would like to thank my committee members Dr. Aaron Johnson and Dr. Logan Britton for their time and advisement on this project. The 2024 MAB Cohort has made classes entertaining and every one of them has helped me in some way when I did not understand.

As my faith stands foremost in life, I praise God for bringing me on this path that has changed so much of my life and shown me that I can accomplish anything through Him. My thanks go out to many friends and family that have supported me along my MAB journey, too many to name. Thank you to my grandparents who never miss an opportunity to encourage me along the way and offer their support. I would have never even started the program without the push from MAB alumni Shelby Drye who introduced me to K-State and the MAB program. I cannot miss thanking the MWI Animal Health and Micro Technologies teams for providing me with the information and time I needed on this project.

Last but not least, the greatest of thanks go to my parents who have not only encouraged me on this journey but have taken many things off my shoulders when I needed the relief. I would have never made it if it wasn't for your support. I love you Mom and Papa!

CHAPTER I: INTRODUCTION

Micro Technologies was established in1971 by Bill Pratt. Originally known as Micro Chemicals, the company was built around a unique system that allowed cattle feeders to adjust the micronutrient levels in cattle feed. This allowed feeders to get a more precise feed and to be able to change nutrient levels as feed inputs changed. Through the years, Micro Technologies developed and modified many systems including bunk reading, feed truck, and batching systems in addition to programs for feed mills, drug inventory management, tracking and replenishment systems, feedlot business systems, dairy collar, and water systems among others. Micro Technologies' Process Verified Program (PVP) has been approved for use by the USDA in age and source verification and the verification program for Non-Hormone Treated Cattle (NHTC) program.

In 1999, Micro Chemical became Micro Beef Technologies to describe company goals more accurately. In 2011, Micro Beef Technologies (Micro Beef) was purchased by MWI Veterinary Supply with the goal of utilizing their systems and programs in companion animal veterinary practices. MWI and Micro Beef were acquired by AmerisourceBergen in 2015 with an eye on utilizing Micro Beef systems in the human health industry. In 2016, the name Micro Beef Technologies was shortened to Micro Technologies as the company continues to diversify its offerings. Although there have been changes to the company and the name, the original "Micro Metering System" designed in 1971 remains the basis of the Micro Technologies micronutrient and batching system used to this day in dairy and feedyard feed mills.

As Micro Technologies has moved into the dairy industry, there is a need for the development of a tool that the Micro Technologies sales team can use to help sell the

systems and show dairy producers the value of utilizing a Micro Technologies Micro-Weigh Micro Ingredient Delivery System and Pro-Control Plus Feed Batching System. While costs of micronutrient ingredients are typically higher when utilizing Micro Technologies systems over pre-mix minerals, a dairy can offset those costs through efficiencies in batching times, reduction in mineral pre-mix shrink loss, and by eliminating some micro ingredients in feed rations for production stages that do not require those ingredients.

1.1 Micro-Weigh Micro Ingredient Delivery System

Since the original Micro Metering System was developed in 1971, the Micro Technologies Micro-Weigh Micro Ingredient System (Micro-Weigh) has undergone many upgrades to become what it is today. The Micro-Weigh system is a machine that measures exact amounts of micronutrient feed ingredients and introduces them into the feed of a dairy or feedyard. Micronutrient ingredients are stored in hoppers and measured, then dropped onto short conveyors where they run into a hopper and are then mixed with water to become a slurry. The slurry is then evenly sprayed onto and mixed in with the feed. This allows for a more even distribution of the micro ingredients in the feed at the bunk compared to mineral pre-mix usage. With the use of a Micro-Weigh system, a dairy manager or nutritionist can adjust the micronutrient amounts by simply adjusting numbers on a screen. This can be done from anywhere, including inside the mill at the machine or remotely using a computer or phone that is logged into the system.

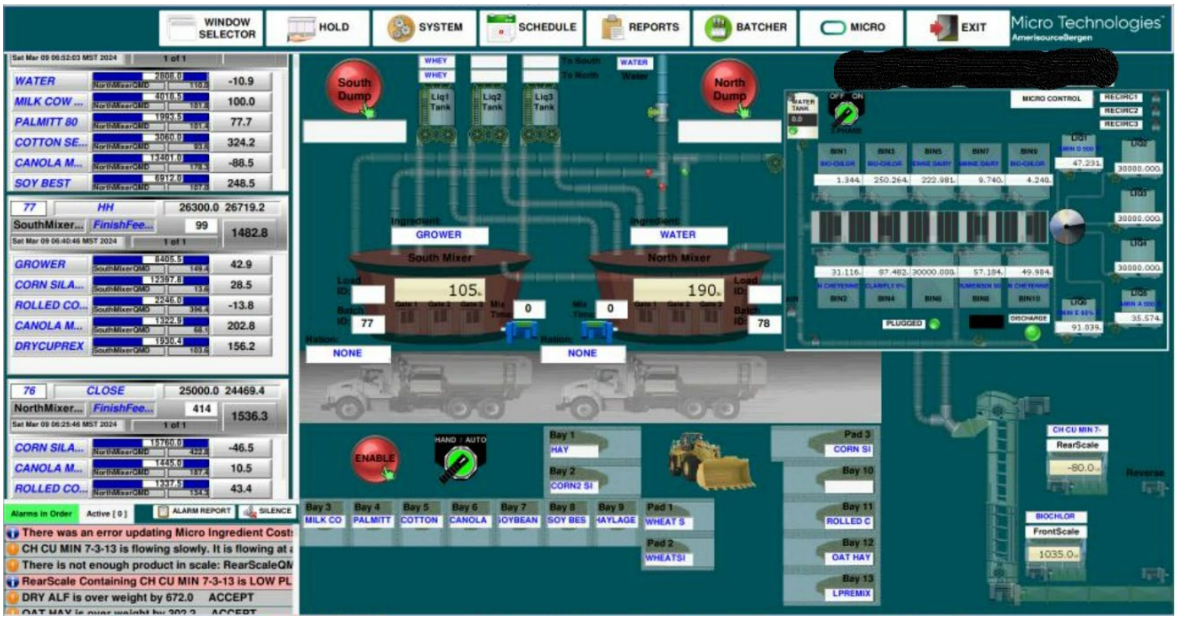
1.2 Pro-Control Plus Feed Batching System

Micro Technologies' Pro-Control Plus Feed Batching System (Pro-Control) is a computer system installed into dairy feed mills that is designed to streamline feed ration

manufacturing, help manage macro ingredients, customize diets, consistently mix micro ingredients, and reduce batching time. Each Pro-Control Feed Batching System is highly customized to the individual operation. Most Pro-Control systems include installing computers into loaders used to load feed ingredients into mixers, scales and controls on the mixers, and automatic dispensing of liquids such as molasses and oils, micro ingredients, and some dry ingredients into each ration. Specific rations can be made for different stages of development or milk production to allow for customized feeding of each group of cows. This reduces over-feeding of ingredients that are not needed in some rations. Feed mills are also able to use the Pro-Control batching system to create their own bulk pre-mixes. These may include ingredients that are needed in rations in volumes less than bulk ingredients, such as hay, but larger volume than what may be run through the Micro-Weigh system.

Figure 1.1 shows the computer control panel for the Micro Technologies Pro-Control Plus Feed Batching System. Through the use of this system, not only are the operators able to view and manipulate specific controls of the program, the dairy manager is able to view the operations from their computer and make necessary adjustments.

