FEEDING AUSTRALIAN COMMERCIAL CATTLE IN THE PHILIPPINES

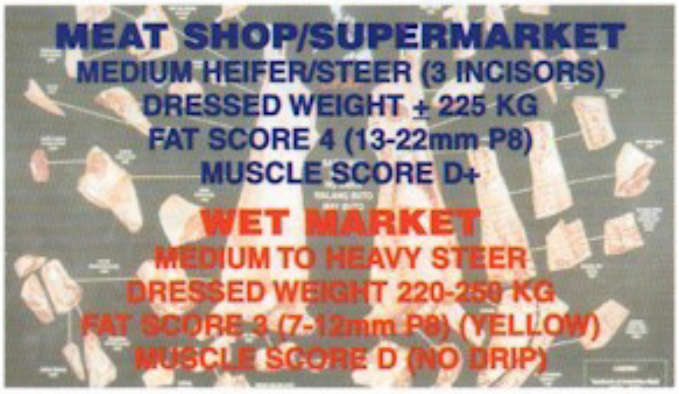
A Luzon Feedlot, Philippines

OVERVIEW OF OPERATION

More than 150,000 head of live cattle are exported from Australia to the Philippines annually. Both steers and heifers are imported for value adding operations mainly located around Manila (Luzon) and in Mindanao. Cattle with at least 50% Brahman content are normally selected with a growing preference for crosses with later maturing European breeds.

Types of feedlot production systems range from growing and finishing feeder cattle (330-350 kg) over a 60-90 day feeding period, to finishing heavier feeders (± 375 kg) or reconditioning and holding trade cattle (380-400 kg) prior to slaughter.

Cattle are finished at 380-450 kg and processed/marketed either within the operation for sale in meat shops/supermarkets or sold by liveweight (LW) to traders and butchers for the wet markets. The meat shop/supermarket trade generally requires a category medium steer (± 400 kg LW) with good fat cover whereas a much leaner carcass is preferred by the wet market traders, with yellow fat a desirable attribute.



The performance of cattle in the feedlot is affected by many factors including, sex, breed, prior history, feed additives and treatments with growth hormone promotants (HGPs). Standard Brahman crossbred feeder steers can achieve average daily gains (ADG) of 1.2 kg on optimum rations, however heifers do not perform as well (ADG ± 1.0 kg) whereas bulls outperform steers by about 10%.

A mixture of breed types is necessary to combine heat tolerance characteristics of the Brahman breed with faster growth rates and better meat quality characteristics of temperate breeds in order to maximise feedlot performance under SE Asian conditions. Brahman x European breeds, which tend to be larger than Brahman x British breeds of the same age, produce a heavier leaner carcass. The economic importance of traits of various Brahman crossbreds is an ongoing debate.

There are also differences within breeds because of prior history, which subsequently affects performance in the feedlot. For example, young feeders that enter the feedlot in forward store condition will tend to finish at lighter weights than older feeders of similar live weight and well-developed body frame. Feeders in backward store condition due to a period of restricted nutrition during the northern Australian dry season, will usually compensate with better than expected growth rates on feedlot rations.

The use of ionophores as feed additives and implants of HGP can significantly boost cattle performance in the feedlot. Ionophores increase feed efficiency and HGPs can improve ADG by 5-15%.

Thus performance of cattle in the feedlot depends on the type of feeder selected and their management at the start and during the feedlot operation. Moreover, formulation of optimum rations depends on seasonal availability of a range of good quality stockfeeds which can supply the nutrients to meet production requirements. It is therefore important to have realistic targets and follow best industry practices for feedlot management in order to maximise productivity, efficiency, and economic viability of the enterprise.

AVAILABILITY OF STOCKFEEDS

Roughages: These are fibrous bulky feeds (crude fibre > 20%) mainly in the form of green forages and dry hays or straws. Crop residues and silages are also included in this category.


Corn Forage

There is extensive use of fresh corn forage and Napier grass as sources of roughage in feedlot rations. These forages are generally available all year throughout the Philippines, although supply may be limited towards the end of the dry season (January-May) in Luzon where irrigation is not used. Supply can also be restricted by inaccessibility during the wet season (June-September). Amounts of roughage offered in the ration may also vary depending on the source, because operations that cultivate their own forage tend to incorporate higher levels into the ration than operations that rely on contract-grown forage. Sugarcane tops are available for about 6 months during the milling season (dry season). Rice hay is also abundant during the dry season, but has limited use as a stock feed because of its low nutritive value. Other sources of roughage are pineapple pulp/leaves and corncobs.

Concentrates: These feedstuffs contain high levels of protein and energy nutrients. They include energy feeds such as tapioca and cereal milling byproducts (corn bran, rice bran, wheat pollard), and protein meals derived from oilseed extraction processes (palm kernel cake, copra meal).

Corn grain is normally too expensive for cattle feed whereas corn forage, harvested with grain at doe stage, is a cheaper option for providing high quality concentrated energy feed. In Mindanao, dried cobs of corn are relatively inexpensive and when chopped provide an excellent source of energy as well as fibre in the ration. The availability of rice bran is seasonal with prices in Luzon falling at harvest following the wet season. The supply of wheat pollard is less predictable and is dependent on milling stocks for bakery industries throughout the Philippines. Tapioca is grown in Mindanao and the tubers, which are harvested all-year-round, can be chopped and sun-dried as a concentrated energy source for feedlot rations.


