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Computerized Concentrate Feeders

Introduction

During the past 25 years, the average dairy cattle herd has nearly doubled in size. This has dramatically changed the housing, milking, feeding and managing of dairy cattle.

Increased herd size created a demand for automated, mechanized, labor-efficient housing, milking and feeding systems. Free-stall barns replaced confinement stall barns; milking parlors replaced bucket and pipeline systems, and group feeding strategies replaced individual cow feeding strategies.

In typical tie-stall or stanchion bams, cows were fed forages separately. Free-choice and concentrates were hand-fed according to guidelines such as milk to grain ratio, or from calculations based on milk yield, milkfat test, body weight, age or predicted forage intake(s). Cows were fed concentrate as individuals according to production. Early group feeding strategies focused on bunk feeding forage(s) and feeding concentrate in the milking parlor. This strategy was effective until milking parlor automation and the demand for increased nutrients (because of increasing production) made it difficult for cows to consume their total daily concentrate during two 8- to 12-minute trips through the parlor.

Today, dairy producers have the following strategies available for feeding additional concentrate to group-fed cows.

1. Feed a fixed amount of concentrate in the bunk with or without the continued parlor feeding of high-pro- ducing cows.
2. Group cows according to production, and feed a total mixed ration (TMR), with or without continued parlor feeding of high-producing cows.
3. Provide supplemental concentrate with or without parlor feeding, via:
   a. magnetic-activated feeders,
   b. electronically controlled feeding door or doors,
   c. transponder activated feeders, or
   d. computer controlled feeders.

Herd size, facilities, labor, milk production, economic resources and personal preferences all play an important role in determining appropriate feeding strategies.

Group Feeding Strategies

Bunk-Fed Concentrate

Research clearly indicates topdressing bunk-fed forages with concentrates is less than ideal, as typically early-lactating, high-producing cows are underfed and late-lactating, lower-producing cows are overfed. However, this system can be effective in small herds of 40 to 50 cows where a confinement stall bam serves as the milking parlor.

Small herds milked in a confinement stall bam generally have ample time to consume large quantities of concentrate, thus minimizing the problem of underfeeding early-lactating, high-producing cows. Likewise, over-feeding can be minimized when cows are fed concentrate as individuals.

Total Mixed Rations

Research has indicated that total mixed-ration feeding systems are far superior to bunk feeding forages and parlor feeding grain for group feeding of cows. A successful TMR feeding program will depend on grouping or splitting cows into production groups, and accurate measurement and mixing of ration ingredients. Current recommendations are for a minimum of two, preferably three or more, production groups plus a dry cow group. Grouping affords the dairy producer the following advantages.

1. Increased income over feed costs.
2. Concentrate can be more appropriately fed to high producers in early lactation, without low producers being overfed.
3. Forage-to-grain ratios can be maintained and controlled within production groups according to forage quality, purchased feed prices and milk prices.
4. Grouping provides easier and more intensive application of management practices, such as post-calving treatments, heat detection, breeding and pregnancy diagnosis.

Failure to group cows in a TMR system often results in one or more of the following.

1. Early lactating cows fail to reach or sustain peak yield.
2. Late lactating cows, and particularly problem breeders, tend to overconsume energy, causing excess weight gain before the dry period.
3. Movement of cows from one group to the other in a two group system frequently results in dramatic decreases in milk yield. Typically, though not always, the decrease in yield can be economically offset by feed saved.

Although grouping has many production and economic advantages, for many dairy producers, supplemental concentrate feeders in place of or in addition to the TMR feeding systems are more suitable.

Supplemental Concentrate Feeders

Magnetic and Electronic Concentrate Feeders

Early supplemental concentrate feeding was accomplished with magnetically or electronically controlled feeders. The premise is that cows with magnets or keys have access to a source of concentrate in addition to what is fed on the bunk or in the parlor. Magnets or keys on neckchains allow cows to enter doors on feeders for ad libitum concentrate consumption.

