
Chapter 6

FEED INDUSTRY

1. INTRODUCTION

Livestock and Fisheries is combined as a sector, which contributed 8% to National GDP and 23% to Agriculture GDP. Livestock sub-sector comprised about 60% of total Livestock and Fisheries Sector. Private sector contributes 98% of total value of Livestock sub-sector. Livestock economy is integrated with agriculture economy. Draft power in use of cattle and buffalo is a major important in the field of crop cultivation and rural transport. About 8 millions of cattle and buffaloes are detained for draft working purpose. Other animal population such as sheep and goat, pig, poultry and duck include 1.97 million numbers, 4.50 million numbers 57.13 million numbers and 72.9 million numbers respectively. 0.7 million metric ton of milk, 0.4 million metric ton of meat and over two billion numbers of eggs are produced yearly. Poultry meat is taken amount in 49% of total meat production. Beef is about 15% and pork is about 27% of total meat of domestic products. Abattoirs and meat processing plants with certain level of standard are being operated on the production of value-added products. Abattoirs and processing plants are needed to strengthen facilities in line with at least ASEAN level.

Myanmar is an agricultural country with the net sown area of 1 million hectares annually. Multiple cropping has been practiced throughout the year. Draught cattle and buffaloes do almost all the land cultivation. Together with the agricultural activities livestock and poultry farming has been undertaken traditionally. With the advent of the market-oriented economy, livestock sector has been on the progress like other sectors. New technologies, breeds and inputs provide large scale production on commercial breeding. Livestock production has been on the increase to meet the requirement of the growing human population. As a result, the demand for feed for the livestock and poultry production is ever increasing.

Generally, feed resources are derived from two sources: from agriculture sector and fishery sector. Related with agriculture sector, several agricultural commodities suitable for animal feeds such as broken rice, maize, soybean, sorghum, rice bran. Concerned with fishery products, there are dried fish meal, steamed fish meal, fish oil, oyster shell and prawn meal, etc. Feed mills, which is major role for agro-based industry are crucial for livestock and fisheries sectors especially for poultry farming, aquaculture farming cattle and swine farming.

Prices of animal feeds depend upon the prices of agriculture and fishery products that utilized for raw materials for mixing proportionately for feeds as pellet forms or powder forms. Systematic and effective utilization of agricultural by-products should be taught to the farmers to adopt the most effective livestock breeding. Arrangements are necessary to facilitate market and credit availability to promote livestock breeding. This will help to establish livestock based supportive industry such as feed mills, cold storage and canning factory.

Proper utilization of non-conventional feedstuffs are also important in some location where major feedstuffs are not available. Some analytical figures of nutritional value for both conventional feedstuffs and non-conventional feedstuffs are mentioned.

Establishment of systematic grazing ground is very important for ruminant farming. Improving pastures by introducing high value legume species and grasses are most crucial areas. Decreasing pasture areas is not to be encouraged large-scale farming to establish location for ruminant animal breeding in Myanmar. Some adjustments on policy issues are recommended at the last section.

2. CURRENT STATUS OF LIVESTOCK AND FISHERIES SECTOR

Currently, government has laid down the policies to produce food locally so as to meet the requirement of the nation's self-sufficiency. Priorities are given to boost the production from agriculture and livestock sectors. Both foreign and local companies become involving in the live-

stock and poultry farming activities. Farming pattern changed from small-scale into semi-commercial and commercial farming system. Intensive poultry farming has been brought out not only in the vicinity of urban area but also in the rural, remote places. Livestock production is characterized by small-scale back yard farming.

2.1. Ruminant Farming

Each and every farmer keeps at least a pair of working cattle or buffaloes. In addition, one or two pigs, a small flock of poultry are kept to meet the food requirement and for emergency sale. Extensive farming is the common practice among village level. Large and small ruminants are usually grazed out to common grazing ground in the morning and brought back home in the afternoon. Animals fully rely on natural vegetation in the rainy season. In summer time, maize, rice straw and other roughages are provided to ruminants.

2.2. Small-Scale Animals Production

Intensive small-scale livestock and poultry farming have been increasing in number after the market economy had been practiced. New breeds of pig and poultry were imported for further breeding. Hatching eggs and day old chicken (DOC) were brought for poultry production. Local hatcheries were set up to fulfill the demand for poultry farming. Large and medium scales feed mills were built up in large cities. Feeds produced by the mills are derived from locally available feedstuff. CP Company from Thailand and May Kha Company from Indonesia are foreign companies landed earlier to launch the livestock enterprise in the country.

2.3. Animal Population and Growth

2.3.1. Livestock Sector

Pattern of livestock farming is small-scale in general by rural farmers. Government and commercial farmers own large-scale breeding farms. To increase animal population resources is a primary objective for the

increased production of domestic livestock products. Animal population and growth data are shown with the following table.

Table 1 : Animal Population

(number in million)

Sr. No.	Species	1996-97	2001-02	Annual growth on the average (from 1996 to 2001)	2002-03
1	Cattle	10.31	11.22	2.1%	11.55
2	Buffalo	2.30	2.51	2.1%	2.55
3	Sheep & Goat	1.64	1.84	2.9%	1.97
4	Pig	3.40	4.14	5.0%	4.50
5	Poultry	33.37	48.27	9.7%	57.13
6	Duck	5.63	6.83	5.0%	7.29

Source: Livestock Breeding and Veterinary Department (LBVD).

Domestic livestock product especially in poultry meat is boosting up with high momentum in recent years.

Table 2 : Livestock Products

(thousand)

Sr. No.	Particular	1996-97	2001-02	Annual growth on the average
1.	Working draft (Head) (cattle/buffalo)	6,922	8,096	4.24%
2.	Beef	51.7	75.3	11.41%
3.	Lamb & mutton (mt)	7.9	11.9	12.66%
4.	Pork (mt)	72.4	134.6	21.48%
5.	Poultry meat (mt)	116.8	247.7	28.02%
6.	Duck meat (mt)	17.9	30.5	17.60%
7.	Others meat (mt)	1.8	2.3	6.94%
	Total meat (mt)	2,68.5	5,02.3	21.77 %
8.	Poultry eggs (Nos.)	107,112	2,108,366	24.21%
9.	Duck eggs (Nos.)	16,122	268,231	16.59%
	Total Eggs	123,234	2,376,597	23.21 %
10.	Milk (mt)	562.7	761.1	8.81%
	Total Milk (mt)	562.7	761.1	8.81 %

Source: LBVD.

2.3.2. Fishery Sector

According to the available data, aquaculture-farming acreage has been

expanded year by year and there are altogether 99,807 acres of fish-ponds in fiscal year 2001-02 are undertaken all over the country except Rakhine State. Fresh water fish were produced by two ways: naturally catch from lakes, creeks and rivers and catch from aquaculture farming. Annual production of fresh water fish are mentioned as follows:

Table 3 : Annual Production of Fresh Water Fish

(million viss)

Sr. No.	Categories	1999/2000	2000/2001	2001/2002	up to May 2002
1	catch from lakes	49.058	55.249	58.320	1.405
2	catch from creeks, rivers, etc.	67.119	88.483	97.263	4.130
3	from aquaculture farming	60.513	60.653	102.893	5.879
	Total production	176.690	204.385	258.476	11.414

Source: LBVD.

According to statistics derived from Ministry of Livestock and Fisheries, acreage of fresh water prawns are expanding year by year and altogether 119,784 acres of ponds are established in Rakhine State, Mon State, Ayeyarwaddy Division, Yangon, Bago Division and Tanintharyi Division. Production of freshwater prawns are tabulated as follows:

Table 4 : Annual Production of Fresh Water Prawns

(million viss)

Categories	2001/2002	up to May 2002
Catch from ponds	4.904	1.401
Total production	4.904	1.401

Source: LBVD.

3. FEEDING SYSTEM

3.1. Feeding to Cattle and Buffaloes

Draft cattle and buffaloes are ranged on grazing in the pasture or uncropping fields. Animals are fed with grass or straws by cut and carry during the crop season. Cattle and buffaloes in some areas are left freely without cowherd into the woodland for grazing the whole year round

apart from the raining season. Some groups of animals are accustomed grazing by moving from place to place under care of cowherd. Dairy cattle are normally fed ration feed on roughages and concentrates in cow-shed.

3.2. Feeding to Poultry, Duck, Sheep, Goat and Pig

Local indigenous breeds of poultry and duck are fed with scavenges. Sheep and goat are ranged in feeding on the grazing ground. Commercial pig, poultry and duck are fed with nutritional diet by intensive system that apply concentrates and fish meals.

