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Limit Feeding Light-Weight Cattle High Nutrient Density Diets Programmed Feeding for Calves (PROGFED2) (Revision 2)

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Special Note: This revision adds five new equations to the program to more accurately predict the gain of medium and large frame cattle with greater growth potential. The original version of this program used the 1974 NRC equations which were developed in the 1960's for steers and heifer calves. Over the years, additional growth potential has been bred into cattle. For example, a group of large frame heifer calves, program fed at Pawhuska Research Station with the 74 equation and feeding for 2 pounds per day, actually gained 2.68 pounds per day. Others have reported that the feeding schedules developed by the original program underestimated gains of many cattle. With the additional five equations published in the 1984 NRC Nutrient Requirements of Beef Cattle, the user should be able to better match this program to the cattle being fed. The two original equations are retained for reference and for the many cattle to which they still apply.

For a cattleman, who has light weight cattle and who does not have adequate forage to maintain growth for some limited period of time, but has sound economic reason to retain the cattle for pasture or feeding at a later date, limit feeding may be the answer. Light weight cattle usually are grown on forages or on bulky high roughage growing diets. Another method to grow cattle at moderate rates of gain is to limit feed at a higher concentrate ration. In times of drought or with high roughage prices, limit feeding concentrates may be more economical. With limited intake of high energy diets, it may be cheaper for cattlemen to buy complete high energy feeds from feed manufacturers and achieve lower costs of gain than buying hay or forage which is expensive and difficult to transport and handle. However, more management is required to handle limit feeding high concentrate diets than

to feed roughages. **Warning!! Complete pelleted diets will not work with programmed feeding.** The usual problem with complete pelleted feed is that it is not possible to maintain adequate roughage particle size to prevent rumen disorders and bloat.

When limit feeding, one must calculate the amount of feed to achieve competitive but restricted gains on growing cattle. PROGFED2 is a Lotus template designed to calculate the daily amount of feed for a pen of cattle. This amount varies with cattle weight, the energy values of the ration, and the desired rate of gain.

Feeding Management. Limit feeding of cattle requires special skills and facilities. Minimum requirements are:

- 1) Adequate bunk space so that most cattle can eat at one time.
- 2) Pens small enough that cattle come up to the bunk when fed.
- 3) Scales or other methods of weighing out the daily feed.
- 4) Roughage feeds to work the cattle up to a high concentrate diet.
- 5) Skill on the part of the manager.
- 6) Sufficient business management skill to assess the economic limitations and opportunities in limit feeding of cattle.
- 7) A sound plan for the use or sale of the cattle following limit growing.

First, a ration must be formulated or purchased. It is simplest to calculate the ration's net energy values (NE_m & NE_g) on a dry matter basis. Appendix I gives the energy values on a number of common feeds which may be used. Rations used for limited intake growing programs require special

formulation. The levels of protein, vitamins, and minerals must be increased over the levels used in ad libitum fed diets. Consult a trained nutritionist or the *1984 NRC Nutrient Requirements of Beef Cattle* for this information. After energy levels are determined, this program (PROGFED2) can be used to estimate the feed intake required to reach a target gain. The user then should compare the amounts of protein and mineral provided against the NRC tables (amount per day for a given weight and gain) and make any necessary additional adjustments. The recently developed "Spreadsheet Programs for Calculating Complete Diets for Beef Cattle and Checking Nutrient Balance" (OSU CR-3027 and AUTONRCA) can help the user in this task.

A sample output from *Programmed Feeding for Calves* is included at the end of the article. Most of the inputs are obvious. In the programs distributed on disk from OSU, all cells are protected except the ones requiring user input. This is done to prevent accidental erasure of critical formulas used in the calculations.

This program will calculate the amount of feed needed by a single animal or a pen of cattle. The cattle will be fed the same amount of feed each day for a two week period. Then, based on the amount of gain presumably achieved, feed will be slightly increased the next two weeks because one is feeding a heavier animal.

The user inputs are illustrated in the example below:

All of the inputs are required except for pen number. Feed cost per cwt, the ration dry matter percentage, and the net

	Inputs
Feed Cost Per CWT as is—>>	\$7.73
Ration Dry Matter % —>>	90.00
NEM of Feed, MCAL/CWT—>>	91.49
NEG of Feed, MCAL/CWT—>>	58.00
Initial Shrunken Weight, LBS—>>	375.00
Expected Daily Weight Gain, LBS—>>	2.25
Number of Head Per Pen—>>	100
Pring Increment, Days—>>	14
Pen Number—>>	1 1976
Body Type (1 - 7)—>>	6 NRC EQUATIONS
Steer Calves	

**** Press ALT D to Enter Starting Date ****

energy values (NEM and NEG) need to be calculated from the ration or obtained from your feed supplier. The initial shrunken weight is either the off truck weight or the gross weight multiplied by 0.96 for full cattle. Programmed feeding will only work with cattle uniform in weight, size, age, and background. Sorting cattle into similar groups may be necessary before starting.

