Chapter 5
Country Statements

Burma

U Than Tint *

NEWCASTLE Disease is the prime cause of losses in the poultry industry in Burma. It is not clear whether the disease was introduced into or already endemic in the country, but the incidence of a large mortality of poultry in 1934 marked the first identification of Newcastle Disease in Burma. Since then the disease is recognised as the most economically significant disease for poultry.

In Burma, apart from fish meat, poultry meat is the major component of meat production (Table 1). It contributes 9.4% of the total meat production, which equals 41.9% of the total livestock meat production of the country. The poultry industry produces some 1076 million chicken eggs and 190 million duck eggs annually.

Most of the chicken population is in the villages (Table 2). The commercial poultry flocks of imported breeds are raised in the vicinity of cities in all States and Divisions. These private farms, and those owned by the government and cooperatives, make up only 15.4% of the total poultry population of the country. The remaining 84.6% of the population is the local, indigenous chickens raised in the villages. This village poultry has a very low egg production, but it is the main source of poultry meat in Burma. It is quite obvious that any measure that promotes the health status of village poultry will in turn promote the production of poultry meat. As mentioned earlier, Newcastle Disease remains the most prevalent poultry disease in Burma that keeps almost all the village poultry at risk, and we have done very little to protect the poultry against this devastating disease.

In Burma, the Livestock Breeding and Veterinary Department is the only government body responsible for the health of domestic animals. There are 564 veterinary graduates and 798 diploma holders in the department. Each of the staff in the field has to look after about 11 000 animal units.

* Director, Livestock Breeding and Veterinary Department, Rangoon, Burma.

TABLE 1. Annual meat production in Burma. (Source: Report to the People 1986-87).

Type	Quantity (t)
Beef	37 030
Mutton & Goat meat	7 672
Pig meat (Pork)	50 628
Chicken meat	84 724
Duck meat	20 279
Other poultry meat	1 656
Fish meat	700 065
Total	902 054

As the economy of our country is based on agricultural production, veterinary care is mainly emphasised in the draught animals. The veterinarians are mainly engaged in the free, routine vaccination programs of cattle and buffaloes against Anthrax, Haemorrhagic Septicaemia and Black Quarter diseases. Preventive vaccination against Newcastle Disease and Fowl Cholera is practiced in the intensive poultry farms. But the village poultry, due to the widespread distribution of very small flocks owned by almost every family in the village is out of reach of our intensive veterinary attention

Background

Newcastle Disease of poultry was first diagnosed in Burma in 1934. The isolated virus was identified with the assistance of the Veterinary Research Laboratory, Mukteswar, India. A killed Newcastle Disease vaccine and a living dried vaccine of Mukteswar strain were first produced locally in 1952. Two types of Newcastle Disease vaccines are now produced by the Biologics Production Division of the department. Both of them are of chicken embryo origin. One type, using the Weybridge F strain, is recommended for eye application of chicks at about 2 weeks of age. Another vaccine, produced with Komarov strain, is recommended as a booster inoculation 8 weeks after initial vaccination with F

TABLE 2. Distribution of poultry population in Burma.

State * Division +	Semi-intensive and commercial	Village poultry	Total
Kachin *	80 686	794 423	875 109
Kayah *	40 051	308 479	348 530
Karen *	12 866	813 059	825 925
Chin *	6 199	773 079	779 278
Sagaing +	383 032	2 332 671	2 715 703
Tennasserim +	30 734	548 848	579 582
Pegu +	484 717	4 739 403	5 224 120
Magwe +	158 790	4 632 008	4 790 798
Mandalay +	911 896	2 066 934	2 978 830
Mon *	278 260	611 171	889 431
Rakhine *	55 570	1 404 446	1 460 016
Rangoon t	1 390 650	2 180 971	3 571 621
Shan *	362 790	1 255 374	1 618 164
Irrawaddy t	779 562	4 799 191	5 578 753
Total	4 975 803	27 260 057	32 235 860

vaccine. It is also advised to vaccinate layers and breeders with Komarov vaccine at (i-month intervals.

In Burma, free vaccination is provided for cattle and buffalo but the vaccines for other animals, including poultry, are sold. A I00-dose ampoule of F strain and a 500-dose ampoule of Komarov strain vaccines are sold at K 2.25 each, the equivalent of about 30¢ (US). Newcastle Disease vaccine production during the last 4 years is presented in Table 3.

Although the figures seem to coincide with the poultry population, all of the vaccines are usually used up by the semi-intensive and intensive poultry flocks of the periurban areas. One might wonder how all the vaccines are consumed by the periurban farms, which constitute only about 15% of the bird population. The fact is that each bird requires two or three vaccinations in a year and small sizes of flocks ranging from 50 to 300 birds dominate the population. Therefore an ampoule of vaccine (either 100 or 500 doses) will have to be used for a single farm, resulting in a high percentage of vaccine wastage. But the poultry keepers do not mind. This fact serves as a good indication of how much they fear this disease and how much faith they have in the vaccines. In Rangoon Division, where the intensive poultry production is concentrated, private farms range from a few hundred to 5000-6000 birds in a holding. One government farm near Rangoon is keeping 200 000–300 000 broilers. But in other divisions and States the poultry flocks contain a few hundred birds each. These poultry farms, mostly concentrated near the cities, are severely affected economically once a Newcastle Disease outbreak is established.

There are as yet. no regulatory measures for registration or reporting the outbreaks of poultry diseases in Burma. However, from the records of the Diagnostic Division of the department, the information is easily obtained as shown in Table 4. Through bitter experience, the poultry farmers are quite aware of Newcastle Disease. The majority of them are quite familiar even with the clinical pictures and postmortem lesions of this disease. They are enlightened enough to practice the recommended vaccination schedules for their birds.

But the picture of poultry farming in the village is a different one. The owners of the 84.6% of the poultry population of the country are not aware of

TABLE 3. Newcastle Disease vaccine production.

Year	Production (millions doses)
1983-84	33.9
1984-85	37.6
1985-86	39.1
1986-87	40.0

Note: Ratio of F and Komarov vaccines approximately 2:3.

TABLE 4. Features of Newcastle Disease in Burma.

Particulars	Remarks
Time of severe outbreaks	March-April August-September
Susceptible age group	Under 3 months At 5 or 6 months
Mortality *	60–70% in severe cases 20-30% more commonly
Type of Virus	Viscerotropic-velogenic

* Early inoculation of Newcastle Disease Komarov vaccine even in a clinical outbreak saved over 50%.

their role in the poultry industry because poultry farming has been traditionally practiced in rural areas only for supplementary income and home consumption. Chickens are fed household scraps and a little grain. Scavenging supplements the other requirements. So farmers are not conscious of the cost of production and their consequent losses. Besides, the per family holding ranges from one or two hens to hundreds of birds of different age-groups, and the loss of some birds, or even the whole flock, does not have a great impact on the economy of an individual farmer. Once an outbreak occurs the whole poultry population in a given area is usually wiped out. So the annual loss due to Newcastle Disease alone is estimated to reach over US$5 million. Though we are aware of all these facts and realise the economic impact it holds, we have no immediate solutions.

Before the establishment of Regional Diagnostic Laboratories in Mandalay, Taunggyi and Bassein in 1986, diagnosis of animal diseases was conducted solely by the Central Diagnostic Laboratory in Insein. A commodity grant from the Japanese International Co-operative Agency (JICA) has enabled the three regional laboratories to be equipped and to upgrade the facilities of the Central Diagnostic Laboratory. Newcastle Disease is diagnosed by postmortem lesions, isolation of virus in embryonated chicken eggs, and by HI test with specific antiserum. Most of the cases examined showed that the virus isolates are viscerotropic velogenic type. The establishment of the above-mentioned laboratories is intended to extend the diagnostic work up to the village level. Newcastle Disease is listed among the diseases to be given priority attention by these laboratories.

But the extension of diagnostic work will have little effect in the direct control of the disease in rural areas. It will only help to define the epidemiology whereas the most urgent need is the prevention and control of the disease. It is unthinkable to manually vaccinate each and every free-ranging village bird in Burma. Our hope lies only on a kind of vaccine which can be dispatched without refrigeration at normal environmental temperatures in feed form, thus requiring no individual inoculation. The results reported at this workshop give us much hope for an effective and revolutionary vaccine.

Indonesia: Current Research

P.W. Daniels, I. Parede, H. Hamid, P. Ronohardjo *

IT is now 60 years since the first isolation of the virus of Newcastle Disease in Java (Kraneveld 1926), with the disease still proving a significant constraint to poultry production in spite of the availability of a range of vaccines. In village chickens which are either unvaccinated or inadequately vaccinated, losses are high (up to 100% in young birds and slightly less in adults), depending on their protection from prior exposure. Outbreaks occur in villages every l–4 years and so the potential for increased production of eggs and meat from village poultry is severely curtailed. In commercial flocks the cost of vaccination programs is considerable, and this is compounded by the fact that vaccination is frequently not totally effective (Ronohardjo 1984; Anon 1986).

Newcastle Disease is considered endemic throughout Indonesia. Balai Penelitian Veteriner (Balitvet), the Research Institute for Veterinary Science at Bogor, has isolates from West and East Java, Irian Jaya and West Timor (Parede unpublished data). The United States Naval Medical Research Unit (NAMRU II) within the Department of Health in Jakarta has isolates from locations in Sumatera, West Java andLombok, and from the bird market in Jakarta (Bartz pers.comm.). The diagnostic laboratories in other parts of Indonesia have also reported isolations.

Balitvet is the primary animal health research facility in Indonesia and as such has the responsibility for conducting the major animal disease research programs in the country. It is expected of the Institute that research will result in improved diagnostic techniques and reagents being made available to the regional laboratories, and in improved control measures for the diseases of livestock, including the development of appropriate vaccines. This paper gives a summary of the Newcastle Disease research in progress and planned in the immediate future.

* Balai Penelitian Veteriner (The Research Institute for Veterinary Science), P.O. Box 52, Bogor, Indonesia.

Economic Importance

Kampung chickens under traditional management lay l0–12 eggs over a 15–l8-day period three times a year, giving an annual egg production per bird of 30-36. About 50% will be sold or eaten, and the remainder have a hatchability rate of 80%. The mortality of chickens to 6 weeks can be over 60%. There is an average turnover of 50% in the adult flock, with local consumption accounting for 35% and mortalities, sales and theft the remainder (Anon. 1986).

Village chickens feed mainly by scavenging, and are a cost-effective enterprise for the farmer in that respect, with the potential to generate a cash flow. While increasing the nutritional status may possibly lead to an increased number of clutches per hen per year, the high mortality rate in chickens to 6 weeks would detract from the attractiveness of such an investment. The inability to control disease, in particular Newcastle Disease, has been cited as a major reason for failure of village poultry improvement projects in the past (Anon. 1986).

In assessing the current livestock disease status in Indonesia, Ronohardjo et al. (1985) considered Newcastle Disease to be the animal disease causing the highest economic loss, based on figures supplied by the Directorate General of Livestock Services. A recent major review of the livestock sector in Indonesia (Anon. 1986) has concurred with this assessment. Newcastle Disease was estimated to cause losses of approximately US$40 million annually.

In their benefit-cost analysis of the research and development program Balitvet, Parsons and Vere (1984) noted that virological research offered significant potential benefits. Newcastle Disease was noted as a disease needing an active research program. Such studies have helped confirm Newcastle Disease research as one of the major priorities.

TABLE 1. Summary of the characteristics of Newcastle Disease isolates (Parede, unpublished data).

Species of origin	No. isolates	Source	Pathotype
Cockatoo	5	West Java	Velogenic
Crossbred chicken	4	West Java	Velogenic
Parrot	1	West Java	Velogenic
Crossbred chicken	3	West Java	Lentogenic
Crossbred chicken	2	West Java	Mesogenic
Pig	1	Irian Jaya	Velogenic
Quail	1	West Java	Velogenic
Jungle chick	1	Surabaya	Velogenic
Kampung chicken	2	West Timor	Velogenic
Kampung chicken	4	West Java	Velogenic

Isolation and Characterisation of Newcastle Disease Virus

Most isolations of Newcastle Disease virus in Indonesia are for diagnostic purposes, and detailed studies of the isolates have not been made. Although it is obvious from the severity of clinical disease that virulent strains are present, there is little information on the Pathotyping of isolates. Studies have therefore been conducted on 23 local isolates (Parede and Young unpublished data).

Isolates were from diagnostic submissions or from unvaccinated village chickens sampled during field surveys. Supernatants from 20% organ suspensions were inoculated into the allantoic cavity of 9-day-old embryonated eggs which were then incubated at 37°C for 4 days or until embryo death at 48-72 hours. Allantoic fluid was tested in a slide agglutination test. Haemagglutinating activity was titrated in a microhaemagglutination (HA) test, and the diagnosis of Newcastle Disease confirmed by a Beta-procedure microhaemagglutination inhibition (HI) test using specific antisera to Newcastle Disease virus.

Pathogenicity testing was conducted using standard procedures (Anon. 1971), the intracerebral pathogenicity index (ICPI), the mean death time at minimum lethal dose (MDT/MLD), and in some cases the intravenous pathogenicity index (IVPI). The results are presented in Table 1. There were 19 velogenic, 2 mesogenic and 3 lentogenic pathotypes.

The results show that pathogenic Newcastle Disease virus can frequently be isolated from chickens and other birds in Indonesia. Such velogenic virus was isolated not only from commercial and village chickens in Java but also from village chickens in West Timor in the eastern islands close to Australia. This collection of characterised isolates forms a useful resource for further studies.

Maternal Immunity

It is the experience in Indonesia that vaccination against Newcastle Disease is not always effective (Ronohardjo 1984). This can be due to any of a number of factors, to problems of the delivery of the vaccine in optimum condition, to problems of interference to the development of immunity caused by other viruses, or most importantly, to problems of maternal antibody interfering with responses to vaccination.

The levels of maternal immunity to the disease and their decline over a period of time have been studied in a commercial poultry farm (Parede and Young unpublished data). Twenty day-old chickens were obtained from each of 15 commercial hatcheries. The parent flocks had received an intensive vaccination program, usually comprising vaccination during the first week of age followed by a second live vaccination 3 weeks later and a killed vaccine just before the point of lay. Sera were collected from experimental chickens at age 2 and 6 days and at weeks 2, 4, 5 and 6. Heat inactivated sera were tested by HI.

The passive immunity levels showed considerable variation (Table 2). Many 2- and 6-day-old chicks had no detectable antibody. By 4 weeks of age antibody was essentially undetectable. However it is the unevenness of the levels of antibody observed within flocks that is of particular interest, given that all birds in each parent flock presumably received the same vaccination regime. This variation would make difficult any attempt to give advice on an optimum time for successful vaccination after the decline of maternal antibody to a level that would not interfere with vaccination. Equally importantly

TABLE 2. Maternal antibody levels (HI titres, log 2) to Newcastle Disease in commercial chickens (data for 5 groups of 10 chickens) – (Parede, unpublished data).

Age	No. birds with antibody	Group averages	Group GMT
2 days (5 groups of 10)	21/50	.4 to 2.3	1.32-4.92
6 days	half	.3 to 1.2	1.23-2.3
4 weeks	most	0 to .3	

the results indicate that even from flocks a large proportion of chickens are susceptible to infection in the first week of life. It seems that the vaccination protocol referred to by Ronohardjo (1948) of vaccination at that time and then again at 4 weeks, is the minimum program for protection of commercial birds that could be contemplated.

Pathogenesis of Velogenic Newcastle Disease

The aim of this study (Parede and Young unpublished data) was to determine, using an Indonesian virulent strain of Newcastle Disease virus, where virus replicates in birds with either high or low antibody titres, and the possible patterns of virus excretion from such birds. An isolate from a kampung chicken from West Java was partly purified by haemagglutination and elution from chicken red blood cells, and then plaque-purified in chicken embryo fibroblasts and kidney cells. After the third plaquing the virus was confirmed velogenic by the MDT/MLD (60), ICPI (1.43) and IVPI (2.83) tests.

