

6. THE PRESENT STATUS OF ANIMAL PRODUCTION AND RESEARCH IN THE PHILIPPINES

Faustino S. MENSALVAS*

Animal Production

The present status of the animal industry in the Philippines might be described as one that is slowly developing because there are so many constraints, the most important of which is the rapid growth in humans population. Overall, local meat production is still inadequate to satisfy the effective demand and is far behind the nutritional requirements. Red meat and milk production is especially low, although production in terms of pork, poultry and eggs is able to meet the effective demand.

Pork, broiler and egg production is characterized by integrated operations. In broiler production, for example, the big hatcheries operate their own breeding farms, feed mills and dressing plants and one operates a chain of stores for barbecue chickens. The big poultry operators, especially those registered with the Board of Investments, have their own contract growers whom they supply with chicks, feeds and biologics, with the contract growers providing only labor and facilities like sheds. This arrangement is similar to those in developed countries like the United States and has been achieved principally due to the efforts of the private sector, with the government providing the right investment climate.

But, on the whole, our animal industry is still too small to support the needs of the country. For a big population (roughly 40 million), our cattle population, including that of the carabao, is still too low to meet the beef requirements of our people. Hence, we continue to import red meat, either frozen or canned. Corned beef is our biggest importation.

Very recently, production of pork, poultry and eggs has suffered a setback due to the feed crisis which is affecting almost every country in the world. We have met with difficulties in importing feed ingredients like soybean meal, fishmeal, and meat and bone meal. Coupled with the grain shortage that we are presently facing, pork, poultry and eggs, including fresh milk have become very expensive food items. In Manila, a kilo of pork costs the equivalent of a daily wage of an industrial worker making ₱8 a day; a kilo of dressed chicken costs almost as much; a dozen medium-sized eggs costs more than 1/3 of a worker's daily earnings; and a quart of fresh milk costs more than 1/4 of a worker's daily wage.

So, to cushion the heavy impact of the feed crisis which especially affects poultry, pork and egg production, we are moving into an expanded feedgrains production, with planting of yellow corn, sorghum and soybean being encouraged and given emphasis. Backyard milk production is being encouraged as well.

And, at this stage, we are moving into beef and carabeef production. The government is looking into the possibility of importing breeder cattle, particularly females. Carabaos will now be looked at not only as a draft animals, but also as a source of meat and milk. (In Greater Manila slaughterhouses, 70 per cent of beef is carabeef).

* Assistant Director of Animal Industry, Bureau of Animal Industry, Department of Agriculture and Natural Resources, the Philippines.

In view of the current world shortage in hides and skins, we have started working on hides and skins improvement. The potentials for hides and skins as shown by the massive importation through the years are great. So, to support our shoe export industry, we are now exploring every possible means to produce quality hides and skins. Lately, we have started processing pig skin and some of our tanneries are researching new methods and uses for carabao hides.

At present, one handicap to increase livestock production is an inefficient marketing system. Most animals slaughtered outside the municipality where they were raised are shipped to Manila. The animals are most often shipped live and pass through the hands of several middlemen. This increases the cost of both transportation and marketing. The government is attacking this problem from two different directions. First, auction markets have been started. They will hopefully increase the knowledge of sellers and encourage competitive bidding. Initially, there have been setbacks, but progress is being made. Plans have also been made to regionalize slaughterhouse facilities. In this way, costs of transporting meat from points of production to points of consumption can be cut. Presently, the implementation of these plans await only the collection of sufficient capital, either domestic or foreign to begin construction.

Population figures show that potential for development of the dairy industry in the Philippines does exist. For example, the latest figures available (1971) show that the Philippines had 4,555,700 carabaos, 1,795,400 cattle, and 924,300 goats. Unfortunately, this potential is very much underutilized since very few of these seven million are being used for milk production. Four or five commercial farms account for most of the milk production from cows. Milk from carabaos comes from a large number of small farmers who have only one or two head which are primarily employed for work. Even so, there are a large number of carabaos which are not milked at all. Also, few goats out of the thousands are milked.