Figure 1.1 Micro Technologies Pro-Control Plus Feed Batching System



Source: Micro Technologies

1.3 Micro Technologies Solutions and Costs

While Micro Technologies does not charge customers for the use of the Micro-Weigh or Pro-Control Plus systems, costs of operation and maintenance are realized in the purchase of the micronutrient ingredients through Micro Technologies. Micro Technologies team members perform regular maintenance and any mechanical problems on the equipment and are also able to fix computer issues, perform updates and generally monitor all systems through the Pro-Control computer program. The Micro-Weigh system and Pro-Control Batching systems can be integrated with other Micro Technologies solutions including Read-N-Feed bunk systems, Pro-Control Mixer and Parlor systems, and Accu-Trac integrated management solution.

The sales prices of those micronutrients through Micro Technologies vary widely depending on the individual dairy. Factors that determine micronutrient costs include but are not limited to, size or number of cattle fed in the operation, integration of multiple

Micro Technologies Solutions, and number and volume of micronutrient ingredients used. Throughout the process of installing and implementing Micro-Weigh and Pro-Control systems in a feed mill, the Micro Technologies team does a thorough evaluation of the mill and operations within the manufacturing of feed. Micro Technologies uses its own programs to optimize the production of feed through modifying operations within the mill. Examples of this include changing locations of feedstuffs within bays, modifying order of adding feedstuffs, optimizing the feed delivery, and adjusting the time each ingredient is mixed. Because of these modifications, dairies often see one to several minutes shaved off the time it takes to make each batch of feed resulting in large reductions in daily feed mill operation times.

1.4 Utilization of Mineral Pre-Mixes

Without the use of Micro-Weigh system, a dairy will use a mineral pre-mix purchased from an outside manufacturer of feedstuffs. Often, a dairy will have one mineral pre-mix that covers the basic nutritional needs of all cows, along with another mineral pre-mix that is designed specifically to be added to the first pre-mix to supplement the needs of high milk cows. This high milk pre-mix has the necessary ingredients to complete the high milk ration but is often then also used in lesser amounts for other rations such as those for cows that are "dry," or not milking. Mineral pre-mixes are formulated by a nutritionist, ordered, and shipped to the dairy. Because of this process, it can take days to receive a new batch of pre-mix so any changes to the nutritional value of the feed will not be realized for several days. A dairy may also see a settling of minerals within the pre-mix due to transportation and handling. This can further result in less consistent feed and lighter ingredients within the pre-mix rising to the top and being more affected by outside forces

such as wind. This all results in a shrink difference in the amount of mineral pre-mix purchased and the amount fed along with inconsistencies in the nutrients within the feed.

1.5 Dairy Production

Throughout the years, the dairy industry has seen highs and lows. Although the milk price market continues to cycle, the costs of inputs such as feed and labor continue to rise steadily. This leaves ever-changing margins for production which makes the use of technologies in all aspects of the industry even more important. The dairy industry continues to improve milk production per cow by not only improving genetics and creating better tools for raising and milking cows, but also by better understanding the nutritional needs of cows in each stage of lactation. Dairy nutritionists and many scientists that work in feed specialties continue to create new feed products that will help increase milk production in dairy cattle. By utilizing the nutritional technologies to their full potential, a producer can continue to advance the dairy industry in ways that are sustainable and beneficial to both the dairy and the cow.

1.6 Thesis Objective

The goal of this project is to develop a spreadsheet tool that the Micro Technologies team can use to help dairy farmers better evaluate the costs of implementing the use of a Micro-Weigh Micro Ingredient System and Pro-Control Plus Feed Batching System in their feed mill. The tool will use partial budgeting to compare micronutrient costs when utilizing Micro-Weigh and Pro-Control systems with micronutrient costs when purchasing a pre-mix. This will include the reduction in costs when removing shrink of a pre-mix and the use of unnecessary micronutrients in some rations. Micronutrient rations will be discussed on a cost per head per day basis. Because there is also value in the reduction of

feed mill operation time, the decision tool will break down that cost into a cost per head per day basis for comparison.

CHAPTER II: LITERATURE REVIEW

Although there are vast amounts of research and publications concerning almost every aspect of the dairy industry, there have been none published specifically regarding the usage of Micro Technologies' Micro-Weigh Micro Ingredient System or Pro-Control Plus Feed Batching System and the values that they bring to a dairy. However, in the context of this project, it is imperative to evaluate the dairy industry costs and income, understand feed rations and micronutrient content and assess how those values integrate into the decision-making process of a dairy manager.

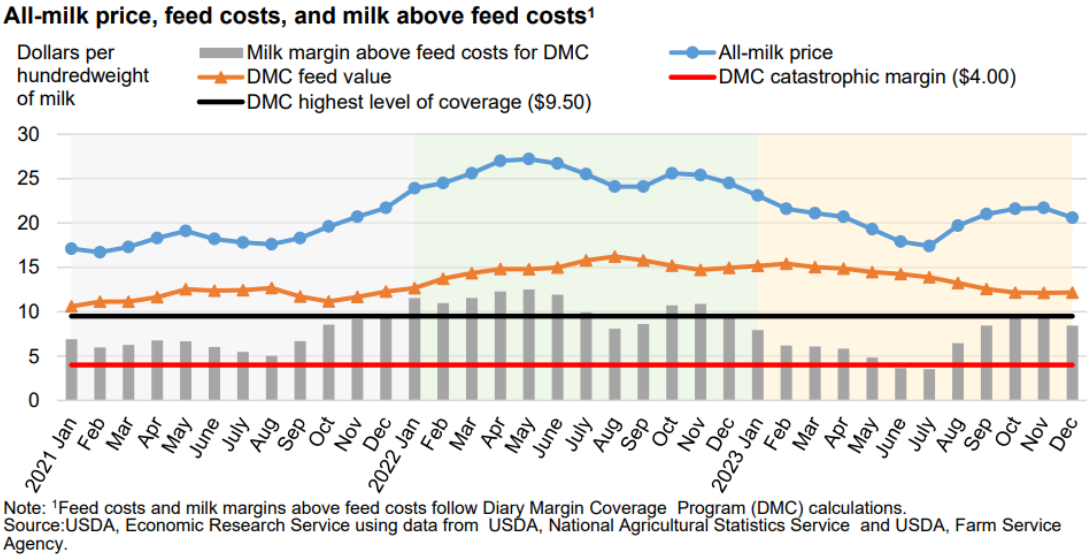
2.1 The US Dairy Industry

According to the United States Department of Agriculture, the US dairy industry produced 226.6 billion pounds of milk in 2023, which averaged $20.48 per hundredweight (cwt). This means that there was over $46.4 billion in milk sold in 2023. While income fluctuates depending on the market price of milk, there are also large fluctuations in operational costs. Feed costs also fluctuate with markets but have seen a consistent rise throughout the years. For example, labor costs have risen 5.5% and equipment costs have risen 1.7% from 2022 to 2023 (USDA, National Agriculture Statistics Service 2024).

"The milk and feed price dynamics in 2023 resulted in some of the poorest margins since the implementation of the Dairy Margin Coverage Program (DMC)" (USDA, Economic Research Service 2024). The DMC is a USDA Farm Bill backed program that provides aid to dairy farmers when the milk-feed margin falls below certain thresholds. The milk-feed margin, also known as the national dairy production margin is the marginal difference between the price of milk and the price of feed. The milk price for the margin is the "all-milk" price, which is the average price that all dairy farms in that state were paid

per hundred pounds of milk at the average fat test. The average feed costs are determined by the USDA based on a standard dairy feed ration and the USDA national prices for those feed ingredients. Dairy producers can sign up for the DMC at varying rates as a form of insurance so that if the milk-feed margin falls below certain thresholds, there is financial backing to help the dairy survive. In 2023, for all but one month, the margin was lower than $9.50, the highest threshold for DMC coverage and even fell to lower than the catastrophic margin of $4.00 for two months during the summer. This means that the income over feed costs was too low to overcome without the help of DMC coverage. (See Figure 2.1) Because the income over feed cost does not consider any other costs of operation such as equipment and labor, this likely meant that most dairies were operating at a loss for those months. With ever-rising costs and narrow margins of dairy operations, producers look towards technologies that will help decrease costs when possible so that they may get the most out of their dairy.