4. FEED SOURCES AND REQUIREMENTS

Feeds are derived from two sources, agriculture and fisheries. Types of feed include roughages, concentrates and fish meals.

4.1. Roughages

Most roughages are by-products and wastes from agricultural sector, such as paddy, rice and wheat straw, maize stover, legumes stems and leaves and cane tops. Natural grass is available only in the raining season at grazing grounds and roadsides. Since multiple cropping of rice is applied in irrigated areas, the volumes of paddy straw become doubled. A certain portion is used as feed and the remainder is burned down for the improvement of soil fertility. Some of the paddy straws are utilized for straw mushroom cultivation at the urban areas, Nattalin and Thegone township of Bago Division. Straw treatment with urea for ruminant feeding was introduced under FAO UNDP program. But the increasingly high price of urea is a limiting factor for further extension. In addition to agricultural wastes, trees planted under forestry activities like glinicia, Baw-sa-kaing (*leucaena leucocephala*), Nyan-pin (*Sesbania aculeate*) are widely used as fodder for ruminants. Wild taro leave stems and Bedapin: water-hyacinth (*Eichhornia crassipes, solms*) are also useful feed sources for swine farming in Myanmar. Wild taro stems are boiled with water and mixed with broken rice and oil cake to feed swine. Some rural household practice small-scale pig farming by using scavenges.

Other naturally available roughages include, wild taro stocks, water-hyacinth and several varieties of grasses. Sorghums and millets are also important animal roughages in Shan State, Chin State, Mandalay, Magway and Sagaing Divisions. Millets include foxtail millet, pear millet, finger millet, common millet and little millet. Another potential roughage is *Kenaf leaf*, which is being famous as 21st century crop.

4.2. Concentrates

Agricultural by-products such as broken rice, rice bran, maize are used as energy feed. For protein sources groundnut and sesame cake are commonly used for feed. These products come from the middle and upper parts of the country where oil crops are extensively grown. Out of 67.6 million hectares of land, 14% of the land area is under crop cultivation where as 49% is under area reserved forests and other forest. At present, 9.67 million hectares are under cultivation. Of the total area sown, about 1 million hectares or 7% is under perennial crops and the rest is under seasonal crops. About 65% was cultivated during monsoon season and 25% and 10% of cultivation were done during winter and summer season respectively. Cereal crops, oil crops and pulses constitute 48%, 17% and 18% of the total cultivated land respectively.

Due to multiple cropping of rice throughout the year, it seems to be a surplus of roughages for ruminant in the country. According to statistics from Livestock Breeding and Veterinary Department, availability of animal feeds for year 2001-02 is as follows: broken rice 6.3 lakh tons, yellow maize 1.2 lakh tons, rice bran 2.8 lakh tons and oil cakes 1.7 lakh tons.

In practice, some animals are unable to access to roughages because of weather and geographical conditions that hinder the accessibility of the animals. When the surplus fodder is not accessible to animals until the next growing season, it is usually burnt for ash fertilizer. Instead of animal feed, some agricultural by-products are used for the other purposes such as local snacks, food and brewery. Preservation techniques like silage making, haymaking are encouraged to maintain nutritive quality of feed and to preserve for future use.

4.3. Fishery Products and Fish Meals

Fish and prawn meals are derived from fishery sector. Fishery resources are divided into fresh water resources and marine water resources. Fresh water fisheries are mainly dependent on the riverine system of the country. The four main rivers such as the Ayeyarwaddy, 2,150 Km, the Chindwin 844 Km, the Sit-taung 563 Km and the Than Lwin 2,400 Km are natural resources for open flood fisheries. The inundated flood plains estimated to form water surface of about 6 million hectares for a period of 4-5 months a year. The total leasable fishery land area is about 3,722 acres and the total area of fishpond in 1999 was 53,123 hectare. The coast line that stretches from 21° North 10° North has an area of 1800 sq Km. With its large number of estuaries and islands the length of the entire coastal line will be close to 3,000 Km. The continental shelf up to 200 m in dept covers in area of 225 sq Km.

Trash fish and fish wastes are used as feed meal for animals. A certain portion is used as human food by preserving it as fish paste, which is essential food for rural population. In the past, most of the trash fish and wastes were thrown away into water because of the raining weather prevents drying under the sun. But nowadays, those fish wastes during the raining season are dried artificially to use as animal feed.

4.4. Feed Requirements and Supply Situation

Feed requirements for total population of livestock, aquaculture fish and aquaculture prawns are approximately 11.46 million metric ton for fiscal year 2001-02 and total feed supply of roughages, concentrates and fish meals are recorded as 34.05 million metric ton for same year. These figures indicate that feed supply can fulfill the feed requirements. The statistics are shown in table 5 and 6.

4.5. Compound Feed Production

There are 12 feed mills in Yangon. The average capacity of production of those feed mill is 60 tons per day. A number of small-scale feed mills that can produce 1 to 2 ton per day are set up in livestock populated

Table 5 : Minimum Feed Requirement For Livestock and Poultry
(‘000 mt)

Sr. No.	Particular	1998-99	1999-00	2000-01	2001-02	2002-03
1.	Straw	7,999	8,114	8,402	8,610	8,824
2.	Paddy	47	47	50	52	53
3.	Broken rice	483	525	576	629	687
4.	Rice bran	215	234	256	279	305
5.	Coarse bran	1,044	1,087	1,165	1,231	1,300
6.	Fish meal	190	213	235	261	290
7.	Maize	98	105	113	121	130
8.	Oil cake	127	141	155	171	189
9.	Gram & Pigeon pea	23	23	24	25	25
10.	Salt	71	74	80	85	90
	Total	10,297	10,563	11,056	11,464	11,893

Source: LBVD.

Table 6 : Feed Production

(‘000 mt)

Sr. No.	Particular	1998-99	1999-00	2000-01	2001-02	2002-03
A	Roughages	26,802	29,984	30,734	31,519	32,342
1.	Straw	17,171	20,252	20,847	21,460	22,091
2.	Groundnut leave/stem	253	285	290	295	299
3.	Cane tops	814	817	930	1,058	1,204
4.	Maize stover	564	630	667	706	748
5.	Grass	8,000	8,000	8,000	8,000	8,000
B	Concentrates	1,964	2,316	2,418	2,536	2,657
1.	Maize	303	349	370	393	417
2.	Broken rice	854	1,006	1,035	1,065	1,095
3.	Rice bran	181	213	221	229	237
4.	Groundnut cake	298	336	341	348	354
5.	Sesame cake	126	178	180	187	190
6.	Fish meal	202	234	271	314	364
	Grand Total	28,766	32,300	33,152	34,055	34,999

Source: LBVD.

areas. In Mandalay, there are 5 feed mills with the capacity of producing feed at 50 tons per day and 3 mills in other regions. The total production mills amounts to about 0.26 million mt per year. About 70% of feed produced from Yangon City is for fishmeal and the rest is for pig and poultry. Most of the small-scale farmers feed their animals with home

mixed feed or feed compound at feed mill in accordance with their own preferred ration formula. Poultry farming fluctuates with the existing prices of locally available feed. Domestic prices of animal feeds depend on the prices of agriculture and fishery products that utilized for raw materials for making feedstuffs. Compound feed mills and capacity are mentioned in Table 7 and Table 8.

Table 7 : Compound Feed Mills

Sr. No.	Location	Name of Feed Mill	Capacity Ton/day	Ton/Yr	Remark
1.	Yangon City	Thein Than Win	40	9,600	Private
2.	"	CP	100	24,000	Private
3.	"	May Kha	80	19,200	Private
4.	"	Sein Pan	30	7,200	Private
5.	"	Anawarmon	60	14,400	Private
6.	"	Golden Flower	80	19,200	Private
7.	"	Top	30	7,200	Private
8.	"	Nay La	20	4,800	Private
9.	"	B&B	30	7,200	Private
10.	"	Super power	50	12,000	Private
11.	"	Moon Light	30	7,200	Private
12.	"	LFME	133	31,920	Government
		Total (Yangon)	683	163,920	
1.	Mandalay	Sanpya	50	12,000	Private
2.	"	Thein Gabar	50	12,000	Private
3.	"	CP	40	9,600	Private
4.	"	May Kha	32	7,680	Private
5.	"	Shwe Win Oo	60	14,400	Private
		Total (Mandalay)	232	55,680	
	Other Cities				
1.	Shwe Bo	KT	100	24,000	Private
2.	Taungyi	Techaung	60	14,400	Private
3.	Loikaw	Nyein Chan Ye	20	4,800	Private
		Total	180	43,200	
		Grand Total	1,095	262,800	

Source: LBVD.

