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DAIRYING IN KWAZULU-NATAL

Practical Feeding of the Dairy Cow

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INTRODUCTION

Conventional wisdom has it that cows should be fed "according to production" and one can seldom read an article on dairying in any agricultural magazine which does not reiterate this notion. It has been known for some time that this approach is biologically unsound, but really practical alternatives have not been offered until recently. As explained in some detail in the manual on the CEDARA dairy feeding program (Jones & Stewart, 1987), milk yield *per se* is a very poor determinant of a dairy cow's nutrient requirements. Our study of the international feeding standards, in particular the British Agricultural Research Council, now the Agricultural and Food Research Council, has led us to the inescapable conclusion that all of the following must be taken into account if a dairy cow's requirements are to be calculated with any degree of accuracy:

- stage of lactation
- age of the cow (lactation no.)
- live-mass
- body condition (body reserves)
- butterfat yield
- stage of pregnancy

These are not set out in any order of importance because this can vary, depending, in particular, on the stage of lactation and the stage of pregnancy. Table 1 shows clearly how unimportant milk yield can be in determining a cow's requirements. The table also demonstrates the difference between determining

individual cow requirements and the common systems of cow feeding, which treat every cow as a "standard" cow. In this hypothetical situation (Table 1) all cows were offered, *ad libitum*, a roughage containing 9,59 MJ/kg metabolizable energy (ME) (64 TDN) and 15 % crude protein (CP) on a dry matter basis, an energy concentrate (MEAL) of 11,7 MJ/kg ME (78 TDN) and 8 % CP at 87 % dry matter (DM) and a protein supplement (HPC) of 10,2 MJ/kg ME (68 TDN) and 36 % CP at 90 % DM. The cows also were required to walk 3 km to and from pasture and climb 5 metres daily. The table and figure merit careful study.

Note particularly the effect of live-mass on dry matter intake. It is clear that small cows producing milk with a high butterfat content will require higher quality diets than will larger cows producing less creamy milk. It follows that, all of the many thousands of farmers who have been feeding "strictly according to production" in fact have been underfeeding some cows (particularly small cows and high butterfat cows) and overfeeding others.

Another kind of conventional feeding wisdom which suffers from the same kind of problem as discussed earlier is the philosophy which says: "This pasture can give me maintenance plus 10 litres of milk. Above this level I will feed 400 g of dairy meal for every litre of milk produced." The problem with this "maintenance plus" approach is that it fails to take into account the finite size of the cow's rumen. As the amounts of concentrates added to a cow's diet are increased she will eat less of the roughage on offer. Therefore, the value of the added concentrate is the difference between the nutrients in the added concentrate and the nutrients lost through the reduced intake of forage. The rate of substitution depends on several factors and is not a 1:1 rate except at very high levels of concentrate supplementation. The better the quality of the roughages, the better the concentrate must be to effect an improvement in the overall nutrient intake of the cow. A simple example:

Assume that the rate of substitution is 0,7:1 and that the energy content of the pasture is 9,5 MJ/kg ME (63 TDN). (All calculations on 100 % dry matter basis). One kg of a concentrate such as maize at 13,4 MJ/kg (89 TDN) would supply 13,4 - (9,5 x 0,7) MJ = 6,75 MJ (450g TDN) additional energy, enough for over 1 litre of milk at 4% BF. If no substitution occurred, 1 kg meal would provide energy for well over 2 litres of milk. If the same cow had been fed a meal containing only 12 MJ/kg then 1.4 MJ less energy would be fed for every kg of concentrates added. At say 8 kg of meal, a normal amount to feed to high producing cows, this would mean a loss of 11.2 MJ (750 g TDN), the equivalent of about 2 litres of milk.

