

APPLIED SCIENTIFIC RESEARCH CORPORATION OF THAILAND

BEEF CATTLE BREEDING IN JAPAN

BY

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PRIMATE RESEARCH INSTITUTE

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JANUARY 27, 1971.

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Beef Cattle Breeding in Japan

Ken Nozawa

(Primate Research Institute, Kyoto University, Japan)

Statistics on Japanese cattle

First of all, I would like to show you some statistics concerning cattle raising in Japan. Slide 1 shows the time trend of numbers of farm animals raised in Japan. Numbers of horses and goats have been decreasing year after year, and numbers of swine, chicken and dairy cattle increasing remarkably. Number of beef and draft cattle has decreased before 1967, but in 1967 the curve turned to increasing. Then, at the present time, we have about 1.8 millions each of dairy cattle and draft cattle.

Now, I have to call your attention to the fact that in our country scale of livestock raising is very small. Slide 2 shows the average numbers of large animals raised in a farm. From this figure we can see that the scale of dairy cattle raising is gradually but steadily expanding now, however that the number of beef and draft cattle per farm is rather constant year after year although a slight increasing being observed. But, in either case, scale of large animal raising in Japan is very much smaller in comparison with European and American countries. I think the same condition would be observed in Thailand too.

Next, I would like to show you kinds of Japanese beef and draft cattle. From the table of Slide 3 you can see that we don't have many beef cattle of European breeds and that a majority of our beef and draft cattle are Japanese Black breed. Other three breeds are kept almost exclusively in some prefectures, Japanese Brown in two

prefectures in southern Japan, Japanese Shorthorn in a prefecture in northern Japan, and Japanese Polled in a prefecture in western Japan. Cattle of Japanese Black breed, which are called "Wagyu", are raised all over the country. The word "Wagyu" is Japanese translation of "Japanese cattle".

Origin and history of Japanese cattle

Archeologists have clarified that cattle have been raised in Japanese Islands since about 2,000 years ago. This time coincides with the time of introduction of rice-cultivation into the islands.

We know from historical documents that in ancient times cattle were used for meat plowing and pulling as well as for milk. But as Buddhism was introduced into Japan in the middle of 6th century, their use for meat was prohibited by governmental authority. Then they had been developed almost exclusively as farming animals during a long period of about thirteen hundred years.

In 1870 Meiji Revolution occurred. That was cultural as well as political revolution. Japanese people devoted their energy to Europeanize themselves and governmental policy was released from influences of religious authority. At that time demand for meat and milk occurred and spread throughout the country. In order to improve meat and milking performances of indigenous cattle, Japan imported foreign breeds, such as Devon, Shorthorn, Jersey, Guernsey, Simmental, Ayrshire and Brown-Swiss, and crossed them with the Japanese cattle, this project being supported by the central and prefectural governments after 1900. The project had been effective to enlargement of body size and increasing milk yield; however, such harmful effects of hybridization were recognized that farming performance and feed efficiency were lowered and individual variation of performances

remarkably enlarged and such weak points were regarded as serious. Naturally Japanese farmers came back to prefer the small native cattle again.

In 1912 the Japanese government turned his policy to fix cattle's characters and performances by artificial selection from their hybrid population. This turning point synchronized with rapid increasing of demand for beef including propagation of fattening business on account of change in the mode of living of the Japanese people. In 1918 a registration system was organized in a prefecture for improvement of cattle performances and such a movement was followed in several other prefectures. I have to point out here that the registration system have to be core for the activities of improving large animals in the circumstances of small-scale agriculture and stock raising in our country. The prefectural cattle registration systems were integrated as the Japanese Cattle Registry Association (JCRA) in 1948, after the 2nd World War.

Number of meat and draft cattle in Japan showed a peak in 1956, 2,720,000 (Two millions 7 hundred and twenty thousand head). After that the number decreased year after year. The cause of this decreasing is propagation of cultivating machine with motor engine in the general farms, removing cattle from farmer's cultivation work. Since 1965 we have come to regard Japanese "Wagyu" cattle as beef cattle, not as beef and draft cattle. Being accompanied with such a trend, the JCRA revised scale of points of the Japanese Black breed of cattle, giving more scores to the characters which related to augmentation of their body capacity. Now, cattle breeders, raisers and dealers in Japan are most interested in increasing capacity of the hind quarters of their animals.

The above is a short history of the "Wagyu" cattle breeding in our country.