Tapioca Chips

Copra meal is the most commonly used protein meal for cattle feed in the Philippines. However because of the declining importance of copra as an export commodity, coconut plantations are being felled for timber and this will inevitably limit the availability of copra meal in the future. The less palatable palm kernel cake is readily available throughout the country. Soyabean meal is usually too costly as a cattle feed because of its demand for pig and poultry rations, however soyabean hulls may be used as a filler in concentrate feeds. Limited quantities of groundnut (peanut) meal can be purchased in Luzon and whole cottonseed is available in Mindanao.

Opportunity Feeds: Byproducts such as brewers spent grains, pineapple pulp and banana rejects, which would otherwise be dumped, are examples of cheap opportunity feeds for cattle rations. Brewers spent grains are a major bulky byproduct used by feedlotters, particularly around Manila, with most operations receiving deliveries two or three times per week. During the festival months of May and December, excess amounts of brewery spent grains are available which can be conserved as silage. Pineapple pulp, which is a byproduct of the canning industries in Mindanao, is the major source of bulk feed available in the region and the pineapple tops are also used as green chop. Green banana rejects are also available to some feedlotters both in Luzon and Mindanao. Other feedstuffs in this category include discarded cocoa pods in Mindanao and high energy feeds like biscuit and breakfast cereal waste which are available to some operations located near to factories in Luzon.

Other Feedstuffs: Molasses, which is a byproduct of sugar mills, is used to improve ration palatability and is generally available throughout the Philippines, however price is strongly influence by its demand for alcohol production. Ipil-ipil leaves from the tree legume leuceana, predominantly found in Mindanao, are sometimes used in rations to produce yellow fat.

Conservation of Feedstuffs: Cultivated forages and bulky byproducts can be preserved as silage with minimal loss of nutrients. The process involves fermentation of plant material in the absence of air, which releases preservatives in the form of acids. Fresh plant material (wilted to 55-65% moisture) is chopped and compacted (on the ground or in a silo) to eliminate air before sealing with black plastic kept in place with old tyres. High moisture bulky byproducts can be compacted in the same way but will tend to lose nutrients in seepage from the silo.

Planning: Knowledge of peak availability and relative cost of stockfeeds during the calendar year will help forward planning of ration formulations and advance purchase of concentrate feeds. Rations using fewer ingredients tend to be more sensitive to seasonal availability and price fluctuations than rations containing smaller amounts of a wider range of ingredients.

Climate and seasonal availability/price range of common feedstuffs in Luzon and Mindanao (1999)

MONTH	J	F	M	A	M	J	J	A	S	O	N	D
Rainfall (Luzon)	Dry Season						Wet Season					Dry
Rainfall (Mindanao)	Wet	Moderate Rainfall										Wet
Corn Forage	P1.00 (Luzon)						Limited by Accessibility					
Corn Stover	P0.40-0.50 (Luzon)											
Napier Grass	P0.20-0.70 (Luzon)			P0.75 (Mindanao)								
Sugacane Tops	P0.50 (Luzon)				Not available							
Pineapple Pulp (Wet)				P0.16 (Mindanao)								
Corn/Maize Grain	P6.00 - 7.40 (Luzon)											
Corn Bran	P4.50 (Luzon)			P3.00-4.50 (Mindanao)								
Corn on Cob				P2.00-3.80 (Mindanao)								
Rice Bran (D1)	P3.00-7.00 (Luzon)							Highest Price		Lowest Price		
Rice Bran (D2)	P1.00-2.50 (Luzon)											
Wheat Pollard	P2.95-6.00 (Luzon) Unpredictable Price Fluctuations											
Brewer's Grains (Dry)	P3.00-3.50 (Luzon)											
Brewer's Grains (Wet)	P0.50-0.70 (Luzon)			Excess		P0.50 (Mindanao)						Excess
Cassava Chip	P4.50-5.00 (Luzon			P2.00-2.50 (Mindanao)							Lowest Price	
Molasses	P2.50-2.70 (Luzon)			P2.20-2.70 (Mindanao)								
Green Bananas				P2.00 (Mindanao)								
Urea	P8.40-8.80											
Copra	P3.40-5.00 (Luzon)			P3.50 (Mindanao)			Price depends on world market					
Palm Kernel Cake	P3.80-4.00 (Luzon)											
Soyabean Meal	P15.00 (Luzon)											
Ipil-Ipil (Leucaena)	P2.50 (Luzon)											
Salt	P2.00-2.50											
Limestone	P1.00-2.00											
Calcium Phosphates	P12.00-16.50											
Premix	P63.00-125.00											

Corn grain, or its milling byproducts (grits and bran) which have similar feed value but higher fibre content, will generally boost feedlot performance when included in the ration. Although usually the most expensive feedstuff, it is desirable to feed about 1 kg/head/day of corn grain or its byproducts. The whole grain should be coarsely hammer milled (10-19 mm screens) or cracked by a roller to expose the grain contents. Another option is to feed 10-12 kg of freshly chopped corn forage with ears at doe stage to provide the equivalent amount of grain plus dietary requirements for roughage.