Chickens studied were either 7 or 20 weeks old. Field experience with commercial chickens in Indonesia indicates these are ages when problems with Newcastle Disease are encountered. Chickens were vaccinated at 4 days with live vaccine (HB, Intervet) by the oronasal route, at 4 weeks with oil adjuvant vaccine (Newcavac, Intervet) and, in the case of the older age-group birds, again at 16 weeks with the oil adjuvant vaccine. HI titres were assessed prior to assigning birds to experimental groups. For challenge a small number of antibody-free chickens were infected by oronasal inoculation and after a 24-hour incubation mixed with the experimental birds. It is believed that this simulation of natural exposure will lead to the results being directly applicable to the field situation.

At regular intervals post-infection birds were killed and tissues (brain, tracheal contents, lung, proventriculus, intestine, caecal tonsil, cloacal contents, liver, spleen, kidney, bursa of Fabricus and blood) examined for the presence of challenge virus by inoculation of organ suspensions into 9-day-old embryonated chicken eggs. Embryo death at 48-72 hours was considered to indicate virulent virus.

In the control group with no detectable antibody, virus was detected in all tissues examined. In the groups with a low level of HI antibody, virus was detected in all tissues except blood. In the groups with a high level of antibody, virus could be detected only occasionally in tracheal contents, cloacal contents, spleen, liver and blood, but frequently in other tissues. Chickens in these groups did not develop clinical signs of disease. Production of virus persisted longer in birds with higher immunity. In the diagnosis of Newcastle Disease the organs most useful for isolation of virus would be proventriculus, caecal tonsil, bursa of Fabricus and brain.

Pathology of Newcastle Disease

The aims of this study (Hamid and Campbell unpublished data) were to describe the sequential pathology of Newcastle Disease infection in birds with high to low immunity, and to study the subclinical responses to infection with lentogenic Newcastle Disease virus.

In the first experiment birds and experimental protocols were as described in the viral pathogenesis experiment above. The incubation period varied from 3 to 10 days, but most fatalities occurred between day 4 and day 8. Clinical signs included depression, increased respiratory rate, and progressive weakness. Greenish watery diarrhoea was first observed at day 3, and continued throughout the course of illness. There was swelling of the subcutaneous tissues of the head, and conjunctivitis, but no head tremor or torticollis. Surviving birds were paralysed and did not recover.

Early haemorrhages and congestion seen in the upper respiratory tract progressed to mucous exudation. In non-immune birds haemorrhagic and necrotic lesions were seen in the lymphoid and digestive organs. No significant gross pathology was seen in immune birds. The necrosis in the lymphoid tissues of non-immune birds was confirmed histopathologically. There was lymphoid hyperplasia in immune birds.

In the second experiment, 40 7-week-old commercial chickens were inoculated with the lentogenic V4 strain (Arthur Webster Co.) in Australia. Birds were killed daily for 4 days and then weekly until 4 weeks. No clinical signs were observed, but haemorrhages and congestion were seen in the upper respiratory organs in the early days post-infection. There was slight enlargement of the spleen on day 4. Histologically there was lymphoid hyperplasia in most organs.

Proposed Research

The studies outlined above are giving a solid base of information on Newcastle Disease virus and disease in Indonesia. Pathogenic virus has been isolated with relative frequency, supporting field observations that this disease is a frequent cause of death in unprotected village chickens. In vaccinated commercial flocks the levels of protection as assessed by antibody status vary significantly in response to standard vaccination programs, and this can lead to disease problems. Velogenic Indonesian virus has the ability to replicate in commercial birds with even a high level of immunity, although without causing disease. If these results can be extrapolated to kampung chickens it therefore would seem that the village is going to remain a potentially contaminated environment, even with vaccination programs. Development of programs should be aimed at developing protective responses in the highest possible proportion of invididual birds.

Current research programs at Balitvet (Ronohardjo unpublished data) are directed towards solving the problem of delivering effective vaccination to village chickens. Attempts are being made to reproduce the work using heat-adapted V4 strain in the feed. Any initiative to help develop this technology in Indonesia would be welcomed, and Balitvet is keen to help adapt this approach to the Indonesian village situation.

It is noted that the monitoring of field work associated with such programs would ideally include a serological capacity to distinguish between antibody responses to vaccination and field challenge. It is possible that this may be achievable using monoclonal antibody to V4 in a competitive-binding ELISA. Balitvet has initiated discussions with the Australian Animal Health Laboratory in Geelong, where a bank of monoclonal antibodies to the V4 strain is being developed (Della-Porta, pers. comm.). It is hoped that Balitvet can assist in the testing of reagents for monitoring field situations, and in determining the reactivity of reagents to velogenic and mesogenic strains of virus. Work of this latter type is already planned in collaboration with James Cook University, who have assembled a bank of monoclonal antibodies to Newcastle Disease from international sources (Burgess pers. comm.).

The Institute's collection of pathotyped Newcastle Disease viruses is an important asset in such work. The availability of a well studied strain of velogenic virus should be an important aid in laboratory studies of the protection to be afforded by V4 vaccines against pathogenic Indonesian strains.

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Indonesia: Disease Control

Bachtiar Moerad *

BASED on the data compiled by The Directorate of Animal Health in 1982, native chickens contributed approximately 25% or 157 000 t of total meat production in the country. At the same time it also contributed at least 11% or 27.9 t of national egg consumption (Anon. 1986).

The chickens are threatened by several infectious diseases, mainly Newcastle Disease that occurs almost yearly and causes high mortality. The significant factor of the Newcastle Disease epidemic is the way chickens are kept by the farmers, known as traditionally extensive.

Control by vaccination has been practiced for many years, yet no satisfactory results have been achieved. One principal reason is the dependence of' the farmers on the government for vaccination. In fact, the support of the government is limited, with only 15% of total native chickens being vaccinated annually (Anon. 1982). Efforts have been made to encourage the farmers to participate (e.g. the program of intensification of Newcastle Disease vaccination in example villages).

Epidemiology

Newcastle Disease was recognised in Indonesia as early as 1926, when Kranneveld reported cases in Java (Hofstad et al. 1972). At present, no province or island is reported to be free of the disease.

Despite control efforts on commercial flocks, Newcastle Disease is still prevalent among native chickens throughout the country. Various factors are responsible:

(1) Almost all families in villages keep native chickens, varying in number from 2 to 5 chickens to more than 100 per family. As almost all the areas have been infected, it is impossible to provide enough vaccine for eradication. This also means that once an outbreak occurs in any area, it is difficult to eradicate the disease.

(2) Generally, most native chickens are kept extensively, with both poor housing and fencing, resulting in high possibilities of contact both among chickens in the area and to other carriers. The extensive keeping system also means lack of additional feeding thus weakening the resistance to infections. This occurs mainly during seasonal changes.

(3) Live vaccines are widely used in Indonesia, and therefore present a potential for an outbreak, unless they are used properly.

(4) Some farmers do not realise the economic value of native chickens. Most of them assume that Newcastle Disease is a common risk for anyone who keeps chickens.

Therefore the epidemiology of Newcastle Disease in Indonesia is very complicated. Many factors play a role and interact to maintain and to spread the disease within the country.

Objectives of the Vaccination Program

Prevention and eradication in commercial flocks has generally succeeded, owing to intensive production methods and good management. Most commercial chickens, both middle and small-size, face no difficulty in overcoming Newcastle Disease. The commercial farmers realise the benefit of vaccination. This is not the case with native chickens. Therefore, with The Fourth National Five Year Plan (Pelita IV) the government has intensified vaccination among the native chickens by introducing example villages where vaccination of native chickens belonging to small farmers in the village is used to control Newcastle Disease.

In the short term, the objective is to motivate the farmers to be self-supporting in controlling Newcastle Disease. For the long term, the goal is prevention and eradication of the disease in native chickens.

The strategies to achieve these objectives are to persuade the farmers to change gradually the management system, from traditionally extensive to intensive or semi-intensive management, through additional feeding, fencing and breeding programs.

* Livestock Service of Riau, Jalan Pattimura No. 2, Pekanbaru, Riau, Indonesia.

Programs

Basic Newcastle Disease control programs were designed with the following objectives:

(1) Intensify vaccination by the 'radial system' in example villages. This system means that one district at least has one focus of activity, where vaccination is performed on the whole population for 3 consecutive years, with the radial spread of the control areas from the original focus. When an area has been vaccinated for 3 years without any more cases of Newcastle Disease, the vaccination is ended. Vaccination continues in the outer areas until the entire area is covered;

(2) Increase extension work by involving key farmers and information officers, in addition to field extension workers;

(3) Increase the number of vaccinators including young people, key farmers, and scouts;

(4) Locate the vaccine retailers at strategic locations; and

(5) Carry out further research regarding methods of application and handling of vaccines including resistant strains of vaccines to room temperature or field condition with longer immunity.

Activities in the Field

Extension

Field extension was done by visits and training on a continuous basis either in the surrounding crop fields or at agricultural extension centres. Various media including radio, television, brochures and leaflets were also used.

Preparation of the Vaccination Program

1. The locations were selected on the following basis:
- High populations of native chickens;
- Access to extension services;
- High prevalence of Newcastle Disease;
- Good social attitude;
- Part of the area of Crops Intensification Program.

2. Time schedule
Schedule of vaccination is arranged by field officers and village officials, usually 1 week before vaccination starts.

3. Coverage
For young chickens under 3 months of age 100% of population. For over 3 months of age at least 80%.

4. Personnel
- Vaccinators: Field officials, key farmers or skilled group members;
- Extension: Field extension workers, information officers, key farmers.

Application

By using government-supplied vaccines the applications were performed four times per year as follows:

(I) Under 4 weeks of age with the F-strain; 4-12 weeks age with the Komarov (half dose); Over 12 weeks of age with the Komarov strain full dose.

(2) Under 4-week-old chickens strains which hatched after first vaccination were given the F-strain and at 4-12 weeks of age were given the Komarov strain half dose.

(3) This procedure was repeated with each batch of chickens that hatched.

(4) Revaccination with the full dose Komarov strain, for chickens at 6-month intervals and those vaccinated at 3 months with the Komarov half dose.

Usually vaccination was applied in the evening, going door-to-door, by a team consisting of several groups of two people; one to perform the vaccination and the other to help and record the data. On average, each group covered 100-200 chickens per night depending on the local population.

Location and Evaluation of the Control Measures

A haemagglutination inhibition test was performed by the Provincial Animal Health Laboratory and Regional Disease Investigation Center to evaluate the effectiveness of the vaccination program.

During the period November-December 1982, sample sera for HI test were taken from vaccinated chickens in West Sumatera, Jambi and Riau Province; 62% of 14 381 chickens in West Sumatera showed a high titre (2^8) and 38% low titre (2^4); 64.7% of 1610 chickens in Jambi showed a high titre and 35.5% low titre. In Riau 44% of 4724 chickens showed a high titre and 56% low titre. There is no difference between local chickens and commercial (exotic) flocks (Soenardi et al. 1982).

In Aikmal of Lombok Island, West Nusa Tenggara, Newcastle Disease vaccination control measures were carried out on native chickens in November-December 1983 and in May-June 1984 respectively.

Surveillance was carried out about 6 months after the last vaccination to determine the effect of vaccination. The surveillance showed that the rate of mortality caused by the disease on native chickens was 50.8% before vaccinations and 8.5% after two vaccinations.

By decreasing mortality, the population of native chickens was increased from 925 chickens to 3459 chickens or about a 263% increase (Mutalib and Djamaluddin 1985).

TABLE 1. Consumption and sale increase of chickens and eggs per family per year according to categories of vaccination area.,

Categories of area	Production				Total Price (Rp)
	Chickens		Eggs		
	Number	Price (Rp)	Number	Price (Rp)	
Unvaccinated	15	30 000	15	1500	31 500
Partial vaccination	48	97 200	51	5 130	102 300
Moderate vaccination	190	379 000	141	14 100	393 100
Complete vaccination	648	465 120	8 600	589 388	1 054 508

The more intensive the vaccination, the higher the production either for sale or consumption. The performances of groups are shown in Table 1.

Economic Analysis

Some economic analyses were made in certain parts of the country to determine the benefits resulting from intensive vaccination against Newcastle Disease.

Village of Lembah Sari, Subdistrict of Rumbai, Pekanbaru District, Riau, 1987.

Results were based on keeping 10 laying hens and 1 rooster. Laying hens (6 months old) were purchased, kept under housing, fencing, additional feeding and intensively vaccinated.

The hens were culled at 27 months of age or at the 21st month after purchase, after 12 months of laying. The hens were allowed to hatch three batches of chickens after 12 months as layers. At the 28th month of keeping, recycling started by purchasing 10 hens and 1 rooster.

After a total input of Rp 433 327.5 in one cycle, the outputs yielded Rp 973 225 or Rp 539 897.5 profit per one cycle, or Rp 19 996 of profit per month.

District of Sumedang, West Java, 1985.

On average, each family kept 10–l1 laying hens at the start of the control program early in 1985.

Intensive vaccinations were carried out four times a year for 5300 chickens. At the end of the year, the population had increased significantly to 12 238 birds, resulting in a population increase of 230%. This situation differed from unvaccinated populations which showed a decline from 3867 early in the year to only 1400 late in the year, or a 74% reduction in the poultry population.

Egg production from vaccinated birds increased as high as 3.24 times more compared with the unvaccinated poultry flock. The number of dead chickens within the intensively vaccinated population was 418, or 4.5 times less than unvaccinated flock. As well, there were no cases of Newcastle Disease among vaccinated chickens, while the unvaccinated group experienced seven outbreaks among different flocks during the period of observation.

With inputs of Rp 7600/month for feed and vaccines, the outputs were priced at Rp 23 415, for a profit of Rp 15 815/month.

With expenditures of a family in villages assumed to be Rp 55 000/month (1985), the amount of Rp 15 000 from the poultry contributed more than 25% of the monthly family income.

Problems in Control

Various problems are being faced in relation to Newcastle Disease vaccination in the field:

1. Farmers in villages have long been introduced to vaccines produced by Veterinaria Farma Surabaya through various projects. The farmers have become accustomed to the vaccines. As government support decreased, other types of vaccine were rarely introduced in villages. It will take time for farmers to get used to new types of vaccine.
2. Generally, distribution and retailing of any type of vaccine are limited to the larger centres of the districts and available only to the commercial farmers. It is difficult for native chicken farmers who live in villages to get the vaccines.
3. Handling of vaccines is a problem. The distance between provincial capitals and locations of many villages in the Newcastle Disease control program vary from a few hours to journeys of several days. The facilities available for the preservation of the vaccine are simple ice thermos bottles, so it will take time before vaccines can be available for all chickens in distant villages due to lack of adequate transport facilities for the preservation of the vaccine. Not all subdistrict officials have been provided with refrigerators for keeping vaccines.
4. Application of vaccines either by injection or dripping is time-consuming and impractical.
5. The keeping system, known as traditionally extensive, is another problem because of the constant spread of the disease.

Discussion

The farmers are accustomed to using certain types of vaccine, namely Vetma products, so they will need time to become familiar with another type of' vaccine compared to the government-supplied commercial vaccines which are distributed to the villages. This may result in declining participation by farmers. Therefore, efforts have to be made to distribute vaccines at the subdistrict level.

Handling procedures for the vaccines, particularly during transportation to the field, are still inadequate.

Native chickens are widely kept by farmers. The smallholders of chickens need more time to change the traditional system to a more intensified one due to the risks of unvaccinated chickens which could act as carriers of Newcastle Disease as well as other avian species which could spread the Newcastle Disease virus. For these reasons the main purpose for the control of Newcastle Disease must be carefully considered, and whether eradication or control measures are appropriate to protect certain poultry-producing areas.

Application of vaccines either by injection or by water is not practicable, so that efforts to start producing vaccines of a more practical application are necessary.

The government effort to eliminate Newcastle Disease among native chickens has been increased steadily. This is understandable because of the important role played by native chickens in contributing to the economy of villages.

Conclusions

1. Newcastle Disease vaccination control programs for native chickens followed by intensive management are successful, and will raise the income of farmers.

2. Based on economic analysis, it was proved that the keeping of 10 native chickens will provide 25% of the monthly expenditure needed per family in villages when Newcastle Disease is controlled.