Reported milk production response and profitability of these supplemental feeders have been variable;

the reason cited most has been the inability to control individual cow concentrate consumption. Other frequent problems with access include increased incidences of displaced abomasum and depressed milk fat percentage caused by the overconsumption of concentrates. There is no way to control how much grain a cow consumes. A dairy producer cannot be sure that all cows are consuming concentrate at a rate that is both commensurate with their production and profitable.

Magnetic or electronic feeder use can be managed by limiting the total quantity of feed available per day, restricting use to a certain number of hours per day or by increasing the loading rate beyond the recommended level of 25 to 30 cows per feeder. These options will help to avoid the problems of overconsumption of concentrate by specific cows, but they will not alleviate the problem.

Transponder Feeders

The inability to control magnet feeders led to the development of transponder feeding systems. Transponder feeding systems rely on cows wearing transponders around their necks. On approaching a feeding station, a transponder is charged, causing the delivery of concentrate to the feeding bowl in the station.

Each transponder has a manually adjustable dial that determines the quantity of concentrate a cow can receive in a 24-hour period. Transponder settings do not relate to actual pounds of grain to be available, but to the actual minutes of charging time; when these are calibrated with the feed dispensing rate, the quantity of concentrate available per 24 hours is determined.

Transponders are superior to magnetic or electronic feeders in that the dairy producer can allocate grain on an individual cow basis. However, daily consumption by individual cows remains unknown. All that is known, via meter readings on the systems, is the total quantity of concentrate dispensed per 24 hours. A comparison of the amount dispensed with the grain allocated for dispensing is the only index a dairy producer can use to determine if all cows consumed a portion of their daily allocation.

Current recommendations are for a 25 to 30 cow loading rate per feeding station with adjustments made in relation to total grain to be dispensed, the number of hours of unrestricted use and barn location. The most noted drawback of transponder systems is the need to manually adjust the transponders each time a change in concentrate allocation is made.

Computer Controlled Concentrate Feeders

The rapid development of microcomputers contributed to the development and adaptation of transponder feeders into group feeding systems. The merging of computer technology with transponder feeders has created feeding systems that 1) will feed concentrate on an individual cow basis, 2) record individual daily cow consumptions of concentrate and 3) eliminate the need to manually adjust transponders because all changes in allocations could be made in the office by computer.

The capabilities of computer feeders currently available have advanced as rapidly as computer technology. These systems have the capability to perform at least one, if not all, of the following functions:

1. Feed from 25 to 2,500 cows.
2. Recognize individual cows by neckchain devices.
3. Dispense one or more rations.
4. Simultaneously balance both energy and protein requirements on an individual cow basis.
5. Record daily intake of each ration by individual cow.
6. Printout alarm notations indicating cows that have consumed less than a predetermined percentage of their daily allocation(s).

7. Keep a running tab of each ration dispensed at each feeding station on a daily, weekly or monthly basis.
8. Divide the day into predetermined feeding periods, providing the opportunity for many small meals.
9. Tease cows into feeding stations by running feed for 30 to 60 seconds every 15 to 30 minutes.
10. Repeat recognition of cows in short intervals to prevent a buildup of feed in the feeding station feed bowl.
11. Provide the capability to keep individual cow records.
12. Provide the capability to keep all farm business and related records.
13. Provide timely management reports indicating cows ready to calve, cows in heat, cows to breed, cows to check pregnant and cows to dry-off.

Several of the systems currently available also have or will have the capability to record milk weights in the parlor and body temperatures.

Outlined in Table 1 are the comparative features of magnetic, transponder, single-ration and dual-ration computer feeders.