Here I would like to show you a result of our own investigation on the genetic similarities between different breeds of cattle raised in Japan and its adjacent localities. In this analysis genetic markers were immunological and biochemical trails tested by blood grouping and electrophoretic examinations of cattle blood. Gene frequencies were calculated in each population and genetic similarities among them were estimated by using the statistical method of numerical taxonomy. Slides 7 and 8 show that the gene constitutions of Japanese, and Korean native cattle are more similar to Holstein breed originated in Europe rather than to Taiwan Yellow cattle which is considered as a branch of Indian zebu cattle. I think from this result we can say something about phylogenetic origin of Japanese "Wagyu" cattle. We, the members of the Japanese Research Party on Native Livestock, now, have visited Thailand in order to extend this line of work to Southeastern Asia. I would like to ask your kind help to our field work in your country.

Performance of "Wagyu" cattle

Dr. Ishihara, (1960) Director of the JCRA, has pointed out the reasons why "Wagyu" cattle are raised so generally through Japan. Although the 3rd and 5th items are not so important now, I think his indication is worthy to be cited here.

The standard body size of the "Wagyu" cattle is shown in the next slide (Slide 12). Adult size is almost attained at about 50 to 60 months of age. Heifers and young bulls begin to be used for breeding at about 18 months of age.

Methods of fattening adopted in Japan and the meat producing performance of "Wagyu" cattle are shown in Slide 13. In these four methods, I think, the 1st method virgin heifer fattening is peculiar to our country. The famous Japanese food, Sukiyaki, is cooked from meat produced by this fattening

period, especially in the later stage, the heifers are given with a quantity of concentrates and even a bottle of beer as an appetizer. I would like to show you the pictures of meat shop in Japan (Slide 14) and of "Sukiyaki" dinner of my own home (Slide 15).

Breeding of beef cattle in Japan

A characteristic feature of beef cattle breeding in Japan is that the breeding works are carried out on the basis of cooperation of individual general farmers. As mentioned earlier, the scale of stock raising is extremely small in Japan. In such circumstances improvement of large animals could not be made at all without cooperation of individual farmers. Cooperation of farmers has been promoted by the JCRA and regional cattle breeding associations.

I think that such cooperative breeding works are well exemplified by showing the tradition of establishment of "Tsuru". "Tsuru" is a Japanese word which means "runner of plant", but in this case it means excellent family of "Wagyu" cattle. In the middle of 18th century, cooperation of farmers of mountain villages in western part of Japan succeeded in establishing a family of "Wagyu" cattle which could transmit desirable traits necessary for their farming work by means of inbreeding, linebreeding and artificial selection. After that, establishment of many such families were succeeded. It would be quite interesting that the beginning of such activities in Japan were contemporaneous with the brilliant breeding works of ROBERT BAKEWELL and COLLING BROTHERS in England.

In recent years, however, most of the "Tsuru" have been disappeared. Although the names of "Tsuru" are now still reserved, the substances have been destroyed. Then, after the 2nd World War, the JCRA adopted a policy to establish new "Tsuru" families with the help of modern genetics. The

fundamental conditions and distinguishing characteristics of "Tsuru" families were determined as shown in Slide 16. Several "Tsuru" clubs were organized, an example Azuma Tsuru Cattle Breeding club being shown in Slide 17.

As seen in this slide, "Tsuru" is a small family with its effective population size less than 10. Therefore, we can suppose that inbreeding coefficients in "Tsuru" families would increase remarkably generation after generation and then genetic differentiations highly occur between different "Tsuru" families. I conducted a project of pedigree analysis on four representative "Tsuru" families and general population of "Wagyu" cattle. Result of estimation of total inbreeding coefficient (F) is given in Slide 18. Average increasing of F per generation was about 2.8 percent and we knew that the genetic differentiation between families was high enough to make the distinguishing characteristics of "Tsuru" family conspicuous from each other.

Since 1962, reflecting the change in usage of "Wagyu" cattle as mentioned earlier, a project has been advanced to improve genetically the meat performances of "Wagyu" cattle. Prefectural governments, JCRA and individual cattle breeding associations have participated in the project. On the basis of establishment of "Tsuru" families, and in parallel with such activities, nicking tests between "Tsuru" families have also been carried out in this project.

According to an article of Dr. HABU (1970), the President of the JCRA, the project is composed of the following activities: yearly mating plan, examination of offspring, selection of breeding animals, meat performance test and progeny test (Slide 19). Yearly mating plan is determined by a combined body of the individual cattle breeding associations and a committee organized in the JCRA participates in it. Examination of offspring and selection of breeding animals are also made by the above two organizations. Meat performance test are made to find breeding bulls having

genetically high meat performance. There are two methods, indirect and direct. The former is test of meat quality and quantity on the fattened young progeny of specific breeding bulls, and the latter is growth test on the candidates of breeding bulls. They are carried out mainly in governmental breeding stations. Progeny tests are made to find genetic performances of specific breeding bulls, to find nicking between "Tsuru" families, or to eliminate deleterious genes from mating populations. They are carried out by initiative and guidance of the JCRA.