Processing of milk and milk products is limited mostly to the adding of coconut or corn oil to imported milk solids to form reconstituted filled milk or evaporated milk. The high importation of milk then, is understandable. In 1972, 87,833 metric tons of milk worth \$47.5 million were brought in. In fact, we produce only 2% of the dairy products we consume.

Recognizing the importance of a developed dairy industry, our Congress enacted into law R.A. 4041, otherwise known as "An Act to Develop the Dairy Industry" on June 18, 1964. And, in pursuance of its aims and objectives, its implementing agency, the Bureau of Animal Industry, prepared development programs and plans. From these programs came the Sorsogon Dairy Pilot Project and the Sta. Maria Dairy Plant in Bulacan. Later on, the Florida-blanca, Pampanga and the Cabanatuan Milk Collecting and Chilling Centers were established and operated with the chilled milk being transported to the Sta. Maria Dairy Plant for processing, packaging and marketing. The Alabang Dairy Project at Alabang Stock Farm, Muntinlupa, Rizal was started and later the Baguio Dairy Farm and Processing Plant at Baguio City was added. A project was also started at Boñgabon Stock Farm but was later abandoned.

A severe limitation to the success of the program was the inadequate funding which it received. ₱15 million was originally appropriated from the National Treasury for this program. In the nine years since that time, only ₱1,924,000 has been released. Another problem was encouraging consumption of the milk by the local people. When markets could not be found locally, partial success was found by transporting the milk to larger metropolitan centers.

The milk collection scheme at present gathers 1,105 liters per day from 432 farmers in 71 barrios of Sta. Maria, Bulacan; Floridablanca, Pampanga; and Cabanatuan City. In addition, the projects in Sorsogon, Alabang and Baguio City are producing milk.

As of 1971*, we had only 4,555,700 carabaos; 1,795,400 cattle; 7,050,300 pigs; 924,300 goats; 56,512,300 chickens; and 2,352,000 ducks. Growth in our livestock population has been rather slow. From 1948 to 1960**, cattle population on an average increased by 7.25% each year; carabao, 4.01%; swine, 3.78%; horse, 4.13%; goat, 13.80%; sheep, 5.12%. However, during the period 1961 to 1971, the livestock population average yearly growth rate decreased compared to the period 1948-1960. For 1961-1971, the yearly average increase in cattle for the period was a mere 4.24% carabao, 2.57; hog, 1.31%; horse, 0.92%; goat, 1.88%; sheep disappeared.

The average yearly growth rate in meat production is equally slow. From 1953 to 1960, meat production growth rate per year was a mere 3.26%; from 1961 to 1971, it only increased to 5.14%. But on the whole, these growth rates are far from the ideal, considering that from 1948 to 1960, population growth rate per year was 3.5% and from 1961 to 1970, it only lowered to 3.1%.

Yearly meat import from 1953 to 1960 was 3.35% of total meat consumed; from 1961 to 1971, it decreased to 1.90%. Meat exports during the same periods were negligible.

Meat and meat products available for per capita consumption from 1953 to 1960 was 15.65 kg per year; broken down into species of animal the figures are: pork, 10.07 kg per year, beef and carabeef, 2.91 kg per year and poultry, 1.95 kg per year.

Meat and meat products available for per capita consumption from 1961-1971 was 15.08 kg per year; again broken down into species of animal the figures are: pork, 9.31 kg per year, beef and carabeef, 1.97 kg per year and poultry, 2.03 kg per year. The low percentage of meat that comes from cattle and carabao is another reason why the government is shifting its emphasis towards increased production of these two animals.

Technical Problems

I. Animal Breeding

One of the main problems in animal breeding in the Philippines is the inefficient use of high quality breeding stock. This is partly a result of the nature of livestock production in the Philippines, that is, a large number of relatively small scale producers. We have not as yet initiated any significant efforts in performance testing which makes it difficult to identify genetically superior stock. Artificial insemination as a tool in improved animal production and quality has been used for more than ten years but with little success. This is perhaps because the advantages, disadvantages and potential of artificial insemination are not well understood by the technicians (inseminators) and the animal owners who should benefit from it. Poor facilities for handling, storing and transporting semen and a lack of understanding of estrus detection has resulted in low numbers and poor quality offspring which, in turn, produced a lack of confidence in artificial insemination. Finally, the very small breeding base of high quality purebred cattle, hogs, and chickens limits the improvement of the overall population.

