The Use of Loading Reports to Evaluate the Accuracy of the Total Mix Ration

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INTRODUCTION

The Cal Poly feed program needs to be very accurate in order to save time and money. However, the dairy does not use a software program to calculate the accuracy of the feed contents, weights, and consistency. Therefore, it is very important the feed being mixed and delivered is done as accurately as possible. Without the regulation and precision of the process excess feed is wasted leading to a decrease in profits.

The Cal Poly dairy exercises a “learn by doing” method of teaching. The employees are students and these students are often being taught how to feed or still learning the routine. Although this is a great opportunity for the students this leaves a lot of room for error. The dairy is a facility that utilized a nearly new total mixed ration (TMR) feed mixer. Cal Poly dairy is a very small dairy and does not have the resources for this technology.

A solution to this problem can be approached in a few different ways. One possible solution is to mandate the feeders to calculate the ration and feed exactly what the animal nutrition program advises. Another solution to this problem would be to purchase the EZ Feed program. This would be a very costly and time consuming solution. A solution to this current problem can help the dairy to lose less money and increase their feeding efficiency.

The purpose of this paper is to evaluate the accuracy of the feed loading system that is currently in place at the Cal Poly dairy. The paper will include reviews and data taken from students at the university.

LITERATURE REVIEW

Management of Feeding Dairy Cows

Computer software can impact the dairy business. EZ feed is a computer software program that increases the efficiency of feeding using a tool for accurate mixing and delivery of the Total Mixed Ration (TMR). Dairy Herd Improvement (DHI) conducted a test using EZ feed to determine the impact of the program on the average dairy. There were 14 dairies examined. The average herd size was 1,735 cows. The data was collected for six months and it was compared to the data records kept on the daily prior to the EZ feed installation. The results noted that there was a “dramatic increase in their annual rolling herd average milk production” (6). In the figure below, each herd increase their milk production average by at least 1.5% within the first six months. Shown in figure 2 on the next page, the 14 herds that were examined also had a steady decline in the cull rate once again, at the 6 month range. The cull rate for the 14 herds was an average decrease of 2.64%.

The increase in milk production and decrease in culling rate led to an increase in profits, which put these dairies in better financial standing. This improved financial standing can be correlated with the analysis done on the EZ feed. The company DHI-Provo has done a complete economic and investment analysis of this product. The Table 1 following, shows the impact of profitability with the use of EZ feed. The first table shows that the cost of purchasing the EZ feed software is $6,595 and this loss was regained in about one and a half months. In one year, the return on this investment will be more that 800%. In conclusion, EZ feed is a tool for dairies that is proven to be efficient and accurate in calculating, mixing and feeding the TMR (6).

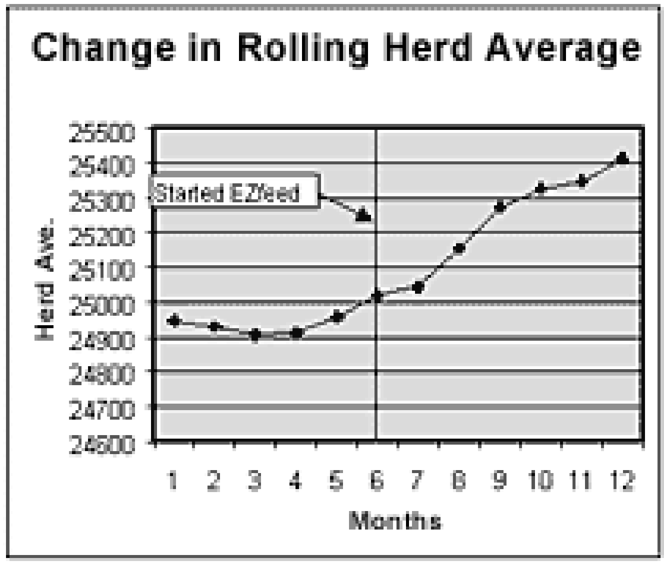

Figure1. Plotted change in rolling herd average (6).