Table 1. The effect of different cow characteristics on feed requirements

Effect to note	**Cow data**						**Supplement**		**Nutrients required & supplied**				
	Mass kg	**LN**	**LS**	**Y kg**	**BF %**	**CS**	**Meal kg**	**HPC kg**	**ME MJ**	**CP kg**	**DMI kg**	**ME MJ**	**CP kg**
Standard cow	550	3	9	20	3,5	2,5	3,7		167	1,7	16,1	167	2,1
Mass	**450**	3	9	20	3,5	2,5	6,0	0,8	153	1,6	13,8	153	1,7
Age + mass	**450**	**1**	9	20	3,5	2,5	8,5		174	1,8	13,8	162	1,8
LS	550	3	**39**	20	3,5	2,5	3,2		162	1,7	15,7	162	2,1
LS + CS	550	3	**39**	20	3,5	**3,0**	4,4		165	1,7	15,7	165	2,0
LS NP	550	3	**39**	20	3,5	2,5	2,4	0,9	164	1,7	16,1	163	2,2
	550	3	9	20	**4,5**	2,5	8,3		188	1,9	16,7	188	2,0
	550	3	9	**30**	3,5	2,5	10,5		214	2,2	17,2	202	2,2

BF% Yield													

NOTE:	Mass = live-mass Y = milk yield NP = not pregnant CP = crude protein	LN = lactation number BF = butterfat ME = metabolizable energy DMI = dry matter intake	LS = lactation stage (weeks) CS = condition score ME/kg = MJ ME/kg DM Supplement = concentrate supplied

All cows for which LS > 9 weeks except cow "LS NP" are in calf.

This is particularly important in early lactation, when a loss of 2 litres of milk could result is 500 or more litres being lost over the whole lactation. If the average rate of substitution was higher than 0,7:1 (as it will be with very good roughages) the effects will be even greater. These facts help to explain why, in temperate climates where pasture qualities are far superior to anything we can produce in most of southern Africa, researchers often fail to get responses to concentrate levels exceeding about one third of the ration. Under our conditions, high-yielding cows will respond when concentrates are fed at a rate of up to two thirds of their dry matter requirement.

Thus, any rational approach to feeding must take this substitution effect into account. In a sense, there are seven possible situations which arise in everyday feeding of the dairy cow. These are illustrated in Figure 1. Notice (in Figure 1) how there is an apparent increase in size of the rumen capacity, reflected by the higher dry matter intakes, as the diet improves (substitution is not 1:1). Except in the case of cows which really are hungry (the first two examples in the figure), this increase in dry matter intake is due to the faster rate of digestion which occurs with higher quality diets. Beware, however, of diets which are too high in concentrate, or lacking in long fibre. In these cases high dry matter intakes may be recorded but the efficiency of digestion drops, and the actual nutrient intake may be no higher than on a conventional diet. Further complications can include changes in the fatty acid balance and pH in the rumen, leading to a drop in butterfat and other metabolic problems.

