12. DEMAND AND REQUIRED QUALITY OF MAIZE AS FEED IN JAPAN

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Outline of Demand of Maize in Japan

It is well known that maize is one of the most important ingredients of the present mixed feed. Because of maize has a good palatability and a high digestibility to all kind of livestocks, contains high nutritive energy, and the aboundance of its production over the world, that is the reason of keeping equilibrium in the price and of easily supplying the international demand, its importance as the main ingredient of mixed feed will be more advanced in future.

In Japan, the amounts of mixed feed produced in these past ten years have been increasing by very high rate as is shown in Figure 1.

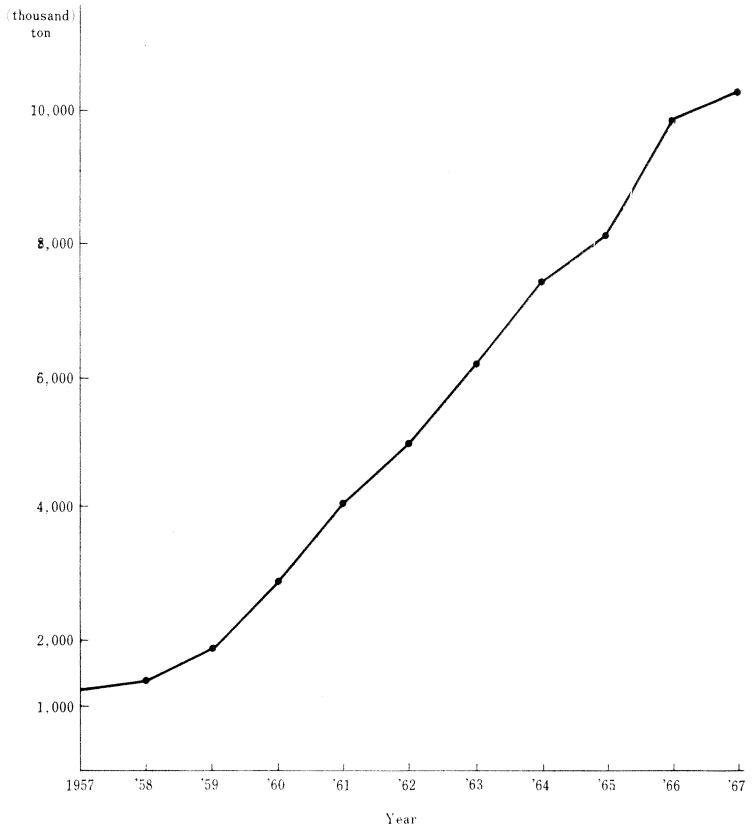

Fig. 1. The amounts of mixed feed production.

These remarkable advances of mixed feed production are chiefly due to the high rate development of livestock industry of this country, that is the marked increase of numbers in hogs and chickens which demand the concentrated feeds mainly. For example, in 1966, the number of hogs was estimated to be 5,160 thousand, 3.3 times over 1957 level, 1,546 thousand and that of chickens, 136,453 thousand, 3.0 times over 1957 level, 45,341 thousand. On the other hand, the number of beef cattle and draft horses have been decreased. The number of livestocks on farm since 1953 is shown in Table 1.

Table 1. Numbers of livestock on farm.

(thousand)

Year	Dairy Cattle	Beef Cattle	Hogs	Chickens
1953	323	2,503	994	36,586
1954	356	2,541	833	41,805
1955	421	2,623	825	45,715
1956	497	2,719	1,170	42,640
1957	588	2,590	1,546	45,341
1958	654	2,465	1,049	50,291
1959	751	2,365	2,244	48,215
1960	824	2,340	1,918	45,627
1961	885	2,326	2,640	71,891
1962	1,002	2,332	4,033	90,006
1963	1,145	2,337	3,296	98,447
1964	1,238	2,208	3,461	120,912
1965	1,289	1,886	3,976	138,476
1966	1,310	1,577	5,160	136,453

In this way, the total volume of mixed feed production has been increasing by high rate reflecting the great development of livestock industry of this country, and in 1967, it was passed ten million tons mark. The volume of mixed feed production classified by use is shown in Table 2.

