Animal Agriculture in Indonesia

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Even though the average inhabitant of Indonesia had only 0.07 animal units and consumes only 2.5 grams of animal protein per day, animal agriculture is important to both the agricultural and overall economy. The significance of this statement will become clear as we study the farming system in Indonesia along with the purpose of animals in these systems.

Since Indonesia is a new country and is far-removed from the North American continent, it is possible that our understanding would be greater if there were discussions on some general features of Indonesia, such as its location and size, its people, and the total population and density. In addition, there are some distinct breeds in Indonesia, thus it is indicated that the animal genetic resoures be discussed.

General Features of Indonesia

Indonesia is strategically located as it is near the population centers of China, India, and Japan. The Stratis of Malaca is a busy seaway, providing the shortest route from the Suez Canal to Hong Kong, Korea, and Japan. Indonesia is also near the resource-rich countries of Australia and New Zealand, as shown in Figure 1.

The country is in reality, an island chain stretching from about 95° to 141° west to east and about 5° N to about 11° S, an area of about 5100 km x 1600 km. Within this area are 13,667 islands ranging in size from small coral reefs to one the size of France, Kalimantan (Borneo). There are about 193,494,000 ha of land and inland waters; however, this does not tell the entire story of Indonesia's wealth: There is much shallow water in between the many islands and these waters are teeming with fish, shrimp, and other sea foods, which provide food for its people and earn valuable foreign exchange monies. Even more important, under these shallow water lie many small pools of low-sulfur oils which command high prices in the international markets. Therefore, Indonesia now is beginning to accumulate monies needed for development.

There are about 148 million people in Indonesia making it the fifth largest nation in the world ranking behind China, India, the USSR and the U.S.A. It is the third largest country in Asia, ranking behind China and India.

A study of the people in Indonesia is most interesting because for many years it was a mosaic of island societies, each with its own language and dialects, traditions, and cultures. India, in the third and fourth centuries, and late Islamic influences, in the fifteenth century, made some inroads toward creating larger societies. The Dutch came about 400 years ago setting up colonial rule, but they maintained these disparate societies. Therefore, upon obtaining independence in 1949, Indonesian leaders had the responsibilities of creating "one nation" from these disparate groups.

Indonesia has had only two presidents--Sukarno and Suharto: Sukarno, by incomparable rhetoric, the shared experiences of a bitter struggle for independence and battles to acquire more territories, did much to create "one nation." However, he created economic disaster in so doing. General Suharto, who replaced Sukarno, by building upon the "Panca Sila" (the five principles of the 1945 Constitutions) and by use of a strong military bearing, has kept the nation together. Indonesia is much stronger economically now than ever before; however, she still has tensions:

Islam vs Christians
Javanese Leaders vs the Chinese Minority
Javanese Rich vs the Javanese Poor
Javanese Leaders vs Leaders on Outer Islands and others

About 60 percent of the labor force are in the rural areas and are engaged in agriculture. However, agriculture accounts for only 30 percent of the G.N.P. Also, the G.N.P. is growing by 8.0 percent per year whilst agriculture is only about 3.5 percent.

The average income is $370.00 per year, but the poorest people are found in the villages, and they are farmers.

As a whole, Indonesia has about 148 million people on an area of 1,934,544 km^2, a density of 77 people per km^2. However, the greatest concentration of people are on the islands of Java, Madura, and Bali which have 94,389,000 people on just 137,748 km^2, a density of 685 people per km^2. In contrast, the Outer Islands have 53,727,000 people on 1,797,196 km^2, a density of about 30 people per km^2. In other words, 64 percent of the people live on 7 percent of the land, whilst 36 percent of the people live on 93 percent of the land, see Table 1 and 2.