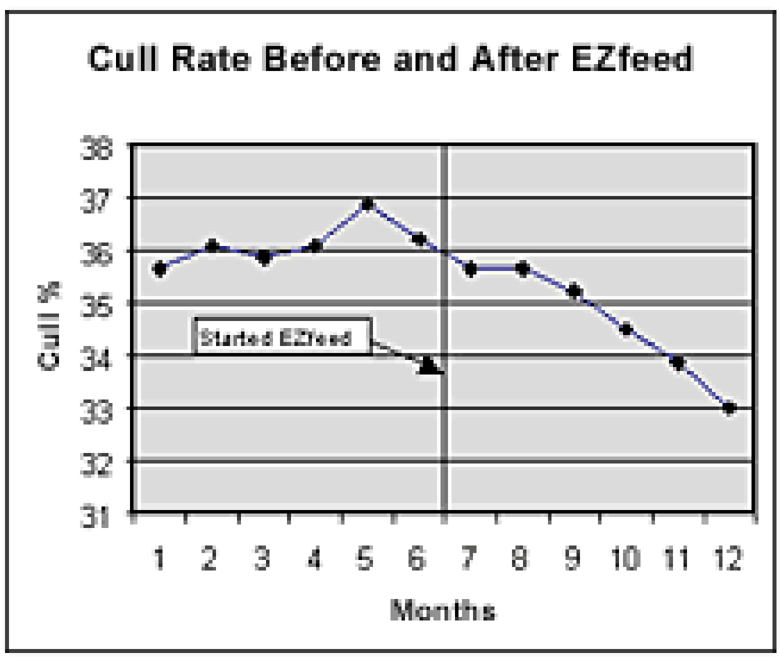

Figure 2. Plot of cull rates before and after implementing the EZ feed program (6).

TABLE 1. EZ feed investment analysis (6).

EZfeed™ Investment Analysis			
Herd Size	1000	Cow replacement value	$1500.00
Milk price	$10.00	Average cull cow value	$400.00
Milk production per cow per day	70	Annual cull cow rate	36.00%
Feed cost per cow per day	$4.00		

		Day	Month	Year
Milk Revenue	$10	$7,000	$210,000	$2,555,000
Replacements per years and costs	360	$1,085	$32,548	$396,000
Feed costs per cow and totals	$4	$4,000	$120,000	$1,460,000
Increased production and income	1.50%	$105	$3,150	$38,325
Replacement savings by decreased cull rate	2.60%	$28	$846	$10,296
Feed savings, through more accurate feeding	.50%	$20	$600	$7,300
Total savings and increased income		$153	$4,596	$55,921

TABLE 1. Continued (6).

Cost of Investment		
Cost of EZfeed™ system includes;	Desktop Software (1 site), Pen tablet Software (1 site), pentablet kit (pentablet, case, cables, & adapters), onsite installation and training (2 days, 10-15 hrs.) One year telephone support	$5,995
Travel expenses billed at cost;	Flight, motel, meals	$600
Total EZfeed™ investment;		$6,595
Number of months to recapture investment		1.43
Net savings and increased annual income		$49,326
Annual Return on Investment		847.93%

Using a total mix ration (TMR) for dairy cows. According to Teri Smith (20) from the Department of Forest Resources and Agrifoods, a total mix ration is, “the balancing and combining of all feeds into one complete ration.” This method of feeding cows allows for the cows to get all the crucial parts of their diet, those that cows are required to eat, and all in one feeding. “Feeding a total mix ration ideally results in rumen bacteria encountering the same mixture of ingredients and nutrients in the cows rumen throughout the whole day, a consistency that helps improve fermentation” (3). Most dairies group their cows so that the cows that need to eat the same ration, are grouped together, making the feeding and management practices easier. According to Mike Hutjens from Hoards Dairyman, it is important to push up the feed as often as possible to prevent sorting of the TMR. There are many advantages of using a TMR. The advantages are listed in the table on the following page.

Although a TMR is the ideal method of feeding cows, it is important that six things are present for TMR success; forage quality must be optimal, accurate weighing, and moisture content of feed is being done, a correctly balanced ration, good dry cow management taking place, and of course, monitoring the intake of the feed daily. Another important factor to implement when using a TMR is to measure the dry matter content of the TMR weekly. When the moisture content is too high that means the cow is not getting enough feed, she is simply consuming more water (3).

The daily log in the feed truck is to be used by the feeder every day. This monitors what the cows are supposed to get fed, and what they actually got feed.