The increasing rate of total mixed feed production has been very high and there are some exceptions, it shows more than twenty per cent over every previous year, but there are some unimaginable fluctuations. As is shown in Table 2, the sub-total volume of mixed feed production for poultry showed declined rate in 1965 (97.8%). This decline was due to the ultimate decrease in the number of chickens caused by the fall in egg price of this year. But in 1966, the increasing rate of total volume of mixed feed production recovered 21.6 per cent over the previous year by the recovery of egg price and the increase in number of hogs and broiler chickens. In 1967, the increasing rate declined again chiefly due to the decrease in number of hogs and growing chicks.

In 1967, the total amounts of mixed feed production reached 10,324 thousand tons, about 8.4 times over 1957 level, 1,234 thousand tons. The total volume of mixed feed produced in this year was composed of 8.7 per cent for growing chick, 7.7 per cent for broiler, 45.7 per cent for layer, 10.4 per cent for dairy cattle, 2.2 per cent for beef cattle, 23.4 per cent for hogs, and 1.8 per cent for others.

Maize is widely used in all kind of mixed feed, especially by very high mix ratio for poultry. According to our survey in 1967, the mix ratio of maize in the mixed feed for poultry is as follows:

Table 2. Production of mixed feed.

Division / Unite base / Fisical year (Apr.-Mar.)	Poultry								Hogs		Dairy cattle		Beef cattle		Others		Total	
	Growing chick		Broiler		Layer		Sub-Total											
	Volume	Percentage to preceding year	Volume	Percentage to preceding year	Volume	Percentage to preceding year	Volume	Percentage to preceding year	Volume	Percentage to preceding year	Volume	Percentage to preceding year	Volume	Percentage to preceding year	Volume	Percentage to preceding year	Volume	Percentage to preceding year
	1,000 tons	%	1,000 tons	%	1,000 tons	%	1,000 tons	%	1,000 tons	%	1,000 tons	%	1,000 tons	%	1,000 tons	%	1,000 tons	%
1957	—	—	(17.0) 210	—	(63.7) 786	—	(80.7) 996	—	—	—	(14.0) 173	—	(0.4) 5	—	(4.9) 60	—	(100.0) 1,234	149.1
1958	—	—	(16.0) 218	103.8	(65.7) 896	114.0	(81.7) 1,114	111.8	—	—	(12.0) 164	94.7	(0.3) 4	80.0	(0.6) 82	136.7	(100.0) 1,369	110.5
1959	—	—	(18.1) 335	153.7	(64.8) 1,201	134.0	(82.9) 1,536	137.8	—	—	(11.9) 221	134.6	(0.1) 2	52.0	(5.1) 94	114.6	(100.0) 1,853	135.9
1960	—	—	(20.3) 586	175.4	(60.2) 1,734	144.0	(80.5) 2,320	151.1	—	—	(10.7) 309	139.6	(0.2) 5	250.0	(8.6) 248	263.8	(100.0) 2,882	155.5
1961	(15.3) 627	—	(3.4) 140	—	(57.6) 2,360	126.1	(76.3) 3,127	134.8	(11.4) 465	—	(9.8) 403	130.4	(0.3) 11	197.0	(2.2) 90	—	(100.0) 4,096	142.1
1962	(13.8) 687	109.6	(3.7) 186	132.9	(56.7) 2,831	120.0	(74.2) 3,704	118.5	(12.6) 628	135.1	(10.4) 520	129.1	(0.3) 16	152.7	(2.5) 122	135.2	(100.0) 4,990	121.8
1963	(14.0) 869	126.5	(4.8) 296	159.0	(54.3) 3,365	118.8	(73.1) 4,530	122.3	(14.1) 875	139.3	(10.3) 640	123.1	(0.6) 36	222.9	(1.9) 120	98.5	(100.0) 6,201	124.3
1964	(12.7) 953	109.7	(5.1) 383	129.2	(54.6) 4,095	121.7	(72.4) 5,431	119.9	(15.5) 1,157	132.3	(9.5) 711	111.1	(0.7) 55	151.9	(1.9) 1,142	118.9	(100.0) 7,496	120.9
1965	(9.7) 793	83.2	(5.6) 455	118.8	(49.9) 4,064	99.2	(65.2) 5,312	97.8	(21.7) 1,774	153.3	(9.8) 804	113.1	(1.0) 77	140.0	(2.3) 183	128.9	(100.0) 8,150	108.7
1966	(9.6) 949	119.7	(7.1) 705	154.7	(44.9) 4,443	109.3	(61.6) 6,097	114.8	(25.8) 2,522	143.9	(9.3) 924	114.9	(1.2) 125	162.3	(2.1) 200	109.3	(100.0) 9,889	121.6
1967	(8.7) 898		(7.7) 795		(45.7) 4,713		(62.1) 6,407		(23.4) 2,423		(10.4) 1,067		(2.2) 234		(1.8) 193		(100.0) 10,324	104.3