Farming Systems

In general, agriculture in Indonesia is an enterprise of small holders, who engage in subsistence agriculture. For example, there are about 6.6 million farms which contain less than 0.5 ha and about 7.8 million which have more than

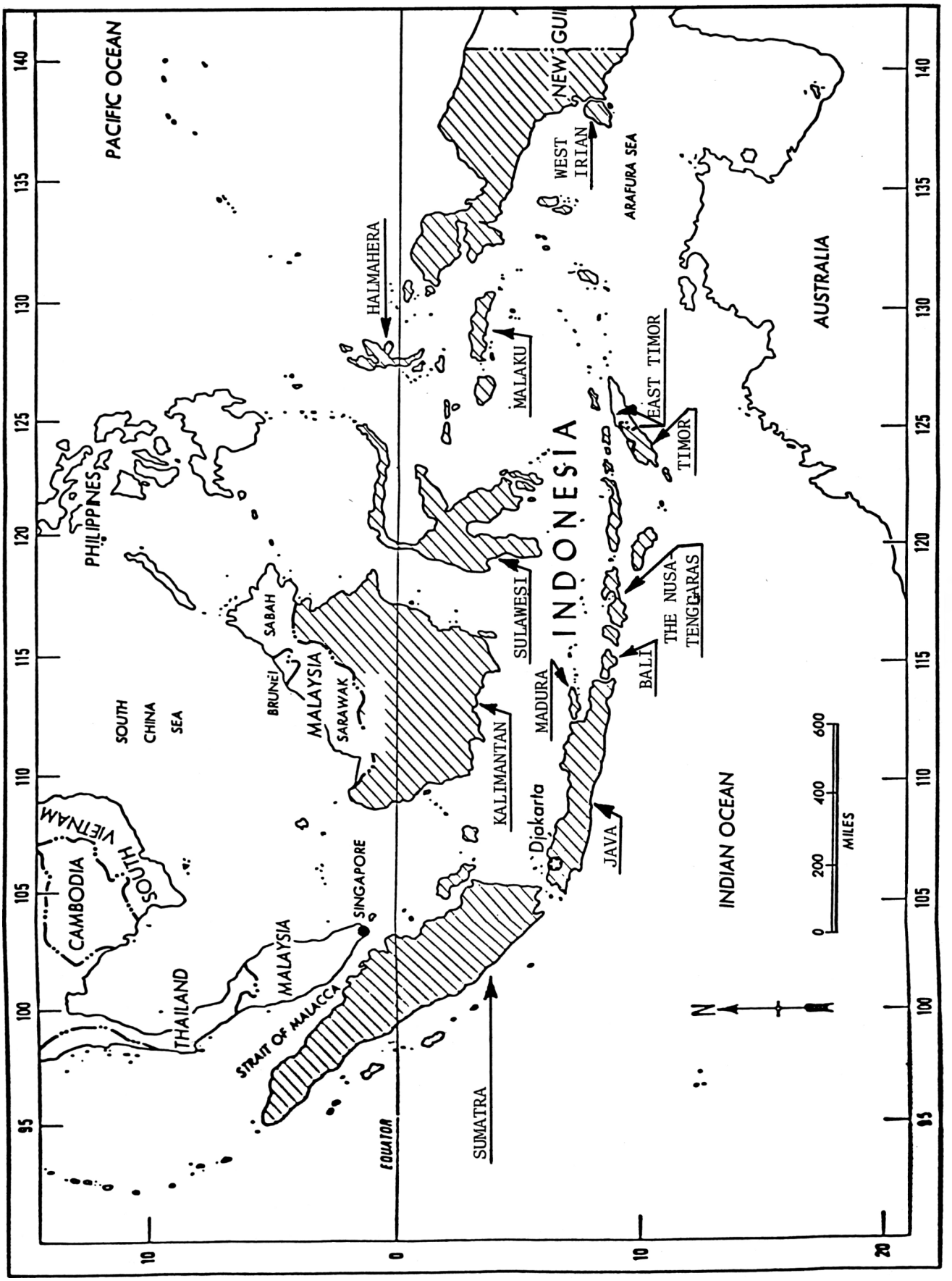


FIGURE 1

Table 1

THE POPULATIONS OF PEOPLE, THEIR LIVESTOCK, AND THEIR DENSITIES IN INDONESA

	Indonesia	
	Numbers (000)	Density (km^2)
LAND AREA, KM^2	1,934.944	—
POPULATIONS:		
HUMAN	148,116	76.5
CATTLE	6,426	3.3
BUFFALO	2,313	1.2
SHEEP/GOATS	11,674.7	6.0
SWINE	2,647.3	1.4
HORSE	619.6	0.3
CHICKENS	89,462.1	46.2
DUCKS	14,183.2	7.3