Figure 2.1 All-milk price, feed costs, and milk above feed costs



Note: ¹Feed costs and milk margins above feed costs follow Diary Margin Coverage Program (DMC) calculations.
Source:USDA, Economic Research Service using data from USDA, National Agricultural Statistics Service and USDA, Farm Service Agency.

(USDA, Economic Research Service 2024)

As dairy margins continue to change, dairy producers are constantly on the lookout for ways to decrease costs and increase profits. To remain profitable and in business, dairies must utilize new tools and technologies that can help in any aspect of the business. This includes, but is not limited to technologies in milking, animal health, inventory management, office operations, and especially feed mill operations. While Micro Technologies builds systems for each of these business groups, the technologies that have been shown to make the most difference in operating costs are those that involve the batching of feed.

2.2 Dairy Feed Rations

According to the USDA, in 2023 the US dairy herd was between 9.357 and 9.444 million head throughout the year, bringing the US dairy cow to an average of 24,115 pounds of milk produced. Since 2014, the US dairy herd has increased in numbers by 125,000 head and the US milk production has increased by 20.316 billion pounds meaning that the average cow is producing 1,868 more pounds of milk, an increase of 8.3% (USDA, National Agriculture Statistics Service 2024). While genetics and milking technologies play a major role in this increase, many of the advancements have resulted from a greater understanding of the nutritional needs of a lactating dairy cow. Dairy producers and dairy nutritionists strive to meet those needs through adjusting the diets of cows to allow them to make better use of the feed rations that they consume.

There is substantial research on the nutritional needs of a dairy cow and what is seen as the ideal diet. The ideal feed ration for a dairy cow varies widely depending on environment, milking frequency, stage of milking or pregnancy of the cow, available feedstuffs, and many other factors. “Diet formulation for the high producing dairy cow requires knowledge of the nutrients that are required by the mammary gland to produce milk. These nutrients include water, protein (amino acids), carbohydrates, fats, minerals,

and vitamins. Understanding of their physical characteristics and their combined interactions are essential to successful dairy cattle feeding" (Erickson and Kalscheur 2020). The bulk of dairy feed is based around the macronutrients of protein (amino acids), carbohydrates, and fats, which come in the form of feedstuffs including hay, straw, pasture, silage, oils, fruits, nuts, mill byproducts and grains such as corn, barley, and oats. While these feedstuffs provide various levels of micronutrients (vitamins and minerals), it is necessary to utilize additional minerals and vitamins to obtain the optimal levels of each micronutrient in the feed.

Furthermore, a dairy must manage the feed rations to meet the needs of a cow throughout her life. In medium to large sized dairies, it is common to group cows by stages of pregnancy and stages of lactation. For example, the simplest feed mix is fed in the form of a "dry cow" ration that is designed to meet basic needs of cows that are not milking. From there, the nutritional needs increase as cows come closer to parturition and after calving where cows may be fed an "up close" or "fresh" ration to provide their needs before and after calving to prepare for the milking stages. As a cow moves along throughout the lactation stages, there are typically different feed rations such as "high-milk" that have the highest nutrient content to provide for the needs of a high-producing animal. By being able to build multiple feed rations with different nutrient values, a dairy can maximize output from a cow. To do this, a dairy will enlist the help of a nutritionist consultant that formulates rations based on the individual dairy. The nutritionist is constantly adjusting those rations due to changes in feed availability, feedstuff nutrient content, weather conditions, and many other factors.

2.3 Micronutrients and Feed Additives

Vitamins are organic compounds needed for metabolism. They can be divided into either lipid (fat) or water-soluble groups. Lipid-soluble vitamins are vitamins A, D, E, and K. Vitamin K is typically made in the stomach during digestion, but A, D, and E typically need varying levels of supplementation. Water-soluble vitamins are usually made through digestion of feeds but can be supplemented when needed. Examples of water-soluble vitamins include biotin and niacin.

"Minerals are typically classified as metal elements that are inorganic compounds required for many bodily functions from structure, and nerve impulses to osmotic balance. Some minerals serve as catalysts for reactions or are necessary for enzyme function (e.g. glutathionine perozidase.)" (Erickson and Kalscheur 2020) There are two categories of minerals. The first category of minerals is macrominerals which are needed in the feed in gram volumes. Examples of macrominerals include calcium, potassium, magnesium, sodium, and sulfur. The second category of minerals is microminerals such as copper, iodine, iron, manganese, and zinc and are required in the feed at milligram levels.

A dairy may also choose to include feed additives in their feed rations. "Feed additives are typically added to dairy cattle diets to improve performance such as growth, milk yield, milk component yield, feed efficiency, and health" (Erickson and Kalscheur 2020). Examples of feed additives include, but are not limited to probiotics, ionophores, yeasts, rumen buffers, and even essential oils. Because feed additives are proprietary mixes that are manufactured by feed or animal health companies, they come with specific recommended volumes to be fed to cows. If a ration has too little of a single feed additive, the benefits of that additive will likely not be realized. Conversely, too much of a feed additive may have adverse effects or simply be a waste of product. These products also tend

to have much more research and data when compared to individual minerals or vitamins. This is typically associated with higher costs to the producer so having the correct volume of that additive in the feed is very important.

2.4 Considerations

Whether it be vitamins, minerals, or feed additives, there can be great value in adding these products into feed rations. However, with larger costs associated with these products, it is important to the bottom line of the dairy that they are fed in the correct amounts for each of the feed rations to reduce waste and get the best utilization. There are two primary ways of introducing micronutrients and feed additives into feed ration. The first comes in the form of a pre-mix and the second is using Micro Technologies' Micro-Weigh and Pro-Control systems. It is important for each dairy to look at their own feed rations and feed input costs to help determine the value of utilizing equipment such as those made by Micro Technologies.

CHAPTER III: THEORY

Financial management is a critical aspect of any agriculture operation, and this especially holds true for the dairy industry. As discussed within the literature review, the milk-feed margin has seen some of its lowest points in years, which makes dairy financial management even more important. The question of the value of utilizing Micro Technologies' Micro-Weigh or Pro-Control Plus systems is a difficult one to answer as there are many variables involved, some of which cannot be easily measured. Because of this, the economic tool of partial budgeting will be used to help show the value of implementation of these systems. This chapter aims to explore and partial budgeting and demonstrate its application as an essential tool in dairy management and decision making.

3.1 Actual vs Perceived Value

Before evaluating partial budgeting as a tool, it is important to explore the difference between the actual values and perceived values of utilizing technology systems such as those from Micro Technologies. While partial budgeting is designed to provide a quantitative assessment of the impact of utilizing these technologies, there are many perceptions of value that are subjective and difficult, or even impossible, to measure. This adds an additional layer of complexity to making these decisions.

Actual values, or explicit values in budgeting refer to tangible, quantifiable changes in revenues and costs. Actual values are based on data that show factual financial implications of decisions made such as the difference in costs of micronutrients from a pre-mix and the cost of micronutrients that are fed utilizing a Micro-Weigh or Pro-Control Plus system. The accuracy of actual values depend on the quality and reliability of the information used in the budgeting process. Examples of actual values throughout this

project include, but are not limited to labor costs, gas and electricity costs, equipment costs, and especially feed costs such as prices of micronutrients.