TABLE 2. Advantages of a total mix ration in dairy cows (7 and 20).

Forage, grains, minerals and vitamins are mixed together for easy intake by the cow
Cows are less likely to sort through their food and pick out what they like best
Stabilizes the rumen function by providing correct particle sizes
Less labor
Increased milk production by 5-8%
Increased DMI
Improved fat percentage milk tests
Uniform composition of feed stuffs, providing fewer digestive upsets
Less palatable feeds can be used in the TMR because of the control of feed size and moisture

Particle size is one of the key elements of feeding a TMR. The cow needs to consume long forages and legumes to allow her to chew her cud, resulting in rumination. According to Amaral-Phillips (2008), overmixing of the TMR can cause the size of the forage to decrease. This too small forage size can cause an increase in the number of cases of ruminal acidosis, laminitis, displaced abomasums, feed consumption, low butterfat tests. Therefore it is severely important not to overmix the TMR when using a mechanical mixer (3).

The most effective and accurate way to measure the particle size of the TMR is to use a Penn State shaker box. The box has three different layers with different size screens on them. The TMR is separated into these three different levels after the box is shook. The figure below shows what the Penn State shaker consists of.

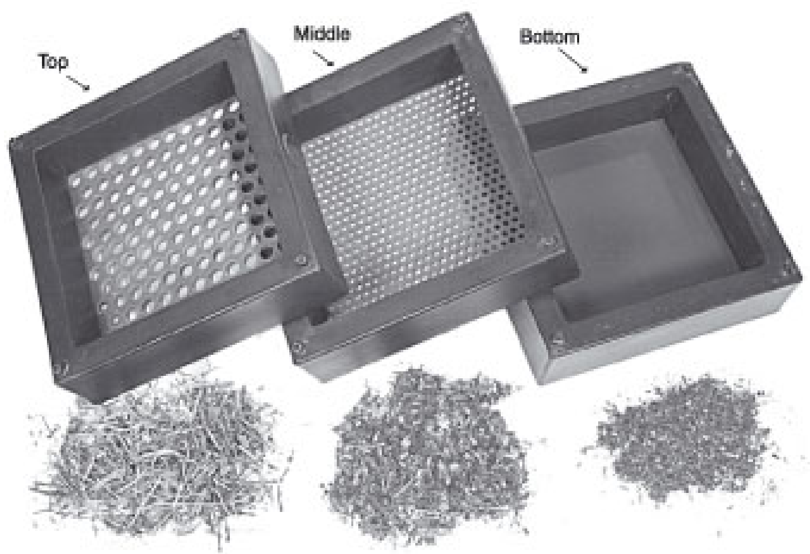

Figure 3. “The Penn State Particle Separator Box consists of three boxes that are stacked on top of one another. The top box retains particles of feed or forage that are greater than 3/4 inch. The middle box retains particles between 5/16 and 3/4 inch. The bottom box has a solid bottom and retains particles under 5/16 inch (3).”

Samples from the feed bunk should be taken and put into this shaker box for testing. The sample should be from different locations in the feed bunk. Some samples should be from the ends of the feeding lanes and some from the middle, this ensures that the feeding truck is accurately mixing and delivering properly. Table 2 shows what the percentage of TMR should be on every layer.

TABLE 3. Recommended distribution of total feed particles by percentage in each of the three boxes of the Penn State Particle Separator Box (3).

Forage or Feed	Box Location		
	Top	Middle	Bottom
TMR	5-15%	40-50%	< 50%
Corn Silage (3/8 in. TLC and unprocessed)	2-10%	> 50%	< 50%
Corn Silage (3/4 in. TLC and processed)	10-20%	50-60%	< 30%
Haylage	10-20%	30-50%	< 45%
Source:Adapted from Penn State and University of Illinois recommendations. Note:*TLC* is theoretical length of chop. *Processed corn silage* refers to corn silage chopped with a kernel processor on the chopper.			

The feed that was not consumed over the course of the day is picked up and evaluated. The feeder should look for particles that are possibly too large or too small. If the particle size is incorrect there will be a decrease in milk yield because of less cud chewing time (3).