Source: FAO Production Yearbook (1979)

About 25 percent of the lands are irrigated whilst the remainder is subjected to dryland farming. In the irrigated sections, three crops are grown each year--two crops of rice and one of the secondary crops, which are maize, peanuts, soybean vegetables and others. The two rice crops are usually grown during the monsoonal season while the secondary crops are grown during the dry season. In the non-irrigated sections, there are usually two crops--rice is grown during the heaviest of the monsoons and is followed immediately by one or more of the secondary crops, which receive some of the tail end of the monsoonal rains, these lands usually lie fallow during the extremely dry months.

Almost 99 percent of the large ruminants are owned by the small holders who integrate their productions with crop production: The cows of cattle and buffalo are used as the draft power source for land preparation and other chores on the farm. These animals usually consume the coarse crop residues, producing valuable manure, which is used in the

Table 2

A COMPARISON OF THE POPULATIONS OF PEOPLE, THEIR LIVESTOCK, AND THEIR DENSITIES IN JAVA, MADURA, AND BALI, TO THE OUTER ISLANDS

	Java, Madura, Bali			Outer Islands		
Items	Numbers 000	Density km^2	% of Total	Numbers 000	Density km^2	% of Total
LAND AREA, KM^2	137.748	—	7.1	1,797.196	—	92.9
POPULATIONS						
HUMAN	94,389	685.2	63.7	53,727	29.9	36.3
CATTLE	4,250	31.3	66.1	2,176	1.2	33.9
BUFFALO	1,077	7.8	46.6	11,236	0.7	53.4
SHEEP/GOATS	9,918	72.0	85.0	1,756.7	1.0	15.0
SWINE	680	4.9	25.7	1,967.3	1.1	74.3
HORSE	130	0.9	21.0	489.6	—	79.0
CHICKENS	58,958.7	428.0	65.9	30,503.4	16.8	34.1
DUCKS	7,786.3	56.5	54.9	6,396.9	3.6	45.1

Source: See Table 1

0.5 ha. Most of the people live on the island of Java where the average farm size is only 0.4 ha, one acre.

The primary purposes of the small subsistence farms are to grow the food crops needed by the family. After these needs are met, the food crops in surplus are sold. Rice is the primary crop whilst maize or corn is a far-distant second.

production of many secondary crops, or it can be sold. In addition, these cows produce one calf during each 15-18 month period, and the young bulls are sold for beef while the heifers are either kept for replacements or are sold to others. Meat, in this system, comes from very old cows, young bulls, and possibly old bulls, which have been used for road draft

purposes.

Because of the close integration of crop production with animal production, the large ruminants (cattle and buffalo), as well as the small ruminants are found where the people are. This point is illustrated by Tables 1 and 2, which exhibit data on the population of people and their animals for all of Indonesia, for Java, Madura, and Bali, the thickly-populated areas, and the Outer Islands, which are sparsely populated with both people and animals.

The Purposes of Farm Livestock in Indonesia

The small subsistence farmers own most of the farm livestock in Indonesia, and these are kept for various purposes which are discussed by classes of livestock, as follows:

The primary purpose of the large ruminants is for *draft power.* Females of both cattle and buffalo are used for land preparation, land cultivation, and transport. In addition, these cows will produce one calf each 15-18 month period and will be slaughtered for meat after their fertile age has passed.

Manure production is of importance in the upland areas where it is of value for the production of vegetable crops. As the animals are fed coarse crop residues in covered pens near the homes, the volume of manure is high, and it is kept with the minimum loss of nutrients; the product is in demand.