Mixed feed	Mix ratio (%) Maximum – Minumum
for growing chick	73 – 10
for broiler	63 – 30
for layer	61 – 29

Followed by the remarkable increasing of mixed feed production, total volume of maize used in the mixed feed has been increasing year after year. The amounts of maize used in mixed feed since 1957 are shown in Table 3, and the details are also shown in Table 4.

Table 3. Maize used in mixed feed (I).

(ton)

Year	Total volume	Average mix ratio
1957	551,009	43.8%
1958	684,686	49.3
1959	925,982	49.1
1960	1,370,967	47.5
1961	1,857,373	44.8
1962	2,285,511	45.4
1963	2,583,256	41.2
1964	3,015,810	40.0
1965	2,869,471	35.0
1966	3,233,169	32.5
1967	3,313,297	32.0

Table 4. Maize used in mixed feed (II).

Year		1963	1964	1965	1966	1967
for Daily cattle	Volume	59,182	44,808	43,181	46,573	57,952
	Mix ratio	8.8	6.3	5.4	5.0	5.4
for Beaf cattle	Volume	—	5,272	5,482	7,298	18,271
	Mix ratio	—	8.9	6.7	5.9	7.6
for Poultly	Volume	2,278,266	2,661,674	2,450,394	2,683,989	2,753,987
	Mix ratio	50.7	49.6	46.5	44.4	43.4
for Hogs	Volume	171,181	228,026	296,715	422,228	405,644
	Mix ratio	19.2	19.6	16.8	16.5	16.6
for Others	Volume	74,627	76,030	73,699	73,081	77,443
	Mix ratio	32.0	33.7	28.5	27.8	31.9
Total		2,583,256	3,015,810	2,869,471	3,233,169	3,313,297

(Volume: tons, Mix ratio: %)

In spite of the total volume of maize used in mixed feed has been increased, mix ratio of maize declined in these few years. In 1967, total volume of maize used was 3,313 thousand tons, mix ratio 32.0 per cent, while in 1965, 2,869 thousand tons, 35.0 per cent. These declines of mix ratio of maize are due to the continuous replacement of maize by grain sorghum. The relationship of mix ratio in total volume of mixed feed between maize and grain sorghum is as follows:

	1962	1963	1964	1965	1966	1967
Maize	45.4	41.2	40.0	35.0	32.5	32.0%
Grain sorghum	8.2	12.5	13.4	18.9	23.8	24.9%
Total	53.6	53.7	53.4	53.9	56.3	56.9%

These replacements of maize by grain sorghum are chiefly due to their price difference and also the increased production of mixed feed for hogs which have comparatively high mix ratio of grain sorghum. Although the mix ratio of maize has been declined in these few years, the mix ratio of both maize and grain sorghum has a constant level. It has been shown fifty three per cent level except to 1966 and 1967. In these two years, the total mix ratio was elevated to fifty six per cent level. Like this tendency that using large amounts of grains in mixed feed is owing to the decrease of use of brans, according to the nutritional theory which shows mixed feed would be better to be contained high nutritive energy and low protein.

On one hand, as is shown in Table 3, very large amounts of maize — over 3,000 thousand tons, 75 billion yen per year — used in mixed feed. On the other hand, the domestic production of maize has been very stagnated. The amounts of domestic maize production since 1959 are shown in Table 5.

Table 5. Domestic supply of maize.

Year	Cultivated area (ha)	Kg/a	Yield (tons)
1959	47,900	217	103,700
1960	43,500	259	112,900
1961	43,100	269	116,000
1962	42,100	246	103,600
1963	38,500	269	103,500
1964	35,600	236	83,800
1965	30,100	250	75,300
1966	26,100	243	63,300
1967	21,200	285	60,500

The domestic supply of maize is only less than 100 thousand tons a year, therefore, almost all the maize used in mixed feed must be depended upon the imported maize. The situations of maize import since 1957 are shown in Table 6.

The increasing rate of mixed feed production would be expected to be 7–8 per cent over the previous year for the time being, the volume of maize used in mixed feed will be increasing followed by the advancement of mixed feed production.