3. Native chickens as a component of village farming are able to give a daily cash income for farmers.

4. Newcastle Disease vaccination should be directed toward protection of economic flocks instead of trying to establish Newcastle Disease-free areas.

Indonesia: Vaccine Production

Darmawan, Ahmad Mahjuddin, Deddy Rifuliadi, Sobari

THE Livestock Development Program in Indonesia grew rapidly in the last 20 years to provide enough animal protein (meat, eggs and milk), to increase the farmers' income, to provide job opportunities, and to promote possible export to assist the Indonesian economy.

The Pusat Veterinaria Farma (The Veterinary Biologics Center) in Surabaya, known as 'Pusvetma,' (within the Directorate General of Livestock Service) has responsibility to produce vaccines, antisera, diagnostic and other biological products for veterinary use in Indonesia.

The Newcastle Disease vaccines produced by Pusvetma are the Besavet (Bl Hitchner strain), Komavet (Komarov strain), Lasovet (LaSota strain), Lentovet (F strain) and Telovet (inactivated F strain).

The first case of Newcastle Disease in Indonesia was reported by Kraneveld in 1926, and 2 years later trials were made to prepare an effective and safe vaccine for immunisation against the disease. Since then, various strains of Newcastle Disease virus have been used to produce the vaccines, such as local strains isolated from domestic chickens, turtle-dove strain, Hertfordshire, Beaudette, Mukteswar and B1 Hitchner (Eissa 1968). The first large-scale Newcastle Disease vaccine production in Indonesia was conducted by Lembaga Penelitian Penyakit Hewan (the Animal Disease Research Institute) at Bogor. At the beginning of 1966, the same vaccine was produced by Lembaga Virologi Kehewanan (the Animal Virology Institute) at Surabaya. In 1978 this Institute became Pusat Veterinaria Farma (the Veterinary Biologics Centre).

This paper presents information on Pusvetma's Newcastle Disease vaccine production.

Pusvetma Vaccine

Production

The annual Pusvetma Newcastle Disease vaccine production is shown in Table 1.

The numbers of doses contained in each ampoule or vial are listed in Table 2.

The vaccines are kept in cold storage (at 2–8°C) in the production laboratory until the Quality Control Division declares the batches can be released.

TABLE 1. Annual Newcastle Disease vaccine production and production capacity ('000 doses) (data from Pusat Veterinaria Farma).

Type of vaccine	1982-83	1983-84	1984-85	1985-86	1986-87	Production capacity
Besavet	190.7	–				
Komavet	54002.9	67438.6	76406.8	45900	12100	80000
Lasovet	770	314.2	360	110	110	1000
Lentovet	13696.2	22281.5	26738.7	21450	5500	30000
Telovet	399.2	201.7	197	100	50	500

Reference: Pusat Veterinaria Farma.

Pusvetma distributes the products to all provincial capital cities throughout Indonesia either by air or refrigerated car. The further distribution of the vaccines to the district and the rural areas in each province is conducted by the Provincial Livestock Service.

* Pusat Veterinaria Farma, P.O. Box W/O 3, Surabaya, Indonesia.

TABLE 2. Type of Newcastle Disease vaccines produced by Pusat Veterinaria Farma.

Type	Strain	Packing	Doses/package	Doses/batch
Besavet	B1-Hitchner	ampoule	100	100000
Komavet	Komarov	ampoule	100	500000
		vial	100/500	
Lasovet	LaSota	ampoule	100	100000
		vial	100	
Lentovet	F	ampoule	100	100000
		vial	100/500	
Telovet	Inactive-F	vial	20	50000

Discussion

Pusvetma is the only institution belonging to government which produces animal vaccines in Indonesia. It was established to serve the public demands for animal vaccines. Pusvetma produces different types of Newcastle Disease vaccines (Table 2), to allow poultry farmers to choose the most suitable vaccine for their own vaccination programs.

The poultry industry in Indonesia is developing well. There are many breeding farms that raise thousands of chickens. Pusvetma recommends Newcastle Disease vaccines of 500-1000 doses/vial for these farms.

The size of Pusvetma vaccine production will depend on the funds provided by the government. Production increased from 1982 until 1984, with a sharp decrease in 1985. The estimated Pusvetma vaccine production capacity is 111 500 000 doses/ year (Table 1).

The success of the vaccination program is largely dependent upon the quantity and quality of the vaccine that is used, and also some other factors such as the handling of the vaccine in the field, and the administration and the skill of the vaccinators. Without good vaccines, the development of the poultry industry in Indonesia would be impossible.

Conclusions

The Pusvetma Newcastle Disease vaccine production has been backed up by the Newcastle Disease vaccination program in Indonesia. The Pusvetma vaccine production could be increased with a larger budget and demand for suitable vaccines.

Malaysia: Disease Control

Abdul Aziz Hussein *

NEWCASTLE Disease still ranks among the most important diseases affecting the Malaysian poultry industry today, despite the continuous efforts made by the Department of Veterinary Services and other agencies to keep it under control. It is still the number one killer of village poultry.

Occurrence

The disease is endemic throughout the country. With rare exceptions limited to the well-managed farms, poultry farmers in the country have experienced the outbreak of the disease in one form or another. The classical form of Newcastle Disease, which causes respiratory and nervous signs with high mortality approaching 100%, is not commonly seen now except in poorly managed and unvaccinated flocks. More frequently the disease is seen in partially immune flocks kept under poor conditions. The clinical signs seen are atypical, ranging from a mild respiratory problem, drop in egg production, to other signs such as stargazing, to total paralysis. These wide-ranging signs which the disease has manifested further complicate diagnostic efforts to differentiate the causal agent.

Though outbreak reports were obtained from various states in Malaysia, some areas record more outbreaks than others. This is likely due to factors such as: (i) density of poultry population; (ii) unsatisfactory vaccination. coverage; (iii) poor handling and management of vaccine (storage and transport); and (iv) farm-to-farm spread is easy through vaccination crews and other service personnel.

Age-Group

The age-groups most commonly affected are those between 3 and 8 weeks (broilers and replacement pullets), because: (i) vaccination schedules are not properly followed; (ii) natural or aggravated low immune competence is prevalent during the early weeks of life; and (iii) maternal antibodies interfere with vaccination.

Seasonal Incidence

Reports from poultry field service personnel indicate that incidence is higher in times of unfavourable environmental conditions (e.g. prolonged drought or rainy season), when there are also present other infectious agents such as infectious bronchitis, mycoplasma and bacterial infections.

Control of Newcastle Disease at Village Level

Control of the disease is based upon the use of two types of vaccines produced by the Veterinary Research Institute, Ipoh, Perak. Importation of other Newcastle Disease vaccine is prohibited. The lentogenic ‘F’ strain is used in the day-old and 3-week-old chickens. The route of inoculation is intranasal and by eyedrop. The Ranikhet ‘S’ (Mesogenic-Mukteswar) vaccine is intended for chickens kept for egg production and breeding. It is administered intramuscularly at 6 and 18 weeks of age. This vaccine, when used according to instructions, produces a strong and uniform immune response. Thus it is noticed that disease incidence among the breeders and layers above 8 weeks of age is relatively low.

The control of the disease through routine vaccination programs forms the integral part of the Veterinary Department’s services to the village poultry industry. The larger commercial farms are now being serviced by the private sector and feedmill veterinarians.

Control of the disease is hampered to a certain extent by various factors, such as: (1) The usage of freeze-dried vaccine, which is more stable during storage and transport, has yet to gain popularity. This is due to the large dose each ampoule provides (500 doses). (2) Standards of hygiene, husbandry

* Regional Veterinary Diagnostic Laboratory, Kota Bharu, Kelantan, Malaysia.

and management of village poultry are still very low. (3) Inadequate education of farmers and some poultry field personnel on the importance of keeping to the strict vaccination schedule/program.

Diagnostic and Research Facilities

As far as diagnostic facilities and tests are concerned, the Veterinary Research Institute and various regional laboratories in the country have the ability to carry out the usual isolation and identification of Newcastle Disease virus by HI method and the pathogenicity test for the isolates. However the typing or characterising of the virus is not routinely carried out.

The Veterinary Research Institute and also the other regional laboratories have been carrying out a number of research projects on Newcastle Disease over the past few years. Some of these projects are:

(i) Correlation between Newcastle Disease – HI antibody level, clinical signs, mortality, pathological lesion at autopsy, seroconversion excretion of the virulent virus in chickens following an experimental challenge;

(ii) Serological screening for Paramyxovirus other than Newcastle Disease virus in poultry;

(iii) Investigation of sparrow as Newcastle Disease virus carrier in poultry;

(iv) Evaluation and Development of a Newcastle Disease LaSota vaccine;

(v) Development of an inactivated Newcastle Disease vaccine;

(vi) A trial of the use of spray vaccination with 'F' Newcastle Disease vaccine on day-old broiler chicks; and

(vii) A preliminary study on the use of 'F' Newcastle Disease vaccine by spray and drinking method.

The Asean Poultry Research and Training Centre, a project funded by the Japanese International Co-operative Agency, which is now being built in the Veterinary Research Institute compound, also places priorities in research programs which covers topics ranging from the use of different methods of administration of vaccine, effect of water quality of vaccine efficiency, to the biology of the Newcastle Disease virus.

Malaysia: Poultry Production

P. Supramaniam *

IT was only after 1945 that poultry diseases were investigated properly in Malaysia. Of these, Newcastle Disease was identified as the greatest single deterrent to poultry rearing especially on a large scale. Fortunately a new vaccine, produced at the Institute for Veterinary Research in India (IVRI), Mukteswar, proved very effective. In 1947 a free vaccination service against Newcastle Disease was started and the demand for the vaccine grew rapidly. From a modest figure of 85 000 vaccinations in 1947 the number grew rapidly to 3 million in 1953 and 7 million in 1957.

In 1948 the Federal Veterinary Laboratory was started temporarily in two wards in a Mental Hospital, in Tanjung Rambutan. One of the first tasks of this laboratory was to produce vaccine using the Mukteswar mesogenic strain in embryonated chicken eggs. In 1953 the new Veterinary Research Institute (VRI), Ipoh, was opened and today it produces 140 million doses of vaccine in both the wet and freeze-dried forms for domestic use and for export. Currently the IVRI is carrying out research in inactivated Newcastle Disease vaccine.

Village Poultry Production System

The Malaysian village poultry production system, if in fact there is a system, is almost identical to that found in other parts of Southeast Asia. It could be summarised as follows:

(i) The chicks are either naturally hatched by mother-hen or they are bought from the hatcheries or at the market;

(ii) Wooden boxes are used for brooding or the mother-hen broods the chicks. In the case of large commercial village poultry production, the villagers use proper and suitable brooder houses with all the modern equipment and with the latest available knowledge;

(iii) Feeding: Chicks in the brooder boxes are fed with poultry mash for about 2-3 weeks and thereafter they are let free around the house to find food for themselves. They are also fed with anything that is cheap and easily available in the village. In a large commercial village poultry farming system, the chickens are fed with the commercial poultry Starter, Grower and Layer mashes. The feeds are given ad libitum and the duration of feeding of the Starters and the Growers varies from farm to farm. Some farms feed the chickens with Broiler Starter and Broiler Finisher mashes — the chickens are expected to put on weight before marketing, usually when they are between 4 and 8 months old;

(iv) Housing: As most of the houses in the villages are built on stilts, the chickens are usually housed under the houses. Some kind of extension is also provided, at the side or the rear of the house, made out of wooden materials, wire netting and thatched or zinc/tin roof. Housing is only for night accommodation. Many large commercially operated farms make use of a nearby coconut or oil palm area. Proper thatched roof with wooden slatted raised-flooring houses are built and a free-range housing system is practiced quite efficiently;

(v) Breeding: There has never been any breeding program followed by the villagers. The males and the females are always grown together, whether they are under the backyard or the large-scale commercial system. The chickens do their own selection which usually results in intensive inbreeding;

(vi) Disease control: The villagers do not follow any vaccination or disease control program. Some of them, after buying the chicks from the market, take the chicks to the District Veterinary Department usually to vaccinate against Newcastle Disease with 'F' vaccine. If their chickens fall 'sick' they are advised, by their experienced neighbour, to give antibiotics in water! Under the existing system of management, it is practically impossible for the Department of Veterinary Services to provide effective and efficient service.

* Director, Poultry Multiplication Centre, Department of Veterinary Services, Ministry of Agriculture, P.O. Box 77, 14007, Bukit Mertajam, Malaysia.

Vaccination Program

The standing population of the village poultry in West Malaysia, in 1985, was estimated to be 6.5 million. This is about 13% of the total standing population of the chicken (48.9 million), excluding ducks. There are several thousand households in West Malaysia, each keeping a minimum of 5–30 to a maximum of 1000–3000 chickens. Most (90%) of the farmers belong to the 5–30 household group.

Under the existing distribution of village chickens, it could be estimated that only about 20% of these chickens are vaccinated, mostly with the 'F' vaccine. The Newcastle Disease standard vaccine is usually not given because the available number of chickens is too small or they are difficult to catch and vaccinate. Larger farm chickens are vaccinated against the disease with the vaccine.

The villagers, especially the men, are usually out of the house during the daytime, doing agricultural work or fishing, leaving the womenfolk at home to do other domestic work, including looking after the chickens. The people do not like the veterinary personnel to come to their houses during their absence, to vaccinate the chickens. Furthermore, the veterinary personnel have more important work to perform than to travel long distances just to vaccinate a few chickens.

Importance of Village Poultry Farming

Village chicken-keeping, in Malaysia, has been with us for centuries and will continue to exist in the years ahead. Chickens have not only become a social necessity, but also an essential economic requirement to the villagers, who keep them to supplement their income and also to save substantial amounts of cash otherwise spent buying chicken for their own consumption. Through the Government Applied Nutrition Program, the villagers have learnt that the chicken can provide more than sufficient amounts of animal protein in the diet of their growing children. A villager always likes to grow more village chickens because they fetch more money than the commercial chickens. The population of village chickens is definitely going to increase, to an estimated 10 million by 1990. The importance and the economics of the village chicken is shown by the following census and the value of the poultry industry in Malaysia: broilers 23.4 million ($M84 million); layers 16.7 million ($M501 million); breeders 2.3 million ($M173 million); and village 6.5 million ($M32 million) (US$l = $M2.60).

Malaysia: Economic Importance

B.T. Oh *

THE Malaysian indigenous chicken 'Ayam Kampung' was developed from the Red Jungle Fowl *(Gallus gallus* and other mixed domesticated breeds. Thus, the ayam kampung is an outcome of unplanned multiple matings of various domesticated breeds. It is therefore very difficult to standardise its characteristics and evaluate its productive performance. There are many variations, thus, an 'ayam kampung' from Kelantan and Kedah may differ significantly from the ayam kampung in Penang, Perak and Selangor. There is also mating between male Jungle Fowl and female 'ayam kampung' resulting in a hybrid population.

It is estimated that over three-quarters of a million rural families keep small flocks of poultry (Leong and Jalaludin 1980). The estimated number of ayam kampung is about 6.5 million birds, with an annual production of about 17 million birds. Annual egg and meat production is estimated at 246.56 million table eggs and 17 000 t respectively. In the 1985 broiler, breeder and commercial layer population, ayam kampung accounted for 12070 of the total standing population, 7% of the total broiler meat production and only 5% of total table egg production. Out of the 624.14 million ringgit obtained from the sale of broilers, $85 million was from ayam kampung accounting for 14% of the total value. Although ayam kampung are kept in small flocks, they contribute significantly to the total annual production of poultry meat in Malaysia. The average ex-farm price of ayam kampung in 1985 was $M5.00/kg and 18 cents/egg. The ex-farm price of liveweight birds is $M6.50/kg for female and $M5.00/kg for male. Eggs are sold at 20 cents each.

Ayam kampung egg production is less significant than meat production and contributes only about 5% of the total table egg production. The value from ayam kampung eggs was only $27.0 million ringgit.

* Faculty of Veterinary Medicine and Animal Science, Universiti Pertanian Malaysia, 43400 Serdang, Selangor, Malaysia.