Perceived values in budgeting encompass the more subjective interpretations and expectations that a producer may have about a particular decision. Perception of value can be influenced by many factors including personal experience, beliefs, and the reasoning biases of the decision makers. For instance, some dairy producers are hesitant to use new technologies while others may be more apt to try new things. Examples of perceived values throughout this project include, but are not limited to ease of use, optimism and understanding of the systems, and flexibility in acceptance of the utilization of the technology.

It is important to understand the difference between the two values as well as recognize that they may never align. Values should be divided into actual versus perceived so that the actual values may be quantified and then perceived values may be utilized for additional support so that there is a more realistic view of decision outcomes. For this project, we will employ actual values to calculate the financial impact of utilizing the Micro-Weigh and Pro-Control Plus systems. However, because perceived values are important and should be presented, they will be discussed within the conclusion as additional support, for or against, utilizing the Micro Technologies systems.

3.2 Partial Budgeting

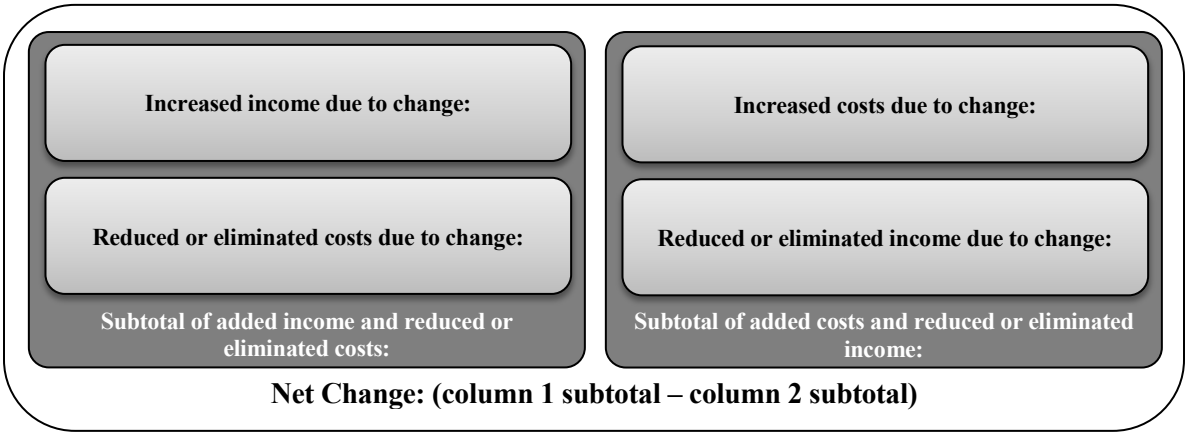
Partial budgeting is one of the many tools that dairy producers can use to make economic decisions about their operation. "A partial budget helps farm owners/managers evaluate the financial effect of incremental changes. A partial budget only includes resources that will be changed. It does not consider the resources in the business that are

left unchanged. Only the change under consideration is evaluated for its ability to increase or decrease income in the farm business" (Tinger 2018). By only focusing on the changes in revenues and costs resulting directly from the implementation of Micro-Weigh and Pro-Control systems, a producer can see a more detailed, targeted analysis.

Partial budgeting includes four main components; increase in income, reduction or elimination of costs, increase in costs, and reduction or elimination of income. The four components are divided into items that increase income in the left column and items that reduce income in the right column. The increased income due to change category includes the estimated revenue that may occur due to choosing to utilize the new systems. The increased costs category lists the new expenses from making the change. The reduced or eliminated costs due to change category lowers or removes costs that would be incurred prior to adopting a new system. Finally, the reduced or eliminated income due to change category adjusts for negative changes in revenue. There is a subtotal for each of the columns and then brought together for a grand total (see figure 3.1).

It can also be viewed that the left column contains items that has positive effects on the business and the right column contains items that will have a negative effect of the business. "Positive effects of the proposed change may result because of the elimination or reduction in cost of ceasing current activities, and/or the generation of additional revenues by adoption of the new activities. The negative effects of such a change could be generated by an increase in the cost by implementing the new activity, and/or a reduction in the revenue from ceasing the current activity" (Dhoubhadel and Stockton 2010).

Figure 3.1 Partial Budgeting Overview



This project will be specifically looking at the costs of feed production within a dairy and present further evaluation into the costs associated with the micronutrients in the feed rations. Because this evaluation of the cost of implementing the Micro-Weigh and Pro-Control systems only looks at the costs and the income levels of the farm will remain unchanged, the categories of increase in income and 'reduction or elimination of income will be blank. The category of 'added costs' will incorporate the expense of utilizing micronutrients purchased from Micro Technologies. The category of 'reduced or elimination of costs' will incorporate the elimination of the cost of purchasing a mineral pre-mix, the reduction in cost of a mineral pre-mix due to shrink, and the reduction in cost of operating a feed mill.

3.3 Calculating Costs

A dairy producer typically looks at feed costs on a basis of cost per head per day. The cost for a cow will vary depending on the feed ration that she is being fed. High milk cows have higher feed and nutrient volume requirements than all the other feed groups. Young heifers and dry cows tend to be the lowest. Because of this, the cost per head per day for a high milk cow is much greater than the cost per head per day of a heifer or dry

cow. As the costs of feed inputs varies, a dairy nutritionist may adjust the amounts of major feed ingredients such as hay or corn to keep feed costs at the lowest while still meeting the nutritional requirements. When adjusting major feed ingredients in a ration, this adjusts the nutrient value of the feed and, subsequently, the micronutrient values may need to be adjusted.

Micronutrient costs while utilizing the Micro-Weigh and Pro-Control systems will be compared to the purchase of a mineral pre-mix that is purchased in bulk and fed in the same volumes. This project follow conventional consideration of dairy feed ration costs and will be discussed on a per head per day basis. When looking at the costs of shrinkage and feed mill operation, those expenses will be divided by the number of head of cows on the facility to get a cost per cow per day basis for comparison.

It is important to note that the costs of installing Micro Technologies' systems occur. These costs vary widely depending on the individual dairy situation. Often, producers choose to install Micro Technologies equipment while completing feed mill renovations or building a new mill. Because the equipment and feed materials must be housed in an enclosed, climate-controlled environment, these buildings often have to be added to the mill. Micro Technologies is heavily involved in the construction of these buildings and costs are established and agreed upon prior to installation. Because these costs can vary so significantly, they will not be included in the analysis.

3.4 Shrinkage

One of the costs that will be evaluated within the partial budgeting format is the cost of shrinkage when using a mineral pre-mix. "Shrinkage is the loss of feed ingredients that never have a potential for economic return. Generally, shrinkage includes not only storage losses, but excessive inclusion rates in rations that are unnecessary to meet the

nutritional needs of an animal" (Harner, et al. 2011). In another article, Harners 2011 paper also discussed "delivery weight errors, wind, birds, rodents, tires and tracked feed, cattle tossing feeds, silage bunker losses, feed refusals, bunk heating and spoilage, moisture losses, mixing errors, scale accuracy and water damage" as causes of shrink. Harner estimated that there could be 15-20% of feed loss due to shrink in the average feed mill. For mineral and vitamins, the volume of shrink loss varies due to many of these causes of shrink.