Table 8 : Raw Material Prices For Animal Feeds

(Kyats/kg)

Sr. No.	Name of raw materials	1998-1999	1999-2000	2000-2001
1.	Broken Rice	27.13	35.17	42.90
2.	Rice Bran	17.51	18.32	22.90
3.	Wheat Bran	27.60	32.50	41.07
4.	Maize	31.91	33.75	40.46
5.	Ground Nut Cake	33.42	39.08	45.92
6.	Sesame Cake	28.58	32.50	38.40
7.	Fish Meal	126.50	147.12	168.80

Source: LBVD.

4.6. Poultry Feeds Production and Requirements of Raw Materials

Poultry statistics for fiscal year 1999-2000 is described with the following table:

Table 9 : Poultry Statistics for Fiscal Year (1999- 2000)

Sr. No.	State/ Division	Layer		Broiler	Indigenous	Total
		RIR	Commercial Layer			
1.	Kachin	34,655	78,122	-	1,237,044	1,349,821
2.	Kayah	640	46,960	-	549,087	596,687
3.	Kayin	-	40,778	19,200	970,548	1,030,526
4.	Chin	-	920	-	826,911	827,831
5.	Sagaing	43,691	410,114	3,600	3,941,006	4,430,811
6.	Tanintharyi	146,340	110,160	60,140	1,200,310	1,516,950
7.	Bago	46,910	64,705	60,498	4,802,417	4,974,530
8.	Magway	89,566	13,936	67,677	3,833,610	4,004,789
9.	Mandalay	40,535	570,865	71,250	3,048,958	3,731,608
10.	Mon	38,210	199,057	79,650	824,298	1,141,215
11.	Rakhine	20,900	35,830	-	1,767,861	1,824,591
12.	Yangon	94,510	675,207	1,072,063	3,679,402	5,491,182
13.	Shan	69,995	495,890	63,952	2,578,602	3,208,439
14.	Ayeyarwady	75,590	115,027	17,700	5,161,249	5,369,566
Total		701,542	2,857,571	1,548,130	34,421,303	39,528,546

Source: LBVD.

Feed requirements for the total quantity of 5.4 millions of layers and broilers is estimated around 16,2060 tons per annum, which is based on

per capita consumption of 0.05 viss/chick. Whole country production of mixed feeds from 31 feed mills in 5 States and Divisions for same year is estimated around 289,080 tons per annum that mentioning surplus of poultry feedstuff for this year. Thirty-one feed mills comprise of government owned feed mill 5 numbers, private owned feed mills 19 numbers and foreign companies invested mill 7 numbers. Required raw materials to produce 162,060 tons of mixed feed are calculated with the feed formula for layer big and this figure is shown as follows:

Table 10 : Requirement of Raw Materials

(ton)

Sr. No.	Name of Feedstuffs	Feed Ratio	Total Requirements
1	broken rice	37 %	59,962.2
2	rice bran	13 %	21,067.8
3	yellow maize	14 %	22,688.4
4	groundnut cake	12 %	19,447.2
5	oil cake	8 %	12,964.8
6	dry fish	8 %	12,964.8
7	shell	8 %	12,964.8
Total		100%	16,206.0

Source: LBVD.

Feed requirements for poultry for year 2002-03 is estimated as follows:

Table 11 : Feed Requirements For Poultry (2002-03)

(ton)

Sr. No.	Name of Feedstuffs	Feed Ratio	Total Requirements
1	broken rice	37%	262,680
2	rice bran	13%	35,760
3	yellow maize	14%	107,280
4	oil cake	20%	64,920
5	dry fish & shell	16%	29,160
Total		100 %	499,800

Source: LBVD.

Statistics of fish pond areas and feedstuff requirements are mentioned with the following table:

**Table 12 : Statistics of Fish Pond and Feedstuffs Requirement
For Year 2002**

State/ Division	Fish/ Ponds (acres)	Yield (viss/ ac)	Total Production (viss 1000)	Feed Requirement (Feed viss/ Fish)	Total Requirement (tons)	
					rice bran (80 %)	groundnut cake (20 %)
Kachin	598.002	1,200	717.72	2.5	2,307.78	576.95
Kayin	269.090	1,000	269.09	2.5	865.24	216.31
Kayar	60.580	500	30.29	2.5	97.40	24.35
Chin	86.375	700	60.46	2.5	194.41	48.6
Sagaing	3,253.817	1,500	4,880.72	2.5	15,693.63	3,923.41
Tanintharyi	94.370	Grouper Seabass raising.				
Bago	9,698.650	1,800	17,457.57	2.5	56,133.67	14,033.42
Magwe	396.055	1,300	514.87	2.5	1,655.53	413.88
Mandalay	5,215.787	1,500	7,823.68	2.5	25,156.53	6,289.13
Mon	424.680	1,600	679.48	2.5	2,184.82	546.21
Rakahine	-	-	-	2.5	-	-
Yangon	43,954.590	2,500	109,886.48	2.5	353,332.73	88,333.18
Shan	1,031.327	800	825.06	2.5	2,652.93	663.23
Ayeyarwaddy	47,206.506	2,500	118,016.27	2.5	379,473.54	94,868.38
Total	112,289.929		261,161.69		839,748.21	209,937.05

Source: LBVD.

Feed requirements for pig, cattle/buffalo and duck for year 2002-03 are 1.42 million tons, 1.39 million tons and 97,800 tons respectively.

Table 13 : Feed Requirements of Livestock (2002-03)

('000 tons)

Sr.	Name of food stuff	Feed requirements by Name of Livestock			Total
		Pig	Cattle & Buffalo	Duck	
1	Broken rice	307.32	33.36	20.04	360.72
2	Fine rice bran	309.48	500.28	69.12	878.88
3	Coarse rice bran	350.64	166.92*	4.32	521.88
4	Oil cakes	188.40	656.52	-	844.92
5	Yellow maize	190.92	33.36	-	224.28
6	Fish meal	72.60	-	4.32	76.92
Total		1,419.36	1390.44	97.44	2,907.60

Source: LBVD.

* only for dairy cattles.

4.6.1. Raw Material Availability and Quality Analysis

Myanmar is endowed with plenty of natural resources and her economy is mainly relying on agriculture. Raw material such as broken rice, rice bran, maize, pulses cakes and oil cakes are derived from agricultural sector. Quality of these by-products is match with the requirement of the standard of feedstuff, which requires for formulating poultry feed. Livestock Breeding and Veterinary Department under Ministry of Livestock and Fisheries plays important roles in analyzing quality of raw materials. Records of these analysis is described with the following table:

Table 14 : Analytic Value of Feedstuff Commonly Used

(percent)

No.	Feed	Moisture	C.P	CF	EE	Aflatoxin	Nacl	T/ASX	Ca	T/P
1	Fish meal	8.82	55.50	1.82	8.11	-	4.88	21.18	-	-
2	Oil cake	6.09	43.77	4.40	7.65	22.72 (5/22)	-	-	-	-
3	Ground-nut cake	7.25	43.92	7.38	3.89	62.07 (18/29)	-	7.81	-	-
4	Maize	10.63	8.96	-	-	44.44 (4/9)	-	-	-	-
5	Broken rice	10.17	8.68	-	12.40	-	-	-	-	-
6	Rice bran	7.96	13.41	8.08	-	-	-	11.67	0.04	-
7	Wheat bran	8.70	13.09	-	-	NIL (0/4)	-	-	-	-
8	Prawn shell dust	8.35	44.48	-	7.01	-	2.12	37.47	11.20	-
9	Oyster shell	-	-	-	-	-	-	-	24.87	-
10	Crushed bone meal	-	-	-	-	-	-	-	4.54	4.42

Source: LBVD.

Some findings of local feedstuff (raw materials) from Assay Laboratory of Livestock Breeding & Veterinary Department are mentioned as follows:

- 1 *Dried fish*: Minimum and maximum water contents are 1.16% and 27.60% respectively. Protein content of first class dried fish is 76.74% and for second-class dried fish is 40.50%. Oil contents is 2.8% to 16.8% and salt contents are minimum 1.16% and maximum 20%.
- 2 *Sesame cake*: Water content ranges from 3.53% to 9.50%. Crude pro-

tein content is 31.50% to 53.31% and fats content ranges from 3% to 7.50%. It was found that aflatoxin content is 20% in sesame cake.