Here, I have to mention of the reproduction of "Wagyu" cattle. Generally speaking, reproduction of cattle in Japan is made by artificial insemination (A.I.). Slide 20 shows percentages of A.I. in dairy cattle, "Wagyu" cattle and horses. About 90 % of total number of inseminations of "Wagyu" cattle are artificial now. Results of my own studies on breeding structure of large animals in Japan have shown that the propagation of A.I. technique leads to homogeneity of gene constitution of population all over the country in dairy cattle, but that in "Wagyu" cattle such trend can not be observed so conspicuously as in dairy cattle. I think this is a reflection of the tradition for establishing cattle families adapted to environmental and agricultural conditions in specific breeding districts of "Wagyu" cattle.

Biometrical genetics of "Wagyu" cattle

Chugoku Agricultural Experimental Station, which is under the control of Japanese Ministry of Agriculture and Forestry, is making biometrical genetic works on the meat performances of "Wagyu" cattle. The results of estimations of genetic parameters concerning growth have been published by Prof. KUMAZAKI and other (1962). I would like to show you their results in Slide 21. They estimated heritability values of five characters and genetic correlation coefficients between them. In addition, by using these estimates

they have obtained a selection index, by which the genetic effects of gain in early one year after birth can be most accurately predicted, as given in the Slide.

We are most interested in obtaining heritability values of body weight gain and feed efficiency during fattening period in "Wagyu" cattle. But, I am sorry, I have to say that such estimations have not yet be published in our country. Now, we are expecting to know such genetic parameters as early as possible.

Outlook and future problems

Land area of Japan is about 70 % of that of Thailand, and is composed of many mountainous islands. And population is about 100,000,000 (one hundred million) and agricultural population is about 20 % of it. In parallel with recent advances in industrialization, agricultural population has been decreasing year after year in our country. In spite of such trend, demand to meat has been increasing now in Japan on account of rise of living conditions of people as shown in Slide 22. Then, we think that importance of beef cattle breeding will grow bigger and bigger. Under such circumstances, I think, there are three problematic points:

- (1) Grass resources are very poor except in mountaineous regions.
- (2) Increasing of "Wagyu" cattle population is very difficult, because market prices of beef have been going now.
- (3) Japanese people are unaccustomed to mass raising of large animals.

From genetic point of view, the within-breed selection programmes must have targets to increasing body capacity especially in hind quarters, premature growth and high feed

efficiency. In order to propagate mass raising of "Wagyu" cattle on the pasture, genetical improvement of gregariousness would be made on the cattle's side. Of course, we have to promote the spread of business of meat performance test and progeny test in "Wagyu" cattle. It can be supposed that in the near future the frozen semen of proved sires would come to be maintained semipermanently and used for insemination.

Recently, Japanese government has sponsored the importation of foreign breeds of beef cattle, that is, Hereford, Aberdeen Angus, Shorthorn and Charolais for breeding materials. Breeders of beef cattle have come to consider that the fattening performances of F_1 young steer from the cross between male of foreign breeds and female "Wagyu" cattle should be tested (KOBORI, 1968). We think, too, it be necessary, and from our history of "Wagyu" cattle breeding, I think that the F_1 individuals should not be used as breeding animals.

5 Million

Number of farm animals in Japan

(Japanese Ministry of Agriculture and Forestry)