Meat production comes from the slaughter of young bulls, old bulls, and old cows. In reality, the sale of these is secondary to the real purpose of keeping animals, the maintaining of a *living savings account.* Since the cows are integrated into the farming system, there is not much flexibility in the sale of these. However, the young bulls do offer flexibility and are only sold when money is needed for various purposes--religious ceremonies, weddings, payment of school fees, etc.

There are only about 100,000 dairy cows in the country, and their primary purpose, of course, is for the *production of milk;* manure and meat productions are secondary.

The primary use of small ruminants is for the production of meat, hairwool, and hides. However, the real purposes of the owners in keeping these animals is to maintain a *living savings account,* as was described earlier. Manure production is a secondary consideration.

There are only a few horses in Indonesia, and the primary purpose is for transport and for sporting activities.

The primary purpose for keeping swine is for meat production. In some areas, manure production is also of interest.

Both chickens and ducks are important. The purposes of poultry keeping are for meat and eggs. About 99 percent of the meat and 40 percent of the eggs in Indonesia are furnished by the native fowl, which are owned by the small holders.

Brief Descriptions of the Livestock (Genetic Resources)

In reality, there have been no concentrated scientific efforts to produce special breeds of animals in Indonesia. However, there are concentrations of animals in given areas which might be classified as breeds. In this light, there will be only a cursory examination of the breeds of animals found in Indonesia as follows:

Most authorities list three breeds of *beef cattle* as *Bos sandaicus* (Bali), *Bos indicus* (Ongole) and Madura cattle, which is probably a cross between Bos sandaicus and indigenous cattle; there is a distinct possibility that there are *Bos taurus* genes in the breed.

The Bali cattle are maintained pure, by law, on the island of Bali. It is a descendant of the wild Banteng animals which was domesticated over many years: there are still wild animals in some areas on Java. The Ongole was an import from India, and is probably related to the Nellore breed from India. The breed is maintained pure, by law, on the island of Sumba.

The color markings and other characteristics would indicate that all of the above are purebreeds. Some authorities differentiate the Ongoles, indicating that those on Sumba are pure while those elsewhere are crossbreeds. Therefore, they use the terms "Sumba Ongoles" and "Peranakan (cross) Ongoles."

All of the breeds are small, as shown in Table 3.

Table 4 exhibits estimates by performances of the three breeds.

In recent years, the Government of Indonesia has established four model cattle ranches on Sulawesi and Sumba. As a result of these efforts, there are about 50 viable large ranches in Indonesia. It is of interest that there have been problems in adaptation of all of the above breeds when moved from the small holder farms on Java, Madura, and Bali to the large ranches in Sulawesi.

The *swamp buffalo* is usually found in the swampy areas of Indonesia, as they are valuable for plowing in the heavy and mucky soils found in many areas.

There are three major color types: The most common one is dark grey in which the horns, hooves, and hair tend to have the same color as does the skin. There are albino buffalo in Indonesia, and it is estimated that the frequency is about ten percent. Also, there are piebald animals, but these are rare. These are so valuable in the burial ceremonies of the Toraja people in South Sulawesi that it is interesting that there has not been greater interests in concentrating the gene frequency for this color trait.

Size and other data on the swamp buffaloes are shown in Table 5.

There are about 100,000 *dairy cows* in Indonesia and most of these are found on Java. The predominant breed is the Grati animal, which is a Holstein-Friesian crossbred animal. The Dutch settlers brought purebred Friesians from Holand and the bulls were bred to the indigenous animals. As most of the Grati animals contain high percentages of Friesian

Table 3

ADULT SIZE OF INDONESIAN BEEF CATTLE

Item	Animal			
	Bali	Madura	Sumba Ongole	Peranakan Ongole
Weight, (Kg)				
Male	384	305	544	384
Female	258	206	408	290
Wither Height, (Kg)				
Male	128	127	149	132
Female	110	109	132	125
Heart Girth, (Kg)				
Male	188	164	210	169
Female	163	142	147	162

Source: Hardjosubrato and Astuti (1979)