Table 1. Comparative features of supplemental concentrate feeders

			Computer-controlled	
Feature	**Magnetic**	**Transponder**	**Single-ration**	**Dual-ration**
Capacity	Depends on no. of feeders	Depends on no. of feeders	Depends on computer and no. of feeders	Depends on computer and no. of feeders
Feeding Capacity	25-30 cows	25-30 cows	25-30 cows	25-30 cows
Recognize individual cows (controlled intake)				
Dispense one or more rations	no	yes	yes	yes
Balance for energy and protein for individual cows	no	no	no	yes
Balance for energy and protein for individual cows	no	no	no	yes
Record daily intake	no	no	yes	yes
Printout daily alarm notation	no	no	yes	yes
Keep tab of total feed dispensed	no	no	yes	yes
Provides for predetermined daily feeding periods	no	no	yes	yes
Tease cycle	no	no	yes	yes
Repeat recognition	no	no	yes/no	yes/no
Provides management information	no	no	yes/no	yes/no

Feasibility and Profitability of Transponder and Computer Controlled Feeders

The rapid influx of mechanized concentrate feeders into the dairy industry, without an abundance of applied research to substantiate their effectiveness, has caused many dairy producers to ask these questions:

Will cows readily and easily adapt to using these feeding systems?

Will milk production increase?

Will herd health be affected?

Are these systems profitable?

Cow Adaptation and Behavior

Much of the initial transponder and computer feeders research has been done on cow adaptation and behavior. University of Illinois researchers have reported: 1) as feeding station loading rate increased (the number of cows per feeder), feeder use became more efficient; 2) use of feeding station side protectors or guardrails avoided problems of boss cows, aggressive behavior, and forequarter and abdominal butting resulting from trying to gain access to the feeder; and 3) out of 500 cows tested, only one cow failed to adapt to the system.

Cornell University researchers reported that during a 17-month trial, comparing a transponder feeder to one and two-group total mixed-ration feeding systems, one cow failed to adapt to the system. They also reported that cows averaged 14 daily visits to the feeding stations, with a range of 2 to 32 visits. There was no correlation between total grain allocated and frequency or duration of visits made to the feeding stations. Aggressive behavior, or problems of cows forcing other cows from the feeding stations, was observed to be of little significance. Less than 5 percent of all visits made" to feeding stations resulted in a cow being forced to leave before she had consumed her dispensed allocation.

Utah researchers have reported that cows rapidly adjust to transponder feeding systems. After an initial learning period, cows use the feeders regularly and,within certain limits, with almost the same daily frequency. Other researchers have reported that feeder visit frequency depends on the location of feeders, the social structure of the group and the presence or absence of horns.

The tease cycle function common to most systems is a management aid for enticing cows into the feeding stations on initial installation of a computer system. The cycle is most likely to benefit large herds, where many cows must leam to use the feeder in a short time. The cycle eliminates the need to physically introduce animals to the feeding stations.

Milk Production Response

Harshbarger and Devore have conducted several short-term trials to determine the effects of electronic concentrate feeding systems on milk production. Both concluded, based on increased milk yields, that electronic individual concentrate feeding was as effective as concentrate feeding in the milking parlor or total mixed rations in providing supplemental concentrates to group-fed cows.

During a 17-month trial, Comell University researchers compared individual concentrate feeding (ICF) with a one-group total mixed-ration (TMR]) and a two-group total mixed-ration (TMRz) feeding system.

Results of the trial are summarized in Table 2.

Table 2. Performance of cows on different feed systems

Item	Feeding system				
	ICF	TMR_1	TMR_{2H}[d]	TMR_{2L}[d]	$TMR^a_{2(H+L)}$
Cow days in milk	19,088	18,811	18,887	16,785	35,672
Average body weight(lb)	1,349	14,00	1,350	1,368	1,357
Intake (lb DM/cow/day)					
Corn silage	11.6	13.8	12.1	15.6	13.6
Hay crop silage	7.2	8.8	5.9	11.6	8.5
Concentrate	20.4	17.6	25.0	10.7	18.2
TOTAL	**39.2**	**40.2**	**43.0**	**37.9**	**40.3**
Percent of body weight	2.9	2.9	3.2	2.8	3.0
4% FCM[b](lb/cow/day)	51.9	45.9	48.4	38.0	43.5
Enery efficiency[c]	61.0	54.4	50.6	50.4	51.0
Days to first observed heat	62.3	68.1			65.2
Days open	85.1	85.3			86.0
Calving Interval	12.1	12.1			12.0