II. Reproduction

Concerning reproduction, a low plane of nutrition contributes to poor fertility. Moreover, carabaos, which have a great potential for meat production, are noted for their poor reproduction rate. Inbreeding is a problem in many areas because uncastrated fattening bulls are allowed to run with cow herd. Reproductive physiology of the various farm animal species is not well understood by the producers. Practices such as year-round uncontrolled breeding in cattle and use of crossbred males limit production, efficiency and progress.

* Source: Bureau of Agricultural Economics

** Source: Bureau of Census and Statistics

III. Management

Problems in management hinge on the fact that many animal producers do not consider their enterprise a business or their goal to maximize profits. The lack of accurate records hinders their ability to make important management decisions. In some cases, credit is hard to secure; however, a large amount of available credit is untapped. Many owners and caretakers have had little or no training in animal husbandry. A better understanding of animal husbandry and management practices would result in fewer disease outbreaks and healthier, more prosperous livestock farms.

In order to make good management decisions, one must be well-informed. This requires the producer to make an aggressive effort to find new information. He should be constantly on the lookout for better methods; he should have the ability to identify and utilize resources from near and far.

IV. Environmental Physiology

Environmental physiology is an important factor in the livestock industry in the Philippines. The tropical climate is certainly not favorable for the development of dairy and rabbit industries. Imported temperate breeds must adapt to the changes in environment. Thus, their productivity and potentials are lowered. Housing designs have not yet been adequately adapted to the tropical conditions.

The prevalence of natural disasters also takes a heavy toll on animals each year. Small farmers who have poor housing facilities and poor disease control practices suffer the most. The intense rainy season is a time of disease build-up and outbreak. Furthermore, small landholdings limit the production of animal feedstuffs by livestock owners. Finally, it has long been known that the amount and intensity of sunlight affects the behavior and production of some species of farm animals. But practical applications of this principle have not been made.

V. Nutrition

Since the nutrient requirements for livestock in the tropics have not been established, the most reliable standards are from countries with temperate climates. Undoubtedly, the conditions for optimum performance differ and we can only conjecture about the nature of these differences until more research has been done. There exists a shortage or rather, perhaps, a poor utilization of qualified animal nutritionists. This has resulted in a lack of understanding of this most important discipline of animal husbandry. As a result, animal raisers are forced to buy only complete prepared feed.

VI. Feeds

The number one problem in the animal industry of the Philippines today is shortage and high costs of feeds. We have to import a large percentage of feed ingredients because domestic production of feedstuffs lags far behind the demand. Because of poor marketing and distribution system, the feedgrains that are produced are not readily available to the livestock producers. Many of the feedstuffs imported for animal production are instead utilized for human consumption.

Another technical problem is the lack of storage facilities, resulting in grossly exaggerated seasonal shortages of feedstuffs.

The lack of standardization for feed ingredients has contributed to the widespread problem of adulteration of feeds. Because of the shortage of commonly used feeds, animal raisers are forced to turn to other new sources of feed ingredients. Unfortunately they do not know how to utilize them effectively.

VII. Animal Products

A. Hides and skins: A well-developed segment of processing, distribution and marketing animal by-products can be a great boost to the animal industry. Utilization of leather, especially in the manufacturing of shoes, is emerging as an industry of great potential in the Philippines. With an expanding domestic demand and booming

foreign market, an all-out effort to develop this industry is justified.

One of the limiting factors, however, is the poor quality and general shortage of processed leather. Because of an inefficient marketing system and the remoteness of some barrios, some hides and kinds are discarded and not processed. Poor management practices have allowed damage to hides by tick infestations and wounds and injuries. Regulations concerning the size, number and placement of brands on cattle have not been enforced and this has caused a decrease in the quality of the raw hides. The butchering and flaying of animals is usually done by untrained laborers who do not realize the economic importance of high quality hides. These butchers commonly allow small children to "scrape" meat scraps from the fresh hides. Again, the cost of these practices in terms of damaged leather is alarming and unnecessary. The absence of production and processing incentive for high quality hides and skins has impeded the improvement of finished leather. The need for approved grades and standards for hides and skins is now recognized but still unsatisfied.