4

3

2

1

Swine

Beef and draft
cattle

Chicken

Dairy cattle

Horse

Goat

Chicken
Million 150

100

50

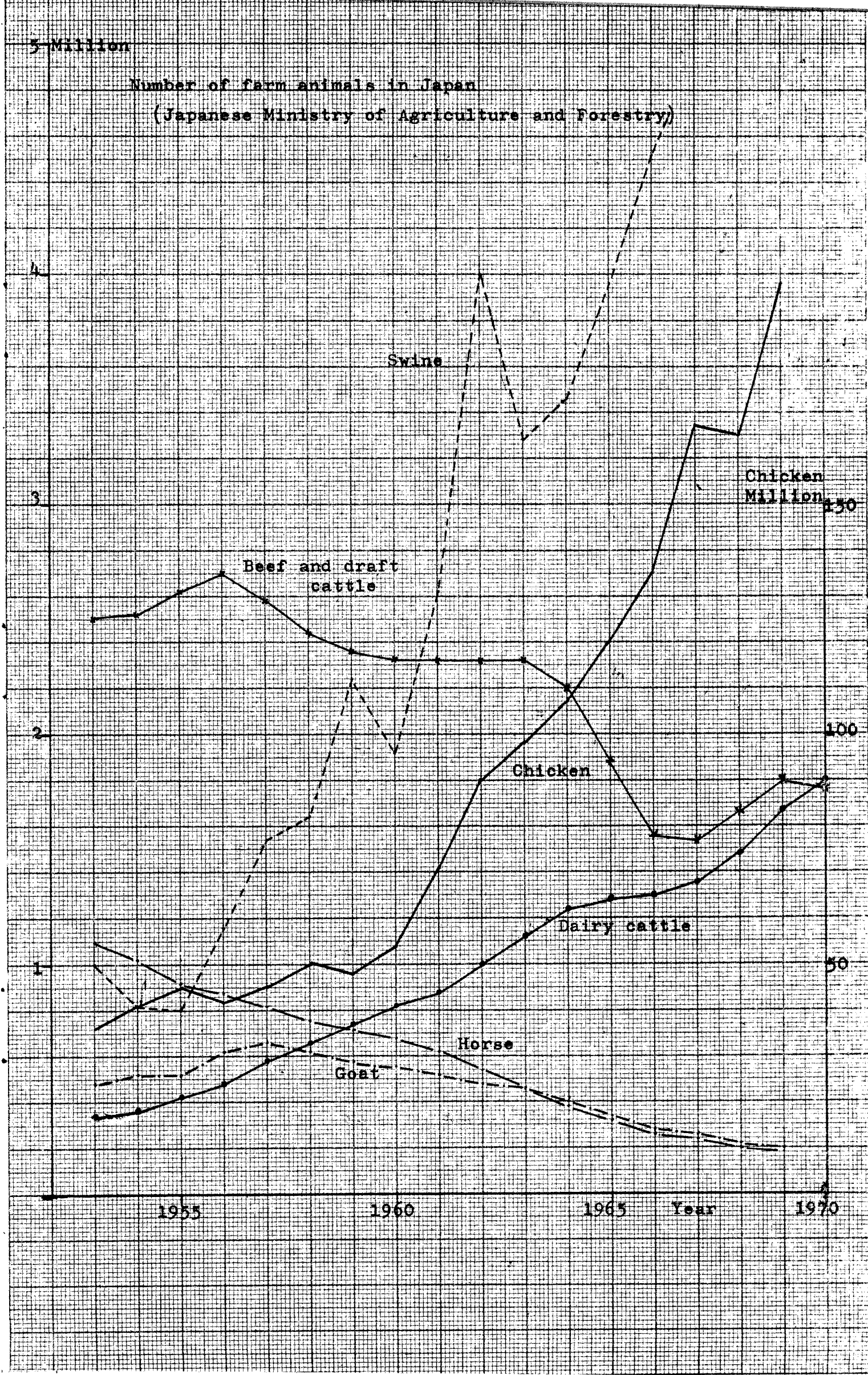
1955

1960

1965

Year

1970



1955

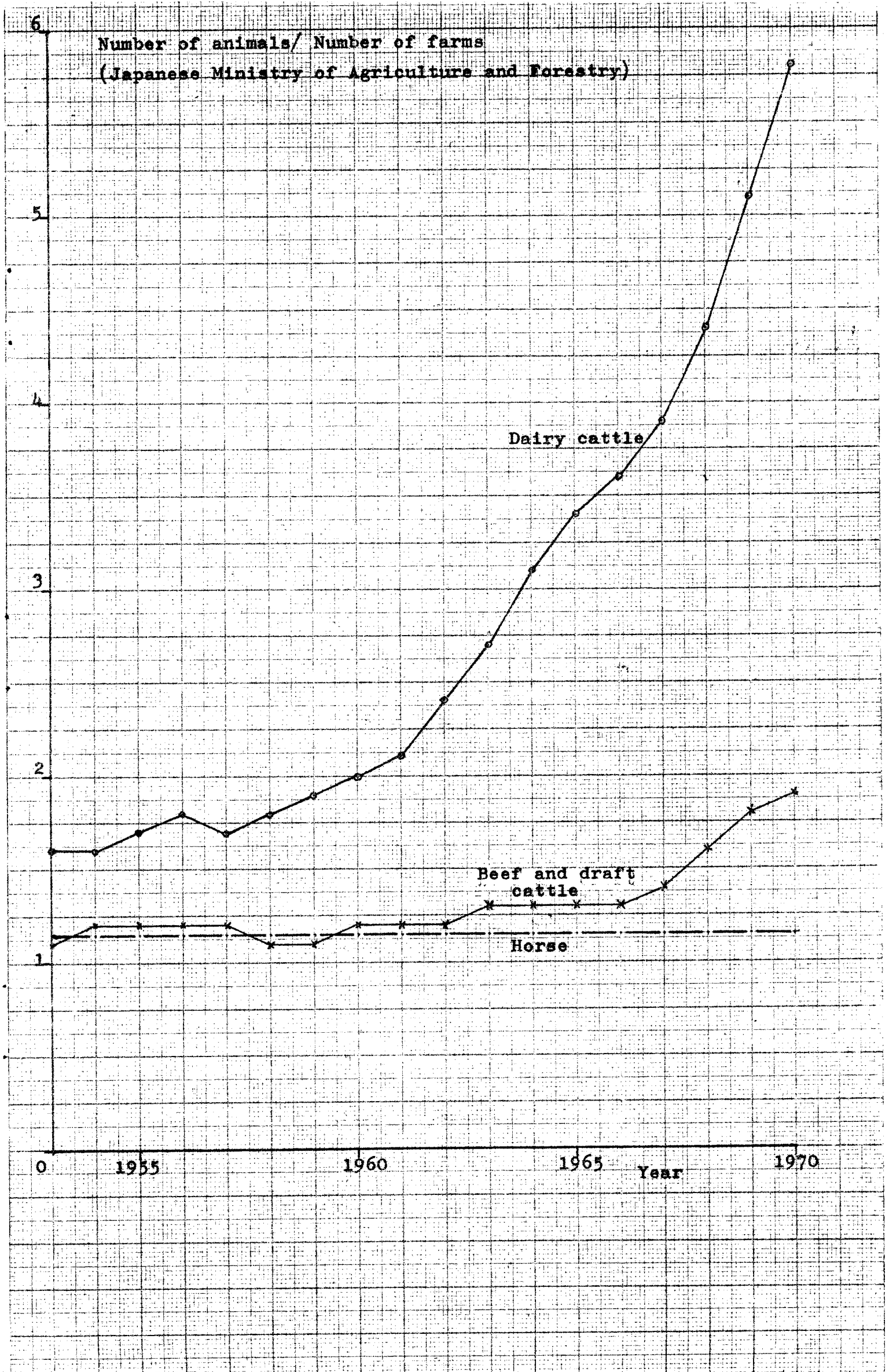
1960

1965

Year

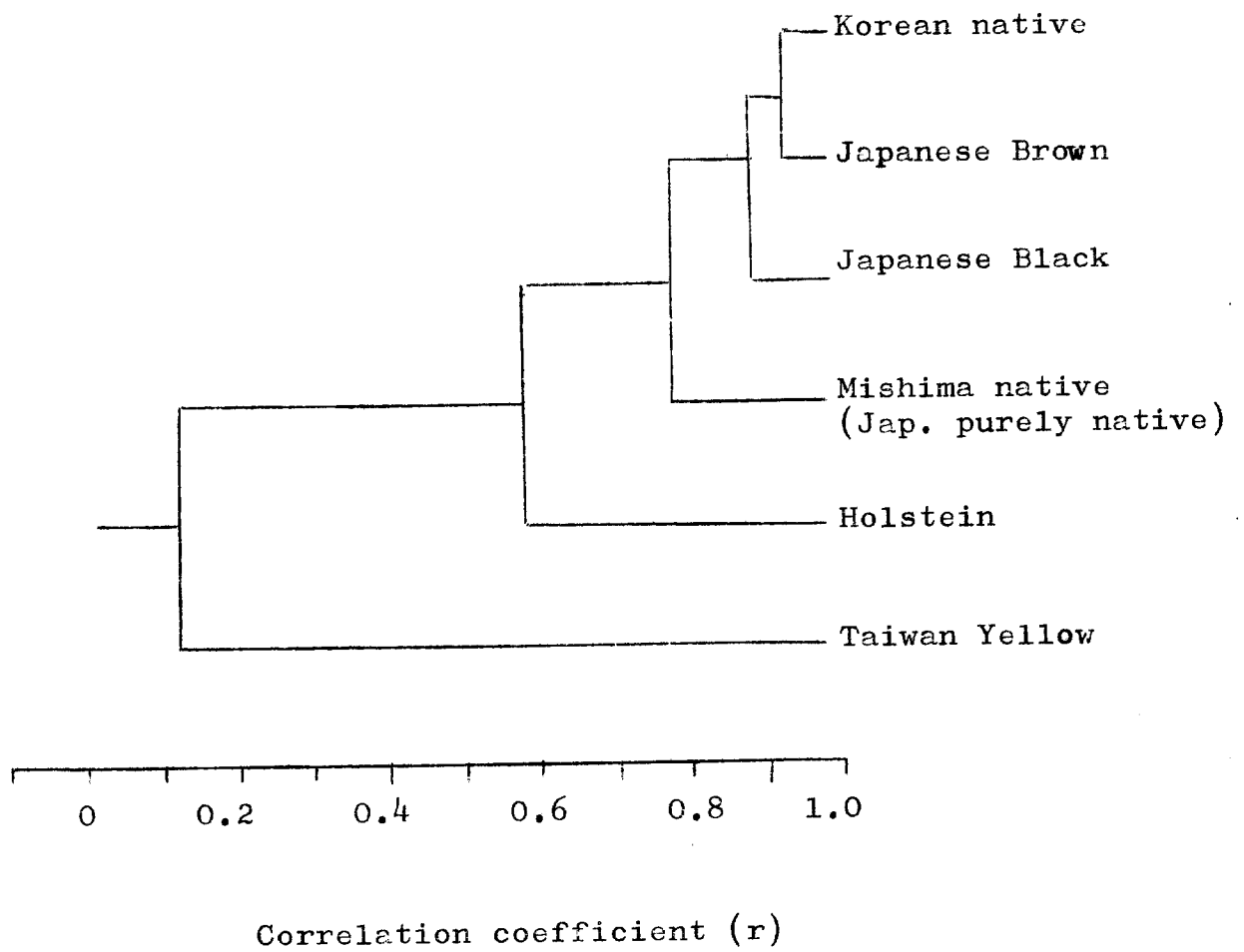
1970

Number of animals/ Number of farms
(Japanese Ministry of Agriculture and Forestry)



Slide 3. Breeds of beef and draft cattle in Japan (1967)

Name of breed	Number	Percentage
Japanese Black ("Wagyu")	1,216,510	82.0
Japanese Brown	232,201	15.6
Japanese Shorthorn	25,077	1.7
Japanese Polled	7,394	0.5
Aberdeen Angus	862	0.2
Hereford	455	
Others	1,470	
Total	1,483,969	100.0



Dendrogram showing genetic similarities among East Asian cattle

Reasons why "Wagyu" cattle are raised so generally throughout Japan. (ISHIHARA, 1960)

1. Being indigenous, they are very healthy, long-lived and commonly successive breeders.
2. They are easily fed with such self-supporting fodder as rice-bran and rice-straw, which can be produced on every farm through our country, as well as with the grass of mountains and pastures. Thus they have a performance of effective feed utilization even on the feeds of poor quality.