The Penn State shaker and its modifications. The Penn State particle separator (PSPS) is used to evaluate the particle size of the TMR feed to the cows. The numbers of shakes done when doing the procedure have an impact on the results as well as the dry matter content of the feed. According to the authors, Kononoff et al. (2003), “the objectives of this project were to test the effects of an additional sieve with smaller aperture size, shaking frequency, and sample moisture content on results obtained.” An increased amount of fiber in the cow's diet has been shown to increase cud chewing time, saliva production, the pH of the rumen, and the acetate to propionate ratio (4). Excessive amounts of long and course fiber can decrease feed intake and therefore affecting the digestion process, all causing a problem with the energy balance of the animal (2). "As the particle size of grain particles decreased, the area available for microbial attack increased, resulting in a greater extent of rumen fermentation" (19). Therefore it is important to monitor the particle size of the TMR on a regular basis to promote the most microbial fermentation.

On the old PSPS there were two sieves, one with 19mm holes and the other with 8mm holes. The common TMR consisted of 40-60% concentrates which was able to pass through the bottom 8 mm sieve. The rest of the TMR consisted of roughages and assuming it was mixed properly, these were not able to pass through the 8mm holes. There was a modification to the PSPS that was done in the project. A third sieve was put in between the bottom tray and the 8mm tray. The new sieve was made with 1.8 mm holes.

The results of this project include the modification of the PSPS. According to Heinrichs (9), and Kononoff (14), there should be another layer put in the PSPS to make a design that is better able to determine the amount of feed that will fall onto the less than 8mm range.

In conclusion, it was determined that the third sieve added to the PSPS improves the effectiveness of the product. Regarding the moisture loss in the TMR effecting the measurement, there was too small of a difference to call it significant (14).

The use of records to make management and nutritional decisions. With the invention of new technology and the use of new and improved techniques the dairy industry is starting to gain an advantage. These new technologies help the producer to reduce costs associated with running the operation. They also encourage the facility to run more smoothly and labor efficiently. Because of these advancements there has been a recent trend towards large herd operations, and kind of “weeding out” small family farms. The role of the manager of a dairy operation is very important, as this person is the ultimate decision maker of the facility. The manager needs advisors and support to make these decisions and to carry out, and put into action the final decisions regarding a situation. The dairy manager role is “to plan strategically and to direct resources in a way that leads to a profitable and sustainable dairy enterprise” (17). The three major functions of this process are: planning, implementing, and controlling. An example of all three of these processes is evaluating and reacting to enhance cow comfort. This is because the manager must plan the right size for the freestalls, rubber mats in the lanes, and plan the milking schedules so the cows do not stand in the holding pen too long. The implementing part of this procedure would be to install the rubber mats, monitor the cows in the freestall barns meaning checking for perching cows or cows facing the wrong way in the stall. The controlling aspect of this example would include observation of the cows to make sure the previous two steps were done correctly and still in place. Record keeping is one of the most vital components of the whole process of running a profitable and highly functional facility. The managers are responsible for making sure accurate records are being kept and in a timely manner.

The one most important part of being a profitable and successful dairy is making sure the cows have high quality feed and plenty of it. Therefore, it is important that the feed advisor and the dairy producer work well together to provide the cows with the best nutrition possible. It is very important for the team of advisers to communicate with the managers and owners. Having a strategy to attack certain situations is absolutely necessary. The company needs to ask themselves: "where are we now, where do we want to go, which strategy is best to achieve this, how to implement this strategy, and how to monitor the process to insure we're on track" (17)? The next step of this process is to check up on the production performance of the herd. It is important that the dairy is reaching their set benchmarks. There should be benchmarks for the milk yield, calving intervals, somatic cell counts, and culling rate.

The financial health of a dairy must be evaluated by the manager and owner every month. The three most important areas of the finances to look at is the return on assets, return on investment, and a good minimum equity position. A minimum amount of accounts payable is preferred because this means that the people that owe the dairy money are paying it back in a timely manner. If clients do not pay the dairy back within about 35 days this means that the dairy is loaning them money and not charging any interest. The operation has a large quantity of assets such as tractors and equipment, which is good, but unfortunately these items depreciate over time. It is necessary that the records indicate this for the future purchases of new equipment.