Importance of Ayam Kampung

The estimated total value of ayam kampung in 1985 was $112 million ringgit. There are many other intangible benefits from such sales:

Extra Income from Fruits

The traditional integrated farming of ayam kampung and fruit crops helps to increase the fruit production. A small flock of 15 chickens can produce about 1–1.2 kg of manure per day. This manure is a valuable source of organic fertilizer. In 1 year a total of 365–438 kg of chicken manure is produced. The sale of fruits such as coconut, durian and rambutan directly contributes to the village economy.

Minimise Feed Cost

The input of organic fertilizer in the land encourages the growth of earthworms. Earthworms, termites, other insects and young grass are the natural food of ayam kampung. Allowing the chickens to roam freely will reduce inputs of feed and weeding costs. Unlike the white broilers, ayam kampung can find their own food.

Conversion of Kitchen Garbage to Protein

Ayam kampung will eat all kitchen garbage. The leftover rice, bread and other food which otherwise are disposed of as waste can be utilised by the chickens to produce eggs and meat.

Disadvantages of Ayam Kampung

The ayam kampung can be quite destructive. They scratch vegetable beds, eat vegetables and destroy young banana shoots. The damage can be minimised by covering the young plants and vegetable beds with wire mesh or traditional bamboo covers.

Ayam kampung may be a nuisance to neighbours who grow flowers and vegetables. This may lead to quarrels and create disharmony among neighbours.

Advantages of Ayam Kampung

Financial Benefits

Small flocks of ayam kampung can Provide supplementary income to a family. Although production levels are low, the cost of production per egg or per kilogram is low because inputs of capital, labour and feed are extremely low. The birds and eggs are sold at premium prices and therefore profit is high. This is only applicable to small flocks. With large flocks the owner will have to buy feed since the household leftover food is not sufficient. An average income from sales of broilers from a 15–20-bird flock is about $50.00 ringgit/month. The flock also provides some eggs and meat for home consumption.

Market Demand

Smallholder farmers should be encouraged to rear ayam kampung rather than fast-growing white broilers. Rearing the white broiler under the intensive system requires high financial and technological input. Moreover, smallholders have to compete with large-scale broiler producers for the same market. The broiler market is very unstable with frequent fluctuations. Very often the ex-farm price is below the cost of production. The price of ayam kampung has been stable for the last few years. There is always a demand for ayam kampung and marketing of these birds does not present any problems because ayam kampung is tastier and has a stronger flavour than the white broilers. The texture of the muscle is finer and smoother. They are well sought after by wealthy urban residents. Another important reason for the great demand for ayam kampung meat is that they are not fed with compounded feed which contains antibiotics, antioxidants, coccidiostat, anti-mould compound, enzymes and sulfur drugs and other chemicals. It is believed that chickens fed with chemicals and drugs have poorer therapeutic value. They do not combine well with ginseng and other herbs when making steamed soup. Young pullets are preferred so they fetch a higher price than the males. The female is claimed to be more beneficial and the meat of this bird is tastier. Steamed soup is supposed to give virility and vigour. It is commonly recommended in Malaysia for pregnant women and for anyone during recuperation.

It is important to undertand these traditional values. Ayam kampung fed with commercial diets will not fetch higher prices as in the case of commercial ayam kampung production. Such large-scale production may affect the market value of ayam kampung. Housewives may have difficulty in distinguishing between real ayam kampung and commercial ayam kampung.

Constraints of Ayam Kampung Production

Newcastle Disease and Pullorum are the two most destructive diseases among the ayam kampung. Newcastle Disease occasionally sweeps through the villages killing most of the chickens. Though free Newcastle Disease and Fowl Pox vaccinations are provided by the Department of Veterinary Services, owners do not vaccinate their flocks regularly. With the incorporation of V4 vaccine in pelleted feed this problem may be solved. Pullorum may kill half of the flock. Those birds that recover from this disease become Pullorum carriers. This is one of the reasons for the high mortality among ayam kampung chicks during the brooding stage. It is difficult to control Pullorum, since there is no vaccine. It is imperative that a vaccine be developed for this disease for the benefit of smallholders. Most of the commercial breeding farms are producing Pullorum-free chicks but with ayam kampung it is nearly impossible.

Recommendations For Improvement

Research and Development

Besides Newcastle Disease control for the ayam kampung flock, other management practices and systems of production should be developed, to improve the efficiency of production. In this respect, a small improvement in the production technique will have a great impact on ayam kampung production. These efforts should be carried out through research and development. Research on the traditional system of production is worth further consideration.

Breed Selection

As far as possible research should be geared towards selecting and improving the ayam kampung breed bearing in mind the preferences of consumers. The government poultry multiplication farms should also produce Pullorum-free ayam kampung chicks for distribution to smallholders.

Management

The next step is to introduce simple artificial brooding using hurricane lamps rather than broody hens. Brooding the chicks in cages for 4-5 weeks will reduce the mortality rate. Broody hens will return to lay earlier. The smallholder farmers can produce ayam kampung in batches with the chickens of the same age per batch. This will improve the disease status as the young chicks do not have to mix with adults. They should be allowed to roam and fend for themselves in the open range after they have been vaccinated at 4–5 weeks. During this time they may be fed with commercial chick starter mash. Once they are released into the open range they should only be given household leftovers plus cracked-corns, wheat grain, palm kernel-cake and copra-cake. Addition of antibiotics and chemicals in the feed should be restricted to treatment only. It is believed that chemicals and drugs will affect the taste of chicken meat.

Housing

Another area for improvement is the provision of cheap and appropriate housing. The house can be made of locally available materials but emphasis should be directed towards proper ventilation and easy cleaning.

Future Prospects

The price of ayam kampung has been increasing each year. This trend indicates that there is a shortage of ayam kampung in the market. Many rural householders prefer to buy eggs from the shops rather than to rear ayam kampung for eggs. Commercial chicken eggs are readily available and are cheap. Prices of ayam kampung eggs will continue to be high. The introduction of new and simple methods of Newcastle Disease vaccination will reduce the mortality in ayam kampung. This may also stimulate further interest in ayam kampung production. If this happens there will be an increase in supply of ayam kampung in the market and the price may drop.

Ayam kampung will continue to enjoy its special market. The low price for commercial broilers during the overproduction period has very little influence on the price of ayam kampung. In early 1987, ex-farm price of broilers in Penang was $M1.30/kg whereas ayam kampung sold at $M5.00-$M6.50/kg.

Malaysia:
Production Systems

Ramlah Hamid, M.N. Shukor *

POULTRY farming constitutes a major livestock activity in Peninsular Malaysia. From a backyard industry of the 1950s, the development of the poultry industry has been characterised by rapid growth, particularly in the 1970s. In 1985, poultry meat production in Malaysia was 202.5 million kg, and consumption of poultry meat (per capita per annum) was 14.5 kg while egg production was 2.95 billion and consumption of eggs (per capita per annum) was 221 eggs (Nik Mahmood 1985). According to the 1984 census, village chicken production contributed about 5.2% of the total egg supply and about 10.2% of the total meat production by poultry (Nik Mahmood 1985). The premium price being paid for village chicken meat and eggs also serves as an important source of income to rural people (Jalaludin et al. 1985). It was estimated that over three-quarters of a million rural families in Peninsular Malaysia still keep indigenous village chickens, estimated in 1985 to be about 6.5 million birds, in backyards in flocks of 15-50 chickens per holding. These numbers represented about 13% of the estimated total number of birds in Malaysia.

The original Malayan fowls were widespread in Malaysian villages before the arrival of Europeans. They are descendants of the Southeast Asian jungle fowl *(Gallus bankiva)*, through natural mating and selection. They are no longer of pure breed as a result of crossbreeding with various exotics introduced into the country by the Europeans, especially the British (Engku Azahan and Zahari 1983). At present, numerous crossbreds of these indigenous fowls can be seen reared extensively in almost every village and suburban area. The indigenous village chicken is a dual-purpose type, small body size with variable body conformations and physical characteristics. These crossbreds are known as indigenous village chickens *(Gallus domesticus)*.

* Faculty of Veterinary Medicine and Animal Science, Universiti Pertanian Malaysia, 43400 Serdang, Selangor, Malaysia.

Two major advantages of village chicken over the exotic breed is that it is an important component of the integrated farming system in the village, and the existence of consumer preferences for village-raised eggs and chicken meat (Jalaludin et al. 1985). The village chickens have been raised on free range and integrated farming systems in the villages for generations. They are given minimal shelter at night and allowed to scavenge for themselves during the daytime, grazing weeds and picking worms and insects (Jalaludin et al. 1985). Sometimes they are given household leftovers and occasionally grain supplements (Leong and Jalaludin 1982). The performances of village chickens in terms of growth, feed consumption, efficiency of feed utilisation, and their performance in terms of laying pattern, egg production and broodiness has been studied (Engku Azahan 1983; Engku Azahan et al. 1980; Kelly 1958). The indigenous village chickens are low producers of either meat or egg as compared to exotic broiler or layer strains found in Malaysia. A lot of information has been obtained regarding the performance of village chickens under experimental conditions particularly on growth, laying characteristics and feeding, but little information is available on production systems at the village level. Therefore, the objectives of this study were to identify the type of breeds reared in villages, production and feeding systems and types of housing and equipment.

Materials and Methods

A total of 39 farmers who kept village chickens as a source of supplementary income were selected from several villages in Selangor and Negeri Sembilan. Information was obtained by interviews, personal observations and recording of the physical characteristics of breed, production and feeding systems, types of houses, construction materials and equipment. The length and width of the houses (including height of houses), feeders, drinkers, nesting boxes were also measured. Chickens of various ages were randomly selected and weighed to evaluate growth performance.

Results and Discussion

System and Type of Farming

Three types of farming systems were identified which are categorised as intensive, semi-intensive and free-range. In the intensive system, the chickens are kept in a poultry house or cage from day-old till market age. They are provided with feed such as concentrates and grains. In the semi-intensive system the chickens are let out during the daytime to scavenge for food within a fenced area. In the free-range system the chickens are let out freely during the daytime to scavenge for food. At night they usually return to the shed.

Flock size varied from approximately 20 to 50 birds. The ages of the birds varied from day-old to about 3 years. About 75% of the population in each flock were birds aged from day-old to 6 months. Each farmer kept at least l–2 adult males and 3-4 adult females in their flock for breeding purposes.

Among the three systems of farming, the free-range system was extensively practiced by 32 farmers (82.1%), followed by semi-intensive (6 farmers, 15.4%) and intensive (1 farmer, 2.5%). Twenty farmers (5 1.3%) kept only village chickens while 19 farmers (48.7%) kept village chickens with other poultry such as ducks, hybrid broilers, swans, jungle fowls, fighting cockerels and turkeys. A total of six farmers (31.6%) who practiced mixed farming kept the village chickens with ducks.

Breed Descriptions

Observations on some physical characteristics of the village chickens comprising 140 females and 112 males showed four distinct plumage colour patterns in males as follows: (i) black-red variety: glossy black colour all over the body with brilliant red lustre at hackle and wing-bow; (ii) red-black variety: rich red colour all over the body with glossy black at the tip of the wing and tail; (iii) black-tortoise-shell variety: hackle, saddle, back and wing-bow is a mixture of brown, yellow and gold colour; the remainder of the plumage is black; and (iv) brown-black variety: dark brown colour all over the body with black colour at the tip of the wing and tail.

In females three distinct plumage colour patterns were identified: (i) black variety: pure black, free from other colours; (ii) dark-brown variety: pure dark brown; (iii) brown-black variety: dark or light brown colour all over the body with mixture of black colour especially at the hackle, wing and tail.

Other characteristics such as yellow-coloured shank were present in 66.1% of the males and 51.4% of the females. Single and pea-type combs were the two most prominent comb-types observed with 57.1 and 30.4% in the males 71.4 and 14.3% in the females, respectively. Rose, walnut and buttercup comb-types were also observed. Seventy-one Percent of the male village chickens had spurs, but these were absent in the females.

Management

Housing

Two types of houses were identified: deep litter with dirt floor (59%), and raised floor (41%). Wooden wall, slatted floor and zinc with lean-to roof type were the house design features widely seen in both types of houses. The floor space of the house ranged from 2.8 to 8.1m^2, with 0.1–0.5m^2 floor space per bird.

This was comparable to modern broiler houses or laying houses in commercial or in smallholder farms. Normally broiler or layer houses in commercial or smallholder levels were properly designed and constructed using good and long-lasting materials. The recommended floor spaces were also followed in order to create a suitable environment for chickens. In the village the houses were contructed using old and used materials, or any materials available, and thus no standard housing design and floor spaces were provided.

Equipment

The flocks were provided at least one nesting box for laying and incubation of eggs. Only about 28 and 34% of the flocks were provided with feeders and drinkers respectively, while the rest were left to scavenge on their own. Various types of feeders and drinkers were used: 50% of the feeders and 80% of the drinkers were plastic containers which were usually used for rearing broilers. Although plastic feeders and drinkers were used by some of the farmers, they are not properly managed and not routinely cleaned.

Performance

Growth

A total of 150 village chickens was weighed and since no records were kept by the farmers, the age of the chickens was estimated. The results are presented in Table 1. The mean body weight of day-old chicks was almost the same as those reported by Engku Azahan et al. (1980), but higher than the weights reported by Kelly (1958).

Laying Characteristics

The female hens reached sexual maturity at about 6-8 months. The estimated number of eggs laid per bird ranged from 30 to 60 eggs/year with egg weight ranging from 37.2±2.3 to 44.92±3.0 g. The female hens would hatch the eggs in the nest boxes about 3-4 times/year and would lay approximately l0-15

TABLE 1. Weight of village chickens at village level.

Age (weeks)	Male		Female	
	No.	Weight (g)	No.	Weight (g)
1 day (M+F)	3	31.0		
1 (M+F)	6	36.6±13.7		
2 (M+F)	6	54.2±10.3		
3	2	195.0±35.3	2	150.0±42.4
4	2	220.0±113.1	11	191.0±39.9
5	3	353.3±28.9	3	253.3±10.6
6	1	410.0	5	308.0±78.2
8	4	463.0±21.4	9	316.0±119.5
10	5	562.0±237.7	9	502.8±208.7
12	19	775.3±58.4	19	682.1±124.0
14	2	1080.0±109.7	4	802.5±107.8
16	4	1114.0±73.7	5	1016.0±112.6
20	5	1418.0±262.5	6	1180.0±120.0
24	7	1527.0±305.7	4	1373.0±162.9

eggs before becoming broody. After the eggs were hatched, the hens would return to lay after 2-3 months. The shell thickness varied between 0.329±0.023 and 0.421±0.016 mm. Hatchability of the fertile eggs was estimated between 70 and 80%. Chick mortality, especially between day-old to 2 weeks old, was estimated between 10 and 20%. Similar findings on egg weight, egg production per year and sexual maturity had earlier been reported (Deveraj 1958; Engku Azahan et al. 1980; Jalaludin et al. 1985). There were no earlier reports on egg shell thickness and chick mortality. Hatchability was similar to that reported by Jalaludin et al. (1985).

Feeding

Natural feed resources such as insects, worms, weeds, grasses and household leftovers were the main feeds the chickens ate. About **87%** of the flocks were fed with feed supplements such as wheat (46% utilisation), paddy (12%), paddy husk and rice bran (12%), corn (9%), concentrates (7%), tapioca (7%), coconut cake (5%), and sago (2%).

Chickens of various ages were fed 2 or 3 times/ day. About 72% of the flock were fed twice a day, early in the morning and evening and about 21% were fed three times/day, early in the morning, afternoon and evening, It is practical to feed the flock twice a day, early in the morning before they are released and in the evening when they come back to roost.

Brooding

Chicks were brooded by the broody hens and no artificial heating was provided. This system of brooding is not satisfactory and artificial brooding could be practiced by using kerosene lamps or electric carbon bulbs in brooding cages.

Marketing

Live village chickens were normally marketed at the age of 4-6 months. The prices of the male and female village chickens during November 1986 were M$5.00 and 6.00/kg, respectively. Demand for the village chickens was not only high during the festivals but throughout the year. Number of birds marketed also varies from 8 to 13 birds at one time. Birds were either sold direct to buyers or at the market. About three farmers (7.7%) brought their chickens to the market while the other 36 farmers (92.3%) sold from their homes. Marketing frequencies also vary among the farmers but normally once within a period of 4-6 months. Frequencies and the number of birds marketed were influenced by the flock size kept by the farmers.