Maize is the largest imported feed in this country. In 1966, the volume of imported maize was 3,101 thousand tons, 37.6 per cent of total feed import. Maize imports from principal countries since 1963 are shown in Table 7.

As is shown in Table 7, maize has been imported from various countries of the world and in these past five years, the majority of imported maize was supplied from the United States. In 1967, major supplying countries are the United States (52.1 per cent), South Africa (19.8 per cent) and Thailand (15.4 per cent). These three countries supplied 2,885 thousand tons, 77.3 per cent of total maize import. With comparing the previous year, imports from the United States, Thailand, Communist China and Cambodia were decreased while from South Africa, Indonesia and Argentina were remark-

Table 6. Change in maize import.

Year	Volume 1,000 tons	Value Million Yen	Average unit price Yen per ton
1957	548	13,416	24,472
1958	657	13,892	21,158
1959	921	19,544	21,230
1960	1,465	31,456	21,470
1961	1,847	38,880	21,054
1962	2,289	46,887	20,479
1963	2,632	59,306	22,531
1964	2,871	66,251	23,060
1965	2,995	72,420	24,182
1966	3,101	76,769	24,753
1967	3,305	79,132	23,956

Note: Average unit price based on CIF.

Table 7. Maize import from various countries.

(Unit base: ton)

Country	1963	1964	1965	1966	1967
Thailand	428,804 (16.3)	853,542 (29.7)	549,058 (18.3)	781,248 (25.2)	509,634 (15.4)
Cambodia	5,440 (0.2)	36,155 (1.3)	17,977 (0.6)	25,110 (0.8)	14,562 (0.4)
Communist China	87,059 (3.3)	175,513 (6.1)	223,118 (7.5)	147,356 (4.8)	57,725 (1.8)
U.S.A.	1,318,240 (50.1)	1,364,316 (47.5)	2,142,388 (71.5)	1,986,319 (64.0)	1,722,662 (52.1)
Argentina	77,134 (2.9)	14,703 (0.5)	3,777 (0.1)	27,336 (0.9)	48,992 (1.5)
South Africa	583,959 (22.2)	347,056 (12.1)	16,197 (0.5)		653,636 (19.8)
Australia		439 (0.0)			
Others	131,452 (0.5)	79,074 (2.8)	42,241 (1.5)	134,002 (4.3)	298,126 (9.0)
TOTAL	2,632,124 (100.0)	2,870,798 (100.0)	2,994,756 (100.0)	3,101,431 (100.0)	3,305,267 (100.0)

ably increased.

From Table 7, we can found that the volume of maize imported from South East Asia is still relatively small and yet it has remarkable fluctuations year by year. In my opinion, maize is so important ingredient of mixed feed that it is considered maize must be imported from impartial countries. Under the present circumstances, whether we like it or not, we cannot help to depending large amounts of maize supply upon the United States. Although there are many difficulties to increase the maize exports, it is expected very much to increase the maize import from South East Asia District.

Qualities of Imported Maize

In Japan, for manufacturing mixed feed, a lots of maize have been imported from various countries of the world up to the present. It is natural that the quality of maize should be changed not only with its species, growing district and harvesting condition but also with the condition of transport and storage. Judging the qualities of maize, we used to analyze the five components such as moisture, crude protein, crude fat, crude fiber and crude ash. Above all, moisture, crude protein and crude fat are very important. The analytical method of these components are as follows:

Moisture: Drying at 135°C for two hours. (A.O.A.C. 22.008)
Crude protein: Improved Kjeldhal method. (A.O.A.C. 2.036)
Crude fat: Ether extract method. (A.O.A.C. 33.033)
Crude fiber: Acid and alkali digestion method. (modified A.O.A.C. 22.040)
Crude ash: Ignite at 600°C for two hours. (A.O.A.C. 22.010)

As for the quality, the most important matter is how little moisture and how much crude protein have contained in maize. Maize contains the less moisture, the better quality we can expect to obtain. High moisture content of maize is not favourable because of it sometimes makes the accidents during the long marine transportation. At the same time, high moisture content makes the dry matter of maize proportionally poor. Moreover, mixed feed made by the high moisture content maize usually decreases its preservable period. This is one of the most difficult point for the manufacturers to keep a good quality of their mixed feed.

Maize mixed by high mix ratio into mixed feed compare with other ingredient, therefore the qualities of maize have a direct and serious infiuences upon the quality of mixed feed.