Another aspect of the facility is looking over the history of animal health problems. "Review of the dairy's veterinary bills and health records can give insight into the animal comfort and animal management status if the operation" (17). If the dairy is experiencing high number of metabolic and calving disorders the manager needs to evaluate the current protocol for the cow diet and the current vaccination programs.

In conclusion, it is most important to have proactive managers for the dairy. This helps prevent mistakes and financial and managerial problems in the future. These managers need to have a strategy for any of the possible events that can happen in the dairy industry, and the economy (17).

Using management to stay profitable. Hutjens (11), from the University of Illinois said, "As feed prices remain high, dairy managers are looking for 'hidden' dollars in their feeding program. Feed shrink represents dollars spent on feed produced or purchased on their farms that are not used to generate revenue" (11). Some examples of this theory are: human error, storage losses, cow impact, and feed factors. Human error includes the incorrect weighing of ingredients, over-feeding, poor bunk management, mixing of the TMR, not uniform delivery of feed, and scale inaccuracy. The storage losses include, wind, rain, snow, birds, rodents, marginal silage packing, incorrect delivery of purchased feed, and wheel contamination and loss. Cow impact includes feed sorting, and feed tossing. The feed factors are harvesting loss, storage losses, seepage, deterioration of wet feed, molding, and variation in nutrient content. Taking these common dairy practices into consideration when evaluating the dairy management is crucial (11).

Health, welfare, and feed intake of dairy cows in different husbandry systems. The objective of this study was to compare the different styles of dairy housing and evaluate the health and animal welfare of these different types of animal housing (18). There were three types of housing that were included in this experiment. The first group abbreviated, TM, was tie stall with the average or regular exercise in the summer months but limited access to exercise in the winter months. The second groups, were in tie stall and had access to outside exercise year around either in an exercise pen or on pasture. The third and last group were in a loose housing situation and with access to regular exercise all year. The study included 134 farms that were evaluation four to six times during the two year study. The dairy cows were observed for lameness, scars, injuries, teat injuries, and broken skin at the hock joints. The scientists also noted whether the animal was lying down or standing. Lameness was recorded on the farms using the Manson and Leaver (15) scoring system. A one means the cow is walking normally and a five means the cow is severely lame. The skin alterations were determined using a zero to three numbering system. Zero being no skin broken and three being an open wound, or an abscess. The teats were examined and recorded as either normal or abnormal, meaning there were scars or they were swollen. The cleanliness of the cows was observed by the protocol, "I less than 10% of the area of the udder skin was covered with dirt, and the udder was evaluated as clean. Dirt between 10 and 50% of the skin area was scored as dirty" (18). Body condition scoring was done by classifying the cows as the ideal condition, under conditioned, and over conditioned. The following table shows the prevalence of these topics discussed previously.

According to the data collected, there was a significant difference between the three types of housing situations. Once again farms were observed for, "lameness, alterations of the skin around the hocks, teat injuries, restricted space for resting, and incidence of medical treatment" (18). The results of the study have shown the correlations of the different housing situations and increased health problems were significant. The data shows that cows living in the loose housing area with regular access to the exercise pen, compared to those in tie stalls, were in fact in better health and welfare. The study proved that regular exercise for the cows was a good way to help prevent lameness or reduce the incidences of injury. There was less injuries to the hock in the loose pens, possible because of a more free type of movement and less restraint on the cow. The article has shown which type of stall is most preferred when taking into account the animal's health issues. So in conclusion, "Keeping dairy cows in loose- housing system combined with regular exercise outdoors was associated with substantially better health and welfare of the animals. Regular exercise also was beneficial for cows kept in tie stall with respect to lameness and teat injuries" (18).   The table on the following page shows the animal's health and injury prevalence's on the Swiss dairy cows.

TABLE 4. Animal health and well-fare in Swiss dairy cows with tie stalls (18).