- 3 *Groundnut cake*: Water content ranges from 5.66% to 10% and crude protein content ranges from 38.01% to 47.60%. Oil content is from 3.60% to 7.20% and aflatoxin content represents 60%.
- 4 *Maize*: Water content ranges from 6% to 17.73% and content of crude protein is minimum 7.50% and maximum 12.30%. Oil content is 3% to 4.60% and aflatoxin content is 44%.
- 5 *Broken rice*: Water content ranges from 8.91% to 11.42% and crude protein content is 8% to 9.36%.
- 6 *Rice bran*: Water content ranges from 5.54% to 12.0% and crude protein is 10.92% to 14.92%. Fiber content ranges from 6.2% to 11.30% and oil content from 10.2% to 14%.
- 7 *Wheat flour*: It was found that water content is 8.7% and protein content is 13.09%.
- 8 *Prawn shell dust*: Water content ranges from 2.52% to 18.82% and protein content from 21% to 63%. Fiber content from 0.80% to 37% and total ash content from 34.73% to 40.20%. Calcium content from 8.95% to 14% and salt content from 1.90% to 2.33%.
- 9 *Oyster shell*: Calcium content is 24% to 27.50% and phosphorus content is negligible amount.
- 10 *Crushed Bone meal*: Calcium and phosphorus content are 4.94% and 4.42% respectively.

Nutrition value of agricultural by-products and animal waste for raw materials are mentioned in Table 15.

Vitamin contents of some useful raw materials are mentioned in Table 16.

Mineral contents of some useful raw materials are mentioned in Table 17.

Table 15 : Nutrition Value of Raw Materials for Animal Feeds
(percent)

Sr. No.	Name of raw material	dry matter	crude matter	crude oil	crude fiber	commodity after extracted nitrogen	ash content
	<i>Agricultural products</i>						
1	Barley	85.50	9.00	1.50	4.50	67.40	2.60
2	Wheat flour	86.50	15.50	4.15	7.50	50.45	4.15
3	Maize	87.00	9.90	4.40	2.20	69.20	1.30
4	Broken rice	87.00	6.70	0.40	1.50	77.60	0.80
5	Rice bran	90.80	12.40	13.60	10.60	39.90	13.30
6	Sorghum	88.00	10.40	3.40	2.00	71.00	2.00
7	Millet	88.00	11.00	5.00	2.00	69.00	3.60
8	Groundnut cake	90.00	45.40	6.00	6.50	26.40	5.70
9	Sesame cake	90.00	44.70	11.90	4.50	21.00	8.90
10	Niger cake	90.00	36.30	9.60	8.30	25.50	12.30
11	Sunflower cake	90.00	37.20	13.70	12.30	20.30	6.70
12	Crushed coconut	90.00	21.20	7.30	11.40	44.20	5.90
13	Crushed oil palm	89.00	19.20	6.00	13.40	16.50	3.90
14	Soya bean cake	89.00	44.90	5.80	5.30	27.40	5.60
15	Mustard seed cake	88.00	17.10	7.50	7.30	10.30	5.00
	<i>Animal products</i>						
16	Dried fish	87.10	61.00	3.50	-	1.50	21.00
17	Bone meal	93.60	26.00	5.00	1.00	2.50	59.10
18	Blood powder	86.00	81.00	1.80	-	1.50	59.10
19	Meat powder	89.20	72.20	13.20	-	-	3.80
20	Bone & Meat powder	90.30	50.30	15.00	-	1.00	24.00
21	By-product of chicken	93.40	55.40	13.00	1.60	4.60	18.70
22	By-product of hatchery	93.70	45.70	30.80	-	4.80	12.40
23	Milk powder (without fats)	89.70	32.80	1.50	-	47.90	7.50

Source: Ministry of Livestock and Fisheries.

Table 16 : Mineral Contents of Feedstuffs

(percent)

Sr. No.	Name of raw amterial	Ca	Mg	Na	K	Cl	p	Fe
	<i>Agricultural products</i>							
1	Barley	0.06	0.13	0.06	0.49	0.15	0.40	0.006
2	Maize	0.02	0.10	0.01	0.29	0.04	0.28	0.002
3	Millet	0.05	0.16	-	0.43	-	0.30	-
4	Broken rice	0.04	-	-	-	0.08	0.25	0.001
5	Rice bran	0.08	0.95	-	1.74	0.07	1.36	0.019
6	Sorghum	0.03	0.13	0.01	0.36	0.06	0.28	0.004
7	Wheat	0.04	0.14	0.06	0.42	0.08	0.39	0.006
8	Wheat flour	0.13	0.59	0.06	1.23	0.04	1.29	0.017
9	Coconut cake	0.21	0.36	0.04	1.96	0.03	0.64	0.680
10	Cotton seed cake	0.20	0.52	0.07	1.48	0.16	1.11	0.016
11	Groundnut cake	0.16	0.24	0.42	1.15	0.03	0.54	-
12	Sesame cake	2.00	-	-	-	-	1.60	0.010
13	Soya bean cake	0.27	0.25	0.24	1.77	0.07	0.63	0.016
14	Sunflower cake	0.26	-	0.04	1.08	0.09	1.22	-
15	Dried Alfafa	1.74	-	-	-	-	0.28	0.039
16	Dried grass	1.20	-	-	-	0.80	0.80	-
17	Carrot	0.05	0.23	1.17	4.77	1.27	0.02	0.0006
18	Rock sugar	0.66	0.36	0.17	3.67	2.75	0.08	0.019
	<i>Animal Products</i>							
19	Dried fish	6.76	-	-	-	-	3.69	-
20	Salted dried fish	4.41	0.10	0.18	0.33	0.41	2.57	0.030
21	Blood powder	0.32	0.22	0.32	0.09	0.27	0.25	0.376
22	Meat powder	5.70	-	-	0.58	1.20	4.50	-
23	Meat & bone meal	10.70	0.13	0.73	1.48	0.75	0.30	0.050
24	Milk power (without fats)	1.28	0.12	-	1.46	-	1.04	0.006

Source: Ministry of Livestock and Fisheries.

Table 17 : Vitamin Contents of Feedstuffs

Sr. No.	Name of raw material	Viti: (A) (U/gm)	Viti: (E) (mg/ 100 gm)	Chlorrine (mg/ 100gm)	Riboflav in (mg/ 100gm)	Nicotinic Acid (mg/ 100gm)	Viti:B12 (mmg/ gm)	Thaimin e (mg/ 100gm)
Agricultural products								
1	Barley	0.70	0.50	101	0.13	5.20	3.30	0.50
2	Wheat flour	0.40	1.00	102	0.19	18.80	-	0.80
3	Maize	5.00	0.40	111	0.11	2.10	0.20	0.40
4	Broken rice	-	1.20	78	0.04	1.50	-	0.25
5	Rice bran	-	-	99	0.26	27.50	-	1.80
6	Sorghum	0.70	-	44	0.11	6.60	-	0.50
7	Millet	-	-	-	0.10	1.00	-	0.60
8	Groundnut cake	0.30	-	188	0.22	16.60	-	-
9	Sesame cake	0.70	-	144	0.37	-	0.10	0.30
10	Sunflower cake	-	0.60	120	0.40	25.00	-	-
11	Crushed coconut	-	0.16	111	0.33	2.70	-	0.09
12	Soya bean cake	-	0.08	284	0.40	3.20	-	0.80
13	Dry Alfafa	267.00	20.00	111	1.66	4.30	-	-
14	Dry grass	327.00	15.00	89	1.55	7.40	-	-
Animal products								
15	Dried fish	-	2.10	310	0.66	6.20	100.00	0.13
16	Blood powder	-	-	111	0.22	3.30	-	0.14
17	Meat powder	-	-	243	0.55	5.50	55.30	0.02
18	Milk powder (after extraction of fats)	0.30	0.04	108	2.10	1.20	55.30	0.35

Source: Ministry of Livestock and Fisheries.