[*] sum or weighted average

["] FCM = (.4 x lb milk) + (15 x lb fat)

[c] (milk energy ÷ NE_L intake) x 100

[d] TMR_{2H} and TMR_{2L}. represent cows fed high and low levels of concentrate in the 2-group TMR feeding system.

Sample: Partial budget to evaluate the change in net farm income as a result of proposed feeding system

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Assumptions:	Make a list of assumptions: for instance, herd size, expected change in production, price of milk, feed and labor, cost of new equipment and interest rates.		
	Items That Add to Net Income		
Added returns:	Increased milk production? Reduced forage intake? Dollar value alarm list?		
		Total	$____
Reduced costs:	Less feeding labor? Less feed purchsed?		
		Total	$____
Total added returns and reduced costs (A)			$____
	Items That Reduce Net Income		
Reduced returns:	Decreased milk production?		$____
		Total	$____
Added costs:	Increased concentrate? DITI+AAOC?[a] Increased labor? Milk marketing?		
		Total	$____
Reduced returns and added costs (B)			$____
Change in net farm income (A-B)			$____

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[a] DITI= depreciation, interest, taxes and insurance/shelter costs

AAOC = average annual operating costs

Total cow days were similar for each group. The TMR_2 subherd necessarily had twice the number of cow days because it was composed of two groups. ICF and TMR_2 cows gained and maintained similar quantities of weight throughout the trial; while TMR_1 cows gained and maintained more weight than either ICF or TMR_2 cows. This weight differential is attributable to TMR_1 cows gaining more weight during late lactation than either ICF and TMR_2 cows.

Average dry matter intakes were similar for all three feeding systems, particularly in relation to body weight. Concentrate intakes by TMR_1 and TMR_2 cows were 2.8 and 2.2 pounds per day less, and forage intakes were 3.7 and 3.3 pounds per day more, respectively, than for ICF cows.

ICF cows produced significantly more milk, 5.9 and 8.3 pounds per day (4 percent FCM) than TMR_1 and TMR_2 cows, respectively. ICF cow's energy efficiency was significantly greater than that of TMR_1 and TMR_2 cows. Energy efficiency, or the relationship between feed energy consumed and milk energy produced, was 61.0, 54.4 and 51.0 percent, for ICF, TMR_1 and TMR_2 cows, respectively. In other words, ICF cows more efficiently converted feed energy to milk energy than did either TMR_1 or TMR_2 cows.

Measures of reproductive performance were similar for the ICF, TMR_1 and TMR_2 subherds and were typical of the yearly average values for these parameters since the herd was established.

The Comell study clearly indicates transponder concentrate feeding was as effective and, in fact, superior to either TMR with respect to milk production response and energy efficiency.

Herd Health

Comell researchers also reported no difference in the incidences of retained placentas, displaced abomasums, ketosis or milk fever cases between cows fed concentrate individually and those fed in total mixed ration feeding systems.

One of the greatest management potentials of computerized feeders related to herd health is the alarm notation list printed daily. Generally, the dairy producer selects the percentage of concentrate that must be consumed each day before a cow will be noted on the alarm list. For example, if a dairy producer chooses 80 percent as the warning level, any cow not consuming 81 percent or greater of her previous day's allocation appears on the alarm list.