Table 4

SOME CHARACTERISTICS OF LOCAL INDONESIAN CATTLE

Items	Bali	Madura	Ongole
Fertility	+++	++	+
Calving Difficulties	—	—	—
Calf Mortalities	+	++	+
Birth Weight, (Kg)	13-15	12-18	20-25
Weaning Weight, (Kg)	70	60	85
Daily Gain, (Kg)	0.35	0.25	0.30
Feed Conversion	++	+	++
Age At Puberty, Month	18-24	20-24	24-30
Disease Resistance	++	+++	+++
Heat Tolerance	+++	+++	+++
Male Libido	++	+	+
Grazing Ability	+++	+++	+++
Mothering Ability	+++	+++	+++
Milk Production	+	+	+
Mature Weight			
Male, (Kg)	375	275	400
Female, (Kg)	275	250	300
Dressing Percentage	56	48	45

Source: Hardjosubrato and Astuti (1979)

genes, they closely resemble Friesians found anywhere, except the Indonesian animals are smaller.

There are a few Hissar cattle in North Sumatra, and these were brought in from India by Indian immigrants many years ago. These have been crossed with the native animals, but for the most part the crosses resemble the Hissar parent.

Some data on the Grati dairy cattle breed is shown in Table 6.

As most of the Grati animals are bred using A.I. and semen from purebred Friesians in the U.S., New Zealand, and elsewhere, the indigenous animals are approaching Friesians in size, color and performances.

In case of the *small ruminants*, the distinction between breeds in both sheep and goats is much more hazy than in the case of cattle and buffalo. Nevertheless, some authors have listed three breeds of sheep and three breeds of goats, as follows:

SHEEP

(1) Javanese thin-tailed
(2) Priangan
(3) Fat-tailed

The author feels that there are no great differences between the Javanese thin-tailed and the Priangan, thus the distinction should be dropped and one name or the other be used. This breed probably originated from crossing cape sheep from South Africa, possibly the Africander, with the local sheep.

Table 5

SOME CHARACTERISTICS OF THE SWAMP BUFFALO IN INDONESIA

Items	Male	Female
Body Weight, (Kg)	600	500
Wither Height, (Cm)	128	124
Heart Girth, (Cm)	191	180
Gestation Period, Days		300
Birth Weight	27	26
Daily Gains, (Gm)	410	390
Lactation Period, Days		270
Daily Milk Yields, (Kg)		2-4
Milk Fat, Percentage		7
Heat Tolerance	FAIR	FAIR
Age First Calving, Months		42
Breeding Interval, Months		14-18
Feedlot Performance:		
Daily Gains, (Gm)	730.0	-
DM Intake, G/Kg $^{0.75}$	76.6	-
Feed Conversion, Kg Feed/Kg Gain	8.0	-
Dressing Percentage	51.8	-
Muscle: Bone Ratio	3.34:1	-
Fat Disposition	HIGH	-

Source: Hardjosubrati and Astuti (1979)

Table 6

SOME CHARACTERISTICS OF THE GRATI DAIRY CATTLE IN INDONESIA

Items	Male	Female
Body Weight, (Kg)	500	400
Wither Height, (Cm)	130	120
Chest Girth, (Cm)	193	180
Lactation Period, Days		323
Dairy Milk Production, (Kg)		6-15
Age At First Calving, Months		38
Calving Interval, Months		14
Heat Tolerance	GOOD	GOOD

Source: Hardjosubrato and Astuti (1979)

The fat-tailed sheep are found in Central and East Java and were brought in from Southwest Asia, probably Iran, in the 19th Century. It resembles fat-tailed sheep found in Iran, Afghanistan, and Pakistan. Data on sheep are presented in Table 7.

GOATS

Some authors report that there are three major breeds of goats, but these distinctions are not clear. The breeds are:

(1) Kacang
(2) Grade Ettawa
(3) Gembrong or Bligor

The Kacang (peanut) goat is small and is found over a wide area. There is no uniformity of color, ranging from the base colors of black brown, and white, and it seems that all possible variations are present.

The Grade Ettawa is a cross between the purebred Ettawa (jumnapara), which was imported from India, and the local breeds.

The Gembrong or Bligor is difficult to define. Data on goat are presented in Table 8.