In Mindanao, chopped dried corncobs (with grain) fed at a rate of 40% of the ration can provide both concentrate energy and bulk fibre which substitutes for roughage. However, most operators also include some fresh green forage in the ration when feeding corncob.

Other Energy Concentrates: The most commonly available feedstuffs in this category are the cereal byproducts rice bran (from polishing process) and wheat pollard (from flour milling) and cassava tubers processed as tapioca chips or cassava (tapioca) waste after starch extraction.

Both rice bran (D1 grade or D1/D2 blends) and wheat pollard (hard or soft) are normally fed together as mixtures to benefit from the range of nutrients supplied and to minimise effects of changes in ration composition when availability of one of these ingredients is limited.

High quality rice bran (D1 grade) which is least contaminated with hulls (<9% crude fibre) is the best substitute for corn if corn is not available. However since rice bran contains relative high levels of unsaturated oil, it should not exceed 25% of total dietary dry matter to avoid deposition of soft fat.

Wheat pollard is a very palatable energy and protein source for cattle, and is also rich in phosphorus and vitamin E. The pollard may be fed up to 45% of the total ration (dry feed basis), however cattle performance on pollard alone may not be as good as mixtures that includes corn and rice bran.

Dried tapioca chips and waste can also be fed as the major energy source for feeder rations and can be included at levels up to 50%, however better performance is likely when included with corn or mixed with other cereal byproducts. Since tapioca contains very little protein it should be fed with urea (2.5% urea/kg tapioca) or a protein source that is readily degraded in the rumen of cattle.

Protein Meals: Copra and palm kernel cake (PKC) are the main concentrate proteins meals used in feedlot rations in the Philippines. Brewers spent grains (dry) also serve as a suitable protein source as do wet spent grains. Other protein sources available include soyabean and groundnut meals, cottonseed and dried ipil-ipil.

CONCENTRATE FEED OPTIONS (5-7 KG AS FED)	
Energy Concentrates:	
Corn Grain	20%
Rice Bran Wheat Pollard Tapica Waste (+ Urea)	35-40%
Protein Meals:	
Copra Meal Palm Kernal Cake Brewers Grains (Dry)	30%
Soyabean Meal Groundnut Meal Cottonseed Whole/Meal Ipil-Ipil (Leucaena)	(<15%)
Molasses	6-12%
Urea	0-1.5%
Salt	0.3%
Limestone/MAP	1.5% / 1.5%
Limestone/Monocalphos	0.75% / 1.5%
Dicalphos	2.5%
Tricalphos	2%
Premix	0.2%

Copra is a better feed than PKC in terms of protein quality and palatability. There are variable losses in nutrients from wet brewers spent grains and regular analysis of feed value should be considered. However protein quality is usually improved by drying.

Copra, PKC and brewers grains (dry) are interchangeable as protein sources in the concentrate feed and can be fed individually or combined at a rate of 30% in the concentrate feed.

Soyabean and groundnut meals are both high in protein. Soyabean meal provides a very high quality protein source whereas groundnut meal is the more variable product. Both protein meals may comprise up to 15% of the concentrate feed.

Cottonseed (whole/meal) contains toxic compounds and is restricted to 15% of the concentrate feed. Chemical residues form heavy crop spraying may also limit the use of this feed.

Ipil-Ipil (dried leucaena leaves) is a good quality protein supplement for cattle. The leaves contain the toxin mimosine which cannot be degraded by many Australian cattle. Therefore this feed should be restricted to about 15% of the concentrate feed. Most feedlotters include ipil-ipil in the ration to produce yellow fat.

Approximate feed value and level of ration ingredients used for lotfeeding Australian cattle in SE Asia (dry feed basis).

DM Dry Matter
CP Crude Protein
RDP Rumen Degradable Protein
CF Crude Fibre
ME Meta-bolisable Energy
MJ Megajoules
Ca Calcium
P Phosphorus