4.6.2. Some Nutritional Value of Non-conventional Feedstuffs

To be effectively run the livestock and aquacultures business, least cost feeding systems that utilized not only agricultural products but also agricultural and forest byproducts such as locally available non-conventional feedstuffs plays a crucial role. Formally, these non-conventional feedstuffs such as bagasse, spent grain (waste from beer processing), groundnut stocks, sesame stocks, Baw-sa-kaing and poultry and swine manure are neglected to use as animal feedstuffs. Nowadays, some scientists from Livestock Breeding and Veterinary Department analyze these non-conventional feedstuffs at the *Assay Lab*. The results of nutritional value for these products are mentioned with the following table:

Table 18 : Analytic Values of Non-conventional Feedstuff

(percent)

No.	Name of Sample	Moisture	C.P	E.E	C.F	T/A	A/A	Ca	T/P	Na cf
1.	Spent Grain	58.71	16.18	2.91	1.52	-	-	-	-	-
2.	Beer By-products	5.19	67.20	8.0	4.1	3.68	2.71	0.78	0.10	-
3.	Mustard Cake	-	33.60	-	-	-	-	-	-	-
4.	Thit Saint Oil Cake	6.3	44.6	-	5.42	8.12	1.16	2.65	0.72	-
5.	(UMMB)Urea jiggery	26.00	11.73	1.6	8.4	22.5	3.0	2.3	-	3.25
6.	Pellet feed for cattle (Malaysia)	8.60	15.40	7.8	18.8	7.0	3.0	1.2	-	0.46
7.	Pi-law-pi-nan (Tapioca/ cassava)	14.19	3.33	2.87	4.97	-	-	-	-	-
8.	Baw-sa-kaing (Leucaena Leucocephala)	-	21.70	6.50	14.3	8.38	-	2.7	0.17	-
9.	(Water - hyacinth) (powder)	-	12.25	-	-	-	-	-	-	-
10.	Buddha Tharana (Canna Indica)									
	Tuber	19.44	7.35	-	8.96	9.51	-	-	-	-
	Stem	19.12	15.75	-	19.5	14.2	-	-	-	-
	Leaves	17.23	15.75	-	16.86	12.08	-	-	-	-
11.	Cashew nut	14.27	10.15	-	8.86	2.85	-	-	-	-
12.	Dry Fruit of acacia (Albizzia Lebbeck)	18.29	15.06	0.36	11.8	2.89	-	-	-	-
13.	Tamarind Seed	9.41	14.35	-	8.0	1.84	-	-	-	-
14.	Roasted Tamarind Seeds	7.99	16.80	1.6	9.4	1.99	-	-	-	-
15.	Groundnut stock	17.08	10.5	2.8	38.2	7.74	-	-	-	-
16.	Sesame stock	12.23	3.5	3.4	56.6	2.57	-	-	-	-
17.	Cane top	48.3	1.93	-	31.94	1.72	-	-	-	-
18.	Bagasse powder	-	2.2	-	15.17	-	-	-	-	-
19.	White Sorghum	8.84	11.90	2.0	1.0	-	-	0.6	0.88	-
20.	Red Sorghum	8.80	8.75	2.4	10.8	-	-	1.6	0.34	-
21.	Poultry Manure	22.71	14.7	1.94	8.30	38.04	17.51	5.49	3.33	-
22.	Swine Manure	16.25	24.85	-	-	-	-	-	-	-

Source: Dr. War War Han, (et al, 2002), *Study on nutritional value of non-conventional feedstuffs in Myanmar*, LBVB, Yangon.

Moisture contents, protein contents, fats contents, fiber contents, mineral contents, vitamin contents and calorie contents are very important factors for animal feed formulation, which has huge impact on animal growth rate and meat, eggs and milk production. Laboratory test should be carried out as complete as possible to find out the proximate analysis value.

FAO conducted some research on utilization of locally available non-conventional feedstuffs to be mixed with animal feeds, with the purpose of solving the scarcity of animal feeds all over the world.¹ Some important points are mentioned in this paper.

Gossipol that contains in cotton seed cake may affect the animal growth rate but if dosage is too much, it can cause death. *Hydrogen cyanides* (HCN) that contains in cassava can affect the animal health and the dangerous dosage is 0.5 to 3 mg/kg of body weight. HCN contents may reduce by boiling the cassava and *methionine amino acid* can decrease the HCN content. *Mimosine*, which contains in Baw-sa-kaing is valuable if 5 to 10% of the feed is used as animal feeds. However, more than this amount may cause toxicosis. Small leaves and fruits of Baw-sa-kaing contain 5 to 13% of *mimosine* and 4 to 5% in the seeds. *Saponin*, which contains in Me-zel and Myint-zu-tha-ka plant has bitter taste and burble and it has foaming property.

Castor plant has *phytohaemagglutinin*, which has coagulate action. Even though protein content is 35%, it can not suitable for animal feed. However, aged leaves of castor are feed to sheep but its seed is not suitable for animal feed. Nyan-pin, pauk-pan-phyu and pauk-pan-ni leaves have *alkaloid* and it may cause blood evacuation and they are not suitable for animal feed. Koke-ko leaf (a kind of acacia) contains *cyanogens*, which may transform to HCN and it is not suitable for animal feed. It is valuable to note that soybean contains high rate of *lysine*. However, it also contains *trypsin inhibitor*, which may disturb digestion. By heating soybean, this chemical may decompose.

4.6.3. Nutrition Requirement and Types of Feeds For Poultry

Nutrition requirements for poultry vary according to the age, types and production quality and feeding methods. Base on the feeding method and nutritional value, one can formulated the poultry feed. It can be categorized as follow:

- 1) *Meal*: All the raw materials are grinded as powder forms and mixed together.

¹ FAO, *Animal Production and Health paper No.102*

- 2) *Mash*: (1) raw material is grinded and mixed as meal form
 (2) raw materials are initially mixed and then grinded as powder form.
- 3) *Pellet*: All grinded raw materials are made as pellet forms by using pellet-making machine that can make the size of 3 mm to 10 mm. The benefits of making pellet forms is; reduce the waste of feeds, easy to use and it is suitable for hot season particularly for adult ducks and layer parent stocks.
- 4) *Crumb*: This type of feed is smaller than pallet forms and the size is around 2mm to 4 mm. It can obtain by crushing pallet forms of chicken feeds. It is suitable for small layers.

4.6.4. Calculation of Feed Requirements For Layer Chicken

Feed consumption rate of layers depends on the following facts:

- (i) Age of layer
- (ii) Size of layers (small/ medium/ big)
- (iii) Calories of feed (K cal ME or MJ)
 (1 K Cal = 0.00 4184 MJ, 1 MJ = 239 K Cal)
- (iv) Types of feeds (concentrates/roughages/ pallets/ mash etc.)
- (v) Room temperature of layer's house
- (vi) Length of feed container (normally 10 cm/ bird for long trough)
- (vii) Health condition of layers
- (viii) Cleanness of water and usage amount and
- (ix) Space availability for layer for movement.

Two important categories can be emerged for calculation of feed requirements, one for body maintenance and another for egg production.

1) *Body Maintenance feed*: Standard norm is noted based on body weight of layer, location of poultry house, temperature and energy value of the feeds.

If Body weight of layer is 2 kg LW, Temperature is 20' C and the Energy value of feed is 2,750 K cal ME, then daily consumption of one hen is 70 grams. If the above standard is not match, adjustment can be applied.

2) *Egg Production feed*: 70 grams/bird/day is the standard norm of feed for production.

Table 19 : Kind of Feed, Feeding Method and Nutritional Requirement for Chicken
(Expressed as K cal /Kg for ME in percent in Feed)

Kind of feed	Bird	Age	Feeding Method	quantity of feed/bird	Nutrition Value						Maximum			
					Me Kcal	cp %	Lysine %	Methio-nine %	M+C	Ca	P	Pav	C. fat	C. fiber
Chicken mash	Chick	0-8 weeks	Ad Lib	1.5-2.5 Kg	2800	20	1.00	0.45	0.80	1.00	0.70	1.50	5	5
Grower mash	Grower	9-22 weeks	Ad Lib	6-10 Kg	11.70	16	0.80	0.32	0.70	1.00	0.60	0.35	5	5
Layer mash	Layer	23 weeks & on wards	Restricted Ad Lib with control of feed use	40-55 Kg (or) 110 to 140 grams/bird	2700	11.30	0.70	0.28	0.60	2.50	0.80	0.50	5	6
Complete Layer mash	Layer	— do —	— do —	— do —	2700	16	0.70	0.28	0.60	3.50	0.80	0.50	5	6
High Energy mash	Layer	— do —	— do —	34-45 Kg (or) 100-120 grams/bird	2800	17	0.75	0.30	0.65	2.0-3.5	0.80	0.50	5	5
Layer cereal Balance mash	Minerals vit: & Source for home mixing for layer Broiler	23 weeks & Onwards	— do —	— do —	As complete layer mash									
Broiler Starter mash	Broiler	0-4 weeks	Ad Lib	1 Kg/ bird	3100	22	1.20	0.50	0.90	1.00	0.80	8.00	3.5	
Broiler Finish mash	Broiler	5 wks & onwards	Ad Lib	2-5 kg/bird	3200	20	1.00	0.45	0.80	1.00	0.50	8.00	3.5	
Broiler Parent Stock Breeder mash	Broiler parent stock	24 weeks & Onwards	Restricted	40 Kg or 140-160 grs/bird	2600	16	0.70	0.28	0.60	2.00	0.45	5.00	6.00	
										3.50				

4.6.5. Raw Materials and Price of Mixed Feeds

Raw material prices are collected from Bayint-naung Brokerage House from 1996 to 2000. By evaluating price variation of these raw materials, feed mill manager can adjust the purchasing and damping of raw materials with cheap prices. By this way least cost formulation of mixed feeds can be carried out effectively. Feeds Formula, price and protein content ratio produced by Da-nyin-kone feed mill from 1996-97 to 1999-2000 are mentioned with the following tables.