3. They are gentle-natured and intelligent as farm working animals, and are quick and skilful in working even on the narrow sections of rice-paddies.
4. They fatten effectively. The quality of meat is excellent; the grain of meat is very fine, the marbling very remarkable, the tenderness high and the taste delicious.
5. Though their amount of milk secretion is only about the same as that by goats, the fat content is high, and, in case of need, it is readily available to the farmers for their family use.

Slide 6. Standard size of Japanese Black breed as
breeding animal

	<u>female</u>	<u>male</u>
Withers height	125 cm	137 cm
Body Weight	420 kg	700 kg
In percentage ratio to withers height:-		
Hip height	100	98
Body length (horizontal)	118	122
Heart girth	142	153
Chest depth	53	55
Chest width	36	38
Rump length	40	41
Hip width	39	38
Thurl width	36	37
Pinebone width	24	25
Shin circumference	13	15

Slide 7. Methods of fattening and changes of body weight
(modified from TSUCHIYA (1970))

Basal animal	Period of fattening	Body weight (kg)	
		Basal	Final
1) Virgin heifer (2-3 yrs. old)	10-12 months	370-420	550-630
2) Cow (3-11 yrs. old)	3- 6 months	340-400	450-525
3)* Young steer (Weaning, castrated 2-3 months old)	11-12 months	160-200	450-480
4)* Adult stag (castrated, 2-3 yrs. old already used for farming)	5- 6 months	370-420	500-600

*

Hormonal substances (stilbesterol or thiouracil) are frequently given.

Slide 10. Fundamental conditions and distinguishing characteristics for "Tsuru" families (UESAKA, 1958)

Fundamental conditions:

- (1) Strong constitution, gentle temperament and no vices.
- (2) Vigourous fertility and successive breeder.
- (3) Belonging to a long-lived and successive breeding strain.

Distinguishing characteristics ("Tsuru" family must inherit strictly and prepotently some of the following traits):

- (1) Proportional and capacious body.
- (2) High efficiency of feed utilization.
- (3) Udder capacious and well formed with teats separately placed.
- (4) Clean cut of general appearance, firm body and fine bone.
- (5) Clean cut of the face.
- (6) Firm and strong legs and hoofs.
- (7) Good hair and hide
- (8) Good forms and qualities of both horns and hoofs.

Slide 11. Azuma Tsuru Cattle Breeding Club
(from UESAKA, 1958)