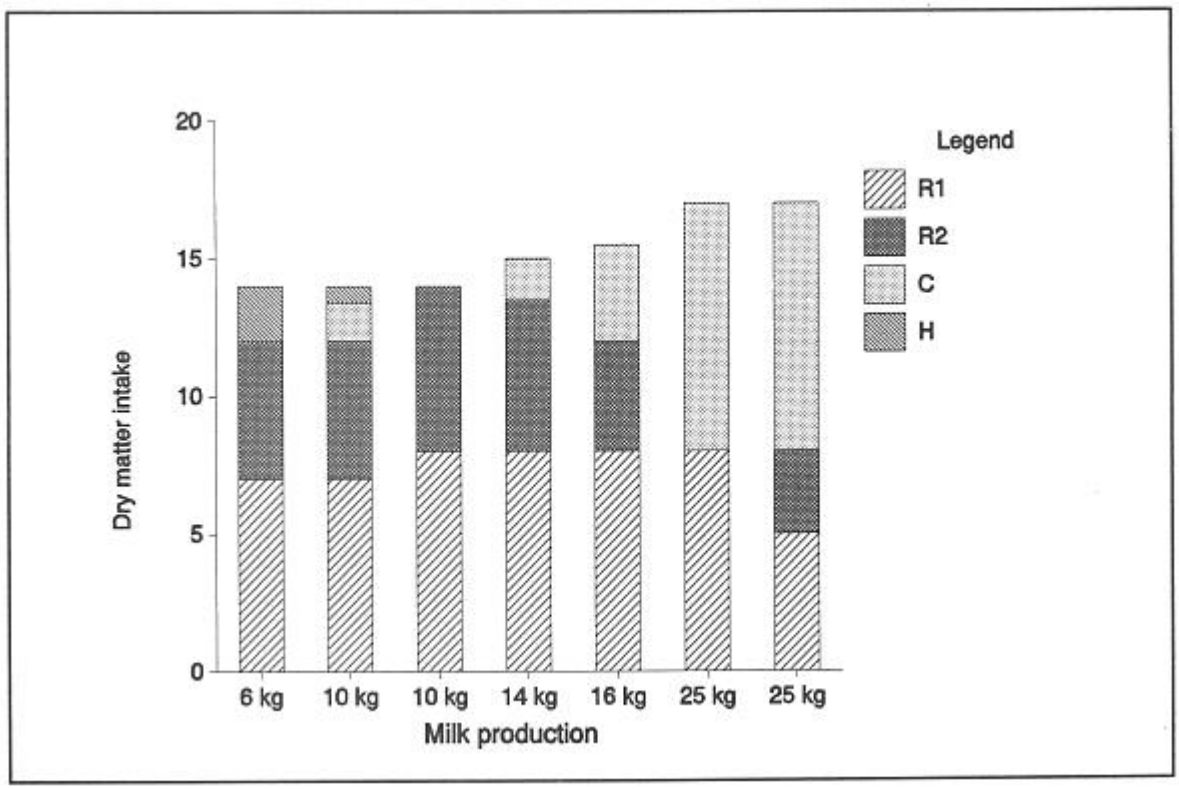
ESTIMATING A COW'S FEED REQUIREMENTS

The calculation of a cow's requirements, taking all of the above factors into account, can be done from tables and equations. But this is practicable only for groups of cows, because it is far too time consuming to work out the requirements of each cow in a herd. Nevertheless this approach is particularly useful for quick diagnostic work, *e.g*. to answer such questions as: "Are the high producers in early lactation on this farm short of protein?". Estimating the cow's requirements is only the first part of the problem. The second and the more difficult part, *viz*. satisfying the cow's requirements from the available feeds and determining the amount of supplementary feeding, still must be done. To do this with precision is really practicable only with a computer. However, not every farmer has a computer or access to a computer, wants a computer, or should even attempt to feed according to a computer program.

What alternative approach, other than calculating individual requirements on computer, can be adopted to ensure economical concentrate allocation? The dairy cow partitions her food between body reserves and milk production. If she is fed more than she requires for milk production, the surplus tends to be laid down as body reserves. If underfed (the normal situation in early lactation), she will draw on body reserves to maintain milk production. This being so, can the dairyman use this ability to store energy and then withdraw this energy from body reserves to buffer his feeding system? The answer is yes, provided that the feeds allocated come reasonably close to meeting the cow's requirements, and that the cow neither loses mass too rapidly, nor is expected to lose more mass than is biologically advisable (*i.e*. she must be in good condition to begin with). Conversely, it is uneconomical, and could be deleterious to the cow's health, to feed her to gain more condition than is necessary.

In the "Blue Book" *Feeding and Management of Dairy Cattle in Natal* (Bredon & Stewart, 1979), an attempt was made to take into account all the factors affecting a cow's feed requirements. The method was relatively laborious and even the 1 400 pages of supplementary feeding tables did not cover all possible feeding situations. The authors attempted to feed cows precisely according to their requirements and they did not take advantage of the buffering effect. The approach was used very successfully by a large number of dairy farmers, but has been abandoned by most as being too time consuming. The new approach suggested here may seem a radical departure from conventional wisdom, but is only an adaptation of the system used, albeit unknowingly, by a large number of farmers.