B. Meat—Almost all meat is sold to the consumer as fresh meat with little differentiation in cuts of meat. However, some large poultry farms succeeded in marketing frozen broilers. Freezing, canning, and other processes are not common partially due to high capital requirements and poor butchering and storage facilities. As the feed shortage becomes more critical, we are searching for additional potential sources of feed ingredients. The use of animal blood for the production of blood meal seems to be one of the largest untapped resources and meat and bone meals are also possibilities which should find a place in domestic production.

Animal Research

Prior to November, 1972, all agricultural researches in the Philippines were independently undertaken by several agencies. Independent in the sense that a coordinating body was non-existent at that time. Thus, the common problems met during those days were the inadequate research funds and facilities and the lack of direction towards a definite research goal. Researchers worked their way out, for instance, utilizing their resourcefulness to avail of facilities in other agencies which they lack in their own institutions.

Seeing these predicaments, the idea of creating a body that will coordinate the conduct of all researches by government agencies, universities and commodity institutes was born. Hence, the Philippine Council for Agricultural Research was created by a Presidential Decree on November 10, 1972, with the following duties: to define the goals, purpose and scope of research in agriculture, forestry and fisheries; to establish a system to generate funds for research; to identify, evaluate and review agriculture research programs; and to initiate the establishment of a repository of research information. The Philippine Council for Agricultural Research will, hopefully, provide the most efficient and effective plan to harness the full force of agricultural research for national development.

The Philippines has reputable agencies and institutions which conduct agricultural researches. Among them may be mentioned the Bureau of Animal Industry, state agricultural colleges and universities such as the College of Agriculture, University of the Philippines, the Central Luzon State University, Mindanao State University, Central Mindanao University, and private university such as the Araneta University Foundation.

The country is not far behind other developing countries when it comes to manpower requirement, since we have a good number of highly trained technical men who can handle the challenges of agricultural research. With all these tools which we shall be using for the seventies, the Philippines is hopeful that its agricultural research program revolving around the first priority commodities covering poultry, pork, and beef

and carabeef will be successful and give valuable contributions to the economic stability of the country.

This paper deals with a review of some important researches covering a ten year period (1963-1973). It may be gleaned that in the breeding and reproduction aspects, only a few studies have been made, while in nutrition, feeds, management and animal products much have already been done. Since the topics in nutrition sometime overlap with feeds, and management with environmental physiology, the studies therefore were distributed in a manner where they are best classified.

Animal Breeding and Reproduction

In the field of animal breeding, researchers have been trying to combine the advantages of size, growth, and meatiness of imported breeds of swine with the disease resistance and adaptability of the native breeds.¹⁾ It is believed that the triplecross hybrid pig (Landrace, Large White and native breeds) which they have produced has great potential in the development of the swine industry in the Philippines.²⁾ Performance records on swine are scarce, but one group of scientists fed a group of twenty Large White pigs a nutritionally balanced ration from day 56 to day 210 to establish some baseline data.³⁾ At 210 days of age, the pigs had an average weight of 83.19 kg. with an average backfat thickness of 3.36 cm. They gained an average of .50 kg. per day and required 3.27 kg. of feed per kg. liveweight gain. Ten pigs of that group which were slaughtered had an average dressing percentage of 80.40, an average carcass length of 70.23 cm. and an average loin eye measurement of 24.44 sq. cm.

Due to lack of records and the unavailability of breeding stock, inbreeding is a problem in the Philippines. A decline of 1.9 pigs per litter was calculated for every 10% increase in the inbreeding of the dam in a recent study.⁴⁾ Another work has been completed enumerating some guidelines for selection of breeding stock.⁵⁾

The year or month of the birth of pigs was studied to determine the effect this might have on the number of pigs born or weaned.⁶⁾ The only significant relationship found was that litters born in July have fewer pigs weaned per litter than pigs born during other months of the year. The fact that this occurred during the rainy season (May to October) may be significant.