	1999			2000		
	TM* (*n* = 458 cows)	TR ** (*n* = 818 cows)	LR*** (*n* = 1025 cows)	TM (*n* = 676 cows)	TR (*n* = 713 cows)	LR (*n* = 1042 cows)
Lameness/irregular gait	21	16	13	17	12	10
Skin injuries around the hock (including reddening or swelling of skin)	21	19	8	12	8	3
Callosities at carpal joints	65	59	17	60	58	4
Teat injuries (lesions or scars)	0.6	0.9	0.2	1.6	0	0.2
Skin injuries (at locations other than hock and teats)	11	12	8	2	5	6
Restriction of space for lying	41	44	18	51	49	9
Delayed or abnormal rising	34	34	28	32	18	30
Over-conditioned	12	11	8	16	16	12
Under-conditioned	11	12	17	7	8	12
>10% of udder skin covered with dirt	12	13	11	14	9	9
>10% of hind leg skin	40	41	60	33	29	33

*TM= tie stall with regular exercise
**TR= tie stall with outside access year around
***LR= Loose housing with exercise year around

Use of feeding efficiency for lactating cows. The typical number of feedings per dairy per day is twice or three times. In Finland the number of feedings is one or two. "In review of 35 experiments, Gibson (8) concluded that increasing the feeding frequency to 4 or more times a day, compared to once or twice, increased the milk fat percentage by 7.3% and the yield by 2.7%" (16). The study done by Mantysaari published in the J. Dairy Sci. states that robots were used to feed the cows the TMR. These robots allowed the dairy to save money on labor and human error. Another way the robots helped the dairy is because they did not have to build as big of feeding lanes, as the robots take up much less space that a feed truck. Although feed efficiency has been shown to be beneficial, the study was evaluating the feed frequency and its performance on dairy cows. Even though the study did not take into account the housing type, "the housing type can change the feeding behavior and therefore alter the effect of feeding frequency on the cows performance" (1). The study included 40 Ayrshire cows, 24 of the cows were multiparous, and 16 were primiparous. These cows were randomly assigned into two groups of treatment. The first group, FF1, were fed a TMR once a day. The second groups, FF5, were fed a TMR five times a day. The study started right at the calving and continued for 28 more weeks. Every cow was feed the same TMR for all 28 weeks of study. The following table shows the chemical composition and feed values of the TMR.

TABLE 5. The chemical composition and estimated feed values of the ingredients and TMR (mean ± SD) (16).

Item	Grass silage	Concentrate mix[1]	TMR
Chemical composition			
DM, %	25.2 ± 2.6	88.3 ± 0.6	39.6 ± 3.4
In DM, %			
Ash	7.5 ± 0.6	6.8 ± 0.4	7.1 ± 0.3
CP	14.8 ± 0.6	19.1 ± 0.7	17.0 ± 0.4
Ether extract	ND[2]	5.3 ± 0.4	4.7 ± 0.1
NDF	51.2 ± 4.4	22.7 ± 1.6	36.9 ± 2.1
Starch	ND	35.2 ± 3.3	18.3 ± 1.7
Digestible OM	70.6 ± 1.7	ND	ND
Water-soluble carbohydrates	5.7 ± 1.9		
Lactic acid	7.3 ± 1.3		
Acetic acid	2.2 ± 0.5		
Butyric acid	0.02 ± 0.02		
pH	3.97 ± 0.15		
Ammonia-N, g/kg of N	73 ± 6.7		
Soluble N, g/kg of N	571 ± 70.6		
Feed values in DM			
ME,[3] MJ/kg	11.3 ± 0.3	12.5 ± 0.06	11.9 ± 0.09
AAT,[4] g/kg	86 ± 1.6	116 ± 1.1	101 ± 0.9
PBV,[5] g/kg	1 ± 6.3	6 ± 5.6	4 ± 3.3

[1]A mix (% in DM) of barley (60.6), rapeseed meal (27.0), molasses sugar beet pulp (10.0), and mineral and vitamin mix (2.4).

[2]Not determined.

[3]Metabolizable energy (MAFF, 1975, 1984).

[4]Amino acids absorbed from the small intestine (MTT, 2004).

[5]Protein balance in the rumen (MTT, 2004).