Table 20 : Market Sales Feed Formula and Protein Content Ratio (1996-97)

(percent)

Sr.	Name of Raw Material	Layer (big)		Layer (medium)		Layer (small)		Broiler (big)	Broiler (small)
		1	2	1	2	1	2		
1	Broken Rice	7	38	51	51	40	45	48	50
2	Rice Bran	13	10	15	10	10	10	10	8
3	Maize	14	14	10	12	15	10	12	9
4	Groundnut Cake	20	22	15	18	25	25	23	25
5	Dry Fish	8	9	6	7	9	8	5	8
6	Shell	8	7	3	2	1	2	2	-
Price (Ks/viss)		24.15	24.80	22.80	23.20	27.70	28.10	26.65	28.50
Protein		18.00	19.07	16.25	17.59	20.57	20.15	18.33	20.33

Source: Ministry of Livestock and Fisheries.

Table 21 : Market Sales Feed Formula and Protein Content Ratio (1997-98)

(percent)

Sr.	Name of Raw Material	Layer (big)		Layer (medium)		Layer (small)		Broiler (big)	Broiler (small)
		1	2	1	2	1	2		
1	Broken Rice	35	39	40	32	40	27	48	50
2	Rice Bran	6	10	20	14	-	10	10	8
3	Maize	20	14	15	29	20	25	12	9
4	Groundnut Cake	15	21	-	16	25	25	23	25
5	Dry Fish	7	9	7	6	15	12	5	8
6	Shell	7	7	3	3	-	1	2	-
7	Sesame	10	-	15	-	-	-	-	-
Price (Ks/ viss)		30.59	31.05	28.15	27.2	34.55	33.40	32.30	35.55
Protein		19.23	18.77	16.80	16.28	22.86	21.60	18.33	20.33

Source: Ministry of Livestock and Fisheries.

Table 22 : Market Sales Feed Formula and Meat Contain Ratio (1998-99)

(percent)

Sr.	Name of Raw Material	Layer (big)			Layer (medium)			Layer (small)			Broiler (big)			Broiler (small)		
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
1	Broken Rice	39	37	37	51	51	51	42	40	40	38	30	38	46	20	46
2	Rice Bran	12	13	13	15	15	15	10	10	10	9	1	9	-	2	-
3	Maize	15	14	14	11.5	10	10	15	15	15	17	50	15	18	50	15
4	Groundnut Cake	12	12	17	7	7	14	15	15	22	21	1	21	26	5	26
5	Sesame Cake	8	8	3	8	8	1	10	10	3	-	-	-	-	5	-
6	Dry Fish	6	8	8	4.5	6	6	7	9	9	7	17	9	9	16	12
7	Shell	8	8	8	3	3	3	1	1	1	8	1	8	1	2	1
	Price (Kyats)	57.65	58.85	57.55	54.80	57.25	57.05	63.55	64.80	63.05	57.05	66.15	61.25	65.05	67.40	69.65
	Protein	17.30	18.09	18.03	15.74	16.35	16.26	19.91	20.69	20.60	17.84	15.76	18.65	20.74	18.09	21.96

Source: Ministry of Livestock and Fisheries.

Table 23 : Market Sales Feed Formula and Meat Contain Ratio (1999-2000)

Sr.	Name of Raw Material	Layer (big)			Layer (medium)			Layer (small)			Broiler (big)			Broiler (small)		
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
1	Broken Rice	18	15	10	32	12	-	20	10	20	46	-	-	38	-	-
2	Rice Bran	10	10	-	14	14	-	9	9	-	3	-	-	2	10	-
3	Maize	35	38	48	29	49	61	35	45	40	22	-	-	20	51	-
4	Groundnut Cake	21	21	10	15	16	10	25	25	10	20	-	-	24	26	-
5	Dry Fish	9	9	10	6	6	8	10	10	10	9	-	-	12	12	-
6	Shell	7	7	7	3	3	7	1	1	7.5	-	-	-	-	1	-
7	Sesame Cake	-	-	15	-	-	14	-	-	12.5	-	-	-	4	-	-
	Price (Kyats)	61.00	80.25	77.50	58.85	73.85	73.40	65.40	84.50	84.40	66.00	-	-	69.30	-	-
	Protein	18.48	18.43	20.03	16.28	15.99	18.73	20.66	20.52	19.29	18.97	-	-	24.46	21.53	-

Source: Ministry of Livestock and Fisheries.

5. PASTURE ESTABLISHMENT

Pasture development is very important for ruminant animal production and it can produce nutritious animal feed, which may enhance the productivity in animal production. Pasture should be established in a systematic ways and due to the following benefits, these pastures are established:

1. *Development pastures are different with natural pasture and it have high nutritious value;* Concerned with natural pasture, crude protein (CP) contents that is major nutrient contains 6.08 to 10.7% and 3.19 to 3.31% in rainy season and summer season respectively. However, crude protein contents in high standard pasture range from 11.19% and 5.33% for young stage and old stage respectively. Pasture that wild legumes are grown has more CP contents; 23.8% for young stage and 15.8% for old stage respectively.
2. *Pastures can increase the soil fertility and it has high yield;* Dry matter of grasses and wild legumes per acre per year is calculate for pasture yield. To calculate crude protein contents, we must analyze the nitrogen contents of dried pasture under 80°C keeping 24 to 48 hours. If nitrogen contents are 2%, we can calculate crude protein content by multiply with 6.25. By grazing animal at the pastures, their excrement can develop the fertility of soil. Wild legume can provide nitrogen to the soil by reaction of *rizobium* bacteria on the nitrogen fixation nodule. Quantity of nitrogen produced by these nodules depend on variety of legumes;
 - 1) *Cintro* can produce 112 Kg of Nitrogen/ acre/ year.
 - 2) *Stylo* can produce 33.60 Kg of Nitrogen/ acre/year.Recommended combination of grass and legume varies on the weather condition. *Rotes* grass and *Siyartro* legume is suitable for dry zone and *Gini* grass and *Sintro* legume is good combination for humid area. After 3 or 4 years period, other cereal or pulses can be grown as soil fertility is increased.
3. *Maintenance task is not too heavy as other crops.*
4. *Pastures can expand easily.*
5. *Cattle prefer to eat at the pastures rather than artificial feeding system and buffaloes prefer wide range of pasture for mating.*
6. *Pastures can control from soil erosion problems:* Naturally grown

plants and trees are destroyed in accordance with the expansion of agricultural farmland area by logging trees of the forests areas by burning on the ground and by conducting tillage operations. Cultivating crops also destroy physical features of the soil for a long period. By covering with pastures, soil surface areas are protected from soil erosions. Soil particles may not loose by protecting with pastures and rainfall water cannot direct to erode the soils.

7. *Sometimes, pastures can be used as green manures;* Wild legumes plant are wide by used as green manure, which can supplement nitrogen and change the soil texture. By using green manure, dosage of Nitrogen Fertilizer can be reduced.
8. *Pastures have resistance to pest damages and drought situation.* Continuous cultivation of single crops at the same farm plot may cause the damages by same pests and diseases. By practicing crop rotation and rotation with pasture cultivation may decrease these damages.

5.1. Different Types of Pastures

(a) Natural Pastures: Natural pastures means grasses and wild legumes are naturally grown without assistance of human being. These pastures are used as grazing ground. A natural pasture has low feeding value compared to high standard pastures.

(b) Developed Pastures: Good variety of grasses and legumes are systematically cultivated to establish high standard pastures. To achieve high feeding value, these pastures are properly maintained by providing required fertilizers irrigation and weed control. Rotation of grazing for particular pastures plot should be undertaken systematically.