Studies on the performance of the SC White Leghorn & White Rock chickens under Philippine conditions are helpful in comparing them to other breeds.^{7,8)} Comparative studies on the incubation performance of various breeds of chickens have shown that the White Rock breed is superior to White Leghorn and White Cornish in both hatchability and fertility.⁹⁾ This study and another corroborating it¹⁰⁾ have found that better hatches are obtained during the rainy season as opposed to the dry season.

Feeding and Management

Considerable research has been done in the area of feeding and management of poultry. Poultry raisers have observed that pullets which begin producing eggs after about six months have a tendency to produce bigger eggs after about six months have a tendency to produce bigger eggs than those which begin sooner. This is presumably because the extra time allows the productive system of the pullet to develop more fully. Knowing that ipil-ipil has an inhibiting effect on egg production when fed to hens, researchers successfully used a feeding regime of 15% ipil-ipil leaf meal plus 3% calcium to 16 weeks old pullets to delay their sexual maturity.¹¹⁾ When the ipil-ipil leaf meal was removed from the diet at 26 weeks of age, the rate of egg production increased to the same as that of the control group but the eggs of the treatment group were significantly heavier.

Researchers have reported a significant advantage in egg production after clipping

the wing and tail feathers of pullets.¹²⁾ Debeaking is a common practice to control cannibalism in poultry. Research has shown an advantage in weight gain by debeaking broiler chicks at day 1 as opposed to day 10. Furthermore, an advantage in feed efficiency was seen when only the upper beak was removed.¹³⁾ In another study with layers, debeaking had no significant effect on egg production but debeaked birds consumed significantly less feed and were less efficient in converting feed into eggs than birds with beaks intact.¹⁴⁾ A recommended frequency of feeding was established when researchers observed that layers fed twice a day consumed less feed and laid more eggs than those fed three or five times a day.¹⁵⁾

On swine, the practice of isolating runts and feeding them a high protein diet was recommended by one study.¹⁶⁾ An alternative to giving baby pigs iron dextran injections was advanced when it was shown that the addition of soil in the creep area for pigs five days to eight weeks of age has a similar result to the giving of soil plus the iron dextran injection.¹⁷⁾ After comparing pre-scrotal and scrotal method of castration, the latter was recommended since the incision of pigs in that group healed generally two days sooner than those on which the pre-scrotal method was used.¹⁸⁾

No difference in performance was seen between wet and dry feeding for pigs but dry feeding was recommended because it is more convenient.¹⁹⁾ Most pigs in the Philippines are hands fed; however, self-fed animals compared to those hand fed had a higher average daily gain but were considerably less efficient in converting feed to meat and had a lower dressing percentage.²⁰⁾ In addition, the feed cost per kilogram liveweight gain was ₱0.11 higher for the self-fed group.

One of the most important management factors in the production of cattle is pasture management. One recent study demonstrated the increased carrying capacity of improved and well-managed pastures.²¹⁾ Other areas of research on feeding and management of cattle have been primarily concerned with the use of diethylstilbestrol. One recent study in which native bulls were fed primarily rice straw with a concentrate mixture composed mostly of copra meal and molasses indicates a possible relationship between DES and the level of urea in the ration.²²⁾ Bulls implanted with DES and fed concentrate rations containing 2.0% urea had significantly lower average daily gains and were significantly less efficient in converting feed than those fed a concentrate ration containing no urea.

Progress in the dairy industry has been slow. However, one research article recently enumerated some theoretical and practical considerations concerning dairy farm management in the Philippines which included pasture management, pasture utilization and recommended breeds.²³⁾

Environmental Physiology

The subject of environmental physiology is important in scientific animal production. Since certain physiological functions are controlled or affected by light, the present investigations on the effect of artificial illumination on egg production and maturity of pullets are timely. Researchers have observed that a decreasing lighting regime, beginning with a photo-period of 22 hours for day-old chicks and ending with about 14 hours when the pullets are 22 to 23 weeks old, is successful in increasing the body weight and egg weight of the pullets by delaying sexual maturity 15-30 days.²⁴⁾ Furthermore, this lighting regime had no significant effect on the rate of egg production, feed efficiency or mortality.