Figure 1. Seven theoretical situations illustrating the ways in which concentrates can replace roughages, using a 550 kg cow in condition score 2 and producing milk containing 3,8% BF



Notes:

H	=	Space (hungry cow!); **C** = Concentrate; **R1** & **R2** = Roughages.
6kg	:	This cow can only meet her requirements for 6 kg milk because of poor roughage intake.
10kg	:	Concentrate compensation for the lack of roughage.
10kg	:	Rumen filled by roughages which, alone, could supply nutrients for 10 kg milk.
14kg	:	Almost full benefit from the first few kg oc concentrate.
16kg	:	R2 being replaced by concentrate.
25kg	:	R2 being replaced completely by concentrate. This would occur if R2 was significantly less palatable than R1 and both roughages were offered *ad libitum*.
25kg	:	Both roughages being replaced by concentrate. The more usual situation as would occur, for example, if the cows were on pasture during the day and hay at night. Under these conditions even if the hay was less palatable than the pasture, the cows would still eat some hay.

A NEW APPROACH TO ALLOCATING CONCENTRATES

Many researchers over the years have shown that the closer a cow's feed supply is to her nutrient requirements, the more economical the system is likely to be. A "New Zealand" system, where no concentrates are fed, has not proved economical in South Africa, even with the present unfavourable concentrate : milk price ratio, because the quality of the forages on southern African farms, relative to New Zealand, are poor for much of the year. What then is the solution? There are two possibilities:

- feed strictly according to cow requirements
- adopt a simpler approach based mainly on body reserves and stage of lactation.

The first approach requires a computer, as was shown by the many farmers who successfully used the CEDARA program. This program was estimated to have saved between 5 and 10 million rand to South African dairy farmers.

The second approach is to make maximum use of the cow's buffering capacity, and to use simple look-up tables to decide on concentrate supplementation. The proposed system is similar to the flat rate and the step feeding systems popular in Europe. However, it attempts to take account of a range of roughage qualities. Six such tables, which cover a

wide variety of common fodder flows, and a table for use with total mixed rations, are attached. There is potential to expand this set of tables if necessary.

Both approaches require good management. Criteria for good management (adapted from Jones & Stewart, 1987) are set out below.

- Sufficient palatable roughage and clean drinking water to meet the herd's requirements are available at all times: no animal is ever hungry or thirsty as a matter of course. **This is an absolute requirement.**
- Cows are condition scored regularly.
- Heifers are weighed regularly, and their growth rates are checked against breed targets.
- Average condition score over all cows is not less than 2 (Mulvany scale).
- Cows respond to strangers in their midst with curiosity rather than fear. (This is a simple test of good stockmanship).
- The herd health is examined every month by a veterinarian, and his advice is followed. The incidence of mastitis is low (somatic cell count less than 500 000).
- Heifers are served first only after attaining more than 60% of the herd mean mature cow mass. They are reared to calve down at 2 to 3 years, weighing (*prepartum*) at least 90 % of mature mass.
- If roughages are fed *ad lib* then proper facilities exist for feeding of concentrates to individual animals.
- Herd record keeping meets the criteria given by Bredon & Stewart (1979) *viz*:
  - Only useful information is kept.
  - Records are kept in such a form that they can be converted easily into information.
  - The record keeping system is simple and easily taught to others.
  - Duplication, which leads to extra work and errors, is avoided as much as possible. The records lead to actions being taken.
- However rough it may be, a logical feeding system is already in operation.

Farmers who cannot maintain, or even aspire to, these standards generally criticize their advisers for making "impracticable" or "unrealistic" feeding recommendations.

If the farming enterprise fails more than one of the tests, or the first test alone, then the farmer must make every effort to correct the situation. If he does not, then do not expect good results from **this or any other** feeding system.