Locality : Hiwa, Hiba County, Hiroshima Prefecture, Japan

Members (Owners of fundamental cattle) : 35

Active Bulls : 3

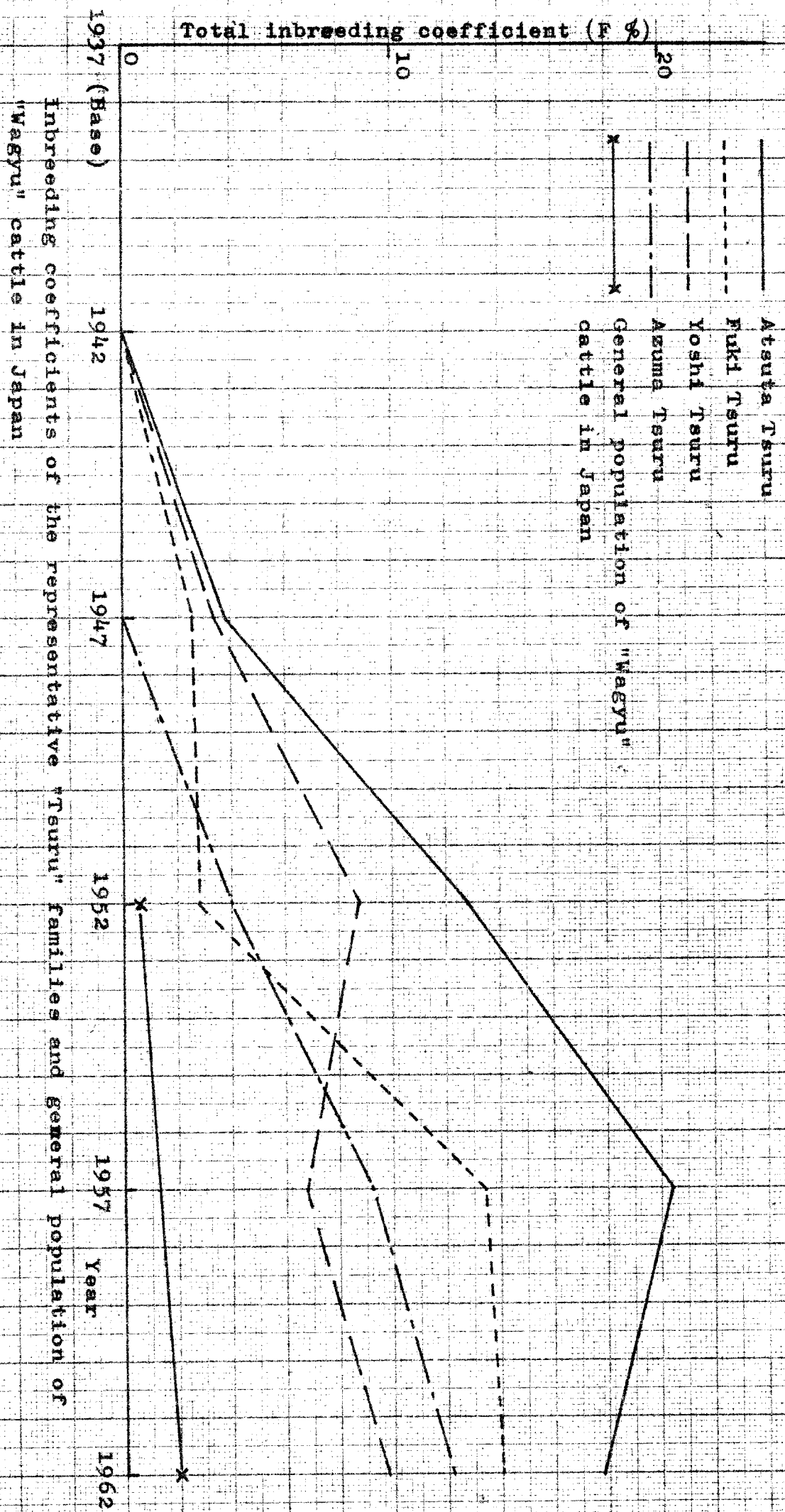
Regular breeding cows : 37

Associate breeding cows of the associate members : 42

Reserved calves (rearing heifers) : 12

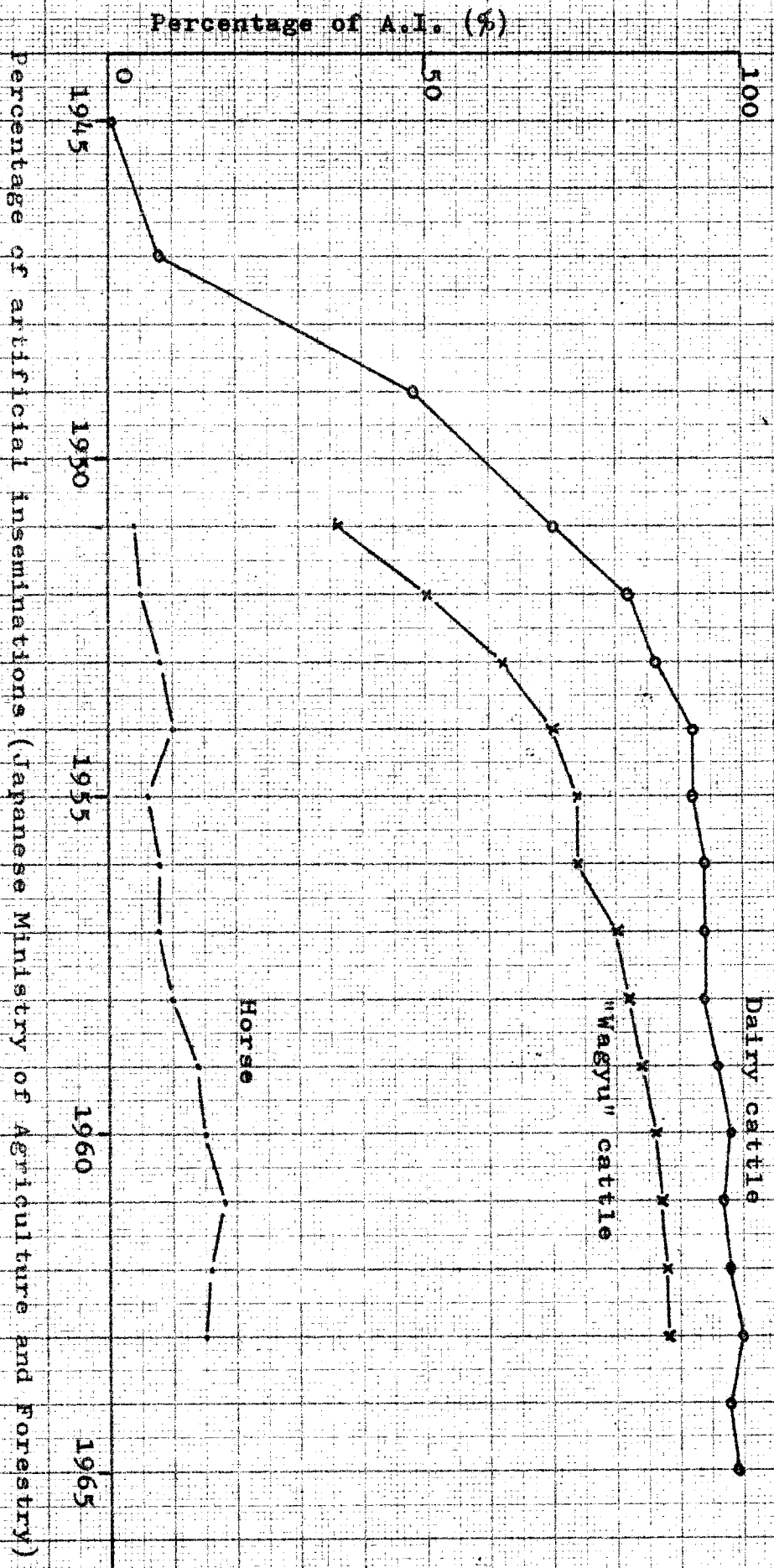
Distinguishing characteristics :

- (1) Well-sprung ribs and deep body
- (2) Firm body and clean cut of the face
- (3) Strong legs and hoofs, and fine bones
- (4) Good hair and hide, horns with high qualities
- (5) Capacious and well-formed udder



Slide 13. Project for genetical improvement of the
meat performances

- (1) Yearly mating plan
- (2) Examination of offspring
- (3) Selection of breeding animals
- (4) Meat performance test
- (5) Progeny test



Slide 15. Genetic parameters concerning growth in
"Wagyu" cattle (KUMAZAKI et al., 1962)

Heritability (h^2)

(1)	Birth weight (X_1)	0.23 ± 0.16
(2)	Weaning (6 months) weight	0.15 ± 0.14