There seems to be an advantage of small cages compared with large ones in better hen-day production, better feed efficiency and large egg size, according to one research effort.²⁵⁾ Another study reported that hens given 3.0 inches of feeder space per head produced more eggs than those given 1.5 inches.²⁶⁾ According to another study, the battery system of raising broilers is superior to the litter systems because chicks in battery

housing recorded a higher daily feed consumption, more total weight gained and improved feed efficiency.²⁷⁾

Nutrition

The present research on nutrition in the Philippines is varied. There is no general agreement on the advisability of supplementing swine diets with enzymes; however, results of investigations in the Philippines indicate that there is no advantage to enzyme supplementation to 4-week old or growing pigs.²⁸⁻²⁹⁾ Vitamin C is known to be required by some animals and not required by others. The dietary of chickens for vitamin C is still unclear, but one group of researchers demonstrated an improvement in the rate of gain and feed efficiency of broilers in the hot season when their diets were supplemented with vitamin C. No such improvement was noted in the cooler season.³⁰⁾ Cattle have the ability to synthesize some important vitamins and amino acids by the action of microorganisms in the rumen. This could be the reason why in a recent study, increased performance was not observed when a vitamin-mineral premix was added to the diet of fattening bulls.³¹⁾

One of the problems in formulating rations for livestock in the Philippines has been the lack of reliable data on the composition and feeding value of feed ingredients. However, the chemical composition of common Philippine feedstuffs has now been compiled and published.³²⁾ The metabolizable energy values of 15 commonly used feed ingredients were determined by another group of scientists using chicks as biological indicators.³³⁾ It was shown that although protein and moisture percentage is relatively consistent, the metabolizable energy of a specific feed ingredient varies widely among samples from various sources. This factor, probably due to variations in season, milling process and length and condition of storage prior to the test, was identified as one worthy of much consideration. Scientists in this study also identified the amino acids present in copra meal, paring meal, rice bran and ipil-ipil leaf meal and determined their quantitative value. Finally, a marked improvement in the preservation of rice bran by adding Santoquin (antioxidant) at the rate of one part per million prior to storage was observed in the same report.

Mimosine presumably has some effect on the ovary of the chicken, delaying sexual maturity in pullets and depressing egg production in hens.³⁴⁾ However, no harmful effect was observed when ipil-ipil leaf meal was fed to pigs at the level of 5%³⁵⁾ In an effort to counteract this effect of mimosine, researchers are trying to find ways to reduce the toxicity of ipil-ipil leaves. Success was achieved when an increase in the feeding value of ipil-ipil leaf meal for chicks was observed after the following treatments: The addition of the structural analogue of mimosine such as tyrosine, pyridoxine and niacin to the diet, the supplementation of the diet with .15 to .30 percent FeSO₄ and the washing of the meal with water.³⁶⁾ A search for possible feed ingredients among animal by-products has resulted in studies which show that chicken manure can successfully be used in chicken diets up to 20% of the total ration.³⁷⁾

Copra is one of the most available feed resources in the Philippines. Millions of pesos worth are exported each year, primarily to Europe. Realizing its value to the livestock industry, researchers are now trying to establish tolerance levels of copra meal for all classes of livestock and poultry, thereby encouraging its maximum utilization. Copra levels of up to 55% of the concentrate ration have been successfully fed to cattle.³¹⁾ Although satisfactory results were obtained when copra was fed to day-old chicks, the best results were observed when up to 30% copra meal was fed to broilers five weeks of age.³⁸⁾ Another study emphasized the importance of adequate levels of methionine and lysine when high levels (30%) of copra meal are fed to chicken.³⁹⁾

Rice straw is the subject of much study today since it is so abundant and has few

other uses. One group of 1½-2 year old bulls were fed a diet consisting of 40% concentrate and 60% rice straw for 120 days. They had an average daily gain of 0.57 kg. and required 14.2 kg. of feed per kg. liveweight gain.²²⁾ In another study, bulls of similar breeding and age were fed 126 days with an average of 54% concentrate and 46% rice straw. The animals gained an average of 0.56 kg. daily and required 11.5 kg. of feed per kg. liveweight gain.³¹⁾

Feeds

Since many livestock producers are presently facing the problem of securing feed supplies, much research is being done to determine the suitability of feeding locally available products to livestock and poultry. Although not so important to cattle, high quality dietary protein is critical in swine and poultry production. Ipil-ipil is a well adapted plant which is readily available throughout the Philippines. The leaves of this plant contains high levels of protein; however, they also contain a toxic substance called *mimosine*.