Malaysia:
Fowl Diseases

R.A. Sani, M. Harisah, Aini Ideris, M. Shah-Majid *

THE indigenous domestic fowl is kept by over three-quarters of a million semi-rural and rural households in West Malaysia as small backyard flocks. These birds are kept free-range in the daytime and return to their sheds at night. There is very little documented information on diseases affecting the indigenous domestic fowl. Most of the work published is on diseases affecting commercial breeds kept in a confined management system. Because of this lack of information, a survey was carried out in 1984 of 22-25 flocks comprising over 200 birds from households in Sungei Besi, Serdang and Ulu Langat, Selangor. The diseases or disease agents specifically sought wereecto- and endoparasites, Newcastle Disease, Infectious Bronchitis, *Salmonella pullorum*, and *Mycoplasma gallisepticum*. In a second survey in late 1986, the prevalence of mycoplasma in 164 fowls was investigated based on isolation of the microorganism.

Methods

Survey 1

Faecal samples were collected and examined for parasite ova by the McMaster's technique. Whole blood samples were examined for haemoprotozoa using thin blood films stained with 10% Giemsa, and antibodies against *Salmonella pullorum* with the rapid whole blood test. Sera samples were tested for antibodies against Newcastle Disease and Infectious Bronchitis with the haemagglutination inhibition test, and against *M. galhepticum* using the rapid slide agglutination test. Eyes and the entire body of the birds were examined for eyeworms and ectoparasites respectively. The respiratory and digestive tracts of 10% of the birds were examined for helminths. These same birds were previously used in an experiment where they were challenged with virulent Newcastle Disease virus or Infectious Bronchitis virus and the survival rate was noted.

Survey 2

In this survey 164 birds were swabbed from the cloacal cleft region using sterile cotton swabs. The swabs were then plated directly onto Mycoplasma Supplement-G agar medium and incubated in 5% CO_2. The typical 'fried-egg' appearance of the growth colonies as seen under a stereomicroscope at x40 magnification was identified as mycoplasma.

Results

From the serological tests carried out, Infectious Bronchitis has the highest prevalence (Fig. 1) — 148 or 63% of the birds were positive for this disease and had high HI titres, ranging from log 6 to 8; 23% of the birds surveyed were positive for *M. gallisepticum*. Only 34 or 15% of the birds had detectable levels of antibodies to Newcastle Disease, even then with very low HI titres. Results from the rapid whole blood test indicated that only 8% of the birds were positive for *S. pullorum* infection.

The birds in the survey had never been vaccinated against either Newcastle Disease or Infectious Bronchitis. The 10 birds used in the challenge

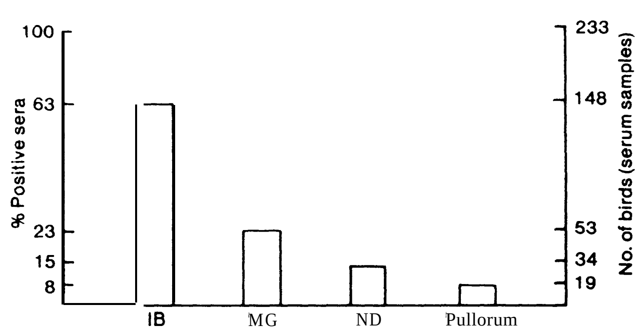

Fig. 1. Results of serological tests for the four diseases (IB = Infectious Bronchitis; MG = *Mycoplasma gallisepticum; ND = Newcastle Disease;* SP = *Salmonella pullorum).*

* Faculty of Veterinary Medicine and Animal Science, Universiti Pertanian Malaysia, Serdang, Selangor, Malaysia.

TABLE 1. Virulent Newcastle Disease virus and Infectious Bronchitis virus challenge in unvaccinated indigenous fowl.

Method	Day 0				Day 15			
	No. chickens	HI-titre	Mortality	% survival	No. chickens	HI-titre	Mortality	% survival
Newcastle Disease Virus								
I/C	5	0.00	0	100	0	2.75	5	0
I/N & I/O	5	0.20	0	100	2	7.00	0	40
Infectious Bronchitis Virus								
I/C	5	2.20	0	100	5	4.80	0	100
I/N & I/O	5	3.20	0	100	5	5.80	0	100

I/C = in contact; I/N = intranasal; I/O = intraocular.

experiment had a mean Newcastle Disease HI titre of 0.2 (Table 1). Five birds were challenged by contact and the other five birds were given the Newcastle Disease virus intranasally and intraocularly. The antibody titre increased during the first week of challenge and maintained a log 7 in the survivors of the inoculated group on day 15. There were no survivors in the group challenged by contact and 40% in the second group.

Another 10 birds were challenged with Infectious Bronchitis virus in a similar experiment (Table 1). During the period of challenge, the Infectious Bronchitis HI titres increased moderately. All challenged birds survived and a few showed very mild clinical symptoms (i.e. rales).

Table 2 shows the faecal evidence of gastrointestinal parasites prevalent in 22 flocks and the average egg count for each of the endoparasites. Identification of the cestode species based on egg morphology alone was not possible.

The helminth populations and their total counts in the digestive and respiratory tracts of 19 birds are shown (Table 3). Nine species of nematodes and five species of cestodes were recovered. All the birds had *Heterakis gallinae* and *Capillaria* sp. and a high proportion had *Raillietina echinobothrida.* In heavy infections with *H. gallinae,* nodules were observed on the caecal mucosa. Four female filariid worms were found in the proventricular washings of one bird. Further identification of the species was not possible since no male worms of the same species were found. Male and female *Tetrameres fissispina* were distinguished based on their stark morphological difference. All birds had more than two helminth species (3 birds with 3 helmith species; 4 with 4; 7 with 5; 4 with 6; and 1 with 7). There is no correlation between the number of birds infected and the number of helminth species infecting each bird.

TABLE 2. Estimation of helminth eggs/coccidia oocysts in the faecal samples of 201 birds from 22 flocks.

Helminth egg/ coccidia oocyst	Prevalence (%)	Average egg/ oocyst count per gram faeces
coccidia oocyst	16 (72.7)	2173
Capillaria egg	13 (59.1)	585
cestode egg	12 (54.6)	800
Strongyloides egg	9 (40.9)	189
Syngamus egg	5 (22.7)	400
Heterakis egg	3 (13.6)	200
Acuaria egg	2 (9.1)	150
Ascaridia egg	1 (4.6)	200
Oxyspirura egg	1 (4.6)	100

Four species of blood protozoa *(Leucocytozoon sabrazesi 52.2%* infected, *Trypanosoma* sp. 4.5% infected, *Plasmodium gallinaceum* 3.5% infected and *Leucocytozoon caulleryi* 1.0% infected) and one type of microfilaria (15.2% infected birds) were identified from blood samples. Most of the birds (73%) harboured only one blood protozoa species while some birds (27%) had two species, namely *Leucocytozoon sabrazesi* and *Trypanosoma* sp.

Examination of the external body of the birds revealed four species of lice and one species of mite (Table 4). Two birds were found to harbour all the four species of lice and the mite while 48 others only one species of lice or only the mite. The most common louse was *Menopon gallinae* affecting 94% of the birds. The only mite found was *Megninia cubitalis*. The degree of the lice infestation was mostly light while 83% of the 90 birds which had mites were heavily infested.

From the second survey, mycoplasma was isolated from 34 or 20% of the 164 crossbred and pure village chickens. The highest isolation was from the 4.5-month-old group (10 positive cultures out of 22 birds) followed by the 2-month-old group (11 out of 30 birds). No mycoplasma was isolated from the 4-month-old group.

Discussion

The high Infectious Bronchitis-HI titres shown by the birds indicated that most of the birds were infected at the time of survey. Newman (1979) gave

TABLE 3. Prevalence and total worm count of helminths found in 19 birds.

Helminth	Site	Prevalence (%)	Average number (range)
Nematode:			
Heterakis gallinae	caecum	100	118 (4-452)
Capillaria sp.	intestine, caecum	100	103 (8-980)
Ascaridia galli (mature)	intestine		2 (1-3)
Ascaridia galli (immature)	intestine		32 (–)
Capillaria annulata	crop	21.1	8 (4-12)
Syngamus trachea	trachea	15.8	2 (1-13)
Tetrameres fissispina (male)	proventriculus	15.8	239 (84-528)
Tetrameres fissispina (female)	proventriculus	15.8	4 (1-7)
Gongylonema ingluvicola	crop	5.3	4 (–)
Oxyspirura mansoni	nictitating membrane	5.3	21 (–)
Filariid worm (female)	proventricular washing	5.3	4 (–)
Cestode:			
Raillietina echinobothrida	intestine caecum	89.5	27 (4-100)
Raillietina tetragona	intestine	42.1	9 (4-16)
Amoebotaenia sphenoides	intestine	31.6	1476 (5 16-3408)
Raillietina cesticillus	intestine	10.5	26 (8-44)
Choanotaenia infundibulum	intestine	5.3	80 (–)

TABLE 4. Ectoparasites found on 201 indigenous domestic birds.

Ectoparasite	Number (%) of birds with Heavy infestation	Number (%) of birds with Light infestation
Lice:		
Menopon gallinae	51 (27.0)	138 (73.0)
Lipeurus caponis	18 (37.1)	30 (62.1)
Goniodes dissimillis	9 (36.0)	16 (64.0)
Goniocotes gallinae	5 (25.0)	15 (75.0)
Mite:		
Megninia cubitalis	75 (83.0)	15 (17.0)

a titre of log 5-6 for birds having clinical Infectious Bronchitis. However, there was no clear evidence of clinical symptoms except for a few birds that had rales. The antibodies present in these birds are protective as shown by the 100% survival among the birds challenged with Infectious Bronchitis virus. These birds were never vaccinated against Infectious Bronchitis but being free-ranging probably contacted the disease from vaccinated commercial birds kept in the vicinity. The very low Newcastle Disease HI titres shown by the birds indicated neither vaccination nor immunity. This is manifested by the low survival of birds challenged with Newcastle Disease virus, Therefore these birds are unprotected against the disease. The risk of

Newcastle Disease outbreak is therefore high and losses up to 50-70% of the total number of birds in a flock may be expected. The low prevalence of *S. pullorum* in the flocks indicates that the disease is not widespread in the area. However those birds with positive sera may act as chronic or potential carriers.

Branton et al. (1984) reported that swabs taken from the cloacal cleft region yielded higher isolation and lower bacterial contamination than tracheal swabs. This method is also less stressful to the birds and there is no feed contamination at the time of sampling. Mycoplasma was isolated from birds at a Very early age, i.e. 2 months old. The route of transmission is probably horizontal, i.e. from the older birds. The d-month-old group which were negative for mycoplasma were all from a separate flock which were probably free from mycoplasma infection.

All the birds observed in the survey appeared healthy. The birds, however, could succumb to the infection or infections should stressful conditions occur such as damp, rainy days, undernourishment, shipping or concurrent infectious disease. One incident that supports this was an outbreak of Marek’s disease, coccidiosis and infectious coryza among originally healthy birds shipped in from Penang to Universiti Pertanian Malaysia.

Philippines

Victor C. Atienza *

BACKYARD poultry raising plays an important economic role in the Philippines, especially in the rural areas. In addition to their usual farm work, farmers often raise chickens (from a few birds to several hundred) for broiler or layer purposes to augment their income or for family consumption. The total number of chickens in the Philippines in 1984 was 59.2 million, down from the all-time high in 1982. About 65-75% of the poultry population is in the 'backyard sector,' with the balance raised by the integrator/commercial raisers. Southern Tagalog has about 25% of all chickens, 14.7 million in 1984, and twice as many as Central Luzon (Fig. 1). In many broiler-producing areas, there is what is known as the 'pa-iwi system' whereby a person will provide the farmer with day-old chicks, feed, vaccine and medication, and after 7-8 weeks the broilers will be sold. After deducting expenses, the net profit will be shared equally by the farmer and the investor.

There are also many successful cooperatives that cater to the needs of the backyard raisers in the form of reduced cost of medicine, feeds, biologics, etc. While most of the feed requirements are supplied by the large feed producers, some cooperatives were able to build their feed mills. In one village or barangay, there can be a population of 10 000-30 000 broilers at any given time, but these are distributed amongst 100-200 raisers within a very small land area.

The type of housing in the village level varies greatly. It is not uncommon to see poultry cages/pens under houses. Locally available materials like bamboo and nipa palm are used for the poultry houses. The more affluent farmers use chicken wire for the flooring and galvanised iron sheet for roofing. Some farms have the single-deck type of housing while others have the double- or triple-deck types to save on space, but raise more chickens.

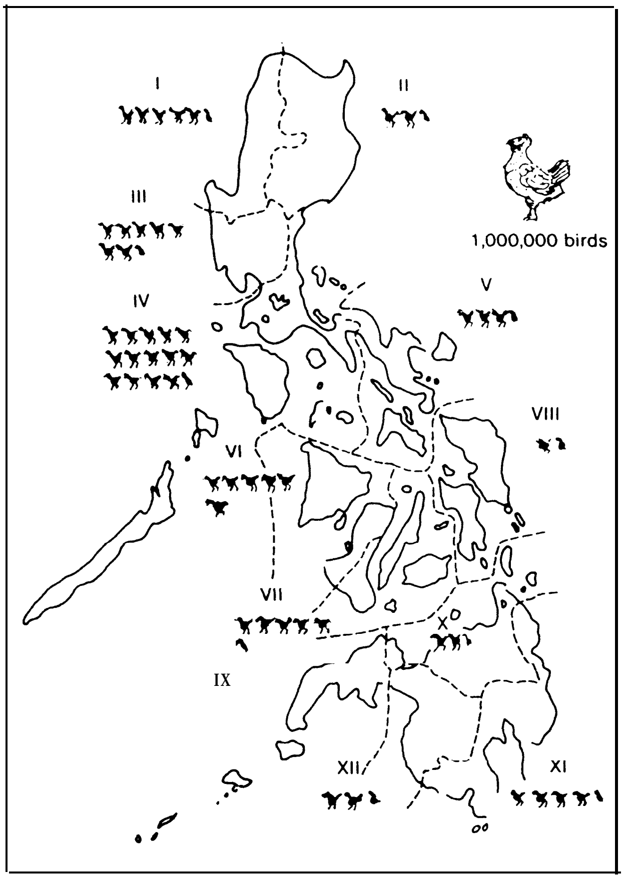

Fig. 1. Regional distribution of poultry in the Philippines (1984). (Source: Philippines Livestock Sector Development Project, 1986, HawaiianAgronomics (International), Inc.)

Several age-groups of chickens can be observed at any given time, and the 'all-in-all-out' system is observed only by the commercial raisers.

Feeding ad libitum is generally practiced and even backyard raisers use growth promotant/feed supplements in the daily ration of their stocks. Medicated drinking water in times of stress is usually given.

* Chief, Quarantine Veterinary Section, Regulations and Control Division, Bureau of Animal Industry, Visayas Avenue, Diliman, Quezon City, Philippines.

Newcastle Disease

To the backyard and commercial raiser, Newcastle Disease is still a very serious problem that causes great economic losses in the poultry industry (Coronel 1947). In 1986 there were 18 717 deaths from 92 738 cases recorded from 38 out of 73 provinces that submitted their annual disease situation report (Table 1). These are probably the best statistics available on the incidence of Newcastle Disease, although we are inclined to believe that there is gross under-reporting because the reports were only based on clinical diagnosis in the field without confirmation by laboratory tests. Furthermore, most of the cases reported were made from the diagnoses of lay inspectors with limited training in the diagnosis of animal diseases. There is a need to increase the number of qualified veterinarians and technical personnel to undertake accurate diagnosis of disease outbreak and accurate reporting (Table 2).

In the study made in 1986 by the Hawaiian Agronomics (International) Inc. the consultants recommended the placement of a governmental veterinarian in each of the municipalities in the nation. This would amount to 1200 veterinarians (of a total of 1500 municipalities). The municipal veterinarian would supervise the existing staff of livestock inspectors in disease control and surveillance activities. This person would also be the lay person in the delivery of an effective animal disease program to the level of the smallholder and backyard farmer in the barangay.