The user of this program should use judgement when inserting **expected daily weight gain**. Experience has shown that the net energy system, which is used in this program is quite accurate. Target gains set between 1 pound per day and 2.5 pounds per day should be permissible. If gains are set low, the cattle will not receive much feed. If the gains are to be set to lower levels (less than 1.75 pounds per day) the roughage level may need to be increased over the example ration shown in Appendix I.

The number of head per pen determines the amount of dry matter or AS FED feed to be delivered to the pen each day. Recent experience at OSU seems to favor once daily feeding over feeding twice daily.

Body Type. This program included seven net energy equations. They are based on (1-5) the 1984 NRC equations. Equations 6 and 7 were used in the original version of this program and are retained for those cattle for which they worked well. The original two equations were used most frequently in receiving programs where weight gain was often a recovery of purchase weights. The equations for large frame cattle (3 and 5) will result in less feed being fed each day for an expected gain. Select the equation which best describes the cattle that are to be fed. Equations 6 & 7 might best describe the medium frame cattle of the 1970's and possibly what some might call small frame today.

- 1) Medium-Frame Steer Calves. 1984 Equation.
- 2) Large-Frame Steer Calves. 1984 Equation.
- 3) Large-Frame Bull Calves. 1984 Equation.
- 4) Medium-Frame Heifer Calves. 1984 Equation.
- 5) Large-Frame Heifer Calves. 1984 Equation.
- 6) Steer Calves 1974 NRC Equation.
- 7) Heifer Calves 1974 NRC Equation.

Type 2 also applies to medium frame yearling steers, type 3 applies to large frame yearlings steers, and type 5 applies to medium frame yearling heifers.

The equation selected is identified in the text on the spreadsheet.

**** Press ALT D to Enter Starting Date **** The format to enter the date on which programmed feeding is to start is MM/DD/YY. The date that starts every two week period will be printed in the feeding table. This function requires Lotus Version 2. If you only have the older version of lotus, request the older version of PROGFEED.

Feed cost of gain is computed for every 2 week period. Feed cost is only a part of total cost of gain. The user can use the companion template FLCALC (OSU CR-304) to evaluate total cost of gain. To do this, the average feed intake for the period must be calculated.

Apparent gains of cattle over short periods of time are often distorted by changes in "fill". Limit fed animals often have less fill than ad libitum fed animals.

Programmed Feeding for Calves

Inputs

Feed Cost Per CWT as is-->	\$7.73
Ration Dry Matter % -->	90.00
NEM of Feed, MCAL/CWT-->	91.49
NEG of Feed, MCAL/CWT-->	58.00
Initial Shrunken Weight, LBS-->	375.00
Expected Daily Weight Gain, LBS-->	2.25
Number of Head Per Pen-->	100
Print Increment, Days-->	14
Pen Number-->	1 1976
Body Type (1 - 7)-->	6 NRC EQUATIONS
Steer Calves	

Average Date	Per Animal /Day			Per Pen / Day		Feed/Only Cost Gain
	Weight	Pounds DM	Pounds AF	Pounds DM	Pounds AF	
03/27/92	390.8	9.19	10.21	919.10	1021.22	\$0.35
04/10/92	422.3	9.74	10.82	974.13	1082.36	\$0.37
04/24/92	453.8	10.28	11.42	1028.14	1142.37	\$0.39
05/08/92	485.3	10.81	12.01	1081.22	1201.35	\$0.41
05/22/92	516.8	11.33	12.59	1133.44	1259.38	\$0.43

Developed by Donald Gill & Britt Hicks, 1992.
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 File Name: PROGFEED2

Appendix I

The following is an example ration for a 450 pound steer to gain about 2.25 pounds per day. This is a very high concentrate ration which cattle will have to be worked up to with caution. For gains below 2 pounds per day, additional roughage may need to be added to increase feed intake. Special techniques must be employed to manufacture this ration. To maintain a minimum amount of roughage factor, this ration must be manufactured in two stages. In the first,

all the ingredients, except the alfalfa pellets, coarsely rolled or flaked corn, cottonseed hulls, and the molasses, are pelleted into a supplement pellet. In the second stage, the supplement pellets are combined with the other ingredients to form the complete ration that is fed. In no case should the corn or the cottonseed hulls be pelleted.