Some authorities believe that there are three breeds of *pigs* in Indonesia as follows: The Java pig, the Bali pig and the

Table 7

SOME CHARACTERISTICS OF SHEEP IN INDONESIA

Items	Thin-Tailed		Priangan		Fat-Tailed	
	Male	Female	Male	Female	Male	Female
Mature Weights, (Kg)	40	30	50	35	40	35
Fleece		HAIRWOOL		HAIRWOOL		HAIRWOOL
Slaughter Weight, (Kg)	22	19	22	22	22	20
Prolificacy,		Excellent		EXCELLENT		Excellent
(Lambs/100 Ewes)		145		156		160
Age At First Parturition, Months		15		15		15
Seasonality of Estrus		NONE		NONE		NONE
Time Between Parturition, Months		8		8		8
Daily Gains, (Gm)		80-140		80-140		80-140
Dressing Percentage		51		51		51

Source: Hardjosubrato and Astuti (1979)

Table 8

SOME CHARACTERISTICS OF GOATS IN INDONESIA

Items	Kacang		Grade Ettawa		Gembrong	
	Male	Female	Male	Female	Male	Female
Mature Body Weight, (Kg)	35	30	60	50	45	38
Slaughter Weight, (Kg)	25	20	50	40	35	30
Dressing Percentage	51	51	51	51	51	51
Daily Gains, (Gm)	60	50	120	100		
Interval Between Paturition, Months	-	7-9	-	7-9	-	7-9
Age At First Parturition, Months	-	14	-	15	-	-
Milk Yield, Kg/Day	-	-	0.5 to 1.2		-	-

Source: Hardjosubrato and Astuti (1979)

Sumatra pig however, there are wise variations within these.

The Java pig originated from a crossing of the indigenous pig which is similar to the Bali pig, and European breeds, primary Landrace and Yorkshire. Because of successive "breeding up" with European breed boars, most of the Java pigs now resemple their European parents.

The Bali pig is of the Chinese (Sus vitatus) type, and all have the extreme swayback condition. The color pattern is black and white, and the pigs are small. All are poorly muscled and are extremely fat.

The Sumatra pig is related to the feral pigs which are numerous in the jungles of Sumatra. It originated from the East Indian pig which was brought into Indonesia by Indian immigrants. Its color is black.

The Java pig now resemples his European parents in performance if feeding and management are normal. However, both the Bali and Sumatra pigs grow slowly and fatten easily. If feeding and management are improved, it would be difficult to justify the use of either the Sumatra or Bali pigs. The *horses* are small (in reality ponies) and are used for road transport and racing.

The indigenous poultry consist mainly of *chickens* and *ducks*; there are *geese, turkeys*, and *guinea fowl* but their economic importance is low.

The chicken breeds are the Kampung (village) and the Kedu (the name of a region in Java). Both originated from the Red Jungle Fowl, which are still found in the wild state in the jungles. Weight data on the indigenous chickens are shown in Table 9.

The average slaughter weight on both breeds is about 1200 gm when they are 20 weeks old. The pullets begin to lay when about 200 days of age, laying about 10-15 eggs before setting on these. About 90 percent of the poultry meat and 40 percent of the eggs in Indonesia are obtained from the indigenous chicken.

Hybrid chickens from all over the world are found in Indonesia. When optimum feeding and management conditions are provided, performances of hybrids for meat and eggs are comparable to that found in the U.S.A. or Europe.

The duck breeds are Tegal, Albio, Bali, and Manila. Color patterns in ducks are three divergent types:

(1) Brown or grey base color with white dots
(2) Green with black stripes
(3) White (from the Pekin duck)

In all breeds, the young grow fast reaching 1.5 kg in seven weeks.

Tegal and Bali ducks, which are found on Java and Bali, lay about 150 eggs per year. Many Alabio ducks are found in South Kalimantan in specialized egg production schemes, and in this system flock averages of 240 eggs per year are obstained, *and in unselected populations*. Manila ducks in the scheme are used to hatch eggs laid by Albio ducks.