Since the start of the reorganisation of the Ministry of Agriculture and Food in 1979, reports from the provincial veterinary office are forwarded to the regional office, and seldom does the main office receive reports from the twelve regional offices. With the autonomy given to the regional offices, it is now more difficult to plan a disease control and eradication program at the national level because each region will have its own priorities.

Although Newcastle Disease outbreaks have been reduced, there is still a need to improve and strengthen the poultry disease control program which would pave the way for eventual eradication.

The main activity of the Bureau of Animal Industry technician at the small poultry farm level is to perform vaccinations and to teach farmers the basic principles of immunity and the vaccination procedure (Arambulo 1986). The farmer is made aware of the importance of vaccination in order to avert losses due to Newcastle Disease. Vaccines are given free of charge and for this reason more poultry farmers have adopted a regular vaccination schedule based on the recommendation of BAI personnel. The strain utilised by the BAI in vaccine manufacture is PD-113 (Philippine Duck), a strain of Newcastle Disease virus isolated from an outbreak in Pateros, Rizal. The virus is attenuated by 113 serial passages in duck egg before being processed into live virus vaccine. The vaccine has proved effective in preventing Newcastle Disease

TABLE 1. Newcastle Disease situation in the Philippines in 1986. (Source: Regulations and Control Division, 1986, Disease Situation Report .)

Region/Provinces	Cases	Deaths
Region 1 — Dagupan City		
Abra		
Benguet	345	250
Mt. Province	210	210
Ilocos Norte	42	32
Ilocos Sur	1005	513
La Union	5938	4778
Pangasinan	1896	230
Region II — Tuguegarao, Cagayan		
Cagayan	1225	733
Isabela	1739	362
Nueva Viscaya	521	521
Kalinga Apayao	505	910
Region III — San Fernando, Pampanga		
Nueva Ecija	27	7
Pampanga	26075	1393
Tarlac	35	4
Zambales	135	28
Region IV — Quezon City		
Batangas	1750	50
Cavite	247	168
Marinduque	344	239
Or. Mindoro	804	353
Occ. Mindoro	31	–
Palawan	1429	1224
Quezon	37500	3325
Romblon	158	43
Region V — Pili, Camarines Sur		
Camarines Sur	1269	515
Camarines Norte	165	56
Albay	127	212
Catanduanes	317	143
Masbate	1043	132
Sorsogon	247	238
Region VI — Iloilo City		
Negros Occidental	2522	
Region VIII — Cebu City		
Cebu	1638	1272
Region IX — Zamboanga City		
Zamboanga del Sur	30	30
Region X — Cagayan de Oro City		
Agusan del Sur	68	22
Bukidnon	2714	484
Surigao de1 Norte	427	240
Region XI — Davao City		
South Cotabato	210	
Total:	92738	18717

TABLE 2. Personnel in Animal Health Services in the Regional Ministry of Agriculture. (Source: Personnel Section, BAI.)

	I	II	III	IV	V	VI	VII	VIII	IX	x	XI	XII	Total
Regional Veterinarian	1	1	1	1	1	1	1	1	1	1	1	1	12
Supervising Veterinarian	2	2	2	2	2	2	2	2	2	2	2	2	24
Senior Quarantine Veterinary Officer	–	1	1	–	1	1	1	1	1	1	1	1	10
Quarantine Veterinary Officer	1		2	3	2	2	2	–	1	1	1	1	16
Provincial Veterinarian	7	7	6	11	6	5	4	6	6	7	5	5	75
Research Veterinarian	1	1	1	1	1	1	1	1	1	1	1	1	12
Veterinarian	–		1	–	–		–	–			–	–	1
Senior Livestock and Poultry Technologist	2	3	2	3	5	4	2	4	3	3	3	1	35
Livestock Inspector	154	145	124	216	96	115	126	71	65	144	95	101	1452
Senior Vet. Laboratory Technician	1	1	1	–	1		1	1	1	1	1	1	10
Vet. Laboratory Technician	1	1	1	1	1	1	2	1	1	1	1	1	13
Vet. Laboratory Aide	1	1	1	1	1	1	–	1	1	1	1	1	11
Total													1671

outbreaks in poultry. Commercial vaccines are sometimes not available in the rural areas and if these are available, the cost is beyond the reach of the ordinary farmers. The vaccine produced by the Laboratory Services Division of the BAI can supply only a part of the requirements of the small farmers. In 1986 the BAI produced 3 17 600 doses, compared with 5 802 400 doses in 1982.

In 1982, the government was able to obtain a loan from the World Bank to improve and upgrade the biological laboratory of the BAI. The target is to supply 80% of the vaccine needs of the raisers. It is expected that if these production figures could be realised, there would be a significant reduction in losses due to Newcastle Disease.

By the end of the World Bank Project in 1989, the twelve regional diagnostic laboratories will be fully equipped to handle the diagnosis of poultry and other livestock diseases. It would no longer be necessary to send specimens to the central laboratory, which is quite remote from many regions of the country.

Seminars are organised by BAI personnel in cooperation with the municipal and village officials to attract more people to raise chickens and to improve the technical competence of those who are already engaged in poultry raising. Technicians are also given special training to enhance their extension activities.

The Regulations and Control Division of the BAI closely monitors the disease situation of large breeder farms which are the sources of day-old chicks to ensure that only healthy day-old chicks are sold to the public. Importations of the breeder chicks are likewise closely monitored so that only healthy chickens are brought into the country.

The ‘Manukang Barangay Project’ is another government-sponsored program. Roughly translated, this means village chicken project. This is a supervised-credit type of project. The farmer is assisted in the preparation of the project study as well as in securing the loan from a rural bank. The farmer-cooperator undergoes training in poultry management and disease control before he starts the project. In addition, the programs and activities in the project are constantly monitored by a technician to ensure the success of the project. In the process the farmer learns and adopts approved disease preventive measures and poultry husbandry practices which he applies to his future projects.

With the assistance extended to the backyard raisers, the BAI is hopeful that in the near future Newcastle Disease can be controlled and eventually eradicated.

Sri Lanka
Disease Control

M.C.L. de Alwis *

NEWCASTLE Disease (Ranikhet Disease) is reported to have been introduced to Sri Lanka in 1927 through table birds imported from India. The disease was investigated in Sri Lanka by Crawford (as cited in Pieris 1969) in 1929 and 1930. He drew attention to the close similarity of the disease to another described by Doyle (cited in Pieris 1969) in Newcastle in England and also Ranikhet Disease described in India. It was subsequently found to be the same disease.

The introduction of the disease to Sri Lanka, has been the chief constraint to the development of the poultry industry. The disease took a heavy toll and was one of the chief reasons why poultry owners did not take up this industry on a large scale.

Present Status of the Disease

Despite the use of vaccines against the disease, and improvements and refinements to the vaccine and vaccination procedures, the disease still exists in Sri Lanka. The records maintained by the poultry diagnostic laboratory at the Veterinary Research Institute reveal that for 1984, 1985 and 1986, 4.6, 4.2, and 3.7% of the carcasses presented for postmortem examination at this institute were cases of Newcastle Disease. This laboratory received carcasses from commercial flocks in most parts of the country and from semi-intensive and village flocks mostly in the central region, within close proximity to the institute.

In an extensive study of poultry diseases, the causes of mortality among all age-groups of layer and broiler birds was monitored over a 2-year period (1983-84) in a large government poultry breeding station. No Newcastle Disease was recorded. A similar study was made in 1984 in 15 commercial flocks scattered in the central region and the western coastal belt, which is the hub of the poultry industry. No incidence of Newcastle Disease was recorded (Anon. 1985a).

Thus the indications are that at present the disease is prevalent mostly among the semi-intensive and village-level poultry.

Diagnostic Facilities

Each Government Veterinary Office staffed by graduate veterinarians has basic facilities for carrying out postmortem examinations on poultry carcasses and arriving at provisional diagnoses. The five veterinary investigation centres are scattered throughout the country, and staffed by veterinary investigation officers who assist the government veterinary surgeons in field and laboratory investigations.

The facility for virus isolation and serological diagnosis is, however, located only in the Division of Poultry Diseases, at the Veterinary Research Institute at Peradeniya. Embryo inoculation tests, and the haemagglutination inhibition tests, are carried out for laboratory confirmation of the disease.

Vaccine Production Systems

Vaccines against Newcastle Disease have been successfully produced in Sri Lanka since 1951. The first vaccine to be made was a live, liquid vaccine, using the Mukteswar strain of Newcastle Disease virus. Whilst the first production of a vaccine against the disease may be considered as a significant milestone in the development of the poultry industry in Sri Lanka, its impact in the early years of production was not fully realised. Firstly, because of the instability of the vaccine, it had to be administered within a few days of production. This was one of the main factors that limited its widespread use. And secondly, in the 1950s most of the poultry consisted of small village-level flocks. Each vaccinator had too large an area and the remote villages were difficult to reach, so vaccination coverage was poor.

* Veterinary Research Institute, Gannoruwa, Peradeniya, Sri Lanka.

Experiments carried out during that Period (Thambiaiyah 1956) showed that vaccine Preserved in glycerinated buffered saline and stored at atmospheric temperature, in transit up to 3 days, could be used to protect chicks by instilling a few drops into the nostrils, or by pricking the wing muscle with a Y-shaped needle, dipped in vaccine. This vaccine was administered to 3-4-month-old birds. Vaccination of layers caused a marked drop in egg production, and younger birds tended to suffer adverse reactions following vaccination.

In 1958, the milder 'Komarov' strain was introduced as the seed virus, in place of the Mukteswar strain. In 1960, the lyophilising facility was introduced and a changeover was made to a freeze-dried, Komarov strain vaccine. This vaccine was prepared as follows: The seed virus after appropriate dilution was inoculated into lo-day-old embryonated fertile eggs (a 0.2-ml volume being inoculated into the allantoic cavity), the eggs sealed, and incubated further. Twenty-four hours later, eggs were candled, and the dead embryos discarded. On the second day after inoculation, the allantoic fluid, together with the chorio-allantoic membranes in the amniotic fluid, and the embryos, were harvested, taking aseptic precautions. An even suspension of this material was obtained by homogenisation in a liquidiser. The material was filtered, antibiotics added, and dispensed in OS-ml volumes into ampoules, freeze-dried and sealed under vacuum.

The chick embryo lethal dose (CE-LD_{50}) of this vaccine was 10^7- 10^8/ml.

Immunisation of Broiler Chicks

With the growth of the broiler industry in the late 1960s, the need for a vaccine to protect very young birds was felt. The 'hot' Komarov strain (mesogenic) was not suitable for this purpose. Another vaccine using a milder Bl strain (lentogenic) was prepared. Whilst the freeze-dried Komarov strain vaccine was used to immunise layer strains of birds at 3-4 months of age, the Bl strain vaccine in liquid form was used as an oral vaccine for day-old broiler chicks. Although the Komarov vaccine consistently gave good results in 3-4-month-old birds, frequent failures were reported in the use of the Bl vaccine in day-old broiler chicks. This was believed to be either due to the poor immunising properties of the Bl strain, or the interferences of maternal immunity present in day-old chicks.

In 1970-71 an attempt was made to produce an oral vaccine using the Komarov strain (Kulasegeram 1971). Preliminary investigations showed that the maternal immunity disappeared at about 3 weeks of age, and it was felt that this was the earliest age at which active immunisation must be carried out. It was found that four times the dose of Komarov vaccine normally given by inoculation to 3-4 month-old birds can be tolerated well by day-olds by the oral route, without any adverse reaction. It was also found that this dose, when administered orally to 3-week-old chicks, gave satisfactory immunity. This alone was considered sufficient for broiler chicks and in the case of layers, a booster immunisation by inoculation at 3-4 months gave adequate immunity for their productive life. This procedure became the routine recommended vaccination schedule in the early 1970s.

After a decade or so of this procedure, oral vaccination was discouraged for several reasons. First, the requirement of four times the normal (inoculation) dose constituted a considerable drain on the supply of vaccine. Second, instances of failure with the oral vaccine became increasingly more frequent. Investigations revealed that improper use of the vaccine may have been responsible. The consumption of inadequate quantities of medicated water, in a limited time, and the survival of the virus in drinking water, were all variable factors which could have accounted for immunisation failures.

Current Vaccine Production and Immunisation Procedures

The Newcastle Disease vaccine is produced at the Veterinary Vaccines Laboratory, a unit within the Division of Veterinary Research of the Department of Animal Production and Health.

Only one type of vaccine (Komarov strain, freeze-dried) is produced at present for distribution through the veterinary staff. The cost of production of this vaccine is approximately 2 Sri Lankan cents per dose (i.e. approximately 1400 doses per US$1).

The amount of vaccine produced in 1977 was 8.74 million doses; in 1978, 9.53; 1979, 12.73; 1980, 13.34; 1981, 6.96; 1982, 16.0; 1983, 11.29; 1984, 12.81; 1985, 8.3; and 1986, 9.36.

The vaccine produced has a CE-LD_{50} of 10^8-10^9, and is dispensed in freeze-dried ampoules sealed under vacuum. Each ampoule is diluted in 100 ml of distilled water, and used to inoculate 400 birds at 3 weeks of age, and 200 birds at 3-4 months of age. Reference samples of each batch are retained.

Import of Vaccines

Like any other pharmaceutical product or vaccine, the import of Newcastle Disease vaccine is regulated by the Veterinary Formulary Committee. If local production meets the demand, no free import of vaccines is allowed. Individual farmers, however, who wish to use an imported product in preference to a local vaccine are permitted to import their own requirements of specified products and in specified quantities. This privilege is used exclusively by large-scale commercial farmers.

Practically all of the vaccines for which import authority is sought are live vaccines, containing the milder lentogenic strains such as the Bl strain.

Government Policy on Newcastle Disease Control

The government policy on Newcastle Disease control is to provide a free vaccination service to all poultry farmers. Vaccination with the locally manufactured vaccine by inoculation is recommended at 3 weeks and at 3-4 months of age. Practically all of the village-level and semi-intensive poultry farmers utilise this service. Most of the large-scale commercial farmers use the option of purchasing locally manufactured vaccine or importing vaccine. These large poultry establishments often employ their own vaccinators.

The free vaccination service is rendered through the 126 government veterinary surgeons, who are distributed throughout the country. Of these, 26 are located in the intensive poultry-breeding areas, which constitute about 7% of the land area, but harbour 50% of the poultry.

Of the total vaccine produced in Sri Lanka in 1984, 1985 and 1986, 64, 66 and 90%, respectively, was used in the vaccination programs of the government veterinary network, whilst the balance was sold, principally to commercial poultry farmers.

Past and Current Research

Research work on Newcastle Disease has concentrated mainly on: (1) improvements to the vaccine, and vaccination procedures, with a view to (a) providing more effective immunity, and (b) reducing the incidence of adverse reactions following vaccination; (2) studies on stability of the vaccine on storage under different conditions, and after reconstitution; and (3) investigations into instances of breakdown in immunity.

Improvements to the Vaccine and Vaccination Procedures

The historical sequence of events that led to the present vaccine production and vaccination procedures has already been described.

Two experiments were recently carried out to compare the immunogenicity and safety of the standard Komarov strain vaccine produced in Sri Lanka with a similar vaccine made using the milder lentogenic ‘F’ strain. The first experiment was carried out on 3-4-week-old White Leghorn chicks. Neither vaccine produced any adverse reactions. With the Komarov vaccine HI antibodies appeared in week one, reached a peak in the second week, and started declining by week three. Peak HI titres with the ‘F’ strain vaccine was in the second week and began to decline thereafter. Low, yet detectable, titres were seen in ‘Komarov’ vaccinated birds up to 9 weeks post-vaccination and in ‘F’ vaccinated birds up to 7 weeks.

All chicks vaccinated with both vaccines, however, resisted challenge at 3 and 8 weeks post-vaccination.

The experiment was repeated using two strains of birds, theRhowhite (a hybrid developed from a Rhode Island Red male x White Leghorn female), and the Shaver Starcross 288 chicks, administered with the normal dose, half and double the normal dose of Komarov and F strain vaccines.