FEEDSTUFF	DM (%)	CP (%)	RDP (%)	CF (%)	ME (MJ)/kg	Ca (%)	P (%)	Max Level
ROUGHAGE								
Forage Maize (75 Days)	25	8.00	53	30	9.9	0.34	0.23	25%
Forage Maize (Stover)	25	5.50	65	30	8.9	0.60	0.10	10-20%
Sugarcane Tops	28	6.00	65	35	7.7	0.50	0.20	25%
Napier Grass (75 Days)	25	8.50	65	34	7.5	0.50	0.30	25%
Rice Straw	92	3.90	75	39	5.5	0.50	0.20	10%
Pineapple Pulp	12	3.30	75	26	10.1	0.40	0.10	20%
ENERGY CONCENTRATES								
Corn (Cracked/Ground)	91	10.00	75	3	12.5	0.03	0.30	85%
Corn Bran	90	9.60	60	13	12.5	0.06	0.73	15-25%
Wheat Pollard	88	17.60	79	8	11.0	0.20	1.00	45%
Rice Bran	91	14.00	66	13	11.8	0.07	1.60	15-25%
Tapioca Chips	88	3.00	80	4.3	12.8	0.15	0.15	65%
Tapioca Waste	90	2.00	90	3	12.0	0.60	0.20	<50%
Sago Rasps	89	0.5	75(?)	5	10.0	0.04	0.02	30%
Green Bananas	22	5.75	80(?)	4	13.0	0.06	0.20	<60%
Molasses	75	5.00	100	0	12.5	0.60	0.10	15, 90%
PROTEIN CONCENTRATES								
Palm Kernel Cake	89	19.00	74	13	12.2	0.30	0.70	<50%
Copra Meal	90	20.00	35	7	12.5	0.20	0.70	25%
Soyabean Meal	89	47.20	65	8	13.7	0.27	0.70	5-10%
Groundnut Meal	86	34.00	80	27	11.7	0.20	0.60	25%
Brewers Spent Grains	22	24.00	73	15	10.0	0.33	0.13	15%
Cotton Seed (Whole)	93	21.10	65	22	14.0	0.16	0.76	10-15%
Kapok Seed Meal	90	31.00	45	30	8.7	0.50	1.30	10%
Cocoa Bean Shell	91	22.60	45	14	12.6	0.15	0.27	10%
Leucaena (Ipil-Ipil) Leaf Meal	92	26.70	45	21	10.9	2.20	0.30	10%
Urea	100	(287)	100	0	0	0	0	<2%
MINERALS								
Limestone	100	0	0	0	0	34.00	0	
Monocalcium Phosphate	100	0	0	0	0	16.00	24.50	
Dicalcium Phosphates	100	0	0	0	0	22.00	19.30	
Tricalcium Phosphate	100	0	0	0	0	39.00	20.00	
Mono Ammonium Phosphate (MAP)	100	[76]	0	0	0	0	27.00	

Molasses: This feedstuff contains 50% soluble sugars plus a wide range of minerals. Too much molasses inhibits digestion of forages in the forestomach, therefore its use is mostly restricted to about 6-12% of the concentrate feed. The primary function of molasses is to increase palatability of the ration, however the sugars may also stimulate flagging microbial activity in the rumen.

Urea: A small amount of fertiliser grade urea is required to provide supplementary nitrogen to rumen micro-organisms when feeding tapioca waste or when feed protein levels are low. The addition of about 1% urea in the ration concentrate will raise the protein equivalent of the concentrate by 2.5%. To avoid poisoning cattle, urea must be administered properly by micro-mixing with a suitable carrier such as rice bran before thoroughly mixing into the concentrate feed, or by dissolving in a molasses solution. Commercial preparations of slow-release urea are more efficient and less risky.

Salt: Provision of adequate salt at a rate of 15 g per head daily is important for cattle in hot climates.

Calcium (Ca) and Phosphorus (P): Standard feeders require 35 g C and 25 g P daily. Adding combinations of limestone and mono (or dibasic) ammonium phosphate (MAP) or monocalcium phosphate can meet this requirement. 100 g of MAP also provides 12 g nitrogen which is equivalent to 26 g urea. Alternatively, 150 g of dicalcium phosphate or 125 g of tricalcium phosphate will provide the needs for both Ca and P.

Sulphur: This mineral is necessary for the formation of proteins by growing colonies of rumen microorganisms, particularly in diets containing urea. About 13 g/head daily of elemental sulphur can be used or 100 g of ammonium sulphate which will also provide 10 g of nitrogen (equivalent to 22 g urea).

Macro mineral mixes: A mix of tricalcium phosphate (50%), salt (5%), potassium chloride (10%), sodium bicarbonate (15%), ammonium sulphate (20%), provided at a rate of 200 g mix/head or 3.5% of a concentrate feed, will generally cover the needs of lot-fed cattle for major mineral nutrients and stabilising additives.

Feed Additives: Monensin and lasolocid are examples of ionophores that increase levels of energy available to the animal from microbial degradation of feedstuffs (fermentation) in the forestomach (rumen). Beneficial responses are increases in feed efficiency (± 10%) and reduction in incidence of bloat. Other additives include sodium bicarbonate and sodim bentonite which stabalise acid levels in the rumen. The latter may also prevent bloat and absorption of toxins.

Trace Trace Minerals and Vitamins (Premixes): Cattle feeding on high concentrate rations need Vitamins A and E, however this is less critical where green forage and yellow corn are being fed. These vitamins can be administered by injection to feeders on entry into the feedlot. Alternatively, vitamins and trace minerals are conveniently supplied in the form of commercial premixes or lick blocks. An example of a premixes is given below.

PREMIX FOR FEEDLOT CATTLE

Nutrient/ Additive	Requirements (per kg dry feed)	Source Material	Amount of Source Material (mg)	(% Mix)	Nutrient Analysis (per kg Mix)
Vitamin A	2,500 iu	β-carotene	4.5	0.23	1,250,000 iu
Vitamin E	20 iu	Di-α-tocopherol acetate	13.3	0.67	10,000 iu
Magnesium	500 mg	Magnesium Oxide	833	37.5	225,000 mg
Manganese	20 mg	Manganese Sulphate	55	2.75	10,000 mg
Iron	30 mg	Ferrous Sulphate	149	8.69	17,500 mg
Copper	5 mg	Copper Sulphate	20	0.98	2,500 mg
Cobolt	0.15 mg	Cobalt Sulphate	0.5	0.02	75 mg
Zinc	25 mg	Zinc Oxide	31	1.56	12,500 mg
Selenium	0.1 mg	Sodium Selenate	0.2	0.01	50 mg
Ionophore	25 mg	Rumensin® (Sodium Monensin)	25	1.25	12.5 g
Antioxidant	2 mg	Butylated hydroxytoluene (BTH)	1	0.05	1,000 mg
Carrier	-	Calcium Carbonate	926	46.3	463 g

Add 2 kg Premix per tonne of dry feed.