Ohio State Extension estimated that feed stored in 3-sided commodity bays tend to see 3-8% loss and that stored in bins typically see losses in the 2-4% range. "An 8% shrink loss on a $400/ton concentrate that is fed at a rate of 6lb/cow/day, amounts to almost $0.10/cow/day" (Harner, et al. 2011). In another part of the study, it was noted that with feed stored in 3-sided commodity bays, there is an increase of 8% in feed loss when the wind blows 10mph when compared to a 5mph wind. This increases by 27% with winds reaching 15mph. These costs are even more important to consider when producers are seeing a loss in overall operation costs due to low milk prices.

For minerals and vitamins, one of the most unnoticed instances of shrink occurs in mixing errors where a loader driver may dump too much or too little of the mineral pre-mix into the ration. When it comes to a mineral pre-mix that is added at a small percentage of the total feed weight, there is a large possibility of over or under feeding that pre-mix. "This occurs daily on most dairies as nutritionist formulate rations to the nearest pound, the weight readout may be to the nearest 10lbs, and the fill mechanism into the mixer is a pay loader which may have an accuracy of 50 to 100lbs depending on the operator" (Harner, et al. 2011). However, when ingredients are purchased through Micro Technologies, they are

delivered as packaged products and weighed precisely to the volume needed in the ration through the Micro-Weigh system, eliminating shrinkage from over-loading. Because the vitamins and minerals purchased through Micro Technologies are packaged products, they are stored inside the feed mill where they are not affected by elements such as rain and wind. With the utilization of Micro Technologies' Micro-Weigh and Pro-Control systems, loss from shrinkage that is seen when using a mineral pre-mix is essentially eliminated, increasing the actual value of the utilization of those systems.

3.5 Feed Mill Operations

This project will also utilize the operation cost of a dairy feed mill in the category of reduced or eliminated costs due to change. The cost to operate a mill varies by dairy due to many factors including labor costs, number of employees working in the mill, fuel costs for equipment such as loaders and machinery, electricity costs, and costs of mill installation and depreciation value. While research has not been done on improvement of batching times while using Micro Technologies' Micro-Weigh and Pro-Control systems, the Micro Technologies team sees steady improvements when the systems are implemented. Efficiencies are realized through minor changes such as adjustments in mixing times, changes in ration preparation order, feed truck wait times, and loader operator training. A reduction of even one or two minutes per feed batch can result in over an hour of mill operation time savings when there are thirty batches made per day. The number of batches made each day in a dairy varies depending on the overall size of the dairy, how the pens are divided, and the number of rations.

For this project, estimates of cost per hour of operation of the feed mill will be used. These estimates come from the dairy manager and their breakdown of annual costs of operation of the mill without the cost of feed ingredients. This number is divided by the

total number of feed mill operation hours through the year. The Micro Technologies team has seen conservative estimates of well-run mills around $500 per hour and less efficient operations close to $2,000 depending on factors included in the costs. Calculations of time saved and cost per hour of operation will be totaled. This cost can be divided by the number of cows being fed to get a value per head per day to be compared to costs of feed ingredients through Micro Technologies.

CHAPTER IV: METHODS

The goal of this project is to answer the question of the economic impact of utilizing Micro Technologies' Micro-Weigh Micro Ingredient Delivery System and Pro-Control Plus Feed Batching System in a dairy feed mill. This will be a case study of an Arizona dairy that has provided the necessary data for this project. This will be done by first analyzing the micronutrient costs while using these systems compared to the micronutrient costs of utilizing a mineral pre-mix. Following micronutrient costs, this project will look at the cost of shrink in the mineral pre-mix and the difference in value when shrink is removed due to purchasing micronutrients as packaged goods from Micro Technologies and using the Micro-Weigh system in administration of those products. Finally, it will look at the estimated hourly cost of operating a feed mill and the value of increasing batching speed thus reducing overall mill operation time.

This project includes the development of a decision tool that the Micro Technologies sales team may use when speaking with dairy managers. Because cost is typically the first inquiry when new technologies are proposed, this decision tool will help answer some of those questions. Values will be broken down into a cost per head per day basis to align with a dairy producers' understanding of costs. There is also value in accounting for adjustments, so the decision tool will be capable of running 'what-if' scenarios for evaluation.

4.1 Partial Budgeting of Costs

Partial budgeting is used as the economic tool for this project. Any possible increase in income would result from an increase in milk production. This would be the result of changes in nutrient values in the feed and not the value of implementation of the Micro Technologies systems. Therefore, this partial budgeting tool will not account for

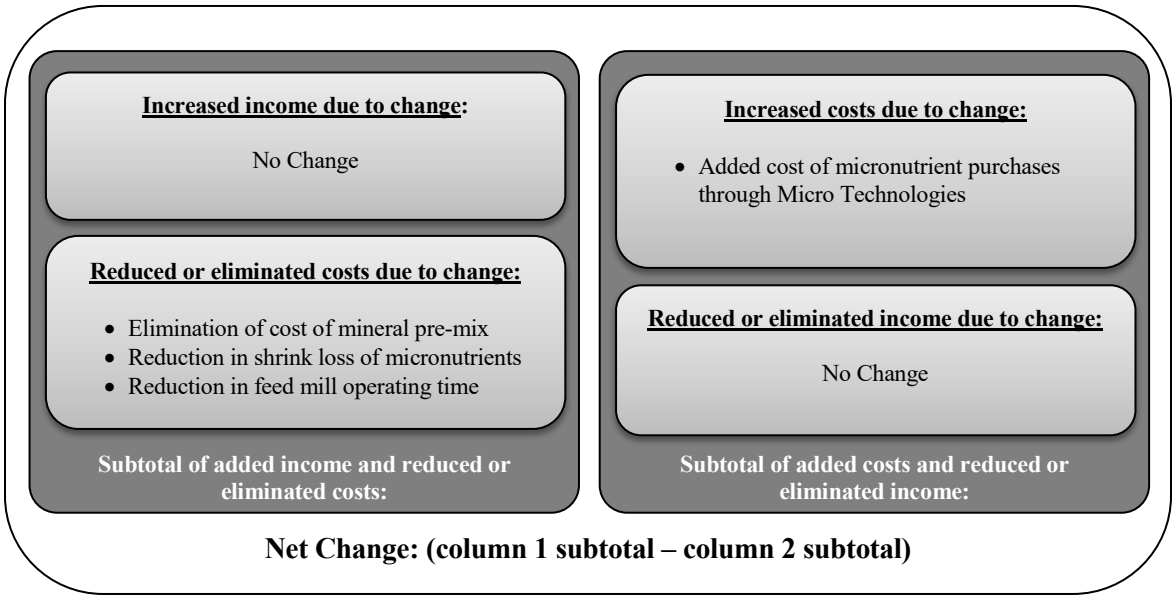
changes in income and the only two categories that will be evaluated are the increased costs and the reduced and eliminated costs due to change. The increased costs due to change are the costs of purchasing packaged micronutrients from Micro Technologies. Packaged micronutrient prices have been provided by Micro Technologies as the basis for the evaluation. The price that a dairy will pay for packaged products varies based on many factors including any contracts with the dairy, the number of cows, and if the dairy has implemented the use of any other technology systems offered.

There are three values that will be evaluated in the category of reduced or eliminated costs due to change. The first cost is the elimination of the cost of purchasing the mineral pre-mix. The mineral pre-mix costs will be broken down into amount used within each feed ration. The cost of purchasing the pre-mix along with the amounts within each feed ration are evaluated on the same basis as the cost of purchasing packaged goods. These prices and volumes are provided by the dairy based on prior use of mineral pre-mix and cost of the bulk product from a feed company. The second reduction of cost is the elimination of a 5% shrink loss that occurs with the utilization of a mineral pre-mix (Harner, et al. 2011). The third reduction in cost due to change is the value of the reduction of operating time due to more efficient batching times. The estimation of cost of operation per hour of the feed mill is provided by the dairy. The estimation of reduction of time of operation is provided by the Micro Technologies team based on evaluation of milling procedures and timing as well as experience with feed ration batching procedures in multiple dairy and feedlot feed mills.