PERSPECTIVES ON CONCENTRATE FEEDING

The proposed system must be seen in proper perspective, from the point of view of unavoidable inaccuracies in concentrate feeding, and of the overall management of a dairy farm in relation to concentrate feeding.

Unavoidable inaccuracies in concentrate feeding

Although the system rests on intensive worldwide research on cattle feeding over many decades, there is still a great deal to be learnt. Nevertheless, present knowledge should be more than adequate in practice. Consider the following:

- The biggest problem concerns errors inherent in the data used to assess a cow's feed needs. Only her actual milk yield can be assessed with any accuracy at any given time. Even weighing a cow is a very imperfect measure of her true weight because of variations in gut fill, and in the time that has elapsed since she was last milked or had a drink. Even if these errors are minimized, her "true" mass is still not known because the amount of fat reserves she is carrying will affect her capacity and her need for feed. Butterfat content, a major determinant of nutrient requirements, is never known with any accuracy owing to sampling errors and the time from sampling to receipt of the information.
- Feeding standards always apply to the "average" cow. There is no such animal. In other words, **it is virtually impossible to determine the exact needs of a given cow, even if her own variables (live-mass, *etc*.) could be measured without error.**
- When more than one *ad lib* roughage is fed, estimating how much of each the average cow consumes is a major source of error. It is even more difficult to estimate what each individual cow eats. This difficulty is not unique to this system.
- Add to the above the problems of accurately specifying the quality of each available feed, given the normal errors in sampling, in laboratory analyses, and in the conversion of analytical data to nutrient concentrations. **The amounts of nutrients supplied to the cow to satisfy her imperfectly known needs, therefore, are also only approximately known.**
- Balancing cow rations is a short-term operation with a time scale of days, while there is a lag effect when changing rations, during which the cow adapts to the ration changes.
- Users of the tables are advised to exercise their own judgement. The stockman is entirely free to override the recommendation made by the tables in respect of any animal, and to feed her as he sees fit, using these recommendation as a guide. An obvious example would be a cow which is about to be dried off.
- The amount and the effect of concentrate actually eaten by a cow rarely will be exactly as calculated. Infrequent feeding (twice a day), rather than having smaller and more frequent meals, rounding errors, errors in measuring out the cow's ration, and wastage will all dull the edge of even perfect

theory. Incidentally, these are the *only* problems in concentrate feeding which automatic feeders seem likely to ameliorate, albeit at considerable cost.

The result of all of these problems is that there is inevitably a discrepancy between the cow's true needs and her daily intake of nutrients. It is overcome by deliberately using the cow's ability to store and mobilise body reserves, the stockman's ability to read the situation in terms of her condition score, and the system's attempt to use that feedback to compensate for the effects on the cow of past errors in feeding. The storing and mobilising of body reserves is not as efficient as feeding exactly to the cow's requirements, but is the best practical solution to the problems outlined. The tables therefore rely heavily on the condition score of the cow. There is no doubt that a computer program based on the same approach does a better job of feeding cows as individuals than these simple tables can do, but we hope that those who do not want to use a computer program will find this simplified approach both practical and economical.

Overall management in relation to concentrate feeding.

The second perspective from which the system must be viewed is the long one. Balancing cow rations is a short-term operation with a time scale of days. Note the following points in the longer term:

- Ration balancing is only one part of dairy herd management. If the other parts are neglected, this exercise will be of relatively little value. In particular, the annual fodder flow is of fundamental importance. If that is weak, then ration balancing amounts to being penny wise and pound foolish. KwaZulu-Natal Study Group results have consistently shown that the most important single factor contributing the most to profits is adequate home-grown roughage of high quality. Other major aspects of dairy management include breeding and fertility control, other veterinary care, milking routine, record keeping and analyses, labour management, and financial management. If one of these, or overstocking, is the factor limiting to production or profitability, then it is pointless to look to supplementary feeding to solve the problem.
- Correct feeding of cows in milk is only part of the dairy feeding operation. Neglect of heifers and dry cows makes nonsense of the most careful feeding of cows in milk. Dry stock must be weighed and condition scored (and otherwise favoured with the master's eye) at least once a month, and properly fed and **watered** every day.
- Cutting costs in concentrate feeding is not the objective of the present recommendations. The real aim is improved margin over feeding costs for an entire lactation, even the entire lifetime of a cow. It is sometimes necessary to spend more on concentrates, not less, to improve profits in the

medium- and the long-term. This often makes it difficult to judge the value of a system before its effect has had time to work through the herd, which could take several months.