The vaccines were administered to healthy 3-week-old birds, and no adverse reactions were observed.

It therefore appears that if administered to healthy birds, under experimental conditions, even double the recommended dose of the Komarov vaccine will not produce any adverse reactions.

Stability of the Komarov Strain

Sealed ampoules of vaccine were stored protected inside a laboratory room, and in the compound outside the laboratory. The $CE\text{-}LD_{50}$ of each ampoule was determined at the beginning of the experiment, after 2, 23 and 70 days. The virus titres of the vaccine were as follows:

	Stored inside laboratory	*Stored outside laboratory*
day 0	10^{8}/ml	10^{8}/ml
day 2	$10^{7.8}$/ml	$10^{7.7}$/ml
day 23	$10^{7.7}$/ml	$10^{7.5}$/ml
day 70	$10^{7.5}$/ml	$10^{6.2}$/ml

After 70 days exposure to atmospheric conditions outside the laboratory, there was a 2 log unit drop in the $CE\text{-}LD_{50}$. It was, therefore, reasonable to assume that vaccine transported by parcel post, and reaching the destination within l-3 days, retained potency without any significant drop (Pieris 1969).

Pieris (1969) further studied the stability of the freeze-dried Komarov strain vaccine after reconstitution. Ampoules of vaccine were reconstituted in the prescribed volume of distilled water, and the $CE\text{-}LD_{50}$ determined. The reconstituted vaccine was then stored for 5 hours at room temperature, and the CE-LD50 determined again. A drop of 2 log units was recorded, and consistent results were obtained with five batches of vaccine.

Breakdown in Immunity

From time to time, sporadic instances of Newcastle Disease are reported in vaccinated flocks. Practically all of these reports, where the batch numbers of the vaccine used are recorded, are investigated. All investigations have revealed that the reference samples of vaccine stored under optimum conditions have remained potent.

It is also significant that almost all such instances recorded arise from village-level or semi-intensive flocks, and only rarely from commercial flocks. One is therefore tempted to conclude that vaccination failures are likely to be due to improper handling of the vaccine in the field, rather than inefficiency of the vaccine itself. It is also reasonable to assume that better conditions for handling of vaccine are available in the large government and commercial poultry farms than under field conditions.

Sri Lanka: Poultry Production

T.M. Fonseka *

OVER 50% of the total poultry population is found within an area 30 miles south and 50 miles north of Colombo (and 9-15 miles inland), and in the Jaffna Peninsula in the northern tip of the country.

The reasons for this concentration of the poultry industry are: (1) proximity to potential markets in the urban and suburban region around Colombo, with a relatively more affluent population; (2) demand from tourist hostels which are mostly located in this region; (3) proximity to the feed manufacturing industry based within this region; and (4) the relative absence of religious prejudices against the consumption of animal products.

The total poultry population in Sri Lanka in 1986 has been estimated at 7 637 700 birds (Fig. 1). There has been a gradual increase in the poultry population over the years, but the rate of increase has not kept pace with the increase in human population. The increase has occurred in the 'Poultry belt' (Table 1), while there has been a decline in all other areas except in the central region of the country. This is a clear indication that market demands play an important role in determining the pattern of growth. Statistics also show that where there has been a steady increase in the layer population, the population of cockerels has remained static. This would point to an increase in the intensively managed sector whereas the extensively managed poultry population has remained constant.

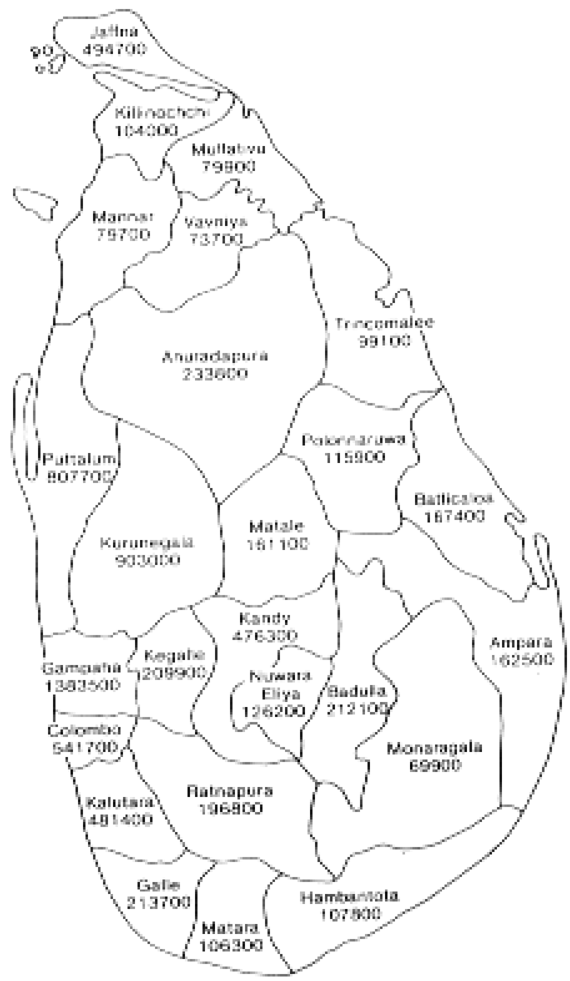

Fig. 1. Sri Lanka poultry population by district.

Poultry Production Systems

The systems of poultry production in Sri Lanka could be broadly classified into three groups: (1) the backyard or extensive system; (2) the semi-intensive system; and (3) the intensive system.

Extensive System

Poultry production under this system is about 2.5 million and of this 1.2 million are hens. This system is prevalent in areas around the outside boundary of the poultry belt and more common in the following districts: Kalutara, Kandy, Galle, Jaffna, Batticaloa, Amparai, Kegalle, Trincomalee, and Mannar.

In Sri Lanka prior to 1950 nearly all the eggs

* Veterinary Research Institute, Department of Animal Production and Health, Peradeniya, Sri Lanka.

TABLE 1. Poultry population *(millions);* source: Dept. of Census and Statistics.

	Cocks	Layers	Other	Chicks	Total
1970	1.30	2.38	1.21	2.04	6.93
1971	0.17	2.61	1.32	2.58	6.68
1972	1.87	2.29	1.39	2.90	8.45
1973	1.54	2.54	1.23	2.21	7.52
1974	1.24	2.27	1.15	1.86	6.52
1975	1.05	1.96	1.04	1.63	5.68
1976	1.04	1.96	1.03	1.66	5.69
1977	1.01	2.08	1.01	1.74	5.84
1978	0.88	1.81	0.85	1.39	4.93
1979	1.01	2.27	0.90	1.69	5.87
1980	0.11	2.62	1.09	1.52	5.34
1981	1.17	2.56	1.00	1.56	6.29
1982	1.07	2.64	0.99	1.54	6.24
1983	1.14	2.74	1 .01	1.57	6.46
1984	1.19	2.84	1.03	1.55	6.61
1985	1.24	3.09	1.12	1.65	7.10
1986	1.33	3.36	1.19	1.75	7.63

produced came from village or 'deshi' poultry reared under this system. These village chickens were generally domesticated jungle fowl especially selected down through the centuries for particular traits. Most of them were, and still are, basically scavenger chickens receiving some kitchen scraps but otherwise find food for themselves. They are usually enclosed for safety only at night in chicken coops most often suspended between two trees. There is a door at one end of the coop which can be closed at night. Wild animals and snakes cannot attack the birds, and they are housed at a height beyond the reach of thieves. The birds, when they go to roost, climb up a bamboo pole from which the side branches have not been fully removed and which acts as a ladder. The cage is closed as soon as all the birds are inside.

Villagers keep these birds in free range which means that no wire netting or other materials has to be bought and very little or no food has to be supplied as the birds find their own food. These chickens have adapted to local conditions. Frequently, however, a disease known as 'Ranikhet' sweeps through an area which can result in 100% mortality unless the village people recognise the first symptoms of the disease, and dispose of all their chickens as quickly as possible. This they usually do, accepting the value of the meat as the limit of income they will receive for that particular lot of chickens.

Semi-intensive System

These are generally small units with each household maintaining a few birds, but not more that 30-40. The average number in a unit is about 15. Until 1930, birds were indigenous types, but after 1940 crosses were being used. Although the Department of Animal Production and Health (then the Department of Agriculture) issued to farmers Rhode Island Reds, Australorps and White Leghorns, they were not able to rear them because the first two breeds were too heavy and could not fly, and the White Leghorn's colour makes it distinct for birds and beasts of prey. Since 1950 Brown Leghorn birds which were issued from the Department of Animal Production and Health have become very popular.

Brown Leghorns have all the advantages of light breeds and additional advantages to rear in the village poultry-keeping system. As chickens they grow wing feathers almost immediately they are hatched, are naturally energetic and wild. They have the wild bird's instinct of laying flat without movement at the approach of danger. Their protective colouring is almost perfect. As growers they are hardy and active and can fly and climb roosting poles at a very early age. As adults the cock is coloured almost as jungle fowl, and the hen has perfect protective colouring. They are active as any other fowl and can forage for themselves to a remarkable extent. Villagers believe when Brown Leghorns are reared males are always first to give notice of approach of a snake or dog. Brown Leghorns reared under these conditions will lay 180 or more eggs a year.

Generally birds reared under this system are self-protective and hardy but low-producing. The average lay today is around 80.

The backyard poultry are sometimes known as 'scavenger' layers, and constitute an important but neglected sector of the poultry industry. These birds, although low producers, are a source of supplementary income and a readily available source of animal protein. Rearing requires little technical skill or capital inputs and is a traditionally accepted activity.

These layers therefore do make a substantial contribution to the total egg production in the country. The important fact worthy of consideration is that these eggs are produced with little capital investment and without any dependence on human food or concentrated animal feeds.

These poultry raisers belong to the poorer levels of Sri Lankan society. They may be crop-producing farmers, labourers or other wage earners. Hence they do not devote much of their working time to backyard poultry keeping, which is done to augment their income and not for immediate consumption. The farmers sell the produce and use the money to purchase carbohydrate food requirements for the family. Some of the eggs produced are consumed when they find it difficult to obtain items of food such as dry fish, which also fetch high prices.

Generally immunisation for Newcastle Disease and Fowl Pox is not carried out.

The poultry population in the country under this system is very small. They are not confined to a poultry house at all times, and some semipermanent types of poultry house or an unused building are used. They are allowed freedom to forage for themselves for limited periods during the day. Generally the flock size is less than 100 and their egg production is low.

Locally available raw materials or materials available at a low price are used to make a ration that is fed usually once a day. This system is very common in coconut-growing areas of the country.

The source of supply of day-old chicks is from the hatcheries of the Department of Animal Production and Health. Prior to 1960 Australorps and AustraWhites were also issued. This was discontinued as this breed and the cross was found to be broody. The commercial chicks produced by Brown Leghorn **x** Light Sussex and Rhode Island Red **x** Light Sussex and Rhode Island Red are popular crosses and breeds in this system.

Two foreign agencies are attempting to help the poultry industry in Sri Lanka by improving the efficiency of village poultry farmers. Because their target groups are unemployed youth and women, their aim is to have more people take up this type of farming. This will not only improve their living standards but also their health status will be improved when they consume more eggs.

The socioeconomic conditions of the poultry raisers under the semi-intensive system in the coconut-growing area are different from those in other districts in the dry zone.

In the coconut-growing area poultry keeping is by caretakers of holdings of coconut land. Along the boundary of the poultry belt this system is practiced in unproductive lands by the owners. Economic conditions of these poultry raisers are better in all respects than backyard poultry keepers. In the dry zone districts this system is practiced by integrated farmers whose economic conditions are not as good as in the above areas.

Intensive System

The population of laying hens under this system of management is around 2.6 million. The main feature of this system is that poultry are raised in deep litter houses where compounded feeds are provided. The compounded feeds are either mixed on the farm or from feed manufacturers. This poultry population is not self-producing, and replacement chicks are purchased mainly from private sector franchise hatcheries.

The farmers in the intensively managed system could be subdivided into four categories based on the size of the operation: (1) large-scale farms (over 5000 birds); (2) medium-large farms (1000-5000 birds); (3) medium-scale farms (500-1000 birds); and (4) small-scale farms (200-500 birds).

Out of these four types, medium and small-scale farms could be grouped under village poultry production.

MEDIUM-SCALE FARMS

Birds are housed in semipermanent sheds, which usually last from 4 to 10 years. The floor is either cement or mud. Walls are planks, mud or brick, to a height of 45-90 cm. The sides are usually made of wire netting. The roof frame is constructed of round timber or coconut rafters and is covered with aluminium sheets, zinc sheets, tiles or cadjan. Tubular feeders are used, and waterers turned out from metal gutters or constructed along the wall with cement and bricks. Laying boxes are made from soft wood. Litter used is paddy husk or wood shavings. In fact, the equipment used and facilities available vary depending on the production area and the ingenuity of the farmer.

There are about 467 such farms in the country, located mainly in Puttalam, Gampaha, Kurunegala, and Kalutara districts.

Producers in this sector devote full time to this activity and capital for the industry is normally provided through bank loans. These producers belong to the upper middle class of society, with incomes of Rs.3000/- to Rs5000/- per month (US$11O-180).

SMALL-SCALE FARMS

Birds are usually in temporary housing (e.g. cadjan sheds). The birds are looked after by a member of the family and generally serve as a source of supplementary income. There are around 2428 such units in Sri Lanka, with most of the farms in the 'poultry belt' of the island. The equipment used and the facilities available vary depending on the producer and the area. Small-scale farmers are handicapped because of difficulties in obtaining bank credit. Their management skills are limited by their lack of sufficient knowledge of poultry husbandry. The efficiency of production is thus low but they gain experience with time, and many eventually are in a position to expand their enterprise.

A unique feature in 'this type of poultry production is that most of the people engaged in farms of this size are middle-class government workers, teachers and low-income people, so this activity serves as a means of supplementing their income.

The source of replacement stock is the farms of the Department of Animal Production and Health. The popular strains they use are Rhowhites.

These producers receive the services of government veterinary field officers to immunise their flocks against Newcastle Disease and Fowl Pox.

Management Practices

A wide variation exists in the management practices adopted by the different categories of poultry farmers.

Housing of Poultry

Poultry farmers of Sri Lanka are fortunate in that special housing is not required to protect poultry against extremes of climate. Housing can be of a simple type but is generally constructed keeping in mind the need for: (1) protection against predators; (2) protection against theft; (3) minimising effects of heat stress; and (4) reducing construction costs.

Automation is not feasible in poultry houses because labour is cheap and electricity costs are high. A few large-scale commercial farmers use automatic drinkers. The large farms generally have permanent houses with brick half-walls and cemented floors, wire mesh sides and aluminium or asbestos roofs on a timber structure.

Preference of Strains of Chicks

Large-scale farmers select strains of chicks that have a good performance record under local conditions. However, this priority in selection may be sacrificed if the price is high or when there is a delay in obtaining chicks. After-sales service is not considered important because farmers in this category are knowledgable and reasonably conversant with good farming practices. The proximity of the supplier to the farms is an important criterion in making choice of replacement flock.

Most farmers prefer light birds weighing not more than 1.8-2.0 kg at maturity with a low feed consumption record.

Small-scale farmers and semi-intensive farmers have a preference for hardiness in birds able to adapt to the environment, as well as low-cost chicks. Not being very knowledgable and competent in poultry management they value after-sales service. This category of farmer tends to prefer chicks offered by the Department of Animal Production and Health in preference to franchise chicks.

The question of preference does not generally arise with backyard poultry farmers since they produce their own replacement stock. A small percentage may purchase chicks from the state farms.

Brooding of Chicks

Many of the large-scale farmers use brooders or canopies which are imported. They are generally brooders with infrared heaters and brooding of chicks is carried out in separate brooder houses. Gas brooders, hot water brooders, and hot air brooders are not used in Sri Lanka. A few sophisticated farmers maintain a separate farm location for brooding and growing chicks.