The reduced and eliminated costs will be compared to the increased cost of micronutrients using this partial budgeting tool. The cost of mineral pre-mix will be

broken down by cost per cow per day based on ration usage and compared to the same rations with micronutrients from Micro Technologies. This will result in an overall cost difference between the systems. The project will then look at the shrink elimination and mill operation efficiency changes to compare an overall value in implementing the Micro-Weigh and Pro-Control systems.

Figure 4.1 Partial Budgeting of utilization of Micro Technologies' systems



4.2 The Decision Tool

The decision tool is designed for the Micro Technologies team to walk through a meeting with a dairy producer to answer the question of costs. It provides questions to guide the discussion so that numbers may be input in an easy-to-use spreadsheet. A Micro Technologies sales representative may work with the dairy nutritionist to understand micronutrient needs in each of the feed rations prior to speaking with the dairy manager so that ration costs are calculated ahead of the meeting. An honest discussion about costs and efficiency of operations, costs and usage of mineral pre-mix, and pre-mix shrinkage will

provide valuable information to complete the spreadsheet and show costs and values of utilizing Micro Technologies' systems.

The decision tool is designed with simplicity in mind so that it may be used in any dairy or cattle feeding operation. There are going to be differences of outcomes based on the specific dairy. Larger dairies, for example have the economies of scale that will allow fixed costs to be divided across more cows so the price per head will be lower for those costs. On the contrary, a smaller dairy may see much larger impacts per head of changes in feed mill management that make the milling process more streamlined or see a much lower impact of higher cost of micronutrients from Micro Technologies. By having this flexibility, this decision tool will be valuable for many settings.

The decision tool spreadsheet is divided into four sections. The first is a guided discussion that a Micro Technologies sales representative may use to talk through costs. This section may or may not be used, depending on preference. The second section is a calculations tab where numbers are entered or transferred from the discussion section. This is where important data such as feed ration names, costs of micronutrients, number of cows consuming each ration, pre-mix information, and feed additives are entered. The third section is a feed ration calculator that generates the cost per head per day of each feed ration and compares it to the cost per head per day of using a mineral pre-mix in that ration. Finally, the final page is a summary of the costs of both using a mineral pre-mix and using the Micro Technology Micro-Weigh and Pro-Control systems.

4.3 Accounting for Adjustments

When evaluating costs due to changes, it is important to recognize that these are the best estimates possible based on the data and experience from both the dairy, the dairy manager, and Micro Technologies. Because we will use estimates, there must be room for

flexibility and an understanding of values, and some questions need to be identified ahead of doing the calculations.

- *What if estimates of shrink loss or operation of feed mill costs are wrong?*
- *What if the mill is already very efficient and adding the new systems does not change batching times?*
- *What if batching times are reduced by much more than the estimates?*
- *What if the cost of the mineral pre-mix goes up?*
- *What if the dairy decides to implement other Micro Technology systems and how will that change the price of the micronutrients and additives in the feed?*

By being able to adjust for changes within the operation, the decision tool becomes more valuable to the dairy manager. As an example of this, this project will use the goal seek tool in Microsoft Excel to determine what the cost of the mineral pre-mix would have to be to equal the cost of the packaged micronutrients from Micro Technologies, even before the evaluation of shrink and feed mill operation costs.

The final part of this project will be to find the difference between the current cost of operation and the changes in costs due to the implementation of the Micro Technologies systems and evaluate the actual values. While it is important to remember there are many other values that are not calculated or are simply perceived values, all of those are used to make the ultimate decision on the systems.

CHAPTER V: DATA

The objective of this thesis is to utilize this case study to help the dairy manager determine if the facility would benefit from utilizing the Micro-Weigh and Pro-Control systems from Micro Technologies. To evaluate this, partial budgeting will be used and data will be evaluated using the decision tool designed to aid in determining costs and values. This will first look at the category of increased cost due to change by looking at cost of micronutrients from Micro Technologies then compare them to the cost of utilizing a mineral pre-mix. These costs will be broken down by cost per head per day and summed as an overall cost per day for the dairy. Next, the cost of shrinkage will be introduced, and the actual cost of mineral pre-mix will be utilized. Finally, estimations on costs of feed mill operations and reductions of mill time will be evaluated. This will give an overall value of cost of utilizing the systems from Micro Technologies, which can be evaluated on a basis of cost per day or a basis of cost per head per day. This project will use data from a medium-to-large sized dairy in Arizona and the data provided is from the manager of the dairy. The feed ration micronutrient values were provided by the nutritionist that formulates the rations. Table 5.1 gives an overall view of the size of the dairy, number of cows being fed each ration, and the Micro Ration. The Micro Ration is the combination of multiple micronutrients that will be added to the overall feed ration. Often, a dairy will use the same name for the Micro Ration as the Ration Name. It is also possible that there may be no micronutrients added to some rations.

Table 5.1 Feed ration, number of cows on feed, and micro ration name

Ration Name	# Cows	Micro Ration
CLOSE	421	CLOSE
DRYCOW	558	DRYCOW
FRESH	683	FRESH
HMLK	5894	MLK
OHEIFER	981	None
Total Head on Feed	**8537**	

Source: Arizona Dairy

There are a total of 8537 cows on this dairy with 6577 of them being milked, thus bringing income into the dairy. For this dairy, the cows are divided into five groups. CLOSE refers to cows that are close to calving. DRYCOW refers to cows that are dry and are not milking. FRESH refers to cows that have recently calved. HMLK refers to cows that are high milk producers. OHEIFER refers to heifers that are open, which means that they have not yet been bred. While the OHEIFER group is not being fed micronutrients, the rest of the ration groups are receiving varying amounts of micronutrients and feed additives.

5.1 Micro Ingredient Rations and Costs

Micro Technologies has provided a baseline cost per pound of micronutrient ration ingredients (Micro Ingredient). These costs are highly dependent on the dairy and can change due to many factors including dairy size, utilization of other Micro Technologies systems, and contracts with manufacturers. Table 5.2 gives an overview of the Micro Ingredients and their costs per pound. Costs of these ingredients are broken down further into the unit values that they are fed. In this dairy, all Micro Ingredients are fed on a milligram per head per day basis.

Table 5.2 Micro Technologies Micro Ingredients, Units Fed, Cost per Pound, and Cost per Unit

Micro Ingredient	Unit	Cost/lb	Cost/Unit
Cheyenne Dairy TM #2	Mg	$ 0.92	$ 0.00000203
Rumensin 90	Mg	$ 12.45	$ 0.00002745
Biozin Cheyenne	Mg	$ 3.85	$ 0.00000850
Bovamine Dairy + CHMSP	Mg	$ 91.80	$ 0.00020238
Clarifly 8%	Mg	$ 23.18	$ 0.00005110
Vitamin D 500 DLC	IU	$ 9.02	$ 0.00000024
Vitamin E 60% DLC	IU	$ 15.95	$ 0.00000042
Vitamin A 500 DLC	IU	$ 20.25	$ 0.00000053

Source: Micro Technologies

Feed rations are designed by the dairy nutritionist and micronutrient needs of a cow vary depending on her gestational stage or lactation stage. High producing cows require higher amounts of micronutrients while cows that have recently freshened may be fed higher amounts of products such as Rumensin 90 to help them heal from calving. Table 5.3 shows the nutritionist provided Micro Ingredients needed per cow in each ration along with the cost of those ingredients on a per head per day basis and a total cost per cow per day Micro Ingredient cost.