Readers who are familiar with the "Flat Rate" or "Step" feeding systems, practised in the UK in particular, should find nothing surprising in the recommended system. The essential difference between the proposed system and flat rate systems is that the proposed system will cater for a wide variety of forage qualities and levels of production. Flat rate systems or modified flat rate systems which work well for many British farmers depend on having very good quality roughages, far superior to anything produced in southern Africa. The simplicity of a flat rate system has very great appeal but such a system is inappropriate under our conditions and forage quality. Further, where experimental results have shown that condition scores of more than 2,5 at calving are unlikely to be beneficial, they were obtained from trials carried out on superior forages.

INSTRUCTIONS FOR USING THE FEED RATIONING CHARTS

The first time these tables are used it could take two to three hours to work out the concentrate allocations for a herd of 100 cows. However, by the time the tables have been used several times, it should be a minor task which could be done while supervising milking.

A line or column must be added to the milk recording book, or the cow byre sheet, for the regular recording of cow condition.

Body condition scoring of all cows must be done at least monthly, preferably fortnightly, and always before feeding levels are adjusted. This is not difficult but it does require more skill than does recording milk production. The details of the technique are set out in KwaZulu-Natal Dairy Leaflet 1.7.

Calving dates and stage of pregnancy, which imply drying off and due dates, must be known for each cow.

Roughages and concentrates fed separately

Assess the roughages being fed, or available to the herd. Classify these into one of the six categories represented by the feeding tables (analyses expressed on 100% dry matter basis), *viz*:

Chart 1	Low quality roughage (approximate nutritive value 7,5 MJ/kg ME, 6,5% CP).
Chart 2	Moderate quality, low-protein roughage (approximate nutritive value 8,5 MJ/kg ME, 10% CP).
Chart 3	Moderate quality, high-protein roughage (approximate nutritive value 8,7 MJ/kg ME, 14% CP).

Chart 4	Very good quality roughage (approximate nutritive value 9,4 MJ/kg ME, 18% CP).
Chart 5	Good quality, low-protein roughage and 3 hours lush pasture (approximate nutritive value roughage; 9,4 MJ/kg ME, 6% CP, value of pasture: 9,6 MJ/kg ME, 18% CP).
Chart 6	Maize silage as the principal roughage (approximate nutritive value 9,5 MJ/kg ME, 6,5% CP).

Total mixed rations

Chart 7	This table offers five total mixed rations with specifications as set out at the top of the table. The levels of energy and protein in these rations were chosen to give a practical range of feeds. It will be noted that the specifications for rations 5 and 6 could be met by roughages alone. For example, maize silage and hay with a small amount of protein supplement. The usual considerations of good stockmanship and rumen adaptation apply when switching cows from group to group.

Weight class

Each cow will fall into one of three weight classes, one of four stages of lactation, one of three condition score classes and one of two yield classes. All animals must be classified individually.

"Jersey"	=	All average sized Jerseys and cows of any breed weighing from 350 to 450 kg.
"H-Fries ave"	=	Cows of any breed from 450 to 550 kg.
"H-Fries large"	=	All cows weighing more than 550 kg.