The housing of the study had the two groups of cows in different compartments of the dairy where the two groups of cows could not see each other, preventing the groups from disturbing each other as the FF5 group was being feed more often. Each cow had an ID collar that calculated each time the cows went to the feed bunk and the milking parlor. There were more than enough head stalls for every cow, allowing them free access to feed all day. The FF1 group was fed at four o'clock and the FF5 group was fed at 8 am, 1:30 pm, 2:30 pm, 6pm, and 7:40pm. There was a 5% refusal every day. The quantity of TMR uptake was measured twice a week. Both groups of cows were milked twice a day. Weights of the cows were taken three times. Behavior of the cows was recorded evaluating the following: eating, lying, standing, lying, cud chewing, and standing. For the results of the study, "During the first weeks of lactation, the primiparous cows on the FF1 treatment, whereas with older cows no difference in the feed intake during the first weeks observed. Instead after the seventh week of lactation, the multiparous cows on the FF1 treatment ate more than the cows on the FF5 treatment. However, the interaction between lactation week and treatment week and treatment on the feed intake was not significant" (16). The study done shows that the cows that were fed once a day spent more time cud chewing when they were lying down. The cows fed five times a day spent more time chewing their cud while standing. According to the above graph, the cows fed once a day had a higher dry matter intake. The reason the study believes the cows eating once a day had a higher DMI is because the cows were more relaxed, due to less stress during feeding time. The FF1 group spent more time lying down and ruminating than the FF5 who were always disturbed with more feed. The study made a conclusion that, because the cows had more time to eat the TMR, they took larger mouthfuls of feed, leading to an increased DMI. In conclusion, “high-producing multiparous cows eat large meals more quickly than low-producing primiparous cows” (5).

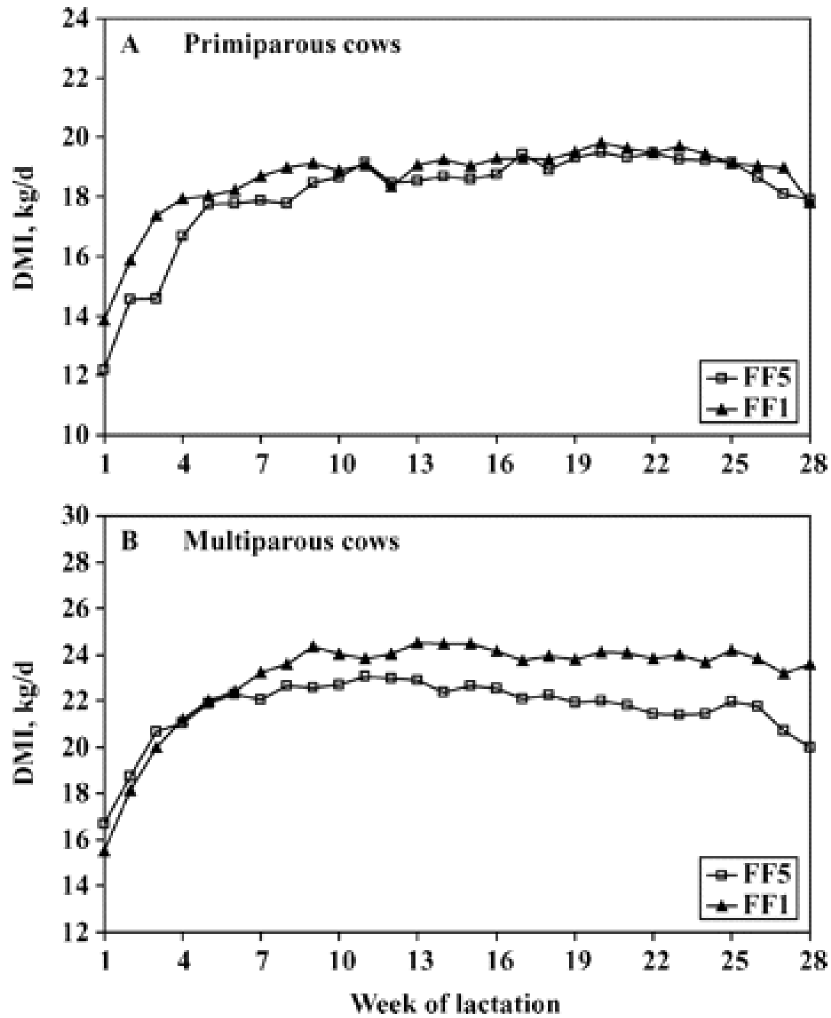

Figure 4. Dry matter intake of primiparous (A) and multiparous (B) cows fed a TMR once (FF1) or five (FF5) times a day (16).