Small crude protein content as maize has, it is useful for crude protein source for mixed feed on account of its high mix ratio. For example, because of mixed feed for poultry has very high mix ratio of maize, considerable amounts of crude protein may be supplied by maize. Consequently, the content of crude protein of maize should be as high as possible.

On our crude fat determination, the colouring matter also determined at the same time. The colouring matter holds carotene, xanthophyll and some other useful pigments for the nutrition. Thus the content of crude fat is important just as crude protein.

The average concentrations of five components of imported maize classified by harvesting country since 1962 which were summarized from samples shown in Table 8, are arranged in Table 9. These analytical results were offered by several principal feed manufacturers in this country.

All result is not indicated the representative value of maize produced in each country because of difference in number of analyzed samples and of the imported periods. But in Table 9, we found that maize from Brazil, Indonesia, Canada and South Africa contained less moisture and from Brazil, Cambodia, Canada and Indonesia had a fairly good content of crude protein.

From the results in Table 9, followed by the imported period, the average amounts of moisture and crude protein were summarized as is shown in Table 10 and 11.

The average moisture content of imported maize had decreasing tendencies in these few years except Cambodia in 1967, and that of crude protein showed various tenden-

Table 8. Number of Samples used to summarize analytical result.

Country	1962	1963	1964	1965	1966	1967	1968	Total
Thailand		6	15	26	50	47	3	147
South Africa	11	9	12			26		58
Communist China		1	8	24	15	2	1	51
Mexico						7	10	17
Brazil		1			2	8		11
Indonesia					4	7		11
Rumania			3	2	1	2		8
North Korea		4	1			2		7
Argentina		2			3			5
Cambodia			1		2	2		5
Canada					1			1
Burma					1			1

Table 9. Average concentration of component according to harvesting country.

Country	No. of samples	Moisture (%)	Crude protein (%)	Crude fat (%)	Crude fiber (%)	Curde ash (%)
Thailand	147	13.0	9.1	3.9	2.1	1.3
South Africa	58	12.2	9.3	3.7	2.0	1.1
Communist China	51	13.4	8.1	4.1	2.1	1.4
Mexico	17	12.7	8.4	4.2	2.0	1.2
Brazil	11	11.6	10.1	3.9	2.0	1.3
Indonesia	11	12.0	9.7	3.9	2.0	1.3
Rumania	8	12.3	9.2	4.0	2.0	1.2
North Korea	7	14.1	7.7	4.0	2.7	1.2
Argentina	5	13.5	9.1	3.9	2.9	1.3
Cambodia	5	13.0	10.0	4.3	2.0	1.4
Canada	1	12.1	10.0	4.2	1.9	1.4
Burma	1	12.9	9.4	4.7	1.5	1.7

Table 10. Moisture content. (%)

Country	1962	1963	1964	1965	1966	1967	1968	Average
Thailand		12.2	13.2	13.6	13.0	12.7	12.6	13.0
South Africa	10.6	12.4	12.8			12.6		12.2
Communist China		12.6	13.7	13.5	13.6	11.9	11.8	13.4
Mexico						12.8	12.7	12.7
Brazil		12.6			13.4	11.1		11.6
Indonesia					12.8	11.6		12.0
Rumania			12.6	12.8	12.0	11.7		12.3
North Korea		14.0	16.3			13.3		14.1
Argentina		12.4			14.2			13.5
Cambodia			13.7		11.7	14.0		13.0
Canada					12.2			12.1
Burma					12.9			12.9

Table 11. Crude protein content. (%)

Country	1962	1963	1964	1965	1966	1967	1968	Average
Thailand		9.4	9.1	9.0	9.2	9.1	8.9	9.1
South Africa	9.3	8.9	9.4			9.4		9.3
Communist China		7.6	8.1	7.8	8.4	8.7	9.4	8.1
Mexico						8.5	8.3	8.4
Brazil		9.9			9.6	10.3		10.1
Indonesia					9.4	9.8		9.7
Rumania			9.2	9.2	10.4	8.8		9.2
North Korea		7.8	6.8			8.1		7.7
Argentina		9.3			9.0			9.1
Cambodia			8.9		10.2	10.3		10.0
Canada					10.0			10.0
Burma					9.4			9.4

cies according to the country. It looks like maize from Thailand has had the most definite quality.