Important notes:

- These refer to individual animals, not to a herd average mass
- These live-masses are based on cows in mid-lactation, in moderate condition (CS=2,5) and not heavily pregnant. Do not necessarily use a cow's present mass to choose a column: rather calculate what she would weigh if in moderate condition and

not heavily pregnant. Since a change of one condition score point is equivalent to about 40 kg change in live-mass with small cows and over 50 kg with very big cows, if she is thin (CS<2,5) add 20 kg for each half point by which she is under 2,5. For example, a Holstein-Friesland cow weighing only 500 kg but with a condition score of 1 is still a large cow. In condition 2,5 she would weigh at least 575 kg. Subtract 8% from the present weight of heavily pregnant cows. Accordingly, a cow in late pregnancy weighing 600 kg has a "true" weight or weight for feeding purposes of 600 - 48 = 552 kg, adjusted for condition if necessary. In practice, the application of these adjustments is very simple. A stockman who knows his cows will have very little difficulty in deciding in which size category a cow belongs.

- No extra allowance has been made for first-calver growth. The system will take care of this through the adjustment for condition score.

Stage of lactation

- **Early lactation** applies to all cows in the first 8 to 14 weeks of lactation. Cows should be kept in this class for not less than three weeks. Cows can stay longer than 14 weeks if exceptionally high yielders and CS<2.
- **Mid-lactation** applies to all non-pregnant cows more than 14 weeks in milk.
- **>165 days pregnant** applies to all cows which are more than 23 weeks pregnant, *i.e.* within two months of drying off.
- **>225 days pregnant and dry** applies to all dry cows. A good stockman will give no concentrates for a few days at the end of lactation to promote drying off. He may also give 1 to 2 kg per day for a fortnight before calving to assist rumen microbial adaptation.

Actual condition score

Each stage of lactation offers three condition score classes ("Actual CS"). The stockman may reduce the feed of cows that are fatter than the maximum tabulated value, but it is unlikely to be economical to increase the feed of thinner cows. It is a good idea ask a colleague to check, at least four times a year, that you are condition scoring correctly.

High or low yield

The data in Table 2 and these two columns in the feeding tables are intended to distinguish between relatively high and low yielding cows. In the first 10 to 14 days after calving it should

be possible to assess in which category a cow probably will remain for her whole lactation. In case of doubt, treat a low yielding cow before peak as a potential high yielder. After peak, feed will be wasted by feeding a low yielder as if she were a high yielder. The suggested levels of production for a cut-off between them are set out in Table 2 and in the feeding tables. Note that high yielding cows can remain in higher groups if so desired, but low yielding cows should not be moved down. For example, a large Holstein-Friesland past peak but still yielding over 25 kg milk could continue to be fed at the higher (before peak) level.

Table 2. Kilograms of milk production for "high" and "low" yielding cows*

	COW TYPE					
	Jersey 400 kg		H-Fries 500 kg		H-Fries 600 kg	
	High	Low	High	Low	High	Low
Early-lactation	>17	<17	>22	<22	>25	<25
	>11	<11	>13	<13	>15	<15
Mid-lactation	> 9	< 9	>11	<11	>12	<12
> 165 days pregnant						

The "high" and "low" columns can also be used by the "minimum concentrate" school of thought. In other words, if the user feels that concentrate price is simply too high in relation to the price he is receiving for his milk then the "low" columns can be considered to be reasonable minimum levels for concentrate supplementation. At these "low" levels there should be no deleterious effects on cow health or the production in subsequent lactations. Remember that this system attempts to feed a cow for her lifetime production and not just for today.

The H.P.C

In all cases H.P.C is assumed to be a commercial high protein concentrate of about 10,2 to 10,5 MJ/kg (68 to 70 TDN) and 36 to 40% CP. Oil cakes can be used instead. These may be slightly higher in protein and energy, but much lower in minerals, particularly calcium. However, the protein contents of oilcakes can be variable and an analysis is recommended for each new batch. The H.P.C. can be fed either alone, or on top of other supplements after milking, or, if silage is fed, sprinkled on top of the silage. It should not be fed in only one meal per day. There is also some evidence that a mix of protein sources gives better results with high

producing cows than does a single source. For example, an oil cake can be mixed with a small proportion of fish meal or carcass meal.