Data summarized in Table 3 are from a 16-month study using a computer controlled concentrate feeder. During this period, 46 cows accounted for 242 alarms. The alarm notation caused the herd manager to check cows. In the cases of injury, lameness and severe illness, it was the alarm notation that brought these conditions to the attention of the herd manager and not vice versa. All cows so ill that they required veterinary services were on the alarm list before any physical symptom identification of illness.

Table 3. Causes of cow alarm incidences

Cause	Percentage of the total alarms*
Loss of transponder	1.5
Inquiry	3.8
Lame	10.7
Heat	11.4
Mastitis	13.1
Unknown[b]	14.5
Ready to calve	19.1
Illness requiring veterinary services	26.1

[a] 242 alarms during 16,500 cow days

[b] most often caused by sudden blasts of cold air

Not all cows with clinical mastitis or all cows in heat appeared on the alarm list. European researchers who have studied the incidence of mastitis and estrus and frequency of alarms have concluded alarm notation is not adequate for detecting either mastitis or estrus.

However, in the Comell study and others, it has been shown that 95 percent of all dry cows appear on the alarm list within 12 to 24 hours of calving. This detection aid has obvious potential for alerting a dairy producer that a dry cow is rapidly approaching calving.

The management potential of computer systems will become more evident as more systems are used in large herds.

Profitability

Comell researchers reported that during the 17-month trial comparing individual concentrate feeding to total mixed ration feeding, returns over feeding system costs were $4.15, $4.03 and $3.71 per cow each day for ICF, TMR_1 and TMR_2, respectively.

Based on their data and partial budgeting, the researchers also determined the profitability of incorporating a transponder feeder system into a 40-cow herd. Change in net farm income was $6,310. These data were based on 1979 prices for equipment, milk, feed and labor.

Extrapolating from their data to a 160-cow herd and using Fall 1984 prices for equipment, milk, feed and labor, expected change in net farm income would be $12,800 and $10,800 if a dairy producer were to change from a one-group feeding system to transponder or computer-controlled feeding systems, respectively.

This is not to say that every dairy producer will increase or decrease net farm income by making identical changes. But, given the research data and all assumptions made in preparing the budgets, individual concentrate feeders were more economically viable than maintaining a one-group feeding system.

University of Illinois researchers have reported that income over feed costs can be maximized by the use of dual-feed dispensing computer feeding systems versus single-feed dispensing systems, if grain

allocations are updated on a weekly basis. Dual-feeders are proving to be more effective and economical than single-dispensing systems, as concentrate feeding can be specifically tailored to compliment forage feeding programs.

Practical Recommendations

Potential Applications

Current indications are that these feeding systems would be most appropriate for a dairy producer who is unable to group or increase the number of production groups because of herd size, barn layout, labor, personal preference or facilities. By placing transponders on some or all of the cows in a group or groups, the dairy producer will have the flexibility of grouping, thus providing the potential for more closely meeting the nutrient needs of all of the cows in the herd.

If restricted from expanding a two-group TMR feeding system to a three-group system in a large herd, a concentrate feeder could be used to create a group within each group, yielding a four-group TMR system. Computer feeders could even be used in a two-group TMR system to bridge the nutrient gap between group rations and lessen the drop in production that commonly occurs when cows change groups.

Computer concentrate feeders can totally eliminate the need to feed in the milking parlor, thereby increasing efficiency and potentially increasing profits because of less mastitis, improved udder health and other factors.

Computer feeders are not a substitute for growing and harvesting quality forages, feeding a balanced ration or managing the herd. Beware of two claims about computer feeders: 1) your milk production will increase, and 2) the feeders require little management. The better a job you are doing feeding your cows before installing a computer feeder, the less likely you are to see a significant increase in milk yield. Proper computer feeder management requires time on a daily basis to check the system, check alarm notations or make changes in grain allocations.