Cane molasses, a by-product of the sugar industry, is a relatively inexpensive, readily available source of energy for livestock. Rations containing 10% and 20% molasses were fed to yearling layers with satisfactory results but no advantage in reduction of cost was observed. In swine, levels of up to 20% were recommended.⁴⁰⁾

Green roughage is an important source of energy and nutrients. Corn silage has long been used as a primary feed for ruminants but researchers here have found that it can also be used in rations of grower finisher swine.⁴¹⁾ They report that 20 to 30% corn silage in the ration can reduce the feed cost but it adversely affects the feeding efficiency. Similar results were obtained with cassava and camote silage fed to growing finishing swine.

The value of cattle to the economy of the Philippines lies in the fact that they do not have to compete with the human population for food. In view of this, one of the priorities in animal research at present is to investigate the practicality and feasibility of feeding grass, farm by-products, industrial by-products, non-protein nitrogen and other unconventional feeds to cattle.^{22,31)}

Some workers have tried ensiling rice straw with molasses. While one group reported an advantage of increased feeding value by this treatment,⁴³⁾ another group has reported that, although adding molasses at the rate of 10% increases its palatability, digestibility is decreased by this process.⁴⁴⁾ Finally, the preliminary results of an on-going study indicate an improvement in the feeding value of rice straw treated with calcium oxide.⁴⁵⁾

Another by-product of rice is rice hulls. Although composed mostly of lignin and silica, they may serve as a bulk ingredient in concentrate mixtures that need to be fed *ad libitum*. A group of researchers have substituted finely ground rice hulls for rice bran in a concentrate ration for Murrah buffaloes with no significant effect on milk production.⁴⁶⁾ But finely ground rice hulls when fed at 15% or more have been shown to cause death in cattle due largely to omasal impaction.⁴⁷⁾ Other studies have shown that corn stover, corn cobs and sugar tops are all potential feed ingredients for cattle.^{43,48)} Urea has been used in cattle rations for many years and studies here have confirmed that it can be safely and efficiently used at levels of up to 1.0% of the total ration as a partial protein replacement in feedlot rations made up of farm by-product roughages and by-product concentrate feeds.^{22,31)}

Sources of dietary protein for swine and poultry are very important but very expensive. In an effort to find an answer to this problem, researchers experimentally produced snail meal and shrimp meal from the locally available supply which contained 31.39% and 51.14% crude protein, respectively.⁵¹⁾ The snail meal proved unsatisfactory,

but the shrimp meal up to 20% of the ration gave good results in the diet of pigs.

Animal Products

On account of the fact that the diet of the Filipinos is still inadequate in protein, especially, from animal origin, the government for the past years concentrated their efforts on the production of animals that are fast multiplying. Hence, among the classes of meat that are most acceptable to the Filipinos are pork, chicken and beef. Other meats as carabeef, horse meat, chevon and mutton are attached with regional discrimination. Tests, however, prove that this prejudice is mainly due to psychological influence, rather than to any quality attribute of these meats.^{50,51,52)}

To prove, carabeef has been extensively used for local canned meat products for the past many years due to its cheapness, high myoglobin content which eliminates addition of artificial coloring to make the finished products more attractive, and better water holding capacity than beef.⁵³⁾ Further more, the protein efficiency ratio and biological values of carabeef are found equal with beef.⁵⁴⁾

As fresh meat, tenderization of carabeef carcass by the aitch bone method and the use of pineapple juice (bromelin) to upgrade the quality of the cuts have been tried.⁵⁵⁾

In the development of new products such as freeze-bried chicken meat,^{56,57)} the effect of processing method on the nutritional value was determined. It was shown that freeze drying only slightly lowers the biological value of the chicken protein compared to egg protein but definitely contributes to the loss of thiamine. Freezing alone did not affect thiamine, riboflavin and niacin values of chicken meat.⁵⁸⁾

Results of investigations on keeping qualities of fresh sausage,⁵⁹⁾ bacon⁶⁰⁾ and chicken ham⁶¹⁾ as improved by the action of sorbic acid, ascorbic acid and packaging materials can very well apply to tropical conditions.