Water: Cool clean water should be available at all times and buried pipes help to keep water cool. The water requirements of cattle increase as the temperature gets hotter. Adding salt to the diet tends to increase drinking rate and high levels of salt in the water can depress feed intake.

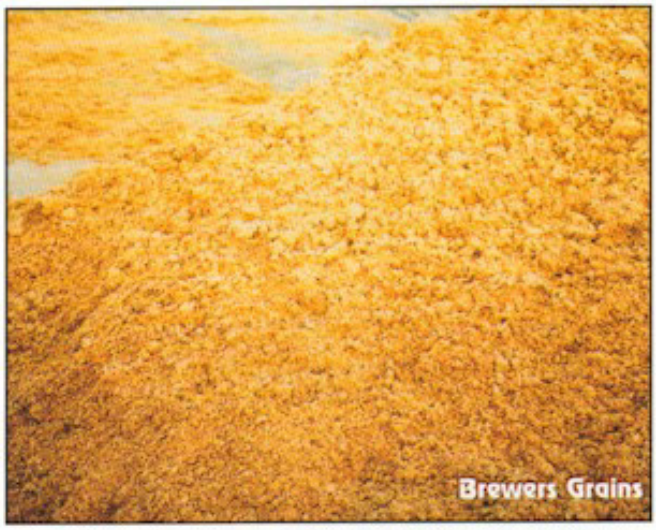
WATER INTAKE OF BRAHAM CATTLE (LITRES/DAY)			
Liveweight	25°C	30°C	35°C
300 kg	30	50	55
350 kg	35	55	65
400 kg	37	60	70


Mixing Feed

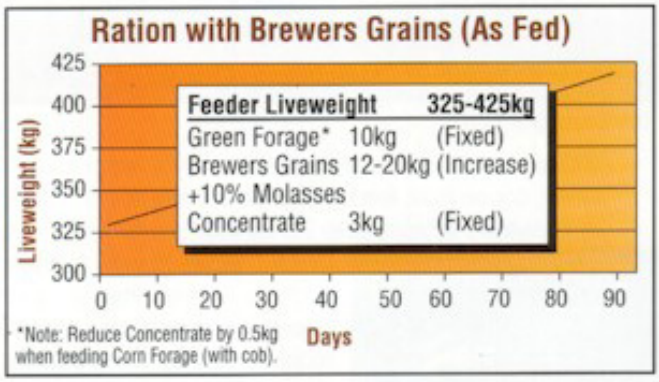
BULKY BYPRODUCTS

Brewers Spent Grains: This byproduct consists of mashed cereal grain (mainly barley and rice). It is a cheap and relatively digestible bulky feed providing energy and substantial quantities of feed protein, thereby reducing the need for concentrate feed in feeder rations. The spent grains may also contain yeast residues, which are rich in B vitamins. The fresh byproduct contains 80% or more water making transport over long distances prohibitively expensive.

Fresh brewer's grains are very palatable to cattle and addition of molasses helps to maintain its palatability until consumed. Some if not all of the wet grains should be mixed together with the other ration ingredients and offered at least twice daily. There also appears to be advantages in mixing the whole ration and leaving it to ferment overnight before feeding out the following day.

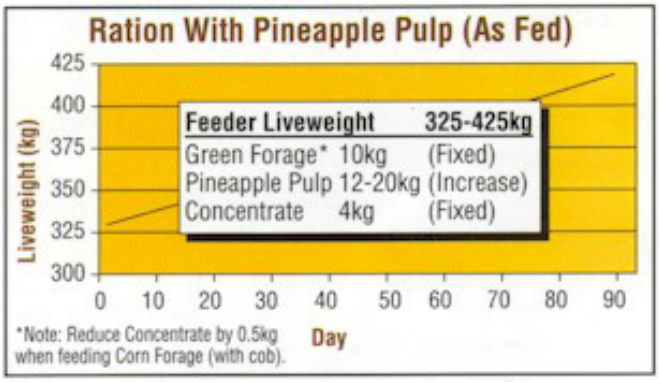


Wet spent grains should be fed within 3 days of delivery, or ensiled with molasses (10%) and salt (5%) and covered tightly with canvas/plastic, or sun dried to 10% moisture and preserved with salt (5%).



Pineapple Pulp: The pulp consists of the outer skin and inner core of the fruit, which contains citric acid and large amounts of sugar. This feedstuff is an excellent energy source for cattle, limited only by its relatively high fibre content. It is therefore best fed as part of the roughage component of the diet (up to 60% fresh basis) together with green forages such as chopped pineapple leaves, Napier grass or corn forage. The fresh pulp is very wet containing ±85% water and when left standing the sugars rapidly convert to lactic acid. Because of the acidic nature of the fresh pulp, it should be gradually introduced to new cattle with the addition of 50 g/head/day of sodium bicarbonate in the concentrate. Feed the roughage/concentrate mix separately on top of the pineapple pulp.