Composition			Ration Composition		
Feed	DM %	As Fed %	Nutrients	DM %	As Fed %
Alfalfa Pellets	8.00	7.88	NEm	91.19	81.77
Calcium Carb	0.94	0.87	NEg	58.00	52.01
Bovatec 68	0.02	0.02	Crude PROT	15.67	14.05
Cane Molasses	3.50	4.18	Ether EXT	3.61	3.23
Rolled Corn	66.16	65.91	Crude Fiber	8.01	7.18
Cotton Meal SOL	13.67	13.47	K	0.90	0.81
Salt	0.30	0.28	CA	0.56	0.50
Soybean Meal 48	2.38	2.38	PHOS	0.42	0.37
Vitamin A-30	0.02	0.02	TDN	79.20	71.02
Cottonseed Hulls	5.00	4.98	Dry Matter	100.00	89.67
			Cost/CWT	8.62	7.73
Total	100.00				

Questions and Answers about Programmed Feeding of Cattle

- 1) **Q. What is programmed feeding?**
 - A. Programmed feeding is the daily feeding of a pre-determined amount of feed. The amount is usually determined by the energy levels in the diet, the animals energy requirements as influenced by its weight, sex, and the desired level of gain.
- 2) **Q. How does programmed feeding work?**
 - A. High concentrate “feedlot type” diets have been known for years to be very efficient. Programmed feeding is the use of similar diets, limit fed to achieve “target levels” of gain. It is a useful technique as long as the “target gain” is less than the genetic gain potential of the animal.
- 3) **Q. How is the amount to feed determined?**
 - A. The everyday amount of feed is determined with the net energy system. The factors used are: the net energy values of the diet, the sex, body type, the weight of the animal, and the desired rate of gain. We use a computer to do this, and because the animal on programmed feeding is growing, we must recalculate the amount to feed every two weeks or so.
- 4) **Q. How do I start cattle on a high concentrate diet?**
 - A. Very carefully!!! High concentrate diets which are concentrated enough to be cost effective will, if consumed freely by unaccustomed animals, frequently result in death, acidosis, and founder. Like many high technology products, the potential benefit and the risk with high energy feeds are both very high. We would recommend that before starting the cattle on the programmed feed, the owner be sure the cattle are full of the old feed. If, for example, the old feed was grass hay, offer free choice grass hay and then start the cattle on 3 or 4 pounds of the high concentrate at the same time. Keep offering the grass hay and each day increase the concentrate feed up to a pound per head per day. When the level of intake of the concentrate reaches the first programmed level, start gradually reducing the amount of grass hay the animals receive. The hay can usually be completely removed after about a week after reaching the programmed level of concentrate.
- 5) **Q. What is the secret of getting cattle on feed without digestive disorders?**
 - A. The key is gradual and very consistent change in the diet of the animal. Skilled feeders can do this in a very few days. As a feeder acquires skill he will learn to read what the animals are eating, rather than what was fed. He will learn to tell on a given day if the animals will eat aggressively or will not eat much at all. Skilled feeders do not change diets on days when weather or social problems within the cattle have upset their normal patterns.
- 6) **Q. How do I use the tables in OSU PROGFED2?**
 - A. **Step 1.** Fill out the information on the ration IE. (cost, dry matter, NEm, and NEg).
Step 2. Enter the initial shrunk weight of the cattle.
Step 3. After entering the body type (sex and body type) of the animals, enter the rate of gain that you feel is appropriate. Look at the feed only cost of gain and add to it the non-feed costs that you feel are appropriate. If the costs are not acceptable, change the rate of gain increase to lower costs) and reevaluate. Remember, cattle grown at rates exceeding 2.25 lbs per day are usually not useful for later grazing medium or low quality pastures. Cattle grown at high rates of gain are usually severely discounted as feeders as well.
Step 4. Enter the number of cattle in the pen. This will result in the calculation of the pounds of dry matter or “as is” feed required each day for the first two week period.
- 7) **Q. Should I feed once a day or twice daily?**
 - A. If bunk space is adequate so that all cattle can eat comfortably at any time, once daily feeding will cost less money to accomplish. Experience at OSU clearly shows an advantage to once daily feeding if the desired level of gain results in a low amount of feed being fed. In some cases the cattle will consume the entire day’s feed in as little as 10-20 minutes. When this happens the cattle will have to be trained or sorted to get to the bunk and get their share. However, if bunk space is limited it may be best to feed twice daily. If you must do this the ration must be bulked up with roughage and the target gain set high enough that there will be feed in the bunk for at least 5 or 6 hours out of the day. One feedlot that has used these programs on thousands of cattle and has limited bunk space, feeds first at 8 AM and then comes back with the second feeding at 11 AM. They report good results and have observed that this technique allows the “timid cattle” best access to feed. The first feeding satisfies the more aggressive eaters