The system adopted by all farmers in brooding is the 'all-in all-out' method. The normal period for brooding is 3 weeks. In broiler production a special feature is the practice of brooding and growing chicks in the same house. In some instances, the brooders are moved out at the end of the brooding period rather than the birds. Small farmers use locally manufactured electric brooders. Most farmers use l00- or 150-w bulbs fitted to a locally fabricated canopy. Those who own biogas plants use this means to provide warmth to chicks.

Semi-intensive farmers originally utilised hurricane-type lanterns or oil lamps for brooding. However with the increase in cost of kerosene oil farmers have adopted a paddy-husk-fired heater for this purpose.

The more experienced and knowledgable farmers operate their heating systems at least 24 hours before the chicks are scheduled to arrive but all others wait till the chicks arrive to start the heating systems. The brooder temperature management practiced in temperate countries cannot be directly adapted to Sri Lanka since the ambient temperature is generally over 26°C. The brooder temperature is maintained at 35°C for the first 2 days and gradually reduced to 28°C by the end of the third week when heating is terminated.

The litter popularly used for rearing of chicks is paddy husk, spread over newspaper during the first week.

Under the backyard system natural brooding under broody hens occurs. A hen will incubate 10-12 eggs. The chicks hatched out remain with the hen until they are able to feed themselves.

Management of Layers

Practically all poultry farmers, except in semi-intensively managed and backyard farms, keep layers for approximately 18 months from the date of hatch. On the other hand, poultry in backyard farms are generally retained for 3-4 years, except for a very small number which are kept until they die from natural causes. This stems from religious beliefs which do not permit the slaughter of animals.

The majority of farmers, however, sell their birds in times of financial need. The disposal of layers is rarely based on such criteria as poor egg lay, moulting, etc., since these economic considerations do not concern them because no financial inputs are considered necessary in rearing poultry.

The style of management adopted under the intensive system is the use of deep litter. The battery management system is rare in Sri Lanka since the capital costs involved are double that required for provision of deep-litter facilities. The litter used is paddy husk or sawdust.

Lighting Program

The seasonal variation in day-length in Sri Lanka has an important bearing on the pattern of egg production during the year. The shortest day is 23 December and the longest day is 21 June. With birds reared under natural lighting, the period between 23 January and 21 June is considered most favourable for egg production. The stimulus of increased day length after 23 January increases egg production for 8-10 weeks. During this period there is generally a resultant drop in egg prices. However, it must be stated that other factors contribute to the fluctuation in egg prices such as the tourist inflow and availability of other protein foods, particularly fish. However, the trend towards increased production beginning in January is a consistent feature in Sri Lanka.

As mentioned earlier the majority of farmers rear birds only under natural lighting. The period 21 June to the following January is considered to be a period of stress for layers when egg production declines. The period of lowest production is between August and October. Farmers who do not provide artificial lighting therefore prefer to obtain their replacement chicks during the period from August to October. Hence the demand for day-old chicks is very high during the period after August. At the same time the demand for chicks is very low during the period starting from 23 January. This low demand could also be attributed to the fact that the price of eggs drops during this time. These chicks reared during the stress period would then attain delayed sexual maturity which is more desirable from the point of view of their subsequent production performance since they would also come into lay during the favourable period. On the other hand birds that come into lay during the early part of the stress period would tend to moult earlier than the time for normal moulting.

Artificial lighting is provided in the large farms so as to remove the effect of variation in day-length. The lighting program used is 13 hours light during the growing up period up to 50% production then 30 min increase every 2 weeks up to 17 hours of light.

Poultry Feeds

Poultry feeds in Sri Lanka are largely dependent on local feed resources for raw material. Expansion of the poultry industry therefore cannot progress beyond the extent of the availability of local feed resources. The major ingredients used in the manufacture of feed are coconut meal, rice polish/bran, maize and fish meal/soybean meal. Of these the latter category comprising the protein-rich feeds are for the most part imported. In addition small proportions of bone meal, shell grit, vitamins/mineral premixes, amino acids, and other feed additives are utilised. Except for bone meal and shell grit these items are imported. Other feedstuffs used when available are Gingely meal, sorghum, coconut refuse, condemned food items such as wheat, flour, rice and milk powder.

Poultry feeds are manufactured on a commercial basis both by the state and the private sector. Several of the large-scale poultry farmers mix their own feed requirements on the farm.

The quality of feed produced is variable. Manufacturers do not observe common standards. Although minimum requirements for different classes of poultry have been laid down by the Bureau of Sri Lanka Standards, acceptance by manufacturers is voluntary. Sri Lanka does not as yet have any type of legislative enactments to regulate manufacture and sale of animal feeds, although most producers attempt to maintain the minimum standards stipulated by the Bureau of Sri Lanka Standards.

Thailand: Disease Control

Wimon Pariyakanok *

IT is not known exactly when Newcastle Disease first occurred in Thailand but outbreaks were confirmed in the 1940s. In that period, Newcastle Disease did not appear to be a serious problem because the poultry industry had not yet been developed. Poultry farming was of the backyard type and about 80% of the chicken population was of the native breed with low egg productivity.

In the 1950s poultry farming rapidly increased. Chickens with high egg productivity were raised instead of the native breed. In this period, Newcastle Disease control programs were considered an important factor in the prevention of serious economic losses by farmers. Therefore, in 1953 the Veterinary Biologics Division, Department of Livestock Development, started producing vaccine using the F strain of Newcastle Disease virus.

During the 1950s the disease spread throughout the country. The mortality rate in some areas was as high as 90-100%. However, the exact number of outbreaks and losses has never been recorded. The extensive use of vaccine during the 1960s greatly reduced serious losses. However, the disease continues to be a major problem especially amongst poorly educated smallholders.

Since 1970, many industrialised poultry farms have been set up by private companies. These companies are well aware of the serious losses caused by infectious diseases, and apply their own strict control measures.

Distribution of Newcastle Disease

The central (highest density areas of livestock population) and northeastern part of Thailand are the main areas for raising livestock. There are three seasons: summer season from February to April, rainy season from May to October, and winter season from November to January. Newcastle Disease often occurs between summer and the rainy season (March to May). In the winter, the climate is dry and windy causing the chickens to weaken. Depending on variations in the weather, chickens are susceptible to the disease.

The poultry industry is expanding rapidly in Thailand. Most of the remaining commercial companies involved in the poultry business have developed an integrated system. They have imported grandparent stock from abroad, especially the US, produce their own day-old chicks to supply subsidiary farms, and buy-back broilers or animal products to be processed at their own processing plants. Poultry production in Thailand is considered to be as highly advanced as in western countries. That is why Newcastle Disease rarely occurs under these circumstances, since the commercial companies have adopted modern techniques of poultry rearing from reputable foreign companies. Furthermore, they have hired veterinarians to improve farm management and implement routine vaccination programs to control disease outbreak.

Intensive commercial farms who buy day-old chicks from the producers have similar vaccination programs. Occasionally Newcastle Disease occurs sporadically since vaccination can give uncertain results. This could be due to several factors such as poor vaccine storage or varying degree of parental immunity.

Semi-intensive commercial farms which raise both broiler and laying flocks have endemic Newcastle Disease. Almost all of those farms are located near the villages. It is believed that air-borne infection and vaccination failure are the main factors, however they have veterinarians visit their farms regularly to advise on vaccination programs and sanitary management.

Village poultry flocks are raised on a small scale with approximately 14-20 chickens each for home consumption and some extra income. These chickens are the indigenous breed and low yielding. The chickens live freely around the house and neighbouring yards. The owners provide little food

* Chief of Newcastle Disease Vaccine Production, Veterinary Biologics Center, Pakchong, Nakornrajsima, Thailand.

(paddy rice, rice bran), housing, or medication or vaccination against infectious diseases. An outbreak of Newcastle Disease currently occurs every year and only a few chickens survive (Table 1). The economic loss is probably more than 600 million bhat per year.

TABLE 1. Outbreaks of Newcastle Disease in Thailand (Source: Yearly Statistic Report (1984), Dept. of Livestock Development).

	No. of			Control
	Outbreaks	Cases	Deaths	measure
1985	135	143380	94191	vaccinated
1986	8	15833	2420	vaccinated

Control at the Village Level

The veterinary officials have been providing knowledge of vaccination programs to farmers for years. In practice, some farmers carry on their own vaccination programs which vary slightly from the suggested one. The commercial intensive farms and some of the semi-intensive farms prefer using imported B1 and LaSota strain. Some semi-intensive farmers and village flock owners buy vaccines produced locally.

Imported Newcastle Disease vaccines are usually applied to birds via drinking water or spraying while the government vaccines (Newcastle Disease F and MP strain) are applied through intranasal, intraocular and intramuscular or wing web stab routes.

Failure to control Newcastle Disease in Thailand is due to: (1) neglect of vaccination by the village farmers; (2) insufficient level of immunity by variation of maternal immunity among different flocks, and the effectiveness of the vaccine in remote areas is in doubt due to poor vaccine storage and poor transportation; (3) predisposing causes (e.g. mycoplasma infection, infectious bursal disease, infectious bronchitis, and coccidiosis); (4) poor sanitation and management; and (5) disease surveillance; Newcastle Disease surveillance and the prompt and precise diagnosis of poultry disease are limited.

Vaccine Production

Two types of live Newcastle Disease vaccine are locally produced at the Veterinary Biologics Center, Pakchong, Nakornratchsima Province, Department of Livestock Development: (1) Lentogenic F (Asplin) strain, and (2) Mesogenic MP (Mukteswar Philippines) strain.

These vaccines are produced in eggs from a flock of layers which have not been vaccinated against and raised at this centre. Both vaccines are produced in ‘dry’ form. The vaccines were produced in ‘wet’ form until 1982. Some of the ‘wet’ vaccine was graduallyreplaced by freeze-dried vaccine and now onlythe ‘dry’ form of vaccine is available. In 1986, for example, 154 666 200 doses were produced (120 517 500 of strain F freeze-dried, and 34 148 700 strain MP).

Imported Vaccine

Private companies have imported vaccine from the USA, France, England, Netherlands, Japan, Israel and Taiwan. Some of them are: (1) Hitchner B1 strain; (2) B1 live virus vaccine combined with infectious bronchitis virus vaccine; (3) LaSota strain; (4) LaSota combined with infectious bronchitis virus vaccine; (5) Ishi strain (live lentogenic strain); (6) inactivated Newcastle Disease vaccine; Ulster strain, Texas strain; and (7) Komarov strain, etc.

Total imported Newcastle Disease vaccine including combined and inactivated forms is estimated to be about 645 700 000 doses/year.

Vaccination Programs

The recommendations of the Veterinary Biologics Division, Department of Livestock Development are as follows: *Broiler:* Intranasal or intraocular application of the F strain during the first week followed by booster at 3-4 weeks to provide adequate immunity to 3-4 months; and *Layer:* First and second vaccinations as recommended for broilers but a third vaccination employing the MP strain is given by wing web stab at 6 weeks. This regimen should provide immunity for about 6-9 months.

Diagnostic and Research Facilities in Thailand

The main activity of Thai people is agriculture, an important part of which is the livestock sector. A major problem is animal diseases. The Department of Livestock Development is responsible for control and eradication of animal disease, including diagnosis and research activities throughout the country. There are presently five laboratories for poultry disease diagnosis in Thailand.

The most common diagnostic tests used for Newcastle Disease in all five laboratories are virus isolation, inoculation in eggs, detection of viral haemagglutinin, and virus identification.

From diagnostic tests of Newcastle Disease cases we have found some infectious bursal disease, infectious laryngotracheitis, infectious bronchitis, mycoplasma involvement, besides the major Newcastle Disease virus.

There is no service charge for diagnostic tests for Newcastle Disease.

Current research includes studies in the preparation of Newcastle Disease V4-strain incorporated into pelletised chicken feed, preparation of inactivated vaccine, and studies on emergency vaccination against Newcastle Disease outbreak in chickens.

Summary

The outbreak of Newcastle Disease in backyard poultry is still a major problem in Thailand. There are many difficulties in the various methods of administering Newcastle Disease vaccine to backyard poultry, so the use of vaccine strain V4 incorporated into pelletised chicken feed should be most suitable and extremely beneficial to Thai farmers.

Thailand: Poultry Production

Jintana Danvivatanaporn *

THAI policy is to promote the raising of native chickens by smallholders and villagers, to help increase household income. The farmers can earn money by selling live chickens to the market or they can keep them as a source of animal protein. One of the very important constraints to increasing poultry raising is the problem of disease affecting the health of the animal.

In Thailand, several infectious diseases hamper the growth of the industry, including Newcastle Disease, despite the fact that vaccine for this disease is available and the protection is reliable. Vaccine application is not popular with the farmers, because of the problems in keeping and storing vaccine, and in its administration.

Incidence of Newcastle Disease

Almost every family in a village keeps 4-5 chickens. They are raised around the house without any confinement, and seek their own food. Occasionally the owners will feed paddy rice or rice bran, but no attention is given to vaccination.

Although the owners know how harmful Newcastle Disease is they still cannot vaccinate their birds because of problems of storing it. Newcastle Disease is found sporadically in every part of Thailand, especially in the northeastern part of the country, such as Khon Kaen, Udon Thani, and Nakornrajasrima.

About 80% of the total Thai population, or about 40 million people, are farmers or engaged in agriculture. The approximate number of farm families is 8 million and about 40 million native chickens are raised in the villages.

These native chickens have a poor growth rate and low feed conversion and egg production. However, there is a premium price for native birds that can be sold 10-15% higher than market price, depending on location and season.

In the case of semi-intensive and commercial flocks, almost all farmers are in the central part of Thailand. Here Newcastle Disease is still a problem although the farmers try to give vaccine at appropriate times and with good sanitation practices. According to the diagnostic laboratory of Kasetsart University, the following present problems:

(1) The wide variation of Newcastle Disease titre of chickens produced from multi-age groups of breeders indicates the presence of parental immunity at any one time. This will result in sporadic outbreaks and losses of 10-30% in spite of vaccination procedures carried out.

(2) The rapid spread of Viscerotropic-Velogenic Newcastle Disease (VVND) or Asiatic-Velogenic Newcastle Disease virus in crowded intensive systems.

Seasonal Variation

Newcastle Disease in Thailand always occurs twice a year in the village poultry, during April-May and November-December. In the first period, the climate changes from summer to rainy season causing stress in the flocks. Susceptible chickens of any age can be affected. In the other period, young chickens seem to be the most susceptible ones.

The loss due to Newcastle Disease in all age-groups of native chickens is 30-50% costing about 600 million bhats annually.

The number of field staff in each province is limited. The smallest unit (Amphur Livestock Office) has only two officers. They must look after animals in about 5-10 tambons (large villages).

There are 1500 officers in rural areas and each officer has to look after animals in about 10 000 livestock units classified by the Department (a livestock unit = 1 cattle, 10 pigs, 100 chickens or ducks). It is therefore difficult for the field officers to look after the farmers in close detail.

* Provincial Livestock Officer, Singhaburi Province, Department of Livestock Development, Thailand.

Village Control Method

We provide training courses to children 12 years of age in the primary schools. Apart from introducing them to the advantages of vaccination, we also guide them to observe simple clinical signs of the disease. When these children have finished school, they can be good poultry farmers,

We also provide training courses for livestock volunteers. We select 4-6 young leaders, who are active and willing to work for their community from each village to attend the course, which emphasises the prevention of Newcastle Disease. After returning to their villages, they will provide guidance on Newcastle Disease control to the villagers without charge.

Each livestock unit has two livestock officers for the following: diagnosis, postmortem, treatment; extension, advice in needed cases; vaccine store to sell to farmers at low cost. The vaccination is carried out by the farmers.

Policy Towards Control

In response to government policy on controlling poultry disease in villages, veterinary officers offer training courses to selected leaders of villages, titled ‘village volunteers,’ to learn theory in the class, and to practice in the field with a government officer. Also training courses are run in primary schools (for 12-year-olds) once a year prior to finishing their school. Villagers are also instructed at least once a year on the poultry disease and good husbandry practices. The government has a policy of national development to overcome the poverty of the rural areas. And finally we hold a veterinary mobile clinic at least twice a month.

Farmers are becoming more aware of Newcastle Disease and its prevention, and recognise the value of vaccination in terms of increasing their income.