Loads of wet pineapple pulp can be left standing for up to 5 days allowing fermentation processes to enhance the nutritive value of the feed. For long term storage, the fresh pulp can be ensiling, for example (fresh basis): pineapple pulp (75%), corn forage with cob (15%), molasses (8.5%), urea (1.5%).



Green Bananas: Rejected green bananas are an excellent source of starch energy (± 70%), however protein content is low. Rations containing high levels of bananas should be supplemented with urea (as 10% urea/molasses offered free choice) or a degradable protein such as groundnut meal or palm kernel cake. Cattle relish bananas and no processing is required, however salt should be added. Long-term feeding banana rations increases horn and hoof growth.

FEED MANAGEMENT

Dry Matter Intake: A major goal of feed management is to maximise intake (consumption) of feed dry matter (DM) by cattle because this is closely related to animal productivity. In the USA and Australia, where cereal grains such as corn/maize and sorghum make up the bulk of the feedlot ration, DM intakes of 3% LW can be achieved. Lot feeding in Asia is based on the availability of agricultural byproducts which are more variable in terms of their feed value compared with grains and DM intakes tend to be lower at 2.3-2.5% LW. Other factors such as breed and temperature also affect feed intakes.

Daily Feed Supply: New arrivals are normally processed (examined, treated, sorted, weighed) before being allocated to pens in the feedlot. Daily feed requirements for each pen group of animals can be calculated from the group weight (see box). Feed consumption should be monitored daily and adjusted weekly according to presence or absence of overnight leftovers. The dry matter consumption factor (2.3%LW) will vary from feedlot to feedlot and can be calculated for each operation from feed consumption records.

Example of Calculating Daily Feed Supply

(a) Total LW of Pen Group (15 hdx325kg) = 4,875kg

(b) Total Feed Required (kg DM) (2.3%xLW) = 112kg

(c) Ration Composition and Daily Supply (DM Basis):

Roughage 25% (x b) = 28kg DM
Concentrate 75% (x b) = 84kg DM

(d) Dry Matter Content of Feedstuff:

Roughage 30%
Concentrate 90%

(e) Daily Supply of Ration Components (kg As Fed)

Roughage (c/d) = 93kg (50%)
Concentrate (c/d) = 93kg (50%)

Introduction to ration: New feeders should not be offered high levels of concentrate feed until their digestive function is normal following shipment and transit to the feedlot. This can take up to 2 weeks. New arrivals should be gradually introduced to the feedlot ration using a feeding program similar to the one above (top of next column).

Days	Roughage	Concentrates
1-3	100%	
4-6	80%	20%
7-9	60%	40%
10+	45%	55%

It is important to observe all new feeders closely during the first few weeks in the feedlot to ensure that they are feeding. Animals that are not feeding must be separated and fed individually with adequate amounts of green fodder. At this point, vitamin complex and antibiotics may be administered. Animals should be slaughtered if they do not respond to treatment.

Sodium bicarbonate can be added to the concentrate feed at a rate of 50g/head/day to help prevent digestive disorders. A solution of electrolyte and energy supplements administered to the trough water also helps to stimulated new cattle to eat after shipment. Electrolyte preparations are commercially available or can be formulated on site. For example, a simple electrolyte (100%) can be made from salt (5%), potassium chloride (KCl) (5%), magnesium sulphate (5%), mixed with water (35%) and molasses (50%), and added to drinking water at a rate of 2% (2 litres electrolyte solution per 100 litres water).

Roughage/Concentrate Feeding Rate: The amount of concentrate feed provided to fast growing cattle in the feedlot depends on the quality (digestibility) of the forage. As shown in the table below, generally higher levels of the more digestible green forages can be fed than poorer quality dry roughages. It should be noted that there is seasonal variation in moisture content of roughages, especially green forages. DM content of feedstuffs can be easily measured (see Measurement of Dry Matter below).

Forage Source	Roughage	Concentrates
Green Forage	± 30% (65%)	± 70% (35%)
Dry Roughage	± 15% (30%)	± 85% (70%)

Dry Basis (As Fed)

With dry, low quality roughage such as rice hay or maize stover, concentrate feed should be at a rate of 6.0 kg/300 kg liveweight increasing to 7.5 kg/400 kg liveweight. For better quality green forages such as forage maize and Napier less concentrate feed is required (5-6 kg over the same liveweight range). Even less concentrate feed is needed when feeding bulky byproducts like pineapple residues and brewers spent grains (3-4 kg over the same liveweight range).

MEASUREMENT OF DRY MATTER

(a) Place about 200g of fresh feed in a paper bag and weigh using kitchen scales, for example 195g.