Management Guidelines

Before you decide to purchase a computerized feeder, consider the following:

1. What is the maximum number of cows that will use the system? Will dry cows be on the system throughout the dry period? The recommended loading rate is 25 to 30 cows per feeding station. How many feeding stations will you need, including one in the dry cow lot?
2. Where will you locate feeding stations? It is best to locate them for maximum use, not where it is cheapest to install them. You will pay for shortcuts later. Feeding stations should be located in well- lighted, well-ventilated and well-traveled (not congested) traffic areas.
3. Will you feed one ration or two? If you purchase all of your concentrate, you need not consider a dual feeder. However, if you feed high moisture corn and a protein supplement consider a dual-ra tion feeder.
4. How important is a tease cycle? Cows can readily adapt without it; but if you will be initiating large groups of animals to the feeder on a regular basis, the tease cycle can save time, labor and money.
5. Repeat recognition has not been proven to be a necessary feature. Current indications are that feed buildup in feeding station bowls is not a common problem.
6. Does the system divide the day into feeding periods? The more often a cow consumes feed, the more efficient her rumen function and nutrient use. The number of feeding periods you have should depend on the number of cows per station, the number of hours each day feeding stations are unavailable (during milking and manure scraping) and the quantity of grain to be fed each day.

The higher the demand for feeder use as when the loading rate maximum is exceeded, cows are restricted from feeders for more than 2 hours per day or large quantities of grain are being fed per feeder per day the longer the feeding periods should be. For example, if 60 early lactating cows are restricted from two feeders for 4 hours per day, then it is better to have two 12-hour feeding periods than 12 2-hour feeding periods. This reduces the pressure on the cows to visit the feeders during predeter- mined periods to receive their allocation. Beware of scheduling more feeding minutes than are avail- able.

7. Will you use the computer for anything other than feeding cows? If you are on the Dairy Herd Improvement Association (DHIA) and some sort of financial recordkeeping system, the ability to keep cow records may not be important to you. Buy only computer features you want and will use, but keep in mind what you may need or use in the future.
8. Purchase your system from a reputable and reliable dealer. You will want prompt repair service on your computer feeder just as you want prompt repair service on your milking equipment.

Having considered all of these points, take the time to prepare a partial budget. A partial budget will help you determine the effect of your decision on net farm income. The sample budget shown has an example of a partial budget for you to follow.

A partial budget is only as good as your assumptions, so take care in formulating and listing your assumptions. For instance, consider how many cows you will be milking, what existing feed storage and delivery you will continue to use, what new equipment you will need, and predict the effect of your decision on milk yield. Be realistic.

Determine which items will add to income by adding returns and reducing costs. Potential added returns and reduced costs are presented in the sample on page 5. Determine which items will potentially reduce costs either through reduced returns or added costs. Again, examples are given in the sample budget.

DITI, listed in the sample budget under added costs, stands for depreciation plus interest plus taxes plus insurance and shelter. Depreciation can be calculated by a straight line method, assuming a 15 to 20 percent salvage value and a 5-year life on the computer system. Interest is considered to be about 10 percent of half of the original equipment cost plus salvage value. There are no taxes, and insurance and shelter can be valued at about 1 percent of the original cost of the system.

AAOC, also listed in the sample budget under added costs, stands for the average annual operating costs. This can be roughly calculated as 8 to 10 percent of the original equipment cost plus $0.50 to $0.75 per cow per yearly energy costs.

Subtract reduced returns from added returns and you will have your expected change in net farm income as a result of the change you propose, assuming all other aspects of management remain the same during the year.

Feeding Guidelines

Dual-ration feeders allow dairy producers to feed the major components of a concentrate mix (energy and protein) in a manner that best compliments their forage feeding program.

For example, a corn silage-based ration requires more protein supplementation than an alfalfa forage diet, and an alfalfa ration requires more energy supplementation than a corn silage diet. The estimated feed savings for a dual versus a single concentrate mix of a corn silage, alfalfa and corn silage-alfalfa ration per 100 cows are $5,690, $3,984 and $4,677 per year, respectively.