The feed base in Indonesia makes an interesting field of study because of the great concentration of ruminant animals on Java, Madura, and Bali; in table 1, it is seen that

Table 9

BODY WEIGHTS OF NATIVE CHICKENS AT DIFFERENT AGES

Age (Weeks)	Kampung (Grams)	Kedu (Grams)
1	38	41
4	113	128
8	359	369
12	713	708
20	1170	1220

Source: Hardjosubrato and Supigono (1972)

66 percent of the cattle, 47 percent of the buffalo and 85 percent of the sheep/goats are found in the area where most of the people live. As would be expected, food crop residues constitute the main roughage source. It is estimated that one ha of irrigated land on Java produces enough food crop residues to meet the coarse forage needs of a pair of cows. The crop residues in order of quantities are as follows: rice straw, maize crop, legume straws (peanuts, soybean and other), cassava (leaves, stems and peelings), sugarcane (tops and leaves) and sweet potatoes (aerial part). In many parts of the country, these residues are supplemented with leaves and stems of legume shrubs such as Leucaena leucocephala, Sesbania grandi-flora, Gliricidia sepium, and others. The islands of Java, Madura, and Bali also have other forage sources from rice field dikes, estates (rubber, tea, oil palm, etc.), cultivated forests, secondary forests, roadsides, football playing fields, and fallow fields, etc.

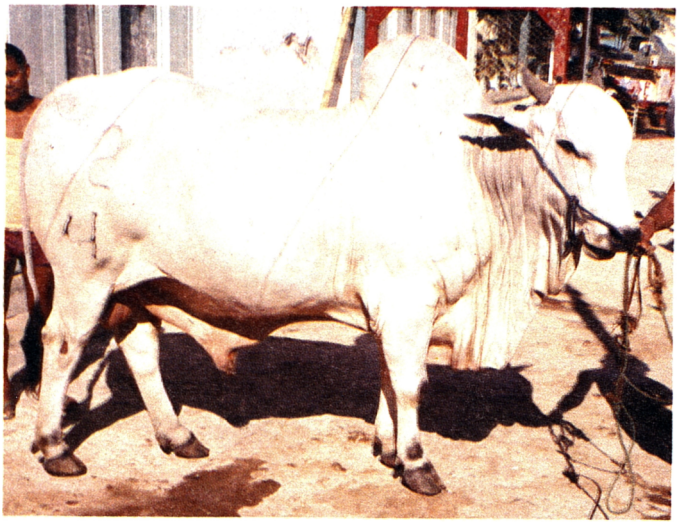
The Outer Islands could provide enormous quanties of forages from natural grasslands if these were managed properly. However, the necessary infrastructure for animal health, supplemental feeds, marketing facilities, and other items needed for extensive livestock handling are not yet in place. There are great developmental opportunities for ruminant livestock production on the Outer Islands.

The major feeds for poultry and swine are rice bran, wheat middlings, corn, fish meal, soybean meal, and various other products. The level of rice bran is sufficient, but there are wide variations in quality. Wheat middlings are obtained from the milling of imported wheat, and it is a good product. All of the fish meal needed could be produced in Indonesia, but its quality is so poor that there are importations. Most of the corn used at this time is of local origin. However, it is expected that significant quantities will be imported in the future. As soybeans produced locally are used primarily for the production of Tempeh and Tahu and other soybean products for human consumption, soybean meal is an import item, and the amounts are expected to increase in the future. Also, copra meal is a valuable protein supplement and its production is increasing.

The animal disease situation in Indonesia is complex. For example, the geographic condition of the country has both advantages and disadvantages: It is an advantage to have

Bali bull (Bos sandaicus) of the wild Banteng origin. This bull was on Bali and had been fed cut grass and a small amount of rice bran. Note that his color is black; steers and cows are the typical reddish color.

A herd of Bali cows and a bull in Sulawesi where my calleagues had a breeding project on a 30,000 acre ranch, "Bila River."



An Ongole bull (Bos indicus) on the small island of Sumba. This thought to be the "Nellore" breed of the Bos indicus from India.