Mineral supplement

Work out, or ask your feed adviser to help you to work out, a suitable mineral supplement. This will depend on both the roughages and the minerals included in the concentrate. This supplement can be fed as a lick, but research has shown that cows are poor balancers of their mineral needs, so the mineral supplement should preferably be fed individually by spoon. A number of suitable mineral mixtures, depending on the roughages used and the availability of raw materials, are listed in KwaZulu-Natal Dairy Leaflet 5.3.

Table 3. Simplified grouping of concentrate feeding levels described in Feeding Chart 3

Meal group	Meal kg	H.P.C. group	H.P.C. kg
1	12	1	1,8
2	1	2	1,0
3	8	3	0,6
4	6	4	0,4
5	4		
6	2		

Grouping

It is possible to simplify the tables even further by doing a little rounding. Thus, although each table has 72 cells (which implies 72 different feeding levels), the number can be reduced considerably. For example, Feeding Chart 3 can be reduced to the levels given in Table 3.

This gives seven levels of energy supplementation between 0 and 12 kg and five levels of protein. Cows could be marked easily using coloured tapes around their tails (don't put them on too tightly) or paint marks to identify their particular grouping. Very little of the precision of the feeding system will have been lost. If you are sceptical, read again the section of this leaflet on perspectives on concentrate allocation.

Adaptation

If the new feeding table means very different levels of concentrates to your present system, then make changes gradually to give the cows time to adapt. Do not reduce concentrates by more

than 4 kg per week. For example, if a cow is getting 12 kg at present, and should only get 6 kg then reduce by 2 kg, wait 3 days, reduce by another 2 kg, wait 3 days, and finally reduce by the last 2 kg. The same applies to increasing concentrates, especially at calving, when maximum concentrates should be reached not sooner than 10 days *post partum*.

A practical example

Farmer Smith has his herd on kikuyu day and night December. The records for a few of his cows are given in Table 4.

Table 4. Selected herd records from Farmer Smith's herd

Cow name	Remarks	Last calf date	Due date	Milk kg	Mass kg	CS	Adj. mass
Alpha	Jersey BP*	051192		18	390	2,0	410
Bravo	Early lac.	011292		28	475	2,0	495
Charlie	Mid lac.	051092	201292	20	520	1,5	560
Delta	Dry	121292	050393	-	560	2,5	510
Echo	low NP-cull	050692	050393	15	520	2,5	520
Foxtrot		150392		12	560	3,0	500
Golf	Preg fat	150592		10	500	1,0	500
	Preg thin						

Note: BP = before peak; NP = not pregnant

These are realistic figures. Note how the weights vary with changing condition and pregnancy. Using Feeding Chart 3 the cows would be fed as given in Table 5.

Table 5. Feeding recommendations for Farmer Smith's cows

Name	Remarks	Meal kg	H.P.C kg
Alpha	Jersey BP*	7	1,7
Bravo	Early lac.	9	1,0

Charlie	Mid lac.	6	
Delta	Dry	1	
Echo	low NP-cull	1	
Foxtrot	Preg fat	1	
Golf	Preg thin	4	

CONCLUSION

It is possible to fine-tune a feeding system by adjusting concentrates and watching the effect on milk, *i.e*. let the cows tell you how much supplement they require. Therefore, the levels of concentrate in the tables need not be seen as absolutes. The whole purpose is to move away from the illogical "according to production" systems to something which is still practical and should give better results. If things do not appear to be working, check again that the criteria for good management are being met. In particular, remember that the more good quality roughage the cows can be encouraged to eat, the more economical the system is likely to be.

Cedara Agricultural Development Institute would appreciate feedback from farmers who use these tables, in particular from those who may be prepared to do comparative trials of this system with an existing system. In order to do a comparison, select at least forty comparable cows, *i.e*. 20 pairs of similar cows. Try the system on 20 of the cows for at least one month and compare their concentrate usage and milk production with the other 20, who, of course, would continue to have their feed supplemented in the old way.

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