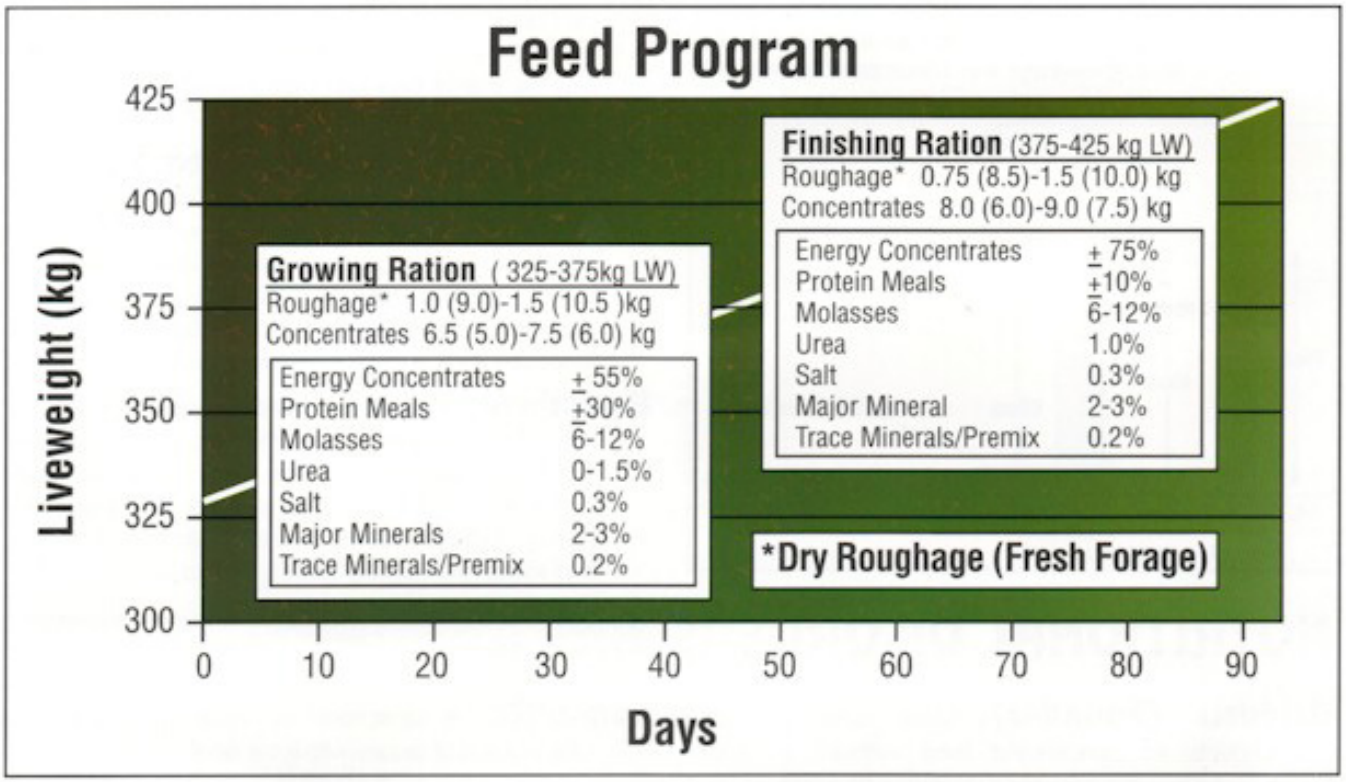
(b) Dry in low oven for 3 hrs (or Microwave for 15 mins).

(c) Weigh sample again. Repeat drying process until weight does not change (±9 hrs for oven drying), for example 50 g.

$$\text{Dry Matter} = \frac{\text{Final Weight}}{\text{Initial Weight}} \times 100\%$$

[50/195] x 100 = 26% Dry Matter

Growing/Finishing Rations: Feedlot operations targeting the meat shop/supermarket trade should consider a two stage-feeding program as illustrated below. It is recommended that the growing ration (standard Asian feedlot ration) is followed by a finishing ration which contains less protein meal (replaced with urea) and more energy concentrate feeds. The finishing ration should be implemented at least 45 days before slaughter to enhance meat quality.



Holding Rations: Feed roughage to appetite and supplement with 2-3 kg of concentrate feed if using good quality roughage.

Method of Feeding: The best method is to chop fresh forage or dry roughage and mix it with the concentrate feed so that each animal gets the required amount of ingredients. If mixing is not possible, the concentrate feed and the roughage can be fed separately. Half the concentrate feed is fed out in the morning mixed (by hand) with a small amount of chopped roughage. The remaining half of the roughage is fed later in the morning. This is repeated in the afternoon with the other half of the daily supply of concentrate feed and roughage. It is important that feed troughs should never be left empty for more than a few hours. Normal practice is to feed at least twice daily, with extra roughage provided overnight.

FEED TROUGHS SHOULD NEVER BE LEFT EMPTY

Ration ingredients should be changed as little as possible, or gradually over a period of time.

Affect of Overcrowding: High pen densities and inadequate trough space encourage nutritional disorders within the pen group. Nutritional problems arise particularly when forage in the ration is limited and fed separately. The more aggressive eaters consume all the forage, leaving one or two animals with only concentrate feed to eat. These animals often stand out as poor doers with evidence of 'empty gut'. Overcrowding should be avoided, or if necessary for a short period, ensure roughage is chopped and mixed with concentrate feed, or provide extra roughage.