MATERIALS AND METHODS

The procedure for this project consisted of 10 sets of data. These 10 were selected from 15 sets that were collected and 5 being eliminated due to incomplete or unfinished data. This data was collected from Dr. Henderson's elements of dairying class at Cal Poly. The students were required to go to the Cal Poly dairy to monitor and report the loading of the TMR and the feeding. The TMR included: oat hay, alfalfa, silage, almond hulls, grain and Megalac. The students recorded the type of feed and how many pounds were loaded into the mixture. They were given the expected or the wanted amount of each feedstuff that was supposed to be loaded into the feed mixer. They were to calculate the difference and the percent error that was made comparing the expected amount of feed loaded and the actual amount of feed that was loaded. This data was compared with the data from the nutritionist. The nutritionist data, or expected feed, states what the cows are programmed to be fed that day. The percent error is a calculation of the expected amount divided by the actual amount fed. The sets of data were inserted into excel and an average percent error was determined to evaluate the accuracy of the feeding efficiency at the Cal Poly Dairy.

RESULTS AND DISCUSSION

The Cal Poly dairy feeding procedure is currently done without the use of computer software technology. The lack of this technology means there is room for human error at the facility. There was evidence that shows that there was a 4% average loading error at the Cal Poly dairy. This led to an economic loss and eventually led to thousands of dollars of lost money. The expected amount loaded and the actual amount loaded showed a difference ranging from 0- 40%. This can lead to decreased milk production due to the lack of a complete nutritional diet. What was often noticed in the data was that the person feeding would make up for the certain feed which they over or under loaded with a different feed, leading to an inaccurate diet.

The data collected was separated into two categories, the Jerseys and the Holsteins. According to the results from the data collected for the Jersey's, the oat hay had the most deviation with a percent error of 6%, which may be due to the bulky nature of the feed. This is more of a percent error than is considered acceptable but is it less than the Holstein ration. This could be because the Jersey ration contains less feed as a whole that the Holsteins, allowing less room for error. The alfalfa, silage, and almond hulls were all at a 3% error. The grain was a 2% error and the Megalac was only a 1% error. Table 6 on the following page shows the results for the data collected. It is broken up by the feedstuff, the expected amount feed, the actual amount feed and the percent error.

TABLE 6. Jersey ration percent error.

[redacted]

The Holstein ration had a higher percent error than the Jersey ration for the oat hay. The range for the Holsteins was recorded to be between 0 and 20%. The percent error was between 0 and 38%, which is considered high for I feeding. The alfalfa and grain were both a 3% error. The silage, almond hulls and Megalac were all recorded at a 1% error.

TABLE 7. Holstein ration percent error.

[redacted]

The feeders at the Cal Poly dairy have shown adequate job is done feeding the cows the required amounts of nutrition. Small loads in the feed mixer were challenging because there was more room for error. According to the data in the literature review section of the project, the EZ feed machine has shown to be very economically successful, as shown on page 6. The Cal Poly dairy is not a large enough dairy for the EZ feed to pay for itself in a timely manner, therefore the Cal Poly dairy will continue to use the method of feeding cows that was currently in place during the time of the study.

CONCLUSION

In conclusion, it is very important for the Cal Poly feed program to be as accurate as possible. In the project done, the author was able to precisely measure the accuracy of the feeding process at the Cal Poly dairy. Because the university offers a “learn by doing” approach, the employees are students and they are often still learning or practicing their techniques. The percent error recorded at the Cal Poly averaged to be 4% meaning that there is plenty of room for improvement. Improvement in the feeding efficiency and accuracy at the Cal Poly dairy is to be done by more precise and exact loading amounts.

The possible solutions to this problem include better feed accuracy by taking more time while loading the feedstuffs, or to purchase the EZ feed computer software to monitor the accuracy daily. The computer software program is not feasible for the dairy to purchase due to the small size of the dairy. The solution to practice better management in the feeding sector of the operation is the best option. This can be implemented by a more strict training procedure for the new feeders at the Cal Poly dairy. The new feeders will need to take this training before they are able to feed on their own. The manager will be required to observe the new feeder for a few days before he or she can do it without supervision.

This project was done to evaluate the accuracy of the feed loading system that currently takes place at Cal Poly dairy. It was successful in determining the percent error, at the dairy and new technologies are to be adopted when they become more economically feasible.

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