The efficiency and economy of dual-ration feeding becomes obvious when protein and energy are fed together in the proper ratio. Dual-ration feeding enhances nutrient use in the rumen and one of the

nutrients does not have to be overfed to satisfy the total nutrient requirements of the cow.

Outlined in Tables 4, 5 and 6 are suggested grain or protein supplement mixes for corn silage, alfalfa and corn silage-alfalfa forage feeding programs. Depending on your forage feeding program, you will want to add minerals and salt to either the grain (such as corn and barley) mix or the protein supplement. Given that a corn silage diet will require protein supplementation at all levels of production, minerals and salt are most logically added to the protein supplement. An alfalfa forage diet would dictate adding minerals and salt to the grain mix. A ration based on a combination of corn silage and haylage could go either way depending on the ratio of each in the diet. Do not neglect adequate mineral or salt supplementation, particularly at the lower levels of production. Keep mineral and salt supplementation in mind when preparing grain and protein mixes for a dual feeder.

Table 4. Protien and mineral for a corn silage ration

Ingredient	lb/ton
Soybean meal(49%)	1,784
Dicalium phosphate	76
Limestone	67
Trace mineral salt	44
Dynamate	13
Vitamin A,D and E supplement	16

Table 5. Grain and mineral mix for a corn silage- alfalfa ration

Ingredient	lb/ton
High moisture corn	1,956
Dicalium phosphate	20
Trace mineral salt	17
Vitamin A,D and E supplement	7

Table 6. Grain and mineral mix for an alfalfa ration

Ingredient	lb/ton
High moisture corn	1,984
Monosodium phosphate	5
Trace mineral salt	6
Vitamin A,D and E supplement	5

Feeding schedules for high moisture corn and a 49 percent soybean meal supplement are presented in Table 7. These are guidelines for feeding energy and protein at different levels of milk production. These schedules are based on the mixes in Tables 4, 5 and 6.

The corn silage ration assumes cows are bunk-fed 60 to 65 pounds of corn silage per cow each day and 3 to 5 pounds of 16 percent CP alfalfa hay per cow per day.

Table 7. Feeding schedules for corn silage, alfafa or corn silage feeding program[a]

lb 3.8% milk/day	Corn Silage		Alfafa		Corn silage-alfafa	
	grain[b]	protien[c]	grain[b]	protien[c]	grain[b]	protien[c]
	(lb/day)		(lb/day)		(lb/day)	
19	0	1	12	0	2	0
27	0	2	16	0	4	0
34	0	4	19	0	7	1
42	4	5	23	0	10	2
50	9	6	26	1	13	3
57	14	7	29	2	17	4
64	28	8	31	3	20	5
72	27	9	34	5	24	6
79	32	11	37	6	29	8
87	34	12	39	6	33	9
94	36	13	41	7	35	10

[a]based on Tables 4, 5 and 6

[b]high moisture corn

[c]soybean meal, 49% CP

The alfalfa haylage ration assumes all forage dry matter will come from alfalfa either exclusively from haylage or from haylage and 3 to 4 pounds of hay per cow per day.

The corn silage-alfalfa program assumes cows are bunk-fed a 55 to 45 corn silage to alfalfa haylage mix on a dry matter basis.

These schedules are only guidelines and should be ad-justed according to the forage feeding program, the level of milk and fat production, and the feeds fed. Also, be careful to set the number of feeding periods per day in accordance with the number of cows per feeding station and feeder availability.

Summary

Computerized concentrate feeders seem most appropri- ate in situations where cows cannot be grouped into three or more TMR production groups, or where providing supplemental concentrate cannot be controlled or where it decreases the efficiency of milking. By placing some or all of the cows in a herd on a computer feeder, the potential for meeting the nutrient requirements of each animal is enhanced.

A computer feeder is not a substitute for quality forage and a herd health program, but rather it enhances good forage feeding and herd health programs to improve the efficiency and profitability of milk production.

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