and permits timid cattle the opportunity to come to the bunk. To use PROGFED2 to produce a sheet showing the amount of feed for each of a twice day feeding schedule, enter half the number of cattle that are in the pen. If there is an odd number of cattle in the pen, enter number including the fraction (IE 41.5 for a pen 83 head).

8) Q. What will happen if we miss a day's feeding due to breakdown or other problems?

A. Depending on the degree of restriction and how "hot" the ration is, the possibility is there, to ruin or kill cattle if you just put the same feed out at a later time. If something makes you late with a feeding, you will have to fill the cattle with hay and work them up on feed again. Doing this will cost a lot of money because gain and feed efficiency of the cattle will be adversely affected during the workup period.

9) Q. Are there cattlemen who should not even consider programmed feeding?

A. Yes, anyone who has a history of having a hard time getting things done on a regular time schedule should not attempt programmed feeding. The same with cattlemen who seem to have more than their share of breakdowns. One experienced feeder relates the story of a pen of cattle that had been and were used to being fed at exactly 8 AM and one day, they were 30 minutes late in the feeding, the cattle were ready to climb over the fence and were very upset. He stated that if they knew that they were going to be late again he would at least have offered a reasonable amount of hay at the regular feeding time.

10) Q. Why not simply feed the animals all they want to eat?

A. For a feedlot that is what they will do, unless there is good reason, for example, to want the cattle to gain less than two pounds per day. The real potential for programmed feeding is in the "growing" or holding of animals. For example, a 600 pound steer could be grown at a rate of 2 pounds per day on a self-fed low energy ration. It could eat 24 pounds per day of feed. However, it is possible to formulate a high energy diet which would give the same gain with 12 pounds of feed. The best program is likely to be the one that costs the least per day if they both give the same gain.

11) Q. Are high energy feeds more expensive?

A. Per pound, usually yes, but in terms of gain potential per dollar, usually not. Cost per unit of gain in the cattle business is what is important along with mar-

ket timing. These are the reasons for considering programmed feeding.

12) Q. Does it pay to have cattle gain less than their maximum genetic potential?

A. From a true biological efficiency standpoint, never. However, market timing and the potential for using forage resources at a later date, or the opportunity for better balancing cattle and forage often spell profit opportunity in holding cattle at less than maximum gain.

13) Q. Are rations for programmed feeding hard to develop?

A. No. The important factors in developing ration are to formulate to obtain a high NEg value per dollar of ration cost and then to adjust the protein and mineral content of the ration to the animal's requirements that are determined by the selected gain, the animal's weight, the sex, and the frame size. Cattlemen could buy complete rations or buy specially formulated supplements for on-the-site mixing with grains and roughages. Warning!! Complete pelleted diets will not work with programmed feeding. The usual problem with complete pelleted feed is that it is not possible to maintain adequate roughage particle size to prevent rumen disorders and bloat. However, rations can be developed with only whole corn and specially formulated supplement pellets. With the whole corn program, the supplement and whole corn will have to be carefully mixed before they are fed.

14) Q. How do different feeds rank in terms of gain potential?

A. The following table shows the NEm and NEg values of some common feeds. Note the difference in the NEg values of wheat straw and corn, for example. Corn has 67 and wheat straw has 7, showing that corn has nearly 10 times the potential for adding weight gain to cattle as does the straw. Non-feedlot cattlemen should study this table carefully. Note that a lot of feeds which have good utility as supplements for grass have non competitive NEg values. Unless these feeds are very low priced they may not work from a financial viewpoint. Examples of lower NEg feeds are wheat middlings, cottonseed meal, and all the roughage feeds. Examples of high nutrient density feeds are corn, well processed milo, wheat, and soybean meal. Net energy values of selected feeds shown below are expressed as megacalories per 100 pounds of dry matter. These values are for typical high quality feed ingredients found in feedlot diets.