(3)	Gain (birth to weaning) (X_3)	0.10 ± 0.12
(4)	12 month weight	0.65 ± 0.34
(5)	Gain (6 to 12 months) (X_5)	0.67 ± 0.34

Genetic correlation (r_G)

	(2)	(3)	(4)	(5)
(1)	0.940	0.887	0.559	0.223
(2)		0.995	0.684	0.283
(3)			0.683	0.282
(4)				0.890

Selection index (I) for estimating genotype of the gain
from birth to 12th months.

$$I = 1.221 X_1 + 0.464 X_3 + 0.774 X_5$$

Slide 16. Trend of demand to meat in Japan (X 1,000 tons)
 (Japanese Ministries of Public Welfare and of Finance)

Year	Beef			Pork			Chicken		
	Production	import	Total	Production	Import	Total	Production	Import	Total
1960	142	6	148	147	6	153	75	0	75
1961	143	5	148	206	1	207	97	0	97
1962	146	5	151	324	0	324	121	0	121
1963	186	5	191	279	7	286	142	3	145
1964	224	6	230	298	4	302	176	6	182
1965	208	11	219	365	0	365	204	6	210
1966	156	13	169	505	0	505	240	8	248
1967	147	16	163	547	0	547	303	10	313
1968	172	15	187	511	18	529	336	18	354

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