Seed requirements and suitable pasture plants for different agro-ecological locations are mentioned with table 24.

Table 24 : Seed Requirement and Suitable Pasture Plants for Different Locations of Myanmar

Pasture (Region)	Seed Requirement	Lower Myanmar	Upper Myanmar	Dry Zone	Shan State/ Hilly Region
<u>Type of Grasses</u>					
Gini	2-6	^	-	-	-
Signal	2-4	^	-	-	-
Sactaria	2-5	^	-	-	^
Green Panic	0.5-6	-	^	^	^
Survi	0.5-6	-	^	-	-
Buffel	0.5-4	-	^	^	-
Rthode	0.5-6	-	^	-	^
Maka	2-3	-	^	^	^
Birdwood	0.5-4	-	-	^	-
Para	-	^	-	-	-
Nepia	-	^	-	-	-
Kikuyu	-	-	-	-	^
<u>Types of Legumes</u>					
Scofield Stylo	2-3	^	-	-	-
Indeva Stylo	2-3	^	-	-	^
Cook Stylo	2-3	^	-	-	^
Virano	3-4	^	^	^	^
Sica	3-4	^	^	^	-
Centro	4-5	^	-	-	-
Siratro	4-5	^	^	^	-
Glycin	4-5	-	-	-	^
Baw- Sa- Kaing	-	-	^	^	-

Source: Ministry of Livestock and Fisheries.

5.2. Grazing Ground Availability

Legislated land for communal pasture is not plenty, only about 0.3 million hectares to be grazed for draft cattle and buffalo. Not only communal pasture land but also many lands for grazing ground such as huge land for fallow and uncultivated wasteland and other woodland are much available.

Table 25 : Available Grazing Ground Area (2000-01)

(‘000 ha)

Sr. No.	Land for use in grazing	Area available
1	Legislated communal pasture	316.00
2	Uncultivated land	7820.00
3	Other woodland	20,190.00
Total		28,326.00

Source: Ministry of Livestock and Fisheries.

According to the statistics, the grazing ground areas is decreasing 16,387 hectares from 330,678 hectares in 1997-98 to 314,291 hectares in year 2001-02. The grazing ground areas for last five years is mentioned with the following table:

Table 26 : Grazing Ground Areas From 1997-98 to 2001-02

(hectares)

Sr. No.	State / Division	1997/98	1998/99	1999/00	2000/01	2001/02	Increase/Decrease from 1997/98
1	Kachin	1,992	2,060	2,060	2,060	2,060	(+68)
2	Kayar	-	-	-	-	-	-
3	Kayin	17,061	17,038	17,037	16,686	16,637	(-424)
4	Chin	1,542	1,542	1,542	-	-	-
5	Sagaing	12,205	120,798	12,078	7,518	7,853	(-4,352)
6	Tanintharyi	20,895	20,804	20,634	20,566	20,069	(-826)
7	Bago (East)	48,795	46,455	42,179	42,297	42,055	(-6,740)
8	Bago (west)	11,958	11,953	11,958	11,490	11,327	(-631)
9	Magawe	1,863	1,863	1,863	1,863	1,863	(0)
10	Mandalay	2,208	2,208	2,208	6,767	6,743	(+4,535)
11	Mon	20,786	20,694	20,694	20,394	20,414	(-372)
12	Yakhaine	34,940	34,900	34,900	34,900	34,334	(-606)
13	Yangon	29,955	28,690	28,405	28,330	27,701	(-2,254)
14	Shan (South)	12					
15	Shan (North)						
16	Shan (East)						
17	Ayarwaddy	126,466	124,130	124,090	123,238	123,235	(-3,231)
Total		330,678	324,415	319,648	316,109	314,291	(-16,387)

Source: Ministry of Livestock and Fisheries.

6. PRODUCTION AND EXPORT OF SOME IMPORTANT CROPS

Production data of important crops, which can use as raw materials for animal feeds such as maize, millet, cassava, groundnut and soybean, are

mentioned with the following table. All crops production increased if we compared with 1991 figures. Annual growth rate of crop production for soybean, maize, cassava, groundnut and millet are 17.1%, 6.6%, 6.2%, 5.2% and 3.1% respectively.

Table 27 : Production Data of Important Crops of Myanmar

No.	Categories	Unit	1991	1998	1999	2000	2001	Annual Growth Rate
I	Maize							
1.	Harvested area	'000 ha	124	183	203	211	205	5.3%
2.	Yield	kg/ha	1,541	1,681	1,716	1,731	1,707	1.2%
3.	Production	'000 MT	191	308	349	365	350	6.6%
II	Millet							
1.	Harvested area	'000 ha	178	238	251	250	235	3.0%
2.	Yield	kg/ha	673	631	671	676	702	0.1%
3.	Production	'000 MT	119	150	169	169	165	3.1%
III	Cassava							
1.	Harvested area	'000 ha	6	7	8	8	9	4.5%
2.	Yield	kg/ha	10,157	11,148	11,394	10,073	10,685	1.6%
3.	Production	'000 MT	57	81	88	77	97	6.2%
IV	Groundnut in Shell							
1.	Harvested area	'000 ha	529	446	490	560	586	1.0%
2.	Yield	kg/ha	892	1,211	1,145	1,132	1,247	4.1%
3.	Production	'000 MT	472	540	562	634	731	5.2%
V	Soybean							
1.	Harvested area	'000 ha	32	78	102	108	114	15.1%
2.	Yield	kg/ha	811	960	837	918	968	1.8%
3.	Production	'000 MT	26	75	85	99	110	17.1%

Source: FAO, 2002 *Selected Indicators of Food and Agriculture Development in Asia – Pacific Region 1991-2001*.

Export of some crops and oil cake are mentioned with the following table. Export quality of maize in 1998-99 is highest with the data of 174,000 metric tons.

Table 28 : Export of Some Crops

(Qty- MT Value- '000 Kyats)

No.	Name of crops	1994-95	1995-96	1996-97	1997-98	1998- 99	1999-00
1.	Maize (Seeds)						
	Quantity	70,352*	62*	102,540	49,972	174,375	88,846
	Value	48,880	46,402	107,211	45,288	115,639	54,468
2.	Soybean						
	Quantity	240	520	164	666	4,014	161
	Value	379	831	263	1,219	7,804	240
3.	Sesame Cake						
	Quantity	6,210	1,319	-	100	-	-
	Value	5,232	1,022	-	98	-	-
4.	Groundnut Cake						
	Quantity	7,687	619	-	-	-	724
	Value	6,712	523	-	-	-	746

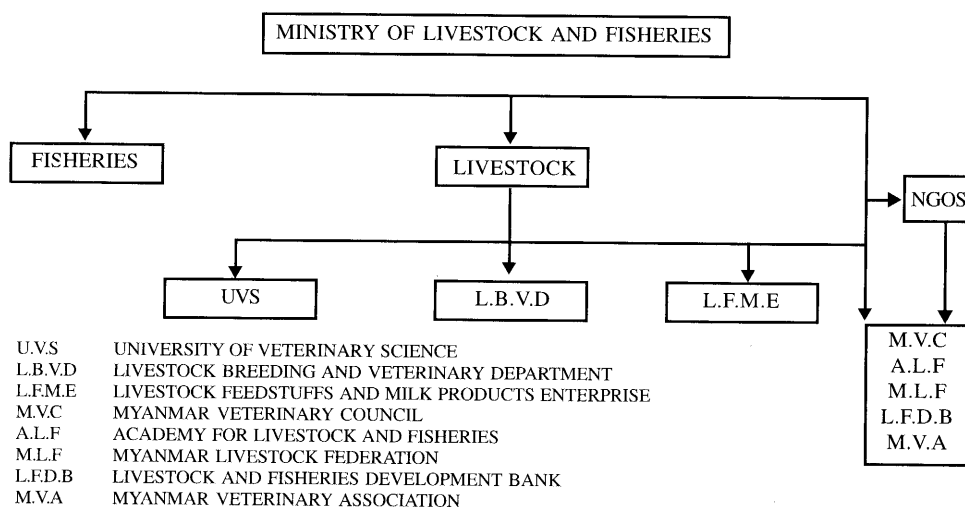
Source: CSO and DAP, 2001, *Myanmar Agricultural Statistics. (1989-90 to 1999-2000)*

* Un-milled maize com

7. HUMAN RESOURCE DEVELOPMENT FOR FEED INDUSTRY

Feed industry involves both public and private sectors. Livestock Feedstuffs and Milk Products Enterprise (LFME) under Ministry of Livestock & Fisheries has responsible for feed mills activities.