Feed	Megacalories/Cwt DM	
	NEm	NEg
Alfalfa, dehy. 17%	66	31
Alfalfa hay, excellent	66	34
Alfalfa hay, good	57	27
Barley, 48-52#/bu.	97	64
Barley, 44-46#/bu.	80	53
Barley, 38-42#/bu.	73	46
Cane molasses	79	50
Corn, dent no. 2	103	67
Corn silage, typical feedlot	73	43
Corn silage, high grain	73	46
Corn stover	56	27
Cottonseed meal	77	50
Cottonseed hulls	47	10
Cottonseeds, whole	91	54
Fat, blend	208	127
Hominy feed	100	65
Milo, minimum process	80	53
Milo, semi process	90	60
Milo, extensive process	97	64
Sorghum silage	67	30
Soybean oil meal	87	59
Wheat	100	65
Wheat middlings	73	45
Wheat Straw	16	7

15) Q. How do I know if a ration is feasible from a financial standpoint?

- A. You can use the programmed feeding program (PROGFED2) to calculate the “feed only” cost of gain. After adding the appropriate fixed costs to this figure, determine if the cost is feasible from an economic standpoint. Predicting gain by means of the net energy equations has proven quite accurate in the past, it will be foolish to think that your costs might be less than the projections. If anything does go wrong, it will likely be that the gains may be lower because of delay in working cattle up on feed.

16) Q. Should ionophores (Rumensin or Bovatec) be included in diets for programmed feeding?

- A. Yes, either product at the recommended level will improve both the rate and efficiency of gain. There is good reason to believe that diets formulated for programmed or limit feeding may not work well without the ionophore. Many of the potentially undesirable effects of feeding very high concentrate diets are moderated or reduced by ionophores.

17) Q. Should antibiotics be included in high concentrate diets designed for programmed feeding?

- A. Maybe. Antibiotic feeding can improve the efficiency of feed conversion. If you use Rumensin you can include the antibiotic Tylan in the formula. If you use Bovatec you can include Terramycin at a level of 75 mg per head per day. The use of antibiotic should aid in preventing liver abscess that presumably reduce gains in cattle. The levels of antibiotic included with ionophores will have little or no effect on shipping fever. As you increase the amount of roughage in the diet the advantage for the antibiotic decreases.

18) Q. Should I offer a small amount of grass hay each day along with the programmed ration?

- A. Not after the cattle are worked up on feed. A minimum amount of “roughage factor” must be built into your programmed ration. After this is done any additional roughage will only reduce the efficiency of the program.

19) Q. Will programmed feeding work with pasture cattle?

- A. No. The reason is that if the ration is palatable and there is plenty of pasture, then all that will be occurring is a substitution of feed for grass. Because of the variation in the quantity and palatability of forage produced day to day it will be impossible to predict total nutrient intake, and thus gain. The ideal ration for drylot programmed feeding will be a very poor supplement for grass due to the negative associative effects of the diet and forage.

20) Q. How do I prepare the cattle for Programmed feeding?

- A. The cattle to be fed together need to be as uniform as possible in body type, weight, size, age, disposition, and previous background. This means sorting cattle in most cases. The cattle should also be healthy, which means that many groups will have to go through a conventional receiving program before they are ready for feeding.

21) Q. What kind of cattle are the best prospects for programmed feeding?

- A. Usually calves and very light-weight yearlings. When cattle are weighing over 600 pounds, because of their size, the efficient gains necessary to make programmed feeding economically feasible are almost impossible to obtain unless the ration is very cheap in relation to the value of gain of stocker cattle.

22) Q. What do you mean by “value of gain”?

- A. At any time other cattlemen and cattle feeders in particular are usually unwilling to pay more for added weight on cattle than they think it costs them to add it themselves. For example if 500 pound steers were selling for \$1.00 per pound or \$500 per head and if cost of gain in the industry was perceived at \$.50 per pound, then a 600 pound animal might be worth \$500 + \$50 or (\$550 divided by 600 pounds or \$91.66 per hundred weight). When evaluating any feeding program, the cattleman should always know the current “value of added weight gain” on stockers and feeders. Just because calves are selling for \$100 per cwt does not mean that the gain you add is going to be worth that much.

23) Q. What happens if all the feed is consumed before some of the weaker or timid cattle get to the bunk?

- A. When this happens you must react quickly and remove these animals from the pen and restart them in an environment in which they can compete. The alternative is dead or severely retarded cattle. Make provisions to have a place for these cattle before starting to program feed. In many cases some of these animals may be returned to the larger group after they gain strength and become competitive.

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