Table 5.3 Inclusion rates of Micro Ingredients by ration and cost per ration per ingredient

		CLOSE		DRYCOW		FRESH		HMLK		OHEIFER	
Ingredient	**Units**	**Dose**	**Cost**	**Dose**	**Cost**	**Dose**	**Cost**	**Dose**	**Cost**	**Dose**	**Cost**
Dairy TM #2	**mg**	18160	$ 0.0369	13620	$ 0.0277	18160	$ 0.0369	18160	$ 0.0369	0	$ -
Rumensin 90	**mg**	400	$ 0.0110	300	$ 0.0082	350	$ 0.0096	350	$ 0.0096	0	$ -
Biozin	**mg**	12750	$ 0.1083	12750	$ 0.1083	12750	$ 0.1083	12750	$ 0.1083	0	$ -
Bovamine	**mg**	250	$ 0.0506	0	$ -	250	$ 0.0506	250	$ 0.0506	0	$ -
Clarifly 8%	**mg**	56.88	$ 0.0029	56.88	$ 0.0029	56.88	$ 0.0029	56.88	$ 0.0029	0	$ -
Vit D 500 DLC	**IU**	30000	$ 0.0071	25000	$ 0.0059	30000	$ 0.0071	30000	$ 0.0071	0	$ -
Vit E 60% DLC	**IU**	1000	$ 0.0004	650	$ 0.0003	350	$ 0.0001	650	$ 0.0003	0	$ -
Vit A 500 DLC	**IU**	180000	$ 0.0959	150000	$ 0.0799	180000	$ 0.0959	180000	$ 0.0959	0	$ -
	Total Cost of Micros Per Head Per Day		***$ 0.3132***		***$ 0.2333***		***$ 0.3115***		***$ 0.3117***		***$ -***

Source: Arizona Dairy Nutritionist, Micro Technologies

When costs of micronutrients and feed additives are divided out into cost per head per day, a dairy producer is able to see the cost of all of those combined and better analyze the costs of the rations. In this Arizona dairy, the cost of the CLOSE, FRESH, and HMLK rations are very similar and the DRYCOW cost is slightly less with no Micro Ingredients being added into the OHEIFER ration.

5.2 Mineral Pre-Mix Costs

Data has been derived from the Arizona dairy regarding the cost per ton of the mineral pre-mix usage. The cost of the mineral pre-mix is $400 per ton, which is calculated to be $0.20 per pound. Because the pre-mix also contains other nutrients and fillers such as salts and macronutrients, it is estimated that 7% of the premix by volume and 90% of the premix by cost comes from micronutrients. Those numbers allow the dairy to calculate the cost of incorporating only the micronutrients into each of the ration. Table 5.4 shows the number of pounds of mineral pre-mix in As Fed volumes, the pounds per cow of micronutrients from the mineral pre-mix, and the cost per cow per day of feeding the mineral pre-mix.

Table 5.4 Mineral Pre-Mix use by Ration, Pounds per Cow as fed, Pounds per Cow of Micronutrients, and Cost per Cow of Mineral Pre-Mix

Ration	Lbs/Cow AF	Lbs/Cow Micros	Cost/Cow
CLOSE	1.5	0.1050	$ 0.2700
DRYCOW	1.1	0.0770	$ 0.1980
FRESH	1.4	0.0980	$ 0.2520
HMLK	1.5	0.1050	$ 0.2700
OHEIFER	0.0	0.0000	$ -

Source: Arizona Dairy

5.3 Difference in Micronutrient Costs

When comparing Micro Ingredient costs by ration, the decision tool finds that utilizing the Micro-Weigh and Pro-Control systems and purchasing micronutrients from

Micro Technologies results in higher costs for Micro ingredients on all rations. Table 5.5 shows the comparison of utilizing Micro ingredients and utilizing a mineral pre-mix. These costs are broken down into both cost per head per day basis and a total cost per day basis within each ration prior to removing the cost of shrink or a reduction in feed mill operation time.

Table 5.5 Micronutrient Costs per head and per day by ration

	CLOSE	DRYCOW	FRESH	HMLK	OHEIFER
Number On Feed	421	558	683	5894	981
Total Cost of Micros Per Head Per Day	$ 0.3132	$ 0.2333	$ 0.3115	$ 0.3117	$ -
Micro Total Cost/Ration/Day	$ 131.85	$ 130.18	$ 212.77	$ 1,836.89	$ -
Total Cost Pre-Mix Per Head Per Day	$ 0.2700	$ 0.1980	$ 0.2520	$ 0.2700	$ -
Pre Mix Total Cost/Ration/Day	$ 113.67	$ 110.48	$ 172.12	$ 1,591.38	$ -
Difference in Cost Per Head Per Day	***$ 0.0432***	***$ 0.0353***	***$ 0.0595***	***$ 0.0417***	***$ -***
Difference in Cost Per Day	***$ 18.18***	***$ 19.69***	***$ 40.66***	***$ 245.51***	***$ -***

Total Number of Head on Feed	8537
Total Cost of Micros in all Rations / Day	$ 2,311.69
Average Cost / Head / Day of Micros	$ 0.2708
Total Cost Pre Mix in all Rations / Day	$ 1,987.65
Average Cost / Head / Day of Pre-Mix	$ 0.2328
Difference in Cost for All Rations/Day	***$ 324.04***

Overall, the results show that there is a daily increase in micronutrient costs of $324.04 when utilizing the Micro Technologies systems.

5.4 Calculating Mineral Pre-Mix Shrink

Because the shrink cost of feed ingredients is important to measure, this project is assessing the cost of the mineral pre-mix with an additional cost due to loss from shrinkage. Often, these additional costs due to shrink are not accounted for in daily feed costs, but are evaluated elsewhere in the feed mill operation budget. This results in them being overlooked when evaluating the feed costs and when evaluating the value of implementing systems such as those from Micro Technologies. It is important to note that due to human errors such as spilling of bags and mishandling of materials, shrink is never zero while using Micro Technologies' bagged products. However, in this project, shrink while using Micro Technologies will be noted as zero for calculation purposes due to the minimal amount of shrink typically occurring.

Through discussions with the dairy manager, the Arizona dairy estimates a 5% shrink loss of the mineral pre-mix due to multiple factors including wind, rain, rodents, and over feeding. With mineral pre-mix cost of $400 per ton, a 5% loss is an estimated $20 per ton of pre-mix increase in cost. This increases the cost per cow per day of mineral pre-mix to $0.2835 for the CLOSE ration, $0.2079 for the DRYCOW ration, $0.2646 for the FRESH ration, and $0.2835 for the HMLK ration. Over the span of all cows on feed, this raises the daily cost of mineral pre-mix by $99.38 per day from $1,987.65 to $2,087.03. Furthermore, the additional 5% cost of mineral-pre mix when calculating for shrink reduces the difference in Micro ingredients through Micro Technologies and the cost of using a mineral pre-mix to $224.66 per day or $0.0264 per cow per day.

5.5 Calculating Feed Mill Operation Time and Costs

The feed mill operation costs are estimated by the Micro Technologies team and approved by the dairy manager. The cost per hour of operation of a feed mill varies based on many factors including labor costs, electricity and gas costs, equipment costs, and even depreciation costs of building the mill. The Micro Technologies team has seen estimates of realistic operation costs ranging from around $500 to $2000 per hour depending on factors included. For this project, an estimate of $500 per hour will be used to calculate a conservative value in implementing the use of the Micro Technologies systems. In total, on February 14, 2024, the Arizona dairy made 967,616 pounds of feed with an average time of just over 15 minutes 12 seconds per batch operation time.