Ongole cows at plow in Central Java.

wide distances between islands in preventing the spread of contagious diseases if they had adequate quarantine facilities and procedures. However, it is a disadvantage in that many animal health units will be needed; there are 13,667 islands.

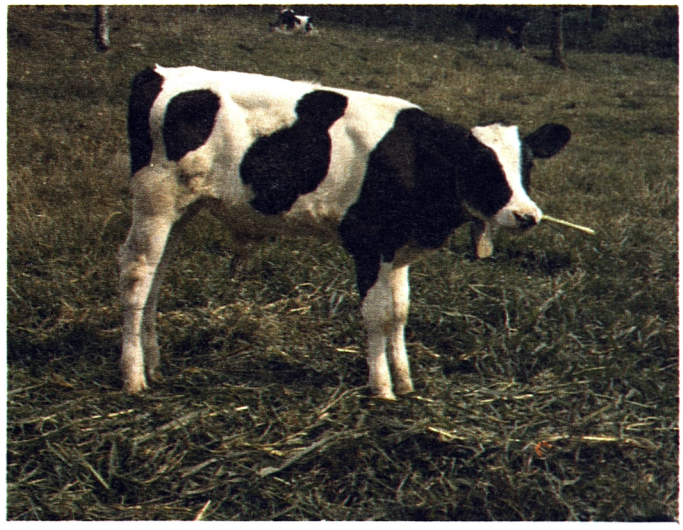
Veterinary service is a function of the Government of Indonesia (GOI), as the numbers of veterinarians in private practice is very small; for the most part those in private practice are located in large cities and have their private practice (primarily household pets) at their homes after work hours in GOI service.

The important bacterial diseases are hemorrhagic septicemia, anthrax, blackleg, and brucellosis, while the most important viral diseases are foot-and-mouth disease, newcastle disease, fowl pox, leucosis and bovine malignant catarrhal fever. In recent years, Jembrana disease has been found in Bali cattle, parasite diseases are widespread and these include the Indoparasites-trematodes. A major helminth problem is caused by Fascioliasis or liver flukes. Most livers from ruminants, which were observed by the author in slaughter houses, contained liver flukes. Surra is found in some areas in Indonesia. Also, *Babesia bigemina,*

Madura cows at plow on the island of Madura.

Madura bull fitted out in his regalia for the "Kerapan Sapi," the famed Madura Bull Races in Madura.

Dairy cows in the "usual" stall in Central Java. These are Grati cows, which have a high percentage of Friesian genes.



Grati calf which contains about 95 percent or more Friesian genes.

Anaplasma marginale, and *Theileria mutans* are other blood parasitic diseases.

Mineral deficiency diseases occur in Indonesia, however the extent and importance of these are not known. It is likely that phosphorus is deficient over a wide area, and especially on the red-yellow prodzolic soils on the Outer Islands. However, this has not been studied extensively. Special care is needed regarding levels of calcium in rations of poultry and swine which contain high levels of rice bran and low levels of calcium. Nutritional hyperparathyroidism, often called bran disease, is widespread in horses on Java fed high levels of rice bran.

There is little or no doubt that trace minerals are deficient in many areas. However, detailed studies on these have not been made. Iodine is deficient in many areas of Java, and is suspect elsewhere. There are indications that copper, molybedenum, selenium, and zinc are deficient in some areas.

It appears unlikely that one would encounter severe vitamin deficiences in any livestock in Indonesia.

There are many constraints to a rapid development and expansion of animal production in Indonesia. The first-limiting constraint upon production concerns the lack of well-trained production-oriented personnel at all levels in

Horse (ponies) at work in Madura. These "dokars" serve as taxis in many rural areas.

the government and in the private sector. Indonesia has recognized this and recently asked the World Bank to evaluate its needs for well-trained manpower while evaluating the quality factors in the present system. The author was a member of that team, reporting on all phases of animal production. As a result of this and other studies, Indonesia is rapidly building up strong cadre of well-trained people who can, by research and other means, remove constraints, and then by improved extension methods, carry better technology to the farmers. There now is much room for optimism, and especially so if progress during the next seven years increases at the rate found by the author during his seven years (1973-1980) in that country.

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