Irradiation, although a method of food preservation which is at its infancy in the Philippines, has been tried on bacon, sausage and beef "tapa" (dried product). Findings revealed that irradiation at levels ranging from 25 to 3 megarads adversely affected the color, odor and texture of the products, the effects becoming more pronounced as the radiation dose was raised and storage period was prolonged. The salient advantage, however, of this method is the complete eradication of the microbial flora when its action is combined with freezing.^{62,63)}

In any processing establishment, the utilization of by-products or wastes is important to overcome some of the operational expenses. Hence, one profitable way of utilizing slaughter by-products such as ligaments, tendons, scrap skins and bones is the extraction of its gelatin content and subsequent conversion into kroepck, which is promising as an export product.⁶⁴⁾

On egg preservation, the effects of oil coating and refrigeration were compared.⁶⁵⁾ It was found out that oil coating can preserve the viscosity and thickness of the albumen for four weeks at room temperature (27.8 to 31.1°C) and for 12 weeks at refrigerator temperature (10 to 15°C), while same can be attained for eight weeks when refrigeration and no coating was used.

Extensive investigations have been done on the chemical composition of cow,⁶⁶⁾ carabao^{67,68)} and goat milk,⁶⁹⁾ as well as on the effects of temperature and storage on the quality of milk.⁷⁰⁾ Data revealed that the percentage of total protein in cow's milk increased from a low of 3.28 during the second month of lactation to 4.15 for the tenth month. Solids-not-fat also showed a highly significant increase as lactation advanced. In carabao's milk, butterfat content increased as lactation progressed, protein content fluctuated from 4.74% to 6.07%, lactose level was inversely affected, while ash content remained relatively stable throughout the 7-month lactation period. The composition of goat's milk, meanwhile, almost equals that of human milk and makes it highly suitable

for infant feeding.

The creaming properties of carabao's and cow's milk were compared and difference in creaming behavior is attributed to the deficiency in carabao's milk of homogenization sensitive parts of the agglutinin complex.⁷¹⁾

Conclusion

To a large extent, a country's development is built around specific goals. To determine the alternative means and further identify the best approach towards achieving these goals, research is imperative. The Philippines has the potential in terms of available resources. All that is lacking is for the country's leaders to put all the elements together for greater productivity. This is the challenge confronting agricultural research in the Philippines today.

Discussion

M. Fujimaki, Japan: You have shown in your paper on page 14 that carabeef used for canned product, due to high myoglobin content, eliminates addition of artificial coloring to make the product more attractive. In canned meat, myoglobin will have turned into metmyoglobin, brown, not good color. I would like to know the reason why you mentioned the unnecessary of addition of artificial coloring.

Answer: Browned canned meat is preferred in the Philippines than one that is pale or without color.

N. Yamada, Japan: 1) Could you tell me about the plant ipil-ipil? What kind of plant is it? Is it growing naturally as a wild plant throughout your country?

2) Is some worker specialized in forage crop research trying to improve it for better utilization as a feedstuff?

Since it seems to me that there will be a serious competition in food between human beings and animals in future, I am very much interested in that particular kind of plant.

Answer: 1) Ipil-ipil is a leguminous plant that grows in the tropics. It grows naturally in some areas, but planted either by seeds or cuttings in other areas. It is more of a tree than a shrub. Its botanical name is *Lucaena glauca*. Its protein content (leaves) is high, 24 to 27%.

2) I am not aware of any research work being done to improve this plant by breeding. Means and ways of improving its utilization, however, have been and are still being conducted so as to remove entirely or partially its mimosine content which has been shown to have depressing effect on fertility, and egg production.

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