The seasonal variations of the components of maize imported from the United States since 1965 are shown in Table 12. These analytical results were offered by the most famous two manufacturers in Japan. There is no distinct variation by the arrival period to this country, but generally arrived during October to December has less moisture content.

Table 12. Seasonal change of components of U.S. maize according to arrival period. (%)

Arrival Period	No. of samples	Moisture	Crude protein	Crude fat	Crude fiber	Crude ash
1965						
Jan.—Mar.	10	14.73	8.66	4.43	2.20	1.31
Apr.—June	6	13.00	9.03	4.08	1.63	1.18
July—Sept.	5	13.03	9.01	4.25	1.51	1.23
Oct.—Dec.	13	12.91	9.10	4.36	1.92	1.31
1966						
Jan.—Mar.	9	13.51	7.05	4.34	1.91	1.40
Apr.—June	9	13.39	9.06	3.78	2.37	1.22
July—Sept.	19	13.39	8.98	4.39	1.98	1.30
Oct.—Dec.	32	12.80	8.69	4.59	1.88	1.26
1967						
Jan.—Mar.	9	13.22	9.37	3.63	2.22	1.17
Apr.—June	12	12.85	9.50	3.75	2.10	1.30
July—Sept.	16	12.93	9.89	3.96	2.21	2.17
Oct.—Dec.	7	12.78	9.26	3.89	2.17	1.20
1968						
Jan.—Mar.	10	13.15	8.75	3.83	2.37	1.17
Apr.—June	10	13.72	8.91	3.88	2.32	1.34

In order to compare with moisture and crude protein content, the distributions were summarized in regard to the maize imported from the United States, South Africa and Thailand since 1962.

Figure 2 shows the distribution of moisture content. It is evidence that maize from South Africa has less moisture content than others. Figure 3 is the distribution of crude protein content. Maize from Thailand shows more crude protein content than others.

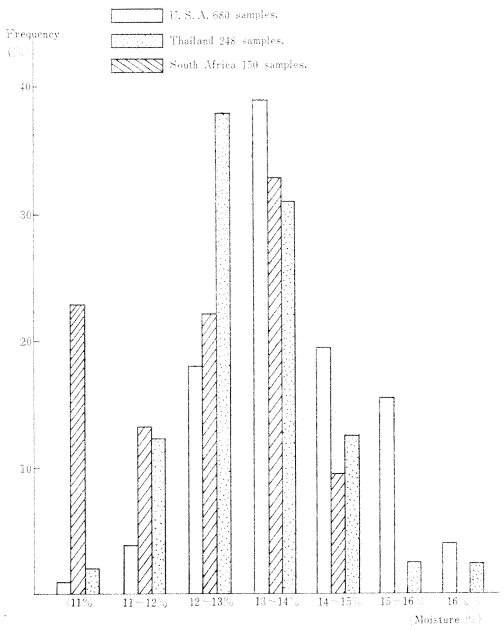

Fig. 2. Distribution of moisture content.

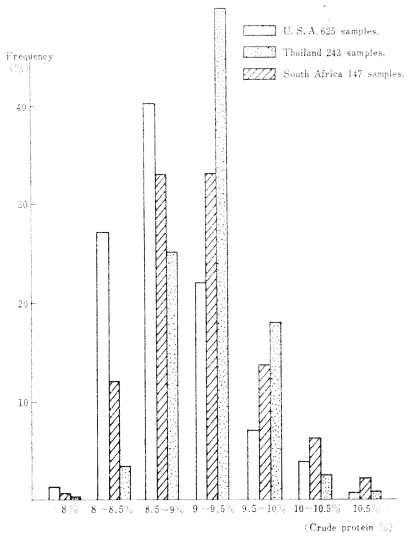

Fig. 3. Distribution of crude protain content.

Minor components in feed such as minor elements and vitamins play a very important role in the maintenance of health and nutrition of livestocks. For example, as for the minor element, deficiency of copper causes the licking sickness of the ruminants which develops symptoms of anemia and general debility and that of zinc, parakeratosis of hogs and chickens. Up to the present, cobalt, copper, iodine, iron, molybdenum, manganese and zinc are recognized as the most important and essential for animal nutrition. Among them, zinc is the most easily detectable element by polarographically. We have been determined the amounts of zinc contained in maize and in mixed feed by the polarographic method in these few years. The method used is as follows:

2.0 grams of ground sample is ashed in an electric furnace at 600°C for two hours. Dissolve the ash with 5.0 ml. of 6N hydrochloric acid solution. After 2–3 hours, the solution is transfered into a 25-ml. volumetric flask using less than 5 ml. of pure water, and then bring the flask to volume with the basal solution. The basal solution was prepared by dissolving 2.6 grams of gelatin, 25.0 grams of potassium chloride, 13.0 grams of sodium sulfite in approximately 400 ml. of pure water. The solution was transfered to a 1-liter volumetric flask and 500 ml. of concentrated ammonium hydroxide

solution was added, the flask was brought to volume with pure water.