Chart 1 : Livestock and Fisheries Sector Organization



Source: Ministry of Livestock and Fisheries.

As Ministry of Livestock and Fisheries is responsible for livestock and fisheries sector, the following policies and objectives are laid down to implement the short term and medium term Livestock and Fisheries Production Plan:

- (i) To distribute improved breed
- (ii) To improve integrated production
- (iii) To be self-sufficiency on livestock and fisheries consumption and to earn foreign exchange by exporting surplus
- (iv) To improve investment in livestock and fisheries
- (v) To expand prawn farming
- (vi) To prevent the degradation of natural resources of fish and prawns
- (vii) To obtain self-sufficiency on fresh water fish consumption and to maintain resources for fish farming
- (viii) To improve socio-economic condition of livestock and fisheries farmers.

L.F.M.E is one of the institutions under Ministry of Livestock and Fisheries. Managing Director is head of L.F.M.E. Approved staff strength of L.F.M.E is 2745 persons but at present, appointed strength is 1634. Out of 1634 staffs only 43 are graduated from U.V.S who holds the degree of B.V.Sc.

There are five feed mills under L.F.M.E, in Daik-Oo, Ywar-thar-gyi, Mandalay, Taryaw (Taunggyi district), and Danyin-kone (Yangon).

Policy for HRD in Livestock Sector Development is introduced as follows:

- 1 To upgrade the higher level education and advanced technology to veterinary field staffs of livestock sector institutions for transferring technology and education to other field technicians and livestock farmers, with animal feed utilization.
- 2 To encourage the study of proper utilization of locally available feed to technicians.

Up to October 2002, total staffs trained from the U.V.S comprise of 3,483 personnel. This data is mentioned as follows:

**Table 29 : Human Resource Development Up To October 2002
From University of Veterinary Science**

Sr.	Name	Male	Female	Total
1.	M. Phil	7	14	21
2.	M.V.Sc	12	19	31
3.	M.Sc	1	-	1
4.	B.V.S, B.V.Sc	2578	852	3430

Source: Ministry of Livestock and Fisheries.

For improvement of training and research activities some staffs have been trained in overseas countries. For instance, five Ph.D students are sent to Malaysia. Three M.Sc students are studying in Japan. Two teachers from University can be studied in India and Germany with assistance from IAEA. To improve computer skills and to be effectively utilized multi media room and learning center language laboratory, some university staffs are trained by teachers from Department of Higher Education. List of students who are attending the degree of B.V.Sc (up to 11.12.02) are as follows:

Table 30 : List of Students Attending The Degree Of B.V.Sc

Sr.	Name of training	Male	Female	Total
1.	First yr (junior)	49	11	60
2.	First yr (senior)	39	8	47
3.	Second yr (junior)	51	11	62
4.	Second yr (senior)	74	17	91
5.	Third yr	68	14	82
6.	Fourth yr	46	14	60
7.	Final yr	73	21	94
Total		466	112	578

List of post-graduate students for fiscal year 2002-03 is depicted with the following table:

Table 31 : List of Students Attending Post-graduate

Sr.	Name	Male	Female	Total
1.	1 st year M.V.Sc	3	9	12
2.	2 nd year M.V.Sc (junior)	-	10	10
3.	2 nd year M.V.Sc (senior)	1	1	2
Total		4	20	24

8. DANYIN-KONE FEED MILL

Danyin-kone feed mill was established in 1964 under Agriculture and Rural Development Corporation (ARDC). In 1973 it was transferred to Livestock Breeding & Veterinary Department. It was again transferred to Livestock Breeding Corporation and Livestock Corporation in 1976 and 1983 respectively. In 1990 it was transferred to Livestock Feedstuffs and Milk Production Enterprise (L.F.M.E). From 1990 to 1994, it was leased out to private feed Company, namely "Gold Star Co., Ltd." It was retransferred to L.F.M.E since 1994-95 and animal feed mill is carrying out under L.F.M.E.

Capacity of the feed mill for mixed feed is 12,000 tons/yr and pallet form is 7,200 tons/yr. At present, production of Mixed feed is 9,600 Tons/yr and pallet form is 6,000 tons/yr. Income, expenditure and operation ratio are shown in Table 32.

Table 32 : Income, Expenditure and Operation Ration

(Kyats in Million)

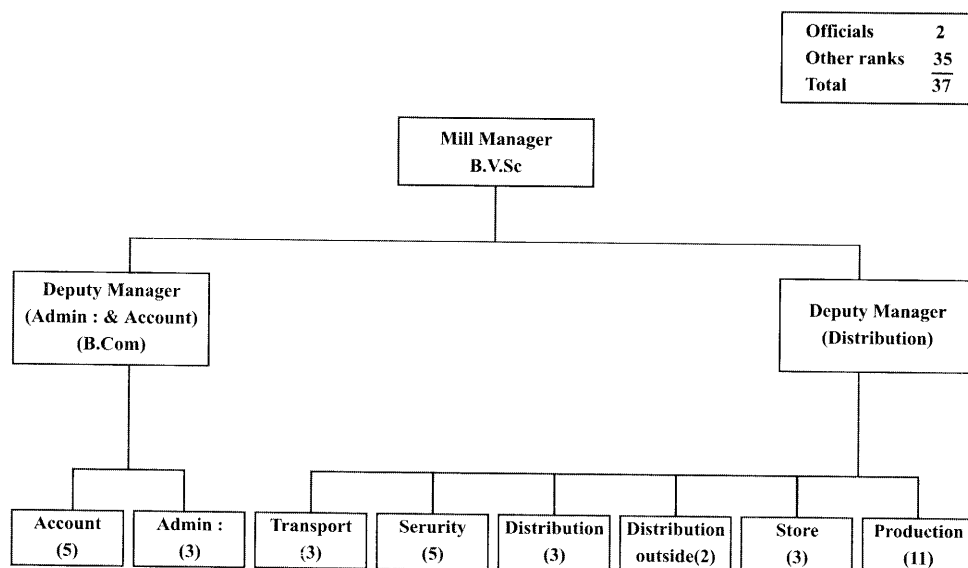
Year	Revenue	Expenditure	Operating Ratio
1998 / 1999	156.66	142.72	91.10 %
1999 / 2000	162.30	135.89	83.7 %
2000 / 2001 (April to Feb:)	187.70	165.52	88.18 %

Source: L.F.M.E.

A manager is incharge of manages Danyin-kone Feed Mill. It is divided into two sections headed by two deputy mill managers (Administration, Accounts and Distribution sections).

Total staff strength is 37, which composed of 2 officials and 35 other ranks (Chart 2). At present, there are only two graduates. Out of this, only one technician is graduated from the U.V.S. For future, it is necessary to recruit technicians who are graduated as M.Sc particularly who specialize in animal nutrition.

Chart 2 : Organization Chart of Danyin-kone Feed Mill



Source: L.F.M.E.

9. CONCLUSION

The following are recommended for further development of feed industry in Myanmar:

1. to encourage establishment of proper abattoir with the purpose of increased exports of livestock products
2. to encourage private sector participation in export of live stock and fisheries products
3. to encourage technicians for the study of proper utilization of locally available animal feed derived from crops, trees, animals and fishes.
4. to manage fulfillment of animal feed for country's requirement
5. to strengthen research and extension services for newly potential feedstuffs such as kenaf, soybean by-products, and other non-conventional feedstuffs
6. to increase foreign direct investment in feed industry by inviting foreign companies
7. to establish livestock special zones near the urban areas and to establish fish and prawn special zones along the coastal areas and delta areas, with purpose of increasing demand for feedstuffs
8. To allow private sectors (both domestic and foreign) to improve dairy farming and beef cattle farming by establishing developed pastures

- in the long run by providing land use rights for these pastures
9. To create better environment for technicians by improving Human Resource Development programs.

In order to get improvement of the livestock production in Myanmar, quality feed must be available sufficiently at reasonable prices. Expansion of livestock farming is mainly dependent on the existing prices of the feed and feed availability. It can be expected that the production of feed from agriculture and fishery sectors will be higher in line with increased farming and production of livestock and fisheries in the future. To gain maximum utilization of locally available feed resources it is necessary to identify the potential of local feed resources potential and the means to use it effectively. The search, the production and utilization of alternative feed resources should be encouraged. In the long run, if meat industry grows up, the feed industry will also play an important role in Myanmar. If the feed production can be expanded, compound feed productions may come to increase and surplus feeds are to be managed for exporting to neighboring countries.