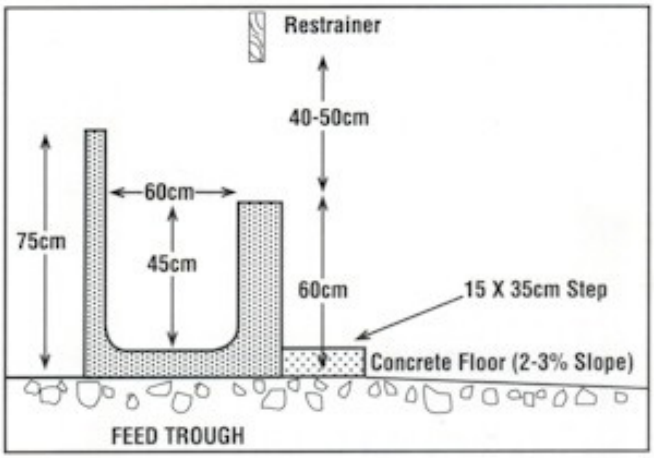
Feed plans/inventories: Feed costs represent a significant proportion (65%) of total operational cost. Feed inventories should be planned as part of operational budget projections for each group or batch of cattle purchased to be fattened. Projected feed requirements can be estimated as for the Calculation of Daily Feed Supply (see box on page 10) using the expected LW at the mid-way point of the planned feeding period. Plan to buy in sufficient feed for the whole feeding period if possible, or at least stocks for one month, ensuring a gradual change from batch of feed to another.

OPERATIONAL BUDGET PROJECTION	
Sales (per month)	Total Income (A)
Purchased Price Feed Costs Transport Feed	Variable Costs (B)
Wages Utility Charges Maintenance Interest charges	Fixed Costs (C)
	PROFIT = A - (B+C)

FACILITIES AND EQUIPMENT

Yards and Troughs: It is easier to manage small groups of animals of about 25 head per yard. The density of animals should not be less than 4.5 m2/animal for sheltered yards with well-drained concrete floors. The average size feeder normally requires at least 50 cm head space at the feed trough if feeding roughage and concentrate separately, or 3/4 this spacing for continuous feeding of a totally mixed ration. See illustration of the cross-section dimensions of a typical feed trough.

Yard dimensions for 25 head (300-400 kg) would be 12.5 m (feed trough) x 10 m. Water troughs (>2 m in length) may be shared between pens but should be located away from the feed trough.



Feed Store/Preparation Area: A feedlot of 1000 cattle will process daily 1-10 MT of forage and 5-7 MT of concentrate feed. A well-ventilated shed is needed to store enough concentrate ingredients for 1-3 months feeding (allow 0.5 MT storage capacity per animal). A covered area with a concrete floor is required to receive and chop the forage and mix feed ingredients.

Equipment: In contrast to Western feedlot operations, much of the work in SE Asian feedlots is done manually. The main equipment used are forage chopper, concentrate feed mixer, tractor with front-end loader (for mixing roughage and concentrate), trailer or truck/wagon, and scales for weighing cattle and feed.

NUTRITIONAL DISORDERS

Acidosis (Founder): Cattle consuming large amounts of concentrate feed without a proper introductory program are susceptible to acidosis. Feed affected cattle with good quality green forage before reintroducing concentrates with sodium bicarbonate added.

Rumenitis/Liver Abscesses: Caused by inflammation of damaged wall of forestomach due to prolonged acidosis or sharp foreign object like a nail. Subsequent bacterial infection can eventually lead to liver abscesses, which are normally treated with antibiotics.

Bloat: This occurs when foamy digestive gases associated with diet, overeating, exercise or rumenitis, are prevented from escaping the forestomach. Treatments include drenching with mineral oil or other surfactants, and in acute cases, using a stomach tube or trocar cannular to release the gas.

Mouldy Feed: Prolonged storage of feeds in hot and humid conditions creates optimum conditions for growth of moulds such as *Aspergillus flavus*. This particular fungus produces a toxic factor called aflatoxin, which mainly causes liver damage with symptoms of diarrhoea, jaundice, unsteadiness and grinding teeth. Younger animals (< 6 months) are more susceptible and than yearlings or adults. Cattle Feeds containing less than 0.05 mg/kg (5ppb) of the toxin should not affect feeder cattle.

Laminitis: A symptom of acidosis caused by inflammation of tissues within the hoof.

Urea Poisoning: Ingestion of urea granules, which have not been dissolved or mixed properly, can result in sudden death.

Polio Encephalomacia: The symptoms of this disease are impared vision, loss of coordination and paralysis of hind legs associated with brain damage. The cause is acute deficiency of thiamine (Vitamin B12) normally produced by rumen bacteria and could be the result of prolonged cobalt deficiency in the animal's diet.

Pasteurellosis (Shipping Fever): An infectious viral disease also known as haemorrhagic septicaemia which affects respiratory tissues and may be brought on by transport or environmental stress including sudden changes in nutrition.

CONVERSIONS

- **Metabolisable Energy (MJ)** = Calories / 4.184 = TDN x 0.1476
- **Crude Protein** = Nitrogen Content x 6.25
- **Crude Fibre** = Acid Detergent Fibre / 1.15 (Approximately)