5.0 ml. of supernatant electrolysis solution is transfered into the polarographic cell and record the D.C. polarogram between −1.0 to −1.5 volts applied. Zinc wave usually occurs at about −1.2 volts. Measure the diffusion current, and calculate the concentration of zinc from the diffusion current of known concentration of zinc.

According to our experiments, because of scanty number of analyzed samples, we could not make clear the difference of zinc concentration in maize followed by the harvesting country. Generally maize contains 10–25 p.p.m. of zinc per dry basis, it seems considerable amounts of zinc in mixed feed to be supplied from maize owing to its high mix ratio.

It must be urgent business to develop the further examinations on minor elements in feed and in maize or in other ingredients for the sake of the advancement of research on the nutrition of livestocks and of clearing up a phase of quality of improted maize. Zinc concentration in maize and mixed feed is shown in Table 13.

Table 13. Zinc concentration in Maize and mixed feed.

	No. of samples	Zn (p.p.m.)	Max.—Min.
Maize from			
Brazil	4	20.1	26.3—14.6
Indonesia	1	13.8	
Rumania	3	16.6	18.3—15.5
South Africa	6	15.3	20.6—13.3
Thailand	3	16.8	19.6—12.6
U.S.A.	18	13.3	18.3—11.5
Mixed feed for			
Growing chick	4	45.2	77.3—20.8
Layer	33	43.1	91.9—15.6
Broiler	2	24.1	27.1—21.0
Dairy cattle	14	47.0	77.3—29.2
Growing hogs	4	91.5	139.5—45.2

The colouring matter in maize is useful for the nutrition of livestocks just like the minor elements. Of them, carotinoide is most important. It has a very important roles whether as a provitamin A or as a colouration substance of egg york or chickens.

Table 14. Average concentration of carotinoid in imported maize.

Country	No. of samples	Moisture (%)	Carotinoid (mg%)
Brazil	4	10.8	2.51
Communist China	2	11.9	2.05
Indonesia	2	10.6	1.94
North Korea	1	13.5	2.23
Rumania	3	11.8	1.95
South Africa	3	10.5	3.38
Thailand	3	11.3	2.53
U.S.A.	11	12.4	2.06

The determination of carotinoide was carried out by the A.O.A.C. method (39.014). The analytical results shown in Table 14 were offered by the most famous feed manufacturer in this country.

As for the colouration of maize, more yellowish one has been required in this country on account of its high concentration of useful pigments and of a good appearance of mixed feed made by yellowish maize. From this point of view, up to the present, it is said that maize from Argentina, Thailand and South Africa has been most favourable for the ingredient of mixed feed.

Remarks

In Japan, maize is the most important ingredient of mixed feed and very large amounts of maize have been imported year by year. It goes without saying that the demand of maize in this country will be increased in future. Under these conditions, it is urgent that to insure and to develop the resources of maize with good quality. From of this point of view, we hope that maize import from South East Asia district should be increased and they could be supplied maize of good quality continuously.

Discussion

D. Sharma, India: What is the importance of zinc in feed mix? Is it very important from nutritional point of view?

Answer: Zinc is an essential element for both plant and animal nutrition. Zinc deficiency causes parakeratosis of livestocks, therefore zinc must be contained in mixed feed more than the minimum required amount for every livestock.

N. Mochizuki, Japan: How do you think about high lysine corn? Have you ever tested it in your station for improving nutritional value of mixed feed in the future?

Answer: High lysine corn will be favourable for mixed feed production. We have no experiment on using high lysine corn in mixed feed.

P. Phit, Thailand: Is there any seasonal variation of moisture content in the corn imported from Thailand? If yes, what is the amplitude of this variation?

Answer: We have no data up to the present.

A. Anós, Spain: Have you analysed the assimilable proteins in the different samples of corn?

Answer: No.