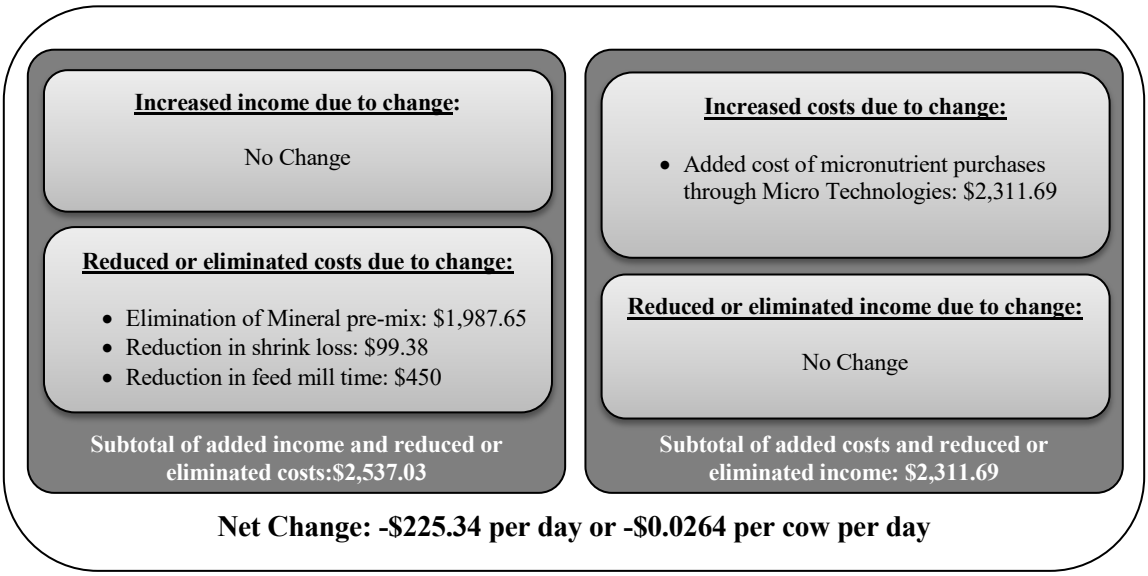
Prior to installation of Micro Technologies Micro-Weigh and Pro-Control Systems, the Micro Technologies team estimated that the feed mill was running at an average of 17 minutes per batch of feed. By installing the systems, an estimated two minutes was saved in run time per batch of feed for the mill. At 27 batches of feed a day and two minutes per batch, installing the Micro Technologies systems eliminated 54 minutes of feed mill operation time every day. With the dairy manager estimating around $500 per hour of operating costs, this brings an estimated value of $450 per day reduction in costs.

CHAPTER VI: RESULTS

By using partial budgeting to evaluate the micronutrient costs of the Arizona dairy, the decision tool calculates that the difference in micronutrient costs when comparing using Micro Technologies' Micro-Weigh and Pro-Control systems to using a mineral pre-mix is $324.04. This means that it will cost the dairy $324.04 more per day to purchase the Micro ingredients from Micro Technologies. This is prior to accounting for shrink of the mineral pre-mix that occurs due to factors such as wind, rain, rodents, and overfeeding or accounting for reduction in costs due to a more efficient feed mill.

After accounting for a daily mineral pre-mix shrink loss of 5% per day, the difference in cost of micronutrients is reduced to $224.66 per day with costs being higher when using the Micro Technologies systems. Finally, when a feed mill becomes more efficient, reducing the batching times by as little as two minutes per batch, with twenty-seven batches per day, this reduces the feed mill operation time by fifty-four minutes per day. Estimating an hourly cost of $500 to operate the feed mill means that the streamlining of the mill will reduce daily operation costs by $450 per day. This all results in a net difference of $225.34 meaning that with the introduction of Micro Technologies' systems, the dairy will see a daily $225.34 reduction in costs.

Figure 6.1 Partial Budgeting Results



Due to the ability of the decision tool to use partial budgeting to separate costs, it is possible look at different scenarios to account for the possibility that estimations of costs are incorrect. In a scenario where not accounting for shrink and feed mill operation time, the decision tool goal-seek finds that with the current cost of ingredients from Micro Technologies, the price of mineral pre-mix would have to be $465.21 per ton to be equivalent to the cost of micronutrients from Micro Technologies. This would be the same as an estimate of 16.3% shrink occurring in the mineral pre-mix. A second scenario that can be investigated may be questions as to the cost of operating the mill. Prior to accounting for shrink, if a mill is able to reduce the time per batch by even 1 minute and 27 seconds, the cost of implementing the Micro-Weigh and Pro-Control systems would be equal to that of using the mineral pre-mix. Further scenarios that can be evaluated involve inquiry into changing prices of Micro ingredients, volumes of mineral pre-mix used, and changing of the micronutrients required in each feed ration.

CHAPTER VII: CONCLUSIONS

Making the decision to make any modifications to a dairy feed mill can be a daunting experience and committing to utilizing new systems such as the Micro-Weigh Micro Ingredient Delivery System and Pro-Control Plus Feed Batching System from Micro Technologies should be done with much consideration to costs and values of the systems. Many times, when presented with the Micro-Weigh and Pro-Control systems, a dairy managers first question will be directed at cost. While only evaluating the cost of purchasing micronutrient and feed additive ingredients from Micro Technologies, the producer will see a rise in costs of the ingredients themselves. However, there is value in utilizing the systems, some of which are actual values, and some are perceived values. This project has shown that it is important to utilize partial budgeting to factor in many different costs and values of the changes that may be made.

It is also valuable to understand that there are perceived values to explore when making changes. For example, one of the benefits of the Pro-Control system is the ability to pull reports on any aspect of the mill operation. This can lead to many opportunities, from adjusting employee management to evaluating why one ration takes longer to batch than others. There is also value in reducing the lead time needed to change a feed ration. When utilizing a mineral pre-mix that needs to be adjusted, the dairy manager and nutritionist may meet to discuss the changes, then the pre-mix has to be ordered from the feed company. Depending on the situation, it may take a few days to use the pre-mix that is already on the premises and receive the new load. With the Micro-Weigh and Pro-Control systems, the micronutrient content can be changed in seconds with the click of a mouse. Other perceived values can include but are not limited to the value of being able to test increases or decreases of micronutrients in feed for only one pen, having a greater

understanding and more control of the micronutrients in the feed, and having a more consistent feed ration.

There is further work that will be done on this project over the next several years as it is just the foundation of a much larger tool for the Micro Technologies sales team. A more complete spreadsheet will be built that will have a more in-depth evaluation of feed mill costs including details on labor costs, heavy equipment operation costs, electricity and gas costs, etc. Over the years, the Micro Technologies team has gathered bits of data from every feed mill they work with prior to installing the new systems. This data has not been collected formally then compiled and compared to the post-installation data for comparison.

In conclusion, the goal of this project was to help develop a tool that the Micro Technologies sales team may utilize to help present the Micro-Weigh Micro Ingredient Delivery System and Pro-Control Plus Feed Batching System to dairy producers so that they may gain a better understanding of the costs and benefits of the systems. While Micro Technologies has been leading the way in the beef industry, it is their goal to continue to move into the dairy industry as well so that they may continue to help producers provide a wholesome and safe food supply efficiently, sustainably, and profitably.

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